



# GHANA WHOLESAL ELEC TRICIT Y MARKET BULLETIN

## MARKET WATCH

Monthly Market Data Analysis

ISSUE NO. 23: 1<sup>st</sup> November 2017 to 30<sup>th</sup> November 2017

This Bulletin covers major developments in the Wholesale Electricity Market (WEM) of Ghana from 1<sup>st</sup> November, 2017 to 30<sup>th</sup> November, 2017. 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 continues with the series on the financial sustainability of the power sector for October 2017 and November 2017.

The Energy Commission (EC) would very much appreciate and welcome comments from readers on the Bulletin. Reasonable care has been taken to ensure that 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

#### Overview of the Month

There was a marginal increase in Electricity supply in November 2017, from 39.59 GWh per day in October 2017 to 40.71 GWh per day in November 2017. The 2.8% increase in daily supply was predominantly due to an increase in supply from thermal sources. Thermal generation increased from 26.43 GWh per day in October 2017 to 27.69 GWh per day in November 2017. The increase in thermal sources was largely due to the increase in electricity supply from Ameri power plant and TT1PP by 44.33% and 45.28% respectively. There was a general reduction in supply from hydro sources by 2.73% due to reduced generation from Akosombo GS and Kpong GS. The Akosombo GS recorded a reduction of 1.9% from the 9.45 GWh per day in October 2017 to 9.27 GWh per day in November 2017, whereas Kpong GS witnessed a cut of 2.1% from the 1.87 GWh per day in October 2017 to 1.83 GWh per day in November 2017. Aside the reduction from the two hydro sources, Bui GS had 20.9% increase in generation from 1.3 GWh per day in October 2017 to 1.68 GWh per day in November 2017. The water level for Akosombo GS and Bui GS reduced by 0.28% and 0.43% respectively when compared to their water levels at the beginning of the November 2017.

There was a reduction in the natural gas flow rate from both WAGP and AGPP for the month of November 2017. The flow rate reduced by 11.29% for WAGP and 1.27% for AGPP in November 2017 as compared to flow rate in October 2017. Natural gas supply from

Table 1 Projected and Actual Outturn of electricity demand and supply in November 2017

	November 2017		October 2017	
	Projected	Actual Outturn	Projected	Actual Outturn
Total Supply (GWh)	1,344.0	1,221.4	1,363.0	1,252.2
Source by Power Plants (GWh)				
AKOSOMBO	279.0	278.1	288.0	286.9
KPONG	55.0	54.8	57.0	55.1
BUI	69.0	50.5	71.0	41.1
Sunon Asogli	151.0	182.6	144.0	163.6
TAPCO	158.0	54.9	159.0	97.7
TICO	176.0	214.8	182.0	220.7
TT1PP	-	20.9	-	15.5
CENIT	-	-	-	-
TT2PP	-	-	-	-
MRP	-	-	-	-
Karpowership	145.0	156.3	150.0	195.1
AMERI	140.0	102.9	145.0	82.6
KTTP	-	0.0	-	2.0
Trojan Power	-	-	-	-
CENPOWER	-	-	-	-
AKSA	161.0	98.2	157.0	83.9
Total Generation (GWh)	1,334.0	1,214.2	1,353.0	1,244.1
Imports (GWh)	10.0	7.3	10.0	8.1
Total Supply (GWh)	1,344.0	1,221.4	1,363.0	1,252.2
Deficit (GWh)	-	(122.6)	-	(110.8)
Ghana Coincident Peak Load (MW)	2,140.0	2,119.1	2,077.0	2,126.9
System Coincident Peak Load (MW)	2,313.0	2,122.1	2,250.0	2,130.9

## HIGHLIGHTS OF THE MONTH

the WAGP reduced from the 45.79 MMSCF per day in October 2017 to 40.62 MMSCF per day in November 2017 and natural gas supply from the AGPP reduced from 101.79 MMSCF per day in October 2017 to 100.5 MMSCF per day in November 2017.

November 2017, witnessed a marginal reduction in system peak demand by 0.41% when compared to October 2017. The System Peak demand reduced from 2,130.9 MW in October 2017 to 2122.1 MW in November 2017. Similarly, the Ghana peak demand decreased from 2,126.9 MW in October 2017 to 2,119.1 MW in November 2017.

Export of electricity increased marginally from 0.34 GWh per day in October 2017 to 0.36 GWh per day in November 2017. There was a significant reduction in import of 35.1% from 0.37 GWh per day in October 2017 to 0.24 GWh per day in November 2017.

### Electricity Demand and Supply

#### Electricity Demand

The System Peak Load decreased in November 2017, from 2130.9 MW in October 2017 to 2,122.1 MW, a reduction of 8.8 MW. Likewise, the Ghana Peak Load reduced by 7.8 MW from 2126.9 MW in October 2017 to 2,119.1 MW in November 2017 which represents a 0.37% reduction. The contribution of the hydro power plants to both the System Peak Load and the Ghana Peak Load increased from 40.6% to 47% while contribution from thermal sources accounted for the rest. On plant by plant basis, Akosombo GS alone contributed 30.68% to the System Peak Load and 30.72% to the Ghana Peak Load. There was a difference of 190.9 MW between the actual and the projected System Peak Load under the 2017 Electricity Supply Plan (ESP) in November 2017. This represents a reduction of 8.25% from the projected System Peak Load. The Ghana Peak Load had a marginal reduction of 0.98%, representing 20.9 MW from the projected Ghana Peak Load.

#### Electricity supply

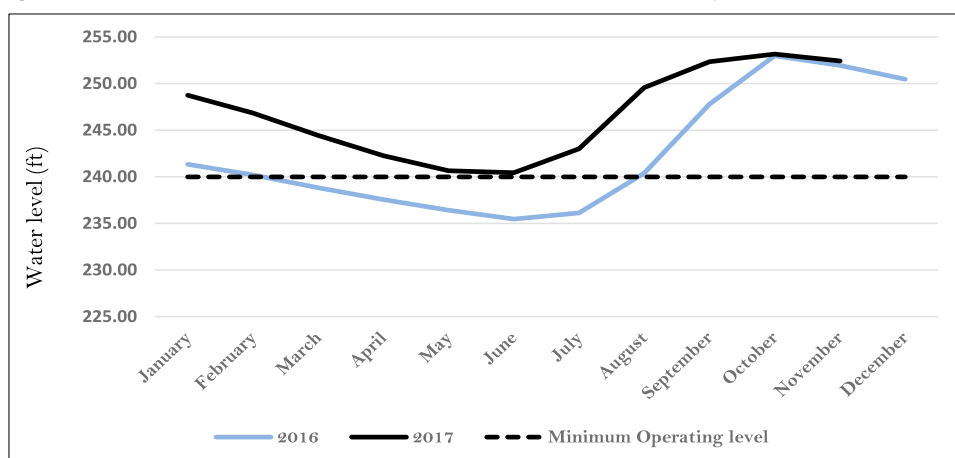
The month of November 2017 witnessed a reduction in the total electricity supply from 1,252.2 GWh in October 2017 to 1,221.4 GWh in November 2017. Average electricity supplied however increased marginally due to fewer days in November 2017 from 39.59 GWh per day in October 2017 to 40.71 GWh per day in November 2017. There was an increase in the proportion of electricity supplied from domestic sources in the month of November 2017 from 99.07% in October 2017 to 99.4% in November 2017. The total electricity supplied in November 2017 was 9.1% lower than the projected 1,344 GWh under the 2017 ESP.

