



GHANA WHOLESALE ELECTRICITY MARKET BULLETIN

MARKET WATCH

Monthly Market Data Analysis

ISSUE NO. 47

1st November 2019 to 30th November 2019

This Bulletin covers major developments in the Wholesale Electricity Market (WEM) of Ghana from 1st November, 2019 to 30th November, 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 reports on the operation of the CENIT Energy Power Plant.

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 has been a 6.5% growth in the System Peak Load in November 2019, from 2,565.9 MW in October 2019 to 2,733.3 MW. Similarly, the Ghana Peak Load has also grown by 5.8%, from 2,332.5 MW in October 2019 to 2,467.3 MW in November 2019. The System Peak Load recorded for November 2019 was 2.5% higher than the 2,666 MW projected in the 2019 ESP. On the contrary, the Ghana Peak Load recorded for November 2019 was 1.5% lower than the 2,506 MW projected in the 2019 ESP. At the System Peak Load for November 2019, a total load of 266 MW was exported to CIE, CEB and SONABEL, which was 66.3% higher than the 160 MW projected in the 2019 ESP. There was no import of electricity from CIE during the System Peak Load in November 2019. The average electricity demand of 2,210.78 MW recorded in November 2019 was 9.4% higher than the 2,021.67 MW projected in the 2019 ESP.

There has been an increase in the total electricity supplied in November 2019 by 7.2%, from 1,484.27 GWh in October 2019 to 1,591.76 GWh. Also, the total electricity supplied in November 2019 was 9.4% higher than the 1,455.6 GWh projected in the 2019 ESP. The total electricity of 1,428.78 GWh consumed domestically was 3.7% higher than the 1,377.4 GWh projected in the 2019 ESP. Out of the total electricity supplied in November 2019, a total of 162.98 GWh was exported to CIE, CEB and SONABEL, which was more than a double of the 78.2 GWh projected in the 2019 ESP.

The share of the electricity generated from hydro sources in the total electricity supplied in November 2019 increased from 37.1% in

Table 1. Projected and Actual Outturn of electricity demand and supply in October 2019 and November 2019.

	November 2019		October 2019	
	Projected	Actual Outturn	Projected	Actual Outturn
Total Supply (GWh)	1,455.5	1,562.9	1,464.8	1,484.7
Source by Power Plants (GWh)				
AKOSOMBO	364.9	409.2	377.1	358.7
KPONG	65.4	61.6	67.6	65.2
BUI	53.4	216.9	55.2	126.3
Sunon Asogli	170.4	251.8	176.2	245.4
TAPCO	144.9	105.6	144.2	106.6
FICO	120.5	137.5	101.2	202.5
TT1PP	-	8.5	54.7	53.9
CENIT	-	73.7	-	25.9
TT2PP	-	12.2	-	12.6
Amandi	-	39.0	-	24.9
Karpowership	248.5	49.3	265.7	54.4
AMERI	59.6	96.7	57.0	89.7
KTPP	57.3	61.7	-	18.9
Trojan Power	-	-	-	-
CENPOWER	-	-	-	18.3
AKSA	166.0	23.4	161.0	38.4
BXC Solar	2.2	2.9	2.3	2.3
VRA Solar	0.2	-	0.3	0.3
Genser	-	0.3	-	27.2
Meinergy	2.2	2.3	2.3	2.0
Total Generation (GWh)	1,455.5	1,552.5	1,464.8	1,473.5
Imports (GWh)	-	10.5	-	11.2
Total Supply (GWh)	1,455.5	1,562.9	1,464.8	1,484.7
Deficit/Over supply (GWh)	-	107.4	-	19.9
Ghana Coincident Peak Load (MW)	2,516.0	2,467.3	2,400.0	2,332.5
System Coincident Peak Load (MW)	2,666.0	2,733.3	2,550.0	2,565.9

HIGHLIGHTS OF THE MONTH

October 2019 to 43.2%. Consequently, the share of electricity generated from thermal sources in the total electricity supplied reduced from 61.9% in October 2019 to 55.8% in November 2019. The share of electricity generated from renewable sources continued to be 0.3% of the total electricity supplied in November 2019.

There was a reduction in the rate of increase in the water level for the Akosombo GS, from 0.2 feet per day in October 2019 to 0.02 feet per day in November 2019. On the contrary, the water level for the Bui GS began to drop at a rate of 0.12 feet per day in November 2019.

The share of the total natural gas consumed continued to increase in November 2019, from 82.3% in September 2019, 87.9% in October to 92.3% in November 2019. Consequently, the share of the total liquid fuel consumed reduced from 12.1% in October 2019 to 7.7% in November 2019.

ELECTRICITY DEMAND AND SUPPLY

Electricity Demand

The System Peak Load of 2,733.3 MW recorded in November 2019 was 6.5% higher than the 2,565.9 MW recorded in October 2019. Similarly, the Ghana Peak Load increased by 5.8%, from 2,232.5 MW in October 2019 to 2,467.3 MW in November 2019. A total of 266 MW was exported to CIE, CEB and SONABEL in November 2019. Out of the total electricity exported, 10 MW was supplied to CIE, 177 MW was supplied to CEB and 79 MW was supplied to SONABEL in November 2019. Electricity generated from hydro sources contributed 46.7% of the System Peak Load and the Ghana Peak Load in November 2019. The remaining 53.3% of the System Peak Load and the Ghana Peak Load was supplied by thermal power plants. Average demand for electricity increased by 10.8%, from 1,994.98 MW in October 2019 to 2,210.78 MW in November 2019. The System Load Factor also increased from 76.1% in October 2019 to 79.1% in November 2019.

