PRICING AND DEREGULATION OF THE ENERGY SECTOR IN GHANA

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1. Introduction

Amidst the current difficulties Ghanaians are facing with regards to getting access to reliable and constant electricity supply to power domestic chores and industrial activities, a cursory look at the current power market in Ghana shows that the load shedding ('dumsor-dumsor') we are going through is mainly self-imposed largely because of our inability to put in place the right incentives and regulatory structures to attract the needed investments. The growing electricity supply market which has an estimated 10% year-on-year growth is driven a pressing need for new generation capacity as the country seeks to expand its industrial base knowing its role as key catalyst for industrial development. The Ghana Wholesale Power Reliability Assessment report[i] for GRIDCO estimated that it costs between US$320-$924 million annually (2% to 6% of GDP) not including a number of indirect costs of lost economic output due to insufficient wholesale power supply. Thus, the economic costs insufficient power cannot be underestimated. The promised changes of the liberalised electricity markets which were to bring increased private investments and expansion of capacity are yet to bear fruit due to an inefficient setup of the regulatory structures compounded by low tariff pricing options and wastage leading to sub-optimal outcomes.

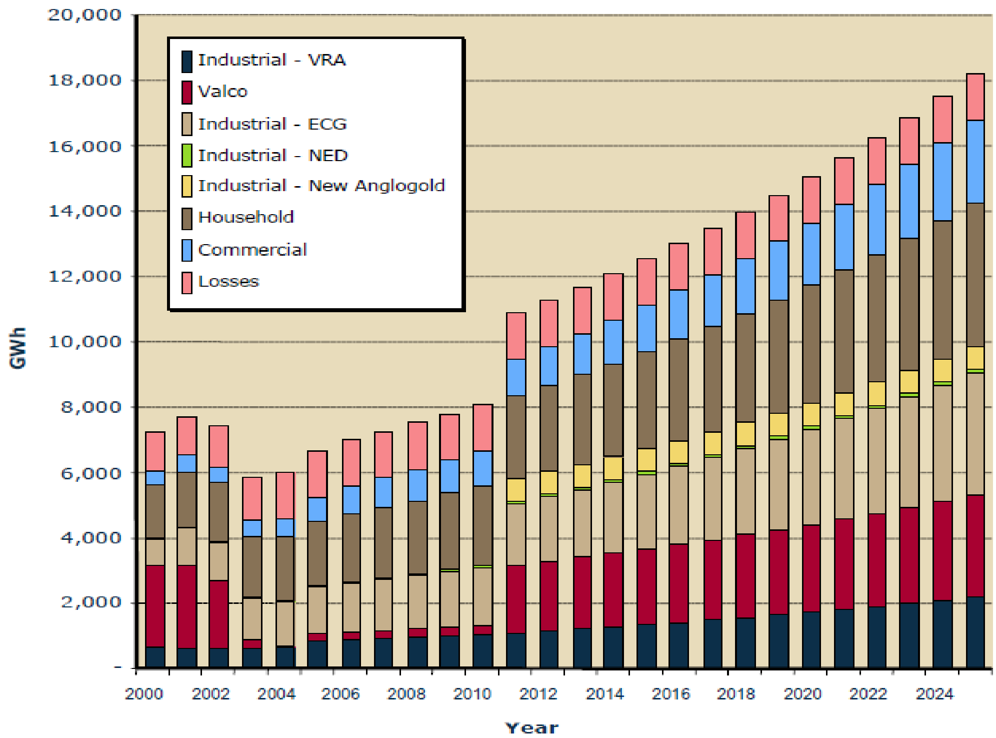

Figure 1: Ghana power demand forecast 2000 – 2025 (Source: Electricity Company of Ghana, VALCO, Mining Companies cited in Tullow Oil Report[ii])

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2. Electricity Economics: The Current Generation Mix

The total installed capacity in Ghana as at December 2011 stood at 2,169 megawatts (MW)[iii] according to the Energy Commission[iv]. The majority comprising 60% of Ghana's generation capacity comes from hydro-based sources exclusive of the yet to be 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 40% of Ghana's supply is currently supplied from thermal based sources using plants which function by converting energy stored in fossil fuels such as oil and natural gas into electrical energy.

