GHANA WHOLESALE ELECTRICITY MARKET BULLETIN

MARKET WATCH

Monthly Market Data Analysis

ISSUE NO. 42 **1st June 2019 to 30th June 2019**

This Bulletin covers major developments in the Wholesale Electricity Market (WEM) of Ghana from 1st June, 2019 to 30th May, 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 continuation of 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

The month of June witnessed a reduction in the System Peak Load by 6.9%, from 2,781.2 MW in May 2019 to 2,589.7 MW. However, the System Peak Load recorded in June 2019 was 1.4% higher than the 2,554 MW projected in the Electricity Supply Plan (ESP) for 2019.

The Ghana Peak Load reduced by 6%, from 2,547.2 MW in May 2019 to 2,394.4 MW in June 2019. Likewise, the Ghana Peak Load recoded in June 2019 was 0.4% lower than the 2,404 MW projected in the 2019 ESP. Electricity Import did not contribute to both the System Peak Load and the Ghana Peak Load in June 2019. The total 223 MW of electricity exported at the System Peak Load in June 2019 which was 48.7% higher than the 150 MW projected in the ESP for 2019.

A total 1,489.83 GWh of electricity supplied in June 2019 which was 7.5% higher than the 1,386.2 GWh projected in the 2019 ESP. Domestic consumption of 1,374.14 GWh of electricity recorded in June 2019 was 5.2% higher than the 1,306.6 GWh projected in the 2019 ESP. A total of 115.69 GWh of electricity was exported to CIE, CEB and SONABEL in June 2019, which was 45.3% higher than the 79.6 GWh projected in the 2019 ESP.

Electricity generated from hydro sources contributed 30.6% of the total electricity supplied in June 2019, which was lower than the 41.5% that was recorded in May 2019. The share of electricity generated from thermal sources in the total electricity supplied in

Table 1. Projected and Actual Outturn of electricity demand and supply in May 2019 and June 2019.

	June 2019		May 2019	
	Projected	Actual Outturn	Projected	Actual Outturn
Total Supply (GWh)	1,386.1	1,455.6	1,482.4	1,613.3
Source by Power Plants (GWh)				
AKOSOMBO	364.9	366.9	377.1	548.3
KPONG	65.4	63.6	67.6	74.1
BUI	53.4	25.8	55.2	47.5
Sunon Asogli	268.5	202.9	272.0	205.0
TAPCO	102.0	97.2	100.1	78.8
TICO	129.8	112.5	202.4	108.1
TT1PP	-	25.9	-	53.1
CENIT	-	-	-	2.7
TT2PP	-	16.4	-	10.9
MRP	-	-	-	-
Karpowership	248.5	150.3	256.7	156.5
AMERI	77.0	113.0	86.4	118.2
KTPP	-	64.8	-	11.8
Trojan Power	-	-	-	-
CENPOWER	-	160.6	-	116.2
AKSA	72.0	42.3	60.0	44.5
BXC Solar	2.2	1.9	2.3	2.4
VRA Solar	0.2	-	0.3	0.3
Genser		0.3	-	24.3
Meinergy	2.2	1.8	2.3	1.3
Total Generation (GWh)	1,386.1	1,446.2	1,482.4	1,603.9
Imports (GWh)	-	9.4	-	9.3
Total Supply (GWh)	1,386.1	1,455.6	1,482.4	1,613.3
Deficit/Over supply (GWh)	-	69.5	-	130.9
Ghana Coincedent Peak Load (MW)	2,404.0	2,394.4	2,491.0	2,547.2
System Coincident Peak Load (MW)	2,554.0	2,589.7	2,641.0	2,781.2

June 2019, increased from 57.6% in May 2019 to 68.5% in June 2019. Solar power generation continued to be 0.3% of the total electricity
supply.

The Akosombo dam and Bui dam continued to drop at a reduced rate in June 2019. The rate of drop in the water level for Akosombo GS reduced from 0.05 feet per day in May 2019 to 0.01 feet per day in June 2019. Similarly, the rate of drop in the water level for the Bui GS reduced from 0.07 feet per day in May 2019 to 0.02 feet per day in June 2019.

The Takoradi – Tema Interconnection Project (TTIP), which tie-in the Ghana National Gas Company (GNGC) pipeline to the West African Gas Pipeline (WAGP) system in Takoradi to allow reverse flow of surplus gas from Western offshore of Ghana to Tema recorded a first flow on 4th June 2019.

Natural gas continued its dominance in the total fuel mix in June 2019. The share of the total natural gas consumed in the total fuel mix increased from 61.7% in May 2019 to 67.5% in June 2019. The share of total liquid fuel consumed reduced from 36.8% in May 2019 to 32.5% in June 2019. There was no consumption of LPG in June 2019 for electricity generation.

ELECTRICITY DEMAND AND SUPPLY

Electricity Demand

There was a reduction in the System Peak Load in June 2019 by 6.9%, from 2,781.2 MW in May 2019 to 2,589.7 MW. Likewise, the Ghana Peak Load of 2,394.4 MW recorded in June 2019 was 6% lower than the 2,547.2 MW in May 2019. The low demand for electricity in June 2019 was due to the cold weather experienced. A total of 223 MW was exported to CIE, CEB and SONABEL at the System Peak Load in June 2019. Out of the total electricity export, 44 MW, 105 MW and 74 MW were exported to CIE, CEB and SONABEL respectively in June 2019. Electricity import did not contribute to both the System Peak Load and the Ghana Peak Load in June 2019. Electricity generated by hydro power plants contributed 33.4% of the System Peak Load in June 2019, while thermal generation accounted for the 66.6%. Average system demand reduced by 4.6% in June 2019, from 2,168.4 MW in May 2019 to 2,069.2 MW. Consequently, the System Load Factor reduced from 77.9% in May 2019 to 75.3% in June 2019.