Electricity supply

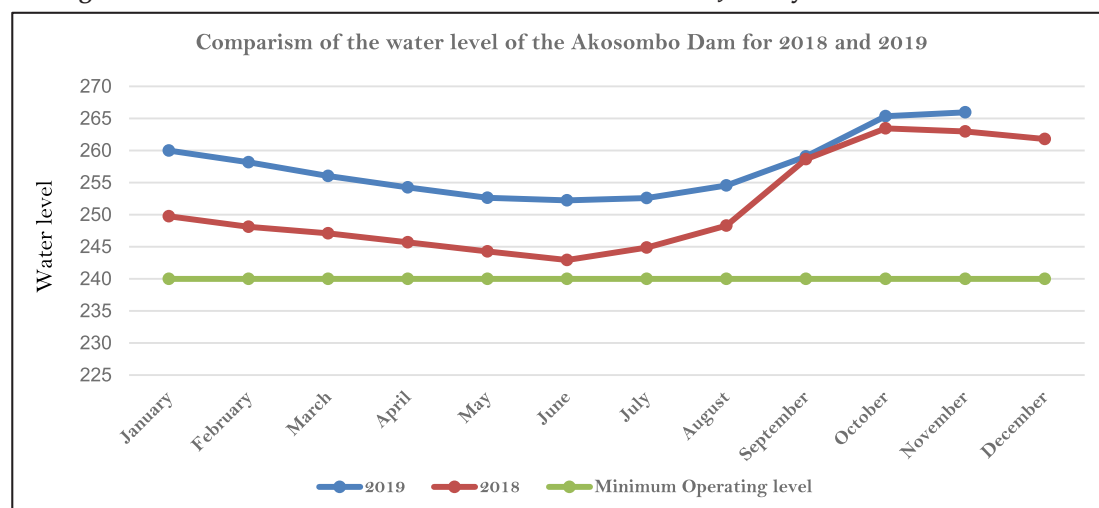
The average electricity supplied in November 2019 increased by 10.8%, from 47.88 GWh per day in October 2019 to 53.06 GWh per day. Similarly, the total electricity supplied increased by 7.2%, from 1,484.27 GWh in October 2019 to 1,591.76 GWh in November 2019. The total electricity supplied in November 2019 constituted 10.46 GWh of inadvertent import from CIE and 1,581.3 GWh from domestic power plants. A total of 162.98 GWh was exported to CIE, CEB and SONABEL in November 2019. Out of the total electricity exported, 6.62 GWh was supplied to CIE, 102.68 GWh was supplied to CEB and the remaining 53.67 GWh to SONABEL. Hydro electricity generation constituted 43.2%, thermal generation accounted for 55.8% and renewable energy accounted for 0.3% of the total electricity supplied in November 2019.

HYDRO DAM LEVELS

Akosombo Dam Water Level continued to increase in November 2019

The water level for the Akosombo dam continued to increase, but at a reduced rate, from 0.2 feet per day in October 2019 to 0.02 feet per day in November 2019. As at the end of November 2019, the water level for the Akosombo dam rose by 0.61 feet, from 265.35 feet at the beginning of the month to 265.96 feet. The water level recorded at the end of the month was 2.98 feet above the water level recorded for the same period in 2018. Also, the water level recorded at the end of the month was 2.98 feet below the maximum operating water level of the dam.

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



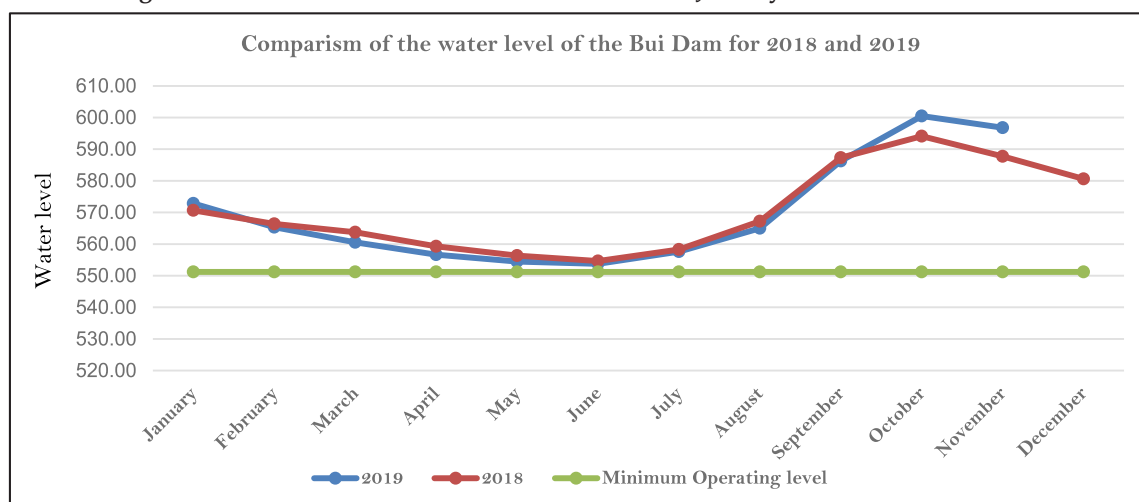
HIGHLIGHTS OF THE MONTH

Bui Dam Water Level begun to drop in November 2019

The water level for the Bui dam begun to drop at a rate of 0.12 feet per day in November 2019. The Bui dam water level dropped by 3.71 feet, from 600.48 feet at the beginning of the month to 596.78 feet at the end of the month. The water level recorded at the end of the month was 9.05 feet above the water level recorded for the same period in 2018. Again, the water level recorded at the end of the month was 3.61 feet above the maximum operating level of the dam.

