AICD

AFRICA INFRASTRUCTURE COUNTRY DIAGNOSTIC

COUNTRY REPORT

Ghana's Infrastructure: A Continental Perspective

MARCH 2010

Africa's Infrastructure | A Time for Transformation

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About AICD and its country reports

This study is a product of the Africa Infrastructure Country Diagnostic (AICD), a project designed to expand the world's knowledge of physical infrastructure in Africa. The AICD provides a baseline against which future improvements in infrastructure services can be measured, making it possible to monitor the results achieved from donor support. It also offers a solid empirical foundation for prioritizing investments and designing policy reforms in Africa's infrastructure sectors.

The AICD is based on an unprecedented effort to collect detailed economic and technical data on African infrastructure. The project has produced a series of original reports on public expenditure, spending needs, and sector performance in each of the main infrastructure sectors, including energy, information and communication technologies, irrigation, transport, and water and sanitation. *Africa's Infrastructure—A Time for Transformation*, published by the World Bank and the Agence Française de Développement in November 2009, synthesized the most significant findings of those reports.

The focus of the AICD country reports is on benchmarking sector performance and quantifying the main financing and efficiency gaps at the country level. These reports are particularly relevant to national policy makers and development partners working on specific countries.

The AICD was commissioned by the Infrastructure Consortium for Africa following the 2005 G8 (Group of Eight) summit at Gleneagles, Scotland, which flagged the importance of scaling up donor finance for infrastructure in support of Africa's development.

The first phase of the AICD focused on 24 countries that together account for 85 percent of the gross domestic product, population, and infrastructure aid flows of Sub-Saharan Africa. The countries are: Benin, Burkina Faso, Cape Verde, Cameroon, Chad, Côte d'Ivoire, the Democratic Republic of Congo, Ethiopia, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, South Africa, Sudan, Tanzania, Uganda, and Zambia. Under a second phase of the project, coverage was expanded to include as many as possible of the additional African countries.

Consistent with the genesis of the project, the main focus is on the 48 countries south of the Sahara that face the most severe infrastructure challenges. Some components of the study also cover North African countries so as to provide a broader point of reference. Unless otherwise stated, therefore, the term "Africa" is used throughout this report as a shorthand for "Sub-Saharan Africa."

The World Bank has implemented the AICD with the guidance of a steering committee that represents the African Union, the New Partnership for Africa's Development (NEPAD), Africa's regional economic communities, the African Development Bank (AfDB), the Development Bank of Southern Africa (DBSA), and major infrastructure donors.

Financing for the AICD is provided by a multidonor trust fund to which the main contributors are the United Kingdom's Department for International Development (DFID), the Public Private Infrastructure Advisory Facility (PPIAF), Agence Française de Développement (AFD), the European Commission, and Germany's Entwicklungsbank (KfW). A group of distinguished peer reviewers from policy-making and academic circles in Africa and beyond reviewed all of the major outputs of the study to ensure the technical quality of the work. The Sub-Saharan Africa Transport Policy Program and the Water and Sanitation Program provided technical support on data collection and analysis pertaining to their respective sectors.

The data underlying AICD's reports, as well as the reports themselves, are available to the public through an interactive Web site, www.infrastructureafrica.org, that allows users to download customized data reports and perform various simulations. Many AICD outputs will appear in the World Bank's Policy Research Working Papers series. Inquiries concerning the availability of data sets should be directed to the volume editors at the World Bank in Washington, DC.

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Synopsis

Infrastructure contributed just over one percentage point to Ghana's improved per capita growth performance during the 2000s, though unreliable power supplies held growth back by 0.5 percentage points. Raising the country's infrastructure endowment to that of the region's middle-income countries could boost annual growth by more than 2.7 percentage points.

Today, Ghana has a very advanced infrastructure platform when compared with other low-income countries in Africa. But as the country approaches the middle-income threshold, it will need to focus on upgrading its infrastructure indicators in line with this benchmark.

Ghana has succeeded in increasing household access to telephone, power, and water services by developing its national infrastructure backbones. Moreover, its success in service coverage is not confined to urban areas—rural water, electricity, and GSM coverage rates are similarly impressive. Very high shares of the country's paved and unpaved roads are in good or fair condition. Institutional reforms have been adopted in the ICT, ports, and roads, and reforms of the water utility have substantially reduced the hidden costs of the sector.

Ghana's most pressing challenges lie in the power sector, where rapid demand growth and periodic hydrological shocks leave the country increasingly reliant on expensive oil-based generation. Ghana's power tariffs are based on the costs of baseload hydropower priced at $0.05 per kilowatt-hour. However, the oil-based generation used to meet incremental demand is priced at more thn $0.20. Since there is no mechanism for automatically adjusting tariffs, this situation generates annual financial losses for the Volta River Authority (VRA) of $400 million—3 percent of GDP. The solution is to diversify the generation portfolio toward gas-fired plants that can deliver backup thermal power for around $0.07 per kilowatt-hour. This process is underway.

Despite Ghana's success with increasing access to infrastructure services, the quality of service remains low. Perhaps the most dramatic case is in the water sector, where exceptionally high losses divert more than half of water produced, leaving little to reach end customers, who are thus exposed to intermittent supplies. Until this issue is resolved, Ghana's recent technical achievement of the Millennium Development Goal for water supply will remain a hollow victory. Power supply is also increasingly subject to reliability problems that stem from neglect of aging transmission and distribution assets. Even in mobile telephony, the increasing rate of dropped calls has become a concern. This overall pattern suggests that Ghana may benefit from a systematic framework for regulating the quality of public services.

With respect to regional integration, Ghana is maintaining its international road corridors but lacks power and ICT connectivity with its neighbors. The Port of Tema is becoming a transit gateway to the landlocked hinterland, but the continuing success of the Ghana Gateway program will depend on tackling capacity constraints at the port.

Addressing Ghana's infrastructure challenges will require sustained expenditure of almost $2.3 billion per year over the next decade, split fairly evenly between investment and operations, on the one hand, and maintenance, on the other. That level of spending is equivalent to just over 20 percent of GDP, comparable to what China has spent in recent years but a significant stretch for Ghana's economy. More than half of spending needs relate to the power sector.

Ghana already spends approximately $1.2 billion per year on infrastructure, equivalent to about 7.5 percent of GDP. A further $1.1 billion a year is lost to inefficiencies, the bulk of which are associated with the underpricing of power. Relative to the country's African peers, subsidy-related losses in the power sector are relatively high. This need not be so. Ghana's urban population is relatively well-off, and cost-recovering tariffs should be possible.

Ghana's annual infrastructure funding gap is about $0.4 billion per year, most of which is associated with power and water. Following its recent oil discoveries, Ghana is in a position to raise additional public funding for infrastructure from increased fiscal receipts. It should also be possible to capture more private finance for infrastructure. Overall, Ghana's infrastructure situation is hopeful. There are several strong areas on which to build, and the country has a solid economic base from which to fund incremental efforts.

The continental perspective

The Africa Infrastructure Country Diagnostic (AICD) has gathered and analyzed extensive data on infrastructure in more than 40 Sub-Saharan countries, including Ghana. The results have been presented in reports covering different areas of infrastructure, including ICT, irrigation, power, transport, water, and sanitation, and different policy areas, including investment needs, fiscal costs, and sector performance.

This report presents the key AICD findings for Ghana and allows the country's infrastructure situation to be benchmarked against its African peers. Given that Ghana is a relatively well-off low-income country well on its way to reaching middle-income status, two sets of African benchmarks will be used to evaluate Ghana's situation. Detailed comparisons will also be made with immediate regional neighbors in the Economic Community of West African States (ECOWAS).

Several methodological issues should be borne in mind. First, because of the cross-country nature of data collection, a time lag is inevitable. The period covered by the AICD runs from 2001 to 2006. Most technical data presented are for 2006 (or the most recent year available), while financial data are typically averaged over the available period to smooth out the effect of short-term fluctuations. Where possible, data have been collected for the period 2007 to 2009 with a view to measuring progress made relative to the baseline. Second, in order to make comparisons across countries, we had to standardize the indicators and analysis so that everything was done on a consistent basis. This means that some of the indicators presented here may be slightly different from those that are routinely reported and discussed at the country level.

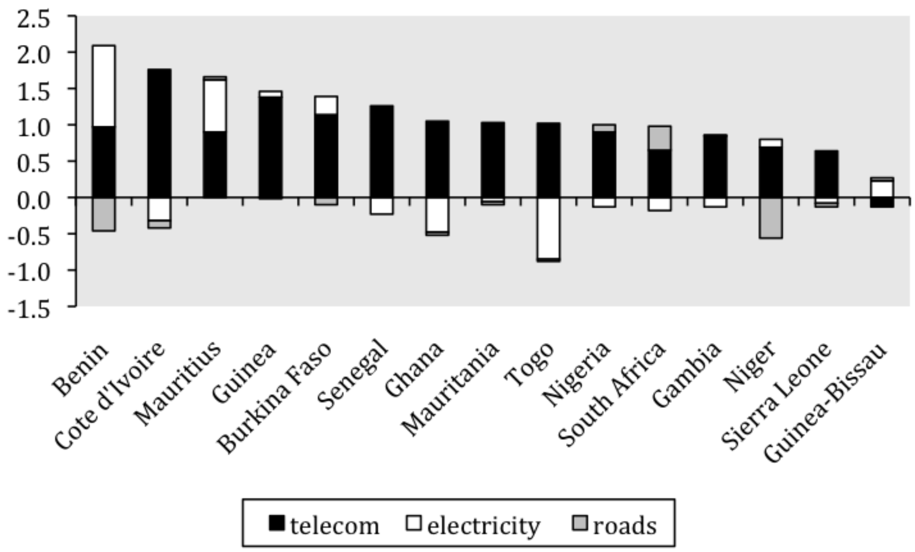
Why infrastructure matters

As on the rest of the continent, West Africa's growth performance improved markedly in the 2000s. The overall improvement in per capita growth rates has been estimated at around 2 percent, of which 1.1

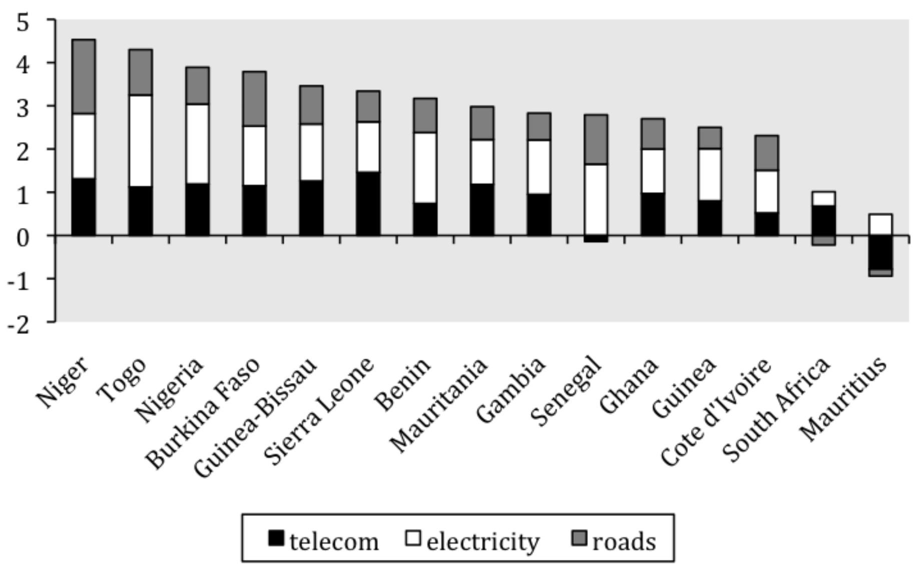
percent is attributable to better structural policies and 0.9 percent to improved infrastructure. During the five years from 2003 to 2007, Ghana's economy grew at an average annual rate of 5.6 percent, which accelerated to 7.3 percent in 2009. Ghana's infrastructure improvements added just over one percentage point to the per capita growth rate for the period 2003 to 2007 (figure 1a).

Figure 1. Infrastructure has contributed much to economic growth—but could contribute much more

a. Infrastructure's contribution to annual per capita economic growth in selected countries, 2003–07, in percentage points



b. Potential contributions of infrastructure to annual per capita economic growth in selected countries, in percentage points



Source: Calderon 2009.

Interestingly, the impact was not as large as in other neighboring West African countries such as Benin, Cote d'Ivoire, and Senegal. It is striking that this boost to growth came exclusively from the ICT revolution. By contrast, Ghana's power sector held back the per capita growth rate by as much as 0.5 percentage points over the same period, while the road sector did not seem to have any major impact on growth performance.

Looking ahead, simulations suggest that if Ghana's infrastructure could be improved to the level of the African leader, Mauritius, annual per capita growth rates would be 2.7 percentage points higher than they are at present. This impact would come broadly from improvements across the three main infrastructure sectors (figure 1b).

The state of Ghana's infrastructure

Ghana's territory is relatively flat and dominated by the Volta River, within whose catchment the entire national territory is nested (figure 2c). The spatial distribution of Ghana's economy shows marked differences between north and south. Most of the country's larger cities are in the south, which has relatively high population density and low poverty rates (figures 2a and 2b). Meanwhile, the north is relatively sparsely populated but with very high incidence of poverty. This pattern also reflects underlying economic activity. Ghana's mineral resources, mainly precious metals, are concentrated in the southwest of the country, along with more recent oil discoveries along the coast (figure 2d). Most of the country's agricultural production takes place in the center and center-north of the country. The north has significant tracts of land with high agricultural value that are not being fully exploited.

The distribution of Ghana's infrastructure networks generally reflects the spatial distribution of economic activity, with a greater density of transport, power, and ICT infrastructure in the south and southwest of the country than in the north (figures 3a, 3b, and 3c). Nevertheless, unlike many other African countries, Ghana's infrastructure backbones cover the entire national territory and help to integrate the different regions. Two road corridors linking north and south, a national power grid, and an ICT backbone interconnect all major population centers. By African standards, Ghana also has extensive water resource infrastructure and some significant pockets of irrigation (figure 3d).

In terms of regional integration, the picture is mixed. Ghana is connected to the SAT3 submarine cable along the west coast of Africa but lacks fiber optic land links with its neighbors (figure 3c). Ghana is interconnected with power transmission lines to Cote d'Ivoire, and with Nigeria via Benin and Togo through the West Africa Gas Pipeline (figure 3b). Further energy interconnections are planned as part of the West Africa Power Pool. Important regional road corridors also run through Ghana, including a portion of the coastal route from Lagos to Dakar and an important north-south road route into Burkina Faso (figure 3a). Most of these routes are in good to fair condition.

This report begins by reviewing the main achievements and challenges in each of Ghana's major infrastructure sectors, with the key findings summarized below (table 1). Thereafter, attention turns to the problem of how to finance Ghana's outstanding infrastructure needs.

