



# GHANA WHOLESALE ELECTRICITY MARKET BULLETIN

## MARKET WATCH

### Monthly Market Data Analysis

ISSUE NO. 32

1<sup>st</sup> August 2018 to 31<sup>st</sup> August 2018

This Bulletin covers major developments in the Wholesale Electricity Market (WEM) of Ghana from 1<sup>st</sup> August, 2018 to 31<sup>st</sup> August, 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 assessment of the National Solar Rooftop programme in light of the current reduction in electricity tariffs.

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.

### OVERVIEW OF THE MONTH

The System Peak Load of 2,296 MW recorded in August 2018 was lower than the 2,342 MW projected under 2018 ESP by 46 MW. Similarly, the Ghana Peak Load of 2,160 MW recorded in August 2018 was 49 MW lower than the 2,209 MW projected under the 2018 ESP. The total electricity export during the System Peak Load was 151 MW, representing 93 MW for CEB Load and 58 MW for SONABEL Load. The total exported at the System Peak Load was 18 MW more than the 133 MW projected under the 2018 ESP.

The total electricity supply of 1,355.31 GWh recorded in August 2018 was 0.69 GWh lower than the 1,356 GWh projected under the 2018 ESP. Domestic consumption was projected to be 1,280 GWh in August 2018, but 1,288.67 GWh was recorded, representing a deviation of 8.67 GWh. The total electricity exported to CIE, CEB and SONABEL of 66.64 GWh recorded in August 2018 was 9.36 GWh lower than the 76 GWh projected under the 2018 ESP.

The water levels for the hydro dams continued to increase in August 2018. The rate of increase in the water level for the Akosombo GS increased from 0.06 feet per day in July 2018 to 0.11 feet per day in August 2018. Likewise, the rate of increase in the water level for Bui GS increased from 0.12 feet per day in July 2018 to 0.29 feet per day in August 2018.

The shares of natural gas in the total fuel consumed stood at 65.7% in August 2018 as the same figure was recorded in July 2018. The shares of liquid fuel in the total fuel mix

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

	August 2018		July 2018	
	Projected	Actual Outturn	Projected	Actual Outturn
Total Supply (GWh)	1,356.8	1,355.3	1,336.8	1,358.3
Source by Power Plants (GWh)				
AKOSOMBO	961.0	980.3	969.0	905.2
KPONG	51.0	58.9	51.0	63.8
BUI	71.0	81.2	71.0	27.2
Sunon Asogli	118.0	232.9	118.0	211.4
TAPCO	179.0	19.7	179.0	34.5
TICO	202.0	215.3	202.0	227.5
TF1PP	-	0.8	60.0	75.1
CENIT	46.0	-	46.0	-
TF2PP	-	-	-	-
MRP	-	-	-	-
Karpowership	163.0	258.5	138.0	251.6
AMERI	76.0	99.6	76.0	74.8
KTPP	65.0	75.5	-	3.2
Trojan Power	-	-	-	-
CENPOWER	108.0	5.1	108.0	3.0
ARSA	14.0	35.7	14.0	31.3
BXC Solar	2.2	2.3	2.2	2.0
VRA Solar	0.4	0.2	0.4	0.2
Genser	-	33.4	-	37.2
MEINERGY	2.2	-	2.2	-
Total Generation (GWh)	1,356.8	1,349.4	1,336.8	1,348.1
Imports (GWh)	-	5.9	-	10.2
Total Supply (GWh)	1,356.8	1,355.3	1,336.8	1,358.3
Deficit/Over supply (GWh)	-	(1.5)	-	21.5
Ghana Coincident Peak Load (MW)	2,211.0	2,159.7	2,211.0	2,242.0
System Coincident Peak Load (MW)	2,384.0	2,296.0	2,384.0	2,349.0

## HIGHLIGHTS OF THE MONTH

increased from 29.2% in July 2018 to 29.9% in August 2018. LPG consumption reduced marginally in August 2018, from 5.1% in July 2018 to 4.4%.

The consumption of liquid fuel increased marginally in August 2018, from 29.2% in July 2018 to 29.9%. This was predominantly due to increase in consumption of LCO and HFO in August 2018. The shares of LCO in the total liquid fuel consumed, increased from 2.4% in July 2018 to 4.8% in August 2018. Consequently, HFO shares reduced from 97.4% in July 2018 to 95% in August 2018.

### ELECTRICITY DEMAND AND SUPPLY

#### Electricity Demand

The System Peak Load recorded a reduction of 2.3% in August 2018, from 2,349 MW in July 2018 to 2,296 MW. The reduction in the System Peak Load was due to a decrease in domestic demand in August 2018. The System Peak Load recorded in August 2018 was 2% lower than the 2,342 MW projected under the 2018 ESP. Likewise, the Ghana Peak Load reduced by 3.7%, from 2,242 MW in July 2018 to 2,160 MW in August 2018. Electricity import contributed 24 MW to the System Peak Load but did not contribute to the Ghana Peak Load in August 2018. Export of electricity to CEB and SONABEL at the System Peak Load was 93 MW and 58 MW respectively. Electricity generation from hydro sources contributed 35.3% of the System Peak Load and 44.4% of the Ghana Peak Load in August 2018. Average electricity demand reduced from 1,826 MW in July 2018 and 1,822 MW in August 2018.

#### Electricity supply

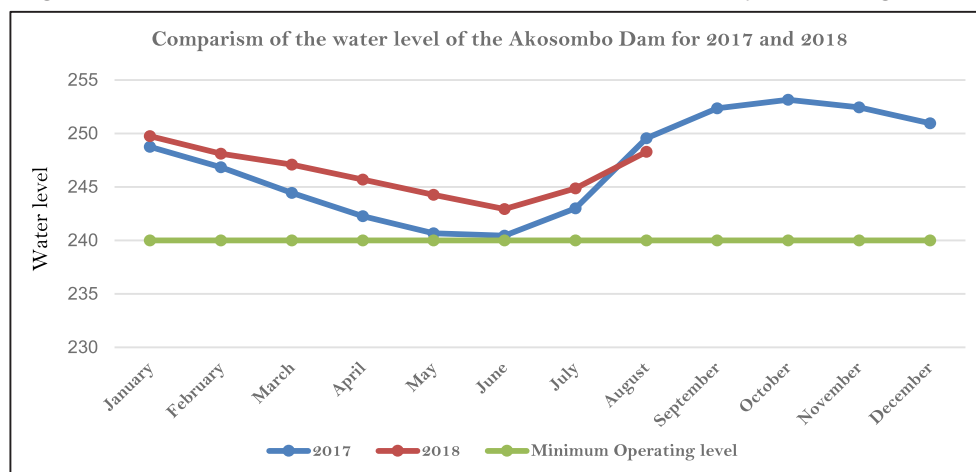
Average electricity supply reduced marginally by 0.2% in August 2018, from 43.81 GWh per day in July 2018 to 43.72 GWh per day in August 2018. A total of 1,355.31 GWh of electricity was supplied in August 2018, and was marginally lower than the 1,358.25 GWh supplied in July 2018. The total electricity supplied in August 2018 was 0.69 GWh lower than the 1,356 GWh projected under the 2018 ESP. Out of the 1,355.31 GWh of electricity supplied, 1,349.39 GWh was from domestic sources and 5.92 GWh was import from CIE. A total of 5.6 GWh, 28.16 GWh and 32.88 GWh of electricity was exported to CIE, CEB and SONABEL respectively in August 2018. Electricity generation from hydro sources, accounted for 27.3% of the total electricity supplied in August 2018.

