GHANA WHOLESALE ELECTRICITY MARKET BULLETIN

MARKET WATCH

Monthly Market Data Analysis

ISSUE NO. 42 **1st July 2019 to 31st July 2019**

This Bulletin covers major developments in the Wholesale Electricity Market (WEM) of Ghana from 1st July, 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 review of 2019 half year performance of the Wholesale Electricity Market.

The Energy Commission (EC) would very much appreciate and welcome comments from readers on the Bulletin. Reasonable care has been taken to ensure the information contained in this Bulletin is accurate at the time of publication, nevertheless, any errors, omissions or inaccuracies therein are regretted.

HIGHLIGHTS OF THE MONTH

The System Peak Load recorded for July 2019 reduced by 4.1%, from 2,589.7 MW in June 2019 to 2,484.2 MW

On the contrary, the System Peak Load recorded in July 2019 was marginally lower the 2,470 MW projected in the 2019 ESP. The Ghana Peak Load reduced by 4.3%, from 2,394.4 MW in June 2019 to 2,484.2 MW in July 2019. Also, the Ghana Peak Load recorded in July 2019 was 1.3% lower than the 2,320 MW projected in the ESP. Electricity import did not contribute to both the System Peak Load and the Ghana Peak Load in July 2019. The total electricity export at the System Peak Load of 231 MW to CIE, CEB and SONABEL increased significantly by 54% in July 2019 when compared with the 150 MW projected in the 2019 ESP. Average electricity demand of 1,954.92 MW recorded in July 2019 was 4.3% higher than the 1,873.92 MW projected in the ESP.

The total electricity supply of 1,454.67 GWh in July 2019 was 4.3% higher than the 1,394.1 GWh projected in the 2019 ESP. Out of the total electricity supplied in July 2019, 109.53 GWh was exported to CIE, SONABEL and CEB with the remaining 1,345.14 GWh consumed domestically. The total electricity consumed domestically was 2.4% higher than the 1,314 GWh projected in the 2019 ESP. Also, the total electricity export to CIE, CEB and SONABEL was 36.7% higher than the 80.1 GWh projected in the 2019 ESP.

Hydro-electric generation increased in July 2019, from 30.6% in June 2019 to 34.1%. Electricity generated from thermal sources

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

	July 2019		June 2019	
	Projected	Actual Outturn	Projected	Actual Outturn
Total Supply (GWh)	1,394.1	1,421.5	1,386.1	1,455.6
Source by Power Plants (GWh)				
AKOSOMBO	297.3	396.2	364.9	366.9
KPONG	67.6	72.2	65.4	63.6
BUI	55.2	27.6	53.4	25.8
Sunon Asogli	277.4	277.3	268.5	202.9
TAPCO	109.4	65.2	102.0	97.2
TICO	159.0	125.0	129.8	112.5
TT1PP	-	7.8	-	25.9
CENIT	-	-	-	-
TT2PP	-	19.5	-	16.4
Amandi	-	3.9	-	-
Karpowership	256.7	130.6	248.5	150.3
AMERI	51.6	156.1	77.0	113.0
KTPP	-	83.5	-	64.8
Trojan Power	-	-	-	-
CENPOWER	-	-	-	160.6
AKSA	115.0	39.3	72.0	42.3
BXC Solar	2.3	2.0	2.2	1.9
VRA Solar	0.3	-	0.2	-
Genser		0.2	-	0.3
Meinergy	2.3	1.6	2.2	1.8
Total Generation (GWh)	1,394.1	1,407.9	1,386.1	1,446.2
Imports (GWh)	-	13.6	-	9.4
Total Supply (GWh)	1,394.1	1,421.5	1,386.1	1,455.6
Deficit/Over supply (GWh)	-	27.4	-	69.5
Ghana Coincedent Peak Load (MW)	2,320.0	2,290.7	2,404.0	2,394.4
System Coincident Peak Load (MW)	2,470.0	2,484.2	2,554.0	2,589.7

decreased from 68.5% in June 2019 to 64.7% in July 2019. The share of electricity generated from solar accounted for 0.3% of the total electricity supplied in July 2019.

The Akosombo dam and the Bui dam recorded a net inflow in July 2019. The rate of increase in the water level for the Akosombo dam was 0.01 feet per in July 2019. Also, the Bui dam water level increased at 0.12 feet per day in July 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

The System Peak Load continued to reduce in July 2019, from 2,589.7 MW in June 2019 to 2,484.2 MW. Likewise, the Ghana Peak Load of 2,290.7 MW recorded in July 2019 was 4.3% lower than the 2,394.4 MW in June 2019. A total of 231 MW was exported to CIE, CEB and SONABEL at the System Peak Load in July 2019. A total of 32 MW was exported to CIE, 111 MW to CEB and 88 MW to SONABEL in July 2019. Import of electricity did not contribute to both the System Peak Load and the Ghana Peak Load in July 2019. Electricity generated from hydro sources contributed 32.9% and 36% of the total load served at the System Peak Load and the Ghana Peak Load respectively in July 2019. Thermal generation accounted for 67.1% and 64% of the System Peak Load and the Ghana Peak Load respectively in July 2019. There was a marginal reduction in the average electricity demand in July 2019 from 2,069.2 MW in June 2019 to 2,020.08 MW. Also, the System Load Factor of 76.7% recorded in July 2019 was lower than the 77.9% recorded in June 2019.

Electricity supply

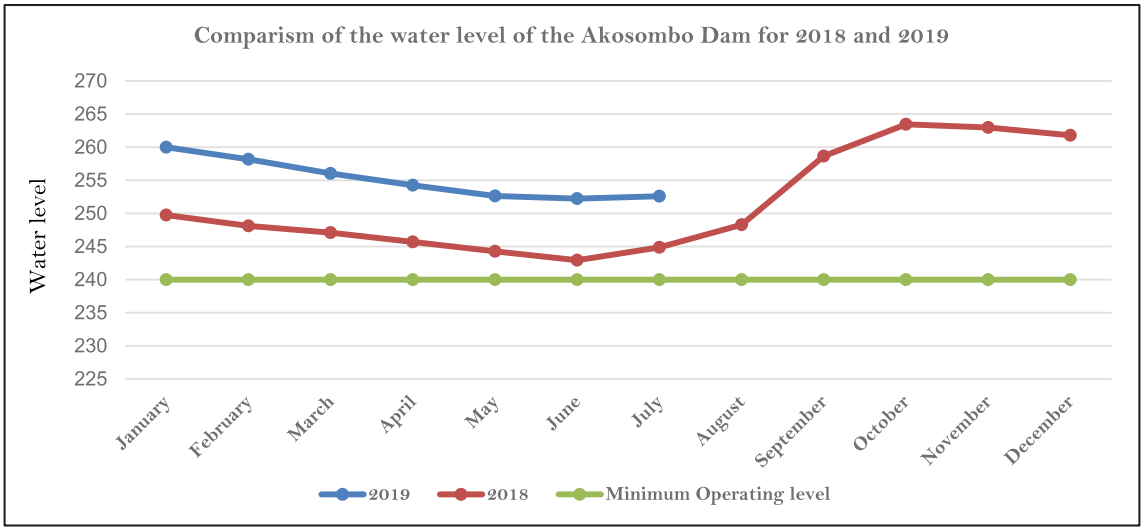
The average electricity of 46.92 GWh per day supplied in July 2019 was 5.5% lower than the 49.66 GWh per day that was supplied in June 2019. Similarly, the total electricity of 1,454.67 GWh supplied in July 2019 was 2.4% lower than the 1,489.83 GWh that was supplied in June 2019. Out of the total electricity supplied, 13.62 GWh was imported from CIE, 109.53 GWh and 1,441.05 GWh was generated from domestic sources. A total of 109.53 GWh was exported to CIE, CEB and SONABEL in July 2019. Out of the total electricity export, 3.04 GWh was supplied to CIE, 56.44 GWh was supplied to CEB and 50.06 GWh was supplied to SONABEL in July 2019. Electricity generated from hydro sources constituted 34.1%, thermal sources constituted 64.7% and solar generation continued to be 0.3% of the total electricity supplied in July 2019.