Table 1. Achievements and challenges in Ghana's infrastructure sectors

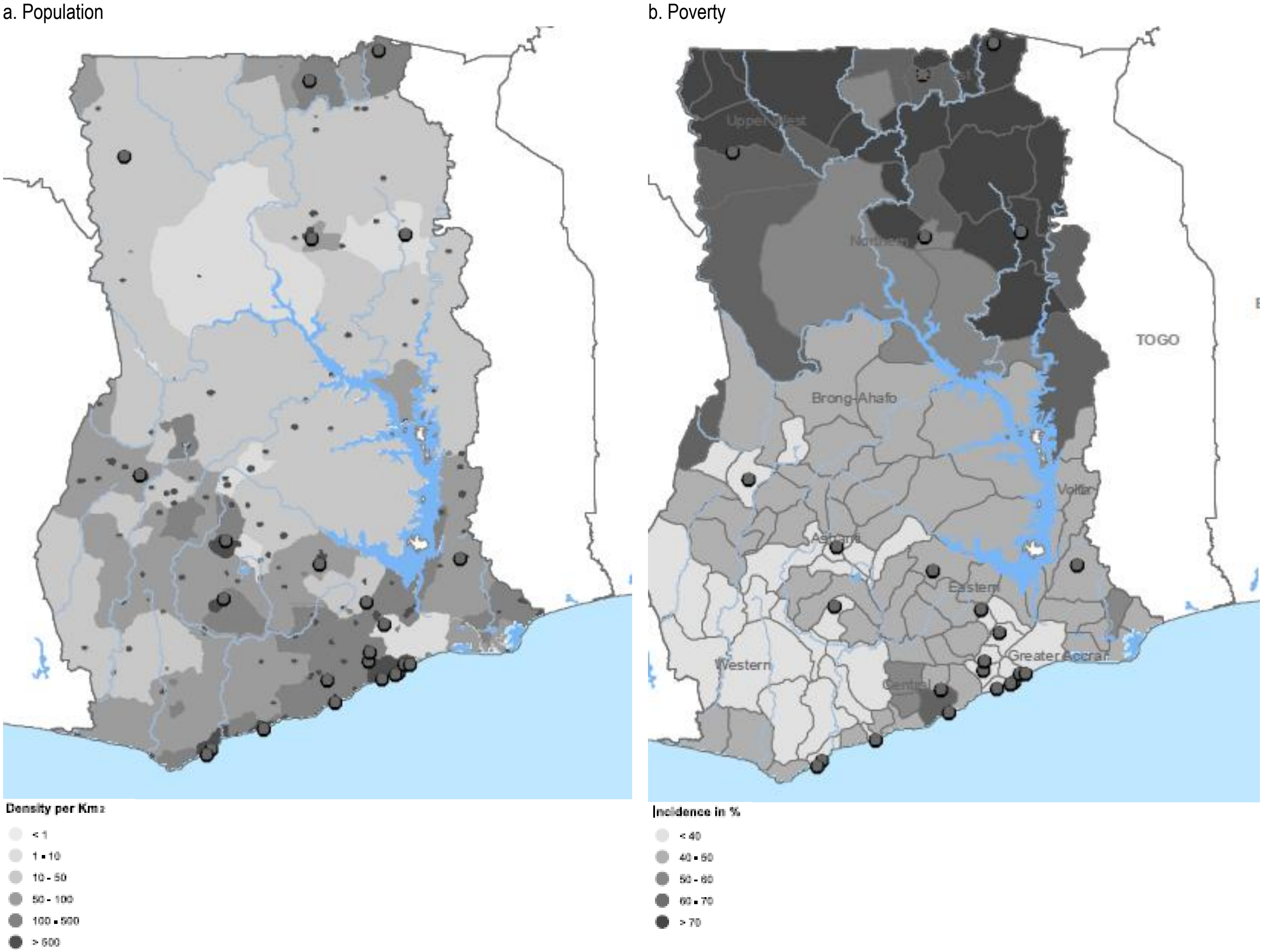
	Achievements	Challenges
Air transport	Emerging role of Accra in serving sub-region, renewal of aircraft fleet.	Improving air safety and security
ICT	Very competitive market with high levels of mobile penetration at relatively low cost	Improving the quality of mobile services Harnessing market to complete universal access agenda (Internet and mobile)
Ports	Advanced institutional reform and private sector participation.	Alleviating capacity constraints that are currently holding back performance
Power	Well endowed with generation capacity Good electrification rate	Improving resilience to hydrological shocks by developing gas-fired power and upgrading aging transmission network Tackling huge hidden costs due to underpricing
Railways		Funding the rehabilitation of the network Improving performance of GRC to recapture mining traffic
Roads	Good performer on road network, both in terms of financing and road network quality	Preserving the real value of the fuel levy. Improving rural connectivity.
Water resources	Substantial volume of water storage available by Africa standards.	Strengthening capacity of new River Basin Organization Developing irrigation potential
Water and sanitation	Reached MDG for water Significant improvements in utility finances	Improving reliability of water supply Reducing non-revenue water Reaching the MDG for sanitation

Source: Authors' elaboration based on findings of this report.

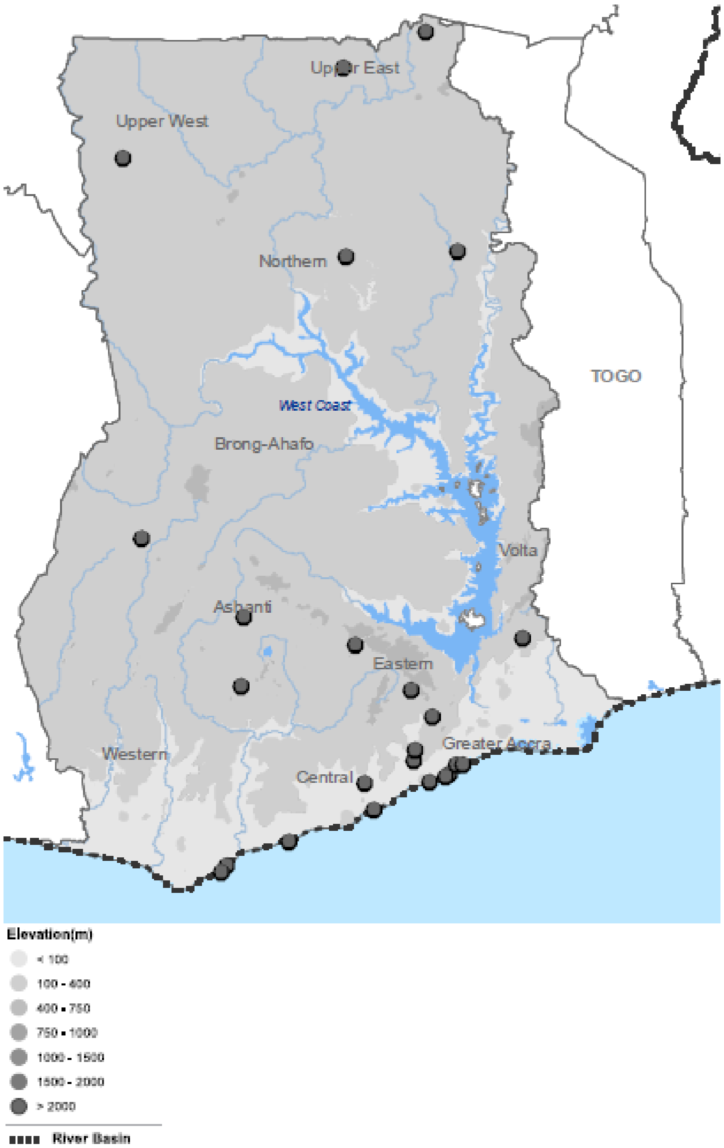
Figure 2. Ghana's population, income, and mineral resources are concentrated in the southern half of the country

a. Population

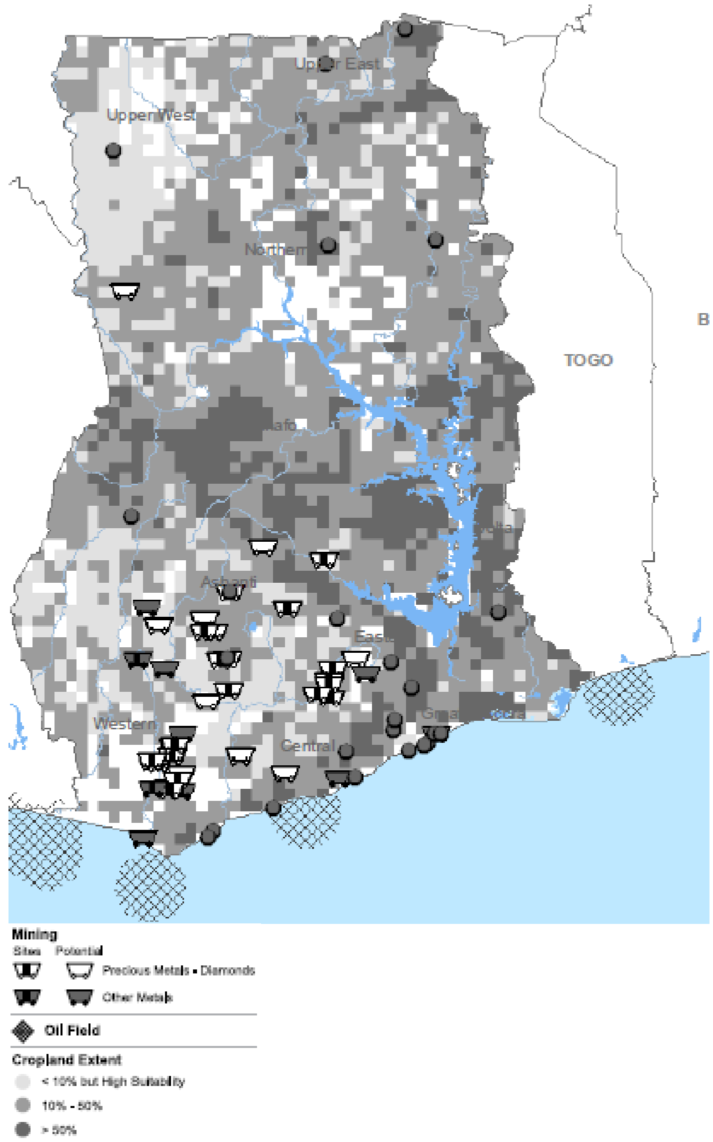
b. Poverty



c. Topography



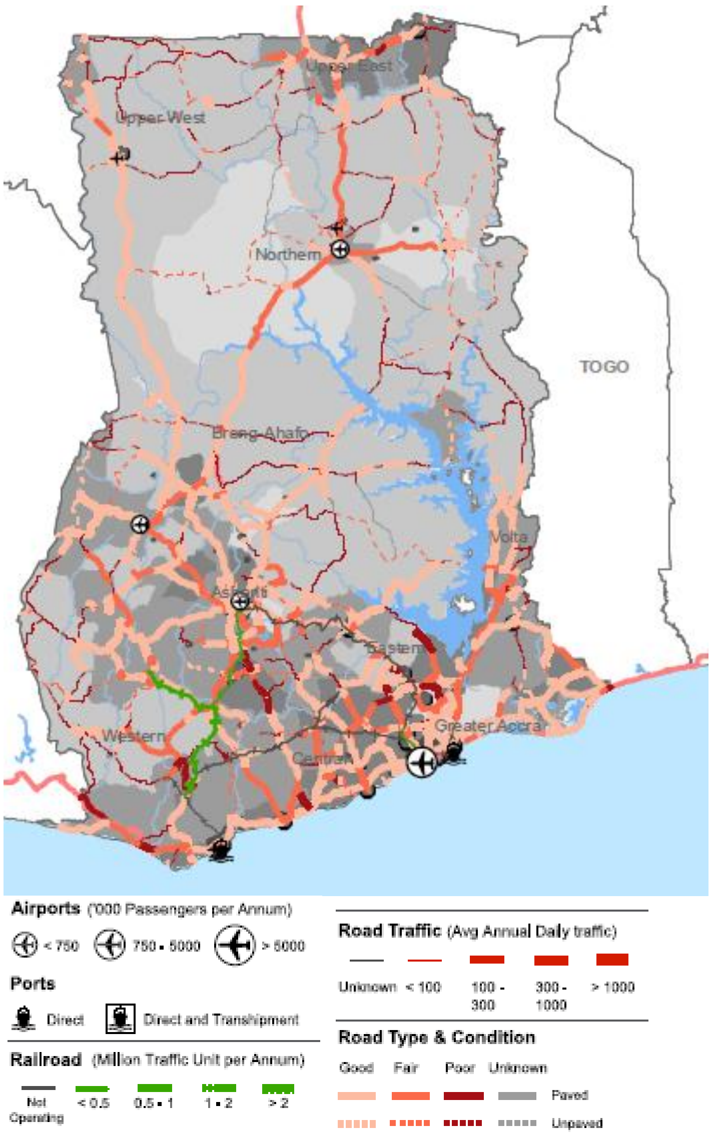
d. Natural resources



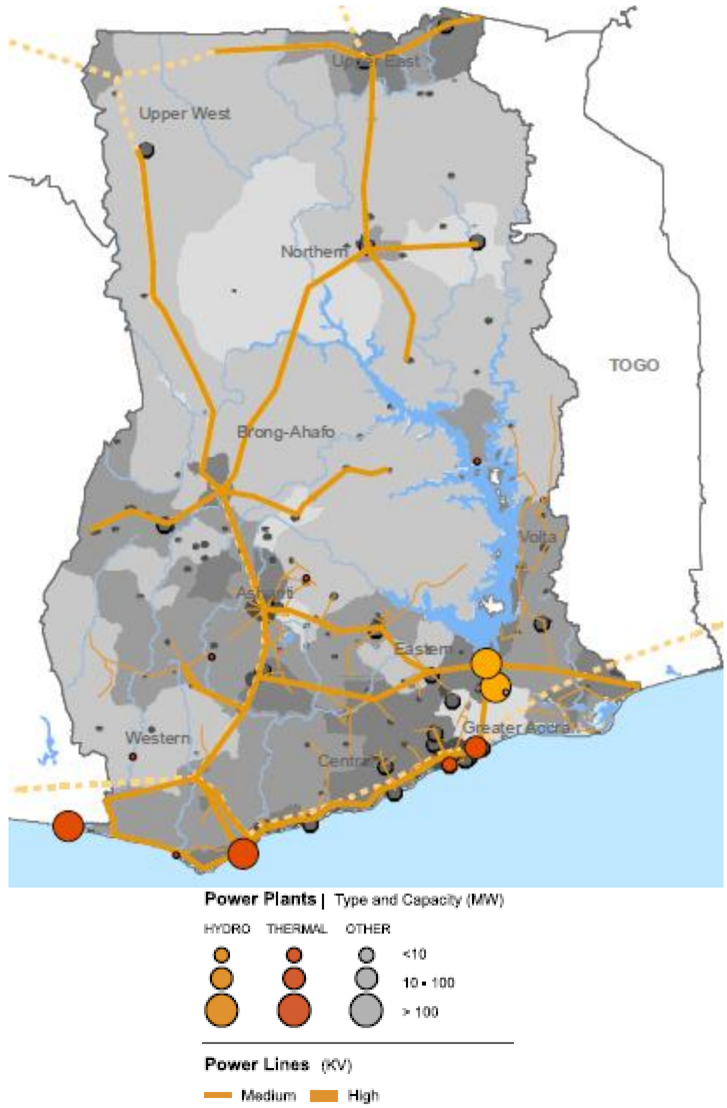
Source: AICD Interactive Infrastructure Atlas for Ghana, downloadable from http://www.infrastructureafrica.org/aicd/system/files/gha_new_ALL.pdf

Figure 3. Ghana's infrastructure networks follow population density

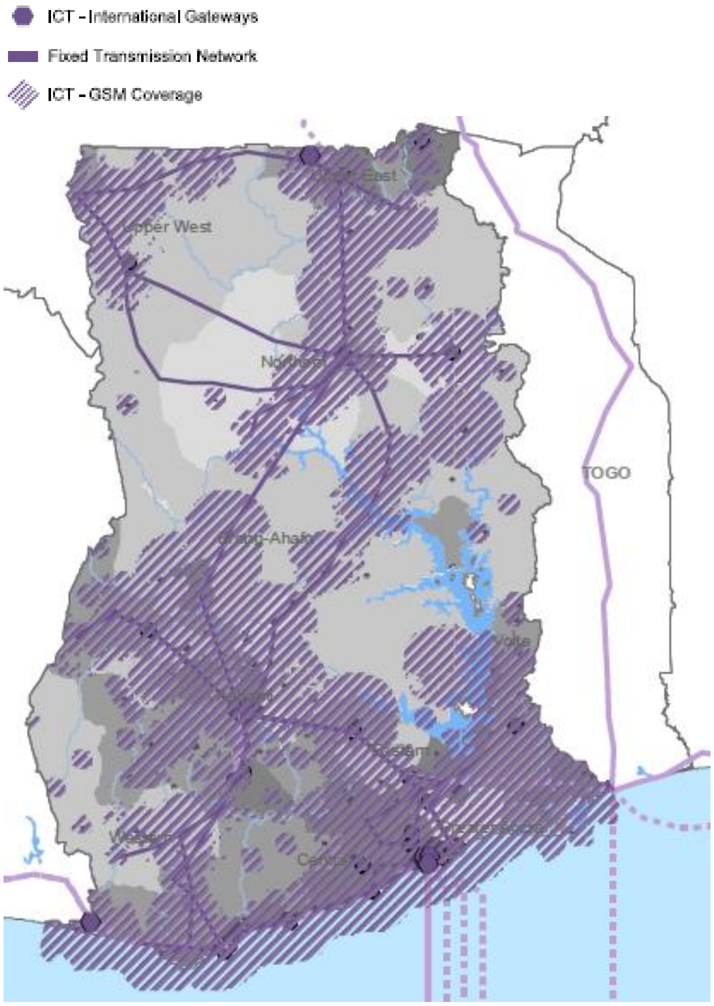
a. Roads



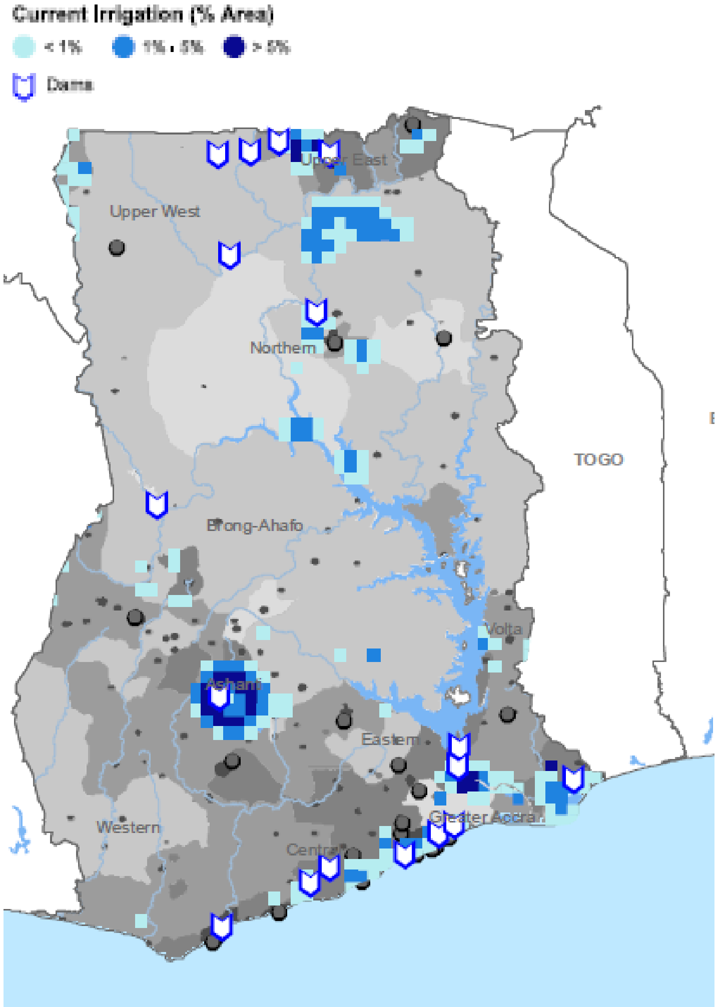
b. Power



c. ICT



d. Water



Source: AICD Interactive Infrastructure Atlas for Ghana, downloadable from http://www.infrastructureafrica.org/aicd/system/files/gha_new_ALL.pdf

Roads

Achievements

Ghana's road transport indicators are strong. By almost all measures, they are well ahead of those found among low-income peers and nearing the levels expected of a middle-income country (table 2). The length of the main (primary and secondary) network is more than adequate to achieve regional and national connectivity. The record on road network quality is quite reasonable, with 75 percent of the paved network in good or fair condition and, more impressive, 74 percent of the unpaved network in good or fair condition.