### Hydro Dam Levels

#### Akosombo Dam Water Level drop rate decreased marginally in November 2017

The rate of drop in water level reduced from 0.03ft per day in October 2017 to 0.02ft per day in November 2017. At the end of November 2017, the water level stood at 252.44ft and was 0.72ft lower than the level of the water recorded at the end of October 2017. The water level was 0.48ft higher than the water level recorded for the same period in November 2016. The water level was also 12.44ft above the minimum operating water level of 240ft. Figure 1 shows comparative end of month trajectory of the level of water in the Akosombo dam from January 2016 to November 2017.

Figure 1: Month-End Water Level for Akosombo Dam from January 2016 to November 2017

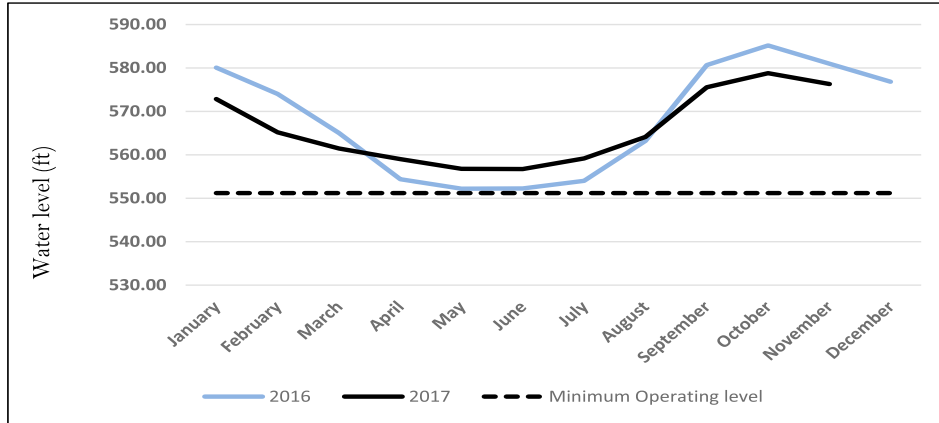


# HIGHLIGHTS OF THE MONTH

## Bui Dam Water Level dropped in November 2017

The Bui dam water level continued to decrease after it reached its peak for the year in October 2017. The rate of drop in the water level was 0.08ft per day. This led to the reduction in the water level to 576.33ft at the end of the November 2017 from 578.82 ft at the beginning of the month. The end of month water level was 4.66ft below the water level recorded for the same time in 2016 and was 27.64ft above the minimum operating level of 551.18ft. Figure 2 shows comparative end of month trajectory of the level of water in the Bui dam from January 2016 to November 2017.

Figure 2: Month-End Water Level for Bui Dam from January 2016 to November 2017

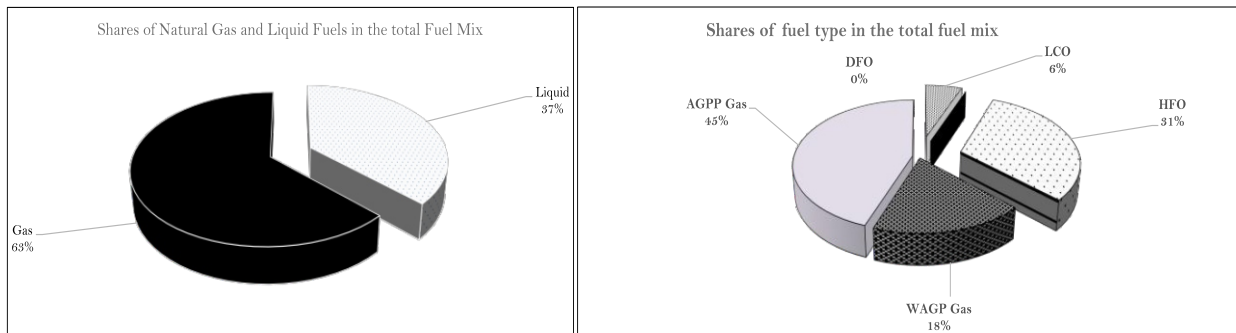


## Fuel Supply for Power Generation

The share of natural gas in the total fuel mix continued to dominate but at a reduced rate. The share reduced from 69% in October 2017 to 63% in November 2017 with liquid fuel accounting for the rest. The share of natural gas supply from WAGPCo in the total fuel mix decreased from 21% in October 2017 to 18% in November 2017 and that of AGPP decreased from 48% in October 2017 to 45% in November 2017. The reduction in generation by KTPP ensured that DFO constituted 0.04% of the total fuel mix and was less than the 1% it recorded in October 2017. The low supply of natural gas to Tema and Kpone necessitated the SAPP to consume LCO in order to meet demand. This increased the share of LCO in the total fuel mix from no consumption in October 2017 to 6% in November 2017. Also, there was an increase in consumption of HFO from 30% in October 2017 to 31% in November 2017 in the total fuel mix.

Figure 3a and Figure 3b shows the shares of sources of fuel and fuel type in the generation fuel mix for electricity generation respectively.

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



## Natural gas flow rate from WAGPCo decreased in November 2017

Natural gas flow rate from Nigeria through the WAGP to Tema and Kpone decreased narrowly to 40.62 MMSCF per day in November 2017 from 45.79 MMSCF per day recorded in October 2017. The total natural gas consumed at the Tema and Kpone, decreased to 1,201.47 MMSCF in November 2017 from 1,332.48 MMSCF in October 2017, representing a 9.8% reduction. The natural gas consumption at Tema and Kpone, reduced from 30% in October 2017 to 29% in November 2017 in the total natural gas consumed and its share in the total fuel consumed reduced from 21% in October 2017 to 18% in November 2017. Out of the total natural gas consumed in the Tema and Kpone, SAPP consumed 80% and 20% by TT1PP.

## Natural gas flow rate from GNGC decreased in November 2017

The Natural gas flow rate at the Aboadze enclave reduced from 101.79 MMSCF per day to 100.5 MMSCF per day in November 2017. As a result of the reduction on the flow rate, there was a 5% reduction in the total natural gas consumed at the Aboadze Power Enclave from 2,899.08 MMSCF in October 2017 to 2,752.51MMSCF in November 2017. The total natural gas consumed in the Aboadze enclave accounted for 71% of the total natural gas consumed and 45% of the total fuel consumed in November 2017. Out of the total natural gas consumed in the Aboadze enclave, TAPCO, TICO, and Ameri power plant each consumed a proportion of 15%, 53% and 32% respectively.

