



GHANA WHOLESAL ELEC TRICIT Y MARKET BULLETIN

MARKET WATCH

Monthly Market Data Analysis

ISSUE NO. 27: 1st March 2018 to 31st March 2018

This Bulletin covers major developments in the Wholesale Electricity Market (WEM) of Ghana from 1st March, 2018 to 31st March, 2018. 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 continues with the series on the financial sustainability of the Power Sector for March 2018.

The Electricity Market Oversight Panel Secretariat 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

Overview of the Month

Electricity supply increased marginally in March 2018 from 43.44 GWh per day in February 2018 to 43.85 GWh per day in March 2018 representing a 0.94% increase. There was a general increase in electricity generation from thermal sources with the exceptions of AKSA, Karpowership, KTPP and TAPCO power plants which witnessed a significant decrease in generation by 30.34%, 97.35% and 17.38% respectively. Average generation from thermal sources increased from 25.74 GWh per day in February 2018 to 30.86 GWh per day in March 2018. Generations from Hydro sources decreased from 17.69 GWh per day in February 2018 to 12.89 GWh per day in March 2018. The generation from Akosombo GS decreased by 15.58%, Kpong GS by 9.68% and the Bui GS by 45.97%. Correspondingly, the rate of drop in water level decreased for both the Akosombo GS and the Bui GS. The Akosombo dam witnessed a decrease in the rate of drop in its water level from 0.058 feet per day in February 2018 to 0.033 feet per day in March 2018 and the Bui dam from 0.152 feet per day in February 2018 to 0.086 feet per day in March 2018.

There was a significant reduction in liquid fuel consumption in March 2018 by 29.39% from 787,140.79 barrels in February 2018 to 555,776.94 barrels in March 2018. Natural gas supply from both AGPP and WAGP increased relatively in March 2018. Natural gas flow rate from AGPP increased significantly from 11.97 MMSCFD in February 2018 to 69.22 MMSCFD in March 2018. The natural gas flow rate from

Table 1. Projected and Actual Outturn of electricity demand and supply in February 2018 and March 2018

	March 2018		February 2018	
	Projected	Actual Outturn	Projected	Actual Outturn
Total Supply (GWh)	1,399.5	1,359.4	1,399.1	1,216.5
Source by Power Plants (GWh)				
AKOSOMBO	288.0	299.6	288.0	354.9
KPONG	57.0	60.3	57.0	66.8
BUI	71.0	39.9	71.0	75.8
Simon Asogli	180.0	185.4	180.0	15.8
TAPCO	162.0	67.5	162.0	81.7
TICO	182.0	206.5	182.0	101.4
TT1PP	-	30.5	-	-
CENTT	-	-	-	-
TT2PP	-	-	-	-
MRP	-	-	-	-
Karpowership	160.0	313.9	160.0	303.2
AMERI	145.0	41.6	145.0	3.1
KTPP	-	0.8	-	31.3
Trojan Power	-	-	-	-
CENPOWER	-	-	-	-
AKSA	152.0	98.1	152.0	140.9
BXC Solar	2.2	2.9	1.9	2.2
VRA Solar	0.3	0.2	0.4	0.2
Total Generation (GWh)	1,399.5	1,347.1	1,399.5	1,175.2
Imports (GWh)	-	12.3	-	41.3
Total Supply (GWh)	1,399.5	1,359.4	1,399.1	1,216.5
Deficit (GWh)	-	(40.1)	-	(182.5)
Ghana Coincident Peak Load (MW)	2,211.0	2,226.2	2,211.0	2,202.7
System Coincident Peak Load (MW)	2,384.0	2,278.2	2,384.0	2,268.7

HIGHLIGHTS OF THE MONTH

WAGP to Aboadze reduced from 32.37 MMSCFD in February 2018 to 27.1 MMSCFD in March 2018. On the other hand, the natural gas flow rate from WAGP to Tema increased significantly from 5.35 MMSCFD in February 2018 to 56.45 MMSCFD in March 2018.

There was an increase in the System Peak demand in March 2018 by 0.42% from 2268.70 MW in February 2018 to 2,278.20 MW in March 2018. Similarly, the Ghana Peak demand also increased by 1.07% from 2202.70 MW in February 2018 to 2,226.20 MW in March 2018.

There was a marginal increase in the export of electricity by 10.98% from 0.82 GWh per day in February 2018 to 0.91 GWh per day in March 2018. Import of electricity on the contrary witnessed a significant decrease by 70.21% from 1.47GWh per day in February 2018 to 0.40 GWh per day in March 2018.

Electricity Demand and Supply

Electricity Demand

The System Peak Load continued to increase in March 2018, from 2,268.70 MW in February 2018 to 2,278.20 MW in March 2018, representing an increase of 9.5 MW. Likewise, the Ghana Peak Load increased from 2,202.7 MW in February 2018 to 2,226.20 MW in March 2018, representing an increment of 23.5 MW. Hydro power plants contributed 926 MW to both the System and Ghana Peak loads representing 40.65% and 41.60% of the System Peak Load and Ghana Peak Load respectively. Generations from thermal sources contributed the rest.

Electricity supply

Electricity supplied in March 2018 increased marginally by 0.94%, from 43.44 GWh per day in February 2018 to 43.85 GWh per day in March 2018. Total Generation increased from 1,216.20 GWh in February 2018 to 1,359.26 GWh in March. The contribution from hydro sources to the total electricity supplied decreased from 40.7% in February 2018 to 29.41% in March 2018. Total electricity supplied in March 2018 was 1,359.50 GWh with 1,347.21 GWh generations from domestic sources and 12.29 GWh imports from La Cote D'ivoire (CIE). The total electricity supplied in March 2018 was 22.5 GWh higher than the 1,337 GWh projected under the 2018 Electricity Supply plan (ESP), representing a 1.68% deviation.

