



GHANA WHOLESAL ELEC TRICIT Y MARKET BULLETIN

MARKET WATCH

Monthly Market Data Analysis

ISSUE NO. 44

1st September 2019 to 30th September 2019

This Bulletin covers major developments in the Wholesale Electricity Market (WEM) of Ghana from 1st September, 2019 to 30th September, 2019. 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 the impact of the relocation of the Karpowership on electricity supply and natural gas demand.

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

The System Peak Load recorded a marginal decline from 2,503.2 MW in August 2019 to 2,457.3 MW in September 2019. The marginal decline was 1.8% of the System Peak Load recorded in August 2019. On the contrary, the Ghana Peak Load recorded in September 2019 was 2% higher than the 2,271.5 MW recorded in August 2019. At the System Peak Load for September 2019, there were no import from CIE. A total of 206 MW was exported to CIE, CEB, and SONABEL which was 37% higher than the 150 MW projected in the 2019 ESP. Average electricity demand of 1,955.63 MW in September 2019 was 1.5% higher than the 1,926.94 MW projected in the 2019 ESP.

A total of 1,408.05 GWh of electricity was supplied in September 2019, which was 0.8% higher than the 1,396.3 GWh projected in the 2019 ESP. Out of the total electricity supplied, 17.3 GWh was imported from CIE with the remaining 1,390.75 GWh generated from domestic sources. A total of 1,327.62 GWh of electricity was consumed domestically which was 1.4% higher than the 1,309.2 GWh projected in the 2019 ESP. Also, the total electricity of 80.43 GWh exported to CIE, CEB and SONABEL was 2.9% higher than the 78.2 GWh projected in the 2019 ESP.

The contribution of electricity generated from the hydro-electric power plants in the total electricity supplied in September 2019 increased marginally from 32.5% in August 2019 to 32.9%. On the contrary, the share of electricity generated from thermal sources in the total electricity supplied increased from 67.1% in August 2019 to 67.5% in September 2019. Electricity generated from solar power plants remained at 0.3% in September 2019.

Table 1. Projected and Actual Outturn of electricity demand and supply in August 2019 and September 2019.

	September 2019		August 2019	
	Projected	Actual Outturn	Projected	Actual Outturn
Total Supply (GWh)	1,387.4	1,408.1	1,409.6	1,425.2
Source by Power Plants (GWh)				
AKOSOMBO	299.2	373.7	377.1	362.4
KPONG	65.4	61.7	67.6	69.0
BUI	53.4	27.9	55.2	32.1
Sunon Asogli	170.4	247.8	277.4	355.5
TAPCO	155.1	72.5	165.4	76.1
TICO	195.8	185.0	202.4	212.8
TTTPP	-	40.4	65.0	74.6
CENIT	-	-	-	-
TT2PP	-	12.1	-	17.7
Amandi	-	9.6	-	0.6
Karpowership	248.3	129.9	-	27.7
AMERI	59.6	120.0	51.6	118.6
KTTPP	37.3	34.0	-	10.8
Trojan Power	-	-	-	-
CENPOWER	-	3.2	-	-
ARSA	78.0	42.5	143.0	23.6
BXC Solar	2.2	1.9	2.3	2.1
VRA Solar	0.2	0.2	0.3	0.2
Genser	-	26.2	-	28.9
Meinergy	2.3	1.9	2.3	1.6
Total Generation (GWh)	1,387.4	1,390.8	1,409.6	1,416.4
Imports (GWh)	-	17.3	-	8.8
Total Supply (GWh)	1,387.4	1,408.1	1,409.6	1,425.2
Deficit/Over supply (GWh)	-	20.7	-	15.6
Ghana Coincident Peak Load (MW)	2,400.0	2,317.1	2,323.0	2,271.5
System Coincident Peak Load (MW)	2,550.0	2,457.3	2,473.0	2,503.2

HIGHLIGHTS OF THE MONTH

The rate of increase in the water level for the hydro dams increased significantly in September 2019 by 1.3 folds. The Akosombo dam water level increased from 0.06 feet per day in August 2019 to 0.15 feet per day in September 2019. The water level for the Bui dam also increased from 0.24 feet per day in August 2019 to 0.74 feet per day in September 2019.

The share of the total natural gas consumed decreased in September 2019, from 95% in August 2019 to 82.3% August 2019. This was mainly due to the increased generation from the AKSA Power Plant in September 2019 compared to August 2019. Consequently, the share of the total liquid fuel consumed increased from 5% in August 2019 to 17.7% in September 2019.

ELECTRICITY DEMAND AND SUPPLY

Electricity Demand

There was a marginal decrease in the System Peak Load by 1.8%, from 2,503.2 MW in August 2019 to 2,457.3 MW in September 2019. On the contrary, the Ghana Peak Load increased marginally by 2%, from 2,271.5 MW in August 2019 to 2,317.1 MW in September 2019. At the System Peak Load, a total of 206 MW was exported to CIE, CEB and SONABEL in September 2019. Out of the total electricity exported, 47 MW was exported to CIE, 69 MW was supplied to CEB and 90 MW was supplied to SONABEL. There was not electricity import at the System Peak Load. Electricity generated from hydro sources contributed 46% of the System Peak Load and 44.7% of the Ghana Peak Load. Thermal generation accounted for 54% of the System Peak Load and 55.3% of the Ghana Peak Load. Average electricity demand increased from 1,916 MW in August 2019 to 1,955.6 MW in September 2019. Average export demand reduced from 127.8 MW in August 2019 to 111.7 MW in September 2019. Export demand for CEB was 57.5 MW, CIE was 3.1 MW and SONABEL was 51.1 MW. Also, the System Load Factor recorded in September 2019 increased from 76.7% recorded in August 2019 to 77.9% recorded in September 2019.