Underpinning these achievements has been a serious reform of road sector institutions that has resulted in the creation of a second generation road fund and road agency. Ghana meets almost all of the best practice guidelines for road sector institutions. The country has also adopted a fuel levy ($0.06 per liter) that, as of 2006, was commensurate with road maintenance needs (figures 4 and 5). In contrast to other African countries, Ghana allocates its road fund resources much more evenly across the different road networks—rural and urban roads receive 30 and 25 percent of the total, respectively. Overall, Ghana has allocated substantial resources to the road sector in recent years; it spends on average 1.5 percent of GDP on roads, one of the highest shares in West Africa.

Table 2. Ghana's road indicators benchmarked against Africa's low- and middle-income countries

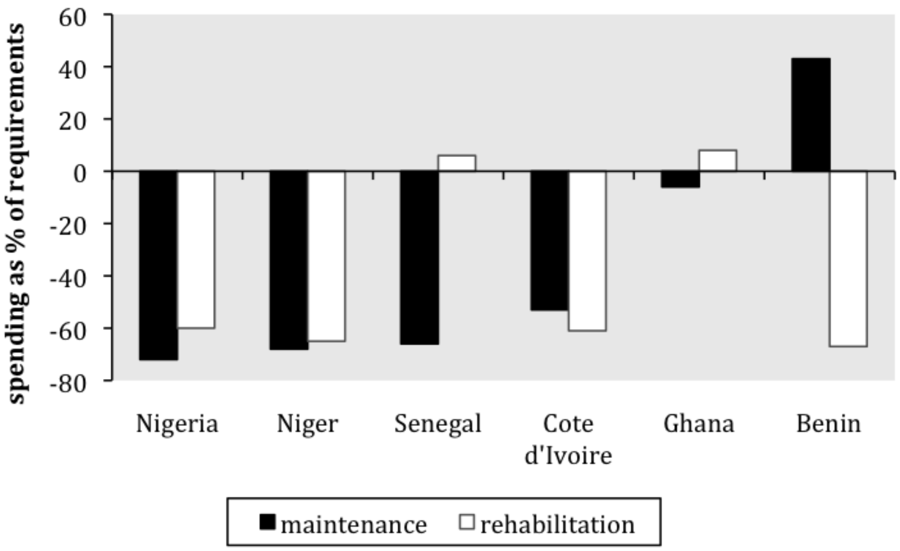
	Unit	Low-income countries	**Ghana**	Middle-income countries
Paved road density	km/1000 km^2 of arable land	86.6	**158.1**	507.4
Unpaved road density	km/1000 km^2 of arable land	504.7	**804.0**	1,038.3
GIS rural accessibility	% of rural population within 2 km of all-season road	21.7	**24.0**	59.9
Paved road traffic	Average annual daily traffic	1,049.6	**1,314**	2,786.0
Unpaved road traffic	Average annual daily traffic	62.6	**40.4**	12.0
Paved network condition	% in good or fair condition	80.0	**75.0**	79.0
Unpaved network condition	% in good or fair condition	57.6	**74.0**	58.3
Perceived transport quality	% firms identifying roads as major business constraint	23.0	**17.6**	10.7

Source: Gwillliam and others 2009. Derived from AICD national database, downloadable from http://www.infrastructureafrica.org/aicd/tools/data

Challenges

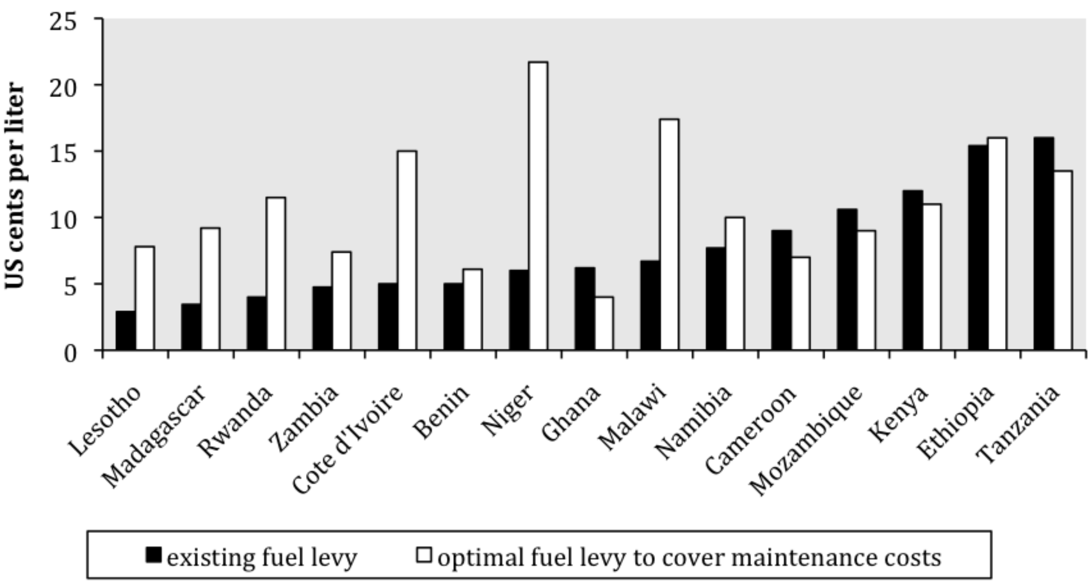
In recent years, the depreciation of the national currency has gradually eroded the real value of the fuel levy. Adjusting its value is essential if Ghana is to sustain its relatively good performance on road network preservation. The absolute value of the existing fuel levy is already relatively low by African standards—about half the levels found in Ethiopia, Kenya, and Tanzania—which suggests that a revision to preserve the real value of the levy should not be overly burdensome for the transportation sector.

Figure 4. Ghana's spending is commensurate with maintenance and rehabilitation needs



Source: Gwillliam and others 2009.

Figure 5. Ghana's fuel levy, though relatively low, appears to be aligned with maintenance needs



Source: Gwillliam and others 2009.

Although rural road quality is remarkably good, the physical extension of the rural network appears inadequate. According to GIS analysis, only 24 percent of Ghana's rural population lives within two kilometers of an all-season road. This is well below the 60 percent found in Africa's middle-income countries. Due to the spatial distribution of Ghana's rural population, raising the index to 100 percent would require a 200 percent increase in the length of the country's classified road network. But if the objective were modified to ensure that there is good road accessibility to land that produces 80 percent of Ghana's agricultural production by value, the requirements shrink substantially. A rural road network of some 6,400 kilometers would suffice for this purpose. By comparison, 13,000 kilometers would be needed to put even 50 percent of the rural population within two kilometers of an all-season road.

Beyond the issue of rural network extension, there is the question of the appropriate standards for rural roads. Spatial analysis of the network suggests that about 30 percent of the rural network may be under-engineered, meaning that it consists of earth roads with traffic levels typically considered high enough to justify gravelling(above 30 vehicles per day). By contrast, some 20 percent of the main road network appears to be over-engineered, meaning that it consists of paved roads with traffic levels not typically considered adequate to justify paving (below 300 vehicles per day).

Finally, like many other African countries, Ghana has focused on developing its road network without taking a broader multi-modal view of surface transport issues. In particular, Ghana has not yet fully explored the scope for inland navigation on the Volta River. Inland navigation has a number of advantages over road transportation for commodities that are not overly time sensitive. In particular, the capital costs associated with establishing basic navigation infrastructure are typically quite modest in relation to the cost of a road or rail network, while the operating costs of transporting goods by river tend to be significantly lower than the equivalent road or rail costs. The Volta Lake and River along the eastern side of the country connects various high value agricultural production areas and therefore should be considered as another transportation option for the country.

Rail

Achievements

Ghana Railways Company (GRC) is a purely national operation without any connections to rail service in other countries. The network forms a triangle that links Accra-Kumasi-Takoradi, though only the Kumasi-Takoradi segment has been operational in recent years. This reflects the main pattern of traffic on the railway, namely the transfer of bauxite and manganese from the mining areas around Kumasi to the Port of Takoradi.

Challenges

In recent years, GRC has been increasingly unable to carry the full volume of mining traffic. A combination of lack of rolling stock, poor quality of infrastructure, and low associated speeds (as well as occasional strikes) diverted a growing share of mineral traffic to the road network, at an additional cost of $1 per tonne for the manganese ore and more for bauxite.

Relative to other railways in West Africa, GRC has modest traffic levels and operational performance that ranges from mediocre to lackluster (table 3). For example, freight wagon productivity is about half of best practice levels. Tariffs are just over $0.02 per tonne-kilometer, which is typical for West Africa, though significantly lower than those found in Central and Southern Africa.

There has been some discussion about the possibility of awarding a concession contract for GRC as a basis for financing the upgrade and possible expansion of the rail infrastructure. More than a dozen African railways are now operating under concession agreements. In the best cases, these concession arrangements have helped to improve the railway's operational performance and to reverse the downturn in rail traffic. However, despite initial expectations, none of the rail concessions has succeeded in financing major track rehabilitation, with the limited investments made being confined to purchases of rolling stock. The basic reason for this is that the traffic volumes on almost all African railways are well below the 1 to 1.5 million net tonnes of traffic needed per year needed to generate sufficient cash flow for investment finance, particularly given that rail tariffs are constrained by intense intermodal competition from the trucking sector. As a result, track upgrades have ultimately been funded by government borrowing from international financial institutions. In the case of Ghana, traffic is not much more than 0.2 million tonnes, making it improbable that track improvements could be funded by the private sector.

Table 3. Railway indicators for Ghana and selected other countries, 2000–05

	GRC (Ghana)	OCBN (Benin)	SITARAIL (Cote d'Ivoire – Burkina Faso)	NRC (Nigeria)	TRANSRAIL (Senegal - Mali)	CAMRAIL (Cameroon)	SPOORNET (South Africa)
Concessioned (1)/ state-run (0)	**1**	0	1	1	1	1	0
Traffic density, freight, 1,000 tonne-km/km	**242**	148	494	15	318	1,091	5,319
EFFICIENCY:							
Staff: 1000 UT per staff	**84**	40	481	37		603	3,037
Coaches: 1000 passenger-km per coach	**416**	900	862	737		4,738	596
Cars: 1000 ton-km per wagon	**458**	74	1020	59	804	868	925
Locomotive availability in %	**7**	3	35	13	40	26	—
TARIFFS:							
Average unit tariff, freight, US cents/tonne-km	**2.4**	2.0	3.3	—	2.2	2.2	—
Average unit tariff per passenger US cents/passenger-km	**4.4**	5.8	5.5	—	3.3	5.2	—

Source: Bullock 2009.

Derived from AICD rail operator database, downloadable from http://www.infrastructureafrica.org/aicd/tools/data

— = data not available.

Ports

Achievements

Ghana has made significant progress in modernizing its ports sector and is committed to making further improvements. It is one of the few African countries in the process of adopting the landlord model, which has become the preferred institutional framework for the sector around the world. At the national level, stevedoring operations have been privatized. The Port of Tema awarded a container terminal concession in 2006, and dry-bulk handling operations are fully privatized. Further concessions are envisaged at the Port of Takoradi, where major new terminal developments are planned.

Ghana's two major ports, at Tema and Takoradi, are large relative to other West African ports (table 4). Demand for both container and general cargo services has more than doubled over the period 1998-2006. Under the Ghana Gateway Program, the ports sector is being developed within an explicit framework of regional integration to ensure smooth transit to the landlocked hinterland countries. Due to the civil war in Côte d'Ivoire, significant traffic has been diverted from that country to Ghana. As a result, transit traffic has increased markedly in recent years to a total of over 10,000 TEUs.

Challenges

As a result of burgeoning demand, ports in Ghana (and the Port of Tema in particular) have become heavily congested. The port has a container handling design capacity of around 375,000 TEUs per year but has been handling 420,000 TEUs in recent years. The congestion problem lies behind a number of shortcomings in the port's performance, and these can be addressed only once the capacity increases.

In terms of performance, the Port of Tema exhibits relatively long delays on container dwell time and truck cycle time (table 4). Pre-berth waiting time compares reasonably well with performance elsewhere in West Africa, while cargo vessel turnaround time is no better than the average. Crane productivity in Ghana, although reasonable, falls significantly short of best practice in the region. For example, general cargo crane productivity is 13.5 moves per hour in the Port of Tema compared with 25 moves per hour in the Port of Durban. The Ghana Ports and Harbor Authority (GPHA) has set a target of 24 moves per hour, but this will be difficult to achieve until the current congestion is alleviated.

Ghana's port handling charges fall toward the middle of the range observed in Africa (see table 4). Nonetheless, the GPHA has set the target of lowering container handling charges from $168 per move to $80 per move. Achieving this goal will require alleviating capacity constraints and strengthening competition within the port.

More broadly, West Africa lacks a clear maritime hub. Abidjan had begun to play that role, but with the advent of the political crisis in Côte d'Ivoire, major shipping lines diverted their West Africa operations to Malaga (Spain) or Tangiers (Morocco). It remains to be seen whether improvements in West Africa's port operations – such as those underway in Ghana – will entice international shipping lines to return and which port will be best positioned to play such a role in the future.

Air transport

Achievements

Ghana's air transport market is small in absolute terms and middle of the range in the African context; it amounts to less than 2 million seats per year across all traffic categories (table 5). The domestic market developed only recently and remains small, with five domestic routes served by a single carrier in 2007. The bulk of Ghana's air transport market is international and about evenly divided between intra-African and inter-continental flights. By far the best served route is that connecting Ghana to Nigeria, which is also the most important route within the ECOWAS area. International service is highly competitive, with a Herfindahl index of only 6.4 percent.

Table 4. Benchmarking port indicators: Tema and Takoradi compared with other ports

	Takoradi (Ghana)	**Tema (Ghana)**	Apapa (Nigeria)	Dakar (Senegal)	Abidjan (Cote d'Ivoire)	Cotonou (Benin)	Mombasa (Kenya)	Durban (South Africa)
CAPACITY								
Actual container handled ('000sTEU/year)	**51**	**471**	336	306	500	158	437	1,899
Actual general cargo handled ('000s tonnes/year)	**4,300**	**7,900**	3,400	6,109	NA	1,100	12,980	16,100
General cargo handling capacity ('000s tonnes/year)	**5,500**	**8,500**	5,000	NA	NA	2,500	1,500	NA
EFFICIENCY								
Average container dwell time in terminal (days)	**NA**	**25**	42	7	12	12	5	4
Average truck processing time for receipt and delivery of cargo (hours)	**NA**	**8**	6	5	2.5	6	4.5	5
General cargo vessel pre-berth waiting time (hours)	**3**	**9.6**	NA	24	2.9	48	36	NA
General cargo vessel turnaround time (hours)	**52.8**	**48**	NA	60	2.2	48	48	NA
Average container crane productivity (containers loaded/unloaded per crane hour)	**NA**	**13**	12	NA	18		10	15
Average general cargo crane productivity (tons loaded/unloaded per crane working hour)	**10**	**13.5**	9	NA	16	15	20.82	25
TARIFFS								
Average container handling charge, ship to gate (US$/TEU)	**NA**	**168**	155	160	260	180	67.5	258
Average general cargo handling charge, ship to gate (US$/tonne)	**7.0**	**10.0**	8.0	15.0	13.5	8.5	6.5	8.4
Average dry bulk handling charge, ship to gate or rail (US$/tonne)	**2.5**	**3.0**	NA	5.0	5.0	5.0	5.0	1.4
Average liquid bulk handling charge, ship to gate or rail (US$/tonne)	**1.5**	**1.5**	1.0	4.0	NA	NA	NA	NA

Source: Mundy and Penfold 2008.

