



GHANA WHOLESAL E ELECTRICITY MARKET BULLETIN

MARKET WATCH

Monthly Market Data Analysis

ISSUE NO. 39

1st March 2019 to 31st March 2019

This Bulletin covers major developments in the Wholesale Electricity Market (WEM) of Ghana from 1st March, 2019 to 31st March, 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 Draft Electricity Transmission Ancillary Services Pricing Policy and Guidelines of PURC for comments and inputs.

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

There was a reduction in the System Peak Load recorded in March 2019 by 1.5%, from 2,691.2 MW in February 2019 to 2,650.2 MW. On the contrary, the System Peak Load recorded in March 2019 was 1.1% higher than the 2,621 MW that was projected in the 2019 Electricity Supply Plan (ESP). On the other hand, the Ghana Peak Load of 2,496 MW recorded in March 2019 was 0.3% lower than the 2,503 MW that was projected in the 2019 ESP. Electricity import from CIE at the System Peak Load was 29 MW in March 2019. Also, the total electricity exported to SONABEL and CEB was 168 MW at the System Peak Load which was 42.4% higher than the 118 MW that was projected in the 2019 ESP.

A total of 1,593.14 GWh of electricity was supplied in March 2019 which was 9.7% more than the 1,452.1 GWh projected in the 2019 ESP. Similarly, the total electricity of 1,504.48 GWh consumed domestically was 10.5% more than the 1,384.5 GWh projected in the 2019 ESP. The total electricity of 88.66 GWh exported to CIE, CEB and SONABEL was higher than the 67.6 GWh that was projected in the 2019 ESP by 31.2%.

The total electricity generated by the hydro power plants constituted 47.1% of the total electricity supplied in March 2019 which was lower than the 51% recorded in February 2019. On the contrary, the total electricity supplied by thermal power plants in March 2019 increased to 51.9% from 48.1% in February 2019.

The rate of drop in the water level for the Akosombo dam in March 2019 was relatively the same as the 0.07 feet per day recorded in

Table 1. Projected and Actual Outturn of electricity demand and supply in February 2019 and March 2019.

	March 2019		February 2019	
	Projected	Actual Outturn	Projected	Actual Outturn
Total Supply (GWh)	1,451.8	1,594.0	1,335.3	1,451.4
Source by Power Plants (GWh)				
AKOSOMBO	941.4	584.3	540.6	539.4
KPONG	83.7	89.5	61.0	74.3
BUI	55.2	76.0	49.9	126.1
Sunon Asogli	271.9	131.5	155.5	125.7
TAPCO	161.5	44.1	79.4	118.2
TICO	67.7	94.2	182.8	38.1
TT1PP	-	-	36.7	20.4
CENIT	-	-	-	-
TT2PP	-	6.7	-	6.8
MRP	-	-	-	-
Karpowership	256.7	211.7	231.9	172.0
AMERI	154.0	137.6	139.1	151.8
KTPP	-	27.9	-	-
Trojan Power	-	-	-	-
CENPOWER	-	9.4	-	1.6
ARSA	55.0	126.5	56.0	30.8
BXC Solar	2.1	2.9	2.1	1.4
VRA Solar	0.3	0.3	0.2	0.2
Genser	-	37.8	-	32.7
Meinergy	2.3	-	2.1	1.4
Total Generation (GWh)	1,451.8	1,580.5	1,335.3	1,441.2
Imports (GWh)	-	13.5	-	10.2
Total Supply (GWh)	1,451.8	1,594.0	1,335.3	1,451.4
Deficit/Over supply (GWh)	-	142.2	-	116.1
Ghana Coincident Peak Load (MW)	2,503.0	2,496.6	2,446.0	2,525.2
System Coincident Peak Load (MW)	2,621.0	2,650.2	2,564.0	2,691.2

HIGHLIGHTS OF THE MONTH

February 2019. The rate of drop in the water level for the Bui dam reduced in March 2019 to 0.15 feet per day from 0.27 feet per day in February 2019.

Natural gas continued to dominate the total fuel mix but at a reduced share, from 69.1% in February 2019 to 54.2% in March 2019. The share of liquid fuel in the total fuel mix increased from 25.2% in February 2019 to 39.9% in March 2019. The share of LPG consumed increased marginally from 5.7% in February 2019 to 5.8% in March 2019.

ELECTRICITY DEMAND AND SUPPLY

Electricity Demand

The System Peak Load in March 2019 recorded a reduction of 1.5%, from 2,691.2 MW in February 2019 to 2,650.2 MW. Similarly, the Ghana Peak Load decreased by 1.1%, from 2,523.2 MW in February 2019 to 2,496.6 MW in March 2019. The reduction in the Ghana Peak Load was due to a reduction in domestic demand in March 2019. However, there was load shedding in March 2019 during peak periods which affected demand during the period. A total of 168 MW was exported to CEB and SONABEL during the System Peak Load and 29 MW was imported from CIE. Out of the total electricity exported, 103 MW was supplied to CEB and MW to SONABEL in March 2019. The Load Factor for March 2019 increased marginally from 78.3% in February 2019 to 78.8%.