Electricity supply

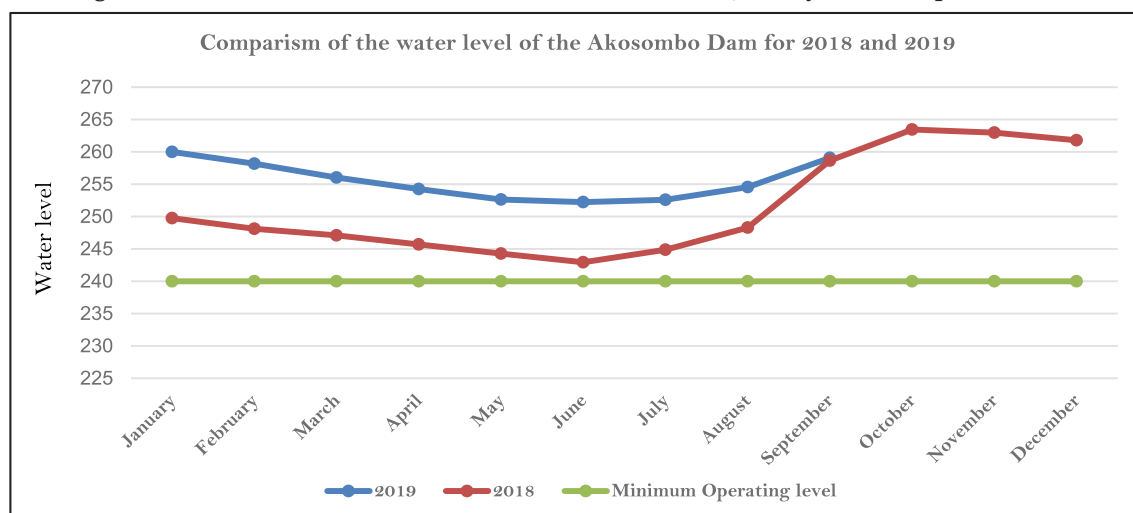
The average electricity supplied in September 2019 increased marginally by 2.1%, from 45.97 GWh per day in August 2019 to 46.94 GWh per day. On the contrary, the total electricity supplied decreased from 1,425.18 GWh in August 2019 to 1,408.05 GWh in September 2019 due to the greater number of days in August than in September. Domestic electricity supply accounted for 98.8% of the total electricity supply. A total of 17.28 GWh of electricity was imported from CIE in September 2019. Electricity export reduced from 3.07 GWh per day in August 2019 to 2.68 GWh per day in September 2019. A total of 80.43 GWh of electricity was exported to CIE, CEB and SONABEL in September 2019 lower than the 95.08 GWh recorded in August 2019. Out of the total electricity exported in September 2019, 2.22 GWh, 41.4 GWh and 36.81 GWh were supplied to CIE, CEB and SONABEL respectively. Electricity generated from hydro sources contributed 32.9% of the total electricity supplied in September 2019 which is marginally higher than the 32.5% recorded in August 2019.

HYDRO DAM LEVELS

Akosombo Dam Water Level continued to increase in September 2019

Net inflows into the Akosombo Dam increase by 1.3 folds from 0.06 feet per day in August 2019 to 0.15 feet per day in September 2019. The water level of the Akosombo Dam increased from 245.55 feet at the beginning of the month to 259.07 feet at the end of the month for September 2019. The water level therefore increased by 4.52 feet for September 2019. The water level recorded at the end of the month was 10.77 feet above the water level recorded for the same period in 2018. Also, the water level recorded at the end of September 2019 was 19.07 feet above the minimum operating level of 240 feet.

Figure 1: Month-End Water Level for Akosombo Dam from January 2018 to September 2019



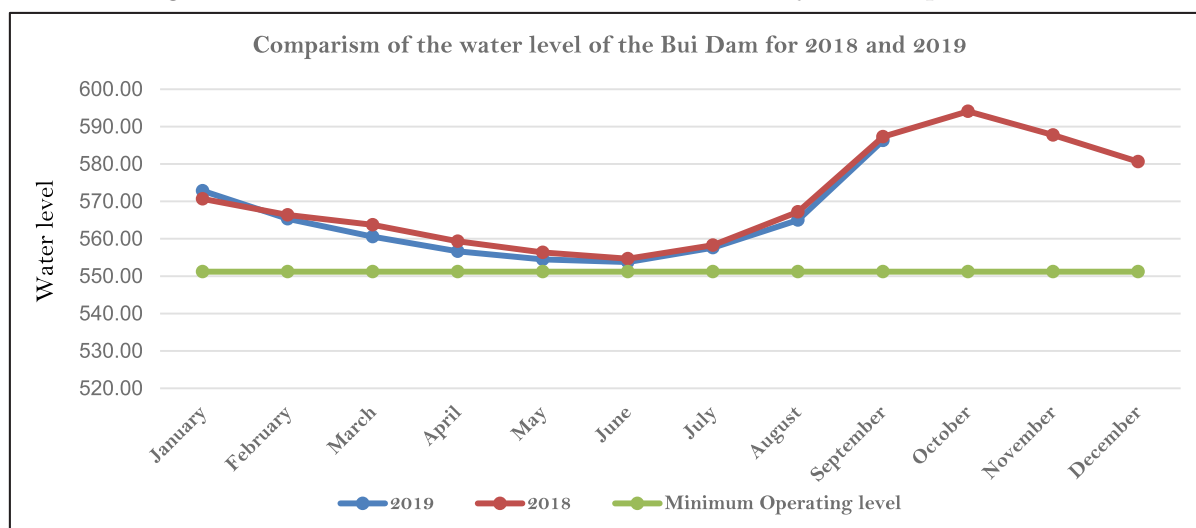
HIGHLIGHTS OF THE MONTH

Bui Dam Water Level continued to increase in September 2019

The rate of increase in the water level for the Bui GS increased from 0.24 feet per day in August 2019 to 0.73 feet per day in September 2019. The water level of 564.46 feet recorded at the beginning of the month increased by 21.82 feet to a month end water level of 586.28 feet. The water level recorded at the end of the month was 19.07 feet higher than the water level recorded for the same period in 2018. The month-end water level recorded for the Bui GS was 35.1 feet above the minimum operating level of 551.18 feet.

Figure 2 shows comparative end of month trajectory of the level of water in the Bui dam from January 2018 to September 2019.