Derived from AICD ports database, downloadable from http://www.infrastructureafrica.org/aicd/tools/data

TEU = 20-foot equivalent units.

Across the region, there has been a tendency for aircraft fleets to be renewed and scaled down in size to facilitate consolidation of routes toward a hub and spoke system. The aircraft fleet serving Ghana has renewed rapidly in recent years, and the share of the fleet that comprises aircraft of recent manufacture rose from 52 percent in 2001 to 97 percent in 2007, which puts Ghana ahead of many of its neighbors. On the other hand, only about 16 percent of aircraft serving Ghana are in the small or medium size category, a share much lower than that of neighboring countries.

Table 5. Benchmarking air transport indicators for Ghana and other countries

Country	Ghana	Nigeria	Côte d'Ivoire	Senegal	Kenya	Tanzania
TRAFFIC (2007)						
Domestic seats (millions per year)	0.14	9.30	0	0.13	2.09	1.87
Seats for international travel within Africa (millions per year)	0.91	1.37	0.85	1.26	3.14	1.27
Seats for intercontinental travel (millions per year)	0.83	2.44	0.30	1.23	2.76	0.59
Seats available per capita	0.08	0.09	0.06	0.23	0.28	0.12
Herfindahl index – domestic market (%)	100.0	18.0	-	100.0	60.5	31.0
Herfindahl index – international market (%)	6.4	6.4	9.8	10.3	34.1	13.0
QUALITY						
Percentage of seat km in medium or smaller aircraft	15.7	29.6	52.3	39.3	23.3	48.6
Percentage of seat km in newer aircraft	96.8	71.4	90.8	98.3	80.2	79.3
Registered carriers on EU blacklist	0	0	0	0	0	0
FAA/IASA Audit Status	Fail	No audit	Fail	No audit	No audit	No audit
Percent of carriers passing IATA/IOSA Audit	0	28.6	0	50.0	11.1	33.3

Source: Bofinger 2008. Derived from AICD national database, downloadable from http://www.infrastructureafrica.org/aicd/tools/data

Challenges

Like many African countries, Ghana continues to face significant safety and security issues in air transport. Ghana failed the FAA/IASA Audit and none of its carriers has passed the IATA/IOSA audit.

More broadly, West Africa lacks a clear air transportation hub to play the role that airports such as Addis Ababa, Johannesburg, and Nairobi are playing on the other side of the continent. Abidjan, Accra, Dakar, and Lagos each play a significant role with respect to their immediate neighbors, but connectivity between each of these zones is much more limited and as a result connections can be much more complicated.

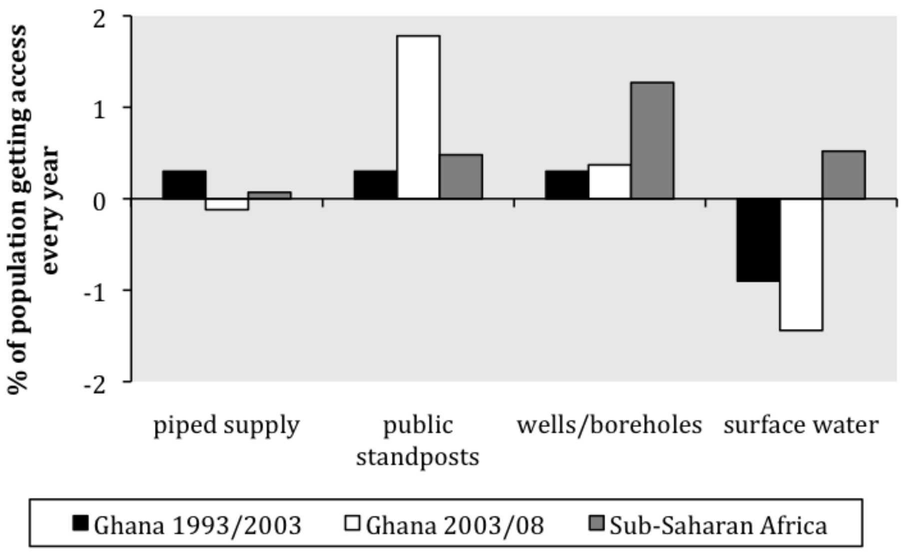
Water supply and sanitation

Achievements

Ghana is one of only five African countries that have already achieved the MDG target for water supply. According to DHS survey evidence, the percentage of households with access to an improved drinking water source rose from 69 percent in the 2003 survey to 84 percent in the 2008 survey, exceeding the MDG target of 76 percent.

Compared with other low-income African countries, Ghana has a relatively large share of the population relying on utility water (private or public taps). In the mid-2000s, 25 percent of Ghanaian households reported access to utility water of some kind, well ahead of the 26 percent in the low-income peer group, but still far behind the 76 percent in the middle-income peer group. By 2008, that figure had exceeded 40 percent (table 6). During the period 2003-08, coverage of stand posts in Ghana rose by 1.8 percent of the population per year and reliance on surface water declined by 1.4 percent of the population per year (figure 6). Nevertheless, as of 2008, about 11 percent of the population continued to rely on surface water.

Figure 6. Ghana has improved access to standposts while reducing reliance on surface water



Source: Banerjee and others 2009.

Rural water reforms played an important role in reducing the reliance on surface water. Ghana is relatively advanced in the adoption of rural water reforms, including a rural water policy, dedicated agency and funding source, and a move toward cost recovery for rural water services. Cross-country analysis indicates that surface water reliance tends to decline more rapidly in countries that have adopted these kinds of reform measures. In rural areas of Ghana, surface water reliance reduced substantially, from 47 percent in 1993 to 32 percent in 2003 and 18 percent in 2008.

Table 6. Benchmarking water and sanitation indicators

	Unit	Low-income countries	Ghana		Middle-income countries
		Mid 2000s	**Mid 2000s**	**Late 2000s**	Mid 2000s
Access to piped water	% pop	10.1	**15.1**	**13.1**	56.4
Access to stand posts	% pop	16.1	**20.5**	**27.5**	20.4
Access to wells/boreholes	% pop	38.3	**42.1**	**40.1**	6.3
Access to surface water	% pop	33.8	**20.1**	**11.1**	13.9
Access to septic tanks	% pop	5.3	**10.3**	**14.1**	44.0
Access to latrines	% pop	57.2	**63.1**	**62.5**	33.9
Open defecation	% pop	37.1	**24.6**	**23.1**	15.8
Domestic water consumption	liter/capita/day	72.4			NA
Urban water assets in need of rehabilitation	%	35.5	**42.0**		25.0
Revenue collection	% sales	96.0	**75.0**	**95.0**	99.2
Distribution losses	% production	33.0	**53.0**	**50.8**	23.1
Cost recovery	% total costs	56.0	**48.4**	**61.8**	80.6
Total hidden costs as % of revenue	%	130.0	**183.7**	**128.9**	84.9

U.S. cents per m^3	Ghana		Scarce water resources	Other developing regions
	Mid 2000s	**Late 2000s**		
Residential tariff	**41.7**	**46.2**	60.26	
Nonresidential tariff	**219.8**	**142.0**	120.74	3.0 – 60.0

Source: Banerjee and others 2009; Morella and others 2009.
Derived from AICD water and sanitation utilities database downloadable from http://www.infrastructureafrica.org/aicd/tools/data

The performance of Ghana Water Company (GWC) has improved somewhat in recent years following institutional reforms and the contracting of a private operator. As of 2005, the utility was recovering only 48 percent of costs and collecting only 75 percent of revenue. Since 2007, tariff increases have substantially improved cost recovery. At the same time, the private operator's stronger commercial incentives have improved revenue collection from 75 percent to 95 percent in a short period of time. As a result, the hidden costs associated with the water sector fell from $113 million per year in 2001 to $96 million per year in 2009 (table 7), and they now absorb a much smaller share of GDP (figure 7). Relative to sector revenue, hidden costs have fallen from 190 to 129 percent over the same period. Nonetheless, Ghana remains only a middling performer on utility efficiency by regional standards (figure 8).

Table 7. Evolution of hidden costs associated with GWC

	Water delivered	System losses	Collection ratio	Average total cost	Average effective tariff	Total hidden costs	Total hidden costs
	(mns m^3/year)	(%)	(%)	(US$/$m^3$)	(US$/$m^3$)	(US$m/year)	(% revenue)
2001	90.2	52.0	77	1.08	0.33	112.9	190.0
2002	86.1	58.0	74	1.18	0.45	121.3	204.1
2003	88.2	57.0	75	1.24	0.53	124.7	209.9
2004	97.8	54.0	75	1.24	0.55	127.0	213.7
2005	98.9	53.4	75	1.14	0.55	109.2	183.7
2006	100.1	52.7	95	1.05	0.61	89.9	147.4
2007	103.9	51.5	89	1.09	0.70	93.1	126.7
2008	107.7	50.1	93	1.19	0.86	90.3	94.9
2009	112.3	51.5	97	1.07	0.66	95.5	128.9

Figure 7. Evolution of hidden costs in Ghana's water sector

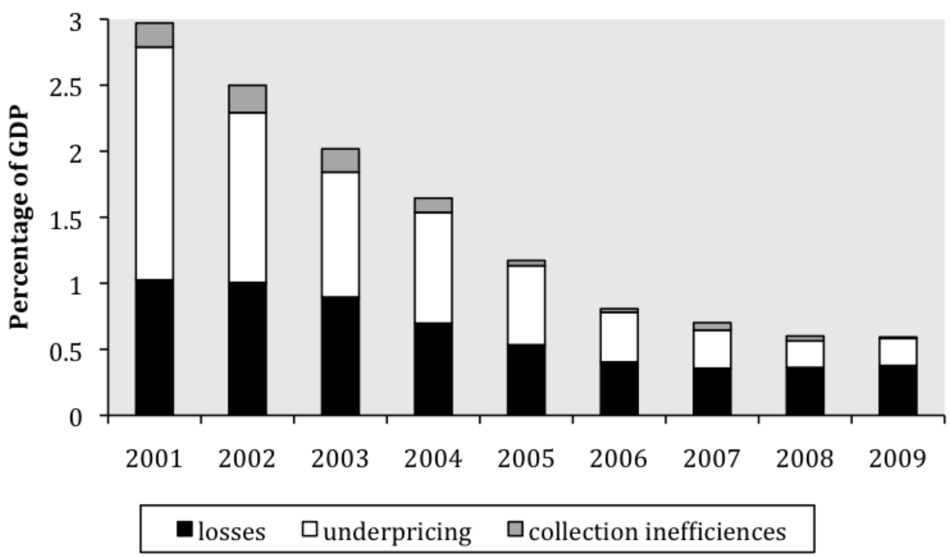
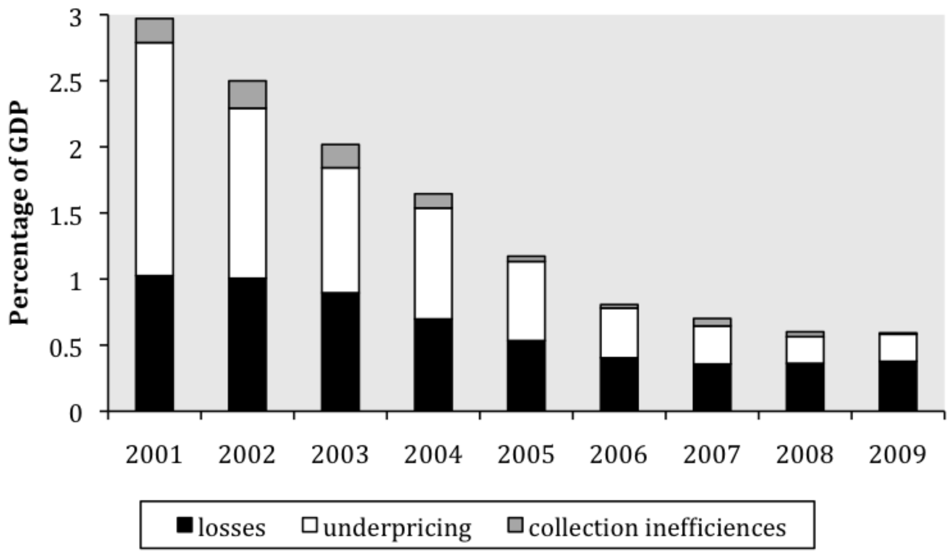


Figure 8. Hidden costs of water utilities



Source: Banerjee and others 2009.

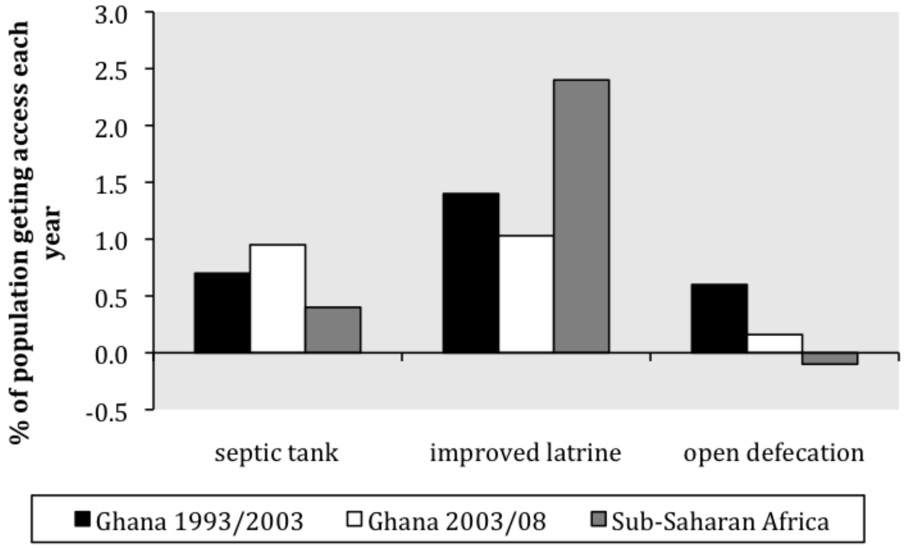
Challenges

Despite the water utility's improvements in cost recovery and revenue collection, distribution losses remain high at around 50 percent with adverse impacts on service quality. By comparison, best practice levels of distribution losses are 20 percent, and the benchmark is 33 percent for the low-income country peer group. There are two explanations for Ghana's poor performance in this respect. One is the country's aging distribution infrastructure, which is full of leaks. The other is large scale commercial theft from the network, sometimes for the purpose of secondary retailing of water sachets. As a result of these huge losses, there is relatively little water left to attend to the demands of the final customer, leading to highly intermittent supply. The very poor quality of water service seriously devalues the country's achievement of the Millennium Development Goal for water, since while water connections are relatively widespread, only intermittently do they supply water. The institutional reforms undertaken in the sector do not seem to have improved this aspect of performance. Going forward, the challenge will be to create stronger incentives for the utility to address this issue.

Although Ghana is on track to meet the MDG for water, it is not on track to meet the MDG for sanitation. According to DHS survey evidence, the percentage of households with some kind of access to an improved sanitation facility rose from 52 percent in the 2003 survey to 66 percent in the 2008 survey. However, the bulk of those accessing improved facilities do so on a shared basis, which does not count for achieving the MDG target. The JMP estimates that the share of the population with exclusive access to an improved facility is only 12 percent—well below the MDG target of 53 percent.

During 1993-2003 and 2003-08, Ghana made significant progress in improving access to flush toilets but only modest progress in access to latrines. At the same time, open defecation has continued to increase (figure 9). As much as 23 percent of the population continues to practice open defecation. While that figure is significantly better than the 37 percent of the population practicing open defecation in the low-income peer group, it is still some distance from the 16 percent for the middle-income peer group.

Figure 9. Open defecation continues to increase in Ghana



Source: Morella and others 2009.

Power

Achievements

Compared with its peers, Ghana has good power generation capacity and has made impressive progress on electrification (table 8). According to the DHS, Ghana's electrification rate in 2003 was approximately 44 percent, which was about three times as high as the benchmark for low-income countries in Africa and well on its way to middle-income country levels. In particular, rural coverage was almost twice as high in Ghana as in the peer group. According to the most recent DHS (2008), coverage has risen to 56 percent. This strong performance is attributable to an accelerated expansion of electricity access in Ghana. During 1993-2003, 1.8 percent of the population gained access to power annually, compared with the low-income benchmark of 1.4 percent. For 2003-2008, the rate of expansion accelerated to 3.2 percent of the population per year.

Challenges

Ghana went through a power supply crisis in 2006-2007, when low rainfall affected the yield of the Akosombo Reservoir. The enterprise survey for 2007 reports 116 days of outages per year, much higher than the 40 day benchmark for the low-income peer group at that time. Similarly, the percentage of firms relying on own generation in Ghana was close to 30 percent, which was substantially higher than the low-income benchmark. Power shortages took a heavy toll on Ghana's economy in 2006, with the lost load valued at around 1.9 percent of GDP, one of the higher levels in Africa (figure 10).