### HYDRO DAM LEVELS

#### Akosombo Dam Water Level continued to increase in August 2018

The rate of increase in the water level of the Akosombo Dam increased significantly by 76% in August 2018, from 0.06 feet per day in July 2018 to 0.11 feet per day. This increase was due to significant inflows into the dam and reduced electricity generation from the Akosombo GS in August 2018. The water level of 244.87 feet recorded at the beginning of August 2018, increased by 3.43 feet to 248.3 feet at the end of August 2018. The month-end water level of the Akosombo Dam recorded in August 2018 was 1.27 feet lower than the water level recorded for the same period in 2017.

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



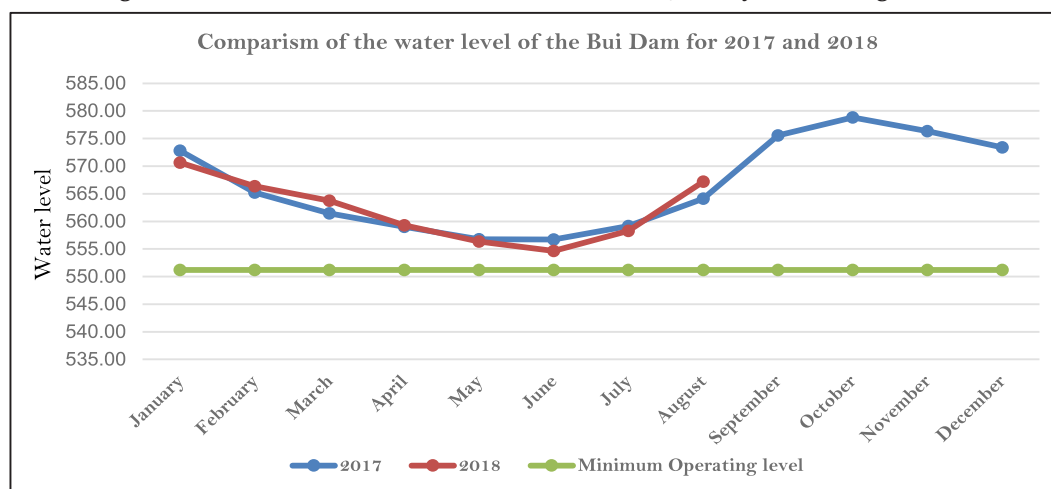
#### Bui Dam Water Level continued to increase in August 2018

The rate of increase in the water level for the Bui Dam increased significantly by over one folds, from 0.12 feet per in July 2018 to 0.29 feet per day in August 2018. The increase, in the rate of increase in the water level for the Bui Dam was due to significant inflows. The water level of 558.29 feet recorded at the beginning of August 2018, increased by 8.92 feet to 567.21 feet at the end of the month. The water level of 567.21 feet recorded at the end of August 2018, was 3.08 feet above the water level recorded for the same period in August 2017. The water level of 567.21 feet was 16.03 feet above the minimum operating level of 551.18 feet.

## HIGHLIGHTS OF THE MONTH

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

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



## FUEL SUPPLY FOR POWER GENERATION

### Natural gas flow rate from WAGPCo increased in August 2018

The natural gas flow rate from WAGP to Tema and Kpone increased from 80.02 MMSCFD in July 2018 to 83.44 MMSCFD in August 2018, by 4.3%. The increased natural gas flow rate from WAGP contributed to the increased electricity generation by SAPP and KTPP in August 2018. A total of 2,711.22 MMSCF of natural gas was consumed at Tema and Kpone in August 2018, which was 5.5% higher than the 2,570.38 MMSCF consumed in July 2018. The share of natural gas consumed from WAGP in the total natural gas consumed increased by 47.6% in July 2018 to 48.2% in August 2018 and constituted 31.7% of the total fuel mix in August 2018. Natural gas supply from WAGPCo dominated the total fuel mix in August 2018.

### Natural gas flow rate from GNGC decreased significantly in August 2018.

The natural gas flow rate from GNGC to Aboadze decreased significantly by 26.2%, from 92.73 MMSCFD in July 2018 to 68.47 MMSCFD in August 2018. A total of 2,122.54 MMSCF of natural gas was consumed from AGPP in August 2018 and was lower than the 2,594.27 MMSCF recorded in July 2018. This was predominantly due to the supply of natural gas from ENI to the Aboadze Power Enclave. Similarly, the shares of the natural gas consumed from GNGC in the total natural gas consumed reduced from 52.4% in July 2018 to 38.7% in August 2018. Natural gas supply from GNGC constituted 25.4% of the total fuel mix in August 2018 which is lower than the 34.4% recorded in July 2018.

### ENI start to supply natural gas to Aboadze Power Enclave in August 2018.

ENI started to supply natural gas to the Aboadze Power Enclave in August 2018 from the Sankofa fields, through GNPC. ENI supplied an average of 21.34 MMSCFD in August 2018. Consequently, a total of 661.44 MMSCF of natural gas was supplied by ENI to Aboadze Power Enclave. The total natural gas supplied by ENI constituted 13.1% of the total natural gas consumed in August 2018. In the total fuel mix, natural gas supply from ENI constituted 8.6%.

## Liquid Fuel

There was an increase in liquid fuel consumption in August 2018 by 5.3%, from 381,381.02 barrels in July 2018 to 401,707.22 barrels. This was due to liquid fuel consumption by TICO and increased electricity generation from Karpowership and AKSA. The shares of LCO in the total liquid fuel consumed increased from 2.4% in July 2018 to 4.8% in August 2018. The LCO consumed constituted 1.4% of the total fuel mix. The shares of HFO in the total liquid fuel consumed reduced from 97.4% in July 2018 to 95% in August 2018. Likewise, the shares of HFO in the total fuel mix reduced from 28.5% in July 2018 to 28.4% in August 2018. The shares of DFO in the total liquid fuel consumed stood at 0.2% in August 2018.

