The Electricity Supply Industry in Ghana: Issues and Priorities

Abeeku Brew-Hammond*

Résumé: *Le Ghana dispose d'un système hydro-électrique depuis presque une trentaine d'années. La Volta River Authority (VRA) a pour mission, la production et la transmission de l'énergie électrique. Jusqu'à une date récente, la distribution de l'électricité dans tout le pays était assurée par l'ECG (the Electricity Corporation of Ghana), c'est-à-dire, qu'au moment où il fut décidé de confier la partie nord du pays au NED (Northern Electricity Department), un démembrement de la structure chargée de la génération et de la transmission de l'électricité (VRA). Le présent article étudie la performance de ces deux services publics au Ghana et compare la performance de l'industrie d'approvisionnement en Energie Electrique du Ghana avec celle des industries similaires dans les pays voisins. Il relève une faiblesse de la VRA qui participe de son manque de capacités technologiques pour le developpement de projets de centrales électriques, et se fonde sur l'expérience coréenne pour indiquer plusieurs possibilités d'apprentissage technologiques que peut saisir l'industrie ghanéenne d'approvisionnement en électricité (ESI), pour briser le syndrome de la dépendance technologique.*

Background

Ghana gained her independence from the British in 1957 and soon after becoming independent, a National Development Plan was launched. Introducing the plan in Parliament, the first Prime Minister of Ghana, Dr. Kwame Nkrumah, stated that 'I have always been convinced that an abundance of cheap electrical power is the soundest base for the expansion of industry in a country such as ours'. This statement, perhaps more than any other, reveals the political underpinnings of Ghana's Electricity Supply Industry (ESI) in the early post-independence era. In 1961, the Volta River Authority (VRA) was established by an Act of Parliament and placed directly under the Office of the Prime Minister. The act gave VRA responsibility for generation and high-voltage transmission of electricity throughout Ghana. The Government capitalised VRA with £35 million, a significant sum of money at the time, and also undertook to guarantee any obligation entered into by VRA. Construction of the country's first hydro-electric plant proceeded in earnest and the first four units at Akosombo, with a total installed capacity of 558 MW, were completed in 1965.

The Government of Kwame Nkrumah was overthrown in a coup d'état in 1966 and in 1967 the Electricity Corporation of Ghana (ECG) was

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established, by a decree of the military government, to replace the Electricity Department which had been operating under the bulk from VRA for distribution throughout the country to all categories of consumers with the exception of the Volta Aluminium Company (VALCO), which operated an aluminium smelter, and the Akosombo township. Meanwhile, growth in VRA's generation system occurred fairly rapidly. Two additional units, with an installed capacity of 324 MW, were completed at Akosombo in 1972, followed by a 160 MW plant at Kpong, also on the Volta River and downstream of Akosombo, which was completed in 1981.

Ghana's economy, however, deteriorated continuously during the 1970s, which also saw several changes in military/civilian governments. The economic decline was exacerbated by the two world oil price shocks and reached its nadir in the early 1980s when a severe drought nearly wiped out what was left of the country's agro-industrial base. The period between the second oil price shock of 1970/80 and the drought of 1983 marked the worst and most deteriorated to rather dismal levels, both in terms of its distribution system and its organisational structure.

An Economic Recovery Programme (ERP) was initiated by the new 'revolutionary' government in 1983. The ERP helped to bring about a turn-around in economic performance and between 1984 and 1986 Ghana's real growth rate averaged 6.3% (Akuffo 1992). Encouraged by the achievements of the ERP, the government made a commitment to extend the reach of electricity to all corners of the country over a 30-year period MFP 1990a). In order not to over-stretch the resources of ECG, which was itself undergoing major rehabilitation and restructuring, VRA established a Northern Electrification Department (NED), and took over responsibility for the distribution of power to all categories of consumers in the northern regions of Ghana in 1987 (Volta River Authority 1987). Thus, at present, VRA (including NED) and ECG constitute the two power utilities involved in Ghana's electricity sub-sector. VRA, on the one hand, is responsible for generation and transmission throughout the whole country as well as distribution in the northern regions; VRA is also responsible for the direct supply of electricity to the mines, certain industries (including VALCO) and the townships where its generation facilities are located. ECG, on the other hand, has responsibility for the distribution of electricity in the rest of the country and still operates a few diesel plants in those areas of southern Ghana which are outside the reach of the national grid. It should be pointed out that VRA's activity are confined not only to electricity generation, transmission and distribution (especially where NED is concerned) but also to a whole variety of other socio-economic activities for which it has specifically set up a few subsidiaries (Volta Lake Transport Co., Kpong Farms Ltd. and Akosombo Hotels Ltd.). Furthermore, VRA is responsible for the civil governance of the Akosombo and Akuse/Kpong townships (where the activities range from the running of public schools and hospitals to sewerage treatment and 'slum clearance') as well as the running of a health service for communities around the Volta Lake, the largest man-made lake in the world (Moxon 1992).