During the low rainfall period, Ghana was forced to rely extensively on oil-based generation. The price differential between hydropower and oil generation depends on the market price of oil but tends to be large. Hydropower has historically cost the country approximately $0.05 per kilowatt-hour, while the average total cost of oil-based generation has exceeded $0.20 per kilowatt-hour in recent years. As rainfall increased again, Ghana was able to shift back toward hydropower. However, more recently, the very high rates of growth in power demand are rapidly outstripping what the Akosombo Reservoir can supply, and as a result the country must use the expensive oil-fired plant to meet demand. Furthermore, the country remains exposed to future hydrological shocks.

To reduce its reliance on expensive oil-based generation, Ghana must diversify its generation mix to include gas. This process is already underway. Significant capacity of combined cycle gas turbine plant has already been commissioned, though it is not yet fully operational. Gas supply from Nigeria via the West African Gas Pipeline is expected to come on stream soon, and further supplies of more abundant and lower cost gas can be expected in the medium-term as Ghana develops its own hydrocarbon potential. The average total cost of gas-fired generation is estimated to be $0.06-0.08 per kilowatt-hour. Once gas-fired generation is available, the cost differential between hydro and thermal plant will be much lower, making the power system (and the economy) much more resilient in periods of low rainfall. For this reason, developing substantial gas-fired generation capacity is one of the most urgent challenges facing the power sector.

Table 8. Benchmarking power indicators

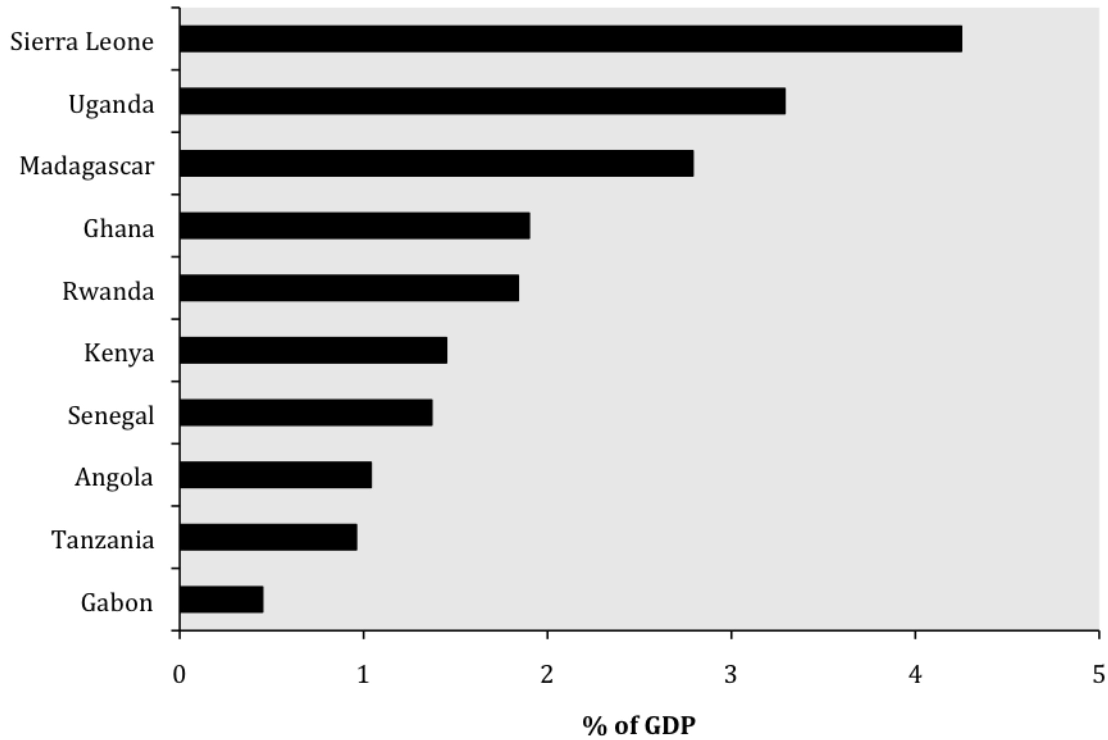
	Unit	Low-income countries	**Ghana**		Middle-income countries
		Mid 2000s	**Mid 2000s**	**Late 2000s**	Late 2000s
Installed power generation capacity	MW/mil. people	24.4	**131.7**		796.2
Power consumption	kWH/capita	99.5	**293.4**	**370.0**	4,473
Power outages	Day/year	40.6	**116.4**		5.6
Firms' reliance on own generator	% consumption	17.7	**29.5**		0.5
Firms' value lost due to power outages	% sales	6.1	**6.0**		0.8
Access to electricity	% population	15.4	**44.3**	**56.0**	59.9
Urban access to electricity	% population	71	**77.0**	**83.8**	83.7
Rural access to electricity	% population	12	**20.9**	**34.4**	33.4
Growth access to electricity	% population/year	1.4	**1.8**	**3.2**	1.8
Revenue collection	% billings	88.2	**89.6**	**89.3**	99.9
Distribution losses	% production	22.1	**25.4**	**25.6**	15.7
Cost recovery	% total cost	90.0	**80.0**	**92.0**	125.7
Total hidden costs as % of revenue	%	67.5	**37.3**	**118.3**	3.5

U.S. cents	**Ghana**		Predominantly hydro generation	Other developing regions
	Mid 2000s	**Late 2000s**		
Power tariff (residential at 75 kWh)	**8.4**	**13.1**	10.27	5.0 – 10.0
Power tariff (commercial at 900 kWh)	**13.9**		11.73	
Power tariff (industrial at 50,000 kWh)	**9.1**		11.39	

Source: Eberhard and others 2009. Derived from AICD electricity database, downloadable from http://www.infrastructureafrica.org/aicd/tools/data

Figure 10. Power outages impose a significant cost on Ghana's economy

Economic cost of power outages in selected countries, 2006



Source: Derived from Eberhard and others 2009.

Ghana's reliance oil-based generation has created a huge financial deficit in the sector. The power generation utility VRA provides bulk supply of power to the distributor ECG, the mining sector, a number of large industries, and neighboring Benin under a long-term export arrangement. During the last five years, VRA's bulk supply tariff has been $0.045-0.065 per kilowatt-hour, while the weighted average cost of generation has been $0.05-0.11 per kilowatt-hour, depending on the share of oil-based generation. The cost of generation peaked at $0.11 per kilowatt-hour in 2007 at the height of the drought. However, despite increased rainfall in 2008-09, thermal production remained high, reflecting strong demand, and the weighted average cost of generation remained high at $0.10 per kilowatt-hour.

Although the cost of power can fluctuate widely from year to year, tariffs adjust only slowly based on standard regulatory procedures. Prices therefore do not adjust quickly to reflect costs. As a result, VRA takes a major financial hit when it must rely heavily on thermal power, and the government is obliged to cover the difference. The hidden costs of underpricing were $46.6 million in 2004, but with rising oil prices and power demand, they escalated rapidly to $411.3 million in 2009 (table 9). Finding a regulatory mechanism to adjust prices and keep this deficit in check is thus a second urgent challenge confronting the sector.

Table 9. Evolution of hidden costs associated with VRA

	Hydro generation	Thermal generation	Average total cost hydro	Average total cost thermal	Average revenue	Total hidden costs	Total hidden costs
	(GWh/year)	(GWh/year)	(US$/kWh)	(US$/kWh)	(US$/kWh)	(US$m/year)	(% revenue)
VRA							
2004	5,277	736	0.048	0.089	0.046	46.6	14.4
2005	5,629	1,159	0.048	0.157	0.046	148.7	42.2
2006	5,619	2,810	0.048	0.169	0.044	391.3	98.3
2007	3,727	2,939	0.049	0.191	0.051	420.5	117.0
2008	6,196	1,978	0.048	0.267	0.065	321.1	60.6
2009	6,431	2,666	0.048	0.210	0.054	411.3	87.4

Table 10. Evolution of hidden costs associated with ECG

	Load served	System losses	Collection ratio	Average total cost	Average effective tariff	Total hidden costs	Total hidden costs
	(GWh/year)	(%)	(%)	(US$/kWh)	(US$/kWh)	(US$m/year)	(% revenue)
ECG							
2004	4,818	26.5	99.7	0.08	0.080	50.9	41.7
2005	5,045	25.4	85.8	0.08	0.080	95.0	60.4
2006	5,252	24.3	100.0	0.08	0.079	55.9	44.3
2007	5,146	24.0	85.3	0.09	0.095	110.4	46.3
2008	5,799	25.6	89.3	0.12	0.131	151.3	27.6
2009	5,949	25.0	89.3	0.14	0.096	331.3	70.4

Ghana's distribution utility, ECG, has historically covered its full costs of operation (including the bulk supply tariff to VRA). However, due to currency devaluation and escalating costs, the utility had opened-up a large deficit by 2009 (table 10). In addition, the operational deficiencies of the utility contribute to hidden costs. Distribution losses, which hover around 25 percent, are about twice the best practice levels. At the same time, the collection ratio has fallen and remained stagnant at around 90 percent. The financial losses associated with these operational deficiencies had climbed to $331 million by 2009.

Overall, the hidden costs associated with Ghana's power sector were a staggering 6.3 percent of GDP in 2009 (figure 11). Underpricing was by far the most important contributor to that total at 3.2 percent of GDP. Viewed differently, hidden costs were 126 percent of sector revenue. This is one of the highest levels among West African utilities, even if it still falls short of the levels found in Nigeria and Niger (figure 12).

Figure 11. Evolution of hidden costs in Ghana's power sector

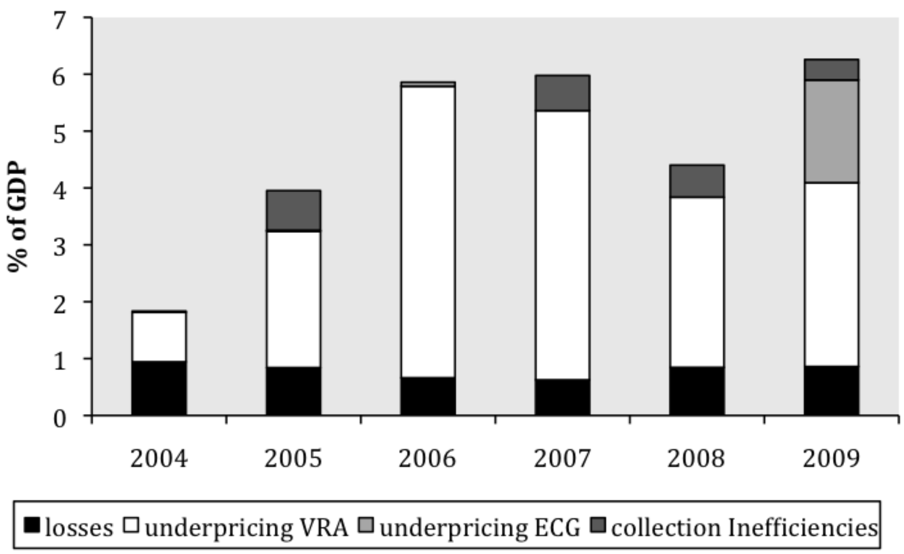
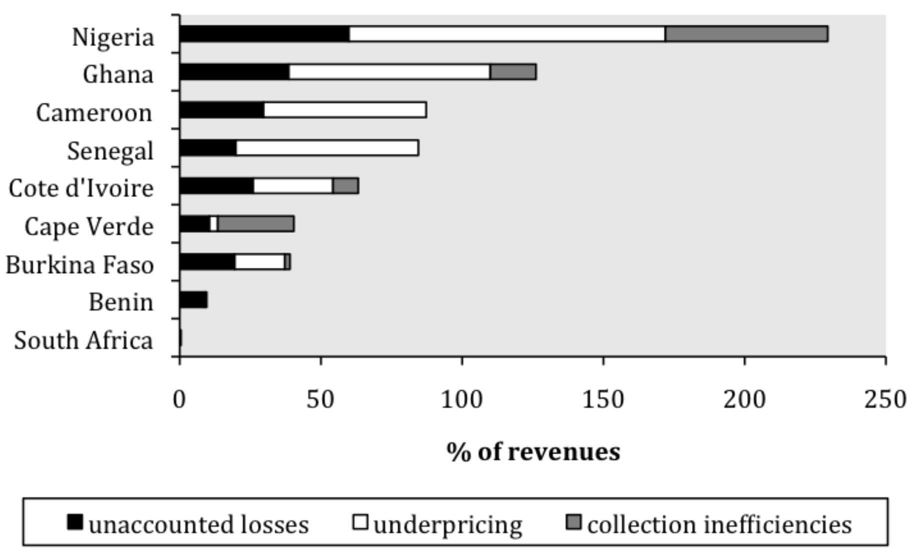


Figure 12. Hidden costs are high in Ghana compared with other West African countries

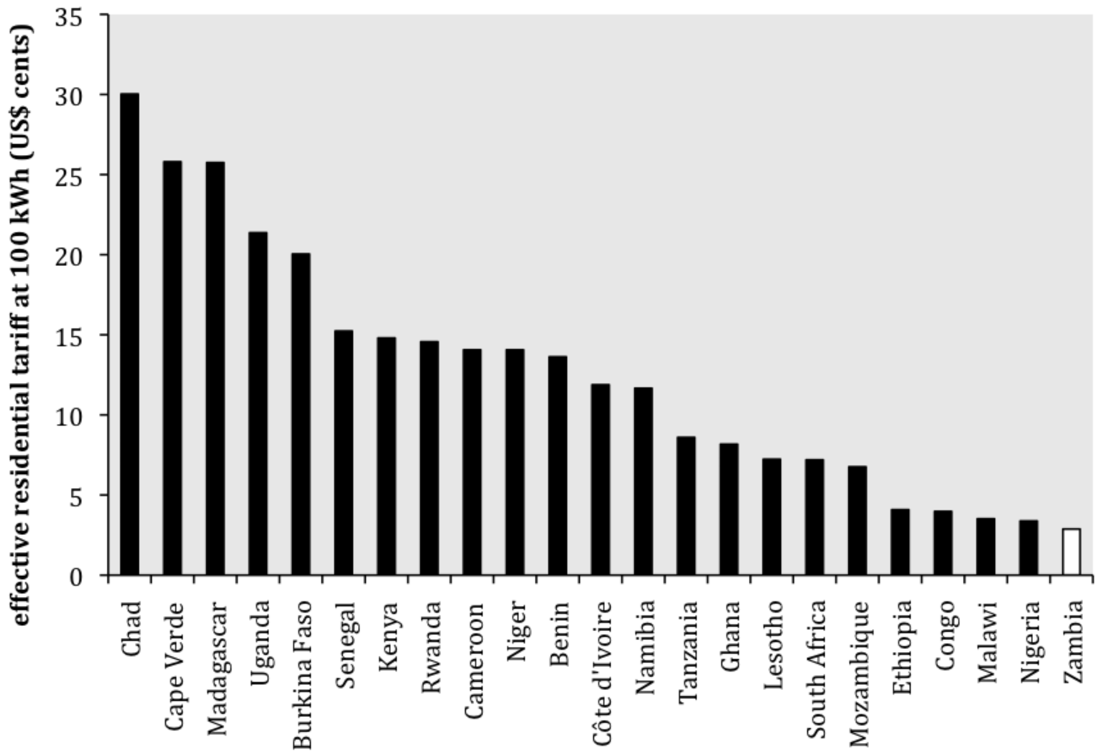
Hidden costs of power utilities in selected countries



Source: Eberhard and others 2009.

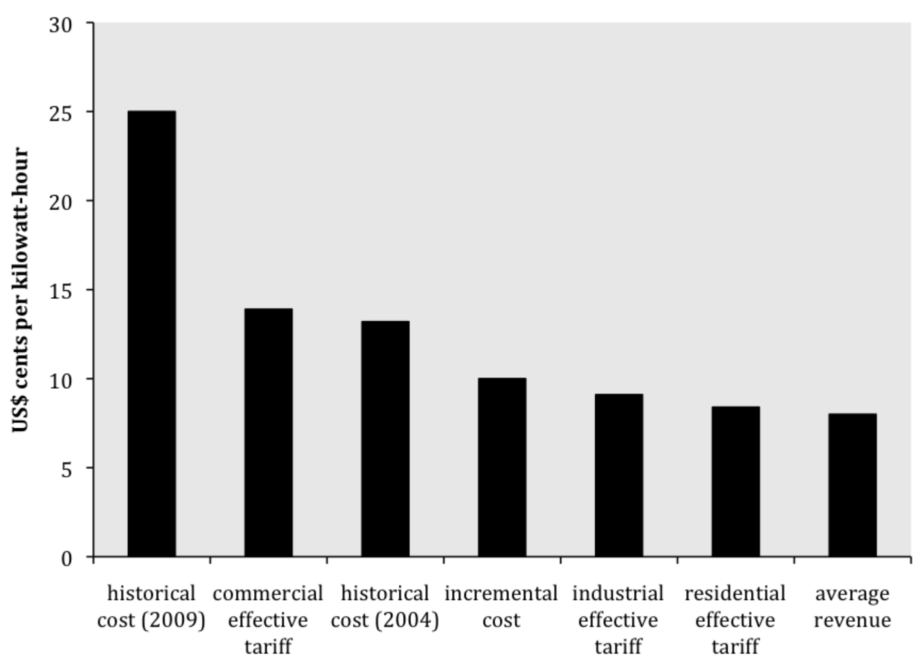
Power tariffs in Ghana are lower than in many other countries in Africa (figure 13). Nevertheless, tariffs fall well short of costs (figure 14). With the introduction of gas-fired plants, costs will come down toward a level closer to prevailing tariffs, but unless some mechanism is found to recover the present high level of costs, the transition will be fiscally costly.

