GHANA WHOLESALE ELECTRICITY MARKET BULLETIN

MARKET WATCH

Monthly Market Data Analysis

ISSUE NO. 41 **1st May 2019 to 31st May 2019**

This Bulletin covers major developments in the Wholesale Electricity Market (WEM) of Ghana from 1st May, 2019 to 31st 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

There was an increase in the System Peak Load in May 2019 by 1%, from 2,752.6 MW in April 2019 to 2,781.2 MW. Also, the System Peak Load recorded in May 2019 was 5.3% higher than the 2,641 MW projected in the 2019 Electricity Supply Plant (ESP). Likewise, there was a marginal increase in the Ghana Peak Load in May 2019 by 0.02%, from 2,546.7 MW in April 2019 to 2,547.2 MW. The Ghana Peak Load recorded in May 2019 was 2.3% higher than the 2,491 MW projected in the 2019 ESP. Import of electricity did not contribute to both the System Peak Load and the Ghana Peak Load in May 2019. At the System Peak Load, there was a total of 234 MW of electricity exported to CIE, CEB and SONABEL in May 2019, which was 56% higher than the 150 MW projected in the 2019 ESP.

A total of 1,613.26 GWh of electricity was supplied in May 2019, which was 8.8% higher than the 1,482.5 GWh projected in the 2019 ESP. Also, the total electricity of 1,491.75 GWh consumed domestically was higher than the 1,399.8 GWh that was projected in the 2019 ESP. A total of 121.51 GWh of electricity was exported to CIE, CEB and SONABEL in May 2019 which was 46.9% higher than the 82.7 GWh projected in the 2019 ESP.

Out of the total electricity supplied, 41.5% was supplied from hydro sources in May 2019 which was higher than the 40.9% recorded in April 2019. Electricity generation from thermal sources contributed 57.6% of the total electricity supplied in May 2019 which was lower than 58% recorded in April 2019. Electricity generated from the solar power plants, contributed 0.3% of the total

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

	May 2019		April 2019	
	Projected	Actual Outturn	Projected	Actual Outturn
Total Supply (GWh)	1,482.4	1,613.3	1,467.2	1,560.8
Source by Power Plants (GWh)				
AKOSOMBO	377.1	548.3	364.9	499.0
KPONG	67.6	74.1	65.4	76.6
BUI	55.2	47.5	53.4	62.8
Sunon Asogli	272.0	205.0	268.5	181.3
TAPCO	100.1	78.8	93.5	51.6
TICO	202.4	108.1	195.8	78.8
TT1PP	-	53.1	-	19.1
CENIT	-	2.7	-	-
TT2PP	-	10.9	-	6.7
MRP	-	-	-	-
Karpowership	256.7	156.5	248.5	201.8
AMERI	86.4	118.2	83.6	144.3
KTPP	-	11.8	-	26.6
Trojan Power	-	-	-	-
CENPOWER	-	116.2	-	36.1
AKSA	60.0	44.5	89.0	123.8
BXC Solar	2.3	2.4	2.2	2.9
VRA Solar	0.3	0.3	0.2	0.3
Genser		24.3	-	35.1
Meinergy	2.3	1.3	2.2	1.9
Total Generation (GWh)	1,482.4	1,603.9	1,467.2	1,548.8
Imports (GWh)	-	9.3	-	12.0
Total Supply (GWh)	1,482.4	1,613.3	1,467.2	1,560.8
Deficit/Over supply (GWh)	-	130.9	-	93.6
Ghana Coincedent Peak Load (MW)	2,491.0	2,547.2	2,491.0	2,546.7
System Coincident Peak Load (MW)	2,641.0	2,781.2	2,641.0	2,752.6

electricity supplied in May 2019.

The rate of drop in the water level for Akosombo GS and Bui GS continued to reduce in May 2019. The rate of drop for Akosombo GS reduced from 0.07 feet per day in March 2019, 0.06 feet per day in April 2019 to 0.05 feet per day in May 2019. The rate of drop in the water level for the Bui GS reduced from 0.15 feet per day in March 2019, 0.13 feet per day in April 2019 to 0.07 feet per day in May 2019.

The total natural gas consumed in May 2019 dominated the total fuel mix with a share of 61.7%, which was higher than the 45.2% in April 2019. The share of the total liquid fuel consumed reduced from 49.6% in April 2019 to 36.8% in May 2019. Similarly, the share of LPG in the total fuel mix reduced from 5.2% in April 2019 to 1.5% in May 2019.

ELECTRICITY DEMAND AND SUPPLY

Electricity Demand

The System Peak Load of 2,781.2 MW recorded in May 2019 was 1% higher than the 2,752.6 MW recorded in April 2019. The Ghana Peak Load of 2,547.2 MW recorded in May 2019 was 0.02% higher than the 2,546.7 MW recorded in April 2019. Electricity import from CIE did not contribute to both the System Peak Load and the Ghana Peak Load in May 2019. A total of 234 MW was exported to CIE, CEB and SONABEL at the System Peak Load in May 2019. Out of the total electricity exported, 16 MW was supplied to CIE, 141 MW to CEB and 77 MW to SONABEL. Electricity generated from hydro sources contributed 35.1% of the total electricity supplied at the System Peak Load and the Ghana Peak Load in May 2019. Generation from thermal sources contributed 64.9% of the total electricity generated at the System Peak Load and the Ghana Peak Load. Export demand increased from an average of 130 MW in April 2019 to 163 MW in May 2019. The Load Factor decreased in May 2019, from 76.7% in April 2019 to 76.6%. Consequently, the average electricity demand reduced from 2,172.37 MW in April 2019 to 2,168.35 MW.