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

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



FUEL SUPPLY FOR POWER GENERATION

Natural gas flow rate from WAGPCo decreased in November 2019

There was a reduction in the natural gas flow rate in November 2019, from 57.91 MMSCFD in October 2019 to 47.47 MMSCFD. Similarly, the total natural gas supplied by the WAGPCo decreased from 1,795.21 MMSCF in October 2019 to 1,424.17 MMSCF in November 2019. The share of total natural gas supplied by WAGPCo in the total natural gas consumed reduced from 27.2% in October 2019 to 19.8% in November 2019. Similarly, the share of the total natural gas supplied by WAGPCo reduced from 24% in October 2019 to 18.5% in November 2019.

Natural gas flow from GNGC decreased in November 2019.

There was a reduction in the natural gas flow rate from the Atuabo Gas Processing Plant (AGPP) to the Aboadze Power Enclave from 47.3 MMSCFD in October 2019 to 40.64 MMSCFD. As a result of the reduced flow rate of natural gas from AGPP to the Aboadze Power Enclave, the total natural gas supplied by GNGC reduced from 1,466.33 MMSCF in October 2019 to 1,219.08 MMSCF in November 2019. Also, a total of 316.43 MMSCF of natural gas was supplied to Genser in November 2019, which was marginally lower than the 319 MMSCF supplied in October 2019. In summary, a total of 1,535.51 MMSCF of natural gas was supplied by GNGC for electricity generation in November 2019. In the total natural gas consumed, the share of the total natural gas supplied by GNGC reduced from 26.1% in October 2019 to 23.5% in November 2019. The share of the total natural gas supplied by GNGC constituted 22.5% of the total fuel mix in November 2019, which was lower than the 22.9% recorded in October 2019.

Natural gas flow from ENI/GNPC increased in November 2019

A total of 3,864.31 MMSCF of natural gas was supplied by ENI/GNPC in November 2019 which was higher than the 3,139.92 MMSCF supplied in October 2019. The share of the total natural gas supplied by ENI/GNPC in the total natural gas consumed increased from 46.7% in October 2019 to 57.3% in November 2019. In the total fuel mix, the share of natural gas supplied by ENI/GNPC increased from 41% in October 2019 to 49% in November 2019.

The natural gas flow rate from ENI/GNPC to the Aboadze Power Enclave decreased significantly from 101.29 MMSCFD in October 2019 to 49 MMSCFD in November 2019. Similarly, the total natural gas supplied by ENI/GNPC to the Aboadze Power Enclave reduced from 1,722.04 MMSCF of natural gas in October 2019 to 1,482.73 MMSCF in November 2019. A total of 2,097.45 MMSCF of natural gas was supplied by ENI/GNPC through the reverse flow facility in November 2019 which was higher than the 1,417.88 MMSCF supplied in October 2019. A total of 286.65 MMSCF of natural gas was supplied to Karpowership for electricity generation in November 2019.

HIGHLIGHTS OF THE MONTH

Liquid Fuel

There was a reduction of 35.6% in the total liquid fuel consumed, from 165,695 barrels in October 2019 to 106,771 barrels in November 2019. The share of HFO consumed in the total liquid fuel consumed reduced from 77.5% in October 2019 to 47.7% in November 2019. In the total fuel mix, the share of HFO consumed reduced from 9.4% in October 2019 to 3.6% in November 2019. The Amandi thermal power plant continued the commissioning of its gas turbine on LCO in November 2019. The share of the total LCO consumed in the total liquid fuel consumed increased from 21.9% in October 2019 to 52.3% in November 2019. In the total fuel mix, the share of the total LCO consumed increased from 2.6% in October 2019 to 4.1% in November 2019.

Plant by Plant Highlights

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

The average electricity generated by the Akosombo GS increased by 17.9%, from 11.57 GWh per day in October 2019 to 13.64 GWh per day in November 2019. Similarly, the total electricity supplied by the hydro power plant increased by 14.1%, from 358.65 GWh in October 2019 to 409.2 GWh in November 2019. The total electricity generated by the hydro power plant constituted 25.7% of the total electricity supplied in November 2019 and was 12.1% higher than the 364.9 GWh in the 2019 ESP. Akosombo GS contributed 919.8 MW to the System Peak Load and the Ghana Peak Load, representing 33.7% of the peak loads in November 2019.

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

There was a reduction in the average electricity supplied by the Kpong GS by 2.4%, from 2.1 GWh per day in October 2019 to 2.05 GWh per day in November 2019. Likewise, the total electricity supplied by Kpong GS decreased by 5.5%, from 65.17 GWh in October 2019 to 61.58 GWh per day in November 2019. The total electricity supplied by the hydro power plant constituted 3.9% of the total electricity supplied in November 2019 and was 5.9% lower than the 65.4 GWh projected in the 2019 ESP. Kpong GS contributed 94 MW to both the System Peak Load and the Ghana Peak Load, representing 33.7% of both peak loads in November 2019.

Electricity supply by the Bui Generation Station (GS) increased in November 2019

The Bui GS recorded a significant increase in the average electricity generated by 77.4%, from 4.07 GWh per day in October 2019 to 7.23 GWh per day in November 2019 as the power plant operated largely as a baseload plant. Similarly, the total electricity generated by the hydro power plant increased by 71.7%, from 126.3 GWh in October 2019 to 216.88 GWh in November 2019. The share of the total electricity generated by the Bui GS in the total electricity supplied was 13.6%. The total electricity supplied by the Bui GS in November 2019 was 3.1 folds higher than the 53.4 GWh projected in the 2019 ESP. The hydro power plant contributed 262.7 MW to both the System Peak Load and the Ghana Peak Load, translating into 9.6% of both peak loads in November 2019.