Electricity supply

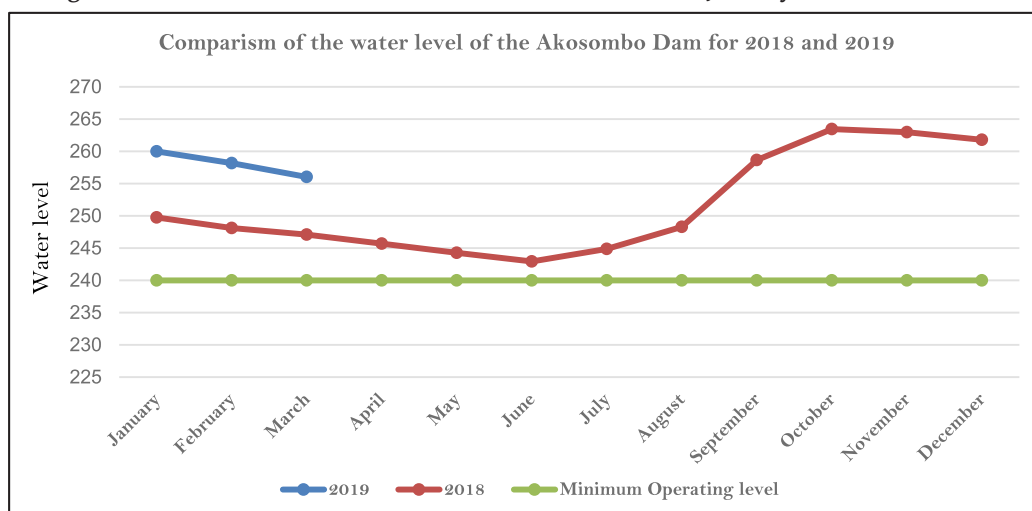
Average electricity supplied in March 2019 decreased marginally by 0.9%, from 51.84 GWh per day in February 2019 to 51.39 GWh per day. Contrary to the reduction in the average electricity supplied, the total electricity supplied increased by 9.8%, from 1,451.39 GWh in February 2019 to 1,593.14 GWh in March 2019. The increase in the total electricity supplied was due to greater number of days in March than in February. Out of the total electricity supplied in March 2019, 13.55 GWh was imported from CIE and the 1,579.59 was generated domestically. A total of 88.66 GWh was exported to CIE, CEB and SONABEL in the proportion of 4.76 GWh to CIE, 54.43 GWh to CEB and 29.47 GWh to SONABEL. Electricity generation from hydro sources contributed 47.1% of the total electricity supplied in March 2019 with thermal accounting for 51.9%.

HYDRO DAM LEVELS

Akosombo Dam Water Level continued to drop in March 2019

The Akosombo dam water level continued to drop in March 2019 at a relative constant rate of 0.07 feet per day as the same rate was recorded in February 2019. The water level of 258.18 feet recorded at the beginning of March 2019, dropped by 2.14 feet to a month end water level of 256.04 feet. The water level recorded at the end of March 2019 was 8.95 feet above the water level of 247.09 feet recorded at the end of March 2018 and was 16.04 feet higher than the minimum operating water level.

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



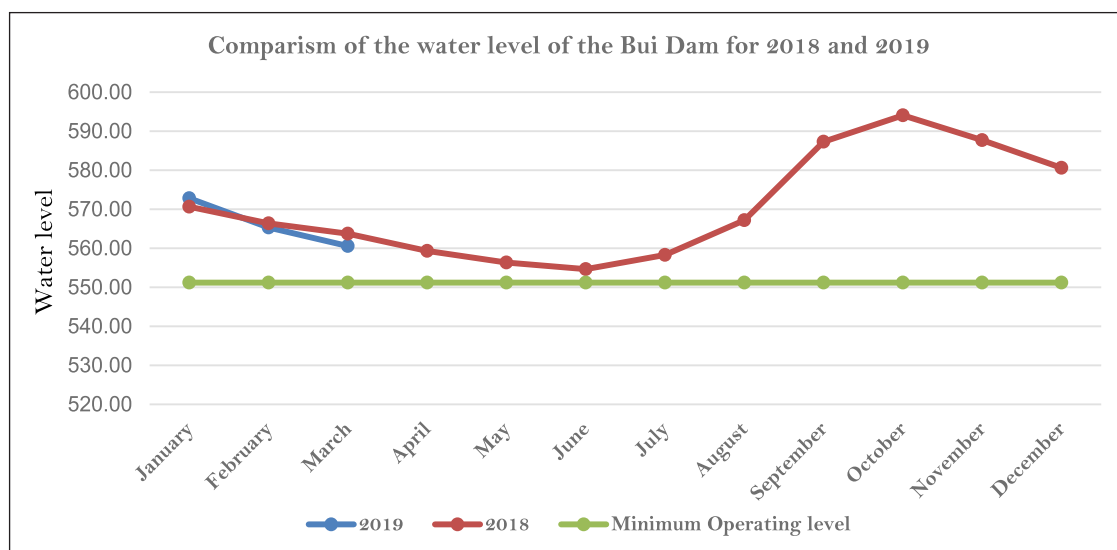
Bui Dam Water Level continued to drop in March 2019

The rate of drop in the water level for the Bui dam decreased in March 2019, from 0.27 feet per day in February 2019 to 0.15 feet per day. The water level of 565.31 feet recorded at the beginning of the month dropped by 4.76 feet to a month end water level of 560.56 feet. The water level of 560.56 feet recorded at the end of March 2019 was 3.17 feet below the water level of 563.73 feet recorded for March 2018. The water level recorded at the end of the month was 9.38 feet higher than the minimum operating level of the dam.

HIGHLIGHTS OF THE MONTH

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

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



FUEL SUPPLY FOR POWER GENERATION

Natural gas flow rate from WAGPCo decrease in March 2019

Natural gas supply from WAGPCo continued to decrease in March 2019, from an average of 47.35 MMSCFD in February 2019 to 43.08 MMSCFD. On the contrary, the total natural gas supplied by WAGPCo increased from 1,278.1 MMSCF in February 2019 to 1,335.62 MMSCF in March 2019. The total natural gas supplied from WAGP contributed 35.4% of the total natural gas consumed in March 2019 which was higher than the 29.7% it recorded in February 2019. In the total fuel mix, the share of natural gas from WAGP constituted 19.2% which was lower than the 20.6% it recorded in February 2019.

Atuabo Gas Processing Plant (AGPP) resumed operations in March 2019.

The supply of natural gas from AGPP to the Aboadze Power Enclave resumed in March 2019 at an average of 34.96 MMSCFD. A total of 978.97 MMSCF of natural gas was supplied by AGPP to the Aboadze Power Enclave. The total natural gas supplied constituted 13.6% of the total fuel consumed and 25% of the natural gas consumed in March 2019.

Natural gas flow from GNPC decreased in March 2019

The average natural gas supplied by GNPC decreased significantly in March 2019, from 106.9 MMSCFD in February 2019 to 51.69 MMSCFD. The total natural gas supplied by GNPC was 1,550.68 MMSCF in March 2019 which was significant lower than the 2,993.34 MMSCF it supplied in February 2019. The total natural gas supplied by GNPC constituted 21.5% of the total fuel mix which was lower than the 44.1% it recorded in February 2019. In the total natural gas consumed, the share of natural gas supplied from GNPC constituted 39.6% in March 2019 which was lower than the 63.7% it recorded in February 2019.