Table 1. Installed Electricity Generation Capacity as of December 2011.

GENERATION PLANT	FUEL TYPE	INSTALLED CAPACITY MW
Hydro Power Plants		
Akosombo	Hydro	1,020
Kpong	Hydro	160
Sub-Total		*1,180*
Thermal Power Plants[14]		
Takoradi Power Company (TAPCO)	LCO/NG/diesel	330
Takoradi International Company (TICO)	LCO/NG/diesel	220
Sunon–Asogli Power (SAPP)	NG	200
Tema Thermal Plant1 (TT1P)	LCO/NG/diesel	110
Mines Reserve Plant (MRP)	NG/diesel	80
Tema Thermal Plant2 (TT2P)	NG/diesel	49.5
Sub – Total		*989.5*
Total		**2,169.5**

Figure 2: Installed generation capacity (Source: Energy Commission, Ghana)

The economics of power generation focusses on the generative capacity of typically an integrated natural monopoly[v] where the installed plant type plays a critical factor in determining end-user tariffs. Typically, supply comes from two types of plants. Plant type 1 provides the base load to meet the minimum underlying demand that the utilities must provide to consumers depending on the daily demand schedule. These plants have high fixed costs (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 the base load and peaking plants.

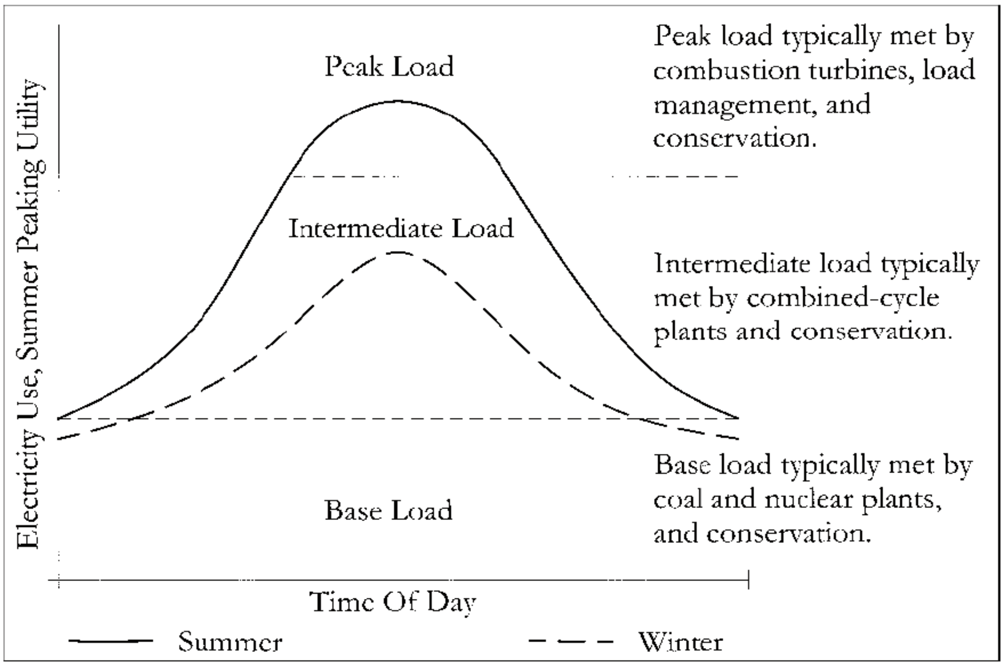

Figure 3: Typical Electric Load Curve

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 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. 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 which is about 10 per cent of system demand. Currently, Akosombo and Kpong hydro units are producing at two-thirds capacity and the breakdown of the West African Gas pipeline (WAGP)[vi] in October 2012 which according to managers of the facility will take until end of April 2013 to bring back on stream only compounds Ghana's current generation challenge. Operations at the 200MW CCGT natural gas fuelled Sunon Asogli Power Plant, a joint venture between Shenzhan Energy Group Limited and the China Africa Development Fund have been shut as result of the curtailment of natural gas supply from the WAGP. As per the bilateral agreement[vii] signed between the respective countries and operators of the pipeline, an initial volume of 170 million standard cubic feet per day (MMSCFD) was to be supplied and peak at a capacity of 460MMSCFD over time. However, supply has been erratic at best dropping at times to 40MMSCFD though Nigeria is contractually obligated to supply Ghana 100MMSCFD. Part of the current energy crisis can be attributed to this supply shortfall.