HYDRO DAM LEVELS

Akosombo Dam Water Level began to increase in July 2019

The rate of increase in the water level for the Akosombo dam was recorded at 0.01 feet per day in July 2019. The water level of 252.23 feet recorded at the beginning of the month increased by 0.37 feet to a month-end water level of 252.6 feet. The water level recorded at the month-end was 9.67 feet above the water level recorded for the same period in 2018. The month-end water level recorded for the Akosombo GS was 12.6 feet above the minimum operating level of 240 feet.

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



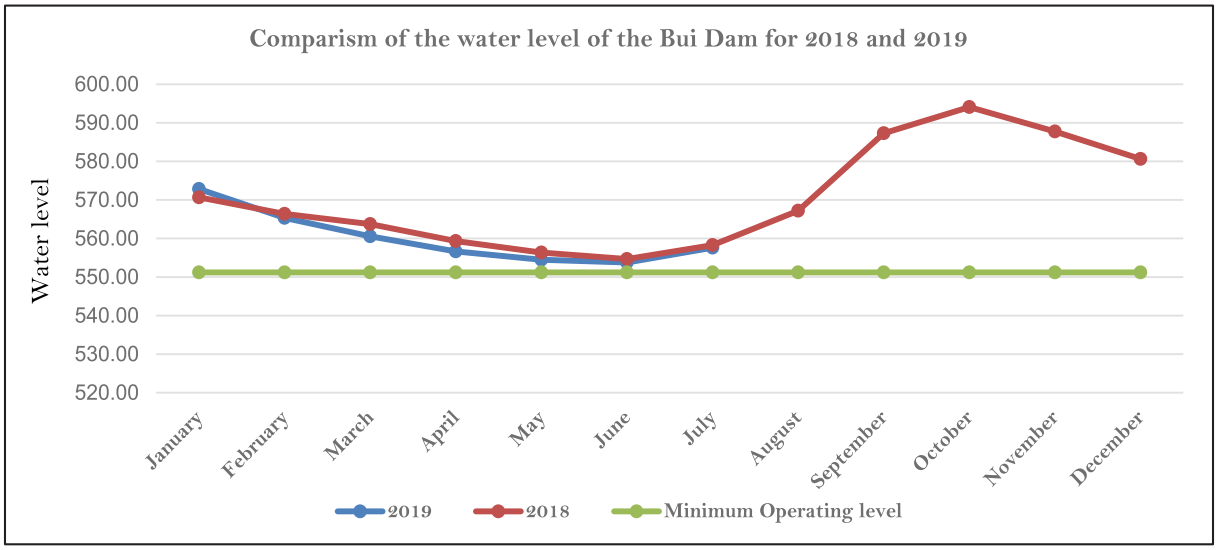
HIGHLIGHTS OF THE MONTH

Bui Dam Water Level began to increase in July 2019

The rate of increase in the water level for the Bui dam was recorded at 0.12 feet per day in July 2019. The water level of 553.77 feet recorded at the beginning of the month increased by 3.84 feet to a month-end water level of 557.6 feet. The water level recorded at the end of the month was 2.95 feet above the water level recorded for the same period in 2018. The month-end water recorded for the Bui GS was 6.42 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 July 2019.

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



FUEL SUPPLY FOR POWER GENERATION

Natural gas flow rate from WAGPCo increased in July 2019

The supply of natural gas from the West Africa Gas Pipeline Company (WAGPCo) to Tema and Kpone increased significantly by 40.8%, from 62 MMSCFD in June 2019 to 87.33 MMSCFD in July 2019. Consequently, the total natural gas supplied by WAGPCo increased from 1,860 MMSCF in June 2019 to 2,707.33 MMSCF in July 2019. The total natural gas supplied constituted 41.5% of the total natural gas consumed in July 2019 which was higher than the 35.3% recorded in June 2019. In the total fuel mix, the share of WAGPCo increased from 23.8% in June 2019 to 33.5% in July 2019.

Natural gas flow from GNGC increased in July 2019.

The supply of natural gas from Atuabo Gas Processing Plant (AGPP) to the Aboadze Power Enclave increased by 7.3%, from 35.93 MMSCFD in June 2019 to 38.55 MMSCFD in July 2019. A total of 1,195.38 MMSCF of natural gas was supplied by GNGC to the power enclave in July 2019, which was higher than the 1,059.55 MMSCF in June 2019. The rate of the reverse flow of natural gas from AGPP to Tema and Kpone increased from 43.38 MMSCFD in June 2019 to 38.54 MMSCFD in July 2019. A total of 637.63 MMSCF of natural gas was supplied in the reverse to Tema and Kpone in July 2019, which was higher than the 607.36 MMSCF in June 2019. On the contrary, the total natural gas supplied to Genser reduced from 394.11 MMSCF in June 2019 to 367.14 MMSCF in July 2019. In summary, a total of 2,200.15 MMSCF of natural gas was supplied by GNGC for power generation in July 2019, which was higher than the 2,061.02 MMSCF in June 2019. The total natural gas supplied by GNGC constituted 32.9% of the total natural gas consumed in July 2019 which was lower than the 36.6% in June 2019. In the total fuel mix, the share of GNGC increased from 24.7% in June 2019 to 26.6% in July 2019.

Natural gas flow from ENI/GNPC increased in July 2019

There was an increase of 3.1% in the natural gas supplied by ENI/GNPC to the Aboadze Power Enclave in July 2019, from 54.34 MMSCFD in June 2019 to 56 MMSCFD. Likewise, the total natural gas supplied by ENI/GNPC increased from 1,630.07 MMSCF in June 2019 to 1,732.89 MMSCF in July 2019. The total natural gas supplied by ENI/GNPC constituted 25.6% of the total natural gas consumed in July 2019 which was lower than the 28.1% in June 2019. On the contrary, the share of natural gas supplied by ENI/GNPC in the total fuel mix increased from 19% in June 2019 to 20.7% in July 2019.

Liquid Fuel

Liquid fuel consumption reduced significantly by 47.5%, from 535,103 barrels in June 2019 to 280,735 barrels in July 2019. The reduced liquid fuel consumed was due to reduced electricity generation from AKSA and Karpowership and sufficient natural gas supply to thermal power plants in July 2019. However, HFO share in the total fuel mix increase from 54.1% in June 2019 to 82.7% in July 2019. On the contrary, the share of HFO in the total fuel mix reduced from 17.6% in June 2019 to 15.9% in July 2019. The share of LCO in the total liquid fuel consumed reduced significantly from 45.6% in June 2019 to 17.3% in July 2019.

HIGHLIGHTS OF THE MONTH

Plant by Plant Highlights

Electricity Generation at the Akosombo Generation Station (GS) increase in July 2019

There was an increase in the average electricity supplied by the Akosombo GS by 4.5%, from 12.23 GWh per day in June 2019 to 12.78 GWh per day in July 2019. Correspondingly, the total electricity generated by the hydro power plant increased by 8%, from 366.88 GWh in June 2019 to 396.16 GWh in July 2019. The total electricity supplied by the Akosombo GS contributed 27.2% of the total electricity supplied in July 2019 and was 33.3% higher than the 297.3 GWh projected in the 2019 ESP. The hydro power plant contributed 601.1 MW to the System Peak Load and 658.2 MW to the Ghana Peak Load in July 2019, representing 24.2% and 27.1% of both peak loads.

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

The average electricity supplied by Kpong GS increased by 9.8%, from 2.12 GWh per day in June 2019 to 2.33 GWh per day in July 2019. Likewise, the total electricity supplied by the Kpong GS increased by 13.5%, from 63.6 GWh in June 2019 to 72.16 GWh in July 2019. The total electricity supplied by the hydro power plant constituted 5% of the total electricity supplied in July 2019 and was 6.7% higher than the 67.6 GWh projected in the 2019 ESP. The Kpong GS contributed 112 MW to the System Peak Load and 115 MW to the Ghana Peak Load. This represents 4.5% of the System Peak Load and 4.7% of the Ghana Peak Load in July 2019.