Electricity supply

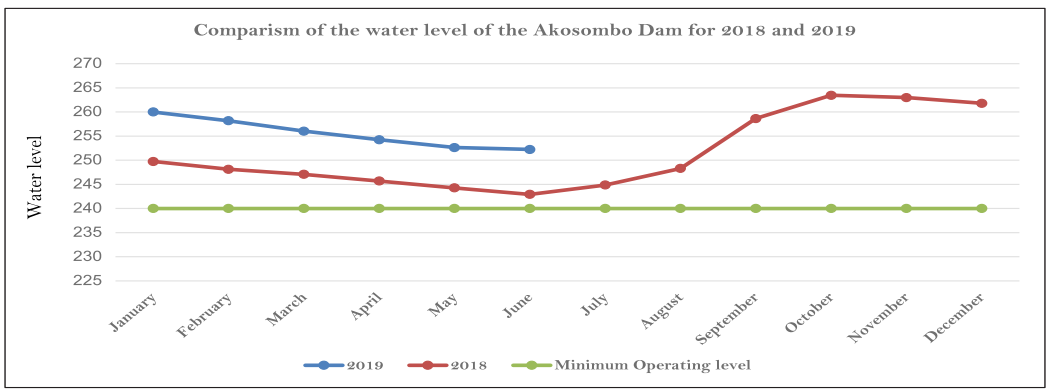
Average electricity supply continued to reduce in June 2019, from 52.14 GWh per day in April 2019, 52.04 GWh per day in May 2019 to 49.66 GWh per day. The average electricity supplied in June 2019 reduced by 4.6%. Similarly, the total electricity supplied decreased by 7.7%, from 1,613.26 GWh in May 2019 to 1,489.83 GWh in June 2019. A total of 9.43 GWh of electricity was imported from CIE in June 2019, which was 1.1% higher than the 9.33 GWh imported in May 2019. Out of the total electricity supplied, 1,374.14 GWh was generated by domestic power plants, representing 92.2% of the total electricity supplied in June 2019. Electricity export decreased by 4.8% in June 2019, from 121.51 GWh in May 2019 to 115.69 GWh. Out of the total electricity exported, 62.73 GWh, 5.69 GWh and 47.27 GWh were supplied to CEB, CIE and SONABEL respectively in June 2019. Electricity generated from hydro sources constituted 30.6%, thermal sources constituted 68.6% and solar constituted 0.3%of the total electricity supplied in June 2019.

HYDRO DAM LEVELS

Akosombo Dam Water Level continued to drop but at a reduced rate in June 2019

The Akosombo dam recorded a net inflow from 13th June to 27th June 2019. As a result, the rate of drop in the water level reduced from 0.05 feet per day in May 2019 to 0.02 feet per day in June 2019. This could be attributed to the significant reduction in generation of about 30% and increased inflow into the dam. The water level of 252.64 feet recorded at the beginning of the month reduced by 0.41 feet to 252.23 feet. The water level recorded at the end of the month was 9.3 feet above the water level recorded for the same period in 2018. The end-month water level for June 2019 was 13.23 feet above the minimum operating level of 240 feet.

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



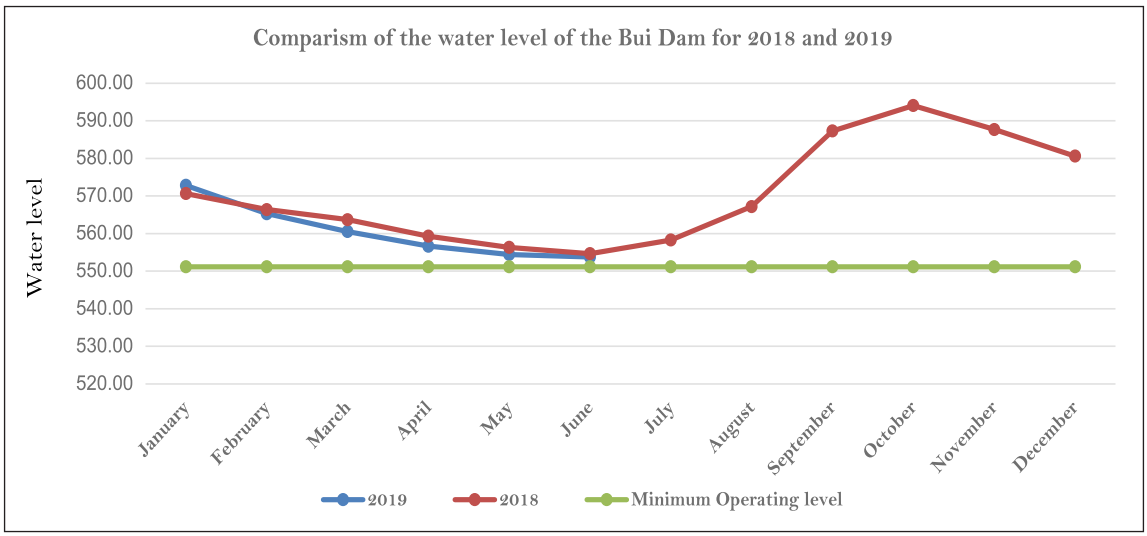
HIGHLIGHTS OF THE MONTH

Bui Dam Water Level continued to drop but at a reduced rate in June 2019

The rate of drop in the water level for Bui GS reduced from 0.07 feet per day in May 2019 to 0.02 feet per day in June 2019. This was due to a significant reduction in the electricity generated by the power plant by 45.7%. The water level of 554.46 feet recorded at the beginning of the month dropped by 0.69 feet to a month-end water level of 553.77 feet. The water level recorded at the end of the month was 0.88 feet lower than the 554.65 feet recorded at the same period in 2018. The month-end water level recorded for the Bui dam was 2.59 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 June 2019.

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



FUEL SUPPLY FOR POWER GENERATION

Natural gas flow rate from WAGPCo decreased in June 2019

There was a reduction in the natural gas flow rate from WAGP in June 2019 by 7.5%, from 67 MMSCFD in May 2019 to 62 MMSCFD. Consequently, the total natural gas supplied by WAGPCo decreased from 1,988.79 MMSCF in May 2019 to 1,860 MMSCF in June 2019. The total natural gas supplied by WAGPCo constituted 35.4% of the total natural gas consumed, which was lower than the 41.6% recorded in May 2019. Also, in the total fuel mix, WAGPCo's share decreased from 25.7% in May 2019 to 23.9% in June 2019.

Natural gas flow from GNGC increased in June 2019.