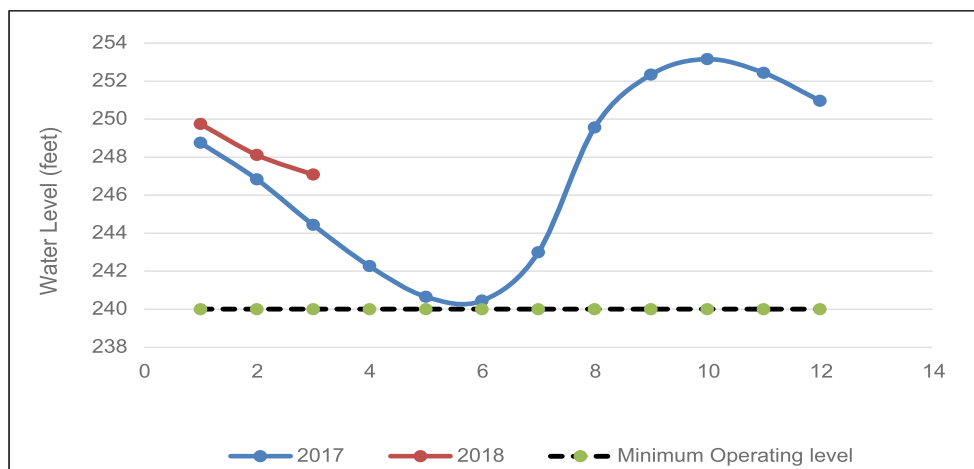
Hydro Dam Levels

Akosombo Dam Water Level continued to decline in March 2018

The water level of the Akosombo dam reduced at a decreasing rate from 0.058 feet per day in February 2018 to 0.033 feet per day in March 2018. The water level at the beginning of the month of March 2018 of 248.12 feet reduced by 1.03 feet to 247.09 feet at the end of the month. The water level was 7.09 feet above minimum operating level of 240 feet and was 2.65 feet higher than the water level recorded for the same time in February 2018.

Figure 1 shows comparative end of month trajectory of the level of water in the Akosombo dam from January 2017 to March 2018.

Figure 1: Month-End Water Level for Akosombo Dam from March 2017 to March 2018



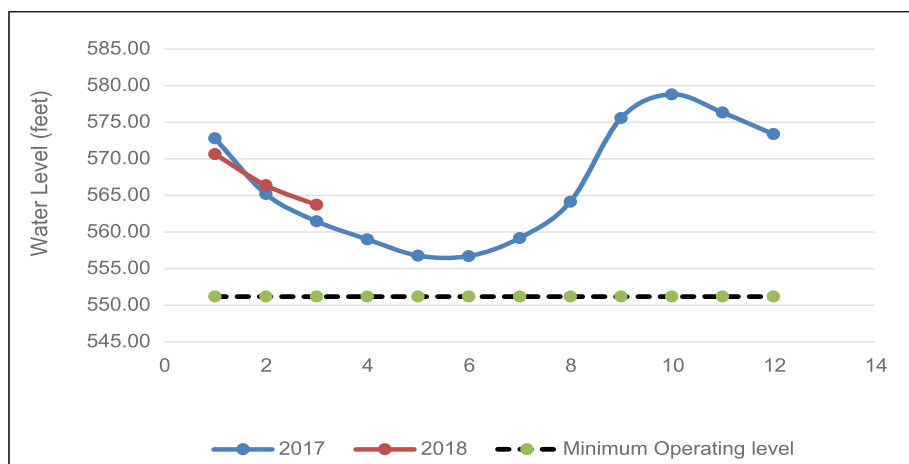
Bui Dam Water Level continued to decline in March 2018

The Bui dam water level dropped at a decreased rate, from 0.15 feet per day in February 2018 to 0.086 feet per day in March 2018. The water level reduced by 2.66 feet in March 2018 to obtain an end of month water level of 563.73 feet from 566.39 feet at the beginning of the month. The end of month water level was 12.55 feet higher than the minimum operating water level of 551.18 feet and was 2.26 feet, higher than the water level recorded for the same period in 2017. The water level for Bui dam dropped by 10.3 feet from the 574.03 feet, recorded at the beginning of the year.

HIGHLIGHTS OF THE MONTH

Figure 2 shows comparative end of month trajectory of the level of water in the Bui dam from January 2017 to March 2018.

Figure 2: Month-End Water Level for Bui Dam from January 2017 to March 2018

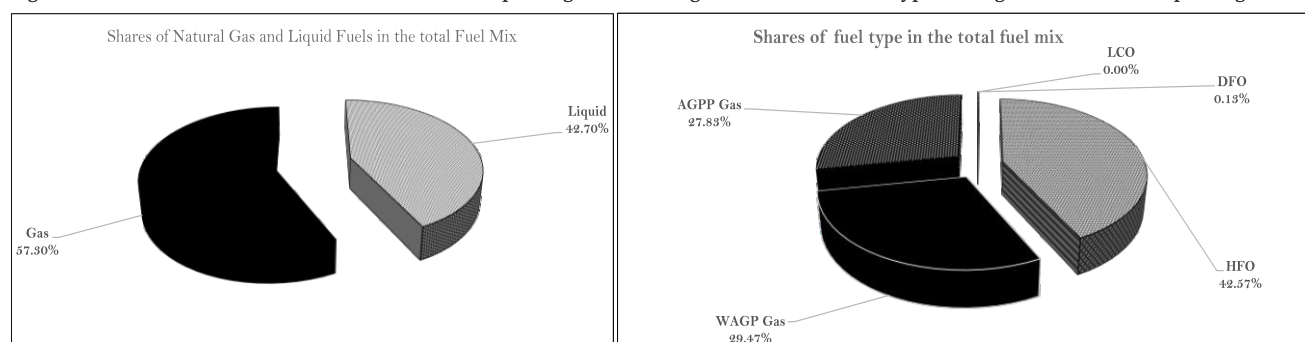


Fuel Supply for Power Generation

Natural gas consumption accounted for 57.30% of the fuel consumed in March 2018, a significant increase in natural gas share in the total fuel supply mix from 18% recorded in February 2018 due to increased flow of natural gas supply from the AGPP as a result of completion of work on the AGPP and other terminals. Share of natural gas supply from the WAPCO in the total fuel supply increased in March 2018 from 17% in February 2018 to 33.33% in March 2018. Similarly, AGPP recorded an increase in its contribution of natural gas supply to the total fuel mix from 1% in February 2018 to 23.97% in March 2018. Consequently, liquid fuel share decreased from 82% in February 2018 to 42.7% in March 2018. The shares of HFO consumed decreased from 64% in February 2018 to 42.57% in March 2018. DFO consumption reduced from 6% in February 2018 to 0.13% in March 2018. LCO had no share in the total fuel supply.

Figure 3a and Figure 3b shows the shares of sources of fuel and fuel type in the generation fuel mix for electricity generation respectively.