The main aim of this paper is to evaluate the performance of the two utilities and the Ghana ESI as a whole. This will be done by comparing the ESI in Ghana with those in neighbouring West African states, especially, Côte d'Ivoire whose ESI has similar characteristics to that in Ghana and is perhaps the most developed economy in the sub-region with a 1990 GDP per capita of US$750 compared to Ghana's US$390 (UNDP 1992). The key issues emerging from this evaluation will be discussed and the key priorities for the future will be identified, drawing upon lessons from the Republic of Korea (which has recorded probably the most impressive achievements of any developing country ESI since the mid-1970s).

Technical Performance

Installed Capacity and Plant Performance

By the mid-1980s Ghana had a total installed hydro-electric capacity of 1072 MW. Thermal generation in Ghana employs diesel plants and is used to supply isolated load centres, with the exception of a 30 MW plant at Tema which is currently undergoing rehabilitation for eventual integration into the hydro-electric grid. Estimates of thermal generation capacity in Ghana vary widely, from 55 MW (Lazenby 1987) to 108 MW (UN 1982). The lower figure is, therefore, used in Table 1 below, to compare installed capacity in Ghana and her neighbouring countries as at 1990.

Table 1: Electricity Generation Capacity (MW) for Selected Countries in West Africa

	Hydro	Thermal	Total
Ghana	1072	55	1127
Côte d'Ivoire	604	331	935
Burkina Faso	14	65	79
Togo	2	126	128
Benin	-	57	57
Nigeria	1,900	5,300	7,200

Source: Compiled by author.

The figures in Table 1 show that Côte d'Ivoire's power system is the closest to Ghana, in terms of installed capacity, and Nigeria has the largest system in the sub-region. It should, however, be pointed out that whereas Ghana's hydro plants are all active, the same cannot be said of plants in the other countries, many of which can be considered as decommissioned, for all practical purposes (De Oliveira 1992).

Hydro energy accounts for more than 90% of total energy generated in Ghana, with thermal (diesel) plants providing the remainder and operating outside the grid. Therefore, Ghana can be considered as having, effectively, an all-hydro system. Figure 1 shows the variation of plant factor[1] and reserve factor[2] since 1966. Ignoring start-up and the drought-affected years around 1983-84, the plant factors for the period varied between 50 and 60%, reaching 66% in 1980. These values are much higher than the corresponding ones for Côte d'Ivoire which rose from about 13% to 24% and then fell to 22% between 1975 and 1990.

System Losses, Interconnection and Reliability

Transmission and distribution losses in Ghana require careful treatment. VRA's other activities, apart from generation, are usually classified under transmission but VRA does some distribution as well (in four northern regions through NED and directly in the two townships of Akosombo and Akuse/Kpong).

In the same vein, ECG does some sub-transmission and even though most of its losses may be classified as distribution losses they do not represent the system as a whole, considering that they now cover six out of ten regions in the country. The available data is presented in Table 2 which also includes the total system losses calculated on the basis of the total energy supplied to final consumers by VRA and ECG combined, and the total energy transmitted by VRA. Between 1987 and 1989, VRA's transmission losses averaged 2.3% while ECG's average was 18.8%, resulting in a value of 7.0% for total system losses. In comparison, Côte d'Ivoire total system losses averaged 15.1%, between 1985 and 1988, which suggests that Ghana's overall system performance was not as bad as ECG's losses tend to suggest.

