



# GHANA WHOLESALE ELECTRICITY MARKET BULLETIN

## MARKET WATCH

### Monthly Market Data Analysis

ISSUE NO. 2: 1<sup>st</sup> February 2016 to 29<sup>th</sup> February 2016

This Bulletin covers the major developments in the Ghana Wholesale Electricity Market (WEM) from 1st February 2016 to 29<sup>th</sup> February 2016. It analyses the performance of the key WEM indicators against their benchmarks, and examines the likely implications of any discernable trends for the future of the market. The Energy Commission (EC) welcomes and very much appreciates readers comments on the Bulletin. Reasonable care has been taken to ensure that the information contained in this Bulletin is accurate at the time of publication, but nevertheless, regrets any errors, omissions or inaccuracies therein.

### HIGHLIGHTS OF THE MONTH

#### Electricity supply was lower than projected for January and February 2016: Are the high tariffs responsible?

Under its planning mandate to ensure that energy supply always meets demand at all times, the EC forecasts the amount of electricity that must be produced to meet the demand for all end-uses in the country. The EC then monitors the actual production and demand for each month.

Electricity consumption in January 2016 and February 2016 were 22.3% and 15.9 % respectively lower than forecasted. Similarly, peak load for both months were significantly lower than what had been projected. Table 1 shows a summary of the comparison of projected and actual electricity demand and supply for January and February 2016.

Peak load in February was 1,975.4 MW compared to the projected figure of 2,477MW representing a reduction of about 501.MW. Correspondingly, peak load of 1,979MW recorded in January 2016 was also lower than projected by about 498MW.

Table 1 Comparative Analysis of power supply and demand for January and February 2016

	January 2016		February 2016	
	Projected	Actual	Projected	Actual
Total Demand (GWh)	1,408.0	1,093.7	1,340.0	1,126.7
Supply by Power Plant(GWh)				
Akosombo	278.0	257.3	260.0	277.9
Kpong	53.0	53.3	50.0	55.7
Bui	71.0	111.1	67.0	122.9
TAPCO	195.0	175.0	183.0	170.7
TICO	104.0	175.0	189.0	112.0
Sunon Asogli	116.0	96.3	79.0	69.9
Sunon Asogli Phase 2	-	-	71.0	-
CENIT	53.0	56.3	64.0	51.5
TT1PP	-	0.4	62.0	0.3
TT2PP	2.0	7.2	11.0	3.3
MRP	-	0.6	-	0.2
KTPP	68.0	-	59.0	-
Ameri	-	6.9	72.0	127.1
Karpowership	134.0	154.5	141.0	135.4
Total Supply (GWh)	1,074.0	1,093.7	1,308.0	1,126.7
Deficit	(334.0)	(314.3)	(32.0)	(213.3)
Reduction in Consumption		-22.3%		-15.9%
Peak Load (MW)	2,477.0	1,979.0	2,477.0	1,975.4

## HIGHLIGHTS OF THE MONTH

At the beginning of the year it was projected that, owing to the low level in the Akosombo dam, electricity generation from the power plant will be pegged at a maximum of 375 MW, corresponding to the operation of three turbines. This was to enable the reservoir to recover and indeed to sustain its integrity after operating below its minimum operating level in 2015. The outturn in generation from the power plant over the period, in January and February 2016, has however been greater than projected. Peak generation from the Akosombo power plant has been consistently greater than 375 MW recording peak generation figures in January and February 2016 of 507 MW and 521 MW respectively. The Bui Generating Station also generated beyond what was planned for the period. Electricity generation from the Akosombo and Bui power plants over what was projected has been to provide relief to the power system at peak times and sometimes during off-peak periods when the power system was in distress owing to unplanned unavailability of the thermal generating resources.

In January 2016 electricity supplied by power plants was 1,093.7 GWh compared to the projected requirement of 1,408.0 GWh. Similarly, electricity supplied in February 2016 was 1,126.7 GWh which was below the projected requirement of 1,340.0 GWh by 15.9%.

The Ghana Grid Company (GRIDCo) has reported that there was no load shedding from 1st January 2016 to the end of February 2016. It is therefore important to find the reasons for such drastic downturn in both the supply and especially the demand for electricity in the first two months of 2016.