Electricity supply

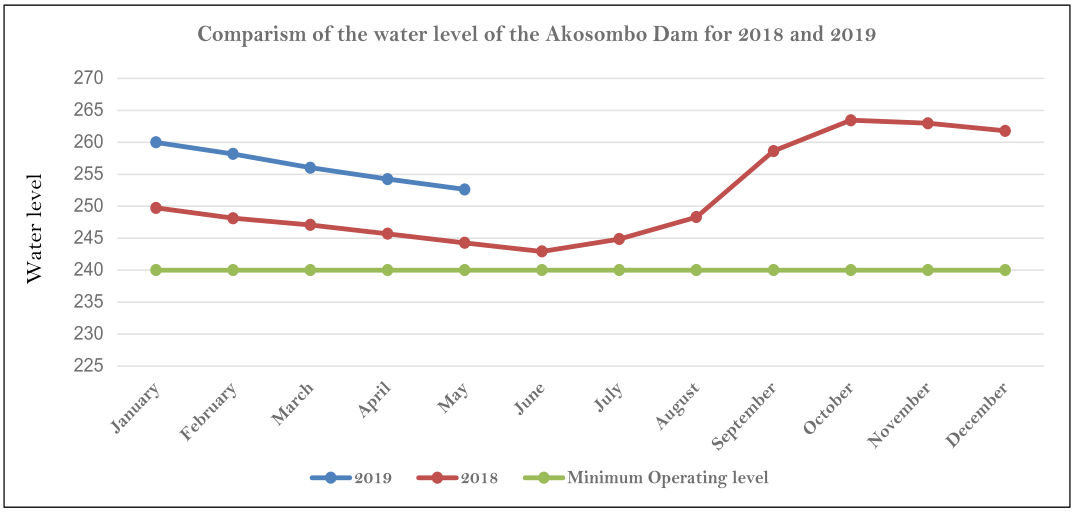
There was a reduction in the average electricity supplied in May 2019 by 0.3%, from 52.14 GWh per day in April 2019 to 51.97 GWh per day in May 2019. On the contrary, the total electricity of 1,613.82 GWh supplied in May 2019 was 8.9% higher than the 1,564.11 GWh that was recorded in April 2019. The increase in the total electricity supplied was due to greater number of days in May than in April. Out of the total electricity supplied, 9.33 GWh was imported from CIE and the remainder 1,604.5 GWh was supplied from domestic power plants. A total of 121.51 GWh was exported to CIE, CEB and SONABEL in May 2019, which was 29.6% higher than the 93.77 GWh that was exported in April 2019. Out of the total electricity exported, 3.49 GWh was supplied to CIE, 75.43 GWh to CEB and 42.59 GWh to SONABEL in May 2019. Electricity generation from hydro sources contributed 41.8% of the total electricity supplied and 58.1% was supplied from thermal power plants in May 2019.

HYDRO DAM LEVELS

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

The Akosombo GS recorded a reduction in the rate of drop in the water level in May 2019, from 0.06 feet per day in April 2019 to 0.05 feet per day. The water level of 254.26 feet recorded at the beginning of May 2019 reduced by 1.62 feet to a month end water level of 252.64 feet. The water level recorded at the month end was 8.36 feet above the water level of 244.28 feet recorded for the same period in 2018.

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

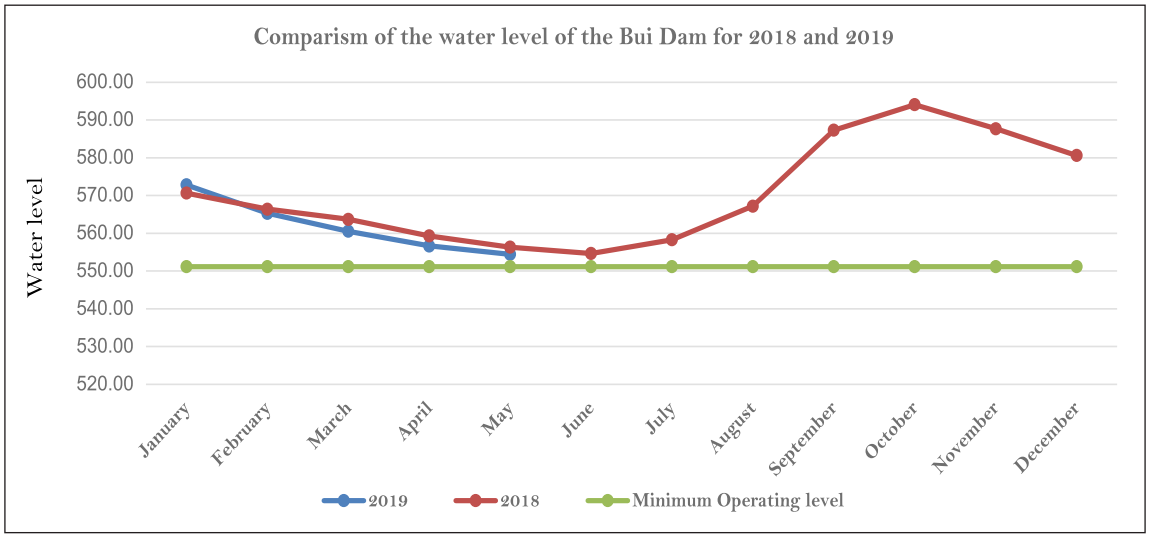


Bui Dam Water Level continued to drop at a reduced rate in May 2019

The Bui GS recorded a reduction in the rate of drop in the water level in May 2019, from 0.15 feet (0.046 meters) per day in March 2019, 0.13 feet (0.04 meters) per day in April 2019 to 0.07 feet (0.021 meters) per day. The water level of 556.65 feet (169.667 meters) recorded at the beginning of the month of May dropped by 2.2 feet (0.671 meters) to a month end water level of 554.46 feet (168.999 meters). The water level recorded at the end of the month was 1.89 feet (0.576 meters) lower than the water level of 556.35 feet (169.575 meters) recorded for the same period in 2018.