## OPERATIONAL POWER PLANTS

### Electricity Generation at the Akosombo Generation Station (GS) reduced in August 2018

The electricity generation from the Akosombo GS reduced by 8.2% in August 2018 as compared to July 2018. The average electricity generation by the power plant reduced from 9.84 GWh per day in July 2018 to 9.04 GWh per day in August 2018. Similar, the total electricity supplied by the Akosombo GS reduced from 305.17 GWh in July 2018 to 280.29 GWh in August 2018. The reduced electricity generation from the hydro power plant was as a result of increased electricity generation from thermal sources. The Akosombo GS generated 7.4% more than the 261 GWh projected under the 2018 ESP. The hydro power plant contributed 570 MW to the System Peak Load and 639 MW to the Ghana Peak Load in August 2018. This translate into 24.8% of the System Peak Load and 28% of the Ghana Peak Load.

## HIGHLIGHTS OF THE MONTH

### Electricity supply by Kpong Generation Station (GS) reduced in August 2018

There was a reduction in the electricity generation from Kpong GS by 7.7% in August 2018 as compared to July 2018. The average electricity generated by the Kpong GS reduced from 2.06 GWh per day in July 2018 to 1.9 GWh per day in August 2018. Likewise, the total electricity supplied by the power plant reduced from 63.83 GWh in July 2018 to 58.91 GWh in August 2018. The power plant generated 13.4% higher than the 51 GWh projected under the 2018 ESP. The power plant contributed 40 MW to the System Peak Load and 119 MW to the Ghana Peak Load in August 2018. This represents 1.7% of the System Peak Load and 5.2% of the Ghana Peak Load.

### Electricity supply by the Bui Generation Station (GS) increased in August 2018

The electricity generation from the Bui GS increased by 14.8% in August 2018 as compared to electricity generated in July 2018. The average electricity generated by the power plant increased from 0.88 GWh per day in July 2018 to 1.01 GWh per day in August 2018. The total electricity generation of 31.22 GWh recorded in August 2018 was 14.8% lower than the 27.19 GWh generated in July 2018. The total electricity generated by the power plant was 56% lower than the projected 71 GWh under the 2018 ESP. The Bui GS contributed 119.5 MW and 203.5 MW to the System Peak Load and the Ghana Peak Load respectively. This translates into, 8.7% of the System Peak Load and 8.9% of the Ghana Peak Load.

### Generation by the Sunon Asogli Power Plant (SAPP) increased in August 2018

There was an increase of 10.2% in the average electricity generation from SAPP in August 2018, from 6.82 GWh per day in July 2018 to 7.51 GWh per day. Likewise, the total electricity supplied by the power plant in August 2018 was also 10.2% more than the 211.39 GWh in July 2018. The total electricity of 232.9 GWh generated by the power plant constituted 17.2% of the total electricity supplied. The SAPP generated 42% more than the 164 GWh projected under the 2018 ESP. The power plant contributed 327.5 MW and 326.7 MW to the System Peak Load and the Ghana Peak Load respectively. This represents 14.3% of the System Peak Load and the Ghana Peak Load respectively. A total of 1,912.71 MMSCF of natural gas was consumed by the power plant at an estimated heat rate of 8,089.43 Btu/kWh in August 2018. The estimated heat rate of 8,089.43 Btu/kWh recorded in August 2018 was higher than the 7,976.39 Btu/kWh in July 2018.

### Ameri Energy Power Plant's generation increased in August 2018

The Ameri power plant's recorded an increase in average electricity generation by 3.2%, from 2.41 GWh per day in July 2018 to 3.21 GWh per day in August 2018. The total electricity generated by the power plant increased from 74.81 GWh in July 2018 to 99.64 GWh in August 2018. The Ameri power plant contributed 7.4% of the total electricity supplied in August 2018. The power plant generated 31.1% more than the 76 GWh projected under the 2018 ESP. Ameri contributed 150.4 MW to the System Peak Load, representing 3.2% of the load served at peak. The power plant contributed 173.2 MW to the Ghana Peak Load, representing 7.6% of the total load served at peak. A total of 988.8 MMSCF of natural gas was consumed by the Ameri power plant, at an estimated heat rate of 10,211.2 Btu/kWh. The heat rate recorded in August 2018 was higher than the 10,102.09 Btu/kWh in July 2018.

### Kpone Thermal Power Plant's (KTPP) generation increased significantly in August 2018

Average electricity generation from KTPP increased significantly also from 0.1 GWh per day in July 2018 to 2.44 GWh per day in August 2018. The total electricity generated by KTPP increased significantly in August 2018, from 3.21 GWh in July 2018 to 75.49 GWh. The total electricity supplied by the power plant constituted 5.6% of the total electricity supplied. The 75.49 GWh generated by KTPP in August 2018 was 19.8% more than the 63 GWh projected under the 2018 ESP. KTPP contributed 105 MW to both the System Peak Load and the Ghana Peak Load, representing 4.6% of the System Peak Load and the Ghana Peak Load respectively. The power plant consumed a total of 789.16 MMSCF of natural gas at an estimated heat rate of 10,237.23 Btu/kWh in August 2018. The 10,237.23 Btu/kWh recorded was lower than the 10,464.1 Btu/kWh in July 2018.

### The Karpowership Power Plant's generation increased in August 2018

Electricity generation from the Karpowership increased marginally by 2.7% in August 2018. The average electricity generated by the power plant increased from 8.12 GWh per day in July 2018 to 8.34 GWh per day in August 2018. Similarly, the total electricity generated by the power plant increased from 251.58 GWh in July 2018 to 258.47 GWh in August 2018. This constituted 19% of the total electricity supplied in August 2018. The Karpowership power barge generated 58.6% more than the 163 GWh projected under the 2018 ESP. The power barge contributed 456.6 MW to the System Peak Load and 407.8 MW to the Ghana Peak Load, representing 19.9% of the System Peak Load and 17.9% of the Ghana Peak Load respectively. The power plant consumed a total of 347,140.74 barrels of HFO, at an estimated heat rate of 8,125.61 Btu/kWh. The heat rate of 8,125.61 Btu/kWh recorded in August 2018 was marginally lower than the 8,135.65 Btu/kWh in July 2018.