1 Plant factor = Average Load/Plant Capacity.
2 Reserve factor = Peak Load/Plant Capacity.

Figure 1 : Hydro Power Plant Performance in Ghana

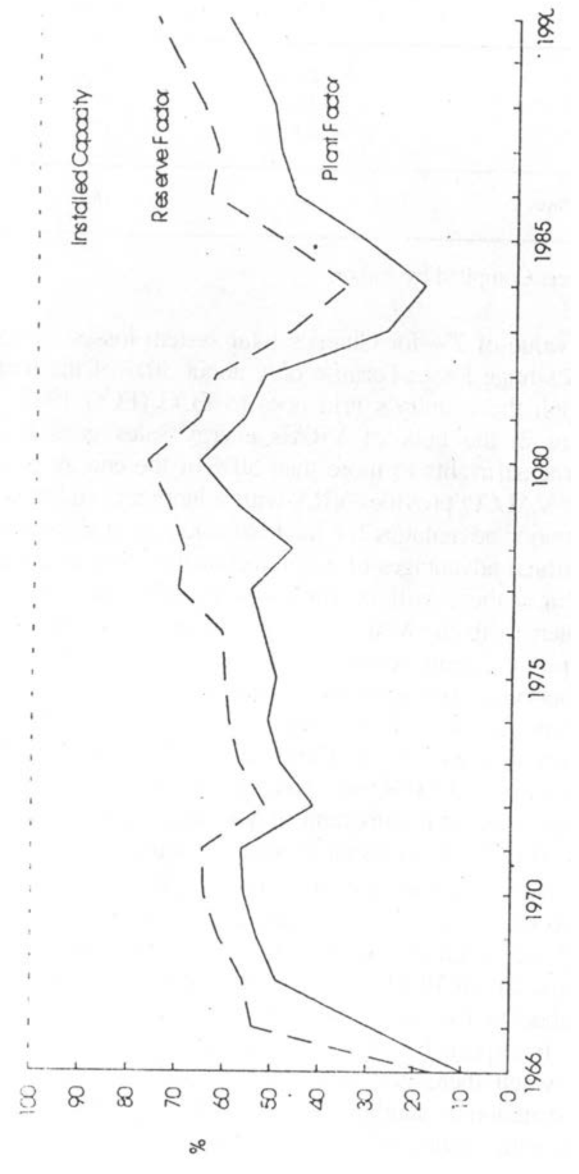


Table 2: System Losses in Ghana

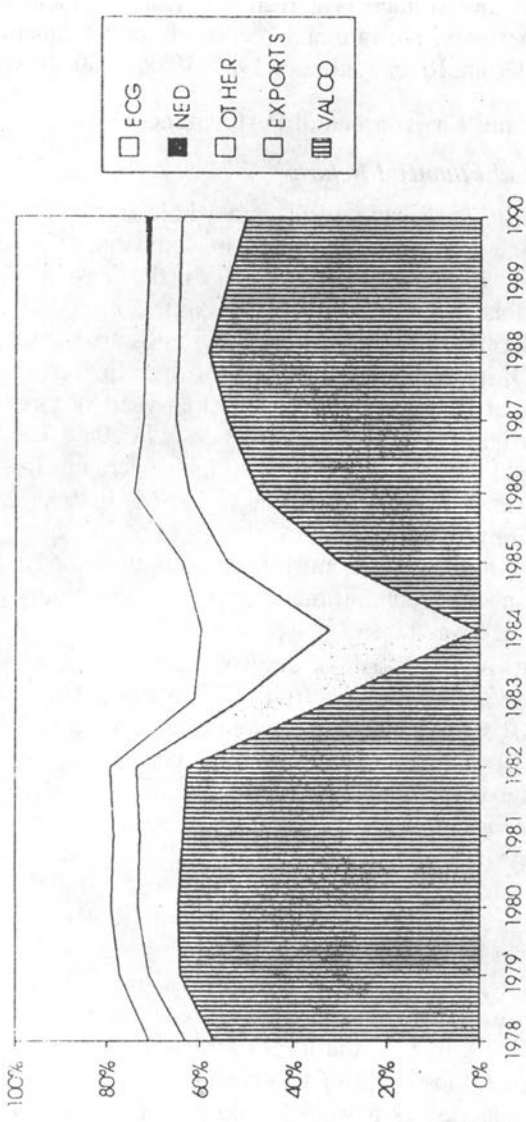
	VRA's Losses (%)	ECG's Losses (%)	Total System Losses (%)
1987	2.4	20.7	6.9
1988	2.2	18.1	6.7
1989	2.4	17.6	7.3
Average	2.3	18.8	7.0

Source: Compiled by author.