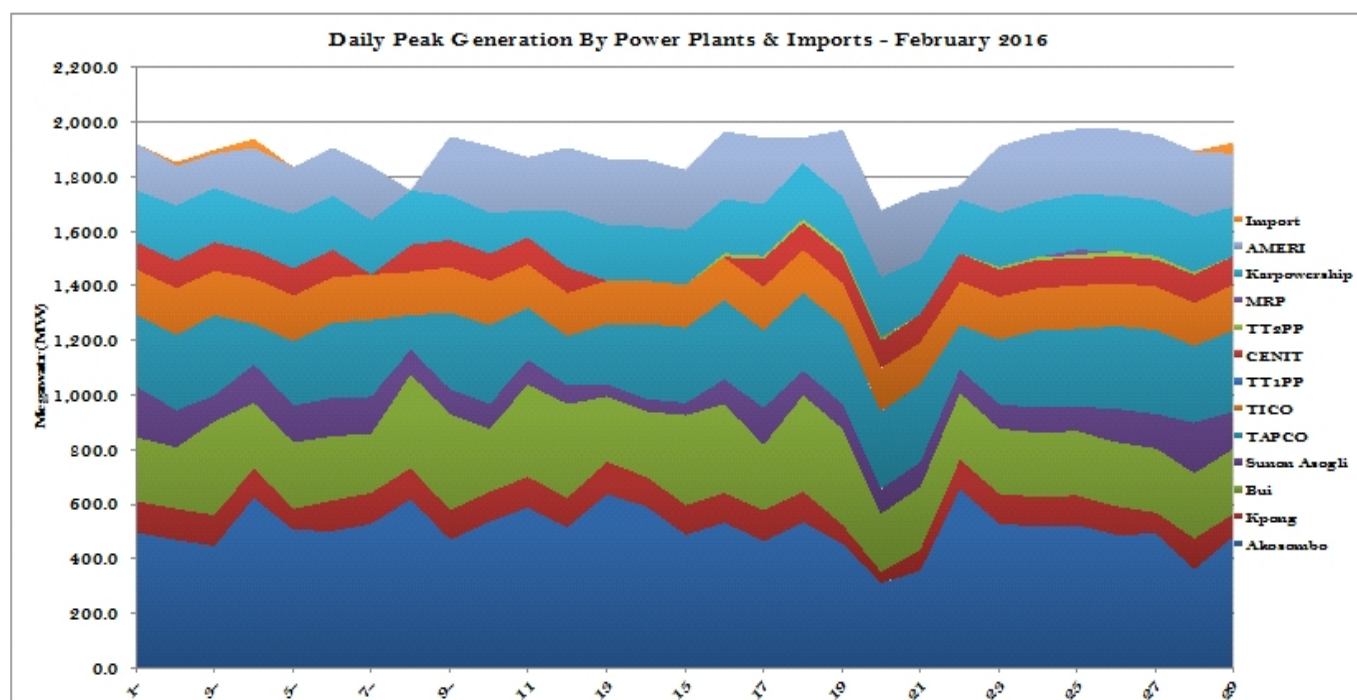
The sharp drop in peak load would almost certainly be due to a drop in domestic demand in response to the very steep increases in tariffs in the second half of December 2015. This is probably in view of the fact that a large proportion of peak load in Ghana is for use in homes at night. Although some experts have attributed part of this fall to the fact that industries were not fully back in production after the massive cut backs during the load restrictions of the previous years, this would not have impacted the peak load level given there is very little industrial activity at night in Ghana. However, it could account for the significant drop in the demand for power during off-peak periods as well as electricity consumption in general.

In December 2015, the Public Utilities Regulatory Commission (PURC) announced increases in electricity tariffs of 59% on the average. In addition to the PURC tariffs, the Government announced increases in the levies which are imposed on electricity consumption for purposes of rural electrification and institutional support. The combination of the PURC tariffs hikes and the GoG levies resulted in an overall average increase in electricity tariffs of 73%. It is believed that many businesses and residential customers have cut back on electricity consumption in order to avoid having to pay astronomical electricity bills.

The Energy Commission has initiated a study to establish the reasons for the reduction in consumption of electricity in the month of January and February 2016.