Liquid Fuel

The consumption of liquid fuel increased significantly in March 2019, by 78.8%, from 276,936 barrels in February 2019 to 495,103. This was significantly due to increased HFO consumption by AKSA and Karpowership and LCO consumption in March 2019. In the total fuel consumed, the share of HFO consumed increased from 25.9% in February 2019 to 37.2% in March 2019. On the contrary, the share of HFO in the total liquid fuel consumed decreased from 98.9% in February 2019 to 93.2% in March 2019. The share of LCO consumed increased from 1% in February 2019 to 6.6% in the total liquid fuel consumed in March 2019. In the total fuel mix, the share of LCO increased from 0.3% in February 2019 to 2.7% in March 2019. The share of DFO in the total liquid fuel consumed increased from 0.04% in February 2019 to 0.2% in March 2019 and constituted 0.1% of the total fuel mix in March 2019.

HIGHLIGHTS OF THE MONTH

Plant by Plant Highlights

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

There was a marginal reduction in the average electricity supplied by the Akosombo GS by 2.2%, from 19.27 GWh per day in February 2019 to 18.85 GWh per day in March 2019. On the contrary, the total electricity supplied by the hydro power plant increased by 8.3%, from 539.43 GWh in February 2019 to 584.32 GWh in March 2019. The total electricity supplied by Akosombo GS constituted 36.7% of the total electricity supplied in March 2019 and was 71.2% higher than the 341.4 GWh projected in the 2019 ESP. Akosombo GS contributed 893.4 MW to the System Peak Load and 858 MW to the Ghana Peak Load in March 2019. The load supplied by the hydro power plant constituted 33.7% of the System Peak Load and 32.4% of the Ghana Peak Load.

Electricity supply by Kpong Generation Station (GS) increased in March 2019

Average electricity supply by Kpong GS increased by 8.5% in March 2019, from 2.66 GWh per day in February 2019 to 2.89 GWh per day. Similarly, the total electricity supplied by the hydro power plant increased by 20.2%, from 74.51 GWh in February 2019 to 89.53 GWh in March 2019. The total electricity supplied by Kpong GS constituted 5.6% of the total electricity supplied in March 2019 and was 7% higher than the 83.7 GWh projected in the 2019 ESP. Kpong GS contributed 115 MW to the System Peak Load and 141 MW to the Ghana Peak Load in March 2019. The total Load supplied by the hydro power plant constituted 4.3% of the System Peak Load and 5.3% of the Ghana Peak Load.

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

Electricity generation from the Bui GS continued to decrease in March 2019, from an average of 5.03 GWh per day in January 2019 and 4.5 GWh per day in February 2019 to 2.45 GWh per day. Similarly, the total electricity supplied by Bui GS decreased by 39.7%, from 126 GWh in February 2019 to 76.04 GWh in March 2019. The total electricity supplied by the hydro power plant constituted 4.8% of the total electricity supplied in March 2019 and was 37.8% higher than the 76.04 GWh projected in the 2019 ESP. Bui GS supplied a load of 203.4 MW to the System Peak Load and 209 MW to the Ghana Peak Load. This translates into 7.7% of the System Peak Load and 7.9% of the Ghana Peak Load in March 2019.

Generation by the Sunon Asogli Power Plant (SAPP) decrease in March 2019

There was a 5.5% reduction in the average electricity generated by SAPP in March 2019, from 4.49 GWh per day in February 2019 to 4.24 GWh per day. Contrary to the decrease in the average electricity supplied by the thermal power plant, the total electricity supplied increased by 4.6%, from 125.71 GWh in February 2019 to 131.53 GWh in March 2019. The total electricity supplied by the SAPP constituted 8.3% of the total electricity supplied in March 2019 and was 51.6% lower than the 271.9 GWh projected in the 2019 ESP. A total load of 270.7 MW and 224.6 MW was supplied by the thermal power plant to the System Peak Load and the Ghana Peak Load respectively. The loads supplied constituted 10.2% of the System Peak Load and 8.5% of the Ghana Peak Load. SAPP consumed a total of 951.6 MMSCF of natural gas and 11,458.35 barrels of LCO at an estimated heat rate of 8,183.72 Btu/kWh in March 2019, which was marginally lower than the heat rate of 8,190.1 Btu/kWh it recorded in February 2019.

Ameri Energy Power Plant's generation decreased in March 2019

There was reduction in the average electricity supplied by the Ameri power plant by 18.1%, from 5.42 GWh per day in February 2019 to 4.44 GWh per day in March 2019. Similarly, the total electricity supplied by the thermal power plant decreased by 9.3%, from 151.83 MW in February 2019 to 137.65 MW in March 2019. The total electricity supplied by the thermal power plant constituted 8.6% of the total electricity supplied in March 2019 and was 16% lower than the 154 GWh projected in the 2019 ESP. Ameri contributed 237.2 MW to the System Peak Load and 238.2 MW to the Ghana Peak Load, representing 9% of both Peak Loads in March 2019. The Ameri thermal power plant consumed a total of 1,339.32 MMSCF of natural gas at an estimated heat rate of 10,012.27 Btu/kWh in March 2019. The heat rate recorded in March 2019 was lower than the 10,291.69 Btu/kWh it recorded in February 2019.

The Karpowership Power Plant's generation increased in March 2019

The average electricity generated by the Karpowership increased in March 2019 by 11.2%, from 6.15 GWh per day in February 2019 to 6.83 GWh per day in March 2019. Similarly, the total electricity supplied by the thermal power plant increased by 23.1%, from 172.05 GWh in February 2019 to 211.73 GWh in March 2019. The total electricity supplied by Karpowership constituted 13.3% of the total electricity supplied in March 2019 and was 17.5% lower than the 256.7 GWh projected in the 2019 ESP. The thermal power plant contributed 439.5 MW to the System Peak Load and 439.8 MW to the Ghana Peak Load, this translates into 16.6% of the System Peak Load and the Ghana Peak Load in March 2019. The power ship consumed a total of 286,062 barrels of HFO at an estimated heat rate of 8,173.91 Btu/kWh in March 2019 which was marginally higher than the 8,158.4 Btu/kWh it recorded in February 2019.