### AKSA Power Plant's generation increased in August 2018

Average electricity generation from the thermal power plant increased by 14%, from 1.01 GWh per day in July 2018 to 1.15 GWh per day in August 2018. Likewise, the total electricity supplied by the power plant increased from 31.29 GWh in July 2018 to 35.66 GWh in August 2018. The total electricity generated by the power plant constituted 2.6% of the total electricity supplied in August 2018. The AKSA power plant generated over a fold more than the 14 GWh projected under the 2018 ESP. The power plant contributed 92.7 MW to the System Peak and 37 MW to the Ghana Peak Load, representing 4% of the System Peak Load and 1.6% of the Ghana Peak Load. A total of 48,147.79 barrels of HFO was consumed by the power plant at an estimated heat rate of 8,169.67 Btu/kWh in August 2018. The heat rate recorded in August 2018 was marginally higher than the 8,188.44 Btu/kWh in July 2018.

### Takoradi International Company (TICO) generation decreased in August 2018

TICO recorded a reduction in its electricity generation in August 2018 by 5.4%. The average electricity generation reduced from 7.34 GWh per day in July 2018 to 6.94 GWh per day in August 2018. Consequently, the total electricity generation from the thermal power plant reduced from 227.49 GWh in July 2018 to 215.27 GWh in August 2018. The total electricity generated by TICO, contributed 15.9% of the total electricity supplied in August 2018. TICO's total electricity generation was 6.6% more than the 202 GWh projected under the 2018 ESP. The power plant's contribution to the System Peak Load and the Ghana Peak Load were 330 MW and 162 MW respectively. This represents 14.3% and 7.1% of the System Peak Load and the Ghana Peak Load respectively.

## HIGHLIGHTS OF THE MONTH

The power plant consumed a total of 1,590.86 MMSCF of natural gas, 5,261.87 barrels of LCO and 21.86 barrels of DFO, at an increased heat rate of 7,733.6 Btu/kWh in August 2018 when compared to the 7,304.03 Btu/kWh recorded in July 2018.

### **Takoradi Power Company (TAPCO) Plant's generation decreased in August 2018**

TAPCO power plant operated for eleven days in August 2018, due to fuel supply constraints and routine maintenance on its gas turbines. The power plants average electricity generation increased 61.2%, from 1.11 GWh per day in July 2018 to 0.64 GWh per day in August 2018. On the contrary, the total electricity generated by the power plant reduced by 42.9%, from 34.54 GWh in July 2018 to 19.73 GWh in August 2018. The total electricity generated by the power plant constituted 1.5% of the total supply and was 89% lower than the 179 GWh projected under the 2018 ESP. The power plant did not contribute to the System Peak Load but contributed 109 MW to the Ghana Peak Load. This represents 4.8% of the Ghana Peak Load. A total of 204.32 MMSCF of natural gas was consumed by the power plant at an estimated heat rate of 10,655.33 Btu/kWh. The heat rate recorded in August 2018 was higher than the 10,575.46 Btu/kWh recorded in July 2018.

### **Tema Thermal 1 Power Plant's (TT1PP) decreased in August 2018**

TT1PP came back for a day and was shutdown to make natural gas available for KTRP in August 2018. The power plant supplied a total of 0.84 GWh in August 2018. A total of 9.35 MMSCF of natural gas was consumed at an estimated heat rate of 10,964.71 Btu/kWh in August 2018. The power plant was projected to be offline under the 2018 ESP.

## **Embedded Generation**

### **Genser Power Plant's generation decreased in August 2018**

The average electricity generation from Genser power plant reduced by 10%, from 1.2 GWh per day in July 2018 to 1.08 GWh per day in August 2018. A total of 33.38 GWh of electricity was supplied by the power plant in August 2018 and was 10.2% lower than the 37.17 GWh supplied in July 2018. The power plant consumed a total of 8,682.36 tonnes of LPG, at an improved heat rate of 11,094.01 Btu/kWh when compared to the 11,106.54 Btu/kWh recorded in July 2018.

### **BXC Solar generation increased in August 2018**

The BXC solar power plant recorded an 11.6% increase in the electricity supplied in August 2018. Average electricity supply increased from 0.065 GWh per day in July 2018 to 0.072 GWh per in August 2018. Correspondingly, the total electricity supplied by the power plant increased from 2.02 GWh in July 2018 to 2.26 GWh in August 2018. The solar power plant generated 2.7% more than the 2.2 GWh projected under the 2018 ESP.

### **VRA Navrongo Solar generation decreased in August 2018**

The VRA Navrongo solar power plant recorded a 4.8% reduction in its electricity generation in August 2018. The total electricity generation by the solar power plant reduced from 0.21 GWh in July 2018 to 0.2 GWh in August 2018. The solar power plant generated 50% lower than the 0.4 GWh projected under the 2018 ESP.

## **Electricity Exchange – Imports decreased significantly while Exports increased in August 2018**

Average electricity import from La Cote D'Ivoire reduced significantly by 41.9% in August 2018, from 0.33 GWh per day in July 2018 to 0.19 GWh per day. Likewise, the total electricity imported reduced from 10.19 GWh in July 2018 to 5.92 GWh in August 2018. This was predominantly due to increased electricity generation from domestic sources. The total electricity import constituted 0.4% of the total electricity supplied in August 2018. Electricity import contributed 24 MW to the System Peak Load, representing 1.1% of the System Peak Load. Electricity import did not contribute to the Ghana Peak Load.

Average electricity export to CIE, CEB and SONABEL increased in August 2018 by 34.6%, 3.8% and 24.3% respectively. The average electricity exported to CIE, CEB and SONABEL increased from 0.13 GWh per day, 0.88 GWh per day and 0.85 GWh per in July 2018 to 0.18 GWh per day, 0.91 GWh per day and 1.06 GWh per day in August 2018 respectively. Consequently, the total electricity exported to CIE, CEB and SONABEL increased from 4.16 GWh, 27.13 GWh, and 26.46 GWh in July 2018 to 5.6 GWh, 28.16 GWh and 32.88 GWh in August 2018 respectively.

Ghana continues to be a net exporter of electricity in August 2018.