Generation by the Sunon Asogli Power Plant (SAPP) increase in November 2019

The Sunon Asogli Power Plant's average electricity supplied increased by 6%, from 7.92 GWh per day in October 2019 to 8.39 GWh per day in November 2019. The total electricity supplied by the thermal power plant increased by 2.6%, from 245.39 GWh in October 2019 to 251.77 GWh in November 2019. The total electricity supplied by SAPP constituted 15.8% of the total electricity supplied in November 2019 and 47.8% higher than the 170.4 GWh projected in the 2019 ESP. SAPP contributed 430.4 MW to both the System Peak Load and the Ghana Peak Load, translating into 15.8% of the peak loads in November 2019. The thermal power plant consumed a total of 1,791.01 MMSCF of natural gas, at an estimated heat rate of 7,593.43 Btu/kWh in November 2019. The heat rate recorded for November 2019 was lower than the 7,928.99 Btu/kWh recorded in October 2019.

Ameri Energy Power Plant's generation increased in November 2019

The average electricity supplied by the Ameri Power Plant increased by 11.4%, from 2.89 GWh per day in October 2019 to 3.22 GWh per day in November 2019. The total electricity supplied by the thermal power plant also increased by 7.8%, from 89.73 GWh in October 2019 to 96.73 GWh in November 2019. The total electricity supplied by Ameri constituted 6.1% of the total electricity supplied in November 2019 and was 62.3% higher than the 57.3 GWh projected in the 2019 ESP. The thermal power plant contributed 213.3 MW to the System Peak and the Ghana Peak Load, representing 7.8% of both peak loads in November 2019. Ameri consumed a total of 951.23 MMSCF of natural gas at an estimated heat rate of 10,119.16 Btu/kWh in November 2019. The heat rate recorded by Ameri in November 2019 was marginally higher than the 10,116.2 Btu/kWh in October 2019.

The Karpowership Power Plant's generation decreased in November 2019.

The Karpowership operated for 17 days in November 2019 and supplied a total of 49.34 GWh. The thermal power plant started its operation on natural gas on 19th November, 2019. The total electricity supplied by the thermal power plant constituted 3.1% of the total electricity supplied in November 2019 and was 80% lower than the 248.5 GWh projected in the 2019 ESP. Karpowership contributed 18.3 MW to both the System Peak Load and the Ghana Peak Load, representing 0.7% of both peak loads in November 2019. The thermal power plant consumed a total of 286.77 MMSCF of natural gas and 15,658 barrels of HFO at an estimated heat rate of 9,896.3 Btu/kWh in November 2019.

AKSA Power Plant's generation decreased in November 2019

AKSA recorded a reduction in the average electricity supplied in November 2019 by 37.2%, from 1.24 GWh per day in October 2019 to 0.78 GWh per day. Similarly, the total electricity supplied by the thermal power reduced by 39.2%, from 38.4 GWh in October 2019 to 23.35 GWh in November 2019. The total electricity generated by the AKSA power plant constituted 1.5% of the total electricity supplied in November 2019 and was 85.9% lower than the 166 GWh projected in the 2019 ESP. AKSA contributed 250.6 MW to the System Peak Load and the Ghana Peak Load, representing 9.2% of both peak loads in November 2019. A total of 31,704.98 barrels of HFO was consumed by AKSA at an estimated heat rate of 8,214.15 Btu/kWh in November 2019 which was higher than the 8,182.32 Btu/kWh in October 2019.

HIGHLIGHTS OF THE MONTH

Takoradi International Company (TICO) generation decreased in November 2019

There was a reduction in the average electricity supplied by the TICO power plant in November 2019 by 29.9%, from 6.53 GWh per day in October 2019 to 4.58 GWh per day. Similarly, the total electricity supplied by the thermal power plant decreased from 202.47 GWh in October 2019 to 137.46 GWh in November 2019. The total electricity supplied by the thermal power plant constituted 8.6% of the total electricity supplied in November 2019 and was 14.1% higher than the 120.5 GWh projected in the 2019 ESP. TICO contributed 156 MW to the System Peak Load and the Ghana Peak Load, translating into 5.7% of the peak loads in November 2019. The thermal power plant consumed a total of 1,102.44 MMSCF of natural gas at an estimated heat rate of 8,252.85 Btu/kWh in November 2019, which was higher than the 8,145.88 Btu/kWh recorded in October 2019.

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

There was an increase of 2.3% in the average electricity supplied by TAPCO, from 3.44 GWh per day in October 2019 to 3.52 GWh per day in November 2019. On the contrary, the total electricity supplied by TAPCO decreased by 1%, from 106.64 GWh in October 2019 to 105.6 GWh in November 2019. The total electricity supplied by the thermal power plant constituted 6.6% of the total electricity supplied in November 2019 and was 27.1% lower than the 144.9 GWh projected in the 2019 ESP. TAPCO contributed 153 MW to the System Peak Load and the Ghana Peak Load, representing 5.6% of both peak load in November 2019. TAPCO consumed a total of 767.92 MMSCF of natural gas at an estimated heat rate of 7,483.12 Btu/kWh in November 2019, which was marginally lower than the 7,545.58 Btu/kWh recorded in October 2019.

Kpone Thermal Power Plant's (KTPP) generation increased in November 2019

KTPP continued its operation in November 2019 and supplied a total of 61.68 GWh which constituted 3.9% of the total electricity supplied in November 2019. The thermal power plant supplied 7.7% more than the 57.3 GWh projected in the 2019 ESP. The thermal power plant consumed a total of 657.72 MMSCF of natural gas at an estimated heat rate of 11,382.38 Btu/kWh in November 2019. KTPP contributed 103 MW to both the System Peak Load and the Ghana Peak Load, representing 3.8% of the peak loads in November 2019.