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**



Natural gas flow rate from WAGPCo increased marginally in March 2018

Natural gas flow rate from Nigeria through the WAGP to Tema and Kpone increased significantly from 5.36 MMSCF per day in February 2018 to 56.45 MMSCF per day in March 2018. On the contrary, the flow rate to the Aboadze Power Enclave decreased significantly from 32.37 MMSCF per day in February 2018 to 27.10 MMSCF per day in March 2018. The total flow rate of 83.55 MMSCF per day was recorded from WAGP in March 2018. The total natural gas consumed from WAGP increased significantly in March 2018 from 977.81 MMSCF in February 2018 to 2,336.97 MMSCF per day in March 2018. The natural gas consumed from WAGP constituted 51.43% of the total natural gas consumed and 29.47% of the total fuel mix in March 2018.

Natural gas flow rate from GNGC increased significantly in March 2018

The natural gas flow rate from the AGPP to the Aboadze Power Enclave increased significantly from 11.97 MMSCF per day in February 2018 to 69.22 MMSCF per day in March 2018 due to completion of work on the AGPP and the various terminals. The total natural gas supplied from AGPP increased significantly from 33.22 MMSCF in February 2018 to 2,145.86 MMSCF in March 2018. The share of natural gas from AGPP in the total fuel mix increased from 1% in February 2018 to 27.83% in March 2018 and its share in the total natural gas consumed increased from 3% in February 2018 to 48.57% in March 2018.

HIGHLIGHTS OF THE MONTH

Figure 4a: Contribution of Gas Supply by sources

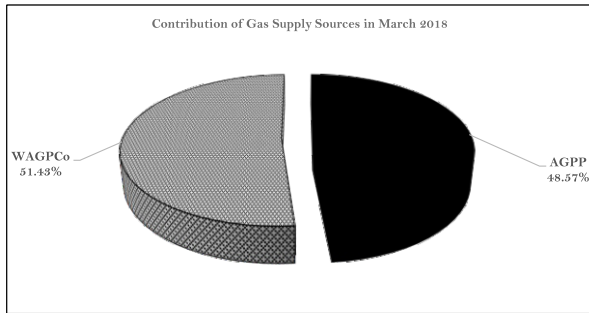
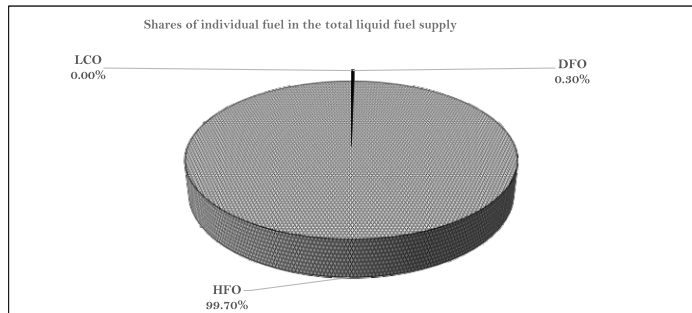


Figure 4b: Contribution of individual fuel in the liquid fuel supply



Liquid Fuel

The total liquid fuel consumption decreased in March 2018 by 29.4% from 787,141 barrels in February 2018 to 555,777 barrels in March 2018. The share of LCO in the total liquid fuel consumed reduced significantly from 14% in February 2018 to no consumption in March 2018. The consumption of DFO decreased from 8% in February 2018 to 0.3% of the total liquid fuel consumed and 0.13% of the total fuel mix in March 2018. HFO's share in the total liquid fuel supplied increased from 78% in February 2018 to 99.70% in March 2018.

Plant by Plant Highlights

Electricity Generation at the Akosombo Generation Station (GS) decreased in March 2018

The Akosombo GS recorded a decrease in its average generation in March 2018, from 12.7 GWh per day in February 2018 to 9.66 GWh per day in March 2018. Likewise, the total electricity generated from Akosombo GS was 299.58 GWh in March 2018 which was 15.58% lower than the 354.86 GWh it generated in February 2018. Total electricity generated by Akosombo GS in the total electricity supplied decreased from 29.2% in February 2018 to 22.04% in March 2018. The Akosombo GS generated 3.98% lower than the projected electricity generation of 312 GWh under the 2018 ESP. The Akosombo GS contributed 647 MW to both the System Peak Load and the Ghana Peak Load representing 28.3% and 29.06% of the System Peak Load and the Ghana Peak Load respectively.

Electricity supply by Kpong Generation Station (GS) decreased in March 2018

The average generation from the Kpong GS decreased by 9.68% in March 2018, from 2.38 GWh per day in February 2018 to 1.94 GWh per day in March 2018. Total generation from the Kpong GS also decreased by 9.68% from the 66.75 GWh in February 2018 to 60.29 GWh in March 2018. Total electricity supplied by the Kpong GS constituted 4.4% of the total electricity supplied in February 2018 and was 18.2% higher than the projected 51 GWh under the 2018 ESP. The Kpong GS contributed 72 MW to meet both the System Peak Load and the Ghana Peak Load in March 2018 and it represents 3.16% of the System Peak Load and 3.23% of the Ghana Peak Load.

Electricity supply by the Bui Generation Station (GS) decreased significantly in March 2018

The Bui GS witnessed a significant decrease of 49% in its average generation in March 2018, from the 2.6 GWh per day in February 2017 to 1.3 GWh. Similarly, the total electricity generation 39.86 GWh recorded in March 2018 was lower than the 73.8 GWh recorded in February 2018. The Bui GS' share in the total electricity supplied in March 2018 decreased from 6.1% in February 2018 to 2.9% in March 2018. The total electricity generation from the Bui GS in March 2018 was 30.1% lower than the 57 GWh projection made under the 2018 ESP. The Bui GS contributed 207 MW to meet both the System Peak Load and the Ghana Peak Load which represent 9.1% of the System Peak Load and 9.3% of the Ghana Peak Load.

Generation by the Sunon Asogli Power Plant's (SAPP) increased significantly in March 2018

There was a significant increase in average electricity generation from the Sunon Asogli Power Plant (SAPP) in March 2018 from 0.6 GWh per day in February 2018 to 5.89 GWh per day in March 2018 due to increased natural gas supply to the power plant. The SAPP generated a total of 185.38 GWh of electricity constituting 13.64% of the total electricity supplied in March 2018. The SAPP generated 169.57 GWh more than the 15.81 GWh generated in February 2018. The SAPP generation of 185.38 GWh was more than the 118 GWh which was projected under the 2018 ESP which represents a 57.1% deviation of the actual from the projected value. The plant contributed 257.4 MW to meet both the System and the Ghana peak loads representing 11.30% of the System Peak Load and 11.56% of the Ghana peak load. The SAPP consumed 1,337.59 MMSCF of natural gas to generate 185.38 GWh of electricity at a heat rate of 7,902.85Btu/kWh an improvement in fuel efficiency over the 8,713.92Btu/kWh recorded in February 2018.