Figure 2: Month-End Water Level for Bui Dam from January 2018 to September 2019



FUEL SUPPLY FOR POWER GENERATION

Natural gas flow rate from WAGPCo decline in September 2019

Natural gas supply from the West African Gas Pipeline Company (WAGPCo) to the Tema and Kpone power enclave declined by 39.8%, from 88.53 MMSCFD in August 2019 to 53.33 MMSCFD in September 2019. Consequently, the total natural gas supplied decreased from 2,744.35 MMSCF in August 2019 to 1,599.76 MMSCF in September 2019. The total natural gas supplied by WAGPCo constituted 24.8% of the total natural gas consumed in September 2019, which was lower than the 35.5% recorded in August 2019. On the contrary, the share of natural gas supplied by WAGPCo in the total fuel mix decreased from 33.7% in August 2019 to 20.4% in September 2019.

Natural gas flow from GNGC decreased in September 2019.

Natural gas supply from the Atuabo Gas Processing Plant (AGPP) to power plants in the Aboadze Power Enclave increased in September 2019. Average natural gas supplied from the AGPP to the Aboadze Power Enclave decreased from 66.78 MMSCFD in August 2019 to 64.59 MMSCFD in September 2019. A total of 1,632.13 MMSCF of natural gas was supplied to the Aboadze Power Enclave in September 2019, which was lower than the 1,734.5 MMSCF supplied in August 2019. Also, a total of 305.62 MMSCF of natural gas was supplied by GNGC to Genser in September 2019, which was lower than the 335.69 MMSCF in August 2019. In summary, a total of 1,937.75 MMSCF of natural gas was supplied by GNGC in September 2019, which was lower than the 2,070.19 MMSCF supplied in August 2019. The share of natural gas supplied from GNGC in the total natural gas consumed increased from 26.3% in August 2019 to 28.2% in September 2019. Similarly, the share of natural gas supplied by GNGC in the total fuel mix decreased from 24.9% in August 2019 to 23.2% in September 2019.

Natural gas flow from ENI/GNPC increased in September 2019

The ENI/GNPC natural supply increased by 5.2%. The average natural gas supplied increased from 97.59 MMSCFD in August 2019 to 102.63 MMSCFD in September 2019. Natural gas supply to the Aboadze Power Enclave on the contrary reduced from 61.4 MMSCFD in August 2019 to 59.74 MMSCFD in September 2019. Consequently, the total natural gas supplied to the Aboadze Power Enclave decreased from 1,914 MMSCF in August 2019 to 1,792.25 MMSCF in September 2019. Natural gas supplied to Tema through the reverse flow facility increased from 1,013.63 MMSCF in August 2019 to 1,286.65 MMSCF in September 2019. The increase in natural gas supply from ENI/GNPC was due to an increase in the flow rate to Tema through the reverse flow. In Summary, a total of 2,927.64 MMSCF of natural gas was supplied by ENI/GNPC for electricity generation in August 2019, which was lower than the 3,078.9 MMSCF in supplied in September 2019. The share of natural gas supplied by ENI/GNPC in the total natural gas consumed increased from 38.7% in August 2019 to 47% in September 2019. Similarly, the total natural gas supplied by ENI/GNPC constituted 38.7% of the total fuel mix in September 2019, which was higher than the 36.7% in August 2019.

HIGHLIGHTS OF THE MONTH

Liquid Fuel

There was a marginal reduction in the total liquid fuel consumption by 12.1% from 280,735 barrels in August 2019 to 246,871 barrels in September 2019. The share of the total HFO consumed in the total fuel mix, increased from 5% in August 2019 to 16.7% in September 2019. On the contrary, the share of HFO in the total liquid fuel consumed reduced from 98.6% in August 2019 to 93.2% in September 2019. The share of LCO and DFO in the total liquid fuel consumed increased from 1.4% in August 2019 to 6.8% in September 2019 due to continuation of the commissioning of Amandi Power Plant.

Plant by Plant Highlights

Electricity Generation at the Akosombo Generation Station (GS) decreased in increased September 2019

Average electricity supplied by the Akosombo GS increased by 6.6%, from 11.69 GWh per day in August 2019 to 12.46 GWh per day in September 2019. Similarly, the total electricity supplied by the hydro power plant increased from 362.44 GWh in August 2019 to 373.7 GWh in September 2019. The total electricity generated by the hydro power plant constituted 26.5% of the total electricity supplied in September 2019 and was 24.9% lower than the 299.2 GWh projected in the ESP. The Akosombo GS generated 796 MW and 914.3 MW at the System Peak Load and the Ghana Peak Load respectively. This translates into 32.4% of the System Peak Load and 37.3% of the Ghana Peak Load in September 2019.

Electricity supply by Kpong Generation Station (GS) decreased in September 2019

There was a reduction in the average electricity supplied by the Kpong GS by 7.6%, from 2.23 GWh per day in August 2019 to 2.06 GWh per day in September 2019. Similarly, the total electricity supplied by the hydro power plant decreased by 10.6% from 68.99 GWh in August 2019 to 61.7 GWh in September 2019. Kpong GS' total electricity supplied constituted 4.4% of the total electricity supplied in September 2019 and was 5.6% lower than the 65.4 GWh projected in the 2019 ESP. The Kpong GS generated 113 MW and 78 MW at the System Peak Load and Ghana Peak Load respectively in September 2019. This constituted 4.6% and 3.2% of the System Peak Load and Ghana Peak Load respectively in September 2019.

Electricity supply by the Bui Generation Station (GS) decreased in September 2019

The average electricity supplied by the Bui GS increased by 9.7%, from 1.03 GWh per day in August 2019 to 0.93 GWh per day in September 2019. Likewise, the total electricity supplied by the Bui GS decreased from 32.08 GWh in August 2019 to 27.95 GWh in September 2019. The total electricity supplied by the Bui GS constituted 1.98% of the total electricity supplied in September 2019 and was 47.7% lower than the 53.4 GWh projected in the 2019 ESP. The hydro power plant contributed 222.6 MW and 102.5 MW of the System Peak Load and the Ghana Peak Load respectively in September 2019. This translates into 9.1% of the System Peak Load and 4.2% of the Ghana Peak Load.