## HIGHLIGHTS OF THE MONTH

Figure 4a: Contribution of Gas Supply by sources

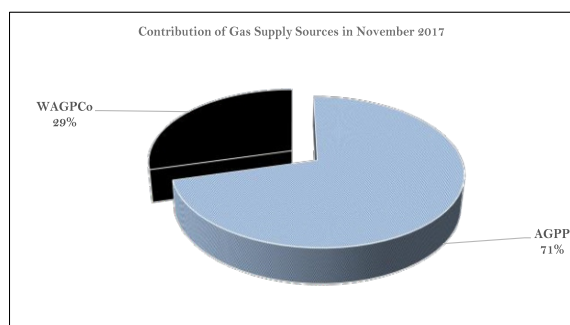
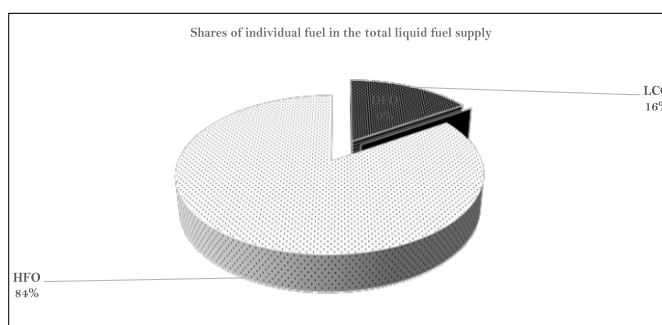


Figure 4b: Contribution of individual fuel in the liquid fuel supply



### Liquid Fuel

In November 2017, the rate of liquid fuel consumption increased by 29% from 11,140 barrels per day in October 2017 to 14,322 barrels per day. As a result of the increase in liquid fuel consumption, there was a 19.6% increase in the total liquid fuel consumed in November 2017. The total liquid fuel consumed comprises of 15.7% of LCO, 0.04% of DFO and 84.29% of HFO. Karpower consumed 50% of the total liquid fuel consumed and 61% of the total HFO consumed in November 2017.

### Plant by Plant Highlights

#### Electricity Generation at the Akosombo Generation Station (GS) decreased marginally in November 2017

The Akosombo GS recorded a reduction of 5.1% in its generation for November 2017 from a generation of 292.97 GWh in October 2017 to 278.12 GWh in November 2017. There was a reduction in generation from 9.45 GWh per day in October 2017 to 9.27 GWh per day in November 2017. Consequently, the share of electricity generated by the Akosombo GS in the total electricity supplied reduced from 23.9% in October 2017 to 22.8% in November 2017. The Akosombo GS generated 0.32% lower than the projected for November 2017 under the 2017 ESP. The Akosombo GS contributed 651 MW to both the System Peak Load and the Ghana Peak Load in November 2017. This figure represents 30.68% of the System Peak Load and 30.72% for the Ghana Peak Load.

#### Electricity supply by Kpong Generation Station (GS) decreased marginally in November 2017

In November 2017, Kpong GS generated marginally lower than in October by 5.8% from 57.97 GWh in October 2017 to 54.79 GWh. Similarly, the generation from the Kpong GS reduced marginally from 1.87 GWh per day in October 2017 to 1.83 GWh per day in November 2017, representing a deviation of 2.1%. The Kpong GS contribution to the total electricity supplied reduced from 4.7% in October 2017 to 4.5% in November 2017 and it deviated marginally from the projected generation under the 2017 ESP by 0.38%. The power plant contributed 111 MW to both the System Peak Load and the Ghana Peak Load which represent 5.23% of the System Peak Load and 5.24% of the Ghana Peak Load.

#### Electricity supply by the Bui Generation Station (GS) increased in November 2017

There was an increase in average daily generation from the Bui Power Plant from 1.39 GWh per day in October 2017 to 1.68 per day in November 2017. The Total generation from the Bui GS increased by 17% from 43.18 GWh in October 2017 to 50.51 GWh in November 2017. The Bui GS total generation for November 2017 was 26.8% lower than the 69 GWh projected under the 2017 ESP and was 4.1% of the total electricity supplied. The power plant contributed 229 MW to both the System Peak Load and the Ghana Peak Load, which represent 10.79% and 10.81% of the System Peak Load and the Ghana Peak Load respectively.

#### Generation by the Sunon Asogli Power Plant (SAPP) continued to increase in November 2017

There was an increase in generation from the Sunon Asogli Power Plant in November 2017 due to the relatively stable supply of natural gas by WAGPCo and availability of LCO. There was an increase of 14.3% in generation from 159.8GWh in October 2017 to 182.63GWh in November 2017 and an increase of 21% when compared with the projected generation under 2017 ESP. Also, there was an increase in its average daily generation by 18.25% from 5.15 GWh in October 2017 to 6.09 GWh in November 2017. Based on this generation, the SAPP made a 15% contribution to the total electricity supplied in November 2017. The SAPP made a contribution of 351.5 MW to both the System Peak Load and the Ghana Peak Load, representing 16.56% of the System peak Load and 16.59% of the Ghana Peak Load. A total of 987.98 MMSCF of natural gas was consumed by the power plant, representing 25% of the total natural gas consumed and 75,174.84 barrels of LCO was consumed to generate 182.63 GWh of electricity in November 2017. There was a reduction in the fuel efficiency for the SAPP in November 2017 from 7,605.49 Btu/kWh in October 2017 to 7,803.62 Btu/kWh.

#### CENIT Power Plant continued to be offline in November 2017

The CENIT Power Plant was offline for the whole of November 2017 due to unavailability of Light Crude Oil (LCO) to power the plant and system demands. The Power Plant was also correctly projected to be offline in November 2017 under the 2017 ESP.

#### Ameri Energy Power Plant's generation increased in November 2017

The Ameri power plant had an increase in its average daily generation from 2.3 GWh per day in October 2017 to 3.4 GWh per day in November 2017. The power plant generated a total of 102.95 GWh in November 2017 and was 44.3% higher than the 71.33 GWh it generated in October 2017. The Ameri power plant contributed 8.4% to the total electricity supplied in November 2017 and was 37.05 GWh lower than the projected generation under 2017 ESP. The Ameri power plant did not contribute to either of the System Peak Load or the Ghana Peak Load. A total of 895.91 MMSCF was consumed to generate 102.95 GWh with its fuel efficiency decreasing marginally by 0.55% to 10,103.25 Btu/kWh in November 2017 from 10,098.06 Btu/kWh in October 2017



## HIGHLIGHTS OF THE MONTH

### **Kpong Thermal Power Plant (KTPP) generation dropped significantly in November 2017**

The KTPP power plant generated as low as 0.02 GWh of electricity in November 2017 which was 99.7% lower than its generation of 7.09 GWh in October 2017. The operation of the KTPP power plant was limited due to system demand. The power plant consumed a total of 49.99 barrels of DFO with its efficiency increasing from 11,361.24 Btu/kWh in October 2017 to 11,210.33 Btu/kWh in November 2017. The power plant was projected to be offline in November 2017 as per the 2017 ESP.