The value of 7% for Ghana's total system losses appears low in relation to ECG's huge losses because only about 30% of the total energy transmitted through the country's grid goes to ECG (ECG 1987, 1989). As shown in Figure 2, the bulk of VRA's energy sales goes to VALCO which has contractual rights to more than 50% of the energy generated at Akosombo. Thus VALCO provides VRA with a large and stable year-round load which has major advantages for load management and system stability. There are additional advantages of a non-technical nature associated with the VALCO load and these will be discussed in subsequent parts of this paper. One problem with the VALCO load is its unpredictability in the long term. The contract to supply power to VALCO expires in 1997. However, VALCO has the option of extending the contract for another 20-year period provided that it gives notice of its intention to do so 3 to 4 years before the contract expires (i.e. by 1994). Thus the future of the VALCO load is currently unknown and this is creating major load forecasting difficulties. Nevertheless, it is important to note that the large share of energy consumed by VALCO constitutes an important feature of the Ghana electricity system.

Another important feature of the Ghana system is the high degree of interconnection between Ghana and her neighbours. As shown in Figure 2, the level of electricity exports to Togo, Benin and Côte d'Ivoire is quite significant; in 1990 these exports constituted 14% of the total energy VRA supplied to its customers. An intertie with Côte d'Ivoire allows VRA not only to export, but also to import electricity when supply exceeds demand (i.e. when there is a possibility of spillage over dams in Côte d'Ivoire). Construction of another interconnection with Burkina Faso is at an advanced stage with exports of electricity scheduled to begin in 1994. An intertie with Nigeria has also been under consideration for some time (Danish Power Consult 1984).

Figure 2: Electrical Energy Sold by VRA



Data on system reliability in Ghana, especially at the level of distribution, is scarce. However, blackouts are known to occur frequently in many parts of the country, including urban areas, sometimes at rates as high as once or twice a week and low voltage is a recurrent feature.[3] Incidents of total system collapse, however, are rare and occur only at a frequency of about once in two years (Volta River Authority 1987, 1988, 1989, 1990).

Economic, Social and Environmental Performance

Operating Costs and Financial Returns

Total operating costs for Ghana's ESI as a whole were 17 US$/MWh in 1987 and fell to 13 US$/MWh by 1989. In comparison, Côte d'Ivoire's production costs in 1987 were 230 US$/MWh, the least in Francophone West Africa, and this was more than ten times the corresponding value for Ghana. Within the Ghana ESI, VRA's operating costs are the least, followed by ECG and NED, in that order. NED's total operating costs have fallen considerably between 1987 and 1990, the first four years of its existence, but the 1990 value for NED is still twice ECG's costs in 1989. These relatively high operating costs for NED translate into high operating losses of more than 600% of power sales in 1989 and nearly 300% in 1990. Even though ECG has also been making losses (40% and 7% of power sales in 1987 and 1988, respectively), the levels are much lower than those of NED and there is an indication of a turn-around in financial performance with ECG's recent operating profit which was 12% of power sales in 1989.

With respect to profits and losses, VRA stands out far ahead its wide profit exceeding 50% of power sales from 1987 to 1990. Apart from its wide profit margin, VRA's financial health is well grounded on 'solid rock' with up to 80% (in 1990) of its power sales revenues coming in foreign exchange from VALCO and exports to neighbouring countries. Thus, VRA presents us with a radical departure from the dire financial straits in which many developing country utilities, including ECG (and NED, if it did not have VRA to lean on) have found themselves in recent times. VRA's good financial health is reflected in its Rate of Return (ROR) on Average Net Fixed Assets, shown in Table 3. Where ECG shows negative values, VRA's RORs are positive and in the last three out of the five years for which data is available, they exceed the World Bank covenanted ROR of 8% (Volta River Authority 1990). In fact, the level of VRA's financial standing is so high that it is able to absorb ECG's losses in addition to NED's and still leave, for the Ghana ESI as a whole, a positive ROR of 3.92% in 1987 compared with Côte d'Ivoire's negative ROR of -8.5% for that same year.

3 Author own experience living in Kumasi, Ghana, between 1984 and 1992.

Table 3: Rates of return (ROR) on Average Revalued Net Fixed Assets

	1986	1987	1988	1989	1990
VRA	6.6	6.76	9.1	9.62	9.16
ECG		-14.25	-4.5	6.19	

Note: VRA: Volta River Authority
ECG: Electricity Co-operation of Ghana.

Source: Compiled by author.

The difference in the financial performance of VRA (the generator), on one hand, and ECG and NED (the distributors), on the other, is so striking that further analysis is required. Indeed, interesting results emerge from a study of the direct costs of power supply : generation and transmission, in the case of VRA, and power purchases, diesel generation and distribution, in the cases of ECG and NED. The ratio of power sales revenues to the direct costs of supply (Sales/Direct-Costs Ratio) for VRA varied between 12 and 21 for the 1987-90 period. ECG's Sales/Direct-Costs Ratio rose slightly from 1.4 to 1.9 between 1987 and 1989 and NED's remained below 1 for the entire period. Thus NED's direct costs of diesel generation and purchase of power from VRA far exceeded its power sales revenue and under these circumstances it was simply impossible for NED to pay for its administrative and other costs, let alone make a profit. Fortunately, many of the diesel plants are being decommissioned, thanks to the grid extensions taking place under the National Electrification Programme and this appears to be the dominant factor responsible for the reduction in NED's losses in 1990.