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

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



FUEL SUPPLY FOR POWER GENERATION

Natural gas flow rate from WAGPCo increased in May 2019

The flow rate of natural gas from WAGP increased in May 2019 by 15.6%, from 57.93 MMSCFD in April 2018 to 67 MMSCFD in May 2019. Consequently, the total natural gas supplied increased in May 2019 by 15.7%, from 1,737.99 MMSCF in April 2019 to 1,988.79 MMSCF. The total natural gas supplied contributed 41.6% of the total natural gas consumed, which was lower than the 48.5% recorded in April 2019. In the total fuel mix, the share of natural gas supplied by WAGP increased from 22% in April 2019 to 25.7% in May 2019.

Natural gas flow from GNGC increased in May 2019.

The natural gas flow rate from the Atuabo Gas Processing Plant (AGPP) increase significantly in May 2019 by 78.1%, from 22.19 MMSCFD in April 2019 to 39.53 MMSCFD. Similarly, the total natural gas supplied increased from 665.83 MMSCF in April 2019 to 1,219.72 MMSCF in May 2019. GNGC commenced the supply of natural gas to Genser for electricity generation in May 2019. A total of 170.98 MMSCF of natural gas was supplied in May 2019. A total of 1,390.7 MMSCF of natural gas was supplied by GNGC in May 2019 for electricity generation. The total natural gas supplied by GNGC constituted 28.1% of the total natural gas consumed in May 2019, which was higher than the 18.1% recorded in April 2019. In the total fuel mix, the share of natural gas supplied by GNGC increased from 8.2% in April 2019 to 17.3% in May 2019.

Natural gas flow from ENI/GNPC increased in May 2019

There was an increase in the natural gas flow rate from ENI/GNPC to the Aboadze Power Enclave in May 2019, from 40.75 MMECFD in April 2019 to 48.67 MMSCFD in May 2019. Likewise, the total natural gas supplied by ENI/GNPC increased from 1,222.55 MMSCF in April 2019 to 1,508.85 MMSCF in May 2019. In the total fuel mix, the share of natural gas supplied by GNPC increased from 15.1% in April 2019 to 18.7% in May 2018. On the contrary, the share of natural gas supplied by ENI/GNPC decreased to 30.3% of in May from 33.3% it recorded in April 2019.

Liquid Fuel

The consumption of liquid fuel reduced by 26.1% in May 2019, from 717,577 barrels in April 2019 to 535,103 barrels. This was due to increased natural gas supply and reduced electricity generation from Karpowership and AKSA in May 2019. Consequently, the share of HFO in the total fuel mix reduced from 31.9% in April 2019 to 19.7% in May 2019. The share of HFO in the total liquid fuel consumed reduced from 64.4% in April 2019 to 54.1% in May 2019. The share of LCO in the total fuel mix reduced from 15.5% in April 2019 to 15.1% in May 2019. On the contrary, the share of LCO in the total liquid fuel consumed increased from 31.4% in April 2019 to 41.5% in May 2019. The share of DFO consumed reduced in the total fuel mix decreased from 2.1% in April 2019 to 1.9% in May 2019. In the total liquid fuel consumed, the share of DFO increased from 4.2% in April 2019 to 4.4% in May 2019.

HIGHLIGHTS OF THE MONTH

Plant by Plant Highlights

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

The Akosombo GS recorded an increase in its average electricity generated in May 2019 by 6.3%, from 16.64 GWh per day in April 2019 to 17.69 GWh per day in May 2019. Similarly, the total electricity supplied by the hydro power plant increased from 499.05 GWh in April 2019 to 548.25 GWh in May 2019. The total electricity generated by the hydro power plant constituted 34% of the total electricity supplied in May 2019 and was 45.4% higher than the 377.1 GWh projected in the 2019 ESP. The Akosombo GS contributed 677.5 MW to both the System Peak Load and the Ghana Peak Load, representing 24.4% of both peak loads in May 2019.

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

There was a reduction in the average electricity generated by the Kpong GS by 6.4%, from 2.55 GWh per day in April 2019 to 2.39 GWh per day in May 2019. Likewise, the total electricity generated by the hydro power plant reduced by 3.2%, from 76.61 GWh in April 2019 to 74.13 GWh in May 2019. The total electricity supplied by the hydro power plant constituted 4.6% of the total electricity supplied in May 2019 and was 9.7% higher than the 67.6 GWh projected in the 2019 ESP. The Kpong GS generated 113 MW to both the System Peak Load and the Ghana Peak Load, representing 4.1% of both peak loads.

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

The electricity generated by the Bui GS continued to reduce in May 2019, from an average of 2.45 GWh per day in March 2019, 2.09 GWh per day in April 2019 to 1.53 GWh per day. Similarly, the total electricity supplied reduced from 76.04 GWh in March 2019, 62.82 GWh in April 2019 to 47.54 GWh in May 2019. The reduced electricity generated by the hydro power plant was due to low water level of the dam. The total electricity supplied by the Bui GS constituted 3% of the total electricity supplied in May 2019 and was 13.9% lower than the 47.54 GWh projected in the 2019 ESP. The Bui GS contributed 184.3 MW to both the System Peak Load and the Ghana Peak Load, translating into 6.6% of both peak loads in May 2019.

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

There was an increase in the average electricity generated by the Asogli power plant by 9.4%, from 6.04 GWh per day in April 2019 to 6.61 GWh per day in May 2019. Also, the total electricity supplied by the thermal power plant increased by 13.1%, from 181.28 GWh in April 2019 to 204.98 GWh in May 2019. The total electricity supplied by the thermal power plant constituted 12.7% of the total electricity supplied in May 2019 and was 24.6% lower than the 272 GWh that was projected in the 2019 ESP. SAPP supplied 339.9 MW to both the System Peak Load and the Ghana Peak Load, translating into 12.2% of both peak loads. The thermal power plant consumed a total of 1,260.03 MMSCF of natural gas, 53,420.9 barrels of LCO, at an estimated heat rate of 7,940.44 Btu/kWh in May 2019. The heat rate recorded by the power plant in May 2019 was higher than the 7,817.63 Btu/kWh it recorded in April 2019.