Figure 13. Comparison of electricity tariffs across Africa



Source: Derived from Eberhard and others 2009.

Figure 14. Comparison of Ghana's power tariffs against various cost benchmarks



Source: Derived from Eberhard and others 2009.

Beyond the challenges with power generation, Ghana's aging transmission and distribution network is beginning to affect reliability of supply. This infrastructure will need to be rehabilitated if service quality is to be maintained.

Water resources

Achievements

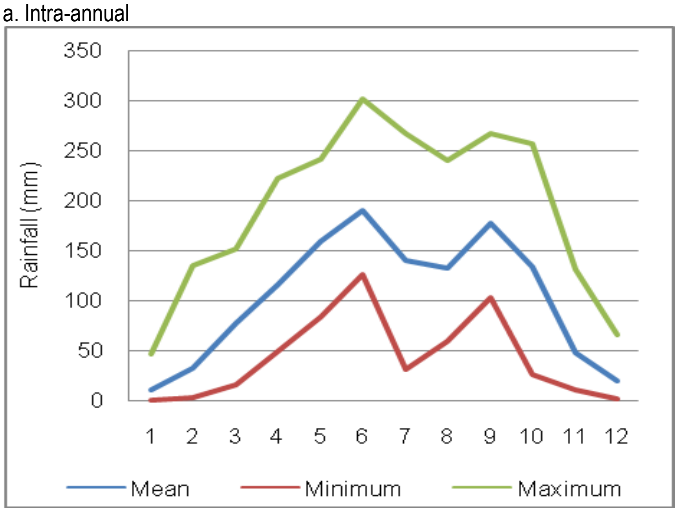
Ghana has significant water resources but makes little use of them. Total actual renewable water resources are estimated to be 53.2 billion cubic meters per year (2,500 cubic meters per person), of which the Volta River accounts for about 38 billion cubic meters per year. Total water withdrawals constitute only about 2 percent of total actual renewable water resources. So while the country has rich water endowments, the economic utilization of the available water resources is very low.

The amount of water available in Ghana changes markedly from season to season (figure 15a) as well as from year to year (figure 15b). It is expected that climate change will increase intra-annual rainfall variability in the country, which will lengthen the dry period and shorten the wet ones. This could also be accompanied by wide variations in stream flows and runoff, which would increase the risk of both floods and droughts in urban and rural areas.

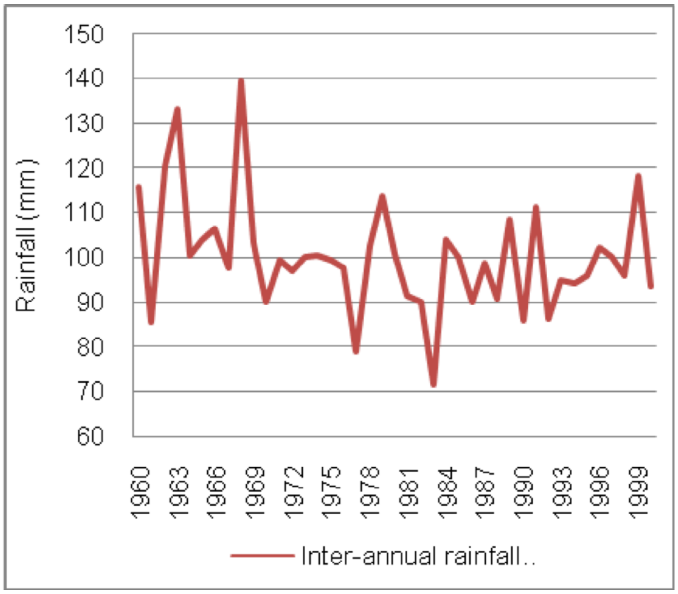
Storage capacity in Ghana is 6,802 cubic meters per person, which is relatively high compared to other African countries. This reflects the country's reliance on hydropower. By comparison, South Africa, for has only 629 cubic meters per person.

Figure 15. Ghana's high rainfall variability

a. Intra-annual



b. Inter-annual



Source: World Bank economic and sector work on water resources development in Ghana, 2010.

Challenges

Ghana has established a Water Resources Commission with a mandate to regulate and manage the country's water resources and coordinate government policies in accordance with the national water policy. The commission is still relatively new and faces a number of important challenges, including: (i) limited use of multi-purpose infrastructure for irrigation, flood control, water supply, and possibly hydropower, especially in rural areas; (ii) lack of a comprehensive assessment and adequate management systems for groundwater as a reliable source for water supply and irrigation; (iii) the transboundary implications of water resources development in Ghana on other riparian countries in shared river basins (such as the Volta river basin) and vice versa; (iv) the effect of expanding access on water quality; and (v) the impacts of hydrological variability and climate change.

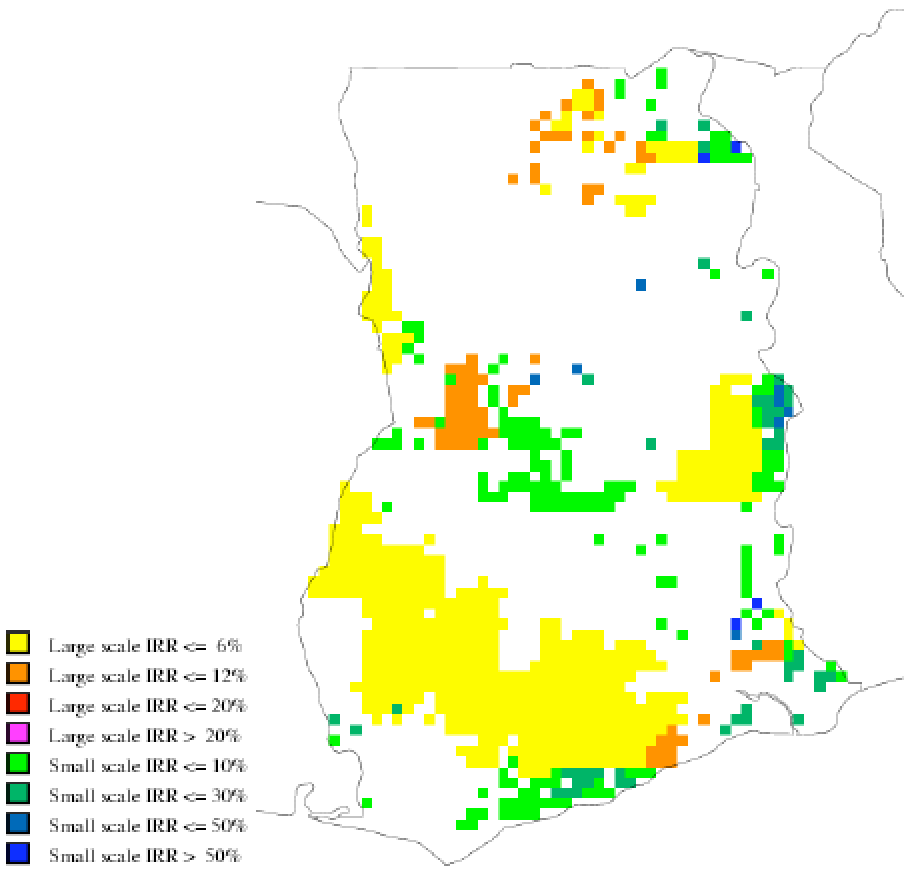
Ghana worked in concert with riparian countries to establish an institutional framework for cooperative management of the Volta River BAsin. About three-quarters of Ghana's land area is located in the Basin, whose waters are shared with five other countries: Benin, Burkina Faso, Côte d'Ivoire, Mali, and Togo. In 2007, the heads of state of the six riparian countries met to ratify a convention establishing the Volta Basin Authority (VBA), which came into force in 2009. The VBA is currently establishing mechanisms for future cooperation among riparians.

The extent of irrigated agriculture in Ghana is very limited. According the 2005 FAO Aquastat Database, Ghana has approximately 30,000 hectares equipped for irrigation, concentrated mainly around the Ashanti area and in the far northeast. However, official national statistics suggest that formal irrigation schemes amount to no more than 9,000 hectares, and informal schemes are estimated to amount to a further 10,000 hectares. In any case, none of these figures represents more than 1 percent of the country's cultivated area, which is lower than the irrigated share of cropland for Sub-Saharan Africa as a whole.

As part of the AICD, a simulation exercise was conducted exploring the economic viability of further expanding irrigation based either on large-scale dams or more localized water collection systems. This simulation tool estimates the potential revenue from irrigation based on existing crop patterns, biophysical potential crop patterns, market prices, and country-specific assumptions about irrigated yield. The cost of irrigation development is assumed to be $3,000 per hectare for schemes based on large dams and $2,000 per hectare for schemes based on localized water collection. Based on these assumptions, the simulation exercise suggests that Ghana may have as much as 315,000 hectares of land that is economically viable for irrigation—more than 10 times the area irrigated today (table 11). Most of this potential is associated with schemes linked to the development of large dams across the southwest of the country (figure 16).

Figure 16. Ghana has significant potential for expanding irrigation

Areas viable for irrigation



Source: You and others 2009.

There is clearly significant potential to expand irrigation throughout Ghana. However, not all irrigation projects considered in the simulation have a high rate of return. If all schemes with a positive net present value are considered, then the internal rate of return is 9 percent. If only schemes that exceed a threshold rate of return of 6 percent are considered, then only around 90,000 hectares could be irrigated, but the internal rate of return rises to 19 percent. As the threshold rate is raised to 12 percent and beyond, the viable area shrinks dramatically, although the returns also become very high. In general, the rates of return on the large dam-based schemes tend to be lower than those associated with localized water collection. The results are highly sensitive to the assumptions made about the unit costs of irrigation development. More generally, the simulation exercise found that the viability of irrigation schemes depends on crops that generate more than $2,000 per hectare, which includes mainly cash crops and horticulture.

More recent work conducted nationally suggests that under some circumstances, returns on irrigation may be even higher than suggested by these first order AICD estimates. The irrigation feasibility study for the Accra Plains found that 142,000 hectares of land could be irrigated with a rate of return between 7 and 25 percent, depending on the assumptions used.

Table 11. Sensitivity of irrigation potential to thresholds for economic return

	Potential ('000s hectares)	Investment needs ($ millions)	Average IRR (%)		Potential ('000s hectares)
	Large dam-based	Local collection	Total	Large dam-based	Local collection
IRR >0%	242.2	73.0	315.2	473	377
IRR >6%	50.8	36.8	87.6	99	190
IRR >12%	0.0	14.9	14.9	-	77
IRR >24%	0.0	6.0	6.0	-	31

Notes: Simulations based on assumptions that large scale dam-based irrigation can be developed at a cost of $3,000 per hectare, while schemes based on localized water collection could be developed at a cost of $2,000 per hectare. Should these costs be significantly exceeded, the number of viable hectares falls sharply.

Source: You and others 2009.

Information and communication technologies

Achievements

As of 2005, when the AICD baseline survey was conducted, Ghana's ICT sector was a strong performer by regional standards (table 12). About 60 percent of Ghana's population lived within access of a GSM voice signal. This was above the average for the peer group, although it still fell short of exceptional performers such as Kenya, Malawi, and Uganda, which had already reached about 95 percent of their population with the GSM signal at that time (figure 17). Ghana also achieved strikingly high rates of service penetration. Some 32 percent of the population already subscribed to a mobile telephone service, twice as the level in the peer group. With respect to Internet penetration, however, Ghana did not outperform the rest of the peer group.

Since 2005, an increasingly competitive environment has resulted in further impressive growth in the ICT sector. There are now six mobile operators (two of which were licensed after 2007), and the international gateway has been liberalized. As a result, the mobile footprint expanded to 82 percent in 2009—still below the performance of Kenya, Malawi and Uganda, but impressive nonetheless. Furthermore, the mobile penetration rate more than doubled, from 32 percent in 2005 to 67 percent in 2009. International bandwidth has grown substantially, and Internet subscriptions have also doubled, albeit from a very low base.

Table 12. Benchmarking ICT indicators

	Unit	Low-income	**Ghana**	Middle-income

		countries			countries
		2005	**2005**	**2009**	2005
GSM coverage	% population	48	**59**	**82**	97
International bandwidth	Mbps/capita	6	**8**	**86**	30
Internet	subscribers/100 people	0	**2**	**4**	2
Landline	subscribers/100 people	1	**1**	**1**	9
Mobile phone	subscribers/100 people	15	**32**	**67**	87

	Ghana			
	2005	**2009**	With submarine cable	Other developing regions
Price of monthly mobile basket	**7.53**	**6.00**	11.12	9.9
Price of monthly fixed-line basket	**8.56**	**5.00**	13.58	—
Price of 20-hour Internet package	**34.53**	**12.00**	47.00	11.0
Price of a call to the United States (US$/min)	**0.39**	**0.33**	0.48	0.67
Price of inter-Africa calls, mean (US$/min)	**0.32**		0.57	n.a.

Notes: Ghana 2005 data together with benchmarks are taken from the AICD Database. Ghana 2009 is compiled from a variety of World Bank sources to give a sense of the progress made during the last five years.

Source: Minges and others 2009. Derived from AICD national database, downloadable from http://www.infrastructureafrica.org/aicd/tools/data

— = data not available. n.a. = not applicable.

One of the key explanations for Ghana's relatively high service coverage has been its relatively low tariffs. In 2005, the price of a standard basket of mobile services was $7.53 in Ghana compared with $11.12 in other comparable African countries. At that time, Ghana also had access to the SAT3 submarine cable through competing international gateways, which can be expected to bring down the costs of international voice and Internet services. The prices of dial-up Internet service and international phone calls in Ghana were significantly lower than in other countries in the peer group with access to a submarine cable. Due to intensifying competition both in the domestic mobile market and on the international gateway, prices have fallen significantly since 2005. The price of a mobile basket is now around $6 per month, and the price of a monthly Internet subscription has fallen substantially from $35 in 2005 to $12 in 2009. Competition in Ghana's ICT market is set to intensify further as landing rights have been granted to two new submarine cables, and international bandwidth could increase to 2,040 bits per second.

Challenges

The recent rapid expansion of Ghana's mobile telephone networks has come at the expense of service quality. While no official statistics are available, a high incidence of dropped calls is being reported. To some extent, there is a tradeoff between investment in network expansion and investment to upgrade the service on the existing network. With the recent award of new licenses, the current focus of the operators is on securing maximum coverage. Nevertheless, the current situation suggests the importance of establishing a more explicit regulatory framework for quality of service so that these aspects of performance can be monitored and appropriate standards and incentives can be established.