## OPERATIONAL FACT SHEET

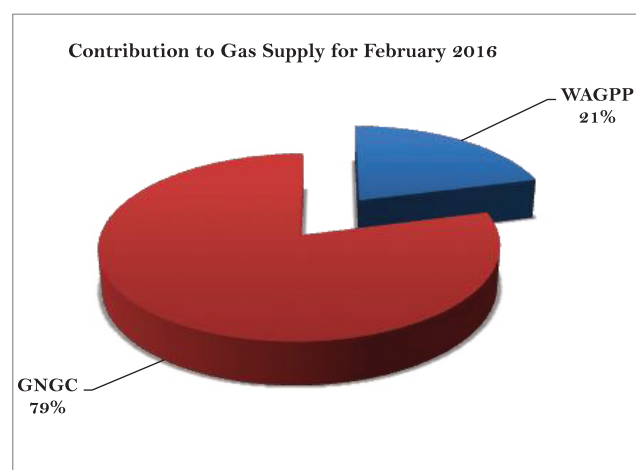
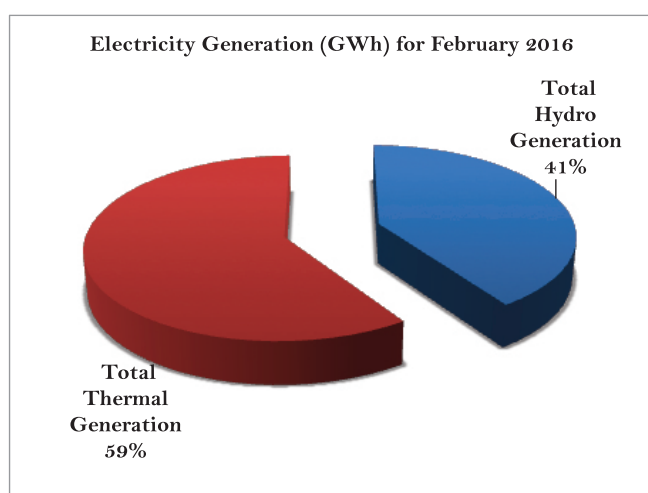
Peak Generation (MW) - February 2016						
Plant/Source of Supply	Week 1	Week 2	Week 3	Week 4	Maximum Peak Generation	Generation at System Coincident Peak
Akosombo	623.0	638.0	532.0	653.0	653.0	521.0
Kpong	113.0	115.0	116.0	114.0	116.0	110.0
Bui	347.0	354.0	354.0	244.0	354.0	238.0
Sunon Asogli	184.0	90.9	135.4	183.9	184.0	89.3
TAPCO	290.0	289.0	287.0	308.0	308.0	284.0
TICO	170.0	164.0	159.0	159.0	170.0	157.0
TT1PP	-	-	-	-	-	-
CENIT	100.0	101.0	102.0	102.0	102.0	101.0
KTPP	-	-	-	-	-	-
TT2PP	-	-	12.9	18.4	18.4	12.1
MRP	-	-	-	20.6	20.6	20.6
AMERI Energy	198.0	246.8	247.0	246.5	247.0	241.3
Karpowership	201.6	201.8	219.8	201.7	219.8	201.1
Import	33.0	-	-	-	-	-
Trojan Power	-	-	-	-	-	-
<b>Total Supply including imports</b>	<b>2,259.6</b>	<b>2,200.5</b>	<b>2,165.1</b>	<b>2,251.1</b>	<b>2,392.8</b>	<b>1,975.4</b>
<b>Total Generation without imports</b>	<b>2,226.6</b>	<b>2,200.5</b>	<b>2,165.1</b>	<b>2,251.1</b>	<b>2,392.8</b>	<b>1,975.4</b>



Ghana Demand Analysis for February 2016		
Maximum Peak Generation	MW	1,975.40
Minimum Peak Generation	MW	1,921.85
Average Peak Generation	MW	1,953.74
Total Energy Generated	GWh	1,126.74
Load Factor (LF)	%	82.0%