Average load factors in Ghana's Energy Mix	**Hydro Electric**	**Thermal Plants**
	70% (75% **)[3]	76% (85%**)

Table 1: Average load factors in Ghana's Energy Mix

Hydroelectric generation will continue to be the dominant feedstock source within the next three years followed by thermal sources fuelled by oil and natural gas sourced from within the country as the Jubilee gas project comes on stream. Assuming NDC's manifesto promise[viii] of delivering 5,000MW by 2016 was to come into fruition, it would entail a substantial change of the feedstock to the extent that most of the new generation capacity is likely to come from thermal sources.

[Insert graph or table here]

Figure 4 Costs and Revenues per KWh of power produced in Ghana by operators

3. Demand Side Load Management

Demand Side Load Management (DSLM) is critical if we are to have the power system 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 ensures efficiency thus reducing the substantial need for new generation and transmission capacity. Under the National energy policy[ix], there is 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 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 in having 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 programs and reforms which were started 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 energy audits and remote monitoring. For example, it should be made mandatory to turn off all air conditioners, lighting systems and computer processing units 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 considered at the national level. All of these if enacted within a comprehensive energy sector demand management strategy can greatly reduce the peak load demand to optimal levels where the current demand would meet supply as well as the reserve margin to meet any contingency requirements.

[3] ** Figures in brackets represent conventional industry load factors

ble 2.1 - Ghana's Ten Largest Load Centres, 2009

Rank	Load Centre	Bulk Power Service Provider	Peak Load (MW)	Energy (GWh)
1	Accra (Achimota + Mallam)	ECG	380.2	2,896.0
2	Tema	ECG	183.0	1,215.9
3	Kumasi	ECG	154.4	1,051.4
4	New Tarkwa (G.G.L.)	VRA/MINES	56.8	308.3
5	New Obuasi (A.G.C.)	VRA/MINES	53.0	458.0
6	Takoradi	ECG	44.7	343.9
7	Tarkwa	ECG	37.7	350.3
8	Sunyani	NED	30.5	226.3
9	Kenyase (Newmont)	VRA/MINES	30.2	251.9
10	Asawinso	ECG	29.8	171.7
Total			**1,000.3**	**7,273.5**
% Of 2009 System Peak Load or Energy			**70.3%***	**71.9%**

* Note that the peak loads across the load centres are not exactly coincident, and hence the number above is approximate.

Figure 5: Peak Demand of Major Load Centres (Source: GRIDCo Ghana, 2010)

Also, the current ratio of distribution losses to transmission which reflects years of under recovery and investments in the bulk distribution systems is unacceptable and needs serious attention. For example, the ratio of distribution to transmission losses has averaged 22% over the past ten years without the gap showing any appreciable decreasing trend. The net effect of this is that almost 22% of total power generated cannot be accounted for. The Electricity Company of Ghana attributes this to technical and commercial losses.