The natural gas flow rate from the Atuabo Gas Processing Plant (AGPP) to the Aboadze power enclave reduced by 9.1%, from 39.53 MMSCF in May 2019 to 35.93 MMSCF in June 2019. Similarly, the total natural gas supplied to the Aboadze power enclave reduced from 1,219.72 MMSCF in May 2019 to 1,059.55 MMSCF in June 2019. Also, a total of 394.11 MMSCF of natural gas was supplied by GNGC to Genser power plant for electricity generation in June 2019. In summary, a total of 1,453.66 MMSCF of natural gas was supplied by GNGC for electricity generation in June 2019, which was 4.5% higher than the 1,390.7 MMSCF in June 2019. The total natural gas supplied by GNGC constituted 24.9% of the total natural gas consumed in June 2019, which was lower than the 28.1% in May 2019. The share of natural gas supplied by GNGC in the total fuel mix reduced from 17.3% in May 2019 to 16.8% in June 2019.

Natural gas flow from ENI/GNPC increased in June 2019

The Takoradi – Tema Interconnection Project (TTIP), which tie-in the Ghana National Gas Company (GNGC) pipeline to the West African Gas Pipeline (WAGP) system in Takoradi to allow reverse flow of surplus gas from Western offshore of Ghana to Tema recorded a first flow on 4th June 2019. The rate of reverse flow of natural gas from GNGC to Tema in June 2019 ranged between 20 MMSCFD and 67.78 MMSCFD, with an average of 43.38 MMSCFD. A total of 607.36 MMSCF of natural gas was supplied by GNGC to the East to be consumed by the Sunon Asogli Power plant in June 2019. The natural gas flow rate from ENI/GNPC increased by 11.6% in June 2019, from 48.67 MMSCFD in May 2019 to 54.34 MMSCFD. Similarly, the total natural gas supplied by ENI/GNPC increased from 1,508.85 MMSCF in May 2019 to 1,630.07 MMSCF in June 2019. In summary. A total of 2,237.43 MMSCF of natural gas was supplied by ENI/GNPC in June 2019. The share of the total natural gas supplied by ENI/GNPC in the total natural gas consumed increased from 33.3% in May 2019 to 39.7% in June 2019. Also, the share of the total natural gas supplied by ENI/GNPC in the total fuel mix increased to 26.8% in June 2019 from 18.7% in May 2019.

Liquid Fuel

There was a reduction in the total liquid fuel consumed in June 2019 by 5.2%, from 535,103 barrels in May 2019 to 507,242 barrels. The reduced liquid fuel consumption was due to increase natural gas supply to most of the thermal power plants. The share of the total HFO consumed in the total liquid fuel mix remained at 54.1% in June 2019. In the total fuel mix, the share of HFO decreased from 19.7% in May 2019 to 17.6% in June 2019. The share of LCO in the total liquid fuel consumed increased from 41.5% in May

2019 to 45.6% in June 2019. On the contrary, the share of LCO in the total fuel mix decreased from 15.1% in May 2019 to 14.8% in June 2019. The share of DFO in the total fuel mix decreased in June 2019, from 4.4% in May 2019 to 0.3%. In the total fuel mix, the share of DFO decreased from 1.9% in May 2019 to 0.1% in June 2019.

Plant by Plant Highlights

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

Average electricity generated by the Akosombo GS decreased by 30.8%, from 17.69 GWh per day in May 2018 to 12.23 GWh per day in June 2019. Similarly, the total electricity supplied by the hydro power plant decreased by 33.1%, from 548.25 GWh in May 2019 to 366.88 GWh in June 2019. The reduced electricity generation by Akosombo GS is to reserve the hydro dam water level. The total electricity supplied by the Akosombo GS was 0.5% higher than the 364.9 GWh projected in the 2019 ESP and constituted 24.6% of the total electricity supplied in June 2019. Akosombo GS contributed 673.4 MW to the System Peak Load and 643.8 MW to the Ghana Peak Load in June 2019. This translates into 26% of the System Peak Load and 24.9% of the Ghana Peak Load.

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

Kpong GS recorded a reduction in the average electricity supplied in June 2019 by 11.3%, from 2.39 GWh per day in May 2019 to 2.12 GWh per day. Likewise, the total electricity supplied by Kpong GS decreased by 14.2%, from 74.13 GWh in May 2019 to 63.6 GWh in June 2019. The total electricity supplied by the hydro power plant was 2.8% lower than the 65.4 GWh projected in the 2019 ESP and constituted 4.3% of the total electricity supplied in June 2019. The Kpong GS contributed 88 MW to the System Peak Load and 74 MW to the Ghana Peak Load in June 2019. This translates into 3.4% of the System Peak Load and 2.9% of the Ghana Peak Load.

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

The Bui GS continued to record a decrease in the average electricity supplied from 2.09 GWh per day in April 2019, 1.53 GWh per day in May 2019 to 0.86 GWh in June 2019. Consequently, the total electricity supplied by Bui GS decreased by 45.6%, from 47.54 GWh in May 2019 to 25.79 GWh in June 2019. The reduced electricity generation by Bui GS was to reduce the rate of drop in the water level. The total electricity supplied by the hydro power plant was 51.7% lower than the 53.4 GWh projected in the 2019 ESP and constituted 1.7% of the total electricity supplied in June 2019. The hydro power plant contributed 104.4 MW to the System Peak Load and 102.4 MW to the Ghana Peak Load in June 2019, this translates into 4% of both peak loads.

Generation by the Sunon Asogli Power Plant (SAPP) increased in June 2019

There was an increase in the average electricity supplied by the Asogli power plant by 2.3%, from 6.61 GWh per day in May 2019 to 6.76 GWh per day in June 2019. On the contrary, the total electricity supplied by the thermal power plant decreased by 1%, from 204.98 GWh in May 2019 to 202.93 GWh in June 2019. The reduction in the total electricity supplied by the thermal power plant was due to greater number of days in May than in June. The total electricity supplied by SAPP was 24.4% lower than the 268.5 GWh projected in the 2019 ESP, and constituted 13.6% of the total electricity that was supplied in June 2019. A total load of 228 MW and 228.5 MW was contributed to the System Peak Load and the Ghana Peak Load respectively in June 2019. This translates into 8.8% of both peak loads. The thermal power plant consumed a total of 1,260.03 MMSCF of natural gas and 53,420.9 barrels of LCO at an estimated heat rate of 8,017.04 Btu/kWh in June 2019. The heat rate recorded in June 2019 was higher than the 7,940.44 Btu/kWh in May 2019.