Ameri Energy Power Plant's generation decreased in May 2019

The electricity generated by the Ameri power plant reduced in May 2019 by 20.7%, from an average of 7.81 GWh per day in April 2019 to 3.81 GWh per day in May 2019. The total electricity supplied reduced from 144.29 GWh in April 2019 to 118.19 GWh in May 2019. The total electricity supplied by the thermal power plant constituted 7.3% of the total electricity supplied in May 2019 and was 36.8% higher than the 86.4 GWh that was projected in the 2019 ESP. The Ameri power plant supplied 216.1 MW to both the System Peak Load and the Ghana Peak Load, representing 7.8% of both peak loads in May 2019. The thermal power plant consumed a total of 1,154.05 MMSCF of natural gas at an estimated heat rate of 10,047.76 Btu/kWh in May 2019. The heat rate recorded in May 2019 was marginally lower than the 10,102.52 Btu/kWh recorded in April 2019.

The Karpowership Power Plant's generation decreased in May 2019

There was a reduction in the average electricity supplied by the thermal power plant by 24.9%, from 6.73 GWh per day in April 2019 to 5.05 GWh per day in May 2019. Also, the total electricity supplied by the thermal power plant reduced from 201.76 GWh in April 2019 to 156.53 GWh in May 2019. The total electricity supplied by Karpowership constituted 9.7% of the total electricity supplied in May 2019, and was 39% lower than the 156.53 GWh that was projected in the 2019 ESP. The thermal power plant generated 444.3 MW to both the System Peak Load and the Ghana Peak Load, representing 16% of both peak loads in May 2019. A total of 209,729.83 barrels of HFO, at an estimated heat rate of 8,106.03 Btu/kWh in May 2019. The heat rate recorded in May 2019 was marginally lower than the 8,132.82 Btu/kWh it recorded in April 2019.

AKSA Power Plant's generation decreased in May 2019

There was a significant reduction in the electricity generated by AKSA in May 2019 by 65.3%, from an average of 4.13 GWh per day in April 2019 to 1.43 GWh per day. Also, the total electricity generated by the thermal power plant reduced by 64.1%, from 123.8 GWh in April 2019 to 44.45 GWh in May 2019. The total electricity generated by AKSA constituted 2.8% of the total electricity supplied in May 2019, and was 25.9% lower than the 60 GWh that was projected in the 2019 ESP. The thermal power plant generated 203.8 MW to both the System Peak Load and the Ghana Peak Load, representing 7.3% of the System Peak Load and the Ghana Peak Load respectively in May 2019. A total of 59,627.89 barrels of HFO at an estimated heat rate of 8,115.05 Btu/kWh in May 2019. The heat rate recorded in May 2019 was lower than the 8,171.52 Btu/kWh that was recorded in April 2019.

Takoradi International Company (TICO) generation increased in May 2019

There was an increase in the average electricity generated by TICO by 32.7%, from 2.63 GWh per day in April 2019 to 3.49 GWh per day in May 2019. Similarly, the total electricity supplied by the thermal power plant increased by 37.1%, from 78.83 GWh in April 2019 to 108.11 GWh in May 2019. The total electricity supplied by TICO power plant contributed 6.7% of the total electricity supplied in May 2019, and was 46.6% lower than the 202.4 GWh that was projected in the 2019 ESP. The thermal power plant contributed 115 MW to both the System Peak Load and the Ghana Peak Load, representing 4.1% of both peak loads in May 2019. The thermal power plant consumed a total of 904.03 MMSCF of natural gas at an estimated heat rate of 8,604.34 Btu/kWh in May 2019, which was lower than the 8,715.16 Btu/kWh in April 2019.

HIGHLIGHTS OF THE MONTH

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

The average electricity supplied by TAPCO increased in May 2019 by 47.7%, from 1.72 GWh in April 2019 to 2.54 GWh. Likewise, the total electricity supplied by the thermal power plant in May 2019 increased by 52.6%, from 51.63 GWh in April 2019 to 78.77 GWh. The total electricity supplied by the thermal power plant contributed 4.9% of the total electricity that was supplied in May 2019 and was 21.3% higher than the 100.1 GWh projected in the 2019 ESP. TAPCO contributed 154 MW to both the System Peak Load and the Ghana Peak Load, representing 5.5% of both peak loads in May 2019. The thermal power plant consumed a total of 663.29 MMSCF of natural gas at an estimated heat rate of 8,664.5 Btu/kWh in May 2019, which was significantly lower than the 10,284.46 Btu/kWh recorded in April 2019.

Kpone Thermal Power Plant (KTPP) continued operation in May 2019

The Kpone thermal power plant continued its operation in May 2019 for 6 days and supplied a total of 11.78 GWh. The total electricity supplied constituted 0.7% of the total electricity supplied in May 2019. The thermal power plant consumed a total of 23,387.27 barrels of DFO at an estimated heat rate of 10,659.09 Btu/kWh in May 2019. The power plant did not contribute to both the System Peak Load and the Ghana Peak Load.

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

The Tema thermal power plant operated for 23 days in May 2019 and supplied a total of 53.13 GWh. The total electricity supplied by the thermal power plant contributed 3.3% of the total electricity supplied in May 2019. TT1PP consumed a total of 566.67 MMSCF of natural gas at an estimated heat rate of 8,604.34 Btu/kWh in May 2019.

Embedded Electricity Generation

Genser Power Plant's generation decreased in May 2019

There was a reduction in average electricity supplied by Genser power plant by 39.4%, from 1.29 GWh per day in April 2019 to 0.78 GWh per day in May 2019. The total electricity of 24.31 GWh supplied by the thermal power plant in May 2019 was 37.4% higher than the 38.82 GWh that was supplied in April 2019. The total electricity supplied by Genser contributed 1.5% of the total electricity supplied in May 2019. A total of 170.98 MMSCF of natural gas and 2,909.3 tonnes of LPG was consumed by the thermal power plant at an estimated heat rate of 12,341.55 Btu/kWh, which was higher than the 11,430.85 Btu/kWh in April 2019.