Generation by the Sunon Asogli Power Plant (SAPP) decreased in September 2019

There was a reduction in the average electricity supplied by the Asogli power plant by 28.2%, from 11.5 GWh per day in August 2019 to 8.26 GWh per day in September 2019. Also, the total electricity supplied by the thermal power plant decreased from 355.53 GWh in August 2019 to 247.76 GWh in September 2019. SAPP's total electricity generated in September 2019 constituted 17.6% of the total electricity supplied and was 45.4% higher than the 170.4 GWh projected in the 2019 ESP. The thermal power plant contributed 186.5 MW to the System Peak Load and 529.3 MW to the Ghana Peak Load, translating into 7.6% and 21.6% of the peak loads respectively. The Asogli power plant consumed a total of 1,862.3 MMSCF of natural gas at an estimated heat rate of 8,023.57 Btu/kWh in September 2019, which was higher than the heat rate of 7,807.69 Btu/kWh recorded in August 2019.

Ameri Energy Power Plant's generation increased in September 2019

The Ameri power plant recorded an increase of 4.4% in the average electricity supplied in September 2019, from 3.83 GWh per day in August 2019 to 8.52 GWh per day in September 2019. Similarly, the total electricity supplied by the thermal power plant increased from 118.64 GWh in August 2019 to 119.96 GWh in September 2019. The total electricity supplied by the thermal power plant constituted 8.5% of the total electricity supplied in September 2019 and was over a fold more than the 59.6 GWh projected in the 2019 ESP. Ameri supplied a total of 170.7 MW to the System Peak Load and 194.5 MW to the Ghana Peak Load, representing 7% and 7.9% of the peak loads respectively. A total of 1,192.45 MMSCF of natural gas was consumed by the thermal power plant at an estimated heat rate of 10,228.32 Btu/kWh in September 2019, which was higher than the 10,079.59 Btu/kWh recorded in August 2019.

The Karpowership Power Plant's Commence electricity generation after relocation.

The Karpowership commenced electricity generation from 5th September 2019 after it was relocated to the Sekondi Naval base from the Tema Fishing Harbour. The power plant operated on HFO as the natural gas receiving station was not fully complete. The average electricity supplied by the Karpowership increased from 0.89 GWh per day in August 2019 to 4.33 GWh per day in September 2019. Similarly, the total electricity supplied by the thermal power plant increased from 27.7 GWh in August 2019 to 129.91 GWh in September 2019. The total electricity supplied by the thermal power plant constituted 9.2% of the total electricity supplied in September 2019 and was 47.7% lower than projected in the 2019 ESP. The Karpowership contributed 15.7% of the System Peak Load but did not contribute to the Ghana Peak Load. The thermal power plant consumed a total of 172,657.36 barrels of HFO at an estimated heat rate of 8,041.02 Btu/kWh in September 2019.

AKSA Power Plant's generation decreased in September 2019

There was a reduction in the average electricity supplied by the AKSA power plant by 35%, from 1.27 GWh per day in July 2019 to 0.82 GWh per day in August 2019. Similarly, the total electricity supplied by the thermal power plant decreased from 39.34 GWh in July 2019 to 25.56 GWh in August 2019. The total electricity supplied by the thermal power plant constituted 1.8% of the total electricity supplied in August 2019 and was 82% lower than the 143 GWh projected in the 2019 ESP. AKSA contributed 48.2 MW and 47.9 MW to the System Peak Load and the Ghana Peak Load respectively. The total electricity generated at both peak constituted 1.9% and 2% of the System Peak Load and the Ghana Peak Load respectively. The thermal power plant consumed a total of 34,660 barrels of HFO at an estimated heat rate of 8,203.79 Btu/kWh which was higher than the 8,182.25 Btu/kWh in July 2019.

HIGHLIGHTS OF THE MONTH

Takoradi International Company (TICO) generation decreased in September 2019

The average electricity generated by the TICO power plant decreased by 10.1% in September 2019, from 6.86 GWh per day in August 2019 to 6.17 GWh per day. Consequently, the total electricity supplied by the TICO power plant decreased from 212.8 GWh in August 2019 to 185.02 GWh in September 2019. The total electricity supplied by the thermal power plant constituted 13.1% of the total electricity supplied in September 2019 and was 5.5% lower than the 195.8 GWh projected for September 2019 in the 2019 ESP. The thermal power plant generated 223 MW and 349 MW to the System Peak Load and the Ghana Peak Load, representing 9.1% and 14.2% of the peak loads respectively. TICO consumed a total of 1,543.85 MMSCF of natural gas at an estimated heat rate of 8,586.42 Btu/kWh in September 2019, which higher than the 8,145.88 Btu/kWh it recorded in August 2019.

Takoradi Power Company (TAPCO) Plant's generation decreased in September 2019

There was a reduction in the average electricity supplied in September 2019 by 1.6%, from 2.46 GWh per day in August 2019 to 2.42 GWh per day. Similarly, the total electricity supplied by the thermal power plant increased from 76.13 GWh in August 2019 to 72.53 GWh in September 2019. The total electricity supplied by the thermal power plant constituted 5.2% of the total electricity supplied in September 2019 and was 53% lower than the 155.1 GWh projected in the 2019 ESP. TAPCO contributed 156 MW and 101 MW to the System Peak Load and the Ghana Peak Load respectively. This translates into, 6.4% of the System Peak Load and 4.1% of the Ghana Peak Load in September 2019. The TAPCO power plant consumed a total of 688.08 MMSCF of natural gas at an estimated heat rate of 9,761.99 Btu/kWh in September 2019, which was lower than the 10,837.32 Btu/kWh recorded in August 2019.

Kpone Thermal Power Plant (KTPP) generation increased in September 2019

The Kpone Thermal Power Plant (KTPP) generated 2.2 folds more than its generation in August 2019. The average electricity generated by the KTPP increased from 0.35 GWh per day in August 2019 to 1.13 GWh per day in September 2019. The power plant generated a total of 34.03 GWh constituting 2.4% of the total supply. The electricity supplied by KTPP was 40.6% lower than projected in the 2019 ESP. The KTPP did not contribute to the System Peak Load but contributed 105 MW to the Ghana Peak Load, constituting 4.3% of the Ghana Peak Load. The thermal power plant consumed a total of 357.01 MMSCF of natural gas at an estimated heat rate of 11,199.05 Btu/kWh in September 2019.