Ameri Energy Power Plant's generation decreased in June 2019

Average electricity generated by the Ameri power plant reduced in June 2019 by 1.2%, from 3.81 GWh per day in May 2019 to 3.77 GWh per day. Likewise, the total electricity supplied by power plant decreased by 4.4%, from 118.19 GWh in May 2019 to 112.95 GWh in June 2019. The total electricity supplied by the thermal power plant in June 2019 was 46.7% higher than the 77 GWh projected in the 2019 ESP and constituted 7.6% of the total electricity supplied. The Ameri power plant supplied 175.9 MW and 174.2 MW to the System Peak Load and the Ghana Peak Load respectively in June 2019. The total load supplied by Ameri constituted 6.8% of the System Peak Load and 6.7% of the Ghana Peak Load. A total of 1,103.31 MMSCF of natural gas was consumed by Ameri at an estimated heat rate of 10,051.21 Btu/kWh in June 2019. The heat rate recorded in June 2019 was higher than the 10,047.76 Btu/kWh in May 2019.

The Karpowership Power Plant's generation decreased in June 2019

Average electricity generated by the Karpowership reduced marginally by 0.8% in June 2019, from 5.05 GWh per day in May 2019 to 5.01 GWh per day. Likewise, the total electricity generated by the thermal power plant decreased by%, from 156.53 GWh in May 2019 to 150.25 GWh in June 2019. The total electricity generated by the thermal power plant was 39.5% lower than the 248.5 GWh projected in the 2019 ESP and constituted 10.1% of the total electricity supplied in June 2019. Karpowership generated a total of 439.4 MW to the System Peak Load and 439.8 MW to the Ghana Peak Load in June 2019. This translates into 17% of both peak loads. The thermal power plant consumed a total of 200,541.56 barrels of HFO at an estimated heat rate of 8,074.98 Btu/kWh in June 2019. The heat rate recorded in June 2019 was marginally lower than the 8,106.03 Btu/kWh recorded in May 2019.

AKSA Power Plant's generation decreased in June 2019

Average electricity generated by the AKSA power plant reduced in June 2019 by 1.7%, from 1.43 GWh per day in May 2019 to 1.41 GWh per day. Similarly, the total electricity supplied by AKSA decreased by 4.9%, from 44.45 GWh in May 2019 to 42.27 GWh in June 2019. The total electricity supplied by the thermal power plant was 41.3% lower than the 72 GWh projected in the 2019 ESP and constituted 2.8% of the total electricity supplied in June 2019. AKSA supplied a total of 109.6 MW to the System Peak Load and 152.7 MW to the Ghana Peak Load, representing 4.2% of the System Peak Load and 5.9% of the Ghana Peak Load in June 2019. A total of 57,013.49 barrels of HFO was consumed by the thermal power plant at an estimated heat rate of 8,159.89 Btu/kWh in June 2019 which was marginally higher than the 8,115.05 Btu/kWh recorded in May 2019.

HIGHLIGHTS OF THE MONTH

Takoradi International Company (TICO) generation increased in June 2019

There was an increase of 7.6% in the average electricity supplied by TICO, from 3.49 GWh per day in May 2019 to 3.75 GWh per day in June 2019. Similarly, the total electricity supplied increased by 4.1%, from 108.11 GWh in May 2019 to 112.53 GWh in June 2019. TICO's total electricity generated in June 2019 was 13.3% lower than the 129.8 GWh projected in the 2019 ESP and constituted 7.6% of the total electricity supplied in June 2019. TICO contributed a total of 172 MW to the System Peak Load and 171 MW to the Ghana Peak Load, representing 6.6% of both peak loads in June 2019. The thermal power plant consumed a total of 848.92 MMSCF of natural gas at an estimated heat rate of 7,762.86 Btu/kWh in June 2019. The heat rate recorded in June 2019 was lower than the 8,604.34 Btu/kWh recorded in May 2019.

Takoradi Power Company (TAPCO) Plant's generation increased in June 2019

TAPCO recorded an increase of 27.6% in the average electricity supplied in June 2019, from 2.54 GWh in May 2019 to 3.24 GWh per day. Likewise, the total electricity supplied by the thermal power plant increased by 23.5%, from 78.77 GWh in May 2019 to 97.24 GWh in June 2019. The total electricity supplied by TAPCO constituted 6.5% of the total electricity supplied in June 2019 and was 4.7% lower than the 102 GWh projected in the 2019 ESP. TAPCO contributed a total of 158 MW to the System Peak Load and the Ghana Peak Load, representing 6.1% of both peak loads in June 2019. The thermal power plant consumed a total of 713.47 MMSCF of natural gas at an estimated heat rate of 7,802.81 Btu/kWh in June 2019. The heat rate recorded by the TAPCO in June 2019 was lower than the 8,664.5 Btu/kWh it recorded in May 2019.

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

KTPP operated throughout June 2019 and supplied a total of 64.85 GWh. The total electricity supplied by the thermal power plant constituted 4.4% of the total electricity supplied in June 2019. KTPP contributed 103 MW to the System Peak Load and 104 MW to the Ghana Peak Load in June 2019, representing 4% of both peak loads. The thermal power plant consumed a total of 678.69 MMSCF of natural gas and 1,046.08 barrels of DFO at an estimated heat rate of 11,258.73 Btu/kWh in June 2019. However, the thermal power plant was projected to be offline in June 2019.

Tema Thermal 1 Power Plant (TT1PP) continued operation in June 2019

The operation of TT1PP was limited to 11 days in June 2019. The thermal power plant supplied a total of 25.94 GWh which constituted 1.7% of the total electricity supplied in June 2019. TT1PP consumed a total of 266.25 MMSCF of natural gas at an estimated heat rate of 10,956.55 Btu/kWh in June 2019. The thermal power plant did not contribute to both the System Peak Load and the Ghana Peak Load in June 2019.