AKSA Power Plant's generation decreased in March 2019

There was a significant increase in the average electricity supplied by AKSA by 2.7 folds, from 1.1 GWh per day in February 2019 to 4.1 GWh per day in March 2019. Likewise, the total electricity supplied by AKSA increased by 3 folds, from 30.79 GWh in February 2019 to 126.46 GWh in March 2019. The total electricity supplied by the thermal power plant constituted 7.9% of the total electricity supplied in March 2019 and was 1.3 folds higher than the 55 GWh projected in the 2019 ESP. A total of 211 MW and 207.6 MW was supplied by the thermal power plant to the System Peak Load and the Ghana Peak Load respectively. This represent 8% of the System Peak Load and 7.9% of the Ghana Peak Load in March 2019. The AKSA power plant consumed a total of 170,774.96 barrels of HFO at an estimated heat rate of 8,169.97 Btu/kWh in March 2019 which was marginally higher than the 8,159.5 Btu/kWh it recorded in February 2019.

Takoradi International Company (TICO) generation increased in March 2019

The average electricity supplied by TICO increased by 1.2 folds in March 2019, from 1.36 GWh per day in February 2019 to 3.04 GWh per day. Likewise, the total electricity supplied by the thermal power plant increased by 1.5%, from 38.08 GWh in February

HIGHLIGHTS OF THE MONTH

2019 to 94.15 GWh in March 2019. The total electricity supplied by the thermal power plant constituted 5.9% of the total electricity supplied in March 2019 and was 39.1% higher than the 94.15 GWh projected in the 2019 ESP. TICO contributed 149 MW to the System Peak Load and 100 MW to the Ghana Peak Load, representing 5.6% of the System Peak Load and 3.8% of the Ghana Peak Load in March 2019. A total of 714.02 MMSCF of natural gas, 8,221.88 barrels of LCO and 22 barrels of DFO was consumed by the thermal power plant at an estimated heat rate of 8,266.81 Btu/kWh in March 2019 which was lower than the 8,933.09 Btu/kWh it recorded in February 2019.

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

There was a significant reduction in the average electricity supplied by TAPCO by 66.3%, from 4.22 GWh per day in February 2019 to 1.42 GWh per day in March 2019. Similarly, the total electricity supplied by the thermal power plant decreased by 62.7%, from 118.18 GWh in February 2019 to 44.12 GWh in March 2019. The total electricity supplied by TAPCO constituted 2.8% of the total electricity supplied in March 2019 and was 72.7% lower than the 44.12 GWh that was projected in the 2019 ESP. The thermal power plant did not contribute to both the System Peak Load and the Ghana Peak Load for March 2019. A total of 476.31 MMSCF of natural gas was consumed by TAPCO at an estimated heat rate of 11,108.95 Btu/kWh in March 2019 which was marginally lower than the 11,190.87 Btu/kWh it recorded in February 2019.

Kpone Thermal Power Plant (KTPP) operated in March 2019

KTPP came back online and operated for 13 days in March 2019. The thermal power plant generated a total of 27.86 GWh which constituted 1.8% of the total electricity supplied in March 2019. KTPP contributed 102 MW to the System Peak Load and 101 MW to the Ghana Peak Load, translating into 3.9% of the System Peak Load and 3.8% of the Ghana Peak Load. KTPP consumed a total of 302.42 MMSCF of natural gas at an estimated heat rate of 11,586.51 Btu/kWh in March 2019.

Embedded Electricity Generation

Genser Power Plant's generation increased in March 2019

The average electricity supplied by Genser power plant increased by 1.2%, from 1.17 GWh per day in February 2019 to 1.22 GWh per day in March 2019. Similarly, the total electricity supplied by the thermal power plant increased by 4.3%, from 32.7 GWh in February 2019 to 37.75 GWh in March 2019. The total electricity supplied by the thermal power plant constituted 2.4% of the total electricity supplied in March 2019. The Genser power plant consumed a total of 10,117.16 tonnes of LPG at an estimated heat rate of 11,430.85 Btu/kWh in March 2019 which was lower than the 11,526.34 Btu/kWh it recorded in February 2019.

BXC Solar generation decreased in March 2019

The BXC Solar power plant recorded a significant increase in the total electricity it supplied in March 2019 by 1.1 folds, from 1.39 GWh in February 2019 to 2.88 GWh. The total electricity supplied by the solar power plant constituted 0.2% of the total electricity supplied in March 2019 and was 25.3% higher than the 2.3 GWh that was projected in the 2019 ESP.

VRA Navrongo Solar generation increased in March 2019

The VRA Navrongo Solar power plant recorded an increase in the total electricity it supplied in March 2019 by 23.1%, from 0.25 GWh in February 2019 to 0.31 GWh. The total electricity supplied by the solar power plant constituted 0.02% of the total electricity supplied in March 2019 and was 2.6% higher than the .3 GWh projected in the 2019 ESP.

Electricity Exchange – Import increased whilst Export decreased in March 2019

There was an increase in the average electricity imported from CIE by 20.5%, from 0.36 GWh per day in February 2019 to 0.44 GWh per day in March 2019. Likewise, the total electricity imported increased by 33.5%, from 10.15 GWh in February 2019 to 13.55 GWh in March 2019. Import of electricity contributed 26 MW only to the System Peak Load in March 2019.

The average electricity export to CIE, CEB and SONABEL decreased by 10.4% in March 2019, from 3.19 GWh per day in February 2019 to 2.86 GWh per day. Average electricity to CIE and SONABEL decreased from 0.22 GWh per day and 1.26 GWh per day in February 2019 to 0.15 GWh per day and 0.95 GWh per day in March 2019 respectively. On the contrary, average electricity export to CEB increased by 2.5%, from 1.71 GWh per day in February 2019 to 1.76 GWh per day in March 2019.

The total electricity export to CIE, CEB and SONABEL decreased by 0.8%, from 89.39 GWh in February 2019 to 88.66 GWh in March 2019. The total electricity supplied to CIE and SONABEL decreased from 6.07 GWh and 35.36 GWh in February 2019 to 4.76 GWh and 29.47 GWh in March 2019. Contrary to the decrease in export to CIE and SONABEL, the total electricity exported to CEB increased by 13.5%, from 47.96 GWh in February 2019 to 54.43 GWh in March 2019.