BXC Solar generation decreased in May 2019

The electricity generated from the BXC Solar power plant reduced in May 2019 by 1.3%, from 2.47 GWh in April 2019 to 2.44 GWh. The total electricity supplied by the solar power plant constituted 0.2% of the total electricity supplied in May 2019. Also, the total electricity generated by BXC Solar, was 6.2% higher than the 2.3 GWh projected in the 2019 ESP.

VRA Navrongo Solar generation increased in May 2019

Electricity generation from the VRA Solar power plant increased marginally by 0.2%, from 0.28 GWh in April 2019 to 0.282 GWh in May 2019. The marginal increase in the total electricity supplied by the VRA Solar power plant was due to greater number of days in May than in April. The total electricity supplied by the solar power plant contributed 0.02% of the total electricity supplied in May 2019 and was 6.1% lower than the 0.3 GWh projected in the 2019 ESP.

Electricity Exchange – Import decreased whilst Export increased in May 2019

There was a reduction in the average electricity imported in May 2019 by 24.7%, from 0.4 GWh per day in April 2019 to 0.3 GWh per day in May 2019. Similarly, the total electricity imported decreased by 22.2%, from11.99 GWh in April 2019 to 9.33 GWh in May 2019. The total electricity imported constituted 0.6% of the total electricity supplied in May 2019. Electricity import did not contribute to both the System Peak Load and the Ghana Peak Load in May 2019.

Average electricity export to CIE, CEB and SONABEL increased by 25.4%, from 3.13 GWh per day in April 2019 to 3.92 GWh per day in May 2019. Average electricity export to CEB and SONABEL increased by 38% and 16.9%, from 1.76 GWh per day and 1.37 GWh per day in April 2019 to 2.43 GWh per day and 1.18 GWh per day in May 2019 respectively. On the contrary, average electricity supplied to CIE decreased from 0.19 GWh per day in April 2019 to 0.11 GWh per day in May 2019.

The total electricity supplied to CEB and SONABEL increased by 42.6% and 20.8%, from 52.89 GWh and 35.25 GWh in April 2019 to 75.43 GWh and 42.59 GWh in May 2019. On the contrary the total electricity exported to CIE decreased from 5.63 GWh in April 2019 to 3.49 GWh in May 2019.

However, Ghana continued to be a net exporter of electricity in May 2019.

Monthly Market Data Analysis

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

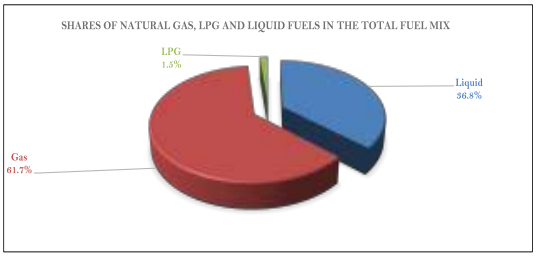


Figure 3b: Shares of fuel type in the generation fuel mix power generation

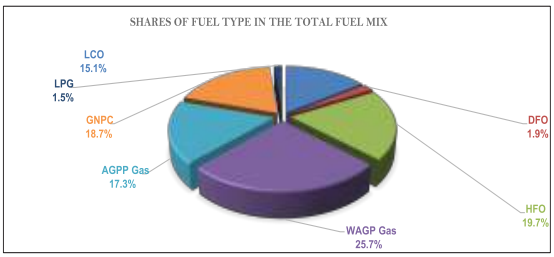


Figure 4a: Contribution of Natural Gas Supply by sources

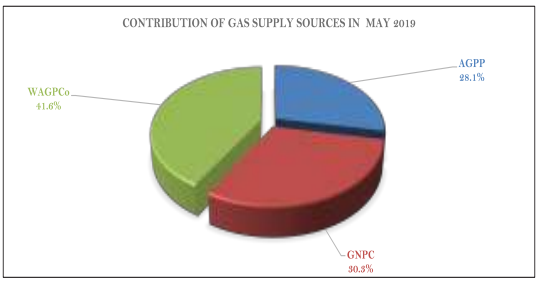
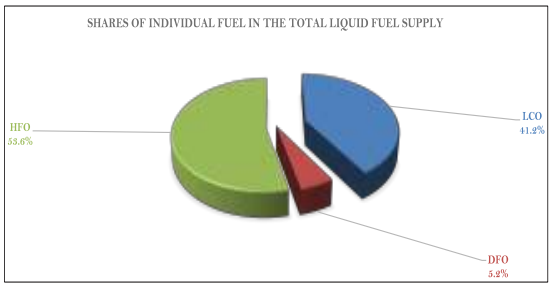


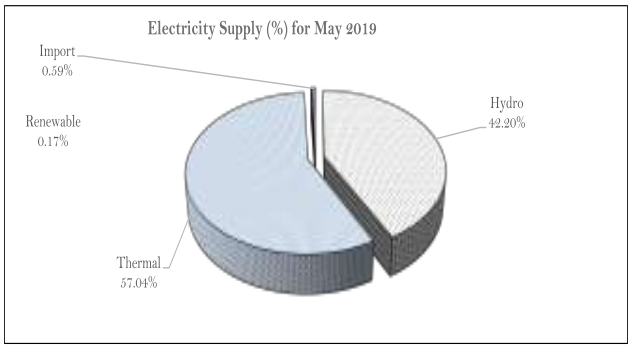
Figure 4b: Contribution of individual fuel in the liquid fuel supply