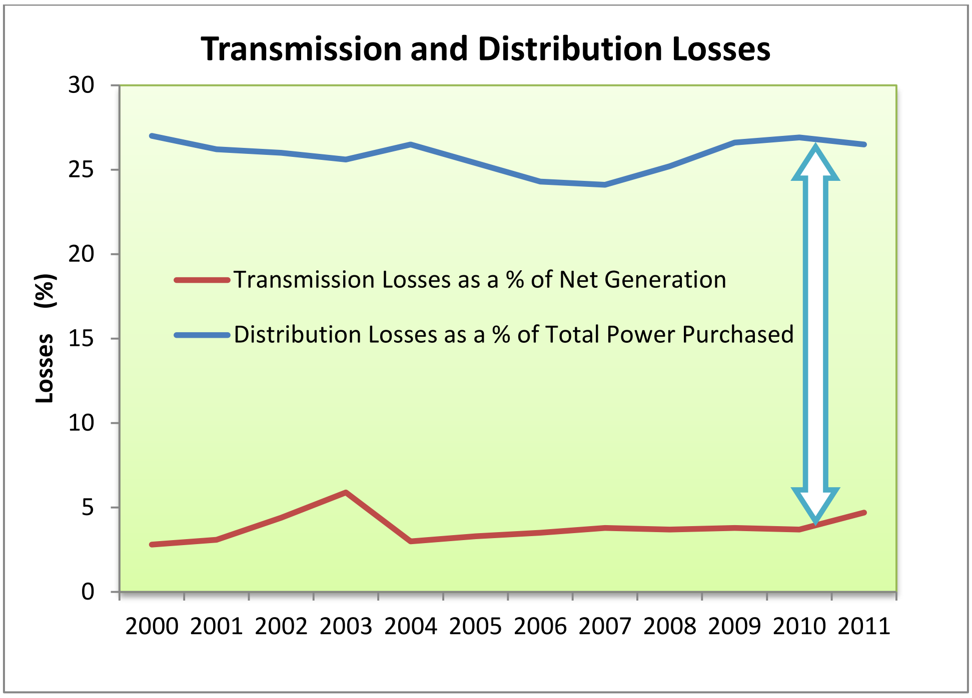

Figure 6: Electricity Transmission and Distribution Losses in Ghana

4. Regulatory Challenges: Paying the Market Price for Power

It is quite clear that Public Utilities Regulatory Commission's (PURC) current mechanism for determining electricity prices though it looks great on paper actually serves a great disincentive for investments in especially in the generation and transmission sectors. The Power Sector Reform Programme which started in 1995 in an attempt to rationalize Ghana's power sector by brining 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 much more to be desired as some of the key benchmarks they 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 increases. 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) 1937[x] which states that "electricity generated from Akosombo and Kpong hydro dams shall not be subjects of a bilateral contract."

The Independent Power Producers (IPPs) who generate most of the thermal power have cited their inability to meet the performance standards set by the regulator based upon which a price review is premised in addition to other market factors to the under recoveries. On 11 February 2013[xi], the major service providers cited under-pricing of utilities as one of their major worries attributing their inability to meet set performance standards to investment to cash flow shortfall due to under recoveries. This has drastically affected their cash flows and hence current and future capital budgeting and investment programmes. A major contributory factor to the under recoveries by the IPPs who entered the sector following the privatization 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 later 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. Debts owed by the government to VRA runs close to $259 million (GH¢509million). The MDAs also owe $117 million (GH¢230million), while ECG owes $138 million (GH¢270million) and VALCO aluminium smelter owes $39 million (GH¢77million) respectively. This brings the total public-sector indebtedness to nearly $560 million (GH¢1.1billion).

This policy of subsidized tariffs has distorted the current pricing regime to the extent that full cost recovery by the IPPs is near impossible. As a result, the current 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 due to a reduction in the deadweight inefficient losses currently being bundled and passed on to the consumer.

Many of the provisions of 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 are the main negotiation tools 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 basis for pricing. Thus, plants with the lowest SR marginal costs such as Akosombo and Kpong are first to be brought on stream to meet demand followed by the thermal units such as TICO and Sunon Asogli.

Though it could be argued that governments have prioritized universal access to electricity as a major poverty alleviating tool, it imperative that the right price of electricity where the full costs borne including a return on investment be paid to ensure long term security of supply. Credit and liquidity risks are very high in the Ghanaian electricity sector because the subsidy component though budgeted for year after year has never been paid to the IPPs on time coupled with non-payment of bills by some industrial and commercial consumers. This severely affects investment decisions for expanding the infrastructure base to meet future demand.

Another issue yet to be resolved is the role of Jubilee gas in meeting domestic energy demand and how its pricing will affect 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) has to ensure that the capital costs expensed on the Jubilee Field are 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 120MMSCFD of associated gas produced and a net of 80MMSCFD. Phase 2 of the Jubilee expansion project will raise the output to 160MMSCFD by 2016 and 400MMSCFD by 2025.