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

The Bui GS recorded an increase in the average electricity supplied by 3.7%, from 0.86 GWh in June 2019 to 0.89 GWh in July 2019. Likewise, the total electricity supplied by the Bui GS increased from 25.79 GWh in June 2019 to 27.64 GWh in July 2019. The total electricity supplied by the hydro power plant constituted 1.9% of the total electricity supplied in July 2019 and was 49.9% lower than the 55.2 GWh projected in the 2019 ESP. The Bui GS supplied 104.4 MW and 102.4 MW to the System Peak Load and the Ghana Peak Load, representing 4.2% of both peak loads in July 2019.

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

The average electricity generated by the SAPP increased by 32.2%, from 6.76 GWh per day in June 2019 to 8.94 GWh per day in July 2019. Also, the total electricity supplied by the thermal power plant increased by 36.6%, from 202.93 GWh in June 2019 to 277.27 GWh in July 2019. The total electricity supplied by the thermal power plant constituted 19.1% of the total electricity supplied in July 2019 and was marginally lower than the 277.4 GWh projected in the 2019 ESP. SAPP contributed 440.3 MW and 356.4 MW to the System Peak Load and the Ghana Peak Load respectively. This represents 17.7% of the System Peak Load and 14.7% of the Ghana Peak Load in July 2019. The thermal power plant consumed a total of 2,110.69 MMSCF of natural gas at an estimated heat rate of 8,125.91 Btu/kWh in July 2019. The heat rate recorded by the thermal power plant in July 2019 was higher than the 8,017.04 Btu/kWh in June 2019.

Ameri Energy Power Plant's generation increase in July 2019

There was an increase in the average electricity supplied by the Ameri power plant in July 2019 by 33.8%, from 3.77 GWh per day in June 2019 to 5.04 GWh per day. The total electricity of 156.12 GWh supplied by the thermal power plant was 38.2% higher than the 112.95 GWh recorded in June 2019. The total electricity supplied by Ameri constituted 10.7% of the total electricity supplied in July 2019 and was two folds higher than the 51.6 GWh projected in the 2019 ESP. Ameri supplied 221.2 MW and 222.5 MW to the System Peak Load and the Ghana Peak Load respectively in July 2019. This translates into 8.9% and 9.2% of the System Peak Load and the Ghana Peak Load respectively. The thermal power plant consumed a total of 1,530.5 MMSCF of natural gas at an estimated heat rate of 10,087.91 Btu/kWh in July 2019 which was marginally higher than the 10,051.21 Btu/kWh recorded in June 2019.

The Karpowership Power Plant's generation decreased in July 2019

The average electricity supplied by the Karpowership reduced by 15.9%, from 5.01 GWh per day in June 2019 to 4.21 GWh per day in July 2019. Similarly, the total electricity supplied by the thermal power plant reduced by 13.1%, from 150.25 GWh per day in June 2019 to 130.56 GWh per day in July 2019. The total electricity supplied by the thermal power plant constituted 9% of the total electricity supplied in July 2019 and was 49.1% lower than the 256.7 GWh projected in the 2019 ESP. The Karpowership supplied 448.9 MW and 409.9 MW to the System Peak Load and the Ghana Peak Load respectively in July 2019. This translates into 18.1% of the System Peak Load and 16.9% of the Ghana Peak Load. The thermal power plant consumed a total of 173,208.73 barrels of HFO at an estimated heat rate of 8,026.03 Btu/kWh in July 2019 which was marginally lower than the 8,074.98 Btu/kWh recorded in June 2019.

AKSA Power Plant's generation decreased in July 2019

The average electricity generate by AKSA reduced by 9.9% in July 2019, from 1.41 GWh per day in June 2019 to 1.27 GWh per day. The total electricity of 39.34 GWh supplied by AKSA in July 2019 was 6.9% lower than the 42.27 GWh in June 2019. The total electricity supplied by the thermal power plant constituted 2.7% of the total electricity supplied in July 2019 and was 65.8% lower than the 115 GWh projected in the 2019 ESP. The thermal power plant contributed 31.9 MW to the System Peak Load and the Ghana Peak Load, representing 1.3% of both peak loads in July 2019. AKSA consumed a total of 53,211.54 barrels of HFO at an estimated heat rate of 8,182.25 Btu/kWh in July 2019. The heat rate recorded in July 2019 was marginally higher than the 8,159.89 Btu/kWh recorded in June 2019.

Takoradi International Company (TICO) generation increased in July 2019

The average electricity supplied by the thermal power plant increased by 7.5%, from 3.75 GWh per day in June 2019 to 4.03 GWh per day in July 2019. The total electricity of 125.02 GWh supplied by the thermal power plant in July 2019 was 11.1% higher than the 112.53 GWh generated in June 2019. The total electricity supplied by the thermal power plant constituted 8.6% of the total electricity supplied in July 2019 and was 21.4% lower than the 159 GWh projected in the 2019 ESP. TICO supplied 278 MW to the System Peak Load and 286 MW to the Ghana Peak Load in July 2019. This represents 11.2% of the System Peak Load and 11.8% of

the Ghana Peak Load. The thermal power plant consumed a total of 708.93 MMSCF of natural gas and 54,202.9 barrels of LCO at an estimated heat rate of 8,133.41 Btu/kWh in July 2019. The heat rate recorded in July 2019 was higher than the 7,762.86 Btu/kWh in June 2019.

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

There was a reduction of 35.1% in the average electricity supplied by TAPCO, from 3.24 GWh per day in June 2019 to 2.1 GWh per day in July 2019. Consequently, the total electricity supplied by TAPCO reduced by 33%, from 97.24 GWh in June 2019 to 65.18 GWh in July 2019. The total electricity supplied TAPCO constituted 4.5% of the total electricity supplied in July 2019 and 40.4% lower than the 109.4 GWh projected in the 2019 ESP. The thermal power plant generated 105 MW to the System Peak Load and 106 MW to the Ghana Peak Load in July 2019. The load served constituted 4.2% of the System Peak Load and 4.4% of the Ghana Peak Load. TAPCO consumed a total of 688.85 MMSCF of natural gas at an estimated heat rate of 10,875.52 Btu/kWh in July 2019. The heat rate recorded in July 2019 was higher than the 7,802.81 Btu/kWh in June 2019.

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

There was an increase of 24.7% in the average electricity supplied by the KTPP in July 2019, from 2.16 GWh per day in June 2019 to 2.69 GWh per day. Likewise, the total electricity supplied by the thermal power plant increased by 28.8%, from 64.85 GWh in June 2019 to 83.53 GWh in July 2019. The total electricity generated by the thermal power plant constituted 5.7% of the total electricity supplied in July 2019. KTPP supplied 103 MW and 104 MW to the System Peak Load and the Ghana Peak Load respectively in July 2019. Thus representing 4.2% of the System Peak Load and 4.3% of the Ghana Peak Load. A total of 884.02 MMSCF of natural gas was consumed at an estimated heat rate of 11,297.47 Btu/kWh in July 2019, which was marginally higher than the 11,258.73 Btu/kWh recorded in July 2019.

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

TT1PP operated for 7 days in July 2019 and supplied a total of 7.78 GWh. The total electricity supplied TT1PP constituted 0.5% of the total electricity supplied in July 2019. The thermal power plant didn't contribute to both the System Peak Load and the Ghana Peak Load in July 2019. TT1PP consumed a total of 114.67 MMSCF of natural gas at an estimated heat rate of 15,733.57 Btu/kWh in July 2019. The power plant was projected to be offline in July 2019.

Embedded Electricity Generation

Genser Power Plant's generation decreased in July 2019

There was a reduction in the average electricity supplied by Genser power plant by 6.4%, from 1.14 GWh per day in June 2019 to 1.07 GWh per day in July 2019. The total electricity of 33.08 GWh supplied by the thermal power plant in July 2019 was 3.3% higher than the 34.19 GWh in June 2019. Genser's total electricity supplied constituted 2.3% of the total electricity supplied in July 2019. The thermal power plant consumed a total of 367.14 MMSCF of natural gas at an estimated heat rate of 11,049.6 Btu/kWh in July 2019 which was lower than the 11,861.3 Btu/kWh in June 2019.