Embedded Electricity Generation

Genser Power Plant's generation increased in June 2019

Average electricity supplied by the Genser power plant increased by 45.3%, from 0.78 GWh in May 2019 to 1.14 GWh in June 2019. Similarly, the total electricity supplied by the thermal power plant increased from 24.31 GWh in May 2019 to 34.19 GWh in June 2019. The total electricity supplied by the thermal power plant in June 2019 constituted 2.3% of the total electricity supplied. A total of 394.11 MMSCF of natural gas was consumed by the power plant at an estimated heat rate of 11,861.3 Btu/kWh in June 2019. The heat rate recorded in June 2019 was lower than the 12,341.55 Btu/kWh it recorded in May 2019.

BXC Solar generation decreased in June 2019

The BXC solar power plant recorded a reduction of 20.7% in the electricity it supplied in June 2019, from 2.44 GWh in May 2019 to 1.94 GWh. The total electricity supplied by the solar power plant constituted 0.1% of the total electricity supplied in June 2019. Also, the total electricity generated by BXC in June 2019 was 12% lower than the 2.2 GWh projected in the 2019 ESP.

VRA Navrongo Solar generation decreased marginally in June 2019

There was a marginal reduction of 2.1% in the total electricity supplied by the VRA solar power plant, from 0.282 GWh in May 2019 to 0.276 GWh in June 2019. The total electricity supplied by the solar power plant constituted 0.02% of the total electricity supplied in June 2019 and was 37.8% higher than the 0.2 GWh projected in the 2019 ESP.

Electricity Exchange – Import increased whilst Export decreased in June 2019

Average electricity import increased by 4.5% in June 2019, from 0.3 GWh per day in May 2019 to 0.31 GWh per day. Likewise, the total electricity imported increased by 1.1%, from 9.33 GWh in May 2019 to 9.43 GWh in June 2019. The total electricity imported constituted 0.6% of the total electricity supplied in June 2019.

Average electricity exported to CIE and SONABEL increased by 68% and 14.7% in June 2019, from 0.11 GWh per day and 1.37 GWh per day in May 2019 to 0.19 GWh per day and 1.58 GWh per day in June 2019 respectively. On the contrary, average electricity export to CEB decreased by 14% in June 2019, from 2.43 GWh per day in May 2019 to 2.09 GWh per day.

The total electricity supplied to CIE and SONABEL increased by 62.8% and 11% in June 2019, from 3.49 GWh and 42.59 GWh in May 2019 to 5.69 GWh and 47.27 GWh respectively. However, the total electricity supplied to CEB decreased in June 2019 by 16.8%, from 75.43 GWh in May 2019 to 62.73 GWh.

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

Monthly Market Data Analysis

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

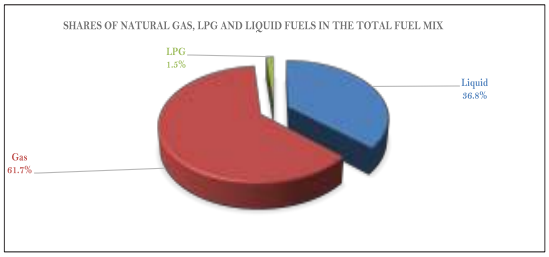


Figure 3b: Shares of fuel type in the generation fuel mix power generation

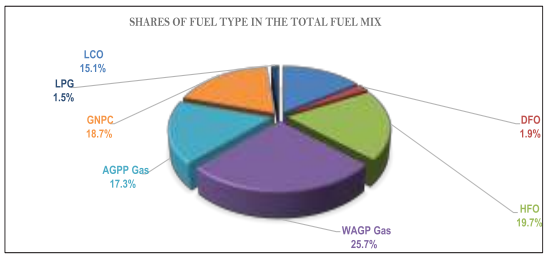


Figure 4a: Contribution of Natural Gas Supply by sources

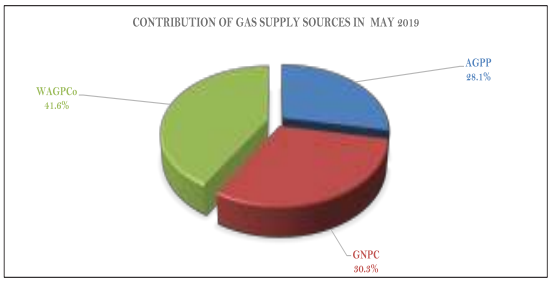
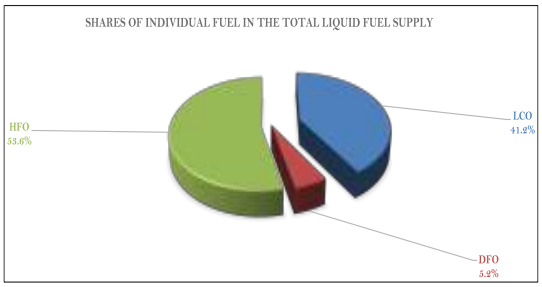


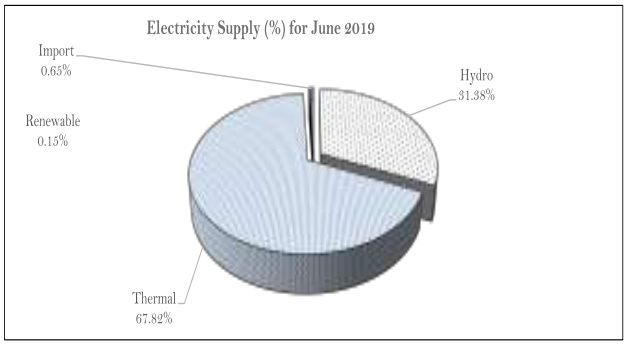
Figure 4b: Contribution of individual fuel in the liquid fuel supply