However, Ghana continues to be a net exporter of electricity in March 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

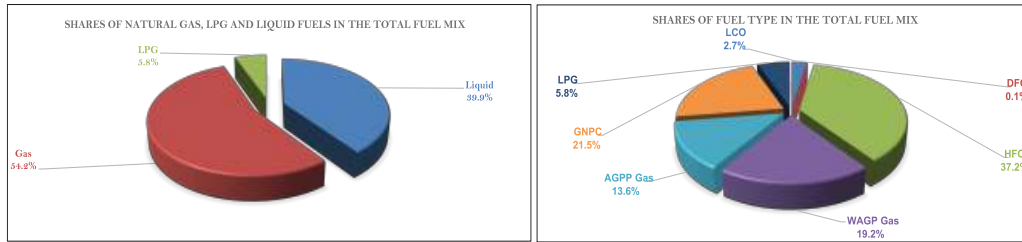


Figure 4a: Contribution of Natural Gas Supply by sources

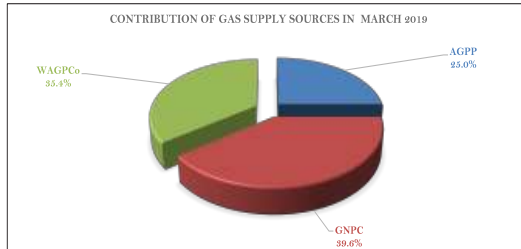
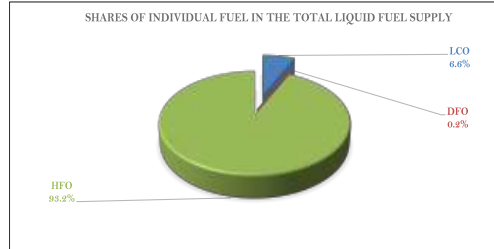


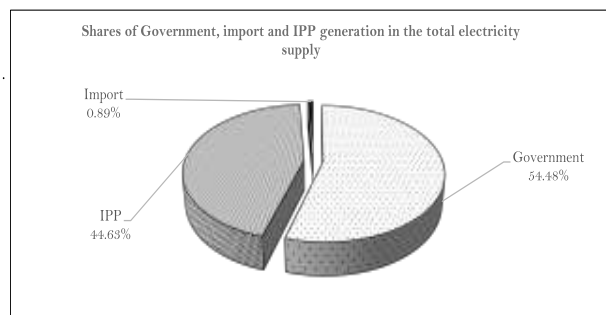
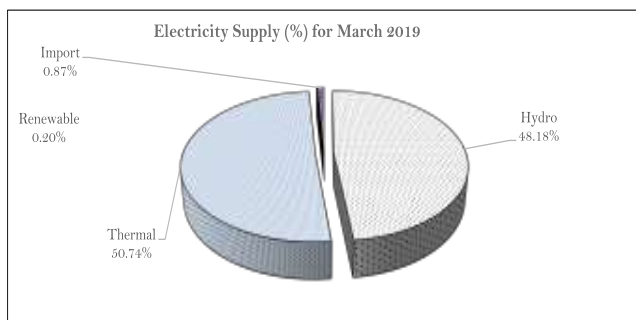
Figure 4b: Contribution of individual fuel in the liquid fuel supply



Peak Electricity Supply - March 2019			
Source of Supply	Generation at System Peak Load of March 2019 (MW)	Generation at Ghana Peak Load of March 2019 (MW)	Electricity Supply (GWh)
AKOSOMBO	893.40	858.00	584.32
KPONG	115.00	141.00	89.53
BUI	203.40	209.00	76.04
SEAP	270.70	224.60	131.53
TAPCO	-	-	44.12
TICO	149.00	100.00	94.15
TT1PP	-	-	-
CENIT	-	-	-
TT2PP	-	6.40	6.75
MRP	-	-	-
KARPOWER	439.50	439.80	211.73
AMERI	237.20	238.20	137.65
KTPP	102.00	101.00	27.86
Trojan Power	-	-	-
CENPOWER	-	124.00	9.40
AKSA	211.00	207.60	126.46
BXC Solar	-	-	2.88
Safisana	-	-	-
VRA Solar	-	-	0.31
Genser	29.00	-	37.75
IMPORT	29.00	-	13.55
Export to CIE at peak	-	16.00	54.43
Export to CEB at peak	88.00	77.00	4.76
Export to Sonabel	66.00	60.00	29.47
System Coincident Peak Load	2,650.20		
Ghana Coincident Peak Load		2,496.60	
Total Supply			1,594.03
Total Supply without export			1,505.37

Ghana Electricity Demand & Supply		
		Mar-19
Maximum System Peak Load	MW	2,650.2
Minimum System Peak Load	MW	2,253.6
Average Peak Generation	MW	2,485.1
System Base Load	MW	1,300.9
Total Electricity	GWh	1,596.0
Load Factor (LF)	%	78.8

OPERATIONAL FACT SHEET



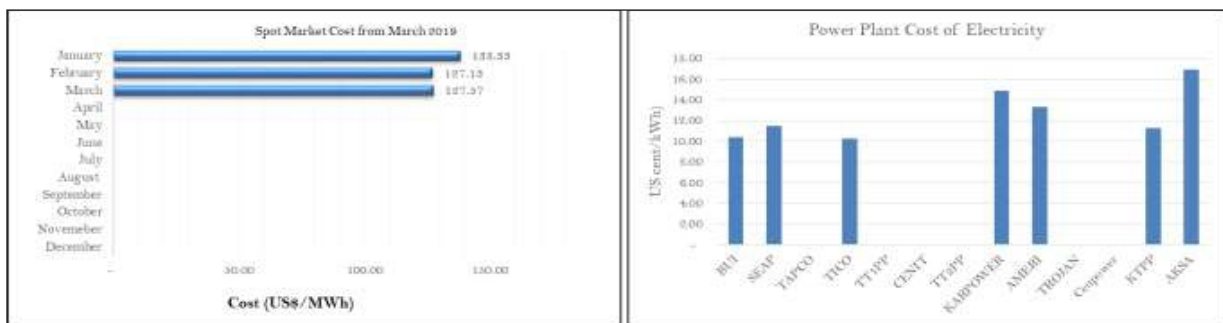
Power Plant Data for March 2019								
	Installed Capacity (MW)	Plant Capacity Utilization (%)	Electricity Generation (GWh)	Gas Consumption (MMBtu)	LCO Consumption (MMBtu)	DFO Consumption (MMBtu)	HFO Consumption (MMBtu)	LPG Consumption (MMBtu)
Akosombo	1,020.00	77.00	584.32	-	-	-	-	-
Kpong	160.00	75.21	89.53	-	-	-	-	-
Bui	400.00	25.55	76.04	-	-	-	-	-
SEAP	560.00	31.57	131.53	1,015,797.37	60,614.69	-	-	-
TAPCO	330.00	17.97	44.12	490,126.69	-	-	-	-
TICO	340.00	37.22	94.15	734,726.78	43,501.17	118.64	-	-
TT1PP	126.00	-	-	-	-	-	-	-
CENIT	126.00	-	-	-	-	-	-	-
TT2PP	49.50	18.33	6.75	87,102.74	-	-	-	-
KARPOWER	470.00	60.55	211.73	-	-	-	1,790,675.71	-
AMERI	250.00	74.00	137.65	1,378,158.36	-	-	-	-
Cenpower	350.00	3.61	9.40	-	93,124.10	5,184.60	-	-
TROJAN	56.00	-	-	-	-	-	-	-
KTPP	220.00	17.02	27.86	322,820.92	-	-	-	-
AKSA	360.00	46.22	123.80	-	-	-	1,033,188.51	-
GENSER	95.00	45.70	32.30	-	-	-	-	431,514.57
VRA Solar	2.50	14.93	0.28	-	-	-	-	-
BXC	20.00	12.10	1.80	-	-	-	-	-
Meinergy	20.00	9.00	1.34	-	-	-	-	-
Total	4,955.00	42.66	1,572.60	4,028,732.86	197,239.96	5,303.24	2,763,864.23	431,514.57