### **The Karpowership Power Plant had a stable generation in November 2017**

The Karpowership generated 5.2 GWh per day in November 2017, similar to its generation in October 2017. The power plant generated 156.3 GWh which was a marginal reduction in electricity generation in the month of November 2017 by 3.05% when compared with the 161.26 GWh it generated in October 2017. The Karpowership contributed 12.8% to the total electricity supplied in November 2017. The Karpowership generate 7.8% more than the 145 GWh projected under the 2017 ESP. The power plant contributed 238.9 MW to both the System Peak Load and the Ghana Peak Load, and represents 11.26% of the System Peak Load and 11.27% of the Ghana Peak Load. A total of 215,491.24 barrels of Heavy Fuel Oil (HFO) was consumed by the power plant to generate the 156.34 GWh of electricity at a reduced fuel efficiency of 8,325.47 Btu/kWh in November 2017 compared to the 8,165.42 Btu/kWh recorded in October 2017.

### **AKSA Power Plant generation increased in November 2017**

The AKSA power plant witnessed an increase in its generation by 16.4% in November 2017 from 84.41 GWh in October 2017 to 98.23 GWh in November 2017. The average daily generation from the AKSA power plant also increased from 2.72 GWh per day in October 2017 to 3.27 GWh per day in November 2017. The generation from the power plant constituted 8.04% of the total electricity supplied in November 2017. The AKSA power plant contributed 225.7 MW to both the System Peak Load and the Ghana Peak Load in November 2017. The contribution of the power plant to both the System Peak Load and the Ghana Peak Load was 10.64% of the System Peak Load and 10.65% of the Ghana Peak Load in November 2017. In the generation of the 98.23 GWh of electricity, the power plant consumed 138,954.09 barrels of HFO with a marginal reduction of 0.2% in its fuel efficiency of 8,544.09 Btu/kWh recorded in November 2017 compared with the 8,528.41 Btu/kWh in October 2017.

### **Takoradi International Company (TICO's) generation increased marginally in November 2017**

The TICO power plant witnessed a marginal increase in its daily generation from 6.99 GWh per day in October 2017 to 7.16 GWh per day in November 2017. The power plant's total generation however reduced in November 2017 to 214.76 GWh from 216.74 GWh generated in October 2017 due to greater number of days in October than in November. The generation from the power plant constituted 17.58% of the total electricity supplied in November 2017 and 22% more than the projected 176 GWh per the 2017 ESP. The TICO power plant contributed 315 MW to both the System Peak Load and the Ghana Peak Load which was 14.84% of the System Peak Load and 14.86% of the Ghana Peak Load in November 2017. In generating the 214.76 GWh of electricity, the power plant consumed 1,454.45 MMSCF of natural gas, with an increase in fuel efficiency from the 7,337.4 Btu/kWh recorded in October 2017 to 7,272.43 Btu/kWh in November 2017.

### **Takoradi Power Company (TAPCO) Plant's generation reduced significantly in November 2017**

The TAPCO power plant had a significant reduction of 48.5% in its generation for November 2017. The power plant generated 54.91 GWh in November 2017 which was 51.8 GWh lower than the 106.71 GWh it generated in October 2017. TAPCO's share in the total electricity supplied reduced in November 2017 from the 8.7% it contributed in October 2017 to 4.5% and was 67.2% lower than the 158 GWh projected under the 2017 ESP. The power plant did not contribute to the System Peak Load and the Ghana Peak Load. A total of 402.15 MMSCF of natural gas was consumed to generate the 54.91 GWh of electricity in November 2017 with its fuel efficiency increasing from 7,989.29 Btu/kWh in October 2017 to 7,864.14 Btu/kWh in November 2017.

### **Tema Thermal 1 Power Plant (TT1PP)'s generation increased significantly in November 2017**

Low gas pressure once again limited the operation of TT1PP in the month of November 2017. The power plant generated a total of 20.92 GWh in November 2017 but was 45.3% higher than the 14.4 GWh it generated in October 2017. The power plant contributed 1.71% to the total electricity supplied in November 2017. The TT1PP generated 0.7 GWh per day in November 2017 and was marginally higher than the 0.46 GWh per day it generated in October 2017. A total of 213.49 MMSCF of natural gas was consumed to generate the 20.92 GWh at a reduced average heat rate from the 11,484.77 Btu/kWh it recorded in October 2017 to 10,613.2 Btu/kWh in November 2017. The TT1PP power plant was projected to be offline per the 2017 ESP and did not contribute to either of the System Peak Load or the Ghana Peak Load.

### **Trojan Power Plant continued to be offline in November 2017**

The Trojan Power Plants in both Tema and Kumasi have been offline since July 2017 and continued to be offline in November 2017 due to fuel supply challenges.

### **Electricity Exchange – Ghana became a net exporter of electricity in November 2017**

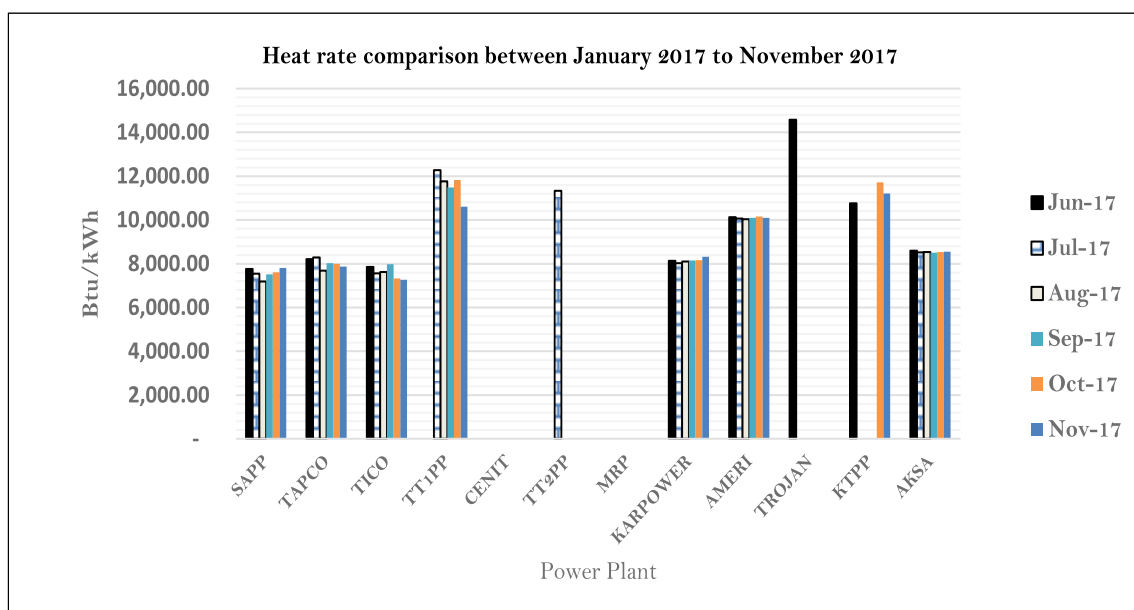
Import of electricity from La Cote D'Ivoire reduced significantly by 35.8% in November 2017 from the 11.34 GWh in October 2017 to 7.28 GWh. The daily import of electricity decreased from 0.37 GWh in October 2017 to 0.24 GWh in November 2017, representing a reduction of 35%. Also, the daily peak import recorded a maximum of 58 MW but did not contribute to both the System Peak Load and the Ghana Peak Load. The electricity imported formed 0.6% of the total electricity supplied in November 2017 and was 27.4% lower than the 10 GWh of electricity projected to be imported under the 2017 ESP.