BXC Solar generation increased in July 2019

There was a marginal increase in the total electricity supplied by the BXC solar power plant by 1.8% in July 2019, from 1.94 GWh in June 2019 to 1.97 GWh. The total electricity supplied by the solar power plant constituted 0.1% of the total electricity supplied in July 2019 was 14.4% lower than the 2.3 GWh projected in the 2019 ESP.

VRA Navrongo Solar generation decreased in July 2019

The VRA solar power plant recorded a reduction in the total electricity supplied by in July 2019, from 0.28 GWh in June 2019 to 0.24 GWh. The total electricity supplied by the solar power plant constituted 0.02% of the total electricity supplied in July 2019 and was 18.8% lower than the 0.3 GWh projected in the 2019 ESP.

Electricity Exchange – Import increased whilst Export decreased in July 2019

There was an increase in the average electricity import from CIE, from 0.31 GWh per day in June 2019 to 0.44 GWh per day in July 2019. Likewise, the total electricity import increased by 44.4%, from 9.43 GWh in June 2019 to 13.62 GWh in July 2019. The total electricity import constituted 0.9% of the total electricity supplied in July 2019.

The average electricity export to CIE and CEB decreased by 12.9% and 48.4%, from 0.19 GWh per day and 2.09 GWh per day in June 2019 to 0.1 GWh per day and 1.82 GWh per day in July 2019 respectively. On the contrary, the average electricity supplied to SONABEL increased by 2.5%, from 1.58 GWh per day in June 2019 to 1.61 GWh per day in July 2019.

Also, the total electricity export to CIE, CEB decreased by 46.6% and 10%, from 5.69 GWh and 62.73 GWh in June 2019 to 3.04 GWh and 56.44 GWh in July 2019 respectively. On the contrary, the total electricity export SONABEL increased by 5.9%, from 47.27 GWh in June 2019 to 50.06 GWh in July 2019.

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

Monthly Market Data Analysis

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

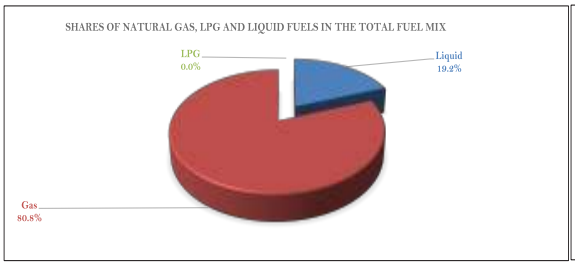


Figure 3b: Shares of fuel type in the generation fuel mix power generation

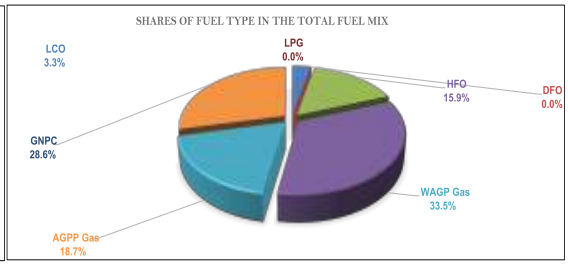


Figure 4a: Contribution of Natural Gas Supply by sources

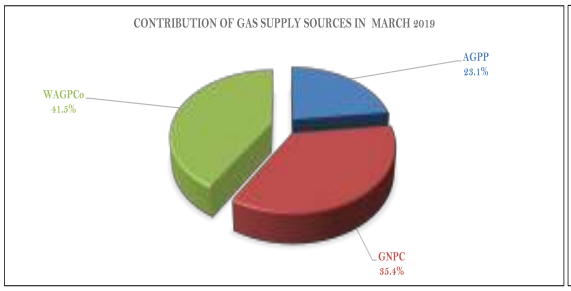
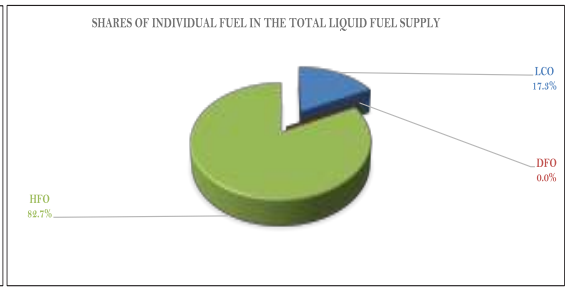


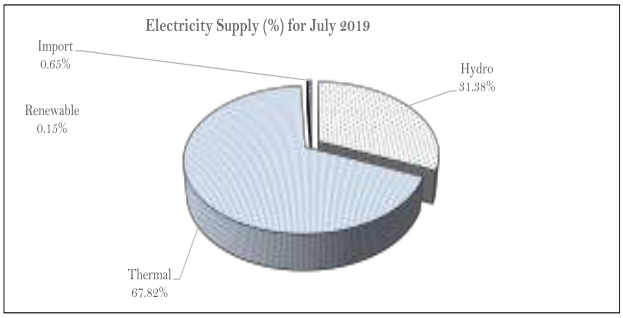
Figure 4b: Contribution of individual fuel in the liquid fuel supply

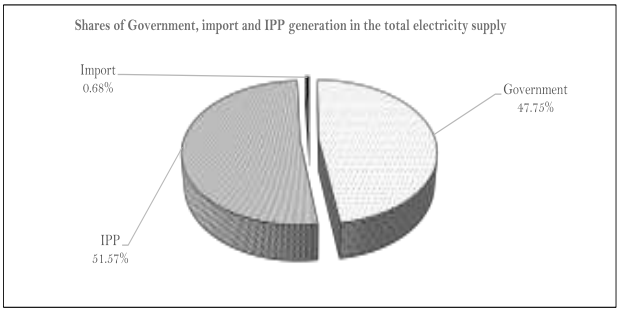


Peak Electricity Supply - July 2019			
Source of Supply	Generation at System Peak Load (MW)	Generation at Ghana Peak Load (MW)	Eleectricity Supply (GWh)
AKOSOMBO	601.10	658.20	396.16
KPONG	112.00	115.00	72.16
BUI	104.40	102.40	27.64
SEAP	440.30	356.40	277.27
TAPCO	105.00	106.00	65.18
TICO	278.00	286.00	125.02
TT1PP	-	-	7.78
CENIT	-	-	-
TT2PP	38.40	38.40	19.49
MRP	-	-	3.90
KARPOWER	448.90	409.90	130.56
AMERI	221.20	222.50	156.12
KTPP	103.00	104.00	83.53
Trojan Power	-	-	-
CENPOWER	-	-	-
AKSA	31.90	31.90	39.34
BXC Solar	-	-	1.97
Safisana	-	-	-
VRA Solar	-	-	0.24
Genser	-	-	32.65
IMPORT	-	-	13.62
Export to CIE at peak	32.00	-	56.44
Export to CEB at peak	111.00	63.00	3.04
Export to Sonabel	88.00	77.00	50.06
System Coincident Peak Load	**2,484.20**		
Ghana Coincedent Peak Load		**2,290.70**	
Total Supply			**1,452.62**
Total Supply without export			**1,343.09**

Ghana Electricity Demand & Supply		
		Jul-19
Maximum System Peak Load	MW	**2,484.2**
Minimum System Peak Load	MW	**2,253.6**
Average Peak Generation	MW	**2,485.1**
System Base Load	MW	**1,781.0**
Total Electricity	GWh	**836.1**
Load Factor (LF)	%	**76.7**