Average Monthly Flowrate (MMSCFD)	
Location	Monthly Average
Etoki	61.91
Tema WAGPCo	44.01
Aboadze WAGPCo	1.06
Aboadze GNGC	84.09

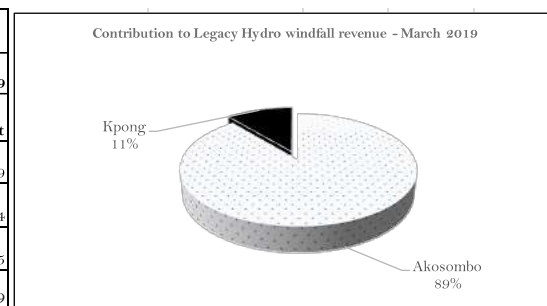
Mar-19			
	Beginning month (ft)	End month (ft)	Change in water level (feet)
Hydro Dam			
Akosombo	258.18	256.04	-2.14
Bui	565.31	560.56	-4.76

ECONOMIC FACT SHEET

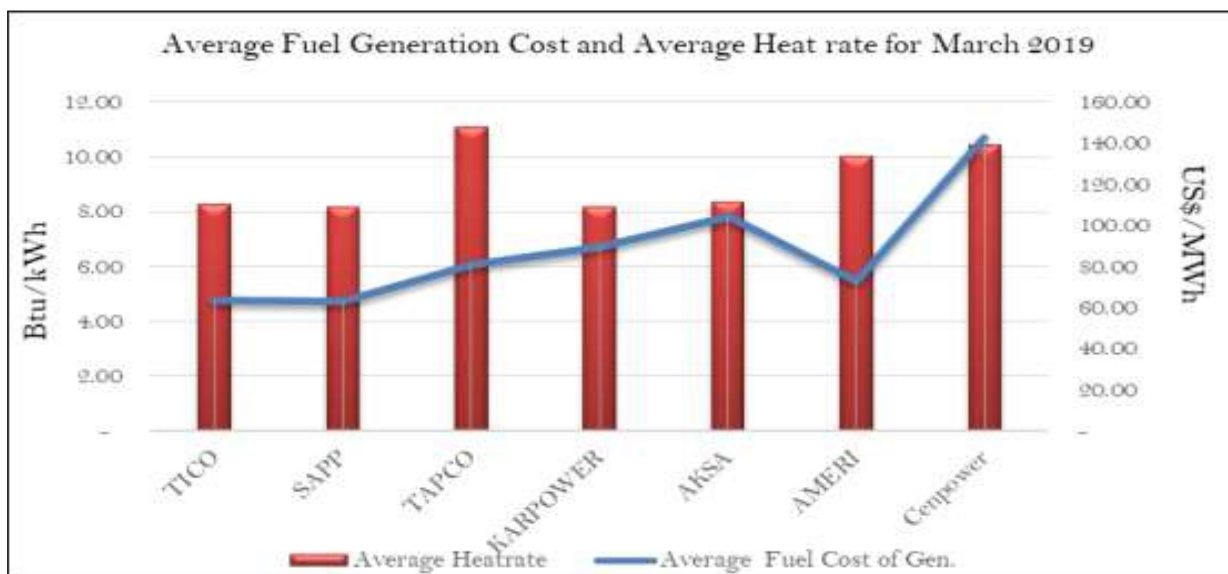
		Actual	Projected	Change
Average Market Energy Cost	US\$/MWh	103.30	90.97	12.33
Average Market Capacity Charge (AMCC)	US\$/MWh	35.40	36.42	(1.02)
Total Average Market Price (TAMC)	US\$/MWh	138.70	127.39	11.31
System Marginal Cost (SMC)	US\$/MWh	124.32	104.88	19.44
System Marginal Capacity Charge (SMCC)	US\$/MWh	23.42	23.42	-
Spot Market Price (SMP)	US\$/MWh	147.74	128.30	19.44
Composite Bulk Generation Charge (CBGC)	US\$/MWh	97.01	97.01	-
Deviation of TAC from CBGC	US\$/MWh	(41.69)	(7.49)	(34.19)
Deviation of SMP from CBGC	US\$/MWh	(50.73)	(41.92)	(9.41)



Average Fuel Prices		
		Mar-19
Fuel Type	Unit	Delivered Cost
Natural Gas	US\$/MMBTu	7.29
LCO	US\$/BBL	76.14
HFO	US\$/Tonne	383.85
DFO	US\$/Tonne	709.99



	Gazetted Natural gas Price	Weighted average Natural Gas Price	LCO	HFO	DFO
US\$/MMBTu	7.29	7.36	14.39	11.56	17.58



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	77.00	-	-	-
Kpong	75.21	-	-	-
Bui	25.55	-	-	-
SAPP	31.57	8,183.72	62.93	0.41
TAPCO	17.97	11,108.95	80.98	0.59
TICO	37.22	8,266.81	63.54	0.41
TT1PP	-	-	-	-
CENIT	-	-	-	-
TT2PP	18.33	12,905.83	94.08	0.68
KARPOWER	60.55	8,173.91	89.80	0.64
AMERI	74.00	10,012.27	72.99	0.53
TROJAN	-	-	-	-
KTPP	17.02	11,586.51	84.47	0.61
AKSA	46.22	8,345.42	104.43	0.66
Genser	45.70	11,430.85		0.72

The EMOP Secretariat is presenting part one of a three part series on the Electricity Transmission Services Pricing Policy and Guidelines of the PURC for comments from stakeholders. Kindly forward your comments to the EMOP Secretariat at the Energy Commission.