# OPERATIONAL FACT SHEET

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

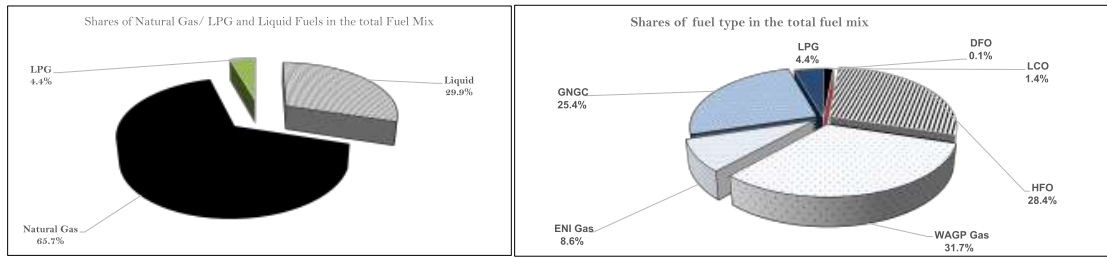


Figure 4a: Contribution of Natural Gas Supply by sources

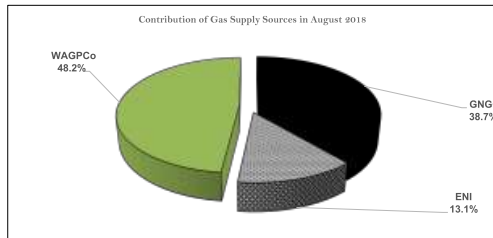
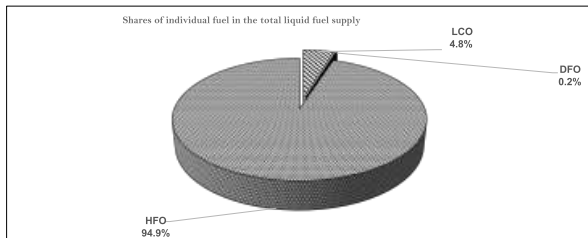


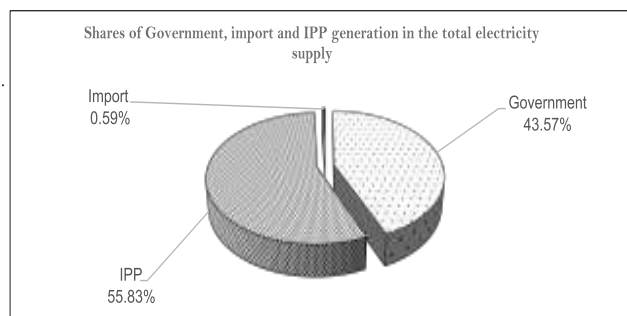
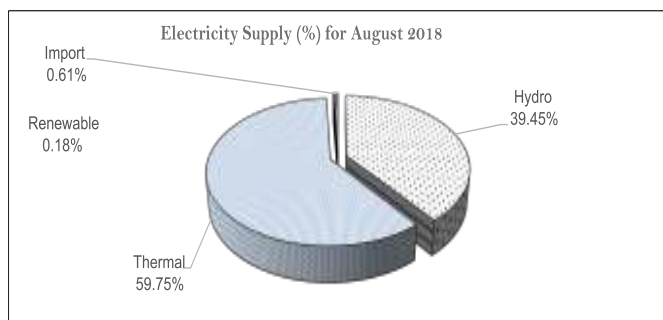
Figure 4b: Contribution of individual fuel in the liquid fuel supply



Peak Electricity Supply - August 2018			
Source of Supply	Generation at System Peak Load of May 2018 (MW)	Generation at Ghana Peak Load of May 2018 (MW)	Electricity Supply (GWh)
AKOSOMBO	570.30	638.50	280.29
KPONG	40.00	119.00	58.91
BUI	199.50	203.50	31.22
SAPP	327.50	326.70	232.90
TAPCO	-	109.00	19.73
TICO	330.00	162.00	215.27
TT1PP	-	-	0.84
CENIT	-	-	-
TT2PP	-	-	-
MRP	-	-	-
KARPOWER	456.60	407.80	258.47
AMERI	150.40	173.20	99.64
KTPP	105.00	105.00	75.49
Trojan Power	-	-	-
CENPOWER	-	-	5.13
AKSA	92.70	37.00	35.66
BXC Solar	-	-	2.27
Safisana	-	-	-
VRA Solar	-	-	0.20
Genser	-	-	33.38
IMPORT	24.00	-	5.92
Export to CEB	-	16.00	28.16
Export to CIE	93.00	42.00	5.60
Export to SONABEL	58.00	64.00	32.88
System Coincident Peak Load	<b>2,296.00</b>	-	-
Ghana Coincident Peak Load	2,296.00	<b>2,223.70</b>	-
Total Supply	2,145.00	-	<b>1,355.32</b>
Total Supply without export	-	-	<b>1,321.56</b>

Ghana Electricity Demand & Supply		
		Aug-18
Maximum System Peak Load	MW	<b>2,296.0</b>
Minimum System Peak Load	MW	<b>2,056.6</b>
Average Peak Generation	MW	<b>2,184.8</b>
System Base Load	MW	<b>1,376.5</b>
Total Electricity	GWh	<b>1,355.3</b>
Load Factor (LF)	%	<b>77.2</b>

# OPERATIONAL FACT SHEET



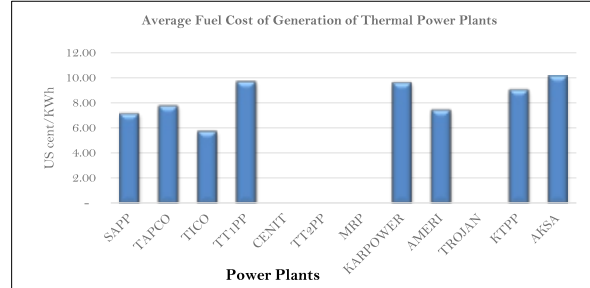
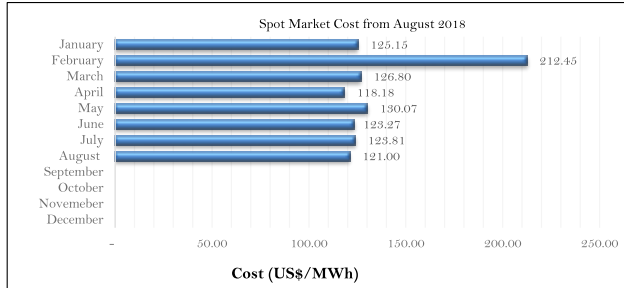
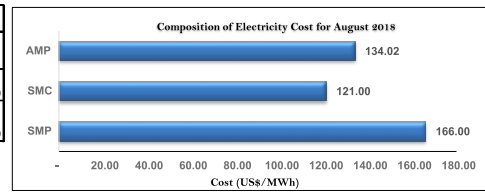
Power Plant Data for August 2018								
	Installed Capacity (MW)	Plant Capacity Utilization (%)	Heat Rate (Btu/kWh)	Natural Gas Consumption (MMBtu)	LCO Consumption (MMBtu)	DFO Consumption (MMBtu)	HFO Consumption (MMBtu)	LPG Consumption (MMBtu)
Akosombo	1,020.00	36.94	-	-	-	-	-	-
Kpong	160.00	49.49	-	-	-	-	-	-
Bui	400.00	10.49	-	-	-	-	-	-
SEAP	560.00	55.90	8,089.43	1,884,019.25	-	-	-	-
TAPCO	330.00	8.04	10,655.33	210,240.28	-	-	-	-
TICO	340.00	85.10	7,734.88	1,636,991.79	27,998.99	117.62	-	-
TT1PP	126.00	0.90	10,964.71	9,210.36	-	-	-	-
CENIT	126.00	-	-	-	-	-	-	-
TT2PP	49.50	-	-	-	-	-	-	-
MRP	-	-	-	-	-	-	-	-
KARPOWER	470.00	73.92	8,125.61	-	-	-	2,100,201.45	-
AMERI	250.00	53.57	10,211.20	1,017,474.64	-	-	-	-
TROJAN	56.00	-	-	-	-	-	-	-
Cenpower	0.00	-	-	-	93,060.86	6,094.77	-	-
KTPP	220.00	46.12	10,237.23	772,855.23	-	-	-	-
AKSA	320.00	14.98	8,169.67	-	-	-	291,294.15	-
Genser	95.00	47.23	11,094.01	-	-	-	-	370,318.19
<b>Total</b>	<b>4,522.50</b>	<b>40.03</b>		<b>5,530,791.54</b>	<b>121,059.85</b>	<b>6,212.39</b>	<b>2,391,495.60</b>	<b>370,318.19</b>