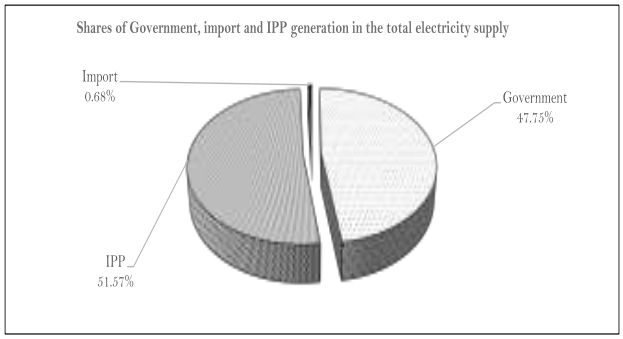


Peak Electricity Supply - June 2019			
Source of Supply	Generation at System Peak Load (MW)	Generation at Ghana Peak Load (MW)	Eleectricity Supply (GWh)
AKOSOMBO	673.40	643.80	366.88
KPONG	88.00	74.00	63.60
BUI	104.40	102.40	25.79
SEAP	228.00	228.50	202.93
TAPCO	158.00	158.00	97.24
TICO	172.00	171.00	112.53
TT1PP	-	-	25.94
CENIT	-	-	-
TT2PP	-	-	16.39
MRP	-	-	-
KARPOWER	439.40	439.80	150.25
AMERI	175.90	174.20	112.95
KTPP	103.00	104.00	64.85
Trojan Power	-	-	-
CENPOWER	338.00	339.00	160.55
AKSA	109.60	152.70	42.27
BXC Solar	-	-	1.94
Safisana	-	-	-
VRA Solar	-	-	0.28
Genser	-	-	34.19
IMPORT	-	-	9.43
Export to CIE at peak	44.00	30.00	62.73
Export to CEB at peak	105.00	102.00	5.69
Export to Sonabel	74.00	61.00	47.27
System Coincident Peak Load	**2,589.70**		
Ghana Coincedent Peak Load		**2,394.40**	
Total Supply			**1,488.01**
Total Supply without export			**1,372.32**

Ghana Electricity Demand & Supply		
		Jun-19
Maximum System Peak Load	MW	**2,589.7**
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	**836.1**
Load Factor (LF)	%	**75.3**

OPERATIONAL FACT SHEET





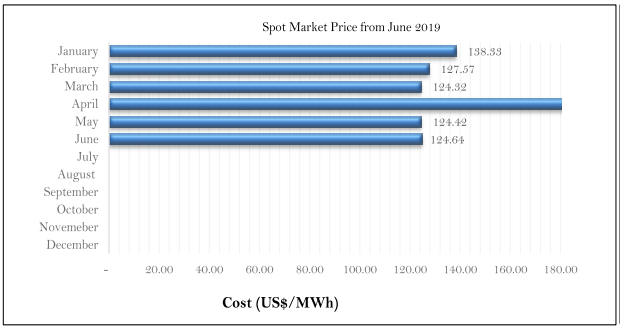
Power Plant Data June 2019								
	Installed Capacity (MW)	Plant Capacity Utilization (%)	Electricity Generation (GWh)	Gas Consumption (MMBtu)	LCO Consumption (MMBtu)	DFO Consumption (MMBtu)	HFO Consumption (MMBtu)	LPG Consumption (MMBtu)
Akosombo	1,020.00	49.96	366.88	-	-	-	-	-
Kpong	160.00	55.21	63.60	-	-	-	-	-
Bui	400.00	8.96	25.79	-	-	-	-	-
SEAP	560.00	50.33	202.93	1,577,655.97	49,231.72	-	-	-
TAPCO	330.00	40.93	97.24	758,776.63	-	-	-	-
TICO	340.00	45.97	112.53	873,542.44	-	-	-	-
TT1PP	126.00	28.59	25.94	284,212.88	-	-	-	-
CENIT	126.00	-	-	-	-	-	-	-
TT2PP	87.00	26.17	16.39	210,540.93	-	-	-	-
KARPOWER	470.00	44.40	150.25	-	-	-	1,213,276.46	-
AMERI	250.00	62.75	112.95	1,135,303.95	-	-	-	-
Cenpower	370.00	60.27	160.55	-	1,262,852.86	3,502.47		-
TROJAN	56.00	-	-	-	-	-	-	-
KTPP	220.00	40.94	64.85	724,476.15	-	5,617.43	-	-
AKSA	360.00	16.31	42.27	-	-	-	344,931.60	-
GENSER	95.00	47.22	32.30	-	-	-	-	-
VRA Solar	2.50	15.43	0.28					
BXC	20.00	12.50	1.80	-	-	-	-	-
Meinergy	20.00	9.30	1.34	-	-	-	-	-
Total	**5,012.50**	39.63	**1,477.90**	**5,564,508.95**	**1,312,084.59**	**9,119.90**	**1,558,208.07**	**-**

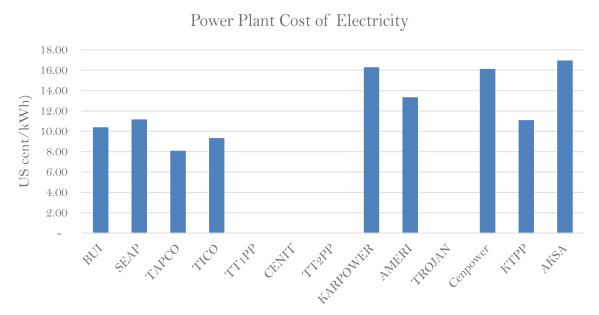
Average Monthly Flowrate (MMSCFD)	
Location	**Monthly Average**
Etoki	**82.93**
Tema WAGPCo	**86.86**
Aboadze WAGPCo	**2.01**
Aboadze GNGC	**94.25**
Reverse Flow	**20.94**

Jun-19			
	Beginning month (ft)	**End month (ft)**	**Change in water level**
Hydro Dam			**(feet)**
Akosombo	252.64	252.23	-0.41
Bui	554.46	553.77	-0.69

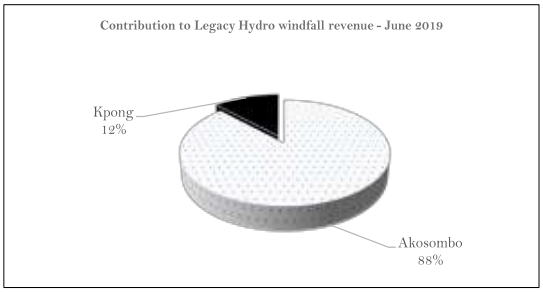
ECONOMIC FACT SHEET

		Actual	Projected	Change
Average Market Energy Cost	US$/MWh	99.38	91.00	8.38
Average Market Capacity Charge (AMCC)	US$/MWh	36.10	36.01	0.09
Total Average Market Cost (TAC)	US$/MWh	135.49	127.01	8.48
System Marginal Cost (SMC)	US$/MWh	124.64	104.88	19.76
System Marginal Capacity Charge (SMCC)	US$/MWh	23.95	23.95	-
Spot Market Price (SMP)	US$/MWh	148.59	128.83	19.76
Composite Bulk Generation Charge (CBGC)	US$/MWh	97.01	97.01	-
Deviation of TAC from CBGC	US$/MWh	(38.48)	(30.00)	(8.48)
Deviation of SMP from CBGC	US$/MWh	(51.58)	(31.82)	(19.76)

