Ghana Energy Situation Report Q1, 2014

PRICING AND DEREGULATION OF THE ENERGY SECTOR IN GHANA: CHALLENGES & PROSPECTS

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1. Introduction

A cursory look at the current power situation in Ghana, against the background of the challenges many Ghanaians face accessing constant and reliable electricity supply for domestic and industrial activities, should reveal that the load shedding exercise (a.k.a ‘Dumsor-Dumsor’) we experienced during the first half of 2013 and which is forecasted to persist in the medium term beyond 2013 though on a reduced scope is primarily a self-imposed one. This is largely because of the State’s inability to provide the right incentives and a misaligned regulatory structure, which together have failed to attract the much needed investments into an electricity supply sector still dependent on legacy infrastructure. Ghana’s electricity supply market currently has an estimated 10 to 15% year-on-year demand growth boosted by increasing domestic and industrial demand. It is imperative therefore that the nation finds new generation sources which can satisfy this demand, whilst revamping the transmission and distribution infrastructure to cope with the increased throughput.

As Ghana seeks to expand its industrial base in the country’s quest to transform its economic fortunes, the reliable supply of energy, primarily electricity supply, will be the crucial factor and catalyst for industrial development which in the process will lift many out of poverty. The 2010 Wholesale Power Reliability Assessment report¹ estimated that Ghana loses between 2 to 6% of GDP annually not including a number of indirect costs of lost economic output due to insufficient wholesale power supply. Thus, the economic costs of inadequate power supply cannot be underestimated. The promised changes of the liberalized electricity markets as part of the IMF-World Bank Structural Adjustment Programmes started in the late 1990s which aims to bring increased private sector investments and expand capacity are yet to be realised due to an inefficient setup of the regulatory structures compounded by low tariff pricing options and gross wastage leading to sub-optimal outcomes for both consumers and the utilities companies almost 20 years down the line.

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Figure 1: Ghana Power Demand Forecast, 2000 – 2025

Source: Tullow Oil Report, 2008

Figure 2: Forecast Power Generation Capacity Demand and Supply

2. The Current Generation Mix

Using public domain data from the Volta River Authority and other public agencies\textsuperscript{iii}, the total installed and effective capacity in Ghana as at December 2013 stood at 2,814 and 2,492 megawatts (MW) respectively.\textsuperscript{iv} The bulk of this supply, comprising about 50% of this generation capacity, comes from hydro-based sources inclusive of the yet to be fully commissioned Bui hydro project. These hydroelectric plants convert water trapped in a dam into electrical energy by using the gravitational force of flowing water to turn a turbine coupled to a generator. The remaining 50% of Ghana’s energy supply comes from thermal based plants which function by converting energy stored in fossil fuels such as oil and natural gas into electrical energy.

<table>
<thead>
<tr>
<th>Plants</th>
<th>Installed Capacity (MW)</th>
<th>Effective Capacity (MW)</th>
<th>Type</th>
<th>Fuel Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akosombo Hydro Station</td>
<td>1,020</td>
<td>1001</td>
<td>Hydro</td>
<td>Water</td>
</tr>
<tr>
<td>Kpong Hydro Station</td>
<td>160</td>
<td>120</td>
<td>Hydro</td>
<td>Water</td>
</tr>
<tr>
<td>Bui Hydro Dam</td>
<td>400</td>
<td>133</td>
<td>Hydro</td>
<td>Water</td>
</tr>
<tr>
<td>Takoradi Power Company (TAPCO) (T1)</td>
<td>330</td>
<td>330</td>
<td>Thermal</td>
<td>LCO/Gas</td>
</tr>
<tr>
<td>Takoradi International Company (TICO) (T2)</td>
<td>220</td>
<td>220</td>
<td>Thermal</td>
<td>LCO/Gas</td>
</tr>
<tr>
<td>Takoradi Thermal Plant (T3)</td>
<td>132</td>
<td>132</td>
<td>Thermal</td>
<td>LCO/Gas</td>
</tr>
<tr>
<td>Tema Thermal 1 Power Plant (TT1PP)</td>
<td>110</td>
<td>110</td>
<td>Thermal</td>
<td>LCO/Gas</td>
</tr>
<tr>
<td>Tema Thermal 2 Power Plant (TT2PP)</td>
<td>50</td>
<td>50</td>
<td>Thermal</td>
<td>DFO/Gas</td>
</tr>
<tr>
<td>Mines Reserve Plant (MRP)</td>
<td>80</td>
<td>80</td>
<td>Thermal</td>
<td>DFO</td>
</tr>
<tr>
<td>Sunon Asogli</td>
<td>200</td>
<td>200</td>
<td>Thermal</td>
<td>Gas</td>
</tr>
<tr>
<td>CENIT</td>
<td>110</td>
<td>110</td>
<td>Thermal</td>
<td>LCO/Gas</td>
</tr>
<tr>
<td>Navrongo Solar Farm</td>
<td>2</td>
<td>2</td>
<td>Renewable</td>
<td>Solar</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,814 MW</strong></td>
<td><strong>2,492 MW</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Recent generation problems returned us to a partial load sharing regime in January 2014. Local media reported in January 2014 that the Electricity Company of Ghana (ECG), the power distributor had to temporarily cut down supplies because of supply constraints from Ghana Grid Company (GRIDco), the network and transmission coordinator. For example, the shut in of production from two units at Bui, low gas pressure from the plants at Tema and operational issues at TAPCO forced about 200MW of load to be shed on 10 January 2014. Some of these generation problems have persisted throughout the month and led to between 30 and 200MW being shed as requested leaving very little to meet the 10% reserve requirement. This further strengthens the case to double up generation efforts by reforming the tariff pricing regime and properly incentivising producers to make an economic return in order to ensure energy security.