Natural gas flow rate (MMSCF/D)	
Location	Monthly Average
Etoki	88.93
Tema WAGPCo	83.44
Aboadze WAGPCo	0.00
Aboadze GNGC	94.26

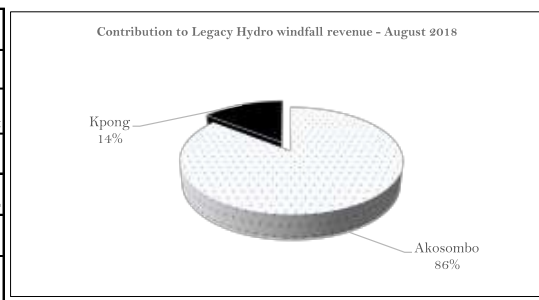
Aug-18			
	Beginning month (ft)	End month (ft)	Change in water level (feet)
Hydro Dam			
Akosombo	244.87	248.3	3.43
Bui	558.29	567.21	8.92

# ECONOMIC FACT SHEET

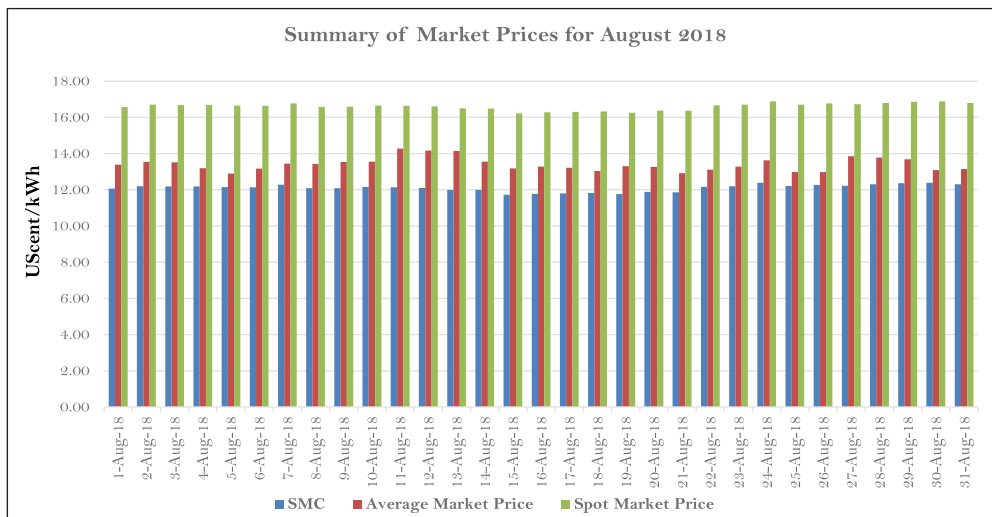
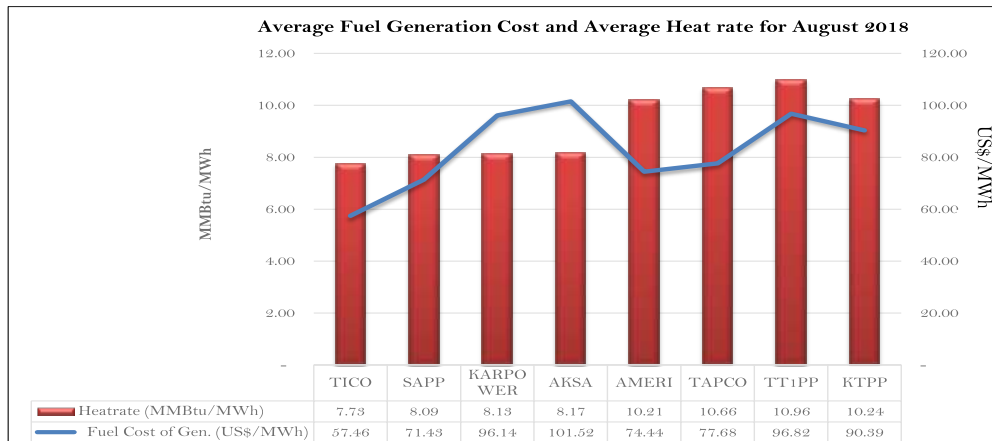
		Aug-18	Jul-18	Change
Average Market Price	US\$/MWh	134.02	123.55	10.46
System Marginal Cost (SMC)	US\$/MWh	121.00	123.27	(2.27)
System Marginal Price (SMP)	US\$/MWh	166.00	168.27	(2.27)



Average Fuel Prices		
		Aug-18
Fuel Type	Unit	Delivered Cost
Natural Gas	US\$/MMBtu	8.11
LCO	US\$/BBL	82.44
HFO	US\$/Tonne	426.42
DFO	US\$/Tonne	791.65



FUEL PRICES (US\$/MMBTU)			
	Natural Gas	HFO	LCO
August 2018	8.1	11.94	15.58





### 1.0 Assessment of the National Solar Rooftop programme in light of the current reduction in electricity tariffs.

The object of the Renewable Energy Act, 2011 Act 832 is to provide for the development, management and utilization of renewable energy sources for the production of heat and power in an efficient and environmentally sustainable manner. This objective encompasses the development of framework to support the development and utilization of renewable energy sources, create the enabling environment to attract investment in renewable energy sources, promote the use of renewable energy sources, diversification of supplies to safeguard energy security, improve access to electricity through the use of renewable sources and build the capacity of indigenous persons in technology for renewable energy sources.