Tema Thermal 1 Power Plant (TT1PP) came back online in August 2019

The TT1PP generated at an average electricity of 1.3 GWh per day in September 2019 which was lower than the 2.41 GWh per day generated in August 2019. The power plant generated a total electricity of 40.42 GWh, constituting 2.9% of the total supply. The power plant was not projected to generate in September 2019 in the 2019 ESP. TT1PP contributed 105 MW to the System Peak Load representing 4.4% of the Peak Load. The power plant did not contribute to the Ghana Peak Load. The thermal power plant consumed a total of 447.11 MMSCF of natural gas at an estimated heat rate of 11,807.74 Btu/KWh in September 2019.

Embedded Electricity Generation

Genser Power Plant's generation decreased in September 2019

The Genser thermal power plant recorded a reduction in the average electricity supplied in September 2019, from 0.93 GWh per day in August 2019 to 0.87 GWh per day in September 2019. Similarly, the total electricity of 26.24 GWh supplied by the thermal power plant constituted 1.9% of the total electricity supplied in September 2019. The thermal power plant consumed a total of 305.62 MMSCF of natural gas at an estimated heat rate of 11,984.91 Btu/kWh in September 2019 which was higher than the 11,964.91 Btu/kWh it recorded in August 2019.

BXC Solar generation decreased in September 2019

The BXC Solar power plant decreased its generation by 6.3% from 2.08 GWh in August 2019 to 1.95 GWh in August 2018. The total supply constituted 0.1% of the total electricity supplied in September 2019 but was 11.4% lower than projected in the 2019 ESP.

Meinergy Solar generation decreased in September 2019

The Meinergy Solar generation decreased from 1.91 GWh in August 2019 to 1.62 GWh in September 2019. The generation from the power plant was lower than projected in the 2019 ESP by 26.4% and constituted 0.1% of the total electricity supplied in September 2019.

Electricity Exchange – Import increased whiles electricity Export decreased in September 2019

Electricity import from CIE increased by over 1 fold from 0.28 GWh per day in August 2019 to 0.58 GWh per day in September 2019. Total import increased from 8.79 GWh in August 2019 to 17.28 GWh in September 2019. The total electricity imported from CIE constituted 1.2% of the total electricity supplied in September 2019.

There was a reduction in the average electricity supplied to CIE and SONABEL by 34.9% and 22.2% respectively in September 2019. Electricity supply to CIE reduced from 0.11 GWh in August 2019 to 0.07 GWh in September 2019. Likewise, electricity supply to SONABEL reduced from 1.58 GWh per day in August 2019 to 1.23 GWh per day in September 2019. On the contrary, the average electricity supplied to CEB increased by 0.3% in September 2019. Electricity supply to CEB increased from 1.376 GWh per day in August 2019 to 1.378 GWh per day in September 2019.

Consequently, the total electricity exported to CIE, CEB and SONABEL reduced by 15.4%, from 95.08 GWh in August 2019 to 80.43 GWh in September 2019. The total electricity exported was however 2.3% higher than the 78.2 GWh projected to be exported in the 2019 ESP. There was a net electricity export of 63.15 GWh in September 2019.

Ghana continued to be a net exporter of electricity in September 2019.

OPERATIONAL FACT SHEET

Monthly Market Data Analysis

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

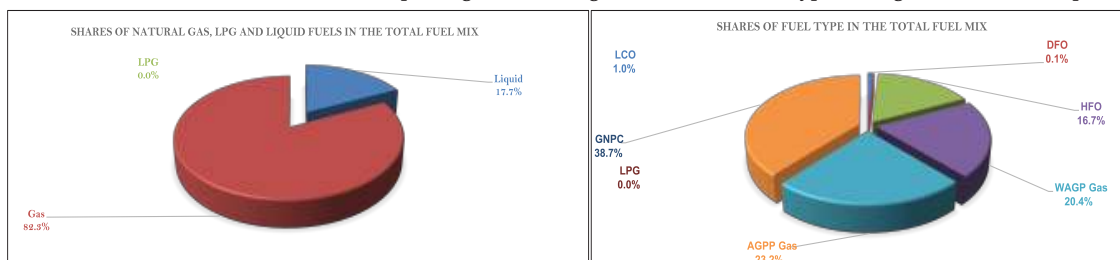
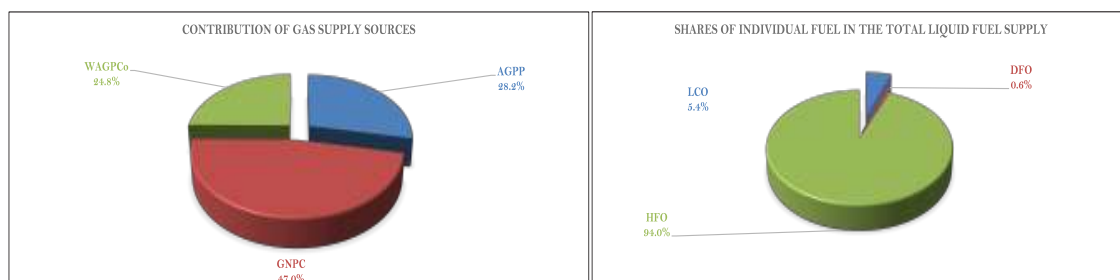


Figure 4a: Contribution of Natural Gas Supply by sources

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

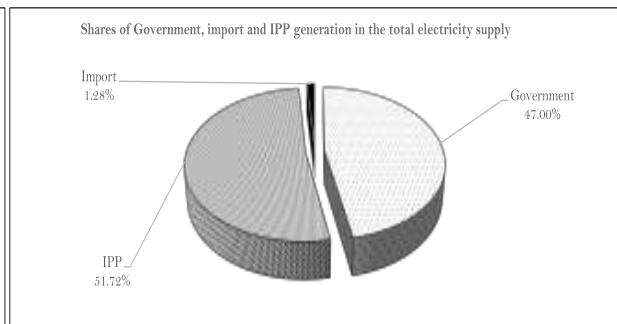
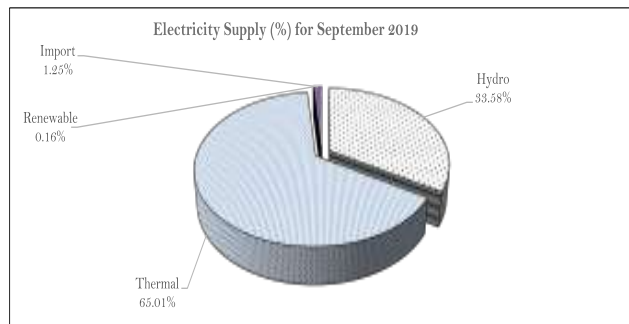