CENIT Power Plant's continued to be offline in March 2018

The CENIT Power Plant remained offline in March 2018 due to low levels of LCO and inadequate supply of natural gas. The power plant was correctly projected to be offline in March 2018 under the 2018 ESP.

Ameri Energy Power Plant's generation increased significantly in March 2018

The Ameri power plant recorded a significant increase in electricity generation in March 2018 from 0.1 GWh per day in February 2018 to 1.34 GWh per day in March 2018. Likewise, total electricity generated of 41.62 GWh in March 2018 was 38.52 GWh more than the 3.13 GWh recorded in February 2018 but 25.68% lower than the 56 GWh projected under the 2018 ESP. The Ameri Power Plant generation constituted 3.19% of the total electricity supplied in March 2018. The Ameri contributed 138.60 MW to meet both the System and Ghana Peak Loads representing 6.08% and 6.23% of the System Peak Load and Ghana Peak Load respectively. The Ameri consumed 435.85 MMSCF of natural gas to generate the 41.62 GWh of electricity at an estimated average fuel efficiency of 10,108.09 Btu/kWh an improvement over the 10,243.18 Btu/kWh recorded in February 2018.

Kpong Thermal Power Plant's (KTPP) generation significantly reduced in March 2018

The KTPP operated for a single day in March 2018 due to increase in flow of natural gas to the Takoradi Power Enclave and the SAPP. The power plant generated 0.83 GWh in March 2018 which is 30.52 GWh lower than the 31.35 GWh it generated in February 2018 and 0.1% of the

HIGHLIGHTS OF THE MONTH

total electricity supplied in March 2018. The KTPP made no contributions to the system and the Ghana Peak Loads and was projected to be offline under the 2018 ESP. The power plant consumed 1,859 barrels of DFO to generate the 0.83 GWh of electricity at an average fuel efficiency of 11,983.03 Btu/kWh a reduction over the 11475 Btu/kWh recorded in February 2018.

The Karpowership Power Plant's generation decreased in March 2018

The Karpowership average generation decreased marginally by 4.63% in March 2018, from 10.8 GWh per day in February 2018 to 10.13 GWh per day in March 2018. The total generation from the power plant increased by 3.53% in March 2018 from 303.2 GWh in February 2018 to 313.88 GWh in March 2018 due to greater days in March as compared to February. The total generation of 313.88 GWh by the power plant constituted 23.1% of the total electricity supplied in March 2018 and was 37.1% higher than the 229 GWh projected under the 2018 ESP. The Karpowership contributed 453.30 MW to meet both the System Peak Load and the Ghana Peak Load, representing 19.90% of the System Peak Load and 20.36% of the Ghana Peak Load. The Karpowership Power Plant consumed 420,784.20 barrels of HFO to generate the 313.88 GWh of electricity with a marginally increased fuel efficiency from 8,128.9 Btu/kWh in February 2018 to 8,110.57 Btu/kWh in March 2018.

AKSA Power Plant's generation reduced in March 2018

The AKSA Power Plant average electricity generation reduced significantly by 36.6% in March 2018 from 5.03 GWh per day in February 2018 to 3.17 GWh per day in March 2018. The power plant generated a total of 98.14 GWh in March 2018 which was 30.34% lower than the 140.9 GWh it recorded in February 2018. The power plant supplied 7.22% of the total electricity supplied in March 2018. The 98.14 GWh of electricity generated by AKSA Power Plant was 11.52% higher than the 88 GWh projected under the 2018 ESP. The power plant contributed 210.90 MW to meet both the System Peak Load and the Ghana Peak Load, representing 9.26% of the System Peak Load and 9.47% of the Ghana Peak Load. A total of 133,134 barrels of HFO was consumed by the power plant to generate the 98.14 GWh of electricity at a reduced average fuel efficiency of 8,207.08 Btu/kWh in March 2018 as compared to 8178.71 Btu/kWh recorded in February 2018.

Takoradi International Company (TICO) generation increased significantly in March 2018

The TICO Power Plant average electricity generation increased significantly in March 2018 by 83.3%, from 3.6 GWh per day in February 2018 to 6.6 GWh per day in March 2018. The power plant generated a total of 206.49 GWh in March 2018 which was significantly higher than the 101.41 GWh recorded in February 2018. The TICO Power Plant's total electricity generation contributed 15.19% to the total electricity supplied in March 2018 and was a 2.2% higher than the projected 202 GWh under the 2018 ESP. The power plant contributed 131 MW to meet both the System Peak Load and the Ghana Peak Load, representing 5.75% of the System Peak Load and 5.88% of the Ghana Peak Load. A total of 1,588.30 MMSCF of natural gas was consumed to generate the 206.49 GWh with an improved fuel efficiency of 7,424.24 Btu/kWh in March 2018 from 7,857.13 Btu/kWh in February 2018.

Takoradi Power Company (TAPCO) Plant's generation decreased in March 2018

The generation from TAPCO power plant decreased from 2.92 GWh per day in February 2018 to 2.18 GWh per day in March 2018. Similarly, total electricity generated by the power plant of 67.48 GWh in February 2018 was lower than the 81.68 GWh recorded in February 2018. The power plant contributed 4.96% of the total electricity supplied in March 2018 and its total generation was 12.48 GWh higher than the 55 GWh projected under the 2018 ESP. This represents a 22.7% deviation of the projected from the actual. The power plant did not contribute to the System Peak Load and the Ghana Peak Load. The TAPCO Power Plant consumed 768.40 MMSCF of natural gas with a significant reduction in its fuel efficiency from 8248.38 Btu/kWh in February 2018 to 10,990.73 Btu/kWh in March 2018.

Tema Thermal 1 Power Plant's (TT1PP) came back online in March 2018

The TT1PP came back online generating at an average of 0.98 GWh per day in March 2018. The power plant generated a total of 30.48 GWh in March 2018 constituting 2.24% of total electricity supplied in March 2018. The TT1PP generated 49.2% lower than the 60 GWh projected under the 2018 ESP. The power plant contributed 105 MW to both the System Peak Load and the Ghana Peak Load which constituted 4.61% of the System Peak Load and 4.72% of the Ghana Peak Load respectively. TT1PP consumed 319.60 MMSCF of natural gas to generate the 30.48 GWh at an average heat rate of 11,484.72 Btu/kWh.

Trojan Power Plant's continued to be offline in March 2018

The Trojan Power Plants in both Tema and Kumasi have been offline since July 2017 and continued to be offline in March 2018 due to fuel supply challenges.