The Energy Commission, which is a regulatory institution, is mandated to implement the provisions of the Renewable Energy Act, 2011 Act 832. One initiative undertaken by the Energy Commission to implement the provisions of the Act, especially section 2 (a), is the National Rooftop Solar Programme (NRSP). The programme was intended to install 200,000 solar Photovoltaic (PV) systems on rooftops in Ghana. The programme commenced in 2016 with a Capital Subsidy Scheme (CSS) by supplying the requisite solar panels after the beneficiary has purchased and installed the requisite Balance of System (BoS) components. Since the inception of the programme, a total of 1,045 systems has been installed at a total installed capacity of 522.5 kW.

In 2016, the Electricity Market Oversight Panel (EMOP) Secretariat published in its 5th edition of the Ghana Wholesale Electricity Market Bulletin (May 2016 edition) an article entitled 'Current regulated electricity tariffs boosts prospects for the National Rooftop Solar Project (NRSP)' compared the solar rooftop system cost to the published Public Utility Regulatory Commission (PURC) tariff (December 2015 gazetted tariffs). The comparison observed that for customers in the 1st Tier (life line customers), solar rooftop system would not be appropriate if we considered the cost of the system compared to the cost of grid electricity. The other tiers of consumption had gains if the solar rooftop system were installed.

Tables 1.1 and table 1.2 shows the solar rooftop comparison with the 2015 gazetted tariffs

**Table 1.1 Potential Savings for residential Customers with solar PV with batteries**

<b>Potential Savings for residential Customers with solar PV with batteries</b>				
<b>Tariff Category</b>	<b>Tariff Band (kWh)</b>	<b>PURC Approved Rates (UScent/kWh)</b>	<b>Solar PV with batteries (UScent/kWh)</b>	<b>Savings (UScent/kWh)</b>
1st Tier	0-50	8.67	22.41	-13.74
2nd Tier	51-300	17.40	22.41	-5.01
3rd Tier	301-600	22.58	22.41	0.17
4th Tier	600+	25.09	22.41	2.68

**Table 1.2 Potential Savings for residential Customers with solar PV without batteries**

<b>Potential Savings for residential Customers with solar PV without batteries</b>				
<b>Tariff Category</b>	<b>Tariff Band (kWh)</b>	<b>PURC Approved Rates (UScent/kWh)</b>	<b>Solar PV without batteries (UScent/kWh)</b>	<b>Savings (UScent/kWh)</b>
1st Tier	0-50	8.67	16.30	-7.63
2nd Tier	51-300	17.40	16.30	1.10
3rd Tier	301-600	22.58	16.30	6.28
4th Tier	600+	25.09	16.30	8.79

In the wake of the current reduced tariff in March 2018 PURC gazette tariffs and the changing prices of the Balance of System (BoS) and installation cost, there is the need to assess if there is still a prospect for solar rooftops system even in the wake of the NRSP. The analysis is broken into four segments; price comparison without battery and without EC subsidies, price comparison with battery, price comparison without battery and with EC subsidies and price comparison without battery and with EC subsidies.

Table 1.3 and table 1.4 shows the comparison of solar rooftop to the 2018 gazetted tariff without EC subsidies

**Tab 1.3 Potential Savings for residential Customers with solar PV with batteries and without EC subsidies**

<b>Potential Savings for residential Customers with solar PV with batteries</b>				
Tariff Category	Tariff Band (kWh)	PURC Approved Rates (US cent/kWh)	Solar PV with batteries (US cent/kWh)	Savings (US cent/kWh)
1st Tier	0-50	6.25	24.35	-18.10
2nd Tier	51-300	12.54	24.35	-11.81
3rd Tier	301-600	16.27	24.35	-8.08
4th Tier	600+	18.08	24.35	-6.27

**Tab 1.4 Potential Savings for residential Customers with solar PV without batteries and without EC subsidies**

<b>Potential Savings for residential Customers with solar PV without batteries and without EC subsidies</b>				
Tariff Category	Tariff Band (kWh)	PURC Approved Rates (US cent/kWh)	Solar PV without batteries (US cent/kWh)	Savings (UScent/kWh)
1st Tier	0-50	6.25	18.11	-11.86
2nd Tier	51-300	12.54	18.11	-5.57
3rd Tier	301-600	16.27	18.11	-1.84
4th Tier	600+	18.08	18.11	-0.03

The current reduction in electricity tariff has made solar rooftop Levelized Cost of Energy (LCOE) more expensive than grid electricity. On an average, it will cost US cent/kWh 11.1 more than the grid electricity for solar rooftop system with batteries and UScent/kWh 4.8 more for solar rooftop system without batteries.

Now, assuming the Energy Commission subsidies, that is, the Energy Commission paying for two (2) 250 W panel, what will be the cost savings?

Table 1.5 and table 1.6 shows the comparism of solar rooftop to the 2018 gazetted tariff with EC subsidies

**Tab 1.5 Potential Savings for residential Customers with solar PV with batteries and with EC subsidies**

<b>Potential Savings for residential Customers with solar PV with batteries and with EC subsidies</b>				
Tariff Category	Tariff Band (kWh)	PURC Approved Rates (UScent/kWh)	Solar PV with batteries (UScent/kWh)	Savings (UScent/kWh)
1st Tier	0-50	6.25	19.06	-12.82
2nd Tier	51-300	12.54	19.06	-6.53
3rd Tier	301-600	16.27	19.06	-2.79
4th Tier	600+	18.08	19.06	-0.98

**Tab 1.6 Potential Savings for residential Customers with solar PV without batteries and with EC subsidies**

<b>Potential Savings for residential Customers with solar PV without batteries and with EC subsidies</b>				
Tariff Category	Tariff Band (kWh)	PURC Approved Rates (UScent/kWh)	Solar PV without batteries (UScent/kWh)	Savings (UScent/kWh)
1st Tier	0-50	6.25	12.82	-6.57
2nd Tier	51-300	12.54	12.82	-0.29
3rd Tier	301-600	16.27	12.82	3.45
4th Tier	600+	18.08	12.82	5.26

The Energy Commission's subsidies will help in reduce the cost of solar rooftop. Despite the reduced cost, solar rooftop with batteries would still not produce any cost savings but will improve the reliability of the system. Cost savings would be realized if the solar rooftop system has no battery banks for tier 3 and tier 4 consumers. A cost saving of UScent/kWh 3.45 for tier 3 consumers and UScent/kWh 5.26 for tier 4 consumers would be realized.