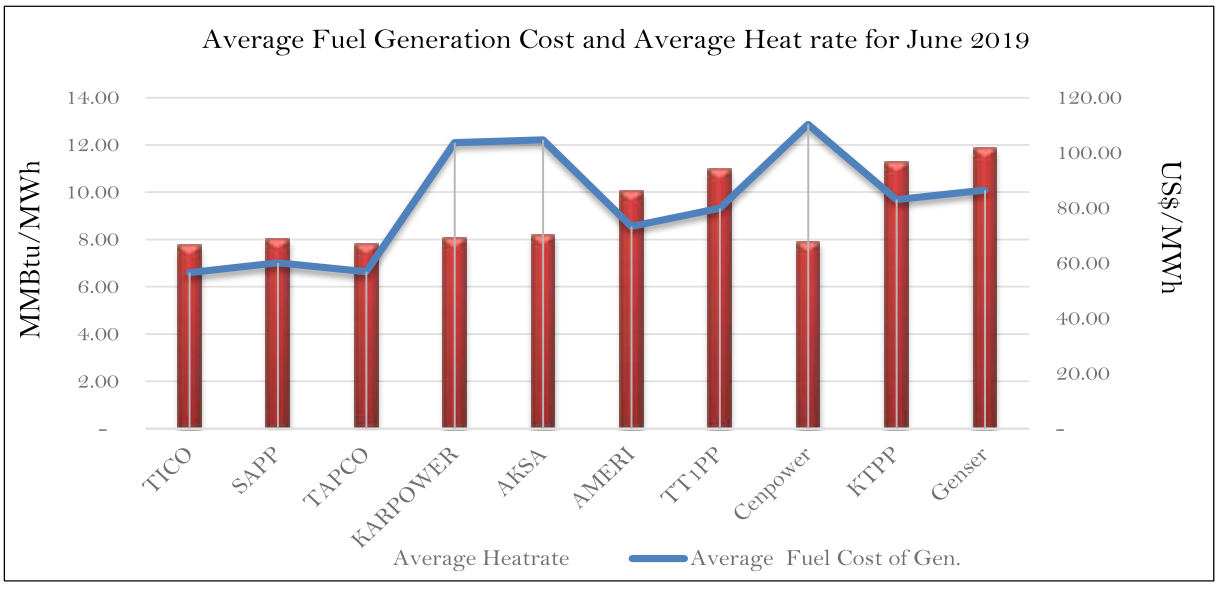




Average Fuel Prices		
		Jun-19
Fuel Type	Unit	Delivered Cost
Natural Gas	US$/MMBtu	7.29
LCO	US$/BBL	74.22
HFO	US$/Tonne	453.89
DFO	US$/Tonne	742.09



	Gazetted Natural Gas Price	Weighted average Natural Gas Price	LCO	HFO	DFO
US$/MMBTu	7.29	7.41	14.03	12.84	18.37



Power Plant	Capacity Utilization (%)	Average Heat rate (Btu/KWh)	Average Fuel Cost of Generation (US$/MWh)	Emission Factor (kgCO2/kWh)
Akosombo	49.96	-	-	-
Kpong	55.21	-	-	-
Bui	8.96	-	-	-
SAPP	50.33	8,017.04	60.08	0.43
TAPCO	40.93	7,802.81	56.88	0.41
TICO	45.97	7,762.86	56.59	0.41
TT1PP	28.59	10,956.55	79.87	0.58
CENIT	-	-	-	-
TT2PP	26.17	12,842.95	93.63	0.68
KARPOWER	44.40	8,074.98	103.66	0.64
AMERI	62.75	10,051.21	73.27	0.53
TROJAN	-	-	-	-
KTPP	40.94	11,258.73	83.04	0.00
AKSA	16.31	8,159.89	104.75	0.64
Genser	47.22	11,861.30	86.47	0.63

		Wholesale Electricity Market Price Data - 2019 (UScent/kWh)				
		January	February	March	April	May
Average Market Price	Actual	14.14	14.26	13.87	16.68	13.91
	Projected	12.79	12.69	12.74	12.97	12.86
System Marginal price	Actual	17.02	16.07	14.77	20.85	14.84
	Projected	12.83	13.00	12.83	12.88	12.83

The EMOP Secretariat is presenting part four of a 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.

DRAFT ELECTRICITY TRANSMISSION ANCILLARY SERVICES PRICING POLICY AND GUIDELINES

4.6 Basic Reactive Power Control
Basic Reactive Power shall be required to maintain adequate system voltages and also to prevent power system failure. and shall be provided from generating units operating within the reactive power limits of 0.85 lagging and 0.9 leading and from Grid Participants with the capability to supply additional reactive power above their requirements. Based on foregoing every generating unit shall provide a minimum amount of reactive power within their factor limits as provided for above.

Provided user loads and generating plants have complied with the normal reactive power compensation requirement, it shall be the responsibility of the ETU to provide whatever additional reactive power compensation that is required to maintain system voltages within stipulated range. Such reactive power compensation, referred to as the basic reactive power compensation, shall be to the account of the ETU as part of the general costs of operating the NITS.

All generating plants shall promptly comply with any dispatch instructions from the ETU to operate at any power factor within the required limits as a normal requirements and provision of such reactive power by any generating plant shall be without compensation. However, the provision of reactive power beyond the normal or standard requirement as per dispatch instructions by the ETU shall attract compensation payment from the ETU.

4.6.1 Operating regime
Reactive power compensation and voltage control services shall be provided by contractually committing to the ETU the ability to reserve and dispatch the reactive output of a generating unit. Reactive power generating units shall be capable of continuous operation for as long as required.

The ETU shall issue dispatch instructions to wholesale suppliers to adjust reactive power output of any scheduled generating unit that has been instructed to be synchronized.