3. Power Economics: What Goes into Electricity Pricing?

The economics of power generation focuses on the generative capacity of typically an integrated natural monopoly where the installed plant type plays a critical factor in determining end-user tariffs. Supply normally comes from two plant types: Plant type 1 provides the base load to meet the minimum underlying demand that utilities must provide to consumers contingent on the daily demand schedule. These plants have high fixed capital expenditures (CAPEX) and low marginal operational expenditures (OPEX). An example of such supply comes from hydro plants such as Akosombo and/or the VRA operated Combined Cycle Gas Turbine (CCGT) plants in Takoradi. Plant type 2 has lower fixed costs but higher marginal
operating costs and is used to support peak demand. Examples of such are the 127 diesel generator sets with capacities of between 1 and 2.2 MW that were imported by the NPP government at a cost of $101 million during the 2007 power crises to augment the supply shortfall. Other plant types that could be considered are mid-merit plants. Like the base load plants, they typically also have high levels of safety and reliability but their generation costs and capacity factors are intermediate ranging between base load and peaking plants.

In all of these discussions, an important component to consider is the load factor. The load factor, a measure of output compared to the maximum installed capacity which could be produced, helps us understand the overload of the power supply system. In Ghana, the combined load factor currently stands at about 90 percent during peak demand with an average off-peak load of about 75 percent.\textsuperscript{vii} Thus, a higher factor implies average supply is only marginally below peak demand. A factor of 100 percent at peak demand leaves very little room for manoeuvre in the event of any demand shock to the supply system. The nation-wide blackout experienced in February 2012 was partially down to the overload of the supply system which at the time had only reserve margin of 6MW instead of the conventional 160 megawatts or about 10 per cent of total system demand.
The Akosombo and Kpong hydro units are currently running at close to full capacity. The resumption of operations of the West African Gas pipeline (WAGP) in June 2013 following the 11 month shutdown for repairs after the pipeline was severed by a ship’s anchor in Togolese maritime waters has brought temporal relief in terms of power availability. This, however, as well highlights Ghana’s current generation challenges. As a result of the pipeline breakdown, operations at the 200MW CCGT natural gas fuelled Sunon Asogli Power Plant, a joint venture between Shenzhen Energy Group Limited and the China Africa Development Fund came to a standstill due the curtailment of natural gas supply from the pipeline. As per the bilateral agreement signed between the respective countries and operators of the pipeline, an initial volume of 170 million standard cubic feet per day (MMscf/d) was to be supplied and expected to peak at a capacity of 460 MMscf/d over time. However, supply has been erratic at best and has dropped at times to 40 MMscf/d though Nigeria is contractually obligated to supply Ghana 100 MMscf/d. Part of the reasons for the 2013 energy crisis can be attributed to this supply shortfall.