The total electricity exported to CEB increased marginally by 5.9% in November 2017 from the 10.68 GWh recorded in October 2017 to 10.91 GWh. The total electricity exported was 85.8% lower than the 77 GWh projected under the 2017 ESP. Hence Ghana became a net exporter of electricity in November 2017, just as it was in March and April 2017.

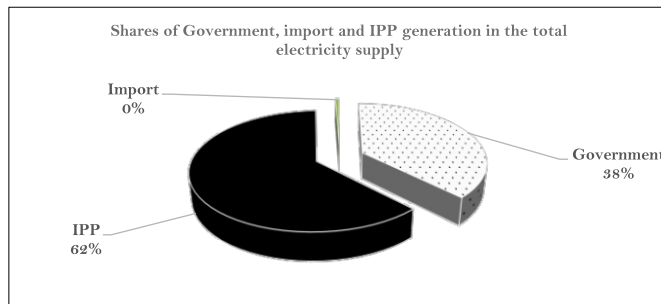
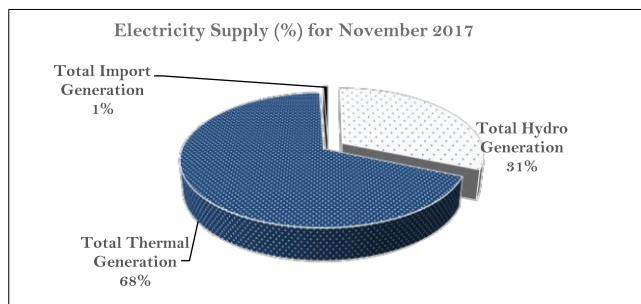
# OPERATIONAL FACT SHEET

Peak Electricity Supply - November 2017			
Source of Supply	Generation at System Peak Load of November 2017 (MW)	Generation at Ghana Peak Load of November 2017 (MW)	Electricity Supply (GWh)
AKOSOMBO	651.00	651.00	278.12
KPONG	111.00	111.00	54.79
BUI	229.00	229.00	50.51
SAPP	351.50	351.50	182.63
TAPCO	-	-	54.91
TICO	315.00	315.00	214.76
TT1PP	-	-	20.92
CENIT	-	-	-
TT2PP	-	-	-
MRP	-	-	-
KARPOWER	238.90	238.90	156.34
AMERI	-	-	102.95
KTPP	-	-	0.02
Trojan Power	-	-	-
CENPOWER	-	-	-
AKSA	225.70	225.70	98.23
IMPORT	-	-	7.28
Export	-	4.00	10.91
<b>System Coincident Peak Load</b>	<b>2,122.10</b>	-	-
<b>Ghana Coincedent Peak Load</b>	-	<b>2,118.10</b>	-
<b>Total Supply</b>	-	-	<b>1,221.45</b>
<b>Total Supply without export</b>	-	-	<b>1,210.54</b>

Ghana Electricity Demand		
		Nov-17
Maximum System Peak Load	MW	2,122.1
Minimum System Peak Load	MW	1,871.3
Average Peak Generation	MW	2,032.7
System Base Load	MW	1,044.6
Total Electricity	GWh	1,221.4
Load Factor (LF)	%	77.4



# OPERATIONAL FACT SHEET



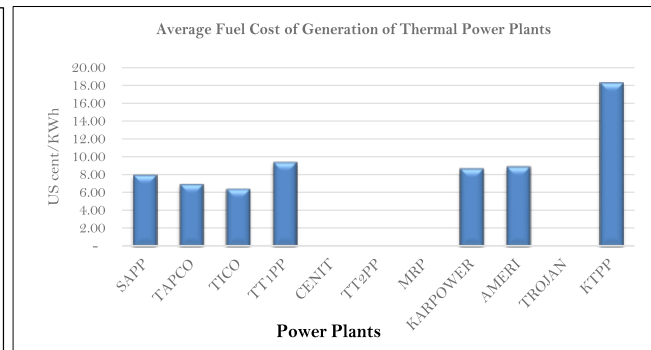
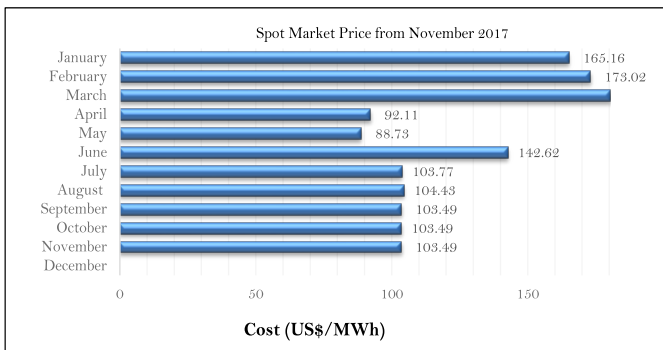
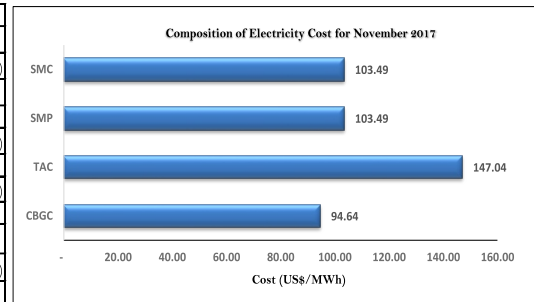
Power Plant Data for November 2017							
	Dependable Capacity (MW)	Plant Capacity Utilization (%)	Electricity Generation (GWh)	Gas Consumption (MMBtu)	LCO Consumption (MMBtu)	DFO Consumption (MMBtu)	HFO Consumption (MMBtu)
<b>Akosombo</b>	900.00	41.54	278.12	-	-	-	-
<b>Kpong</b>	140.00	52.60	54.79	-	-	-	-
<b>Bui</b>	340.00	19.97	50.51	-	-	-	-
<b>SEAP</b>	500.00	49.09	182.63	1,027,494.55	397,674.90	-	-
<b>TAPCO</b>	300.00	24.60	54.91	431,843.26	-	-	-
<b>TICO</b>	320.00	90.21	214.76	1,561,833.58	-	-	-
<b>TT1PP</b>	110.00	25.56	20.92	222,028.19	-	-	-
<b>CENIT</b>	110.00	-	-	-	-	-	-
<b>TT2PP</b>	45.00	-	-	-	-	-	-
<b>MRP</b>	70.00	-	-	-	-	-	-
<b>KARPOWER</b>	235.00	89.42	156.34	-	-	-	1,301,567.09
<b>AMERI</b>	230.00	60.16	102.95	1,040,089.12	-	-	-
<b>TROJAN</b>	56.00	-	-	-	-	-	-
<b>KTPP</b>	200.00	0.02	0.02	-	-	269.05	-
<b>AKSA</b>	230.00	57.40	98.23	-	-	-	839,282.69
<b>Total</b>	<b>3,786.00</b>	<b>43.10</b>	<b>1,214.17</b>	<b>4,283,288.70</b>	<b>397,674.90</b>		<b>1,301,567.09</b>