4.6.2 Procurement
Basic Reactive Power shall be procured from operating generating units. The ETU shall schedule, provide, procure and/or dispatch basic reactive power as necessary to maintain system voltage within limits during normal operations.

4.6.3 Service Provider
Basic Reactive Power shall be provided from operating generating units including secondary spinning generating units that are synchronized and are capable of providing reactive power.

4.6.4 Compensation
The normal provision of basic 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. Compensation for basic reactive power shall be on a plant by plant basis and shall reflect the actual capital and fixed O&M costs of the plant as determined by the PURC. For each plant a Reference Reactive Power Price (RRPP).

4.6.5 Operating regime
Reactive power compensation and voltage control services shall be provided by contractually committing to the ETU the ability to reserve and dispatch the reactive output of a generating unit and reactive power compensation devices. Reactive power generating units shall capable of continuous operation for as long as required.

4.6.6 Procurement
Reactive power shall be procured from both operating generating units on as per real time needs. The ETU shall schedule, provide, procure and/or dispatch reactive power as necessary to maintain system voltage within limits during normal operations.

4.6.7 Service Provider
Reactive power shall be provided from operating generating units that are synchronized and capable of providing reactive power including secondary spinning generating units.

4.6.8 Compensation
The normal provision of basic reactive power requirements by any generating plant shall be without compensation however dispatch instructions for additional reactive power beyond the normal requirement shall attract compensation payments from the ETU.

Compensation for reactive power shall be on a plant by plant basis and shall reflect the actual capital and fixed O&M costs of the plant as determined by the PURC. For each plant a Basic Reactive Power Price (BRPP) shall be calculated. The compensation shall

be the Capacity Charge (GHckW/month) for each power plant times actual reactive power (MVARs) generated in real time over and above the normal reactive power requirements for the plant. The BRPP shall be denominated in US$/MVARs/month.

4.6.9 Payment
The cost of basic reactive power shall be paid by all Distribution Utilities and Bulk Customers as part of the Transmission Service Charge (TSC). This shall be approved by PURC.

4.7 Supplementary Reactive Power Compensation
In the event that a Distribution Utility, Bulk Customer or any NITS off-taker fails to maintain its reactive power requirements or power factor within 0.9, the ETU may procure or provide supplementary reactive power compensation in order to ensure that the NITS voltage standards are achieved. Such users shall be liable to pay compensation to the ETU.

4.7.1 Operating regime
Supplementary reactive power compensation and voltage control services shall be scheduled, provided, procured and/or dispatched by the ETU as necessary to maintain system voltages within limits during normal operations as well as during grid contingency conditions.

4.7.2 Procurement
Supplementary reactive power compensation shall be procured from operating generating units on as per real time needs or any devices installed by the ETU for that purpose.

4.7.3 Service Provider
Supplementary reactive power compensation shall be provided from operating generating units that are synchronized and capable of providing reactive power including secondary spinning generating units or devices installed by the ETU for that purpose.

4.7.4 Compensation
The normal provision of supplementary reactive power requirements by any generating plant shall be without compensation however dispatch instructions for operation beyond the standard requirements shall attract compensation payments from the ETU.

The charge for provision of supplementary reactive power compensation provided by the ETU shall be borne at cost of equipment. The ETU shall inform PURC regarding installation of equipment for the provision of supplementary reactive power compensation.

4.7.5 Payment
The cost of supplementary reactive power compensation shall be paid by all Distribution Utilities and Bulk Customers as part of the Transmission Service Charge (TSC). This shall be approved by PURC.

4.8 Regulation
Regulation services shall be provided by on-line generating units as part of primary spinning reserves taking into account practical experiences of Ghana system to set the requisite spinning margin.

4.8.1 Operating regime
Regulation services shall be provided by on-line dispatchable generating units as long as required.

4.8.2 Method of Procurement
Regulation Services shall be procured/provided as part of primary spinning reserves.

4.8.3 Service Provider
Regulation services shall be provided as part of the primary spinning reserves by synchronised generating units capable of governor control and equipped with automatic generation control (AGC) facilities to respond automatically to frequency deviations in the system.

4.8.4 Compensation
Compensation for provision of regulation services shall be part of payment for primary spinning reserves. Refer to compensation for primary spinning reserves

4.8.5 Payment
The cost of Regulation Services shall be paid by all Distribution Utilities and Bulk Customers as part of the Transmission Service Charge. This shall be approved by PURC

4.9 Load Following
Load Following services shall be provided by separate synchronised dispatchable generating units as part of secondary spinning reserves so as to track intra-hour changes in system load.

4.9.1 Operating regime
Load Following services shall be provided by separate dispatchable generating units that are synchronised but not loaded or on-line when and as long as required.

4.9.2 Method of Procurement
Load Following services shall be procured as part of secondary spinning reserves

4.9.3 Service Provider
Load Following services shall be provided as part of the secondary spinning reserves. Refer to conditions under Service Provider of secondary spinning reserves.

4.9.4 Compensation
Compensation for provision of load following services shall be part of payment for secondary spinning reserves. Refer to compensation for secondary spinning reserves.

4.9.5 Payment
The cost of load following services shall be paid by all Distribution Utilities and Bulk Customers as part of the Transmission Service Charge. This shall be approved by PURC.

4.10 Black Start Capability
Generating plants with Black Start capability shall be required to restore the power system to a Normal State following complete or partial failure of the power system. The ETU shall determine the quantities and locations of generating units that are required to provide black start ancillary services.

4.10.1 Operating regime
Black Start generating units shall be capable of continuous operation for as long as required.

4.10.2 Procurement
The ETU shall procure Black Start ancillary services by contractually committing self-starting generating units.

4.10.3 Service Provider
Black Start ancillary services shall be provided from generating units that have the capability of self-start.17

4.10.4 Compensation
Compensation for Black Start ancillary services shall be based on availability payment (benchmark price set by the PURC). The benchmark price shall be denominated in US$/MW/month to recover the cost of equipment and the fixed O&M with additional payments for fuel denominated in US$/MWh when called upon to operate.

4.10.5 Payment
The cost of Black Start ancillary services shall be paid by all Distribution Utilities and Bulk Customers as part of the Transmission Service Charge. This shall be approved by PURC.

Acronyms

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

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