Peak Electricity Supply - September 2019			
Source of Supply	Generation at System Peak Load (MW)	Generation at Ghana Peak Load (MW)	Electricity Supply (GWh)
AKOSOMBO	796.00	914.30	373.70
KPONG	113.00	78.00	61.70
BUI	222.60	102.50	27.95
SEAP	186.50	529.30	247.76
TAPCO	156.00	101.00	72.53
TICO	223.00	349.00	185.02
TT1PP	105.00	-	40.42
CENIT	-	-	-
TT2PP	6.30	13.50	12.12
MRP	-	-	9.65
KARPOWER	385.00	-	129.91
AMERI	170.70	194.50	119.96
KTPP	-	105.00	34.03
Trojan Power	-	-	-
CENPOWER	-	-	3.18
AKSA	93.20	16.00	42.51
BXC Solar	-	-	1.95
Safisana	-	-	-
VRA Solar	-	-	0.24
Genser	-	-	26.24
IMPORT	-	48.00	17.28
Export to CIE at peak	47.00	-	41.40
Export to CEB at peak	69.00	87.00	2.22
Export to Sonabel	90.00	47.00	36.81
System Coincident Peak Load	2,457.30		
Ghana Coincident Peak Load		2,317.10	
Total Supply			1,406.14
Total Supply without export			1,325.71

OPERATIONAL FACT SHEET

Average Monthly Flowrate (MMSCFD)	
Location	Monthly Average
Etoki	112.30
Tema WAGPCo	121.33
Aboadze WAGPCo	0.00
Aboadze GNGC	121.76
Reverse Flow	33.06

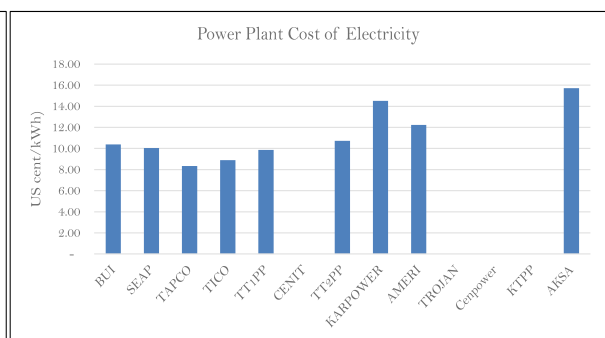
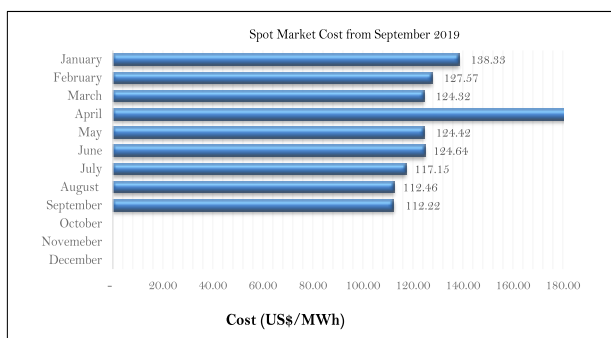
Sep-19			
	Beginning month (ft)	End month (ft)	Change in water level (feet)
Hydro Dam			
Akosombo	254.55	259.07	4.52
Bui	564.46	586.28	21.82



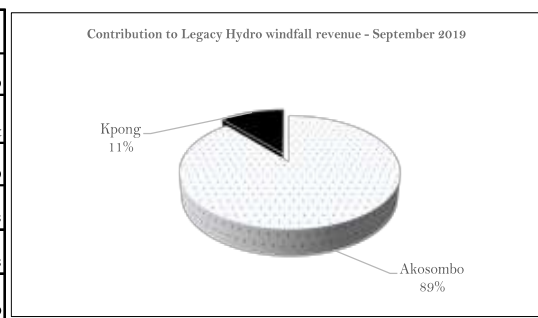
Power Plant Data September 2019								
	Installed Capacity (MW)	Plant Capacity Utilization (%)	Electricity Generation (GWh)	Gas Consumption (MMBtu)	LCO Consumption (MMBtu)	DFO Consumption (MMBtu)	HFO Consumption (MMBtu)	LPG Consumption (MMBtu)
Akosombo	1,020.00	50.89	373.70	-	-	-	-	-
Kpong	160.00	53.56	61.70	-	-	-	-	-
Bui	400.00	9.70	27.95	-	-	-	-	-
SEAP	560.00	61.45	247.76	1,987,929.73	-	-	-	-
TAPCO	330.00	30.53	72.53	708,034.55	-	-	-	-
TICO	340.00	75.58	185.02	1,588,622.60	-	-	-	-
TT1PP	126.00	44.55	40.42	483,233.38	-	-	-	-
CENIT	126.00	-	-	-	-	-	-	-
TT2PP	87.00	19.35	12.12	151,549.97	-	-	-	-
KARPOWER	470.00	38.39	129.91	-	-	-	1,044,577.01	-
AMERI	250.00	66.65	119.96	1,227,030.64	-	-	-	-
Cenpower	370.00	1.19	3.18	40,584.54	-	-	-	-
TROJAN	56.00	-	-	-	-	-	-	-
KTPP	220.00	21.48	34.03	381,097.95	-	-	-	-
AKSA	360.00	16.40	42.51	-	-	-	347,807.79	-
GENSER	95.00	38.36	26.24	-	-	-	-	-
VRA Solar	2.50	13.56	0.24	-	-	-	-	-
BXC	20.00	13.53	1.95	-	-	-	-	-
Meinergy	20.00	13.28	1.91	-	-	-	-	-
Total	5,012.50	38.27	1,381.12	6,568,083.36	-	-	1,392,384.80	-