BXC Solar average generation increased in March 2018

There was a marginal increase in average generations by BXC Solar in March 2018 by 12.5% from 0.08 GWh per day in February 2018 to 0.09 GWh per day in March 2018. Total electricity generation of 2.94 GWh supplied in March 2018 was marginally higher than the 2.15 GWh supplied in February 2018. The total electricity generated by the power plant in March 2018 exceeded the projected 2.2 GWh under the 2018 ESP by 33.63%.

Safi Sana Power Plant's generation increased in March 2018

Total generation by Safi Sana increased by one fold from 0.01 GWh in February 2018 to 0.02 in March 2018. The power plant recorded a Capacity Utilization Factor of 26.88%. There was no projection made for the power plant in the 2018 ESP.

VRA Navrongo Solar generation increased in March 2018

The total electricity generated by VRA Solar increased from 0.15 GWh in February to 0.21 GWh in March 2018 with a Capacity Utilization Factor of 11.29%. The power plant contributed 0.02% of total electricity supplied in March 2018. There was no projection made under the 2018 ESP.

Electricity Exchange – Imports and Exports increased marginally while Ghana became a net exporter of electricity

The average electricity Import from La Cote D'Ivoire decreased significantly from 1.47 GWh per day in February 2018 to 0.40 GWh per day in March 2018. Total import of 12.29 GWh in March 2018 was significantly lower than the 41.3 GWh imported in February 2018. Total electricity generated constituted 0.91% of total electricity supplied in March 2018. Daily peak import in March 2018 reached a maximum of 56 MW and it contributed to both the System Peak Load and the Ghana Peak Load.

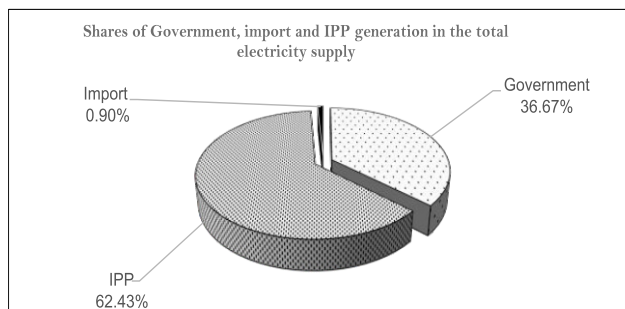
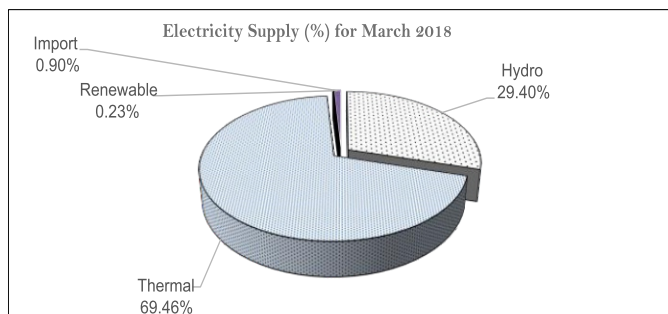
Daily electricity export to CEB increased marginally by 11%, from 0.82 GWh per day in February 2018 to 0.91 GWh per day in March 2018. A total of 28.15 GWh of electricity was exported in March 2018 as compared to the 23.05 GWh exported in February 2018. The total electricity exported was 2.15 GWh higher than the projected 26 GWh under the 2018 ESP. Ghana was a net exporter of electricity in March 2018.

OPERATIONAL FACT SHEET

Peak Electricity Supply - March 2018			
Source of Supply	Generation at System Peak Load of March 2018 (MW)	Generation at Ghana Peak Load of March 2018 (MW)	Electricity Supply (GWh)
AKOSOMBO	647.00	647.00	299.58
KPONG	72.00	72.00	60.29
BUI	207.00	207.00	39.86
SAPP	257.40	257.40	185.38
TAPCO	-	-	67.48
TICO	131.00	131.00	206.49
TT1PP	105.00	105.00	30.48
CENIT	-	-	-
TT2PP	-	-	-
MRP	-	-	-
KARPOWER	453.30	453.30	313.88
AMERI	138.60	138.60	41.62
KTPP	-	-	0.83
Trojan Power	-	-	-
CENPOWER	-	-	-
AKSA	210.90	210.90	98.14
BXC Solar	-	-	2.94
Safisana	-	-	0.02
VRA Solar	-	-	0.21
IMPORT	56.00	56.00	12.29
Export	-	52.00	28.15
System Coincident Peak Load	2,278.20	-	-
Ghana Coincedent Peak Load	-	2,226.20	-
Total Supply	-	-	1,359.50
Total Supply without export	-	-	1,331.35

Ghana Electricity Demand		
		Mar-18
Maximum System Peak Load	MW	2,278.2
Minimum System Peak Load	MW	1,837.2
Average Peak Generation	MW	2,181.1
System Base Load	MW	747.3
Total Electricity	GWh	1,359.5
Load Factor (LF)	%	80.2