Tema Thermal 1 Power Plant's (TT1PP) generation decreased in November 2019

TT1PP continued its operation in November but for just five days. The thermal power plant supplied a total of 8.54 GWh in November 2019, which constituted .5% of the total electricity supplied in November 2019. TT1PP consumed a total of 94.99 MMSCF of natural gas at an estimated heat rate of 11,873.87 Btu/kWh in November 2019. The thermal power plant did not contribute to both the System Peak Load and the Ghana Peak Load. Also, TT1PP was projected to be offline during November 2019.

CENIT Power Plant's generation increased in November 2019

The CENIT power plant continued its operation in November 2019. The thermal power plant supplied a total of 73.69 GWh in November 2019. This constituted 4.6% of the total electricity supplied in November 2019. CENIT contributed 108 MW to both the System Peak Load and the Ghana Peak Load, representing 4% of the peak loads in November 2019. A total of 741.57 MMSCF of natural gas was consumed by the thermal power plant at an estimated heat rate of 10,742.53 Btu/kWh in November 2019.

Embedded Electricity Generation

Genser Power Plants' generation increased in November 2019

The average electricity supplied by Genser power plant increased by 9.7%, from 0.88 GWh per day in October 2019 to 0.96 GWh per day in November 2019. Similarly, the total electricity supplied by the thermal power plant increased from 27.18 GWh in October 2019 to 28.85 GWh in November 2019. The total electricity supplied by the thermal power plant constituted 1.8% of the total electricity supplied in November 2019. A total of 316.43 MMSCF of natural gas at an estimated heat rate of 11,286.02 Btu/kWh in November 2019, which was lower than the 12,088.01 Btu/kWh in October 2019.

BXC Solar generation increased in November 2019

There was an increase in the total electricity supplied by the BXC solar power plant by 50.6%, from 1.9 GWh in October 2019 to 2.86 GWh in November 2019. The total electricity supplied by the solar power plant constituted 0.2% of the total electricity supplied in November 2019 and was 30% higher than the 2.2 GWh projected in the 2019 ESP.

Meinergy Solar generation increased in November 2019

The Meinergy Solar power plant recorded an increase in the total electricity supplied by 13.8%, from 2.04 GWh in October 2019 to 2.31 GWh in November 2019. The total electricity by Meinergy constituted 0.1% of the total electricity supplied in November 2019 and was 4.9% higher than the 2.2 GWh projected in the 2019 ESP.

Electricity Exchange – Import decreased whilst Export increased in November 2019

The average electricity import decreased in November 2019 by 3.1%, from 0.36 GWh per day in October 2019 to 0.35 GWh per day. Similarly, the total electricity imported from CIE decreased by 6.3%, from 11.16 GWh in October 2019 to 10.46 GWh in November 2019. The total electricity imported constituted 0.7% of the total electricity supplied in November 2019.

There was a significant increase of 64.1% in the total average electricity exported to CIE, CEB and SONABEL, from 3.31 GWh per day in October 2019 to 5.43 GWh per day in November 2019. The average electricity exported to CIE, CEB and SONABEL increased from 0.09 GWh per day, 1.96 GWh per day and 1.26 GWh per day in October 2019 to 0.22 GWh per day, 3.42 GWh per day and 1.79 GWh per day in November 2019 respectively.

The total electricity exported to CIE, CEB and SONABEL increased by 58.9%, from 102.6 GWh in October 2019 to 162.98 GWh in November 2019. A total of 6.62 GWh, 102.68 GWh and 53.67 GWh were exported to CIE, CEB and SONABEL in November 2019 which were higher than the 2.88 GWh, 60.63 GWh and 39.09 GWh exported to CIE, CEB and SONABEL in October 2019 respectively.

Ghana continued to be a net exporter of electricity in November 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

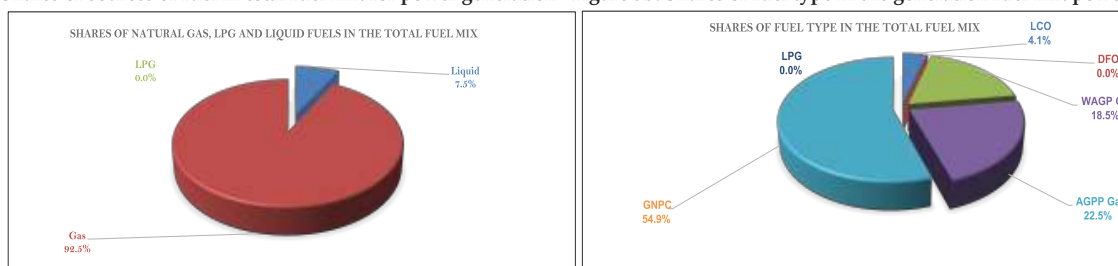
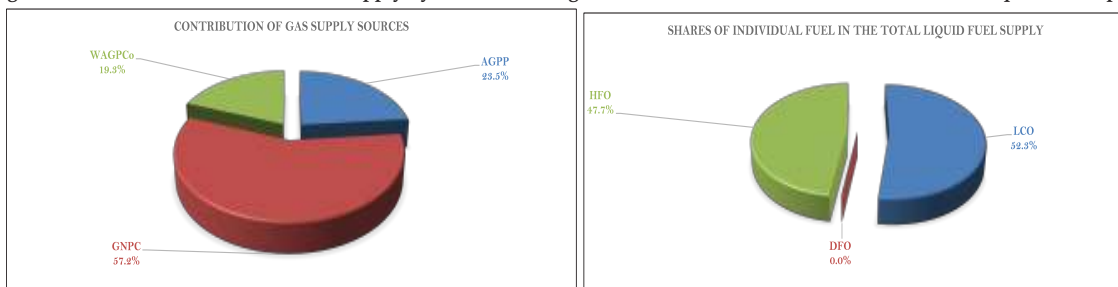