OPERATIONAL FACT SHEET





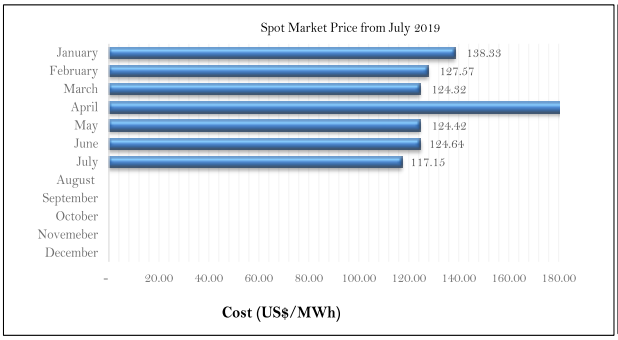
Power Plant Data July 2019								
	Installed Capacity (MW)	Plant Capacity Utilization (%)	Electricity Generation (GWh)	Gas Consumption (MMBtu)	LCO Consumption (MMBtu)	DFO Consumption (MMBtu)	HFO Consumption (MMBtu)	LPG Consumption (MMBtu)
Akosombo	1,020.00	53.94	396.16	-	-	-	-	-
Kpong	160.00	62.64	72.16	-	-	-	-	-
Bui	400.00	9.60	27.64	-	-	-	-	-
SEAP	560.00	68.77	277.27	2,253,077.58	-	-	-	-
TAPCO	330.00	27.43	65.18	708,822.85	-	-	-	-
TICO	340.00	51.07	125.02	729,485.52	286,782.11	601.98	-	-
TT1PP	126.00	8.58	7.78	122,407.20	-	-	-	-
CENIT	126.00	-	-	-	-	-	-	-
TT2PP	87.00	31.11	19.49	251,477.84	-	-	-	-
KARPOWER	470.00	38.58	130.56	-	-	-	1,047,912.82	-
AMERI	250.00	86.73	156.12	1,574,883.93	-	-	-	-
Cenpower	370.00	-	-	-	-	-		-
TROJAN	56.00	-	-	-	-	-	-	-
KTPP	220.00	52.73	83.53	943,650.92	-	-	-	-
AKSA	360.00	15.18	39.34	-	-	-	321,929.80	-
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**	38.50	**1,435.95**	**6,583,805.83**	**286,782.11**	**601.98**	**1,369,842.63**	**-**

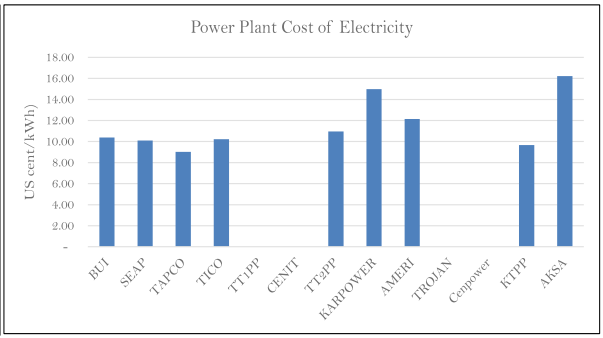
Average Monthly Flowrate (MMSCFD)	
Location	**Monthly Average**
Etoki	**87.56**
Tema WAGPCo	**103.00**
Aboadze WAGPCo	**0.00**
Aboadze GNGC	**101.55**
Reverse Flow	**31.08**

Jul-19			
	Beginning month (ft)	**End month (ft)**	**Change in water level**
Hydro Dam			**(feet)**
Akosombo	252.23	252.60	0.37
Bui	553.77	557.60	3.84

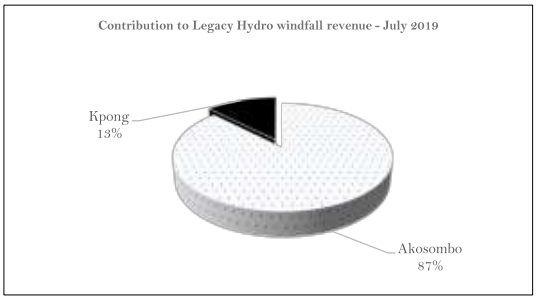
ECONOMIC FACT SHEET

		Actual	Projected	Change
Average Market Energy Cost	US$/MWh	83.63	91.06	(7.43)
Average Market Capacity Charge (AMCC)	US$/MWh	35.45	36.33	(0.88)
Total Average Market Cost (TAC)	US$/MWh	119.07	127.39	(8.32)
System Marginal Cost (SMC)	US$/MWh	117.15	104.88	12.27
System Marginal Capacity Charge (SMCC)	US$/MWh	23.95	23.42	0.53
Spot Market Price (SMP)	US$/MWh	141.10	128.30	12.80
Composite Bulk Generation Charge (CBGC)	US$/MWh	97.01	97.01	-
Deviation of TAC from CBGC	US$/MWh	(22.06)	(30.38)	8.32
Deviation of SMP from CBGC	US$/MWh	(44.09)	(31.29)	(12.80)

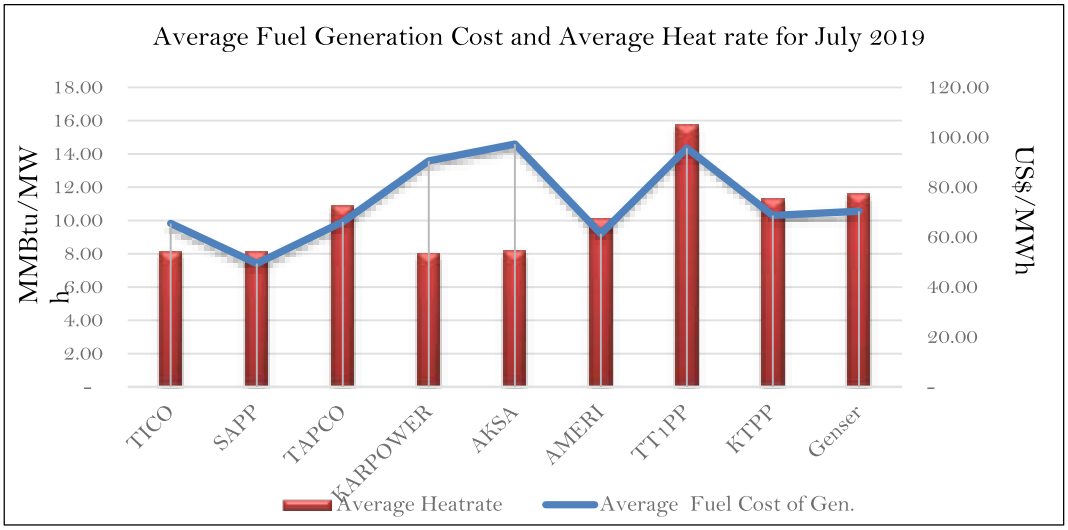




Average Fuel Prices		
		Jul-19
Fuel Type	Unit	Delivered Cost
Natural Gas	US$/MMBtu	7.29
LCO	US$/BBL	69.22
HFO	US$/Tonne	394.90
DFO	US$/Tonne	



	Gazette Natural Gas Price	Weighted average Natural Gas Price	LCO	HFO
US$/MMBTu	6.08	5.97	13.08	11.42



Power Plant	Capacity Utilization (%)	Average Heat rate (Btu/KWh)	Average Fuel Cost of Generation (US$/MWh)	Emission Factor (kgCO2/kWh)
Akosombo	53.94	-	-	-
Kpong	62.64	-	-	-
Bui	9.60	-	-	-
SAPP	68.77	8,125.91	49.41	0.43
TAPCO	27.43	10,875.52	66.12	0.58
TICO	51.07	8,133.41	65.48	0.48
TT1PP	8.58	15,733.57	95.66	0.83
CENIT	-	-	-	-
TT2PP	31.11	12,905.83	78.47	0.68
KARPOWER	38.58	8,026.03	90.52	0.63
AMERI	86.73	10,087.91	61.33	0.54
TROJAN	-	-	-	-
KTPP	52.73	11,297.47	68.69	-
AKSA	15.18	8,182.25	97.25	0.64
Genser	47.22	11,570.77	70.35	0.61

		Wholesale Electricity Market Price Data - 2019 (Uscent/kWh)						
		January	February	March	April	May	June	July
Average Market Price	Actual	14.14	14.26	13.87	16.68	13.91	13.55	11.91
	Projected	12.79	12.69	12.74	12.97	12.86	12.7	12.74
System Marginal Price	Actual	17.02	16.07	14.77	20.85	14.84	14.86	14.11
	Projected	12.83	13	12.83	12.88	12.83	12.88	12.83

1.0 Review of 2019 half year performance of electricity generation and supply

The grid installed capacity for Ghana has increased from 4,412 MW as at December 2018 to 4,819 MW at a June 2019. This is due to the completion of the commissioning of the TT2PP expansion (38 MW) and Cenpower (370 MW). Embedded generation capacity has increased from 173.5 MW as at December 2018 to 193.5 MW at the end of June 2019. This is due to the completion of the commissioning of the 20 MW Meinergy Solar Power Plant.