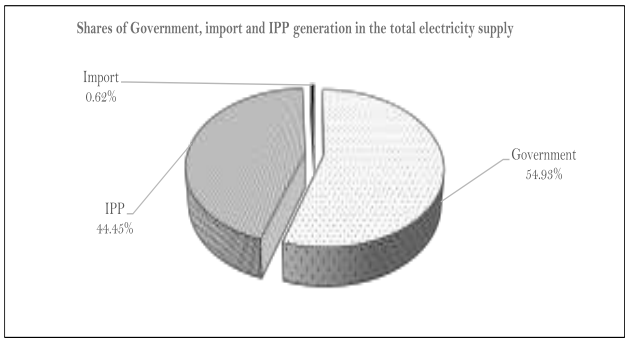


Peak Electricity Supply - May 2019			
Source of Supply	Generation at System Peak Load (MW)	Generation at Ghana Peak Load (MW)	Eleectricity Supply (GWh)
AKOSOMBO	677.50	677.50	548.25
KPONG	113.00	113.00	74.13
BUI	184.30	184.30	47.54
SEAP	339.90	339.90	204.98
TAPCO	154.00	154.00	78.77
TICO	115.00	115.00	108.11
TT1PP	107.00	107.00	53.13
CENIT	-	-	2.65
TT2PP	13.30	13.30	10.88
MRP	-	-	-
KARPOWER	444.30	444.30	156.53
AMERI	216.10	216.10	118.19
KTPP	-	-	11.78
Trojan Power	-	-	-
CENPOWER	213.00	213.00	116.17
AKSA	203.80	203.80	44.45
BXC Solar	-	-	2.44
Safisana	-	-	-
VRA Solar	-	-	0.28
Genser	-	-	24.31
IMPORT	-	-	9.33
Export to CIE at peak	16.00	16.00	75.43
Export to CEB at peak	141.00	141.00	3.49
Export to Sonabel	77.00	77.00	42.59
System Coincident Peak Load	**2,781.20**		
Ghana Coincedent Peak Load		**2,547.20**	
Total Supply			**1,611.94**
Total Supply without export			**1,490.43**

Ghana Electricity Demand & Supply		
		May-19
Maximum System Peak Load	MW	**2,781.2**
Minimum System Peak Load	MW	**2,253.6**
Average Peak Generation	MW	**2,485.1**
System Base Load	MW	**1,391.4**
Total Electricity	GWh	**836.1**
Load Factor (LF)	%	**76.6**

OPERATIONAL FACT SHEET





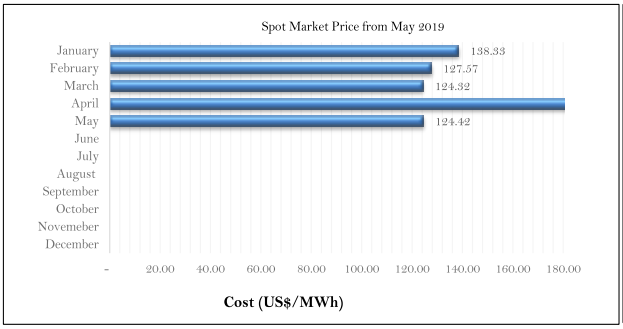
Power Plant Data May 2019								
	Installed Capacity (MW)	Plant Capacity Utilization (%)	Electricity Generation (GWh)	Gas Consumption (MMBtu)	LCO Consumption (MMBtu)	DFO Consumption (MMBtu)	HFO Consumption (MMBtu)	LPG Consumption (MMBtu)
Akosombo	1,020.00	72.24	548.25	-	-	-	-	-
Kpong	160.00	62.27	74.13	-	-	-	-	-
Bui	400.00	15.97	47.54	-	-	-	-	-
SEAP	560.00	49.20	204.98	1,345,030.22	282,596.54	-	-	-
TAPCO	330.00	32.08	78.77	682,528.68	-	-	-	-
TICO	340.00	42.74	108.11	930,248.09	-	-	-	-
TT1PP	126.00	56.68	53.13	604,899.23	-	-	-	-
CENIT	126.00	2.83	2.65	33,008.10	-	-	-	-
TT2PP	49.50	29.55	10.88	140,018.16	-	-	-	-
KARPOWER	470.00	44.76	156.53	-	-	-	1,268,865.47	-
AMERI	250.00	63.54	118.19	1,187,514.41	-	-	-	-
Cenpower	350.00	44.61	116.17	-	968,153.89	8,006.13		-
TROJAN	56.00	-	-	-	-	-	-	-
KTPP	220.00	7.20	11.78	-	-	125,589.64	-	-
AKSA	360.00	16.60	44.45	-	-	-	360,748.76	-
GENSER	95.00	45.70	32.30	-	-	-	-	124,086.79
VRA Solar	20.00	1.87	0.28					
BXC	20.00	12.10	1.80	-	-	-	-	-
Meinergy	20.00	9.00	1.34	-	-	-	-	-
Total	**4,972.50**	43.55	**1,611.30**	**4,923,246.91**	**1,250,750.43**	**133,595.76**	**1,629,614.23**	**124,086.79**

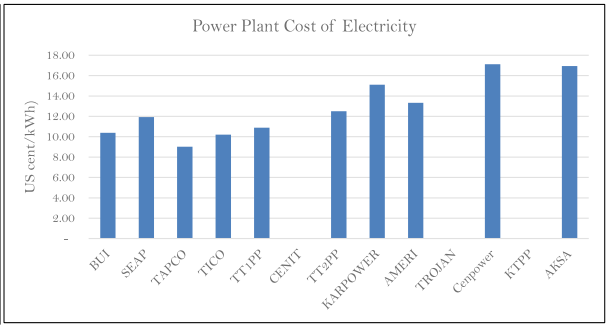
Average Monthly Flowrate (MMSCFD)	
Location	**Monthly Average**
Etoki	**72.28**
Tema WAGPCo	**67.00**
Aboadze WAGPCo	**0.00**
Aboadze GNGC	**91.99**

May-19			
	Beginning month (ft)	**End month (ft)**	**Change in water level**
Hydro Dam			**(feet)**
Akosombo	254.26	252.64	-1.62
Bui	556.65	554.46	-2.20