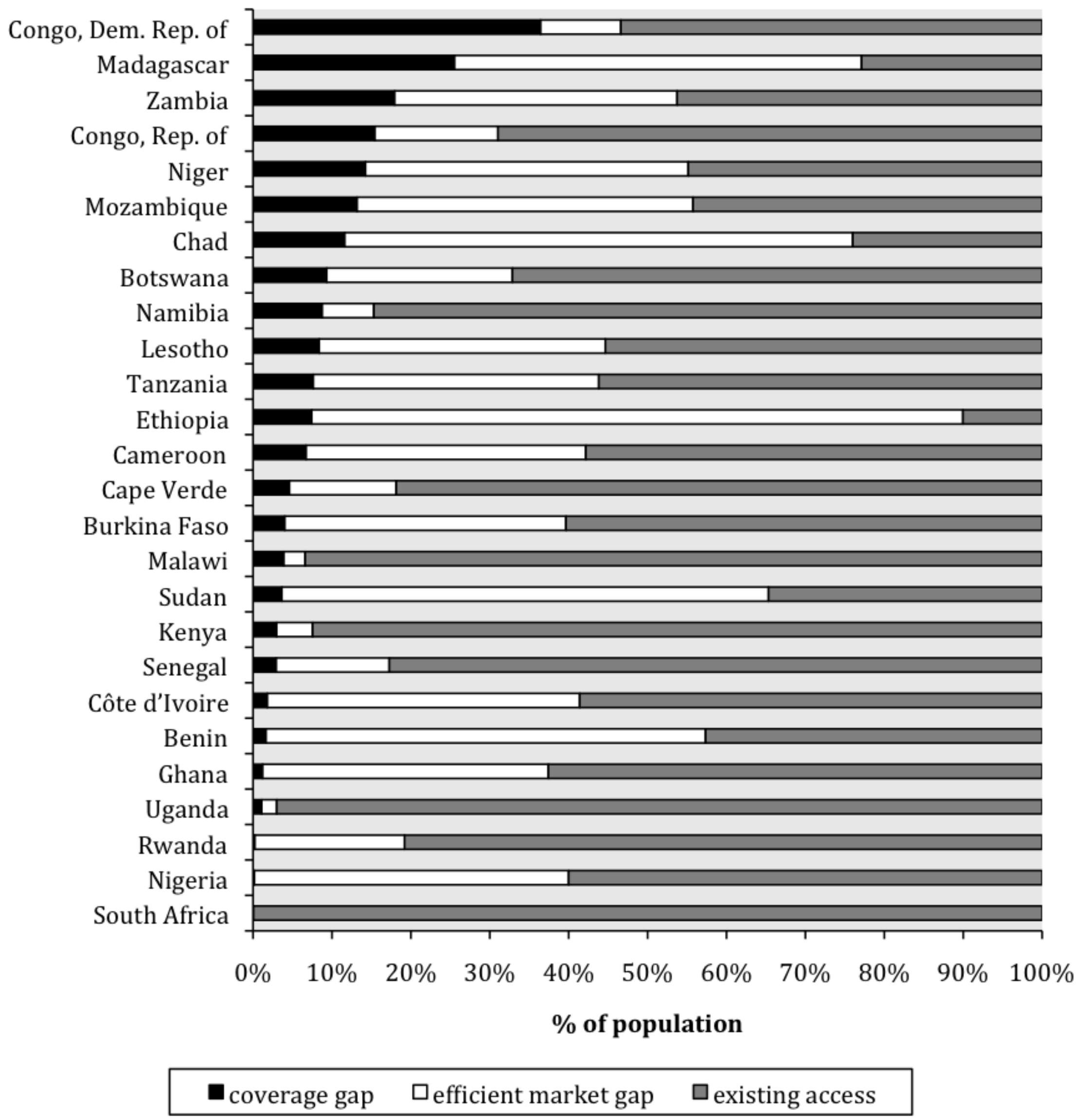
Simulations conducted for the AICD suggest that close to 99 percent of Ghana's population could be reached with a GSM signal on a commercially viable basis, making Ghana one of the most attractive markets in Africa (figure 17).

Figure 17. Almost all of Ghana's population could be commercially served with a GSM signal

Bar segments in dark grey represent the percentage of the population covered by voice infrastructure as of third quarter 2006.

Bar segments in mid grey represent the efficient-market gap—the percentage of the population for whom voice telecommunications services are commercially viable given efficient and competitive markets.

Bar segments in white represent the coverage gap—the percentage of the population for whom services are not viable without subsidy.



Source: Mayer and others 2008.

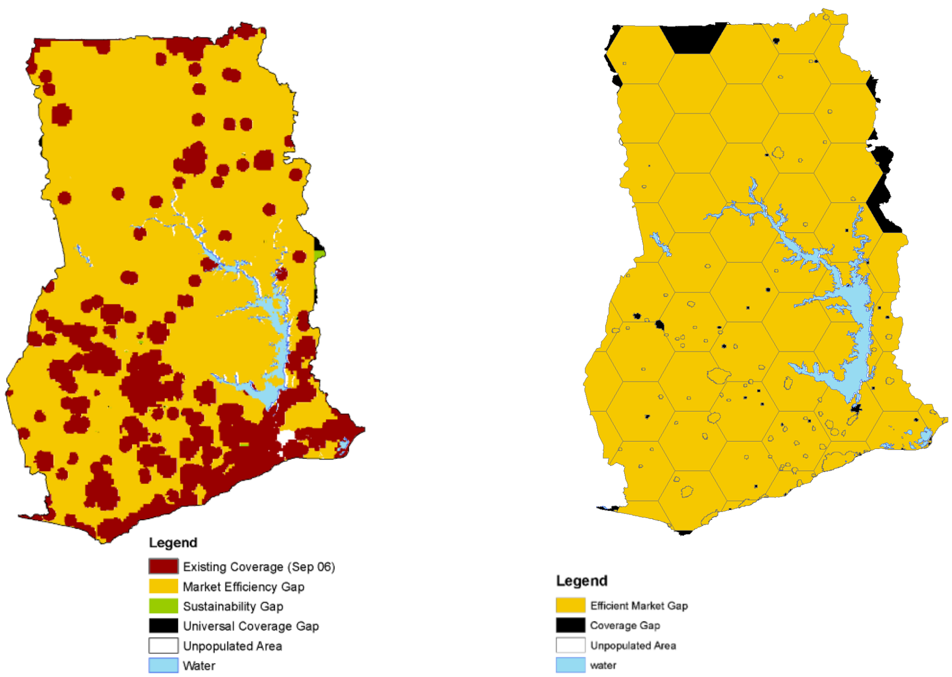
This result is based on the assumption that 4 percent of local income in each area could be captured as revenue for voice telephony services. Even if this assumption were reduced to only 1 percent of local income, it would still be possible to serve 95 percent of the population on a commercially viable basis.

The expansion of the GSM footprint in recent years already indicates that the market efficiency gap—the share of the market that is commercially viable but not yet served—is already coming down rapidly and will likely continue to do so. Beyond ensuring the smooth functioning of competition in the rural hinterland, little government action would appear to be needed to achieve universal access of a voice signal (figure 18a).

Figure 18. Only isolated pockets of Ghana's territory are not commercially viable for voice and broadband

a. GSM voice signal

b. Limited performance broadband (WIMAX)



Note: Existing coverage relates to base year of 2006.

A second set of simulations explored the commercial viability of limited performance broadband services based around limited institutional use and public access telecenters using WIMAX technology. These simulations found that about 95 percent of the population could be provided with such service on a commercially viable basis. This was based on the assumption that the subscription rate in rural areas would be 0.25 percent and that 1 percent of local income could be captured in broadband revenue. However, even if the spending assumption is reduced to 0.25 percent of local income, it would still be possible to serve 75 percent of the population on a commercially viable basis. Those areas that could potentially require public subsidy are confined to the far north and east of the country (figure 18b). Ghana is already auctioning five WIMAX licenses, which could greatly imrpove access to limited performance broadband given the results of the simulations.

Financing Ghana's infrastructure

To meet its most pressing infrastructure needs and catch up with developing countries in other parts of the world, Ghana needs to expand its infrastructure assets in key areas (table 13). The targets outlined below are purely illustrative, but they represent a level of aspiration that is not unreasonable. Developed in a standardized way across African countries, they allow for cross-country comparisons of the affordability of meeting the targets, which can be modified or delayed as needed to achieve financial balance.

Table 13. Illustrative investment targets for infrastructure in Ghana

	Economic target	Social target
ICT	Install fiber optic links to neighboring capitals and submarine cable	Provide universal access to GSM signal and public broadband facilities
Irrigation	Develop additional 15,000 hectares of irrigation schemes with high rates of return (>12% IRR)	
Power	Develop 1,400 MW of new generation capacity	Raise electrification to 76 percent (100 percent urban and 37 percent rural)
Transport	Achieve regional connectivity with good quality two-lane paved road Achieve national connectivity with good quality one-lane road	Provide rural road access to 80 percent of the highest-value agricultural land, and urban road access within 500 meters
WSS		Maintain current access rates for water supply and achieve Millennium Development Goals for sanitation

Sources: Mayer and other 2008; Rosnes and Vennemo 2009; Carruthers and others 2009; You and others 2009.

Meeting these illustrative infrastructure targets for Ghana would cost $2.3 billion per year over a decade. Capital expenditure would account for 60 percent of this requirement. Meeting growing demand for power will require an estimated $1.3 billion per year to install almost 1,400 megawatts of new generation capacity and expand electrification. The water and sanitation sector is the area with the highest spending needs: clearing the sector rehabilitation backlog, as well as sustaining the the Millennium Development Goal target for water and achieving the same target for sanitation, will require over $0.4 billion per year, of which capital expenditure accounts for 70 percent. Requirements for transport and ICT, while less than the amounts needed for power and water and sanitation, are also high in absolute terms—approximately $0.25 billion per year for each (table 14).

Table 14. Indicative infrastructure spending needs in Ghana for 2006 to 2015

$ million per year

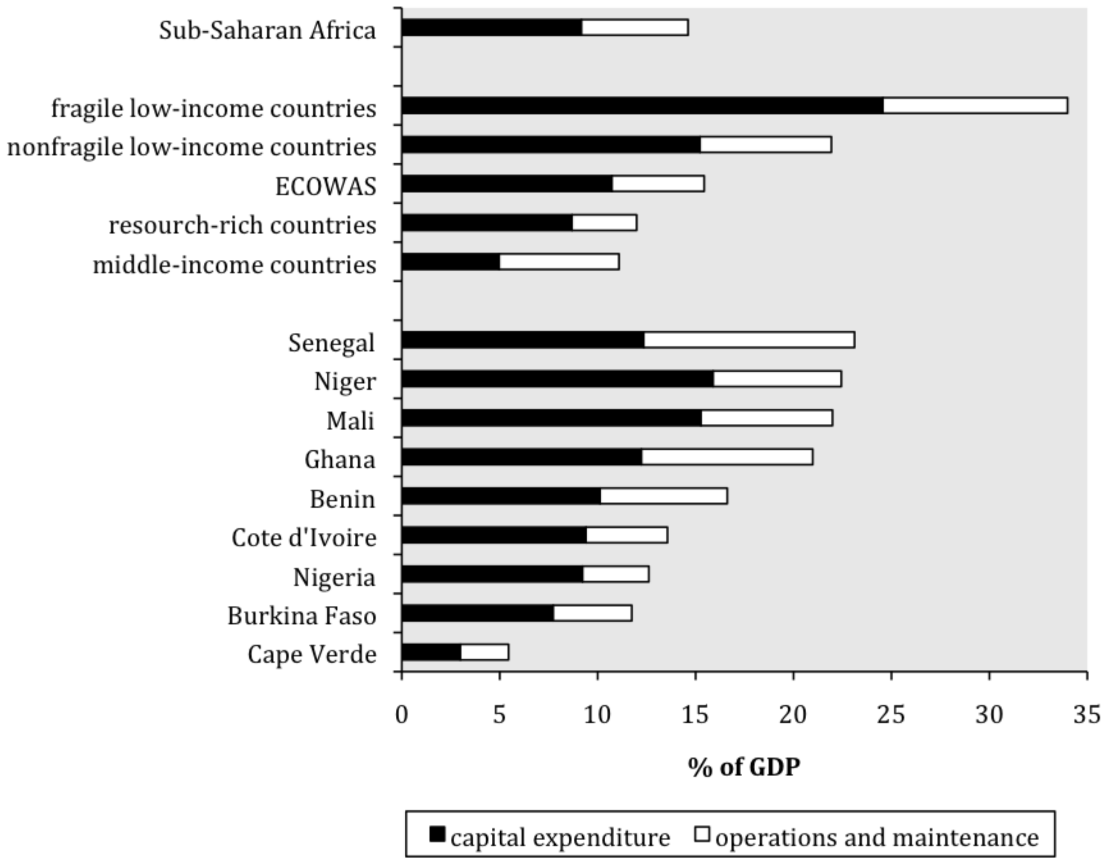
Sector	Capital expenditure	Operations and maintenance	Total needs
ICT	162	34	196
Irrigation	29	30	59
Power	631	624	1,255
Transport	174	133	307
Water supply and sanitation	306	129	435
Total	1,302	950	2,252

Sources: Mayer and others, 2008; Rosnes and Vennemo 2009; Carruthers and others 2009; You and others 2009.
Derived from models that are available online at http://www.infrastructureafrica.org/aicd/tools/models.

Ghana's infrastructure spending needs are especially high relative relative to the size of its economy—as much as 21 percent of the country's GDP in 2006 (figure 19). Investment alone would absorb approximately 12 percent of GDP, not far from the 15 percent China invested in infrastructure during the mid-2000s. However, due to strong economic growth in the last few years, the same amount represents a more manageable 14 percent of Ghana's GDP in 2009.

Figure 19. Ghana's infrastructure spending needs are substantial relative to GDP

Estimated infrastructure spending needed to meet targets, as percentage of GDP



Legend: LIC – Low-Income Country, MI C – Middle-Income Country, COMESA – Common Market for Eastern and Southern Africa
Source: Foster and Briceño-Garmendia 2009.

Ghana already spends close to $1.2 billion per year to meet its infrastructure needs (table 15). About 60 percent of that total is allocated to capital expenditure and 40 percent to operating expenditures. Operating expenditure is entirely covered by budgetary resources and payments by infrastructure users. Funding of capital expenditure is fairly evenly split between ODA (35 percent), public investment (28 percent) and private investment (24 percent). Non-OECD finance also plays a smaller, but still significant, role.

Ghana's recent spending amounts to around 11 percent of 2006 GDP (figure 20). Although that figure is substantially higher than in some of its West African neighbors, such as Côte d'Ivoire and Nigeria, it is close to the average for nonfragile low-income countries. Relative to the low-income peer group, Ghana is reliant on the public budget and non-OECD finance for power and ICT investments and on ODA for transport and water investments (figure 21). The largest share of infrastructure capital spending goes to ICT (33 percent), followed by transport (26 percent) and power (23 percent).

Table 15. Financial flows to Ghana's infrastructure, average 2001 to 2006

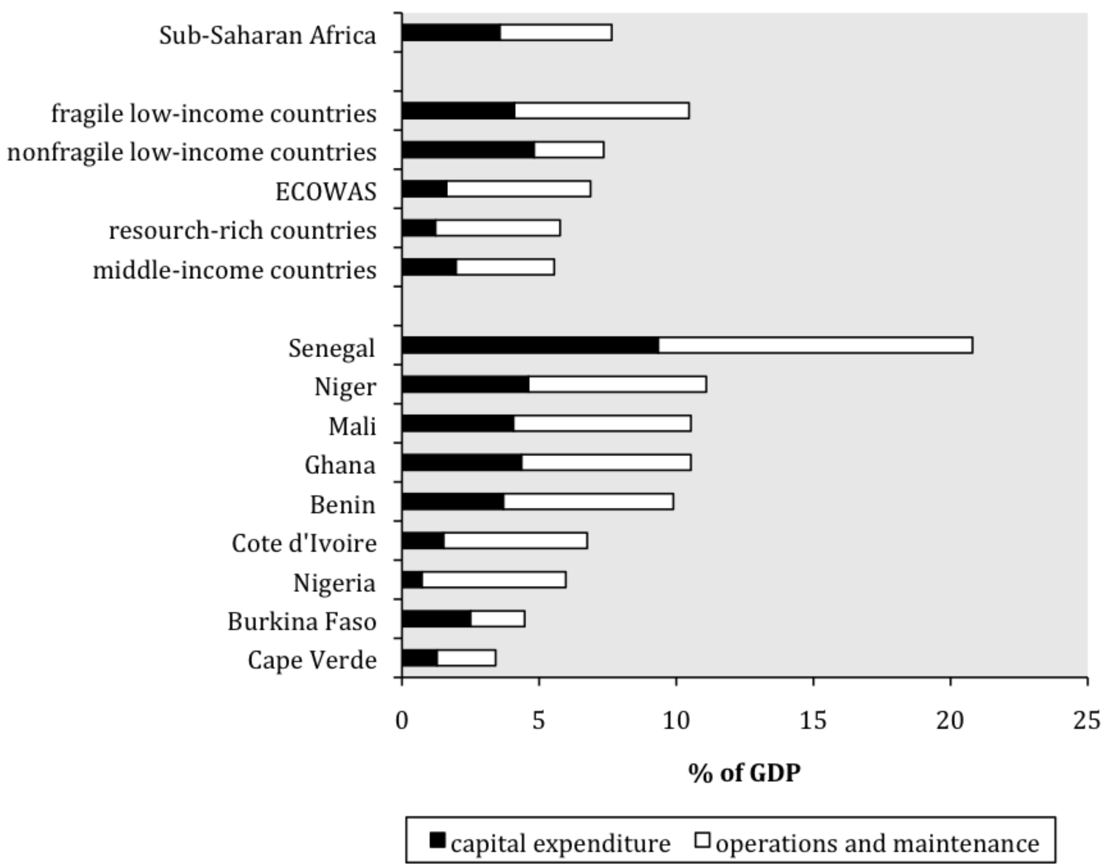
US$ millions per year

	O&M	Capital expenditure					
	Public sector	Public sector	ODA	Non-OECD financiers	PPI	Total CAPEX	Total spending
ICT	175	59	1	28	130	218	394
Irrigation	10	1	0	0	0	1	12
Power	129	60	22	59	6	146	275
Transport	127	50	119	8	1	178	305
WSS	53	23	98	0	31	151	204
Total	494	192	241	95	167	695	1,189

Source: Derived from Foster and Briceño-Garmendia 2009.

O&M = operations and maintenance; ODA = official development assistance; PPI = private participation in infrastructure; CAPEX = capital expenditure; OECD = Organisation for Economic Co-operation and Development.