1.1 Electricity Demand

System Peak demand, made up of domestic and export loads, recorded in the first-half of 2019 was 2,781 MW compared to the 2,525 MW achieved in 2018. There was a 256 MW increase in demand. This was 10.1% higher than the peak demand in the first half of 2018 and 4.8% higher than the peak demand projected in the 2019 ESP. Additionally, average electricity demand recorded in the first-half of 2019 was 8.8% higher than the average demand recorded in the same period in 2018. In meeting the peak demand of 2,781 MW recorded in the first-half of 2019, the supply from all the hydroelectric power stations was 978.8 MW which represented 35% of the total supply while the thermal-based power plants contributed the rest. The Ghana peak demand (domestic peak load) of 2,547.2 MW was recorded on 6th May 2019 with hydro contributing 35 % of the supply and 65% from the thermal-based power plants.

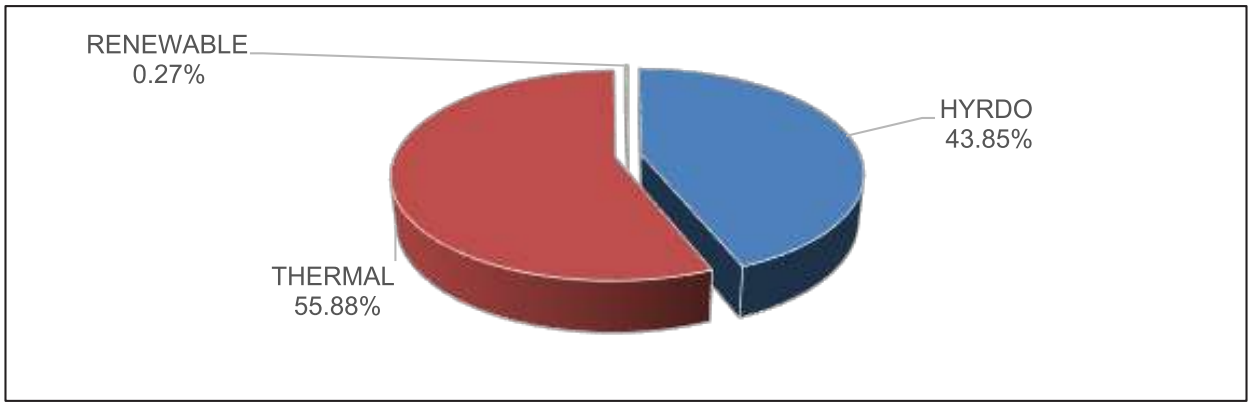
1.2 Electricity Supply

A total of 9,227.36 GWh of electricity was supplied in the first half of 2019, which was 7.2% higher than the projected supply of 8,608.1 GWh in the 2019 ESP. The supply in the first half of 2019 was also 14.2% higher than the electricity supplied for the same period in 2018. The total supply of 9,227.36 GWh was made up of 9,161.88 GWh, that is, 99.04% of the total supply was from domestic sources and 65.48 GWh as a result of inadvertent imports. Also, supply from power plants connected to the National Interconnected Transmission System (NITS) accounted for 96.9% of the total supply whiles embedded generation accounted for the remaining 3.1%.

Thermal-based electricity supply was the dominant source of electricity in the first half of 2019 accounting for 55.9% of the total electricity. Nevertheless, it was 10.11% lower than the projected 66% in the 2019 ESP. Supply from hydro sources therefore increased from a projected 33.7% of the total supply to 43.9% to make up for the shortfall in supply from the thermal power plants. The unavailability of thermal power plants was as a result of technical and fuel supply constraints. Supply from Renewable energy sources (solar power plants) was 0.1% lower than projected in the 2019 ESP.

The VRA power plants supplied 53.1% of the total electricity supplied in the first half of 2019 against a projected share of 49.2%. The Akosombo and Kpong hydro Power Plants accounted for 33.3% and 4.9% respectively of the total electricity supplied in the first half of 2019 against a projected 25.2% and 4.8% respectively in the 2019 ESP. Thus, the VRA thermal power plants supplied lower than projected. Figure 1 shows the shares of the various supply sources in the total electricity supplied for the first half of 2019.

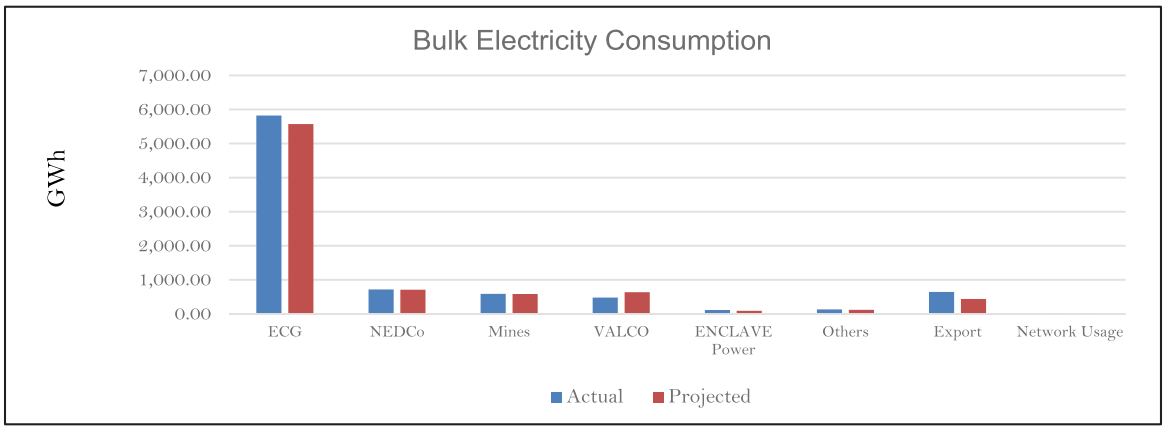
Figure 1: Shares of the various supply sources in the total electricity supplied for the first half of 2019.



1.3 Electricity Consumption

A total of 8,509 GWh of electricity was supplied in the NITS for both domestic and export consumption. Out of this quantity, the ECG/ PDS consumed a total of 5,824.4 GWh of electricity in the first half of 2019, which represents 71.4% of the total. A total of 645.7 GWh was exported in the first half of 2019 to CEB and SONABEL accounting for 7.9% of the total electricity consumed. It was however 12.7% lower than the total electricity exported in 2018. VALCO, which increased its operation on a second pot line in June 2018 consumed 480.9 GWh of electricity thus accounting for 5.8% of the total electricity consumption. It was however 1.9% lower than the projected consumption by 7.8%. Figure 2 shows the Bulk Customer consumption for half year of 2019

Figure 2: Bulk Customer consumption for half year of 2019



1.4 Electricity Import And Export

Ghana exports electricity to its neighbouring countries, Togo and Benin through Communauté Electrique du Bénin (CEB), Burkina Faso through La Société Nationale d'Electricité du Burkina (SONABEL) and also has a power interchange arrangement with La Côte d'Ivoire through Compagnie Ivoirienne d'Electricité (CIE).

Electricity exports in 2019 increased significantly by about 1.2 folds compared to 2018. In the first half of 2019, a total of 65.48 GWh of electricity was inadvertently imported into Ghana which was lower than 81.79 GWh imported in the same period in 2018. Electricity exports in the first half of 2019 was 645.7 GWh which is 356.97 GWh higher than the 288.73 GWh exported in the first half of 2018. Figure 3 shows the comparison of electricity imported for the first halves of 2018 & 2019 while figure 4 shows the comparison of electricity exported for the first halves of 2018 and 2019.