Figure 4a: Contribution of Natural Gas Supply by sources

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



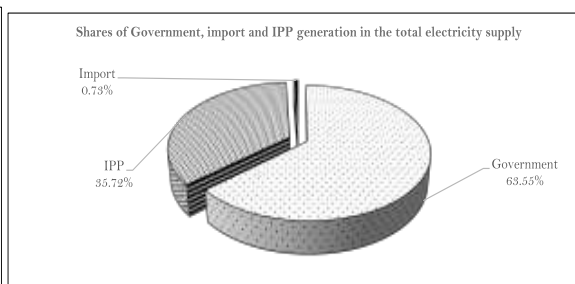
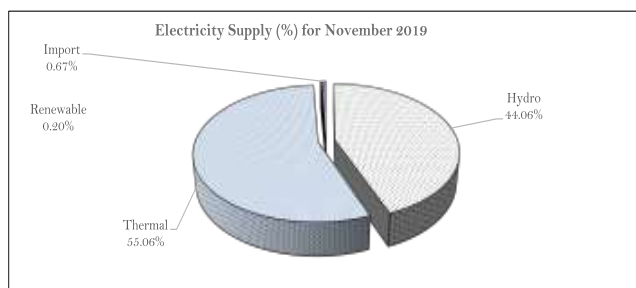
Peak Electricity Supply - November 2019			
Source of Supply	Generation at System Peak Load (MW)	Generation at Ghana Peak Load (MW)	Electricity Supply (GWh)
AKOSOMBO	919.80	919.80	409.20
KPONG	94.00	94.00	61.58
BUI	262.70	262.70	216.88
SEAP	430.40	430.40	251.77
TAPCO	153.00	153.00	105.60
TICO	156.00	156.00	137.46
TT1PP	-	-	8.54
CENIT	108.00	108.00	73.69
TT2PP	24.20	24.20	12.20
MRP	-	-	38.96
KARPOWER	18.30	18.30	49.34
AMERI	213.30	213.30	96.73
KTPP	103.00	103.00	61.68
Trojan Power	-	-	-
CENPOWER	-	-	-
AKSA	250.60	250.60	23.35
BXC Solar	-	-	2.86
Safisana	-	-	-
VRA Solar	-	-	0.31
Genser	-	-	28.85
IMPORT	2,733.30	2,733.30	10.46
Export to CIE at peak	10.00	10.00	102.68
Export to CEB at peak	177.00	177.00	6.62
Export to Sonabel	79.00	79.00	53.67
System Coincident Peak Load	2,733.30		
Ghana Coincedent Peak Load		2,467.30	
Total Supply			1,589.45
Total Supply without export			1,426.48

OPERATIONAL FACT SHEET

Average Monthly Flowrate (MMSCFD)	
Location	Monthly Average
Etoki	66.81
Tema WAGPCo	115.24
Aboadze WAGPCo	0.00
Aboadze GNGC	97.95
Reverse Flow	66.34

Nov-19			
	Beginning month (ft)	End month (ft)	Change in water level (feet)
Hydro Dam			
Akosombo	265.35	265.96	0.61
Bui	600.48	596.78	-3.71

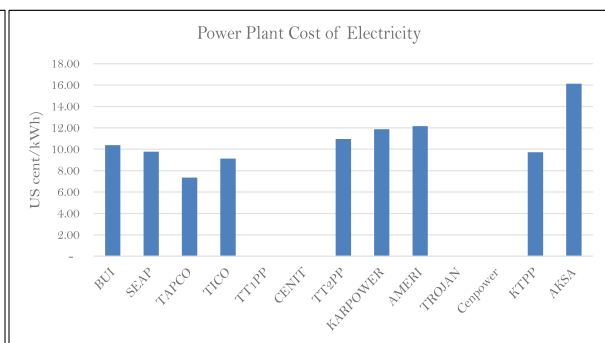
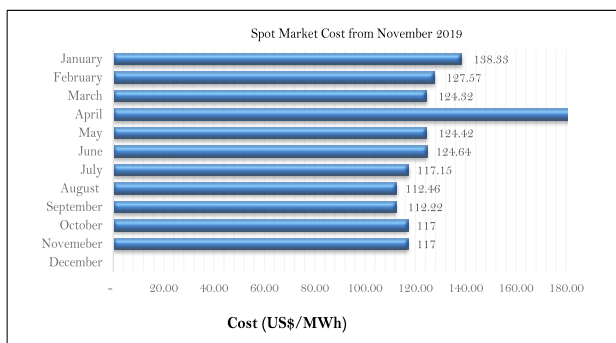
	Nov 2018 Beginning month (ft)	End month (ft)	Change in water level (feet)
Hydro Dam			
Akosombo	263.46	262.98	-0.48
Bui	594.09	587.73	-6.36