1.0 Draft Electricity Transmission Ancillary Services Pricing Policy and Guidelines

This Electricity Transmission Ancillary Services Pricing Policy and Guidelines have been developed in compliance with PURC Act, Act 538, 1997, EC Act 541, 1997, Electricity Regulations, LI 1937, 2008, the National Electricity Grid Code of October, 2009 and other associated Rules and Regulations.

As an important factor in human endeavors, the reliability of electricity supply is critical in the socioeconomic development of any nation including Ghana. Thus in the context of her development agenda and quest for improved socio-economic development the country's power sector development was anchored on the reform of its power sector.

The Electricity Supply Industry, under the Ghana Power Sector Reform Programme which was launched in mid 1990s, witnessed drastic changes in regulatory environment in order to encourage the rapid development of the sector to international standards. The reform efforts have led to the establishment of an independent transmission utility to provide a non-discriminatory bridge between power producers and consumers towards the creation of a contestable market that will enhance the overall goals of ensuring reliable and affordable supply of electricity. A further objective of the reform process is to ensure that pricing of electricity from generation, transmission to distribution is done in a transparent manner to give comfort to all players in the industry and also provide incentive for investments in the sector.

In conformity with the goals of the power sector reforms, the Public Utilities Regulatory Commission has been mandated to approve tariffs for services provided by the transmission utility with the view to ensuring safe, adequate and reliable supply of electricity which then calls for the provision of ancillary services. The provision of Ancillary Services as a critical mandate of any transmission utility must therefore be done in a transparent manner.

Thus under the mandate of the Electricity Transmission Utility (ETU), the following ancillary services have been identified as critical to meeting the objectives of providing safe and reliable electricity:

1. Contingency/Reliability Reserves;
2. Regulation;
3. Load Following;
4. System Black Start; and
5. Reactive Supply and Voltage Control

This Ancillary Services Pricing Policy and Guidelines is intended to provide clear processes and procedures for procurement of ancillary services in the national interconnected transmission system (NITS).

Classification of Ancillary Services

In this document Ancillary services are defined under the following three functional classes:

1. Frequency Control;
2. Network Control; and
3. System Restart

Frequency control services are defined as Primary and Secondary frequency control services which automatically restore the system frequency to normal in the event of an abnormal situation occurring. Network control services are also defined as to cover Voltage Control and Power Flow Controls which are primarily required to automatically maintain system voltages. System Restart (Black Start) services are defined as those services which are required to restore the system back into operation in the event of system collapse.

Provision of Frequency and Network Control Services

Primary frequency control and primary voltage control services shall be provided from spinning reserves by designated power plants which are online. Secondary frequency control, secondary voltage and power flow control services shall be provided by designated standing reserve plants that are synchronized to the system. System Restart services shall be provided.

Legal Authority

The legal mandates under which these policies have been developed are contained in the provisions of the Energy Commission Act 541, Public Utilities Regulatory Commission Act 538 and associated rules, regulations, guidelines and codes of practices.

Primary Legal Mandates

Section 23 of the Energy Commission Act, 1997, Act 541 provides for the establishment of a national interconnected transmission system to be operated by a transmission utility. The EC Act further provides that tariffs to be charged by the Electricity Transmission Utility shall be subject to approval by the PURC. Section 16 and 18 of the PURC Act 538 provides for the manner in which the tariffs for transmission services shall be developed including preparation of guidelines for such services.

As one of the key transmission services to be provided by the transmission utility, ancillary services are required to ensure greater

Other Market News and Trends

supply reliability to meet demand. The nature of these services has been identified in the secondary legislation under the EC Act, Act 541 and the Public Utilities Regulatory Commission Act, 1997, Act 538.

Secondary Legal Mandates

The secondary legal mandates are those legal provisions under subsidiary legislation, rules, regulations, codes and guidelines derived from the primary legal mandates provided in the EC Act and PURC Act.

Electricity Regulations, 2008, LI 1937

Section 3 (2) states that “The Grid Code shall provide for regulations for minimum reserve margins to satisfy demand” Electricity Supply and Distribution (Technical and Operational) Rules, 2005, LI 1816 Section 10 of the LI provides for Power Factor Limits for customers and the mandate of suppliers to impose a power factor surcharge on customers. PURC is also mandated to determine power factor surcharge where customers fail to install compensators to improve factor to at least 0.9.

Electricity Transmission (Technical, Operational and Standards of Performance) Rules, 2008, LI 1934

Section 9 of the LI 1934 requires Distribution Utilities and Bulk customers to procure and deploy adequate reactive electricity compensation and other devices to meet obligations under this LI and the Grid Code.

National Electricity Grid Code

The National Electricity Grid Code, 2009 establishes the requirements, procedures, practices and standards that shall govern the development, operation, maintenance and use of high voltage transmission system in Ghana with the purpose to ensure that the National Interconnected Transmission System (NITS) provides fair, transparent, non-discriminatory, safe, reliable, secure and cost efficient delivery of electrical energy. The following key provisions of the Grid Code relate to the provision of ancillary services in the NITS:

Articles 9.23 and 9.26: Provides for ETU to determine the amount of non-spinning reserve that shall ensure system reliability provided that it is not spinning reserve and can be synchronized and put on load within 30 minutes.

Article 9.24: Provides for the level of non-spinning reserves which shall be a function of largest generating units and load blocks on the system as well as combined system demand.

Article 9.28: Provides for reactive power requirements at all NITS nodes, feeders and substations which must have power factor of 0.9 lagging and unity.