# ECONOMIC FACT SHEET

Weekly Generation (GWh)					
Power Plant	Week 1	Week 2	Week 3	Week 4	Total
Akosombo	61.47	69.83	67.90	78.73	277.93
Kpong	13.20	13.71	13.92	14.90	55.73
Bui	26.54	33.65	34.33	28.33	122.85
Sunon Asogli	20.80	11.81	16.77	20.48	69.86
TAPCO	40.73	36.79	40.94	52.26	170.72
TICO	25.12	25.61	32.46	28.83	112.02
TT1PP	0.26	-	-	-	0.26
CENIT	13.74	11.02	9.17	17.55	51.48
KTPP	-	-	-	-	-
TT2PP	-	-	1.51	1.77	3.28
MRP	-	-	-	0.15	0.15
AMERI Energy	20.34	29.35	38.06	39.35	127.10
Karpowership	32.80	31.40	33.17	37.99	135.36
Import	-	-	-	-	-
Trojan Power	-	-	-	-	-
Total Supply including imports	255.00	263.17	288.23	320.34	1,126.74
Total Generation without imports	255.00	263.17	288.23	320.34	1,126.74



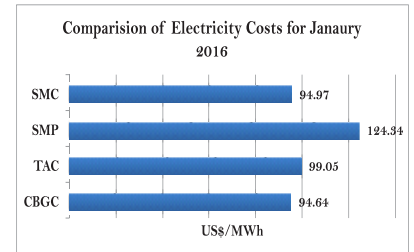
GNGC= Ghana National Gas Company  
WAGPP = West African Gas Pipeline Project

Average Gas Flow (mmscfd) -February 2016					
Location	Week 1	Week 2	Week 3	Week 4	Monthly Average
Etoki	42.27	10.87	31.38	31.38	28.98
Tema	29.30	13.60	24.55	24.55	23.00
Aboadze	111.17	68.37	84.62	84.62	87.20

Water Level (ft) - February 2016					Change in water level
Hydro Dam	Week 1	Week 2	Week 3	Week 4	(feet)
Akosombo	242.04	241.13	240.28	240.28	-1.76
Bui	580.1	578.59	575.74	574.33	-5.77
Akosombo Minimum Operating Level	240	240	240	240	
Akosombo Maximum Level	278	278	278	278	
Akosombo % full	5.4%	3.0%	0.7%	0.7%	

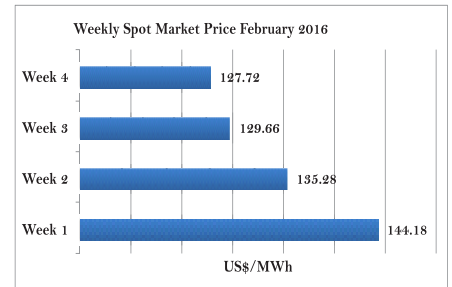
# Other Market News and Trends

Month at a Glance				
		Current Month	Previous Month	Change
Average Market Energy Cost	US\$/MWh	73.86	76.61	2.75
Average Market Capacity Charge (AMCC)	US\$/MWh	25.19	28.94	3.75
Total Average Market Cost (TAC)	US\$/MWh	99.05	105.54	6.49
System Marginal Cost (SMC)	US\$/MWh	94.97	87.33	(7.65)
System Marginal Capacity Charge (SMCC)	US\$/MWh	29.37	29.49	0.12
Spot Market Price (SMP)	US\$/MWh	124.34	116.82	(7.53)
Composite Bulk Generation Charge (CBGC)	US\$/MWh	94.64	94.64	-
Deviation of TAC from CBGC	US\$/MWh	(4.41)	(10.90)	(6.49)
Deviation of SMP from CBGC	US\$/MWh	(29.70)	(22.18)	7.53



CBGC = Composite Bulk Generation Charge, SMC = System Marginal Cost, SMP = Spot Market Price

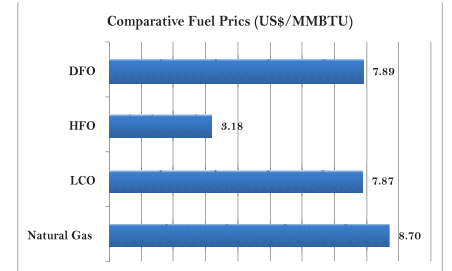
Power Plant	Maximum Non-Coincident Peak Generation (MW)	Plant Utilisation Factor (%)	Electricity Generation (GWh)	Gas Consumption (MMBTU)	LCO Consumption (MMBTU)	HFO Consumption (MMBTU)	DFO Consumption (MMBTU)
Akosombo	653.0	57.2	277.9	-	-	-	-
Kpong	116.0	64.6	55.7	-	-	-	-
Sunon Asogli	184.0	51.0	69.9	633,596.4	43,696.3	-	-
Bui	354.0	46.6	122.9	-	-	-	-
Trojan Power	-	-	-	-	-	-	-
TAPCO	308.0	74.5	170.7	853,561.1	490,517.5	-	9,547.1
TT1PP	-	-	0.3	-	3,238.8	-	-
TICO	170.0	88.6	112.0	1,341,695.0	92,530.7	-	1,147.6
MRP	20.6	1.0	0.2	1,929.3	193.1	-	-
CENIT	102.0	67.8	51.5	-	603,242.6	-	953.0
KTTP	-	-	-	-	-	-	-
TT2PP	18.4	24.0	3.3	39,922.8	2,753.3	-	-
AMERI Energy	247.0	69.2	127.1	1,213,912.4	-	-	-
Imports	-	-	-	-	-	-	-
Karpowership	219.8	92.0	135.4	-	-	1,329,312.8	-
Total	2,392.8	-	1,126.7	4,084,616.9	1,236,112.3	1,329,312.8	11,647.6