ECONOMIC FACT SHEET

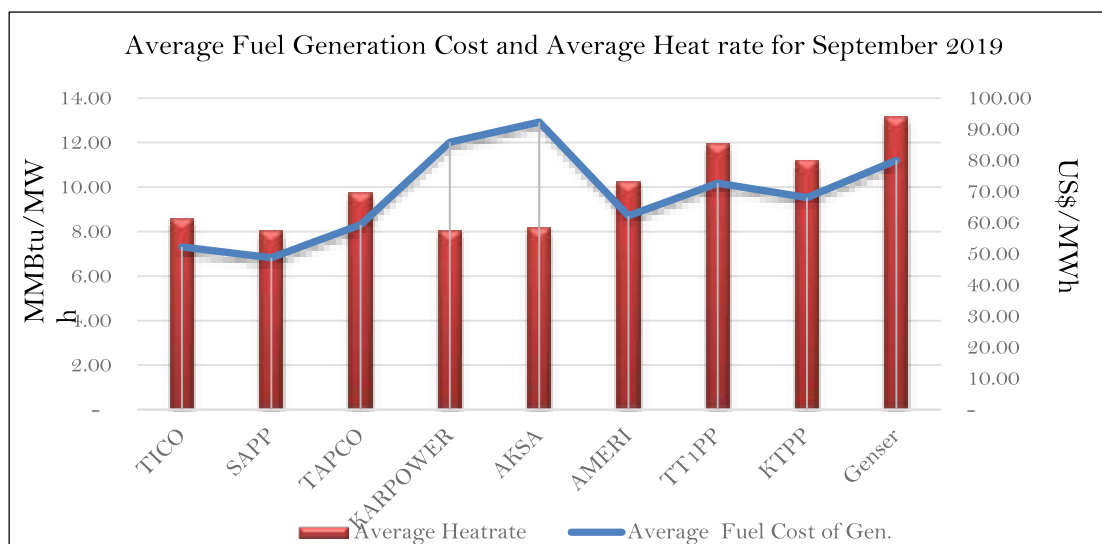
		Actual	Projected	Change
Average Market Energy Cost	US\$/MWh	81.28	79.81	1.47
Average Market Capacity Charge (AMCC)	US\$/MWh	34.71	34.62	0.09
Total Average Market Cost (TAC)	US\$/MWh	115.99	114.43	1.56
System Marginal Cost (SMC)	US\$/MWh	112.22	88.55	23.67
System Marginal Capacity Charge (SMCC)	US\$/MWh	23.95	23.95	-
Spot Market Price (SMP)	US\$/MWh	136.17	112.50	23.67
Composite Bulk Generation Charge (CBGC)	US\$/MWh	97.01	97.01	-
Deviation of TAC from CBGC	US\$/MWh	(18.98)	(17.42)	(1.56)
Deviation of SMP from CBGC	US\$/MWh	(39.16)	(15.49)	(23.67)



Average Fuel Prices		
		Sep-19
Fuel Type	Unit	Delivered Cost
Natural Gas	US\$/MMBtu	7.29
LCO	US\$/BBL	67.83
HFO	US\$/Tonne	372.08
DFO	US\$/Tonne	0.00



	Gazetted Natural Gas Price	Weighted average Natural Gas Price	LCO	HFO
US\$/MMBTu	6.08	5.78	12.82	10.97



ECONOMIC FACT SHEET

Power Plant	Capacity Utilization (%)	Average Heat rate (Btu/kWh)	Average Fuel Cost of Generation (US\$/MWh)	Emission Factor (kgCO ₂ /kWh)
Akosombo	50.89	-	-	-
Kpong	53.56	-	-	-
Bui	9.70	-	-	-
SAPP	61.45	8,023.57	48.78	0.43
TAPCO	30.53	9,761.99	59.35	0.52
TICO	75.58	8,586.42	52.21	0.46
TT1PP	44.55	11,955.30	72.69	0.63
CENIT	-	-	-	-
TT2PP	19.35	12,503.81	76.02	0.66
KARPOWER	38.39	8,041.02	85.84	0.63
AMERI	66.65	10,228.32	62.19	0.54
TROJAN	-	-	-	-
KTPP	21.48	11,199.05	68.09	-
AKSA	16.40	8,182.31	92.32	0.64
Genser	38.36	13,164.14	80.04	0.70

		Wholesale Electricity Market Price Data - 2019 (Uscent/kWh)								
		January	February	March	April	May	June	July	August	September
Average Market Price	Actual	14.14	14.26	13.87	16.68	13.91	13.55	11.91	11.28	11.60
	Projected	12.79	12.69	12.74	12.97	12.86	12.70	12.74	11.54	11.44
System Marginal Price	Actual	17.02	16.07	14.77	20.85	14.84	14.86	14.11	13.64	13.62
	Projected	12.83	13.00	12.83	12.88	12.83	12.88	12.83	11.20	11.25

Impact of the Relocation of the Karpowership on Power Supply

Karpowership signed a contract with the Electricity Company of Ghana in June 2014 to deploy a 450 MW (installed capacity 470 MW) Powership for 10 years. The Karpowership commenced commissioning of its first 235 MW installed capacity Powership in December 2015 and declared COD in January 2016 with 12 wastila Gas Turbine and a steam generator. The Powership was given operating license by the Energy Commission in February 2016. The Karpowership replaced its 235 MW Powership with a 470 MW installed capacity Powership in December 2017. The Powerships since December 2015 operated from the Tema Fishing Harbour.

The Karpowership since December 2015 has operated on Heavy Fuel Oil (HFO). In 2016, a total of 2.496 million barrels of HFO was consumed by the power plant for electricity generation. In 2017 and 2018, the Karpowership consumed 2.467 million barrels and 3.508 million barrels of HFO respectively for electricity generation. As at end of September 2019, the Karpowership has consumed about 1.7 million barrels of HFO.

The Karpowership in 2016 generated 1,822 GWh of electricity into the national grid. In 2017 and 2018, the Karpowership generated 1,814 GWh and 2,556 GWh respectively. As at the end of September 2019, the Karpowership has generated 1,242 GWh of electricity. The Karpowership accounted for 14.1%, 13% and 16.2% of the total electricity generated into the NITS in 2016, 2017 and 2018 respectively.

On 13th August, 2019 the Karpowership relocated it 470 MW from the Tema Fishing Harbour to the Sekondi Naval Base. The relocation was to enable the Karpowership utilize the indigenous natural gas from Ghana's oil and gas fields. The relocation of the Karpowership would affect electricity dispatch, natural gas demand and security of supply.