Hydroelectric and thermal generation will continue to form the backbone of Ghana’s energy mix in the medium term over the next five to ten years. Natural gas from the Jubilee Field will play a vital role in the country’s security of supply amidst unreliable supply from Nigeria. A substantial change of the feedstock to the extent of new generation capacity from thermal based sources remains the surest way of ensuring NDC’s manifesto promise of delivering 5,000MW by 2016 becomes a reality.
4. Demand Side Load Management

Demand Side Load Management (DSLM) is critical if the country’s power system is to operate at efficiency to reduce the supply burden experienced especially at peak times. Good demand side management calls for the introduction of energy policies that ensure efficiency thus reducing the substantial need for new generation and transmission capacity. The National Energy Policy has a goal of “having an efficient production and transportation as well as end-use efficiency and conservation”. The challenge of “inefficient energy pricing” due to the distorted nature of the market caused by energy subsidies and under-recoveries, “inadequate budgetary financing for energy conservation and efficiency” and “limited awareness of energy conservation measures” militates against a successful DSLM strategy. However, a mix of conventional as well as novel approaches using both active and passive demand reduction strategies would serve a great cause towards ensuring an optimal demand balance.

In this regard, we implore the Energy Foundation and Energy Commission to be more active in playing a leading role in championing the introduction of energy efficiency programmes and the reforms which were initiated some years back. These efficiency programmes enacted through mandatory policy initiatives should focus on the reduction electricity usage at the Ministries, Departments and Agencies (MDAs) through frequent energy audits and remote monitoring. For example, it should be made mandatory for all air conditioners, lighting systems and computer processing units to be switched off when not in use. In addition, the installation of Compact Fluorescent Lights (CFLs) that provide similar levels of luminance at lower energy use ought to be utilized at the national level and made a matter of reinforced policy priority. All of these if enacted within a comprehensive energy sector demand management strategy can greatly reduce the peak load demand to optimal levels where current demand would meet supply as well as the reserve margin to meet any contingency requirements.

Also, the current ratio of distribution losses to transmission which reflects years of under recovery and investment in the bulk distribution systems is unacceptable and needs to be rectified. For example, the ratio of distribution to transmission losses has averaged 22% over the past ten years with the trend showing very little appreciable decline. The net effect of this is that almost 22% of the total power generated cannot be accounted for in Ghana. The Electricity Company of Ghana attributes this to technical and commercial losses. ECG’s technical losses are mainly attributable to inadequate equipment capacity and old and obsolete cables. Commercial losses have been identified as due to illegal connections, metering problems, billing and collection challenges.
5. Regulatory Challenges: Paying the Market Price for Power

It remains quite clear that Public Utilities Regulatory Commission’s (PURC) current mechanism for determining electricity prices which on paper is good actually serves a great disincentive for investments in especially the generation and transmission sectors. The Power Sector Reform Programme which started in 1995 in an attempt to rationalize Ghana’s power sector by bringing competition and efficiency setup the Energy Commission as the licensing authority to regulate the technical operations of utilities and the PURC as the body responsible for setting tariffs to ensure competition and international best standards. However, these two institutions have left more to be desired as some of the key benchmarks set have not been achieved. Act 538 which set up the PURC stipulates the Commission to consult with stakeholders comprising both the utilities and consumers before approving price increment. The consultation and engagement process with consumers has often not been satisfactory. In March 2013, the Association of Ghana Industries (AGI) protested against the VRA’s intended implementation of a regulation that sought to increase energy costs to industry by over 75 percent. In their defence, the AGI cited Legislative Instrument (LI) 1937xi which states that “electricity generated from Akosombo and Kpong hydro dams shall not be subjects of a bilateral contract.” There were also mass protestations by the general populace when electricity tariffs were increased by a cut-throat 78.9% in October 2013 after 2 years of price stagnation.
The Independent Power Producers (IPPs) who generate the majority of the thermal power component of our electricity supply have cited their inability to meet the performance standards set by the regulator based on which a price review is premised in addition to other market factors to tariff under recovery. On 11 February 2013\textsuperscript{xiii}, the major service providers cited under-pricing of utilities as one of their major worries and attributed their inability to meet these performance standards to declines in capital investments due to under recoveries. This has drastically affected the cash flow of the IPPs and impacted on their current and future capital budgeting and investment programmes.

A major contributory factor to the under recoveries by the IPPs who entered the market following the liberalization of the electricity sector has been the inefficient market structure where full operational costs including a capital recovery factor are not guaranteed in the tariffs set by the PURC. The quarterly automatic tariff-adjustment formula introduced by the PURC in 2011 which incorporates fluctuations in crude/gas prices, foreign exchange rates, the hydrothermal generation mix, and changes in the consumer price index has not been implemented to the letter because government often interferes in the market price setting mechanism. Government often promises to absorb the price mark-up instead of passing it on the consumer but delays in paying the distributors these subsidies. As at December 2012, the total Government of Ghana stock of energy arrears stood at GH¢420.99 million comprising of GH¢239.89 million indebtedness to VRA; ECG GH¢107.7 million; and the Northern Electricity Distribution Company GH¢73.37 million. Most of these have subsequently been cleared by the government under the Energy Sector Arrears Clearance initiative.\textsuperscript{xiv} The policy of subsidized tariffs has distorted the current pricing regime to the extent that full cost recovery by the IPPs has become near impossible. As a result, the market has become one in which the IPPs have an incentive to sell power to VRA in off-taker agreements rather than as competitors. An efficient competitive setup would have brought down the wholesale price of electricity ultimately leading to greater consumer welfare on account of the reduction in the deadweight inefficient losses currently being bundled and passed on to consumers.