Spot Market Price = SRMC of Energy + SRMC of Capacity

Power Plant	Cost of Gas Consumed (US\$)	Cost of LCO Consumed (US\$)	Cost of HFO Consumed (US\$)	Cost of DFO Consumed (US\$)	Total Fuel Cost (US\$)	Average Fuel Cost (US\$/MWh)	Average Energy Charge (US\$/MWh)
Sunon Asogli	5,702,367.37	943,771.03	-	-	6,046,138.60	86.55	84.05
Trojan Power	-	-	-	-	-	-	-
TAPCO	7,852,762.19	3,859,037.85	-	14,320.61	11,726,120.65	68.69	71.17
TT1PP	-	25,480.70	-	-	25,480.70	98.00	101.20
TICO	11,350,739.51	727,964.78	-	1,721.33	12,080,425.62	107.84	71.11
MRP	16,321.84	1,046.78	-	-	17,368.62	115.79	118.28
CENIT	-	4,745,878.40	-	1,429.44	4,747,307.84	92.22	95.38
KTTP	-	-	-	-	-	-	-
TT2PP	337,746.76	21,660.94	-	-	359,407.70	109.58	105.88
AMERI Energy	10,269,698.74	-	-	-	10,269,698.74	80.80	83.27
Karpowership	-	-	4,229,450.44	-	4,229,450.44	31.25	39.55
Total	35,529,636.61	9,724,840.49	4,229,450.44	17,471.37	49,501,398.91	-	-

Average Energy Charge is the sum of fuel costs and other non-fuel Variable O&M costs

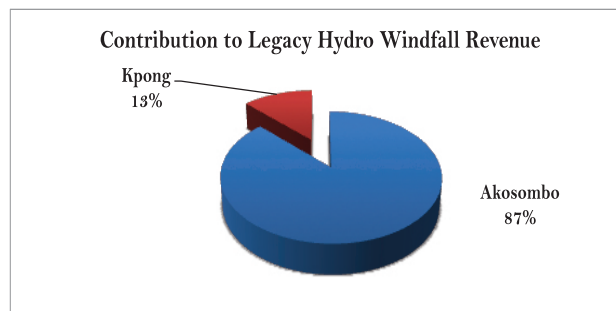
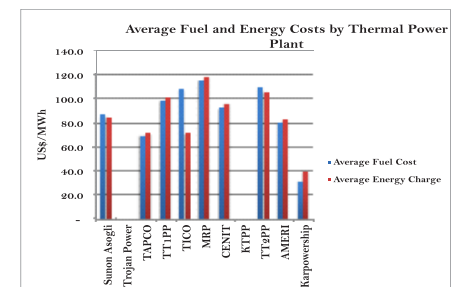


Total Thermal Pow US\$	49,501,398.91
Average Thermal P US\$/MWh	73.86

Legacy Hydro Windfall Revenue for February 2016			
Power Plant	Average Cost (US\$/MWh)	Average SMP (US\$/MWh)	Windfall Revenue (US\$)
Akosombo	33.10	124.34	25,359,033.02
Kpong	59.20	124.34	3,630,262.24
Total	-	-	28,989,295.26

SMP=Spot Market Price

Average Fuel Prices		
Fuel Type	Unit	Delivery Cost
Natural Gas	US\$/MMBTU	8.70
LCO	US\$/BBL	42.80
HFO	US\$/Tonne	390.00
DFO	US\$/Tonne	340.00