Location	Average Gas Flow (MMScfd) - November 2017				
	Week 1	Week 2	Week 3	Week 4	Monthly Average
<b>Etoki</b>	45.79	44.24	73.14	46.93	<b>52.15</b>
<b>Tema</b>	38.38	34.82	58.08	33.28	<b>40.62</b>
<b>Aboadze</b>	100.66	100.26	97.75	102.71	<b>100.50</b>

Hydro Dam	Water Level (ft) - November 2017				Change in water level (feet)
	Week 1	Week 2	Week 3	Week 4	
<b>Akosombo</b>	253.16	252.95	252.80	252.44	-0.72
<b>Bui</b>	578.82	578.00	577.38	576.33	-2.49

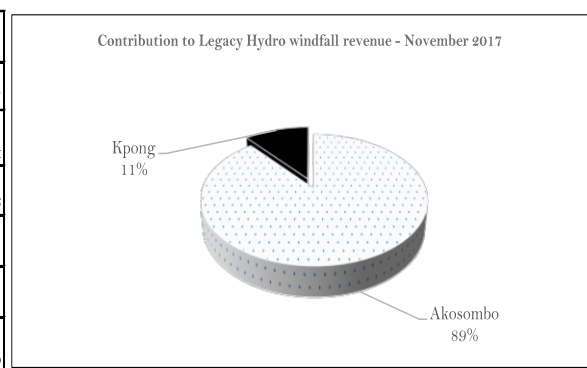
# ECONOMIC FACT SHEET

		Nov-17	Oct-17	Change
Average Market Energy Cost	US\$/MWh	96.02	95.04	0.98
Average Market Capacity Charge (AMCC)	US\$/MWh	51.02	51.47	(0.45)
Total Average Market Cost (TAC)	US\$/MWh	147.04	146.51	0.53
System Marginal Cost (SMC)	US\$/MWh	103.49	103.49	(0.00)
System Marginal Capacity Charge (SMCC)	US\$/MWh	-	-	-
Spot Market Price (SMP)	US\$/MWh	103.49	103.49	(0.00)
Composite Bulk Generation Charge (CBGC)	US\$/MWh	94.64	94.64	-
Deviation of TAC from CBGC	US\$/MWh	(52.40)	(13.78)	(38.62)
Deviation of SMP from CBGC	US\$/MWh	(8.85)	(14.32)	5.47



Nov-17				
Power Plant	Average Cost US\$/MWh	Average SMP US\$/MWh	Difference US\$/MWh	Windfall Revenue US\$/MWh
Akosombo	33.10	103.49	70.39	19,575,895.09
Kpong	59.20	103.49	44.29	2,426,252.80
<b>Total</b>	<b>92.30</b>	<b>-</b>	<b>-</b>	<b>22,002,147.89</b>

Average Fuel Prices		
Fuel Type	Unit	Nov-17 Delivered Cost
Natural Gas	US\$/MMBtu	8.86
LCO	US\$/BBL	72.71
HFO (Karpowership)	US\$/Tonne	362.83
DFO	US\$/Tonne	659.00





## Other Market News and Trends

### 1.0 Financial Sustainability of the Power Sector

#### 1.1 Ability to Recover Cost

##### 1.1.1 Electricity generation unit cost

The ability to recover the cost of the electricity generated (fixed cost and variable cost) in October 2017 and November 2017 did deviate marginally from what was recorded in the third quarter of 2017. This was as a result of an increase in Liquid Fuel consumption from 27% in September 2017 to 31% in October 2017 and 37% by November 2017. The increase in Liquid Fuel consumption ensured that the average cost of generation was above the gazetted BGT. The average cost of generation increased from GHp 41.07/kWh in September 2017 to GHp 41.85/kWh and GHp 45.43/kWh in October 2017 and November 2017 respectively. With respect to United State Dollars (US\$), the average bulk generation tariff increased from US Cents 9.29/kWh in September 2017 to US Cents 9.51/kWh in October 2017 and US Cent 10.33/kWh in November 2017.

Table 1.1.1 shows the comparison between the cost of generation of power plants for October 2017 and November 2017 with the approved BGT tariff by the PURC showing the effect of exchange rate variability on the ability to recover cost. Analysis A presents the BGT in terms of GHp which is the predominant currency for payment in the regulated market. Analysis B presents the effect of exchange rate on the BGT.

The effect of exchange rate was not really influential as the average cost of generation was higher than PURC gazetted US Cent 9.29/kWh.

The ability to recover cost was clearly not met in October 2017 to November 2017.

**Table 1.1.1 Comparison between cost of generation and PURC approved tariff for October 2017 and November 2017**

	Oct-17	Nov-17
<b>Analysis A</b>		
<b>Cost of Generation (GHp/kWh)</b>	41.85	45.43
<b>PURC CBGT (GHp/kWh)</b>	35.97	35.97
<b>Difference (GHp/kWh)</b>	-5.89	-9.46
<b>Analysis B</b>		
<b>Cost of Generation (USCent/kWh)</b>	9.51	10.33
<b>PURC CBGT (USCent/kWh)</b>	9.48	9.48
<b>Difference (USCent/kWh)</b>	-0.03	-0.85
<b>Average Monthly Exchange rate (GHS/US\$)</b>	4.40	4.40

#### 1.2 Ability to reliably meet demand

##### 1.2.1 Ratio of installed capacity to Demand and Capacity Factor

The ratio of installed capacity to demand measures the extent to which our installed capacity adequately meets demand. The ratio was found to be 2.04 for October 2017 and 2.05 in November 2017 which was marginally lower than the average for the various economic classes but compared favorably with the average for the SSA and OECD. However, Ghana's installed capacity could still meet twice of Ghana's demand in both October 2017 and November 2017.

The capacity factor of a power system measures the extent to which the supply system is being utilized. The capacity factor recorded for both October 2017 and November 2017 was 43% and 42% respectively, and was marginally higher than the average of 40% recorded for third quarter of 2017. The increase in the capacity factor was as a result of increase in demand in both October 2017 and November 2017. The capacity factor of 42% was only marginally higher than the average capacity factor for low middle income countries and lower than the 50% average for the globe, South Sahara African Countries, lower and upper middle income countries.