Tariffs and Billing Effectiveness

The cost of power purchases from VRA constitute more than 80% of ECG's direct power costs. Thus in the case of ECG (and increasingly for NED) the ratio of average tariffs for power sales to that for power purchases from VRA becomes very important. Table 4 shows that between 1987 and 1989 the ECG Sales/Purchases Tariff Ratio increased from 1.88 to 2.77; the significance of this modest increase in the tariff ratio with respect to ECG's similarly modest turn-around from loss-making, could be the subject of a more rigorous statistical analysis in future.

Table 4: ECA's Sales/Purchases Tariff Ratio

	1987	1988	1989
ECG's Average Power Sales Tariff, $/MWh	28.4	31.4	26.4
ECG's Average Power Purchases Tariff, $MWh	15.1	12.2	9.6
ECG's Sales/Purchases Tariff Ratio	1.9	2.6	2.8

Source: Compiled by author.

Two additional observations can be made on tariffs in Ghana. First, the average power sales tariff for ECG in 1987 was 28.4 US$/MWh and this was far lower than that for Côte d'Ivoire, which at 160 US$/MWh was the lowest in Francophone West Africa (Girod 1991). Second, a study by Acres International showed that in real terms tariffs fluctuated considerably with the overall effect of a decline between 1985 and 1990 and furthermore there was a wide gap between current tariffs and long run marginal costs (LRMC) (World Bank 1992). The combination of low and declining tariffs cannot augur well for any utility but the earlier discussion on the turn-around in ECG's financial performance suggests that the tariffs structure, reflected in ECG's power sales/purchases tariff ratio, may be as important as (if not more important than) the LRMC and the appreciation or depreciation of tariffs in real terms.

With respect to billing effectiveness, VRA reports an average debtors credit period which varied between a high of 151 days in 1986 and a low of 59 days in 1989. VRA's revenues collection effectiveness can be assumed to be nearly 100% because its sales take the form of bulk supply, with the exception of the distribution activities in Akosombo and Akuse which are two very small townships. Financial arrangements between VRA, ENG and the Government of Ghana ensure that ECG's debts (owed to VRA) are paid for (in effect) and NED's bills, if not paid for in cash, are at least properly entered in VRA's books. In any case, NED's power purchases are only a tiny fraction of VRA's power sales revenues (1.5% in 1990) and NED's metering effectiveness was 92% and 99% in 1989 and 1990, respectively.

ECG, however, reports only a 'gradual shift from quarterly to monthly' billing duration (ECG 1989) and in the authors own experience billing delays of six months and more are not unheard of in Ghana. ECGs revenue collection effectiveness, as the number of meters installed as a percentage of the targeted number of meters are presented in Table 5. ECG's improvement in revenues collection effectiveness from 69% in 1988 to 90% in 1990 is impressive. It is not clear what the basis of the targeted number of meters is but the levels (25%-29%) are appalling. The figures tend to suggest that the 75% of customers who were unmetered in 1989 accounted for only 10% of potential sales revenues and this may look like a small amount of money not commensurate with the scale of metering effort required. A cost-benefit analysis of going after what appears to be a 'widow's mite' may, therefore, be necessary.

Table 5: ECG's Revenues Collection and Metering Effectiveness

	1989	1990
Revenues Collection Effectiveness, %	69	90
Metering Effectiveness, %	29	25

Source: Compiled by author.

Labour Productivity and Socio-economic Impact

Labour productivity date for VRA, NED and ECG were 1988, 55 and 301 MWh/Employee respectively. In 1988, the corresponding value for the Ghana ESI as a whole was over 700 MWh/Employee. This is much higher than that of the ESI in Côte d'Ivoire which, at 475 MWh/Employee was by far the highest among the Francophone West African countries (Girod *et al* 1991).