### 1. Karpowership and Ameri Energy Power Plants become fully operational

The Karpowership and the Ameri Energy power plants achieved full commercial operations in February 2016 with a combined installed capacity of 480 MW. The Energy Commission granted Karpowership Ghana Company Limited an Operating License to operate the 235 MW power ship on 4<sup>th</sup> February 2016. The acquisition of an Operating License is the final stage of a four-stage licensing and permitting process which involve (i) Provisional License, (ii) Siting Permit, (iii) Construction Permit, and (iv) Operating License. Karpowership Ghana Limited acquired their Provisional License in June 2014 and achieved commercial operation (COD) at the end of January 2016 that is 18 months after being granted the provisional license.

Ameri Energy Limited, after installation of their generating units, was granted a temporary operating license in January 2016 to enable them get the power plant to be commissioned which was successfully done. The two power plants contributed significantly to electricity supply in the country in February 2016 both contributing a total of 442.4 MW of capacity to meet system peak load representing 12% of system peak generation.

### 2. Committee to investigate Partial System Collapse submit report to Energy Commission

On 21<sup>st</sup> and 25<sup>th</sup> January 2016 the Ghana power system experienced partial collapses leading to power outages in several parts of the country. The Energy Commission, on the directive of the Ministry of Power, set up a Committee to investigate the causes of the two events and to make recommendations as to how to avoid similar incidences in the future. The eight (8) member Committee submitted their final report to the Energy Commission on 26<sup>th</sup> February 2016 after three weeks of intensive investigations. The report is to be forwarded to the Minister of Power for further action on the Committee's recommendations. The Committee observed that the two events were triggered as a result of sudden losses in transmission system capability along the 330kV Aboadze-Volta line due to harsh atmospheric conditions resulting from the severe harmattan weather. These difficulties have been aggravated by the power generation challenges resulting from incapability of the Aksombo power plant to operate optimally so as to provide adequate reactive power compensation for the power system. Whilst infrastructure development in terms of the increased generation capacity as well as reinforcement of the transmission system is important, a critical finding is that the system does not generate adequate reactive power. The difficulty with generation of adequate reactive power brings to prominence the need for Ghana to establish a market for Ancillary Services as anticipated in the Electricity Regulations, Legislative Instrument (LI) 1937 and the National Electricity Grid Code (NECC).

### 3. Ghana to establish Ancillary Services Market for electricity supply

Ancillary Services are some critical services provided to support reliable transmission of electricity in any matured power system. In the Ghana National Electricity Grid Code, published by the Energy Commission, Ancillary Services include (i) spinning reserves, (ii) non-spinning reserves of adequate margins, (iii) voltage and reactive power control and (iv) black start. Indeed, inadequate provision of ancillary services could be detrimental to the safe and reliable generation and supply of electricity from generating units to consumers. The procurement of ancillary services should therefore be seen as an important component of the Ghana Wholesale Electricity Market if it is function effectively and reliably.

In view of its importance, the Energy Commission intends to roll out a programme in 2016 towards establishing a vibrant and commercially oriented Ancillary Services Market (ASM) in Ghana. The operation of the ASM will include independent third party providers of the services in addition to the Ghana Grid Company (GRRIDCo) who are required, by law, to procure and manage ancillary services for the Ghana Power System. A major challenge currently facing the provision of ancillary services, important as they are, is the absence of a market for them to be procured. Currently, ancillary services that are provided by some power plants to support the operations of the power system are not paid for making it difficult for prospective power plants to provide them optimally. As part of the process of implementing the Wholesale Electricity Market (WEM) concept, the EC will roll out the ASM towards achieving the expected levels of supply reliability envisaged in the respective power sector laws and regulations.

### 4. Governance structure of the WEM is critical to establishing a more robust power system in Ghana

A major medium-to-long-term development priority of the Government of Ghana is to ensure an orderly growth of the power sector as a result of which it has put in place a legal framework (Electricity Regulations, LI 1937) which defines an efficient infrastructure ownership and well thought out electricity market structure with a corresponding division of roles and responsibilities between entities in the power sector. The Electricity Regulations, 2008, Legislative

Instrument (LI), 1937 has provided for and defined a structure for a Wholesale Electricity Market (WEM) in Ghana. The WEM is unique because it provides for a bilateral market which is intended to give sanctity to bilateral contracts and also a spot market in which the comparatively cheaper “legacy” hydro and other available but un-contracted sources of electricity will be sold at the system marginal costs.