OPERATIONAL FACT SHEET



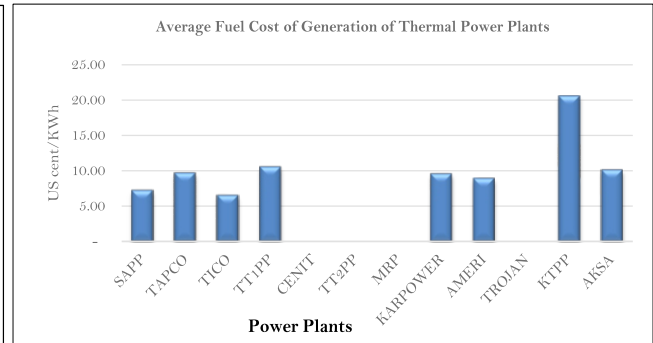
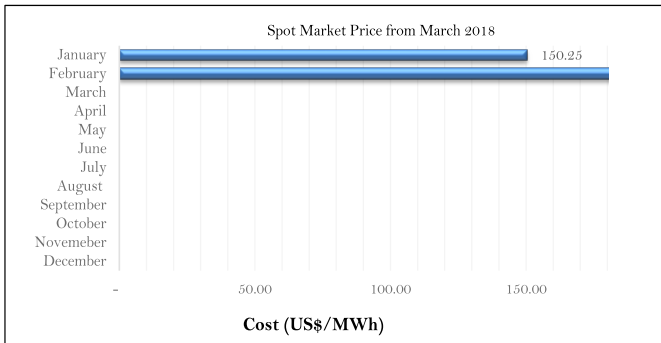
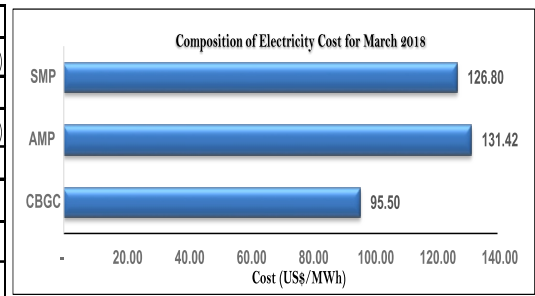
Power Plant Data for March 2018							
	Installed Capacity (MW)	Plant Capacity Utilization (%)	Electricity Generation (GWh)	Gas Consumption (MMBtu)	LCO Consumption (MMBtu)	DFO Consumption (MMBtu)	HFO Consumption (MMBtu)
Akosombo	1,020.00	39.48	299.58	-	-	-	-
Kpong	160.00	50.64	60.29	-	-	-	-
Bui	400.00	13.39	39.86	-	-	-	-
SEAP	560.00	44.49	185.38	1,465,045.06	-	-	-
TAPCO	330.00	27.48	67.48	741,665.66	-	-	-
TICO	340.00	81.63	206.49	1,533,045.09	-	-	-
TT1PP	126.00	32.51	30.48	350,054.18	-	-	-
CENIT	126.00	-	-	-	-	-	-
TT2PP	49.50	-	-	-	-	-	-
MRP	80.00	-	-	-	-	-	-
KARPOWER	470.00	89.76	313.88	-	-	-	2,545,744.39
AMERI	250.00	22.38	41.62	420,688.62	-	-	-
TROJAN	56.00	-	-	-	-	-	-
KTPP	220.00	0.51	0.83	-	-	9,981.87	-
AKSA	290.00	45.49	98.14	-	-	-	805,460.22
Total	4,477.50	40.35	1,344.03	4,510,498.61	-	-	2,545,744.39

Location	Monthly Average
Etoki	80.98
Tema WAGPCo	56.45
Aboadze WAGPCo	27.10
Aboadze GNGC	71.85

Mar-18			
	Beginning month (ft)	End month (ft)	Change in water level (feet)
Hydro Dam			
Akosombo	248.12	247.09	-1.03
Bui	566.39	563.73	-2.66

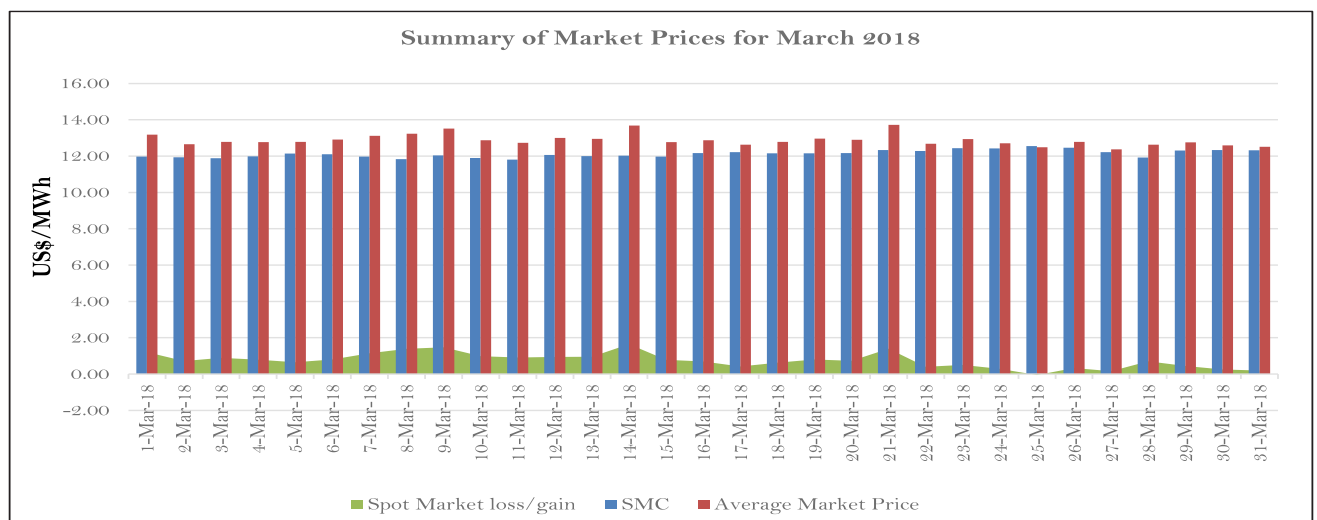
ECONOMIC FACT SHEET

		Mar-18	Feb-18	Change
Average Market Price	US\$/MWh	131.42	149.51	(18.09)
System Marginal Cost (SMC)	US\$/MWh	126.80	212.45	(85.65)
Composite Bulk Generation Charge (CBGC)	US\$/MWh	95.50	95.50	-
Deviation of TAC from CBGC	US\$/MWh	(35.91)	(54.01)	18.09
Deviation of SMC from CBGC	US\$/MWh	(91.90)	(116.95)	85.65



Mar-18				
Power Plant	Average Cost US\$/MWh	Average SMP US\$/MWh	Difference US\$/MWh	Windfall Revenue US\$/MWh
Akosombo	26.60	171.80	145.20	43,499,987.04
Kpong	45.59	171.80	126.21	7,609,007.94
Total	72.18	-	-	51,108,994.98

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1.0 Financial Sustainability of the Power Sector

1.1 Ability to Recover Cost

1.1.1 Electricity generation unit cost

The ability to recover the cost of electricity generated (fixed cost and variable cost) in March 2018, decreased from what was recorded in February 2018. The cost of bulk generation for March 2018 increased from GHp46.42/KWh in February 2018 to GHp53.74/KWh in March due to reduced generation from the hydro sources. The cost of bulk generation was also GHp10.76/KWh higher than the gazetted BGT of GHp42.98/KWh in March 2018 as compared to GHp10.45/KWh difference recorded in February 2018. The gazette BGT Changed from GHp35.97/KWh to GHp42.9/KWh in March 2018 due to tariff review by the Public Utilities Regulatory Commission (PURC) which was effective 15th March, 2018. In United state Dollars (USD), average cost of generation increased from US Cent 10.50/KWh in February 2018 to US Cent 12.19/KWh in March 2018. This represents a difference of US Cent 2.49/KWh.