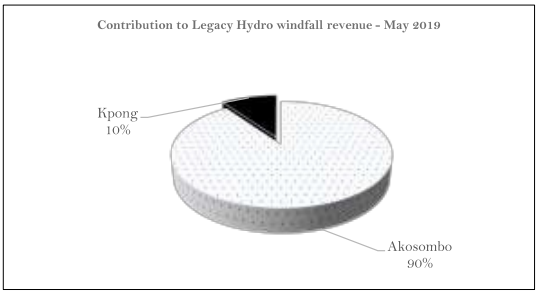
ECONOMIC FACT SHEET

		Actual	Projected	Change
Average Market Energy Cost	**US$/MWh**	104.09	92.82	11.27
Average Market Capacity Charge (AMCC)	**US$/MWh**	34.98	35.73	(0.75)
Total Average Market Cost (TAC)	**US$/MWh**	139.07	128.55	10.52
System Marginal Cost (SMC)	**US$/MWh**	124.42	104.88	19.54
System Marginal Capacity Charge (SMCC)	**US$/MWh**	23.95	23.42	0.53
Spot Market Price (SMP)	**US$/MWh**	148.37	128.30	20.07
Composite Bulk Generation Charge (CBGC)	**US$/MWh**	97.01	97.01	-
Deviation of TAC from CBGC	**US$/MWh**	(42.06)	(31.54)	(10.52)
Deviation of SMP from CBGC	**US$/MWh**	(51.36)	(31.29)	(20.07)

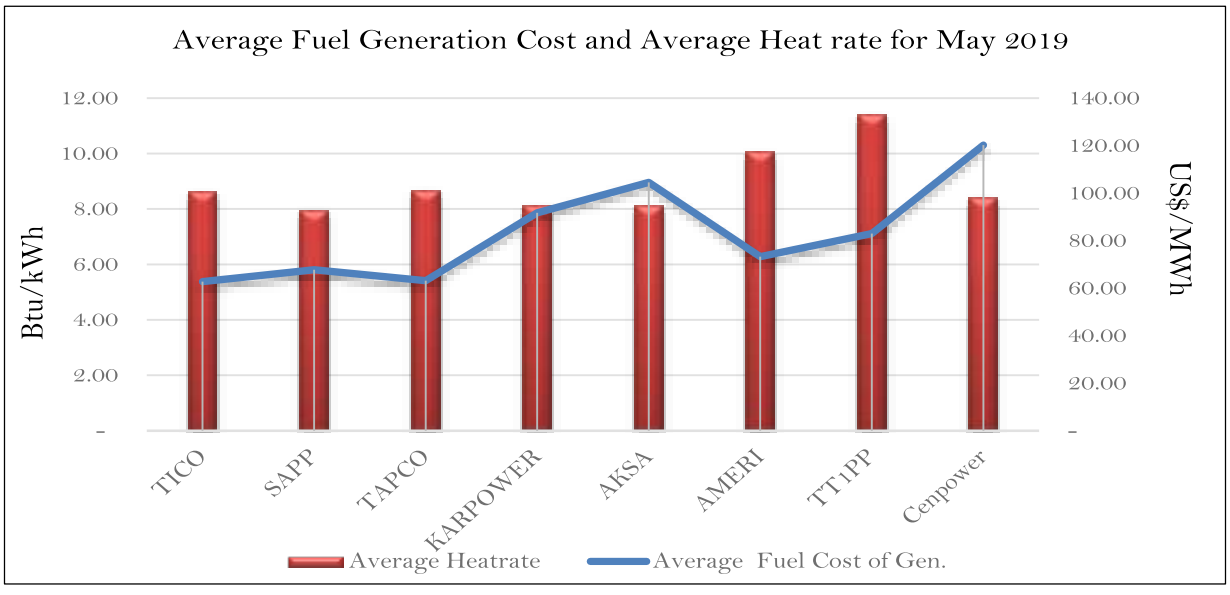




Average Fuel Prices		
		May-19
Fuel Type	**Unit**	**Delivered Cost**
Natural Gas	**US$/MMBtu**	7.29
LCO	**US$/BBL**	76.32
HFO	**US$/Tonne**	396.41
DFO	**US$/Tonne**	785.65



	Gazetted Natural Gas Price	Weighted average Natural Gas Price	LCO	HFO	DFO
US$/MMBTu	7.29	7.31	14.42	11.66	19.45



Power Plant	Capacity Utilization (%)	Average Heat rate (Btu/KWh)	Average Fuel Cost of Generation (US$/MWh)	Emission Factor (kgCO2/kWh)
Akosombo	72.24	-	-	-
Kpong	62.27	-	-	-
Bui	15.97	-	-	-
SAPP	49.20	7,940.44	67.72	0.45
TAPCO	32.08	8,664.50	63.16	0.46
TICO	42.74	8,604.34	62.73	0.46
TT1PP	56.68	11,384.41	82.99	0.60
CENIT	2.83	12,437.58	-	0.66
TT2PP	29.55	12,865.65	93.79	0.68
KARPOWER	44.76	8,106.03	91.74	0.64
AMERI	63.54	10,047.76	73.25	0.53
TROJAN	-	-	-	-
KTPP	7.20	10,659.09	-	0.57
AKSA	16.60	8,115.05	104.52	0.64
Genser	45.70	12,341.55		0.71

The EMOP Secretariat is presenting part three 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

1.2.5 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

1.0 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:

a. establish and govern efficient, competitive and reliable markets for the wholesale supply and purchase of electricity and ancillary services in Ghana;
b. ensure that market participants have non-discriminatory access to the transmission system;
c. facilitate competition in the generation of electricity; and
d. protect the interests of consumers with respect to pricing and quality of electricity services.
e. This policy and guidelines has the following specific objectives:
f. Provide spinning reserves of 20% of dispatchable generating units;
g. Provide non-spinning reserves of 28% of total system demand or as may be determined by the ETU;
h. Provide adequate reactive power to maintain power factor of 0.9 or more in the national interconnected system (NITS);
I. Maintain system voltages in the NITS within the limits of +-5% of the designed nominal voltage; and
j. Maintain frequency within the NITS at between 49.8Hz and 50.2 Hz.