Many of the provisions of Legislative Instrument (LI) 1937 are yet to be met 5 years after its ratification by parliament. The establishment of the Wholesale Electricity Market structure under clauses 5 and 7 are yet to be implemented. In the absence of a spot market for power, bilateral contracts serve as the main negotiation tool for settlement. However, the legislations stipulate a pricing approach based on a merit-order dispatch system where the short run (SR) marginal cost of supply of the individual producers forms the pricing basis. Thus, plants with the lowest SR marginal costs such as Akosombo and Kpong are initially brought on stream to meet demand followed by the thermal units such as TICO and Sunon Asogli. Though it could be
argued that government has prioritized universal access to electricity as a major poverty alleviating tool, it is imperative that the market price of electricity includes the full costs incurred by operators including a return on investment to ensure long term security of supply. Credit and liquidity risks are very high in the Ghanaian electricity sector because the subsidy component which comes from government though budgeted on an annual basis has never been paid to the IPPs on time coupled with non-payment of bills by some industrial and commercial consumers. These have the potential of severely disrupting investment decisions and expanding the infrastructure base to meet future energy demand.

Another yet to be resolved issue is the role of Jubilee gas in meeting domestic energy demand and how its pricing will affect end-user tariffs. Generally, Jubilee gas is supposed to lower the unit operating costs of the CCGT plants that currently run on crude or light cycle oil. However, the gas pricing policy by Ghana National Gas Company (GNGC) needs to ensure that capital costs expensed on the Jubilee Field are fully recovered. Therefore, the pricing of the gas is unlikely to be dramatically lower in the short to medium term of 5 years and may be comparable to supplies from Nigeria through the WAGP until the capital costs are fully expensed. Gas from the Jubilee Field is expected to last 20 years with an estimated production of 120 MMscf/d of associated gas produced and a net of 80 MMscf/d. Phase 2 of the Jubilee expansion project is expected to raise this output to 160 MMscf/d by 2016 and 400 MMscf/d by 2025.

Figure 7: Ghana Gas demand forecast

6. Conclusions
What currently exists in Ghana is a semi-liberalised electricity industry dominated by two state-owned natural monopolies (VRA and ECG) and a weak regulator that has political interference from the State thus preventing it from effectively setting the pricing regime. The main issues that need to be addressed in the short to medium term over the next 5 years are:

a) Expand effective capacity to at least 3,500MW to meet demand and reserve requirements for the next 4 years
b) Sort out the messy tariff system to give incentives for the IPPs to produce and compete at the wholesale level – i.e. the Automatic Adjustment Formula
c) Focus attention on expanding the distribution infrastructure with a fully costed action plan with private sector participation under a Private Public Partnership (PPP) scheme
d) Rigorously enforce regulatory governance to ensure consumers are protected from arbitrary price mark ups and inefficiencies from the utilities being passed onto them.
e) Have an enforceable policy mandate in place for the introduction of energy efficiency programmes especially at the MDAs using energy audits and remote monitoring systems.

Overall, a review of the regulatory framework to ensure competition should increase efficiencies, ensure price guaranties by curbing abuse of market power due to collusive and arbitrary pricing by the utilities ultimately culminating in better consumer welfare.

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7. End Notes


iii See: http://vraghan.com/resources/facts.php

iv Mega Watt measures the unit of energy and is the standard term measure for bulk electricity. One megawatt is equal to 1 million watts or 1,000 kilowatts.


vi Natural monopolies are usually associated with industries (e.g. utilities) where there is a high ratio of fixed (sunk) costs to variable costs. These high capital costs can be a strong barrier to entry for competitors. As such, overall societal welfare is maximized because having multiple firms operating in such an industry tends to be economically inefficient as economies of scale don’t abound until the firm is large relative to the market size.


x See: http://www.johnmahama.org/sites/default/files/downloads/NDC-2012-Manifesto_0.pdf