Table 1.1.1 shows the comparison between the cost of generation of power plants for February 2018 and March 2018 with the approve BGT tariff by the PURC showing the effect of exchange rate variability on the ability to recover cost. Analysis A presents the BGT in terms of GHp which is the predominate currency for payment in the regulated market. Analysis B presents the effect of exchange rate of the BGT.

Table 1.1.1 Comparison between cost of generation and PURC approve tariff for February 2018 and March 2018

	Feb-18	Mar-18
Analysis A		
Cost of Generation (GHp/kWh)	46.42	53.74
PURC CBGT (GHp/kWh)	35.97	42.98
Difference (GHp/kWh)	-10.45	-10.76
Analysis B		
Cost of Generation (USCent/kWh)	10.5	12.19
PURC CBGT (USCent/kWh)	9.48	9.70
Difference (USCent/kWh)	-1.02	-2.49
Average Monthly Exchange rate (GHS/US\$)	4.42	4.41

The effect of exchange rate was not really influential as the average cost of generation was higher than PURC gazetted BGT of US Cent 9.70/kWh. The ability to recover cost was clearly not meet in March 2018.

1.2 Ability to reliably meet demand

1.2.1 Ratio of installed capacity to Demand and Capacity Factor

The ratio of installed capacity to demand measures the extent to which our installed capacity adequately meets demand. This ratio was adequately met in March 2018. The ratio however reduced from the 2.4 recorded in February 2018 to 1.93 in March 2018. The relative increase in demand in March 2018 caused the ratio of installed capacity to demand for March 2018 to reduce from the 2.4 recorded in February 2018. Ghana's installed capacity was almost twice of Ghana's demand in March 2018. The ratio however failed to meet the average for the World, OECD countries and all the Economic Classes of the world.

The capacity factor of a power system measures the extent to which the supply system is being utilized. The capacity factor for March 2018 was 42% a marginal increment from the 41% recorded in February 2018. The capacity factor of 42% recorded for March 2018 is marginally higher than the average capacity factor for low income countries but less than the 50% average for the globe, South Sahara African Countries, lower and upper middle income countries.

Table 1.2.1 Ratio of installed capacity to demand and capacity factor for February 2018 and March 2018

	Ghana		World	SSA	OECD	HIGH Income Non-OECD	Upper Middle Income	Lower Middle Income	Low Income
	Feb-18	Mar-18							
Ratio of Installed capacity to Demand	2.4	1.93	2.60	2.20	2.30	2.50	2.40	3.10	2.90
Capacity Factor	0.41	0.42	0.50	0.50	0.50	0.50	0.50	0.50	0.40

1.2.2 Reserve Margin

The reserve margin of the supply system serves as an indicator in measuring the reliability of a power system. The reserve margin, especially the unconstrained reserve margin throws more light on the utilization of the installed capacity of the country. Constrained reserve margin takes into consideration planned maintenance, unplanned maintenance and fuel supply difficulties. That is, power plants that are technically available, have fuel available and could come up online when needed within the period under study.

Table 1.2.2 Average Constrained and Unconstrained reserve margin

Reserve Margin	Feb-18	Mar-18
Constrained Reserve Margin (%)	15.33	23.00
Unconstrained Reserve Margin (%)	48.37	48.15

The constrained reserve margin saw a significant increment from 15.33% in February 2018 to 23% in March 2018. The increment was as a result of increased gas flow to Tema and the Aboadze power enclave. The improved reserve margin compares favorably with the 18% to 25% recommended by the International Energy Agency (IEA) and the Power Sector Reforms. There was however an average of about 25% capacity unavailable due to technical and fuel supply challenges.

1.3 Ability to make investments

1.3.1 Capacity Annual Growth and Ratio of installed Capacity growth to demand growth

The capacity annual growth indicator measures the annual growth in the installed capacity as a means of our ability to make investment in the power sector. The installed capacity grew by 7.9% between March 2017 and March 2018, compared to 12.3% between February 2017 and February 2018. These measures are considerably higher than the average for SSA, Upper Middle Income; Lower Middle Income and Low Middle Income Countries.

Table 1.3.1 Capacity annual growth and Ratio of installed capacity growth to demand growth

	Ghana		SSA	High Income Non-OECD	Upper Middle Income	Lower Middle Income	Low Income
	Feb-18	Mar-18					
Capacity Annual growth (%)	12.26	7.85	3.10	3.10	2.70	3.90	3.40
Ratio of installed capacity growth to demand growth	2.60	2.52	0.20	0.60	0.70	0.30	0.02

A high growth in capacity will not be significant if it is not able to meet the required demand. The indicator that measures the ability of the growth in capacity to meet the growth in demand is the ratio of the growth in installed capacity to growth in demand. The ratio of installed capacity growth to demand growth for March 2018 reduced to 2.52 as compared to the 2.6 recorded in February 2018. This is as a result of higher increase in demand for March 2018 compared to growth in capacity. This ratio is higher than the average for the World, OECD countries and all the Economic Classes of the world.

1.4 Ability to operate according to environmental and social norms

1.4.1 Emission factor and Fossil fuel dependency

The reduction in supply of electricity from Hydro sources ensured an increase in thermal generation in March 2018. Fossil fuel dependency increased from 59.27% in February 2018 to 70.37% in March 2018. The fossil fuel dependency in March 2018 was higher than the average for low income, lower middle income, Upper Middle income economies, SSA, and the World, while it compared favorably with the average for High Income Non-OECD.

Emission factor for March 2018 increased as compared to that recorded for February 2018. There was an 8.82% increase in the Emission factor from 0.34kgCO₂/kWh in February 2018 to 0.37kgCO₂/kWh in March 2018. The emission factor recorded for March was relatively higher due to reduced generation from hydro sources hence, an increased fossil fuel dependency. The Emission factor for March 2018 was relatively lower than the average for World, SSA and Lower Income countries

Table 1.4.1 compares Ghana's emission factor and fossil fuel dependency with indicators from economies and region of the world.

Table 1.4.1 Emission Factor and Fossil fuel dependency for the March of 2018

	Ghana		World	SSA	High Income Non-OECD	Upper Middle Income	Lower Middle Income	Low Income
	Feb-18	Mar-18						
Emission Factor (KgCO₂/kWh)	0.34	0.37	0.60	0.50	0.90	0.70	0.50	0.30
Fossil Fuel Dependency (%)	59.0	70.37	60.70	45.30	84.40	66.40	59.40	40.60

1.4 Conclusions

The installed capacity of Ghana for March 2018 was a little less than two folds of our required demand due to an increase in demand from 2,268.7 MW in February 2017 to 2,278.20 MW in March 2018. The ratio of installed capacity growth to demand growth witnessed a relative reduction from the 2.6 recorded for February 2018 to 2.52 for March 2018. The capacity annual growth dropped from the average of 12.26% in February 2018 to 7.85% in March 2018. Capacity factor increased marginally from the 41% that was recorded for February 2018 to 42% as a result of increase in demand in March 2018. The constrained reserve margin for March 2018 saw a significant increment from 15.33% in February 2018 to 23% in March 2018. This value falls in line with the recommendations of IEA and the power sector reform. The emission factor increased relatively in March 2018 by 8.82% due to an increased supply from thermal sources.