**Table 1.2.1 Ratio of installed capacity to demand and capacity factor for October 2017 and November 2017**

	October 2017 indicator							
	Ghana	World	SSA	OECD	High Income Non-OECD	Upper Middle Income	Lower Middle Income	Low Income
<b>Ratio Installed capacity to Demand</b>	2.04	2.6	2.2	2.3	2.5	2.4	3.1	2.9
<b>Capacity Factor</b>	0.43	0.5	0.5	0.5	0.5	0.5	0.5	0.4
	November 2017 indicator							
	Ghana	World	SSA	OECD	High Income Non-OECD	Upper Middle Income	Lower Middle Income	Low Income
<b>Ratio Installed capacity to Demand</b>	2.05	2.6	2.2	2.3	2.5	2.4	3.1	2.9
<b>Capacity Factor</b>	0.42	0.5	0.5	0.5	0.5	0.5	0.5	0.4

### 1.2.2 Reserve Margin

The reserve margin of supply system serves as an indicator in measuring the reliability of a power system. The reserve margin, especially the constrained reserve margin throws more light on the utilization of the capacity available. Constrained reserve margin takes into consideration planned maintenance, unplanned maintenance and fuel supply difficulties. That is, it considers power plants that are technically available, have fuel available and could come up online when needed within the period under study.

**Table 1.2.2 Average Constrained and unconstrained reserve margin**

	<b>Oct-17</b>	<b>Nov-17</b>
<b>Constrained Reserve margin (%)</b>	24.75	25.95
<b>Unconstrained reserve margin (%)</b>	51.10	51.30

The constrained reserve margin over the past few months has improved significantly but witnessed a marginal reduction from 28.34% in September 2017 to 24.75% in October 2017 and 25.95% in November 2017. This development could be attributed to reduced supply of natural gas to the various power enclaves. These reserve margin compares favorably with the 18% to 25% recommended by the International Energy Agency (IEA). There was however about 25% capacity unavailable due to technical and fuel supply challenges.

### 1.3 Ability to make investments

#### 1.3.1 Capacity Annual Growth and Ratio of installed Capacity growth to demand growth

The capacity annual growth indicator measures the annual growth in the installed capacity as a means of our ability to make investment in the power sector. The installed capacity grew by 23.8% between both October 2016 and October 2017 and November 2016 and November 2017. This measure is considerably higher than the average for SSA, Upper Middle Income; Lower Middle Income and Low Middle Income Countries. That is, Ghana has made substantial investment in generation capacity.

**Table 1.3.1 Capacity annual growth and Ratio of installed capacity growth to demand growth**

	October 2017 indicator					
	Ghana	SSA	High Income Non-OECD	Upper Middle Income	Lower Middle Income	Low Income
<b>Capacity annual growth (%)</b>	23.80	3.1	3.1	2.7	3.9	3.4
<b>Ratio of installed capacity growth to demand growth</b>	3.37	0.2	0.6	0.7	0.3	0.02
	November 2017 indicator					
	Ghana	SSA	High Income Non-OECD	Upper Middle Income	Lower Middle Income	Low Income
<b>Capacity annual growth (%)</b>	23.80	3.1	3.1	2.7	3.9	3.4
<b>Ratio of installed capacity growth to demand growth</b>	11.16	0.2	0.6	0.7	0.3	0.02

A high growth in capacity will not be significant if it is not able to meet the required demand. The indicator that measures the ability of the growth in capacity to meet the growth in demand is the ratio of the growth in installed capacity to growth in demand.

The ratio of installed capacity growth to meet demand growth was found to be 3.37 in October 2017 which is marginally higher than the 3.06 recorded for September 2017. The ratio for October 2017 was marginally higher than the average for the SSA, Lower Middle Income and Low Income countries but not for Upper Middle Income and High Income Non-OECD. The ratio increased to 11.16 in November 2017 and was significantly higher than all the Economic Classes of the world.

### 1.4 Ability to operate according to environmental and social norms

#### 1.4.1 Emission factor and Fossil fuel dependency

The lower supply of electricity from Hydro sources ensured an increase in thermal generation. The proportion of fossil fuel dependency grew marginally from an average of 67.2% in the third quarter of 2017 to 67.59% in October 2017 and 68.42% in November 2017. These results were significantly higher than SSA and Lower Middle Income countries.

The emission factor has been relatively constant since July 2017 to November 2017; it has been fluctuating between 0.34kgCO<sub>2</sub>/kWh and 0.35kgCO<sub>2</sub>/kWh. In October 2017, the emission factor was found to be 0.34kgCO<sub>2</sub>/kWh and 0.35kgCO<sub>2</sub>/kWh for November 2017. The emission factor for November 2017 was marginally higher than that of October 2017 due to the increase in liquid fuel consumption. The emission factor for both months is relatively lower than the average for the World, SSA and Lower Middle Income countries.

Table 1.4.1 compares Ghana's emission factor and fossil fuel dependency with indicators from economies and region of the world.

**Table 1.4.1 Emission Factor and Fossil fuel dependency for the third quarter of 2017**

	October 2017 indicator						
	Ghana	World	SSA	High Income Non-OECD	Upper Middle Income	Lower Middle Income	Low Income
Emission Factor (KgCO <sub>2</sub> /kWh)	0.33	0.6	0.5	0.9	0.7	0.5	0.3
Fossil fuel dependency (%)	69.21	60.7	45.3	84.4	66.4	59.4	40.6
	November 2017 indicator						
	Ghana	World	SSA	High Income Non-OECD	Upper Middle Income	Lower Middle Income	Low Income
Emission Factor (KgCO <sub>2</sub> /kWh)	0.35	0.6	0.5	0.9	0.7	0.5	0.3
Fossil fuel dependency (%)	68.42	60.7	45.3	84.4	66.4	59.4	40.6

## 1.4 Conclusions

Ghana continues to make significant improvement in its installed capacity and utilizing the capacity to meet demand in both October 2017 and November 2017. The ratio of installed capacity growth to demand growth increased in November 2017 to 11.16 while capacity growth remains constant for October 2017 and November 2017. Capacity factor however increased from an average of 41% in the third quarter of 2017 to 43% in October 2017 and 42% in November 2017 due to significant increase in supply. There has also been a stable emission factor between 0.33kgCO<sub>2</sub>/kWh and 0.35kgCO<sub>2</sub>/kWh in the power sector from July 2017 to November 2017 and is lower than the average of most of the economic classes. The constrained reserve margin was found to be 24.75% in October 2017 and 51.1% in November 2017 and was significantly high due to stable supply of fuel.

## 2.0 Performance Indicators of Power Plants

### 2.1 Capacity Utilization Factor (CUF)

There was a marginal reduction in the CUF for Akosombo GS and Kpong in November 2017 from 43.75% and 55.65% in October 2017 to 41.54% and 52.6% respectively. Notwithstanding the drop in CUF for the Other Hydro power plant, the CUF for Bui increased to 19.97% in November 2017 from 17.07% in October 2017.

The CUF for most of the thermal power plants increased in November 2017 except TAPCO, Karpower, TICO and KTRPP. The SAPP had an increase in its CUF from 42.96 in October 2017 to 49.09% in November 2017, and that of AKSA increased from 49.33% in October 2017 to 57.4% in November 2017. The CUF for AMERI and TT1PP increased from 41.63% and 17.6% in October 2017 to 60.16% and 25.56% in November 2017 respectively. The CUF for TAPCO reduced significantly from 47.81% in October 2017 to 24.6% in November 2017, that of TICO, Karpower, and KTRPP all had a reduction from 91.04%, 92.23% and 4.77% in October 2017 to 90.21%, 89.42% and 0.02% in November 2017 respectively.