The reduction in the tariff has greatly affected the viability of solar rooftop. The current tariff does not boost the exploit of solar rooftop. It will cost more for households to install solar rooftop than in using grid electricity. Even with the Energy Commission subsidies, solar rooftop with battery banks will cost more than grid electricity. The only solar rooftop system that produces cost savings are those systems with no battery banks and receives subsidies from the Energy Commission. The current PURC gazette tariff does not therefore boost the prospect of residential solar rooftop without the capital subsidies of the Energy Commission.

### 2.0 Dominance of Natural Gas in the fuel mix a boost to the Power Sector

Thermal generating capacity has increased significantly over the years from 27% in the year 2000 to 61% in 2017 and 64% in 2018 in the total installed capacity of Ghana. This increase in thermal capacity has resulted in the increase in fossil fuel consumption. Fossil fuel consumed in Ghana for power generation include; Light Crude Oil (LCO), Natural Gas (NG), Distillate Fuel Oil (DFO), Heavy Fuel Oil (HFO) and Liquefied Petroleum Gas (LPG).

Natural Gas has gradually become an integral fuel supply in power projection in Ghana since the commencement of supply from the West African Gas Pipeline (WAGP) in 2010, Ghana National Gas Company (GNGC) in 2015 and Ghana National Petroleum Company (GNPC) in August 2018. In 2017, natural gas consumption accounted for 54.6% of the total fuel consumption with liquid fuel accounting for the rest. Of the total liquid fuel consumed, HFO accounted for 62.9% and LCO accounted for 30.4%.

Natural gas consumption in the total fuel consumed has increased to an average 57% in the first 8 months of 2018. Apart from February 2018 when there was a shutdown of the FPSO Kwame Nkrumah for Turret remediation works, the shares of natural in the total fuel consumed averaged 59% of the total fuel consumed in those months. In the first 8 months of 2018, a total of 31,722 MMSCF of natural gas was consumed for electricity generation compared to a total of 36,488 MMSCF in the whole of 2017.

The dominance of natural gas in the total fuel mix is very beneficial to the power sector because of its technical, economic and environmental benefits. Technically, power plants operating on natural gas has less routine maintenance than Liquid fuel therefore increasing the reliability and availability of the power plant. Economically, prices of natural gas in Ghana are relatively stable than liquid fuels and will help make electricity prices more stable and predictable for off-takers. Natural gas prices in Ghana are relatively cheaper than the price of liquid fuels, like LCO and HFO. Average natural gas prices is about US\$ 8.8/MMBtu, while HFO and LCO prices averaged about US\$11.97/MMBtu and US\$15.26/MMBtu respectively for the first 8 months of 2018. Environmentally, natural gas has less negative effect on the environment than liquid fuels. Natural gas emits 50% to 60% less CO<sub>2</sub> than liquid fuels and produces negligible amounts of sulfur, mercury, and particulates. Burning natural gas does produce nitrogen oxides (NO), which are precursors to smoke.

Natural gas also provides the Power Sector of Ghana a certain degree of fuel supply security with indigenous natural gas supply accounting for an average of 55% of the total natural gas consumed and 35% of the total fuel consumption in the first 8 months of 2018. The shares of natural gas consumption is projected to increase to above 60% in 2019 with Karpowership operating on natural gas and Cenpower plant beginning commercial operation on natural gas.

With the immense importance of natural gas to the Power Sector and Ghana, there is the need for government to continue to prioritize natural gas consumption in the Power Sector and provide the needed support in achieving it.

### 3.0 Capacity Utilization Factor (CUF)

Aug-18			
Power Plant	Capacity Utilization (%)	Average Heat rate (Btu/KWh)	Average Fuel Cost of Generation (US\$/MWh)
<b>Akosombo</b>	36.94	-	-
<b>Kpong</b>	49.49	-	-
<b>Bui</b>	10.49	-	-
<b>SAPP</b>	55.90	8,089.43	71.43
<b>TAPCO</b>	8.04	10,655.33	77.68
<b>TICO</b>	85.10	7,734.88	57.46
<b>TT1PP</b>	0.90	10,964.71	96.82
<b>CENIT</b>	-	-	-
<b>TT2PP</b>	-	-	-
<b>MRP</b>	-	-	-
<b>KARPOWER</b>	73.92	8,125.61	96.14
<b>AMERI</b>	53.57	10,211.20	74.44
<b>TROJAN</b>	-	-	-
<b>KTPP</b>	46.12	10,237.23	90.39
<b>AKSA</b>	14.98	8,169.67	101.52
<b>Genser</b>	47.23	11,094.01	-

There was a general reduction in the Capacity Utilization Factor for most of the power plants in August 2018 due to a reduction in electricity generation. The CUF of Akosombo GS reduced from 40.2% in July 2018 to 36.9% in August 2018. Also, the CUF of Kpong reduced from 53.6% in July 2018 to 49.5% in August 2018. On the contrary, the CUF of Bui GS increased from 9.14% in July 2018 to 10.5% in August 2018. The CUF of TAPCO and TICO decreased from 14.1% and 89.9% in July 2018 to 8% and 85.1% in August 2018 respectively. Similarly, the Capacity Utilization Factor for TT1PP and Genser reduced from 80.2% and 52.3% in July 2018 to 0.9% and 47.2% in August 2018. Contrarily, the CUF of Karpowership and AMERI increased from 71.9% and 40.2% in July 2018 to 73.9% and 53.6% in August 2018. Similarly, the CUF of SAPP and KTPP and AKSA increased from 50.7%, 2% and 13.1% in July 2018 to 55.9%, 46.1% and 15% in August 2018 respectively.

#### 4.0 Fuel Efficiency

The fuel efficiency for most of the thermal power plant reduced marginally in August 2018 when compared with the fuel efficiencies recorded in July 2018. The fuel efficiency of SAPP and TAPCO reduced from 42.8% and 32.3% in July 2018 to 42.2% and 32% in August 2018 respectively. Similarly, the fuel efficiency of TICO, TT1PP and AMERI reduced from 46.7%, 31.6% and 33.8% in July 2018 to 44.1%, 31.1% and 33.4% in August 2018 respectively. On the contrary, the fuel efficiency of Karpowership and KTPP increased from 41.9% and 32.6% in July 2018 to 42% and 33.3% in August 2018 respectively. Likewise, the fuel efficiency of AKSA and Genser increased from 41.7% and 30.7% in July 2018 to 41.8% and 30.8% in August 2018 respectively.

#### Acronyms

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