2.0 Performance Indicators of Power Plants

2.1 Capacity Utilization Factor (CUF)

There was a general reduction in Capacity Utilization Factor (CUF) by the Power Plants excluding TICO, SAPP, KARPOWER and Ameri power plants recording increases in their CUF from 40.09%, 3.79%, 86.70%, and 1.68% in February 2018 to 81.63%, 44.49%, 89.76%, and 22.38% in March 2018 respectively. All the hydro power plants recorded reductions in their CUF. The Akosombo recorded a CUF of 39.48% in March 2018 from 46.76% recorded in February 2018. The Bui GS and Kpong GS each recorded a CUF of 13.39% and 50.64% in March 2018 from 24.79% and 56.64% in February 2018 respectively. The TAPCO, KTPP and AKSA power plants also recorded reductions from 33.27%, 19.15% and 65.30% respectively in February 2018 to 27.48%, 0.51% and 45.49% respectively in March 2018. BXC recorded a capacity Utilization factor of 19.75% which is higher than the average of 19% for solar systems.

The System Load Factor increased from 79.2% to 80.2%.

The Plant utilization factors of the various plants are contained in table 2.1.

Table 2.1.1: Power Plant Capacity Utilization, Average heat rate and Average Fuel Cost of Generation

Power Plant	Capacity Utilization (%)	Average Heat rate (Btu/KWh)	Average Fuel Cost of Generation (US\$/MWh)
Akosombo	39.48	-	-
Kpong	50.64	-	-
Bui	13.39	-	-
SAPP	44.49	7,902.85	72.71
TAPCO	27.48	10,990.73	97.71
TICO	81.63	7,424.24	65.63
TT1PP	32.51	11,484.72	105.66
CENIT	-	-	-
TT2PP	-	-	-
MRP	-	-	-
KARPOWER	89.76	8,110.57	95.92
AMERI	22.38	10,108.09	89.36
TROJAN	-	-	-
KTPP	0.51	11,983.03	205.45
AKSA	45.49	8,207.08	101.3

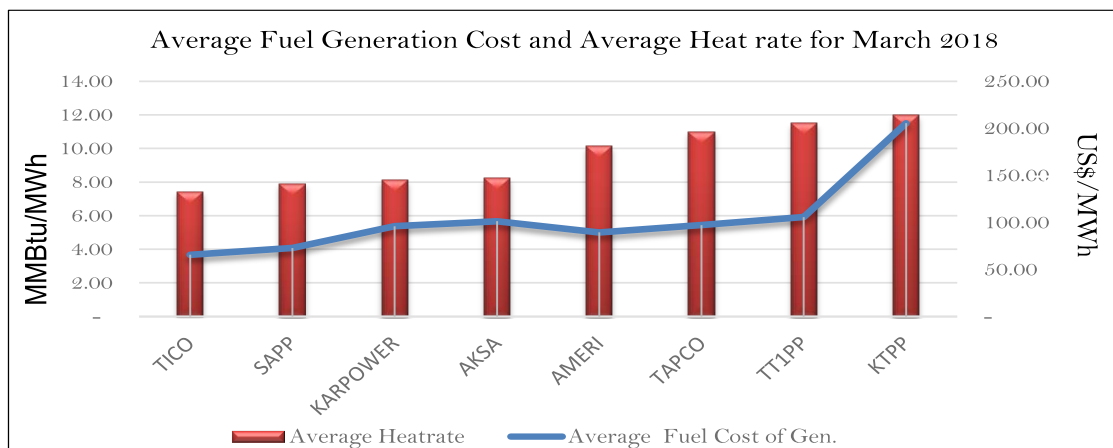
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2.2 Heat Rate (Fuel Efficiency)

Fuel efficiency increased for most of the thermal power plants except for AKSA, KTPP and TAPCO which experienced reductions in their fuel efficiencies. The fuel efficiency of SAPP and TICO power plants increased from 39.2% and 43.4% in February 2018 to 43.2% and 46% in March 2018 respectively. The Ameri and Karpower also experienced marginal increases from 33.3% and 41.97% in February 2018 to 33.8% and 42.1% in March 2018. A significant reduction in fuel efficiency was recorded for TAPCO from 41.1% in February 2018 to 31% in March 2018. The KTPP and AKSA power plants also witnessed marginal reductions from 29% and 41.7% in February 2018 to 28.5% and 41.65 in March 2018 respectively.

Figure 2.1 shows the ranking of the thermal power plants based on their efficiency of the thermal power plants.

Figure 2.1: Fuel efficiency ranking of thermal power plants with their respective fuel cost of generation.



2.3 Average Fuel Cost of Electricity Generation

There was a general decrease in the average fuel cost of generation for thermal power plants in March 2018 from an average of US\$107.95/MWh in February 2018 to US\$104.15/MWh. This represents a 3.52% decrease in average fuel cost of electricity generation. The decrease in average fuel cost of generation was as a result of increased natural gas flow to the Tema and the Aboadze Power Enclave. The TAPCO and AKSA power plants were the only plants that recorded increases in their fuel cost of generation in March 2018. The TAPCO power plant recorded a 34% increase in average fuel cost of generation from \$72.92/MWh in February 2018 to \$97.16/MWh in March 2018. Similarly, the AKSA power plant also recorded a 0.43% increase in average fuel cost of electricity generation from \$100.87/MWh in February 2018 to \$101.30/MWh in March 2018. The TICO power plant recorded a significant reduction in its average fuel cost of electricity generation from \$103.83/MWh in February 2018 to \$65.63/MWh in March 2018 mainly as a result of the power plant operating solely on natural gas instead of natural gas and LCO. The SAPP also recorded a reduction from \$80.17/MWh to \$72.71/MWh largely due to increased fuel efficiency. Similarly, the Karpowership, Ameri and KTPP recorded reductions from \$96.05/MWh, \$90.55/MWh and \$211.25/MWh in February 2018 to \$95.92/MWh, \$89.36/MWh and \$205.45/MWh respectively, in March 2018 also due to increased fuel efficiency.

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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