Figure 3: Comparison of electricity imported for the first halves of 2018 & 2019

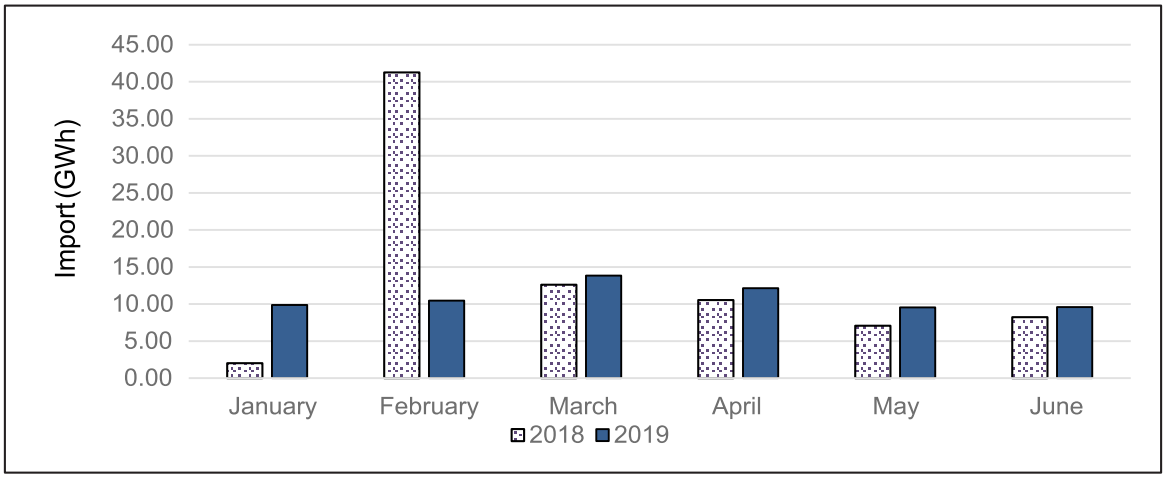
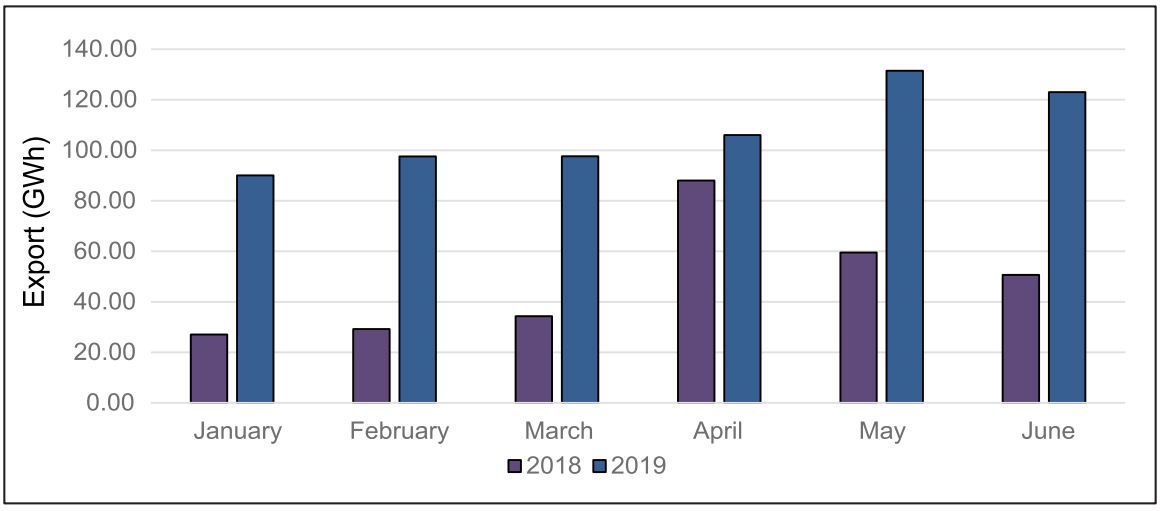


Figure 4: Comparison of electricity exported for the first halves of 2018 & 2019



The peak import demand of 91 MW recorded in the first half of 2018 was lower than the 128 MW imported in the first half of 2018 representing a reduction of 28.9% in the first half of 2019 compared to the same period in 2018. Peak export demand of 291 MW in the first half of 2019, was however marginally lower than the 295 MW peak export recorded in the first half of 2018. Ghana therefore continues to be a net exporter of electricity.

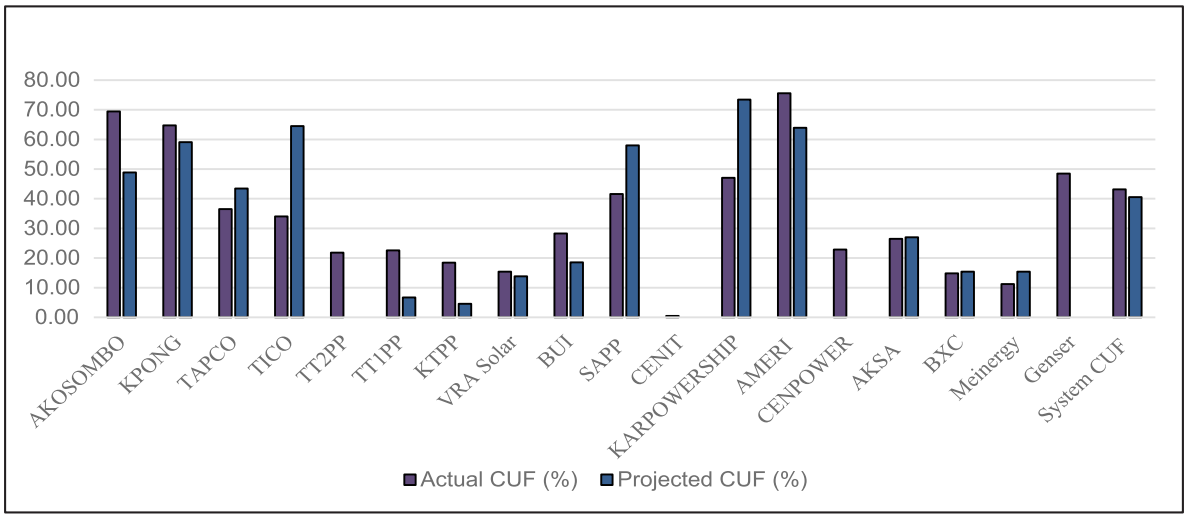
1.5 Power Plant Capacity Utilization

All the hydro power plants had higher Capacity Utilization Factors than projected. The Akosombo, Kpong and Bui Power Plants had CUFs of 69.4%, 64.7% and 28.3% respectively which were higher than the 48.9%, 59.1% and 18.6% projected in the 2019 ESP. Apart from the Ameri Power Plant, all the other power plants in the Aboadze Power Enclave had a lower than projected CUF. The Ameri power plant achieved a CUF of 75.6% which is 11.7% higher than the projected 63.9%.

Fuel supply challenges mainly limited the supply from these plants. Technical challenges also limited supply from the TAPCO and TICO power plants in the first half of the year which reduced their projected capacity utilization from 43.4% and 64.5% respectively to 36.5% and 34% respectively.

The Load Factor recorded for the half year of 2019 was marginally higher than projected by 1.7%. The load factor recorded was 76.4% and this was marginally lower than the 74.7% projected in the 2019 ESP. Figure 5 below shows the Capacity Utilization Factors for the various power plants in the first half of 2019.