With respect to socio-economic impact, Ghana has seen some interesting developments in recent times. By the mid-1980s distribution of electricity was heavily concentrated in the urban areas and the national grid covered a rather small section in the southern part of the country. A District Capitals Electrification Programme was first initiated to connect all district capitals (including those that had diesel plants) to the national grid. A National Electrification Planning Study was also commissioned and the government made a commitment to extend the reach of electricity to all corners of the country within 30 years (i.e. by the year 2020). By 1990, out of 110 districts capitals, 62 (56%) were connected to the national grid (MFP 1990b). At the national level, access to electricity grew from about 12% of the population in 1989 to 33% in 1992 (Botchway 1993). This implies that Ghana could now have a higher level of electrification than Côte d'Ivoire, which had an access rate of 25% in 1988, the highest in Francophone West Africa (Girod *et al.* 1991). The National Electrification Planning Study Report, submitted by Acres International in 1991, concluded that Ghana's National Electrification Scheme 'represents an economically efficient application of national investment resources' and this has received the stamp of approval from the World Bank (1992). Armed with this, the Government of Ghana stands poised to make good its commitment to electrify the whole country by the year 2020.

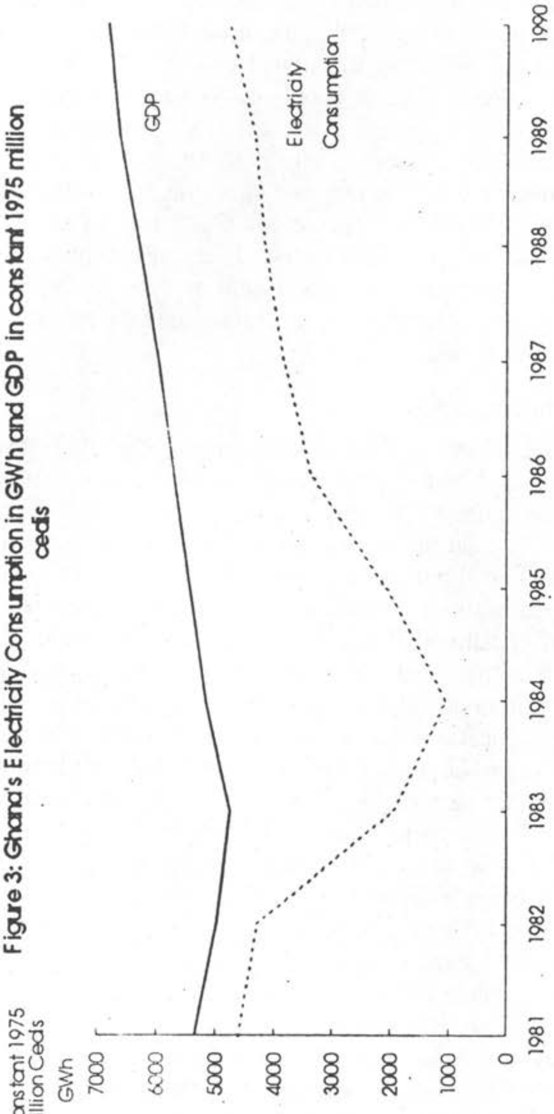
It is important to situate Ghana's recent gains in electricity access rates and the NES within wider context of growth in the national economy since the launching of the Economic Recovery Programme. Figure 3 shows the GDP in constant 1975 cedis and electricity consumption in GWh for Ghana during the 1980s. Ghana's economy has grown steadily since 1984, with GDP growth rates averaging 5.2% per annum in the first five years. Electricity consumption followed GDP very closely throughout the decade, with the exception of the more pronounced effect of the drought. In the post-drought economic recovery period, electricity consumption has risen steadily at an average of 9.3% per annum from 3.354 GWh in 1986 to 4.776 GWh in 1990 (barely exceeding the pre-drought 1981 level of 4.597 GWh). This growth in electricity consumption is a result, on the one hand, of recovery from the drought of 1984 and, on the other hand, increasing demand from different sectors of the economy. Investment flows into the ESI have also been relatively high. Between 1983 and 1990 the energy sector attracted external loans to the tune of US$ 466 million ; the ESI alone accounted for 74% of all these loans with VRA taking 42% and ECG, 32% (MFP 1990b).

What was a 'lost decade' for most of Sub-Sahara Africa was, in the case of Ghana, a period of 'economic rebirth' and electricity consumption will almost certainly continue to grow for as long as growth in the economy is sustained, given the greater-than-one GDP elasticity of electricity demand recorded in recent times. Ghana's GDP growth rate fluctuated between 3% and 5% around the turn of the decade and there is speculation that even higher growth rates could be achieved if Ghana pursues the 'right' policies (World Bank 1993). As things stand now, GDP per annum is forecast to grow at 5% up to the year 2000 and the Government remains committed to extending electricity to all corners of the country by the year 2020. Thus, the stage seems set for significant increases in electricity demand and the ESI is certain to be called upon to deliver, not only the higher quantities but, also, an increasing quality of service.