Article 9.34: States that all generating units must be capable of power factor of 0.85 lagging and 0.95 leading

Article 9.42: Provides for compensation payments that the normal provision of reactive power requirements by any generating plant shall be without compensation but dispatch instructions for operation beyond the standard requirement shall attract compensation payments from the ETU as provided for under the Electricity Market Rules.

Ghana Electricity Market Rules (Phase-1)

The Ghana Electricity Market Rules (Phase-1) and subsequent Phases of the Market Rules to be approved by the Energy Commission, shall establish procedures and practices which shall govern the Wholesale Electricity Market (WEM), with respect to the sale, purchase and dispatch of ancillary services in the wholesale electricity market. The rules shall further provide a minimum specified operating capacity, a year ahead for each dispatchable generation registered facility to be allocated to spinning reserves.

Objectives Of The Policy

The goal of this policy and guidelines is to ensure safe, adequate and reliable transmission of electricity in the national interconnected transmission system in consonance with the performance and reliability standards of the National Electricity Grid Code as well as to:

1. establish and govern efficient, competitive and reliable markets for the wholesale supply and purchase of electricity and ancillary services in Ghana;
2. ensure that market participants have non-discriminatory access to the transmission system;
3. facilitate competition in the generation of electricity; and
4. protect the interests of consumers with respect to pricing and quality of electricity services.

This policy and guidelines has the following specific objectives:

1. Provide spinning reserves of 20% of dispatchable generating units;
2. Provide non-spinning reserves of 28% of total system demand or as may be determined by the ETU;
3. Provide adequate reactive power to maintain power factor of 0.9 or more in the national interconnected system (NITS);
4. Maintain system voltages in the NITS within the limits of +5% of the designed nominal voltage; and
5. Maintain frequency within the NITS at between 49.8Hz and 50.2Hz.

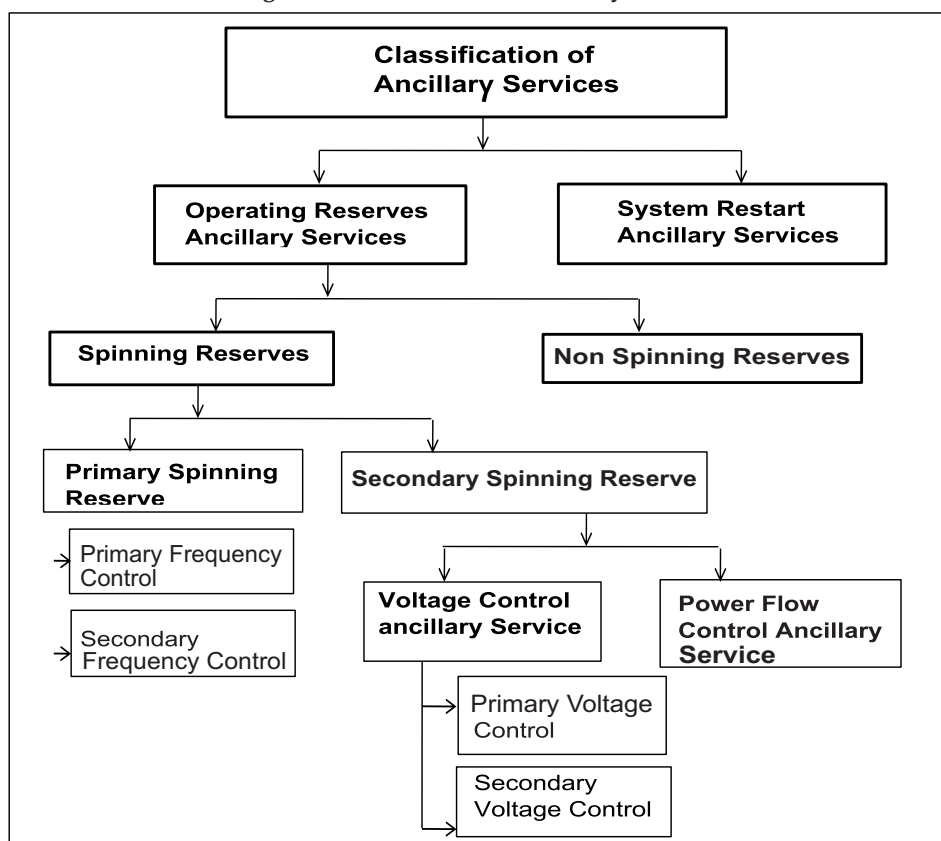
General Approach

Ancillary Services Agreement

The National Electricity Grid Code requires the ETU to enter into agreements to provide sufficient ancillary services to meet the system performance requirements, taking into account those services which are available or are provided under Connection Agreements. The following key policy issues are addressed in this document in respect of provision of ancillary services:

1. Nature of the ancillary service required;
2. Operating regime of the service;
3. Providers of the services;
4. Compensation for the provision of the service;
5. Payment arrangements; and
6. Determination of the cost of the service.

Figure 1 Classification of Ancillary Services



Acronyms

AGPP = Atuabu Gas Processing Plant
CBGC = Composite Bulk Generation Charge
DFO = Distillate Fuel Oil
ECG = Electricity Company of Ghana
ESP = Electricity Supply Plan
GHp = Ghana Peseva
GWh = Giga-watt Hours
KTPP = Kpone Thermal Power Plant
MRP = Mine Reserve Plant
LCO = Light Crude Oil
LTA = Long Term Average
MMScf = Million Standard Cubic Feet
NITS = National Interconnected Transmission System
SAPP = Sunon Asogli Power Plant
SNEP = Strategic National Energy Plan
TT2PP = Tema Thermal 2 Power Plant
VRA = Volta River Authority
WAGP = West African Gas Pipeline

Btu = British Thermal Units
CUF = Capacity Utilization Factor
EC = Energy Commission
EMOP = Electricity Market Oversight Panel
FPSO = Floating Production, Storage and Offloading
GNGC = Ghana National Gas Company
HFO = Heavy Fuel Oil
kWh = Kilo-watt hours
LEAP = Long-range Energy Alternative Planning
LI = Legislative Instrument
MW = Megawatt
MWh = Mega-watt hours
PV = Photovoltaic
SMP = System Marginal Price
TEN = Tweneboa, Enyenra, Ntomme
TT2PP = Tema Thermal 2 Power Plant
WAGPCo = West African Gas Pipeline Company
WEM = Wholesale Electricity Market

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