To ensure the effective governance of the WEM, a number of entities are to be created under the Legislative Instrument (LI) 1937 with the responsibility to monitor and manage the operations of the WEM. The entities include the Electricity Market Oversight Panel (EMOP), the Electricity Technical Committee (ETC) and the Compliance and Oversight Committee (COC). The Electricity Technical Committee (ETC) is responsible for ensuring compliance with the National Electricity Grid Code by all power generators, the transmission utility company and distribution companies as well as bulk customers. The Compliance and Oversight Committee (COC) is to assist the ETC to carry out its oversight responsibility.

### 5. Government Consent & Support Agreement (GCSA) vrs Put/Call Option Agreement (PCOA) as instruments for credit enhancement: What level of guarantee do they give?

Ghana has chosen the path of private sector investment as the major vehicle for building energy sector infrastructure. This commitment has been given effect through the Power Sector Reform Programme adopted by the Government of Ghana in 1995. Since then private sector investment in the power sector in the form of Independent Power Producers (IPPs) has gained traction with over 1,800 MW of additional generating capacity having either been developed or being developed as full-scale IPPs. Private sector investors would normally require guarantees from government under which the government undertakes to mitigate commercial risks associated with financing such power projects and to make payments in the event of financial breaches by the project sponsor. An emerging concern in recent times, however, has been the type of instrument to be used to mitigate potential commercial risks associated with such private sector-led investments.

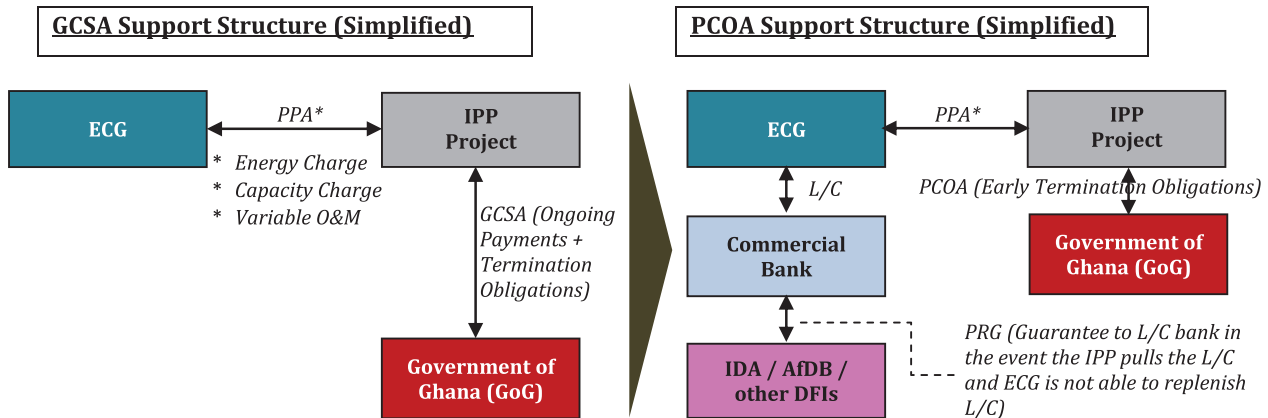
Indeed, while a mature, strong and transparent regulatory regime would generally obviate the need for guarantees especially for commercial risks, this is hardly the case in Ghana leading to the consistent requests for government guarantees by sponsors and lenders of power projects. Generally, besides directly guaranteeing payments on its own merit, governments may use third party guarantors, such as development banks or offshore commercial banks, to provide the first line of funding for such guarantees in the form of loans or letters of credit as the case may be. The GoG has, in the past, used Government Consent Support Agreement (GCSA) as the primary risk-mitigating instrument on behalf of the major state-owned electricity off-takers, the Volta River Authority (VRA) and the Electricity Company of Ghana (ECG). The GCSAs would normally indemnify the investor against all manner of political as well as commercial risks including termination, higher operational costs, revenue shortfalls, etc. Owing to the recent fiscal challenges facing the economy, the GoG, in a major policy shift, is exploring other forms of guarantees to manage certain specified risks (partial risk guarantee) or specified payments (partial credit guarantees) associated with power projects. The new GoG policy is to issue either a Put/Call Option Agreement (PCOA) or a Partial Risk Guarantee (PRG) as credit enhancement instruments in the stead of GCSA. The PCOA is basically a risk mitigation instrument deployed in the event of early termination of a PPA upon specific breaches.