Environmental Impact

The development of Ghana's hydro-electric system has not been without costs to the environment and, in particular, local populations around the dams. The Akosombo dam alone flooded 5% of the whole country and required the resettlement of about 78,000 people from 700 towns and villages (Moxon 1987). These figures translate into-flooded-area capacity ratios of 38 km^2/MW and 86 people/MW. Brazil is one country whose case of hydro-related displacement of indigenous populations has attracted a lot of international attention. However, specific and aggregate data is unavailable for comparison with Ghana.

Figure 3: Ghana's Electricity Consumption in GWh and GDP in constant 1975 million cedis



Ghana's hydro-related environmental problems go beyond flooding and displacement of people. Water-born disease — malaria, schistosomiasis, elephantiasis, onchocerciasis (river blindness), etc. — increased sharply after the construction of the Akosombo Dam and it is estimated that in the Volta Basin alone up to 70,000 people are now blind from onchocerciasis (Lazenby and Jones 1987). As mentioned earlier, VRA has been making some efforts at redressing these problems. A recent Ministry of Energy environmental impact assessment concluded that 'from a public health point of view, the Volta River Project helped to solve some health problems through better medical attention and immunisation, but created other serious health and sanitation problems which are still unsolved (World Bank 1992). Thus, much work still remains to be done and judging from recent government pronouncements, environmental concerns should receive a higher priority in technology policy decisions relating to Ghana's electric power sub-sector, in future.

Options and Opportunities

From the forgoing discussion, a key question emerges with respect to the technical and financial performance of the two electric power utilities. VRA, on one hand, has manages to maintain very high performance standards throughout its more than 30 years lifetime. Its plant factor, load factor and transmission losses rival those of the Newly Industrialising Countries (NICs) and leading industrialised countries. Its financial performance is also impressive, with positive RORs often greater than the World Bank's covenanted value of 8%; and VRA has been described as having 'a strong reputation for corporate efficiency' and being 'on the whole, ... a well-managed, technically efficient and financially sound institution' (World Bank 1992). ECG, on the other hand, has been 'struggling between life and death' for the greater part of its 26 year history. Its electricity distribution losses are just as bad as those found in many Sub-Sahara African countries and the utility is known to have been in dire financial straits for many years. NED, in spite of being a department of VRA, has not fared any better. Its financial losses are huge that they make ECG's losses look like 'child's play'. This had led to some concern about the possibility of the distribution part of the industry being and inherently loss-making activity, as far as 'less developed countries' are concerned.

A major problem for the Ghana ESI, therefore, is the poor financial (and, in the case of ECG, technical) performance of the distributors, compared to the impressive performance of the generator. How and why is it that two public utilities operating in the same country can have such strikingly different levels of performance and what can be done to improve the situation?

An analysis of the problems confronting the distributors in Ghana shows quite clearly that they have been subjected to tariffs that are well below the levels required for even their day-to-day operations. ECG, in particular, has also had to operate within rather bureaucratic government structures. In contrast, VRA, the generator, obtains most of its revenues in foreign exchange, under international agreements, and until the mid-1980s, VRA also enjoyed a 'most-favoured company' status, with direct access to the Office of the Head of State.

Thus, there are major issues concerning tariffs and the institutional arrangements that are most likely to enhance the performance of the ESI, as a whole, and the distributors, in particular. With respect to tariffs one option is to increase tariffs on the basis of specific criteria such as average costs or long-run marginal costs. In the particular case of Ghana, which is a major exporter of electricity in the West African sub-region, it appears that there may be room for using some of the export revenues, in view of the higher costs in neighbouring countries, to cross-subsidise domestic consumers. Given the importance of electricity as a key input for modern industries and a highly valued social amenity, any possibilities for supplying electricity to Ghanaian consumers at 'least cost' will need to be explored. Nevertheless, the financial viability of the utilities cannot be sacrified and it is therefore necessary that tariffs are set in a manner that is both rational and transparent. Here too, there are several options, one of which is to appoint an independent regulator, with powers to determine tariffs, as is the case in many industrialised countries. However, this option has serious political implications in a developing country like Ghana and the human and institutional capacities required should not be under-estimated. Therefore, a more feasible option with respect to tariff-setting may be to concentrate efforts on building the necessary capabilities within the country.