4.0 General Approach

4.1 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:

a. Nature of the ancillary service required;
b. Operating regime of the service;
c. Providers of the services ;
d. Compensation for the provision of the service;
e. Payment arrangements; and
f. Determination of the cost of the service.

generation registered facility to be allocated to spinning reserves.

4.2 Spinning Reserves

Spinning reserves shall consist primarily of the additional output from currently operating generating plant that is realisable in real time and shall be large enough to enable the grid withstand any one of the following:

(i) the loss of the generating unit currently producing the highest amount of power within the NITS, or
(ii) the loss of generation capacity that could result from any single transmission equipment failure, fault or other contingency, or
(iii) the loss of any power in-feed from an interconnected system, whichever is the largest, or
(iv) provide for regulation and load following.

The ETU shall allocate and distribute the required spinning reserves among the generating units operating within the NITS such that the grid is able to withstand any single contingency. Spinning reserves shall be provided in two forms as follows:

1. Primary spinning reserves; and
2. Secondary spinning reserves

4.3 Primary Spinning Reserves

Primary spinning reserves shall be required to meet expected variations in system demand and frequency and must respond automatically to frequency deviation with response time of 15 seconds and must be in full operation in 30 seconds.

4.3.1 Duration of operating regime
Primary spinning reserves shall have a maximum use of 15 minutes.

4.3.2 Method of Procurement
Primary spinning reserves shall be procured on contracts with the ETU. In essence, the ETU shall determine the processes of procuring primary spinning reserves.

4.3.3 Service Provider
There shall be no separate reserve plants to provide primary spinning reserves. Primary spinning reserve shall therefore be provided 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. All generators larger than 10MW shall be required to have active governors that respond to frequency deviations.

4.3.4 Compensation
Compensation for provision of primary spinning reserve services shall be based on availability payment which shall correspond to pre-determined benchmark price set by the PURC. The benchmark price shall be denominated in US$/MW/month. Payment shall be made in Ghana Cedis

4.3.5 Payment
The cost of primary spinning reserves shall be paid by all Distribution Utilities and Bulk Customers as part of the Transmission Service Charge (TSC).

4.4 Secondary Spinning Reserves
Secondary spinning reserves are required to maintain power system security in the event of NITS or generation outages where primary spinning reserves are insufficient. In addition, secondary spinning reserves shall be used to respond to load following and regulation during normal operations.12

4.4.1 Operating regime
Secondary spinning reserves shall be provided from an allocation of non-spinning reserves capacity which may be synchronized but not loaded. The NITS shall carry at least enough secondary spinning reserves to cover the most severe single contingency. Hence Secondary spinning reserves shall be required to meet expected variations in system demand and frequency and must respond to signals from the ETU Dispatch Centre as well being in full operation within 15 minutes. Secondary spinning reserves shall be capable of continuous operation for as long as required

4.4.2 Method of Procurement
Secondary Spinning reserves shall be procured from synchronised generating units allocated from Nonspinning reserves on contracts with the ETU. In essence, the ETU shall determine the processes of procuring Secondary Spinning reserves.

4.4.3 Service Provider
Secondary spinning reserves shall be provided from synchronized generating units capable of being started, synchronized and loaded within fifteen minutes and capable of operating at the designated output level for at least one hour. Controllable loads may also provide secondary spinning reserves. The controllable loads that provide secondary spinning reserve must be able to respond to curtailment requests fully within 10 minutes (including communication time).

4.4.4 Compensation
Compensation for secondary spinning reserves shall be based on availability payment which shall correspond to pre-determined benchmark price set by the PURC. The benchmark price shall be denominated in US$/kW/month with additional payments for fuel cost in US$/MWh when called to produce. This shall be payable in Ghana Cedis. Controllable loads would also be compensated under contracts at prices determned by PURC based on the cost of unserved energy to the consumer.

4.4.5 Payment
The cost of secondary spinning reserves shall be paid by all Distribution Utilities and Bulk Customers as part of the Transmission Service Charge (TSC). This shall be approved by PURC.

4.5 Non-Spinning Reserves
Non-spinning reserves shall be provided by generating capacity not operating or synchronized to the system but which is available to serve demand within thirty minutes of being requested to do so. Nonspinning reserves are required to maintain power system security in the event of NITS or generation outages or increased demand, shall be used mainly to respond to demand forecast errors, generation or transmission maintenance or other such problems that may occurs in the NITS. There shall be separate reserve plants to provide non-spinning reserves. Non-Spinning reserves may be supplied from generation, controllable load or coordinated adjustments to interchange schedules. The NITS shall carry at least enough non-spinning reserves to cover the most severe single contingency.

Non-Spinning reserves required to meet expected variations in system demand and frequency and must respond to signals from the ETU Dispatch Centre and must be in full operation in 15 minutes.

4.5.1 Operating regime
Non-Spinning reserves shall be capable of continuous operation for as long as required but at least for one hour.

4.5.2 Procurement
Non-Spinning reserves shall be procured from separate generating units under contracts with the ETU.

4.5.3 Service Provider
Non-spinning reserves shall be provided from synchronized generating units capable of being started, synchronized and loaded within thirty minutes and is capable of operating at the designated output level for at least one hour.

Controllable loads may also provide non-spinning reserves.

4.5.4 Compensation
Compensation shall be based on availability payment which shall correspond to pre-determined benchmark price set by the PURC. The benchmark price shall be priced in US$/MW/month with additional US$/MWh when called to produced. This shall be payable in Ghana Cedis.

4.5.5 Payment
The cost of non-spinning reserves 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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