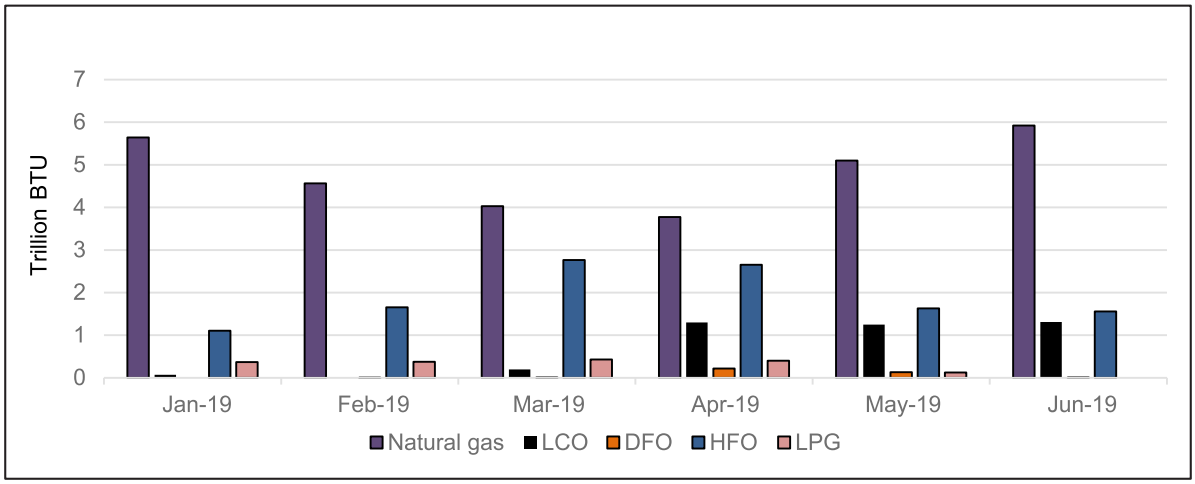
Figure 5: CUFs against Projected CUFs for the first half of 2019.



1.6 Fuel Consumption

A total of 46.6 trillion Btu of fuel was consumed for electricity supply in the first half of the year 2019. Natural gas consumption of 29 trillion Btu dominated the total fuel mix, representing a share of 62.3%. The total HFO consumed was 11 trillion Btu, which constituted 24.4% of the total fuel consumed for the first half of 2019 whilst 4 trillion Btu and 365 billion Btu of LCO and Diesel Fuel Oil (DFO) were consumed respectively. Liquefied Petroleum Gas (LPG) consumption for the first half of 2019 by Genser power plants was 1.7 trillion Btu. Figure 6 shows the Monthly fuel consumption for the first half of 2019.

Figure 6: Fuel consumption for first half of 2019.



Natural gas from ENI dominated the natural gas supply with a share of 40.1%, whilst supply from the West African Gas Pipeline Company (WAGPCo) and Ghana National Gas Company (GNGC) constituted 36.3% and 23.6% respectively.

The Takoradi – Tema Interconnection Project (TTIP), which will allow reverse flow of surplus 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 gas flow from GNGC to Tema in June 2019 ranged between 20 MMSCFD and 67.78 MMSCFD, with an average of 43.38 MMSCFD.

On the average, total natural gas actually consumed by thermal power plants on monthly basis was lower than what was projected within the period. The variance between the projected natural gas consumption and the actual natural gas consumed on monthly basis ranged between 17.1% and 44%.

The highest shortfall in natural gas consumption on monthly basis was recorded from February 2019 to April 2019. Natural gas flowrate from the WAGP averaged 47 MMSCFD in February 2019, lower than 74 MMSCFD projected for the period. In February 2019, the supply of natural gas from GNGC lasted for 7 days due to the gas release from the PV breaker (Cargo tanks) on the FPSO in which event supply to the Aboadze Power Enclave was only from the ENI sources. Again, in March 2019, natural gas supply from all the supply sources in the West (Takoradi) were low owing to the diversion of natural gas supply through the Schlumberger by-pass which had a limitation of 100 MMSCFD, compared to a projected demand of 110 MMSCFD. The diversion was to pave way for the Takoradi–Tema Gas pipeline interconnection works. Similarly, supply from the WAGP of 45.9 MMSCFD was lower than the average demand of 74 MMSCFD required in March 2019.

There was no natural gas supply from the GNGC from 30th March 2019 to 11th April 2019 due to maintenance works at the Atuabo Gas Processing Plant while natural gas supply from ENI was also curtailed from 30th March to 7th April 2019 for maintenance works and tie-in at the Takoradi Regulating and Metering Station (TRMS) to be carried out.

It was projected that LCO would not be used for electricity generation in the 2019 ESP in anticipation of high volumes of natural gas from the Sankofa, Jubilee and TEN fields. On the contrary, some LCO was consumed during the first half of 2019 because of challenges with natural gas supply to the Aboadze and Tema Enclaves. The commissioning of the Cenpower plant also contributed to consumption of LCO during the first half of 2019.

The consumption of HFO was lower than projected in the 2019 ESP owing to the inability of Karpowership and AKSA power plants to procure the needed HFO for electricity generation as a result of the indebtedness of the power off-taker (ECG).

1.7 Liquid Fuel Prices

Heavy fuel oil (HFO) prices averaged US$68.51 per barrel during the first half of 2019 slightly higher than the average price of US$67.24 recorded during the same period in 2018 representing a marginal increase of 1.9% year-on-year. On a monthly basis, HFO prices have varied in 2019 but with a discernable downward trend in the second quarter when prices declined gradually from US$72.37/bbl in April to US$67.65/bbl June 2019. Compared to 2019, 2018 showed a discernable trend with prices gradually reducing from US$66.89/bbl in January to US$62.75 in March 2018 and then rising from US$72.37/bbl in April to US$73.87/bbl in June 2018

Light crude oil prices averaged US$76.04/bbl in the first half of 2019 compared to an average of US$80.64/bbl during the same period in 2018 representing a reduction of 5.7% between 2018 and 2019. Figure 13 shows trends in LCO prices in the first half of 2019 compared to the same period in 2018.

1.8 Performance of the Transmission System

Ghana's transmission infrastructure includes 5,965 circuit km of high voltage lines operated at 330kV, 161kV and 69kV connected to 64 bulk supply points (BSPs) with 134 transformers with a total capacity of 7,191.2 MVA. The transmission system has faced voltage challenges in the past especially in the Ashanti, Western and Northern regions.

A number of critical transmission infrastructure were commissioned during the period which brought about improvements in the transmission of power in the NITS. The 330 kV Aboadze to Kumasi transmission line, 330 kV Kintampo to Bolgatanga and the 161 kV Asawinso to Juaboso were completed and commissioned in the first half of 2019. The completion of the 161kV transmission line from Asawinso to Juaboso has resulted in some improvement in voltage levels in the Western and Ashanti Regions. Additionally, the commissioning of the 330kV transmission line from Aboadze to Kumasi has resulted in appreciable improvements in voltage levels in the central and northern parts of the NITS.

Despite these efforts to stabilize the reliability of power transmission, there were three partial collapses of the transmission system in the first half of 2019 occurring on the 12th March 2019, 20th April 2019 and 27th June 2019. These system disturbances occurred owing to tripping of some transmission lines, dips in pressure in natural gas supply and the inability of some plants to respond quickly to surges in demand.

In general, the transmission system performance was mixed in the first-half of the year. Electric power transmission losses were relatively high averaging 5.482% in the first-half of the year compared to an average of 4.708% in the same period in 2018. This represents an increase of 16.44% between 2018 and 2019. The transmission system in the first half of 2019 recorded an average

system availability ranging between 98.92% and 99.86% and a reliability of 99.11% to 99.82%. During the first half of 2019, the percentage of time that the power system operated within the normal limits of 49.8 Hz to 50.2 Hz ranged between 55.2% and 84.8% with the worst period occurring in June 2019.

1.9 Ancillary Services

An important requirement of the LI 1937 is the provision and management of ancillary services in the NITS. In compliance, the Public Utilities Regulatory Commission (PURC) developed an Electricity Transmission Ancillary Services Pricing Policy and Guidelines to provide clear processes and procedures for procurement of ancillary services in the National Interconnected Transmission System. These guidelines were developed in 2012 but has since not been implemented.

To superintend the process towards the successful implementation of the guidelines, the EMOP has carried out a review of this Policy and Guidelines. As part of the review, the EMOP Secretariat circulated copies of the document to stakeholders via the Energy Commission's website and the March, April and May editions of the Wholesale Electricity Market bulletin for comments.

A report of the review has been submitted to the Energy Commission for the necessary action.

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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