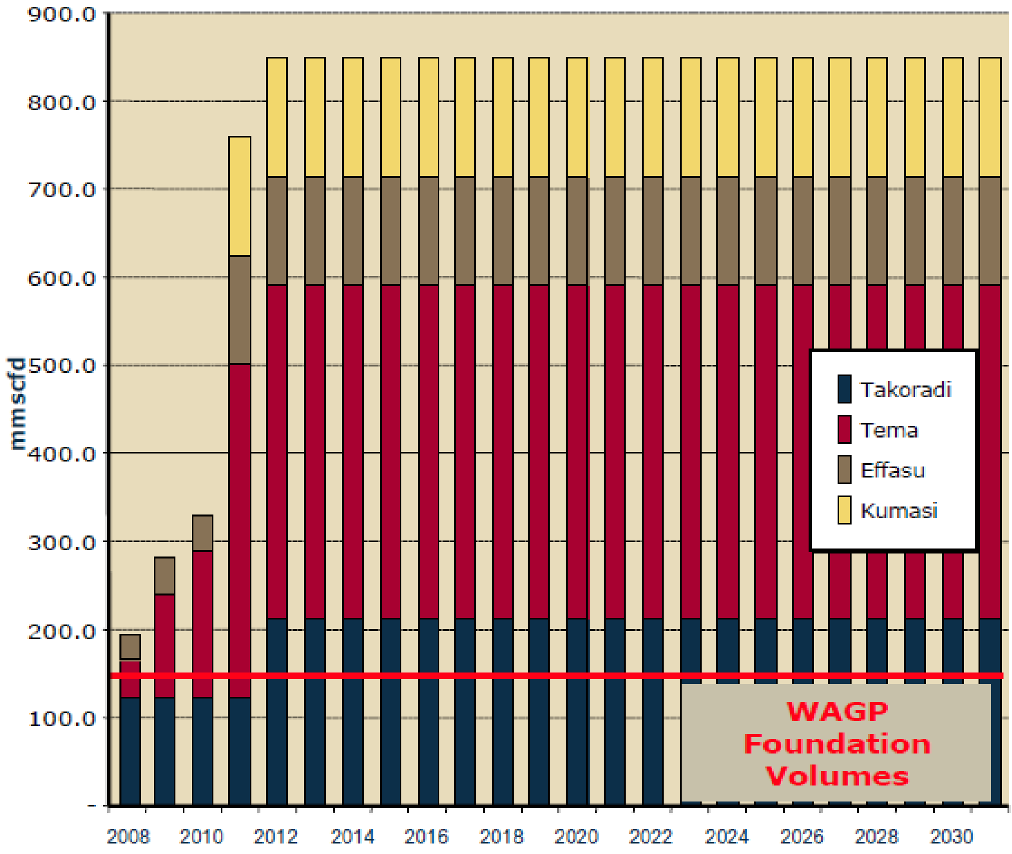

Figure 7: Gas demand by the IPPs in Ghana (Source: Tullow Oil, 2008)

5. 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 huge political interference from government. The main issues to deal with in the short to medium term of 5 years are:

1. Expand capacity to at least 3,500MW to meet demand for the next 4 years;
2. Sort out the messy tariff system to give incentives for the IPPs to produce and compete at the wholesale level;
3. Focus attention on expanding the distribution infrastructure with an action plan fully costed with private sector participation under a Private Public Partnership (PPP);
4. Rigorously enforce regulatory governance to ensure consumers are protected from arbitrary price mark ups and inefficiencies; and
5. Have an enforceable policy mandate in place for the introduction of energy efficiency programs 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. This should ultimately culminating in a better consumer welfare.

6. End Notes

[i] Power Systems and Energy Consulting (PESC) report available at: http://www.gridcogh.com/site/downloads/27a623e256c7d94a7dce43d5ef82d3e3GridCoReportFinal.pdf

[ii] See: http://www.tullowoil.com/files/pdf/ghana/Jubilee-gas-commercialisation.pdf[ii]

[iii] 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.

[iv] National Energy Statistics available at: http://www.energycom.gov.gh/files/Energy_Statistics_2011.pdf

[v] 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.

[vi] See: http://www.ventures-africa.com/2012/10/west-african-gas-pipeline-to-miss-target-due-to-vandalization/

[vii] See: http://wagpco.com/index.php?option=com_content&view=article&id=122&Itemid=85

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

[ix] National Energy Policy available at: http://ghanaoilwatch.org/images/laws/national_energy_policy.pdf

[x] See: http://www.purc.com.gh/purc/sites/default/files/li1937.pdf

[xi] See: http://www.ghanaweb.com/GhanaHomePage/NewsArchive/artikel.php?ID=264671