With respect to the institutional framework within which the utilities operate, there are many options which include streamlining the relevant government executive machinery, introducing private participation and splitting up the utilities to promote competition and effectiveness. VRA no longer enjoys direct access to the highest political authority in the land. It is, therefore, imperative that the Government machinery that deals with the utilities is well streamlined so that both VRA and ECG are not subjected to a frustrating bureaucratic environment. Any attempt at splitting up the utilities would also have to take into account the fact that Ghana's ASI is a small one, in terms of energy generated and consumed, when compared with ESIs in industrialised countries. Ghana already has two distributors— ECG and NED — and the difficulties of a wide geographical coverage may warrant a certain degree of splitting up but some caution will be necessary in view of the well established principle of scale economics. In the particular case of VRA, a strong national utility would be required if VRA was to continue playing an active role in the regional energy market.

VRA currently occupies a position of technical and financial superiority within the West African sub-region. However, VRA has some serious deficiencies. Practically all its power plant project development activities are undertaken by foreign consultants. This over-dependence on foreign consultants could be suppressing its growth towards technological maturity. Thus, the whole ESI in Ghana is characterised by technological dependence and this includes ECG, which has not even been able to develop the institutional capability necessary for conducting its technical and financial operations efficiently. Therefore, a key priority for the industry over the next few decades, would be to seize as many learning opportunities as it can to break out of the technological dependency syndrome by which it now finds itself afflicted.

Drawing on lessons from the ESIs in other developing countries like the Republic of Korea, which have managed to develop technological and managerial capabilities to remarkably high levels, may be a useful exercise for the Ghana ESI. In the case of Korea, between 1960 and 1980, that country quadrupled its GDP per capita from US$ 780 while increasing industrial output and electricity consumption by 25 and 20 times, respectively (UNCTAD 1985). Economic growth was industry driven and electricity played a strategic role with 70% of consumption attributed to the industrial sector. The Korean Government ceased to rely on straight turn-key arrangements with foreign companies for the supply of power equipment and engineering services, from the mid-1970s. From that time onwards, a deliberate technological learning objective was pursued in a determined and systematic manner, with the Korean Electric Power Company (KEPCO) accumulating technological and managerial capabilities covering all its functional areas. There were acquisition within KEPCO and selected Korean firms and these investments in technological learning were reinforced with pay and promotional incentives. By 1987, indigenous technological capacity in Korea had reached such a high level local content ratio for hydro power plants and transmission lines which was nearly 100% and for thermal and nuclear plants, about 92% and 75%, respectively.

These are several technological learning opportunities which the Ghana ESI can take advantage of, in its own process technological accumulation. VRA has embarked on a Generation Expansion Programme which seeks to install between 500 and 1000 MW of thermal power plants over the next 15 years (World Bank 1992). There is also the National Electrification Scheme to which the Government of Ghana is committed and which, if implemented, would see the reach of electricity being extended to all corners of the country over the next 30-years (MFP 1990b). The generation Expansion Programme and National Electrification Scheme represent major technological learning opportunities. A strategic development of Ghana's Hydro resources, alongside the thermal power development programme, could also provide significant opportunities. Other technological learning opportunities include twinning arrangements with utilities in industrialised countries, such as the one that currently exists between VRA and Ontario Hydro of Canada; a similar arrangement for ECG could also prove to be beneficial if it is based on learning and research, such as the School of Engineering of Ghana's only University of Science and Technology, would also provide a bedrock for the accumulation of even deeper technological capabilities.

Conclusions

Ghana at present has two power utilities involved in the electricity sub-sector — VRA (together with NED) and ECG. VRA, on one hand, has managed to maintain very high performance standards throughout its more than 30 years lifetime. ECG, on the other hand, has performed poorly during the greater part of its 26 year history. A key priority for the Ghana ESI, therefore, is to reform its macro-policy environment and institutional framework in order to bring about major improvements in ECG without endangering VRA's position as a leader in the regional electricity market.

Several options for implementing the necessary reforms have been discussed in this paper. A serious deficiency in VRA, in spite of its impressive performance, has also been identified and various technological learning opportunities indicated. Thus, Ghana currently finds itself faced with a range of opportunities which she can either ignore or seize, following the example of Korea and other NICs, to break out of the technological dependency syndrome and further research will be needed to identify those factors that will play a major role in turning this strategic policy decision one way or the other.

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* Senior Lecturer, University of Science and Technology, Kumasi, Ghana.