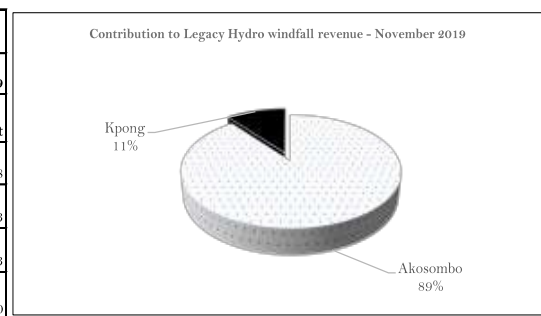
Power Plant Data November 2019								
	Installed Capacity (MW)	Plant Capacity Utilization (%)	Electricity Generation (GWh)	Gas Consumption (MMBtu)	LCO Consumption (MMBtu)	DFO Consumption (MMBtu)	HFO Consumption (MMBtu)	LPG Consumption (MMBtu)
Akosombo	1,020.00	55.72	409.20	-	-	-	-	-
Kpong	160.00	53.45	61.58	-	-	-	-	-
Bui	400.00	75.31	216.88	-	-	-	-	-
SEAP	560.00	62.44	251.77	1,911,835.35	-	-	-	-
TAPCO	330.00	44.44	105.60	858,579.14	-	-	-	-
TICO	340.00	56.15	137.46	1,232,582.40	-	-	-	-
TT1PP	126.00	9.41	8.54	101,402.86	-	-	-	-
CENIT	126.00	81.23	73.69	791,594.76	-	-	-	-
TT2PP	87.00	19.48	12.20	157,489.84	-	-	-	-
KARPOWER	470.00	14.58	49.34	309,381.00	-	-	94,729.78	-
AMERI	250.00	53.74	96.73	978,816.65	-	-	-	-
Cenpower	370.00	-	-	-	-	-	-	-
TROJAN	56.00	-	-	-	-	-	-	-
KTPP	220.00	38.94	61.68	702,092.23	-	-	-	-
AKSA	360.00	9.01	23.35	-	-	-	191,815.15	-
GENSER	95.00	42.18	28.85	-	-	-	-	-
VRA Solar	2.50	17.22	0.31	-	-	-	-	-
BXC	20.00	19.86	2.86	-	-	-	-	-
Meinergy	20.00	16.02	2.31	-	-	-	-	-
Total	5,012.50	42.74	1,542.34	7,043,774.24	-	-	286,544.93	-

ECONOMIC FACT SHEET

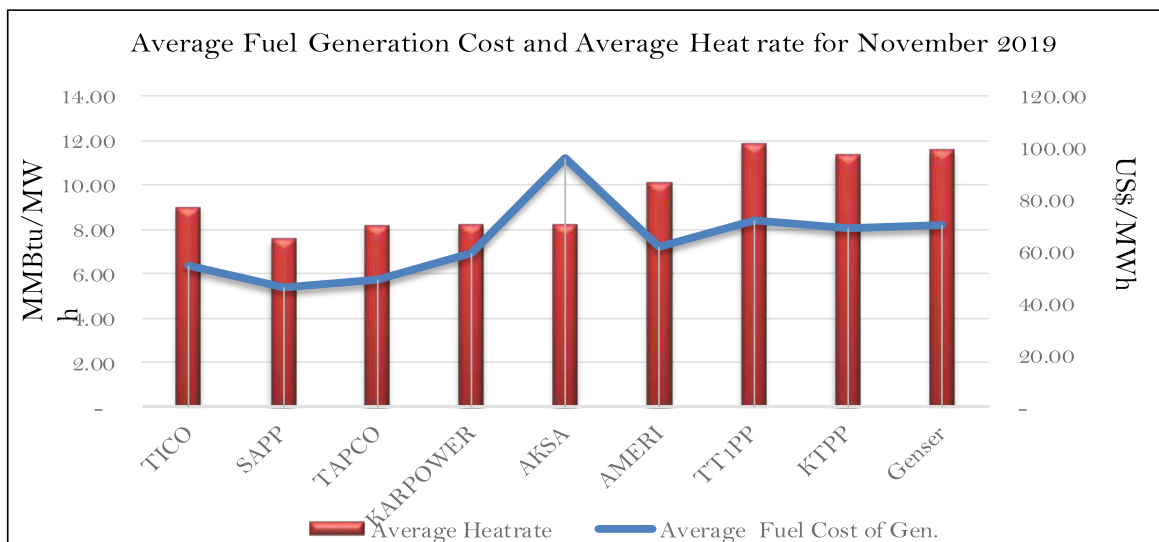
		Actual	Projected	Change
Average Market Energy Cost	US\$/MWh	73.92	79.81	(5.89)
Average Market Capacity Charge (AMCC)	US\$/MWh	32.05	34.62	(2.57)
Total Average Market Cost (TAC)	US\$/MWh	105.97	114.43	(8.46)
System Marginal Cost (SMC)	US\$/MWh	116.25	88.55	27.70
System Marginal Capacity Charge (SMCC)	US\$/MWh	23.95	23.95	-
Spot Market Price (SMP)	US\$/MWh	140.20	112.50	27.70
Composite Bulk Generation Charge (CBGC)	US\$/MWh	97.01	97.01	-
Deviation of TAC from CBGC	US\$/MWh	(8.96)	(17.42)	8.46
Deviation of SMP from CBGC	US\$/MWh	(43.19)	(15.49)	(27.70)



Average Fuel Prices		
		Nov-19
Fuel Type	Unit	Delivered Cost
Natural Gas	US\$/MMBtu	6.08
LCO	US\$/BBL	64.13
HFO	US\$/Tonne	389.03
DFO	US\$/Tonne	0.00



	Gazetted Natural Gas Price	Weighted average Natural Gas Price	LCO	HFO	DFO
US\$/MMBTu	6.08	5.97	12.12	11.53	0.00



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	55.72	-	-	-
Kpong	53.45	-	-	-
Bui	75.31	-	-	-
SAPP	62.44	7,593.43	46.17	0.40
TAPCO	44.44	8,130.72	49.43	0.43
TICO	56.15	8,967.06	54.52	0.48
TT1PP	9.41	11,873.87	72.19	0.63
CENIT	81.23	10,742.53	-	0.57
TT2PP	19.48	12,905.83	78.47	0.68
KARPOWER	14.58	8,191.16	59.49	0.48
AMERI	53.74	10,119.16	61.52	0.54
TROJAN	-	-	-	-
KTPP	38.94	11,382.38	69.20	-
AKSA	9.01	8,214.15	96.36	0.65
Genser	42.18	11,572.06	70.36	0.61