The System Load Factor (LF) increased marginally from 77.3% in October 2017 to 77.4% in November 2017.

The Plant utilization factors of the various plants are contained in table 2.1.

**Table 2.1.1: Power Plant Capacity Utilization, Average heat rate and Average Fuel Cost of Generation**

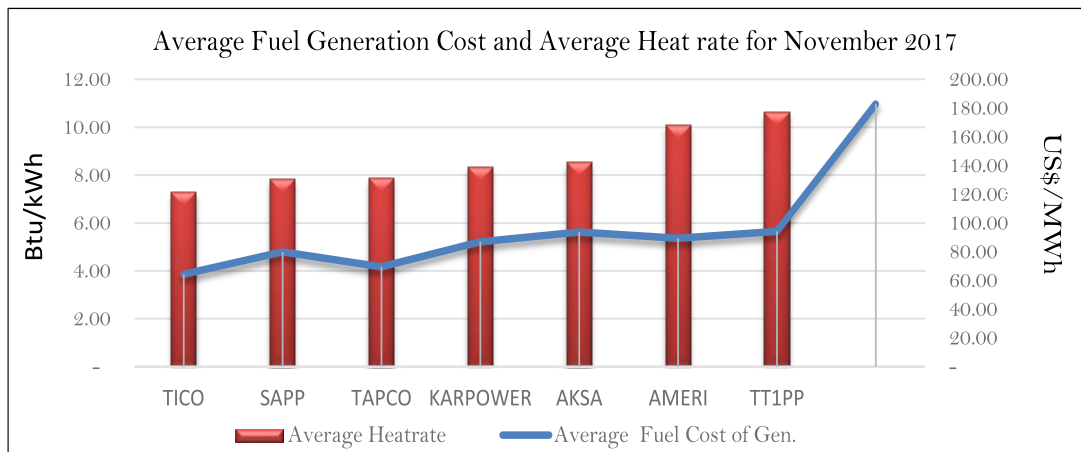
Power Plant	Capacity Utiliation (%)	Average Heatrate (Btu/KWh)	Average Fuel Cost of Generation (US\$/MWh)
Akosombo	41.54	-	-
Kpong	52.60	-	-
Bui	19.97	-	-
SAPP	49.09	7,803.62	79.84
TAPCO	24.60	7,864.14	69.52
TICO	90.21	7,272.43	64.29
TT1PP	25.56	10,613.20	94.17
CENIT	-	-	-
TT2PP	-	-	-
MRP	-	-	-
KARPOWER	89.42	8,325.47	86.99
AMERI	60.16	10,103.25	89.31
TROJAN	-	-	-
KTRPP	0.02	11,210.33	182.88
AKSA	57.40	8,544.09	93.71

## 2.2 Heat Rate (Fuel Efficiency)

The fuel efficiency of most thermal power plants increased in November 2017 except for SAPP, Karpower, and AKSA. TT1PP witnessed the greatest improvement in fuel efficiency of 10.3% in November 2017 from 11,832.56 Btu/kWh in October 2017 to 10,613.2 Btu/kWh. With respect to TAPCO, TICO, AMERI and KTRP, these power plant also had an increase in their fuel efficiency from 7,989.29 Btu/kWh, 7,3377.4 Btu/kWh, 10,159.17 Btu/kWh and 11,723.02 Btu/kWh in October 2017 to 7,864.14 Btu/kWh, 7,272.43Btu/kWh, 10,103.25 Btu/kWh and 11,210.33 Btu/kWh in November 2017 respectively. There was marginal reduction in fuel efficiencies for SAPP, Karpower and AKSA from 7,605.49Btu/kWh, 8,165.42 Btu/kWh and 8,528.41 Btu/kWh in October 2017 to 7,803.62 Btu/kWh, 8325.47 Btu/kWh and 8,544.09 Btu/kWh in November 2017 respectively. The TICO power was once again the most efficient power plant in November 2017.

Figure 2.1 shows the ranking of the thermal power plants based on their efficiency levels with their corresponding fuel cost of electricity generation. The chart indicates the effect of fuel prices on the cost of generation of the thermal power plants.

**Figure 2.1: Fuel efficiency ranking of thermal power plants with their respective fuel cost of generation.**



## 2.3 Average Fuel Cost of Electricity Generation

There was a general increase in average fuel cost of generation for thermal power plants in November 2017 when compared with that of October 2017 from US\$94/MWh to US\$ 96.02/MWh. The increase in fuel cost of generation was as a result of increase in consumption of LCO by SAPP in November 2017. The increase in the average fuel cost of generation was from US\$67.48/MWh in October 2017 to US\$79.84/MWh in November 2017 and US\$162.97/MWh in October 2017 to US\$182.88/MWh in November 2017 for SAPP and KTRP respectively. Similarly, Karpower and AKSA also had an increase in their average fuel cost of generation from US\$79.16/MWh and US\$87.1/MWh in October 2017 to US\$86.99/MWh and US\$93.71/MWh in November 2017 respectively. Contrarily, TICO, TAPCO, TT1PP and AMERI power plants had a reduction in their average fuel cost of generation from US\$64.86MWh, US\$70.63/MWh, US\$104.98/MWh, and US\$89.81/MWh in October 2017 to US\$64.29/MWh, US\$69.52/MWh, US\$94.17/MWh, and US\$89.31/MWh in November 2017 respectively.

### Acronyms

AGPP = Atuabu Gas Processing Plant	Btu = British Thermal Units
CBGC = Composite Bulk Generation Charge	CUF = Capacity Utilization Factor
DFO = Distillate Fuel Oil	EC = Energy Commission
ECG = Electricity Company of Ghana	EMOP = Electricity Market Oversight Panel
ESP = Electricity Supply Plan	FPSO = Floating Production, Storage and Offloading
GHp = Ghana Pesewa	GNGC = Ghana National Gas Company
GWh = Giga-watt Hours	HFO = Heavy Fuel Oil
KTRP = Kpone Thermal Power Plant	kWh = Kilo-watt hours
MRP = Mine Reserve Plant	LEAP = Long-range Energy Alternative Planning
LCO = Light Crude Oil	LI = Legislative Instrument
LTA = Long Term Average	MW = Megawatt
Mmscf = Million Standard Cubic Feet	MWh = Mega-watt hours
NITS = National Interconnected Transmission System	PV = Photovoltaic
SAPP = Sunon Asogli Power Plant	SMP = System Marginal Price
SNEP = Strategic National Energy Plan	TEN = Tweneboa, Enyenra, Ntomme
TT1PP = Tema Thermal 2 Power Plant	TT2PP = Tema Thermal 2 Power Plant
VRA = Volta River Authority	WAGPCo = West African Gas Pipeline Company
WAGP = West African Gas Pipeline	WEM = Wholesale Electricity Market

**For any enquiries please contact the:**  
EMOP Secretariat, Energy Commission, Accra.  
Tel: 0302 813756/7/9 E-mail: emop@energycom.gov.gh