Ghana has a total on grid installed capacity of 4,819 MW as at September 2019 with an embedded generation capacity of 193 MW. Prior to the relocation of the Karpowership to the Sekondi Naval Base, the installed capacity at Tema and Kpone was 1,959 MW while the installed capacity in the West (Takoradi) stood at 920 MW. The Karpowership movement to the Sekondi Naval Base meant that installed capacity at Tema and Kpone reduced to 1,489 MW while the capacity in the West increased to 1,390 MW. With the completion of the commissioning of Amandi Power Plant, installed capacity at the West will increase to 1,582 MW. This invariably means that the maximum load centres will shift from the East (Tema and Kpone) to the West (Takoradi). This could have an effect on dispatch of electricity and losses on the grid.

Natural gas demand of natural gas fired power plants (assuming 85% Capacity Utilization) as at August 2019 was 370 MMScfd which will increase to 434 MMScfd after the relocation of the Karpowership and converting it to operate on natural gas. Natural gas demand would increase to 460 MMScfd with the complete commissioning of the Amandi Power Plant. Natural gas demand at Tema and Kpone will stand at 239 MMScfd while demand at the West will be 221 MMScfd. It therefore means that natural gas demand will increase by 65 MMScfd.

Table 1: Natural Gas requirement by Power Plants

Power Plants	Natural Gas Demand (MMScfd)
Asogli Phase I	31
Asogli Phase II	50
TAPCO	42
TICO	44
TT1PP	26
CENIT	26
TT2PP	11
KTPP	43
AMERI	45
Amandi	26
Cenpower	51
Karpowership	65
Total	460

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The actual total natural gas consumption after the relocation of Karpowership might either be lower or higher depending on grid conditions which will dictate dispatch.

Electricity supply security is very important if we want to endure sustainable supply of electricity. One important component of electricity supply security is the ability to have fuel supply security and multiple fuel for electricity generation. The relocation of natural gas to the West to utilize the indigenous natural gas supply will ensure the at supply of fuel to the power plant is not affected by any international factors. In the event that there is a curtailment of natural gas from the oil and gas fields to the power plant, the Karpowership could also generate on HFO because it is dual fuel.

The relocation of the Karpowership has increased the demand for natural gas and could also increase the total consumption of natural gas. The relocation would reduce the payment for unconsumed natural gas as a result of the take-or-pay obligation on natural gas. The consumption of natural gas in place of HFO by the Karpowership would reduce the operational cost of the Karpowership by over 40%. In terms of electricity supply security, the ability of Karpowership to operate on HFO and natural gas provide alternative fuel choices when there are problems with natural gas supply. On the downside to the Karpowership location is the possibility of increasing the transmission losses.

EMOP Develops Wholesale Electricity Market Manuals

The EMOP was established by regulation 16 (1) of L.I. 1937 to supervise the administration and operation of the wholesale electricity market. The EMOP broadly has three functions; Monitoring, Adjudication and Advisory. The specific functions of EMOP, as enshrined in Regulation 18 of the law (L.I. 1937) are to:

- (a) monitor the general performance of the market administration functions of the Utility;
- (b) ensure the smooth operation of the wholesale electricity market;
- (c) review the operations of the wholesale electricity market and studies related to the development of the market;
- (d) review procedures, manuals and electricity market rules for the operation of the wholesale electricity market;
- (e) monitor pre-dispatch schedules;
- (f) resolve disputes referred to it by market participants in respect of transactions in the wholesale electricity market;
- (g) ensure the effective and consistent application by the Utility of the rules and standards of the wholesale electricity market;
- (h) ensure the long-term optimization of hydro-electricity supply sources in the country;
- (i) make appropriate recommendations to the Commission in respect of the Panel's functions; and
- (j) perform any other function conferred on it by the Commission.

In order for the EMOP to achieve some of its mandate, the EMOP have developed manuals aimed at helping market participant to understand the processes and functions of EMOP. The EMOP has developed the Monitoring Protocol and Dispute Resolution Procedure.

The Monitoring protocol is aimed at fulfilling Regulations 18 (a), 18 (b) and 18 (g) of L. I. 1937, which mandates the Electricity Market Oversight Panel (EMOP) to:

- Monitor the general performance of the market administration functions of the Market Operator;
- Ensure the smooth operation of the Wholesale Electricity Market; and
- Ensure the effective and consistent application by the Market Operator of the rules and standards of the Wholesale Electricity Market.

The Monitoring Protocol specifies each markets participants obligation in achieving the monitoring functions of th EMOP. The document also provides the contact information of EMOP for monitoring related information. The document then specify how the EMOP intends to undertake it monitoring functions. The document specifies two methods of monitoring which include:

- Market Intelligence: Assessing information received from stakeholders that may identify matters requiring further investigation;
- Market Monitoring: Analyzing market data through a suite of tools and systems (e.g. dispatch data, outage data etc.) which will identify potential areas of non-compliance;

The Monitoring Protocol also specified obligation of the Market Operator in achieving the monitoring functions of the EMOP including reporting obligations.

Finally, the Monitoring Protocol provide information on how EMOP will undertake investigation if there is any breach of the laws governing the WEM and provides how market participant or the market operator can appeal any decision taken by EMOP on the breach of any of the rules governing the WEM.

The Dispute Resolution Procedure is aimed at achieving Regulations 18 (b) and 18 (f) of L.I. 1937 which mandates the Electricity Market Oversight Panel (EMOP) to:

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- ensure the smooth operation of the Wholesale Electricity Market (WEM); and
- resolve disputes referred to it by market participants in respect of transactions in the Wholesale Electricity Market.

The Dispute Resolution Procedure specifies the grounds that a market participant or the Market Operator can complain and the process needed to be exhausted before complaint can be lodged at the EMOP. The document further specifies the information needed by the EMOP from the complainant. The Dispute Resolution Procedure further specifies the dispute resolution procedure and the time span for the dispute. The document provide timelines for appeal and process of appealing a decision of EMOP.

The EMOP in the year 2020 will engage market participants and the Market Operator on these two document with the aim of explaining to them the purpose of the document and modalities in undertaking what is stated in the document. The EMOP will circulate copies of this document to all market participant and the Market Operator early 2020.

Acronyms

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

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