		Wholesale Electricity Market Price Data - 2019 (Uscent/kWh)										
		January	February	March	April	May	June	July	August	September	October	November
Average Market Price	Actual	14.14	14.26	13.87	16.68	13.91	13.55	11.91	11.28	11.60	11.01	10.60
	Projected	12.79	12.69	12.74	12.97	12.86	12.70	12.74	11.54	11.44	11.89	11.91
System Marginal Price	Actual	17.02	16.07	14.77	20.85	14.84	14.86	14.11	13.64	13.62	13.97	14.02
	Projected	12.83	13.00	12.83	12.88	12.83	12.88	12.83	11.20	11.25	11.20	11.25

Tema CENIT Thermal Power Plant (TCTPP) resumes operation

The Tema CENIT Thermal Power Plant (TCTPP) resumed operation in October 2019 after it went offline for over a year due to low LCO stocks.

¹CENIT Energy Limited (CEL) is a wholly owned Ghanaian company that is a developer, owner, and operator of energy infrastructure projects. CEL's sole shareholder, CENIT Investment Limited, a special purpose investment vehicle that is owned by the Social Security and National Insurance Trust (SSNIT).

The fundamental objective of CEL as an Independent Power Producer (IPP) is to contribute to the power generation needs of the country, while showcasing local content capability and capacity to achieve this objective. CEL's maiden project was the development of the 126 MW (ISO) Tema CENIT Thermal Power Plant (TCTPP) which began commercial operations in October 2012. Net output of the plant is 110 MW.

¹History of CENIT Energy Limited is sourced from <https://cenitenergy.com/our-company>

The plant consists of one open-cycle General Electric frame 9171E Gas Turbine and including all associated Balance of Plant (BOP).

The TCTPP, which is designed to generate power over a twenty-five year period, is situated at the Tema Thermal 1 Power Plant (TT1PP) Site of the Volta River Authority (VRA) with whom the plant shares common facilities such as a centralized control room and switchgear building, raw and demineralized water supply, and light crude oil treatment plant and storage tanks among others, through a Shared Services Agreement (SSA) between CEL and the VRA.

An Interconnection Agreement between CEL and the Ghana Grid Company (GRIDCo) allows the power generated by the CEL plant to be exported onto the national grid.

Operations and Maintenance (O&M) Services for the CEL plant is being provided by GTS Engineering Services Ltd, a wholly owned Ghanaian engineering company. Since achieving Commercial Operations in the last quarter of 2012 the TCTPP has maintained the highest levels of availability and reliability.

CEL is collaborating with VRA to develop their two plants into a combined cycle. The project will involve the combination of VRA's TT1PP and CENIT's TCTPP into a combined cycle power plant which will add another 110 MW to the power currently being produced by the two entities separately. The project is being jointly developed by VRA and CENIT.

The TCTPP is a dual fuel power plant that operates on Light Crude Oil (LCO) and natural gas. The TCTPP operated on LCO from 2012 to 2017. In 2012, TCTPP commenced generation from October, generating a total of 94.17 GWh and consumed 195,437 bbls of LCO. The generation from TCTPP increased to 545.35 GWh in 2013 with a corresponding increase in LCO consumption. In 2014, 2015 and 2016, the TCTPP generated 512.84 GWh, 317.13 GWh and 413.42 GWh respectively on LCO. The power plant consumed 1.1 million bbls, 0.68 million bbls and 0.899 million bbls of LCO in 2014, 2015 and 2016 respectively. The TCTPP supplied 4.2%, 4% and 2.8% of the total electricity supplied in 2014, 2015 and 2016 respectively. The power plant could not generate consistently in 2017 and was offline in 2018 due to unavailability of LCO as a result of limited LCO storage capacity.

The Takoradi – Tema Interconnection Project (TTIP), which will allow reverse flow of natural gas from the west of Ghana to the Tema Power Enclave in the east of the country was completed and commenced gas delivery in June 2019. The TCTPP is an offtaker of gas from Ghana National Petroleum Cooperation, which is transported through the reverse flow facility from the west to the east.

The power plant resumed operation on 21st October, 2019 on natural gas through the reverse flow facility. The power plant generated 26.03 GWh, consuming 248 MMSCF of natural gas. The natural gas consumption of TCTPP constituted 17.4% of the total natural gas supplied through the reverse flow facility for October 2019.

In November 2019, the TCTPP generated 73.69 GWh at an average capacity of 102.3 MW, operating for a full month since July 2016. The total generation of 73.69 GWh constituted 5.1% of the total electricity supplied in November 2019. The power plant consumed 747 MMSCF of natural gas constituting 36.4% of the total natural gas supplied through the reverse flow.

The consumption of natural gas is critical for the power plant to generate at a lower operating cost as natural gas prices are comparatively lower than LCO prices. Natural gas is also a lighter fuel compared to LCO and therefore there is less strain on the gas turbine. This reduces the frequency of maintenance on the gas turbine and a possible reduction in the maintenance cost.

The continuous operation of the thermal power plants in the East on the natural gas through the reverse flow facility will potentially reduce our un-utilized take-or-pay obligation on natural gas. The availability of fuel, especially natural gas to all available power plants could help in the effective implementation of merit order dispatch that could reduce the weighted cost of electricity generation.

Figure 1: A view of the Tema CENIT Thermal Power Plant (TCTPP)



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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ENERGY COMMISSION website

ELECTRICITY MARKET OVERSIGHT PANEL (EMOP)

2019 MID-YEAR
REPORT

**REVIEW OF THE GHANA
WHOLESALE ELECTRICITY
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