Under a PCOA, the buyer (ECG) and GoG shall have a “call option” over all of the shares upon the early termination of a PPA and the Seller and Shareholders shall have a “put option” over the shares upon early termination owing to a breach of the PPA as may be duly specified in the agreement.

Generally, the use of these instruments should be viewed as temporary arrangements towards GoG relinquishing its current role as a guarantor for ECG and VRA towards creating the requisite environment for these state-owned companies to operate as commercial enterprises that are able to finance their expansion programmes on their own balance sheets. In that regard, it is important for the GoG to build a strong regulatory environment that would promote and improve the technical efficiency and financial sustainability of the power sector entities. A pragmatic and forward-looking policy platform should also be developed to build the confidence and attract private sector investments in Ghana's energy sector infrastructure. There is seemingly adequate space within the existing legislative regime to bring about such developments if the “systems” already in place would be allowed to work in accordance with the provisions in the contemporary energy sector laws. Indeed, the GoG credit enhancements should be deployed to promote specific public policy objectives such as to enhance local content in the ownership and management of energy infrastructure. Figure 6.1 shows the simplified structure of GCSA compared to PCOA.

# Other Market News and Trends

Figure 6.1 Government Consent and Support Agreement vrs Put/Call Option Agreement



- **GCSA considered a financial guarantee**
  - Entered into between IPP and GoG
- **Irrevocable and unconditional guarantee of ECG obligations under the take-or-pay PPA between IPP and ECG**
  - Ongoing payments
  - Termination payments
  - Foreign exchange availability
- **GCSA no longer sustainable due to the high contingent obligations placed on GoG**
  - IPPs can continue to operate even if ECG defaults and ask GoG to honor ongoing payments

- **PCOA considered a performance guarantee with an option to acquire an asset at exercise of the put or call when an early termination event occurs**
- **PCOA only covers the obligations of an early termination**
  - Entered into between ECG, GoG, IPP and IPP shareholders
- **Ongoing payments need to be covered by liquidity instrument e.g. Partial Risk Guarantee (PRG)**
  - L/C between ECG and Commercial Bank will be covered by IDA, AfDB, other DFIs or alternative guarantee programs
- **PCOA is preferred because of the limited GoG obligations which only occur in the event of early termination**
  - The obligation is only based on the occurrence of a low probability event
  - Asset is purchased by GoG
    - Purchase Price is limited to debt outstanding obligations at the time of the early termination, termination costs and depending on the cause of termination, a limited return to equity holders

## Acronym

### Acronyms

- |  |   |
|--|---|
| <p>ASM = Ancillary Services Market<br/>         EC = Energy Commission<br/>         EMOP = Electricity Market Oversight Panel<br/>         GCSA = Government Consent &amp; Support Agreement<br/>         GWh = Gigawatt Hours<br/>         LCO = Light Crude Oil<br/>         MWh = Megawatt hours<br/>         kWh = Kilowatt hours<br/>         NITS = National Interconnected Transmission System<br/>         PCOA = Put/Call Option Agreement<br/>         PRG = Partial Risk Guarantee<br/>         PV = Photovoltaic<br/>         WEM = Wholesale Electricity Market</p> | <p>ECG = Electricity Company of Ghana<br/>         CBGC = Composite Bulk Generation Charge (gazetted by the PURC)<br/>         HFO = Heavy Fuel Oil<br/>         GoG = Government of Ghana<br/>         KTPP = Kpone Thermal Power Plant<br/>         LI = Legislative Instrument<br/>         LI = Legislative Instrument<br/>         MoP = Ministry of Power<br/>         NPV = Net Present Value<br/>         PPA = Power Purchase Agreement<br/>         PURC = Public Utilities Regulatory Commission<br/>         WAGPP = West African Gas Pipeline Project<br/>         COD = Commercial Operating Date</p> |
|--|---|

For any enquiries please contact the:  
 EMOP Administrator, EMOP Secretariat, Energy Commission, Accra.  
 Telephone: +233-302813756/7/9;  
 Or email: marketoversightpanel@energycom.gov.gh

Unique Xpressions 0302 231484 / 227810