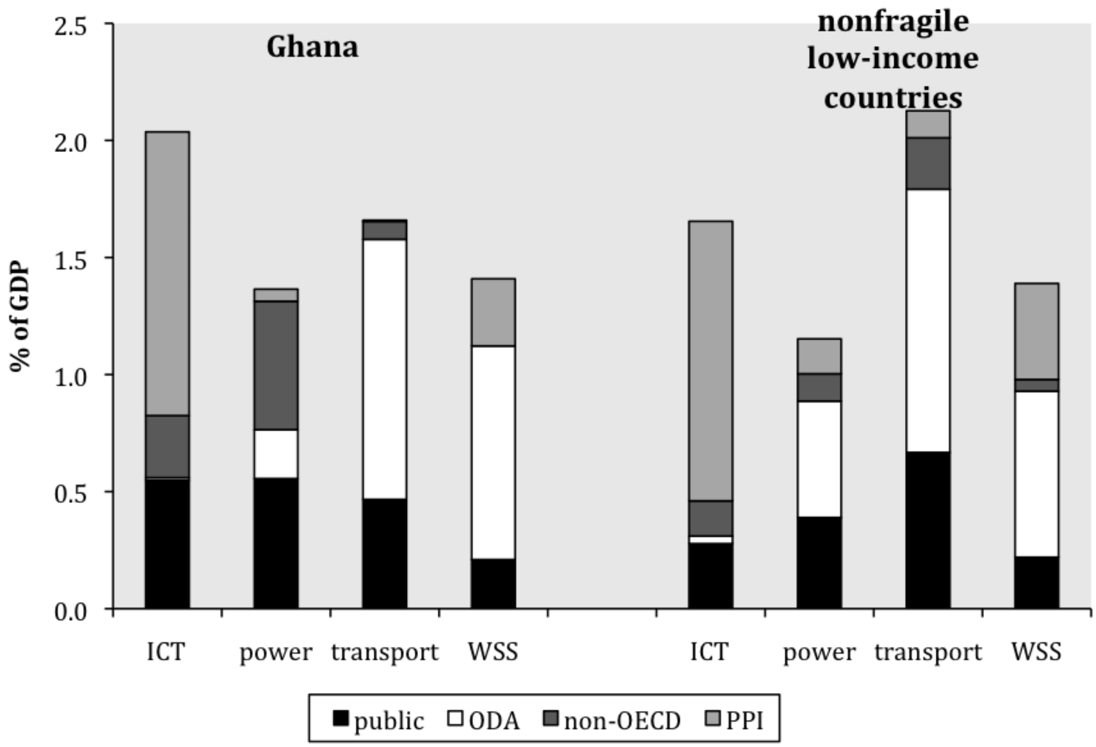
Figure 20. Ghana's existing infrastructure spending is not particularly high



Source: Derived from Foster and Briceño-Garmendia 2009.

Figure 21. Ghana's pattern of capital investment in infrastructure differs from that of comparator countries

Investment in infrastructure sectors as percentage of GDP, by source



Note: Private investment includes self-financing by households.
Source: Derived from Briceño-Garmendia and others 2009.

How much more can be done within the existing resource envelope?

Almost $1.1 billion of additional resources could be recovered from Ghana's infrastructure sectors each year by improving efficiency (table 16). By far the largest potential source of efficiency gains is improving cost recovery in the power sector. Distribution losses, particularly in power, are also significant, as are overstaffing in the ICT incumbent and underfunding of road maintenance. Looking across sectors, the power sector is by far the most problematic with inefficiencies of around $0.8 billion per year; no other sector comes close.

Table 16. Potential gains from greater efficiency

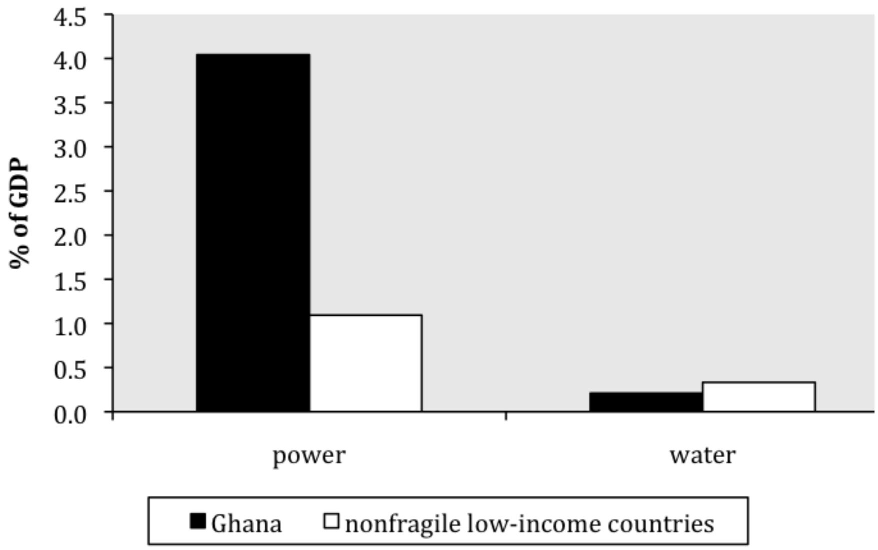
$ millions	ICT	Irrigation	Power	Transport	WSS	Total
Overstaffing	82				7	89
Distribution losses			110		47	157
Undercollection			46	34	2	82
Low budget execution	0	1	0	0	1	2
Underpricing			641	42	46	729
Total	82	1	797	76	103	1,059

Source: Derived from Foster and Briceño-Garmendia 2009.

Underpricing of power costs Ghana about $641 million each year, or around 4 percent of the country's GDP. While underpricing of power is commonplace across Africa, it is more significant in Ghana than in other countries in the peer group (figure 22). In Ghana, the key issue is the relatively low bulk supply tariff applied by VRA to both residential and large industrial customers, which does not cover the costs of thermal generation needed to address shortfalls in the availability of hydropower.

Figure 22. Underpricing of power and water a more serious issue in Ghana than elsewhere

Financial burden of underpricing in 2006, as percentage of GDP

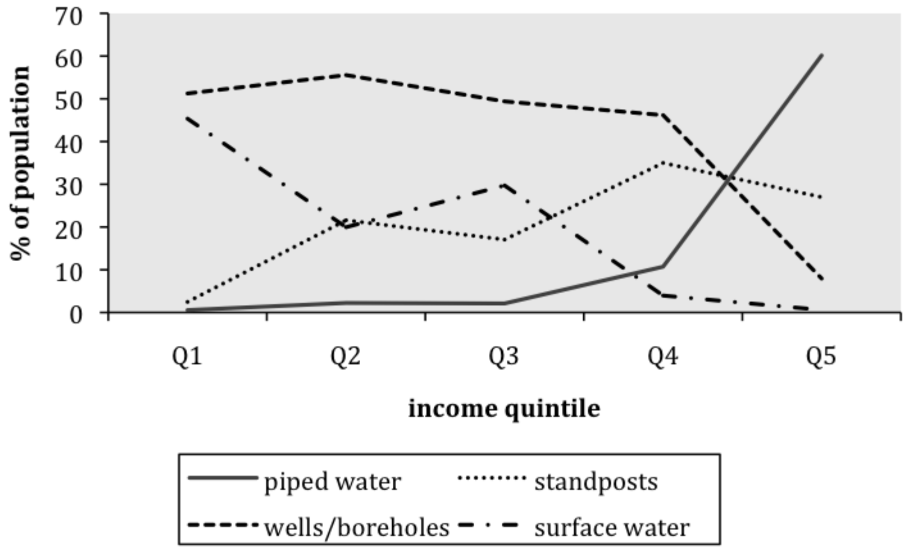


Source: Derived from Briceño-Garmendia and others 2009.

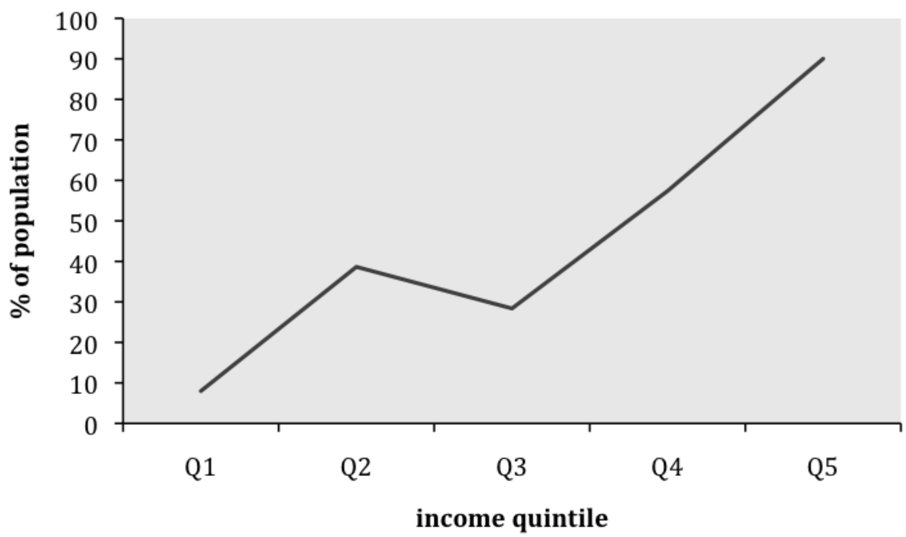
Access to utility services in Ghana is relatively high by African standards. Access is much more prevalent among the rich, even if a significant minority of lower-income households have access to electricity (figures 23a, b). Because access to power services in Ghana is so inequitable, subsidized tariffs are highly regressive. Recent empirical analysis shows that poor households capture far less than their fair share of power and water subsidies in Ghana. In the case of power, poor households capture one-third of the subsidy that should reach them based solely on their share in the overall population. In the case of water, poor households capture one-sixth of the subsidy that should reach them based solely on their share in the overall population. While it is typical for utility subsidies to be regressive in African countries, the distributional performance of Ghana's subsidies is particularly poor (figure 24).

Figure 23. Consumption of infrastructure services in Ghana is highly differentiated by budget

a. Mode of water supply, by income quintile



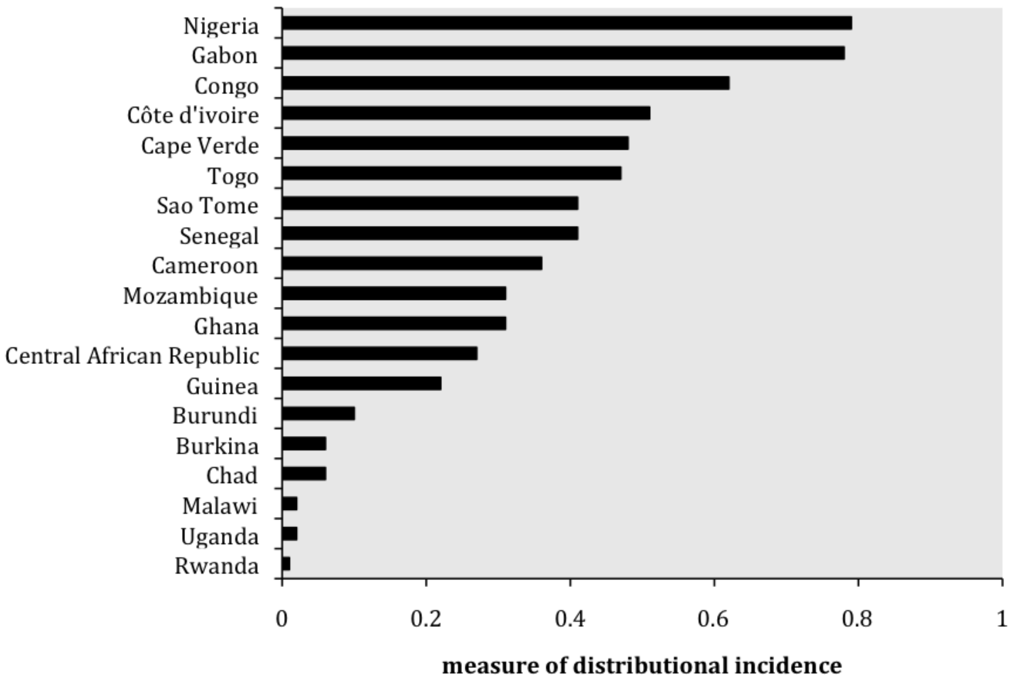
b. Prevalence of connection to power grid among Kenyan population, by income quintile



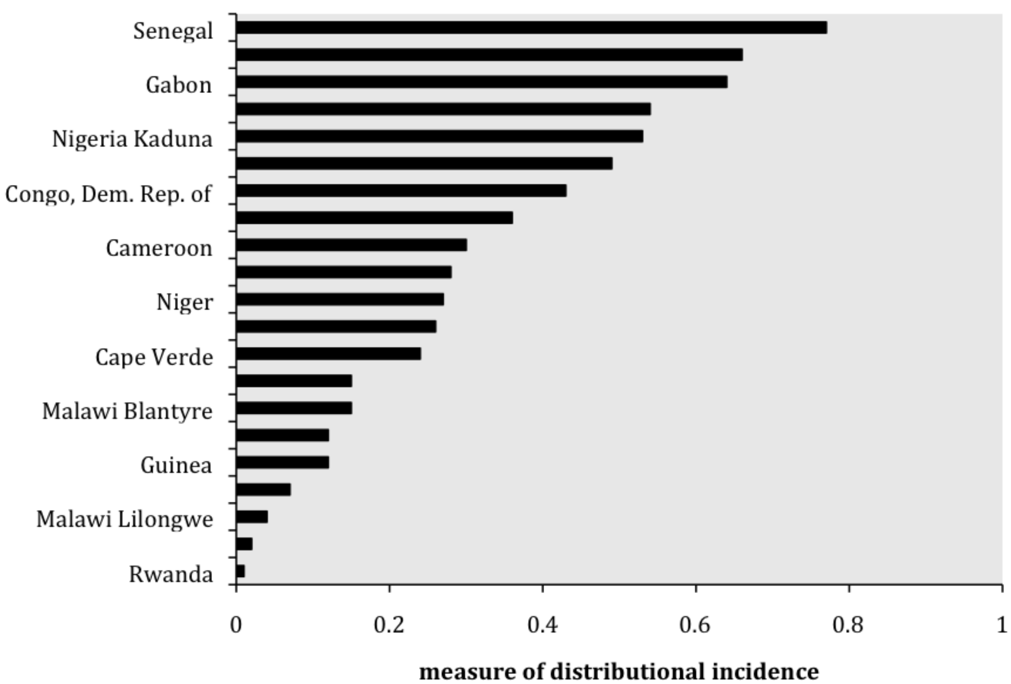
Legend: Q1 – first budget quintile, Q2 – second budget quintile, etc.
Source: Banerjee and others 2009.

Figure 24. Electricity and water subsidies in Ghana are highly regressive

a. Electricity



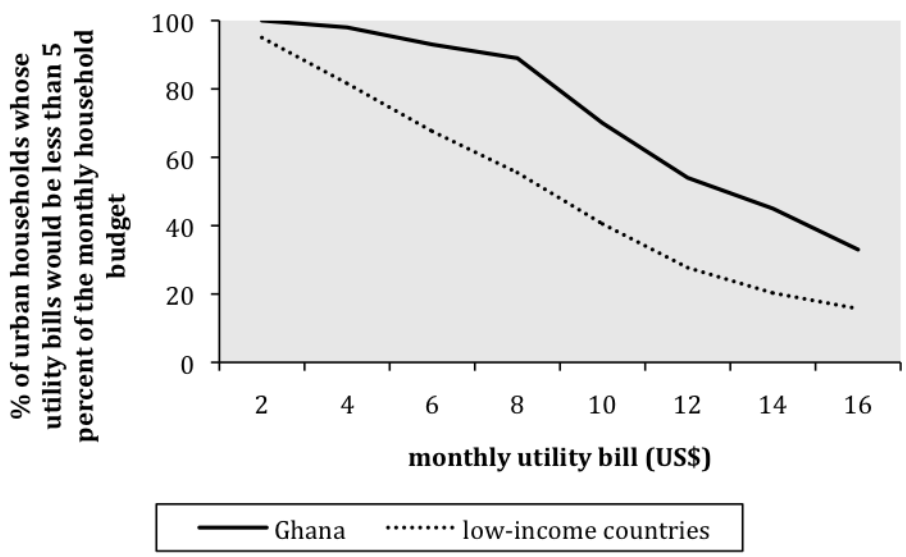
b. Water



Note: Omega is a measure of distributional incidence that measures the share of subsidies received by the poor as a percentage of their share in the population. The higher the value of omega, the better the distributional performance of the subsidy. Values of omega below one denote a regressive subsidy. Values of omega above one denote a progressive subsidy.

How expensive would utility bills become if tariffs reflected costs? For power, with a cost recovery tariff of $0.14 per kilowatt-hour and a monthly subsistence consumption of 50 kilowatt-hours, the associated power bill would be $7 per month. For water, with a cost recovery tariff of $1.07 per cubic meter and a monthly subsistence consumption of 6 cubic meters, the associated water bill would be $6.40 per month. Based on the distribution of household budgets in Ghana, 90 percent of the population could afford monthly utility bills at those levels (figure 25). The share of the population that could afford the service is therefore much higher than the share of the population that already has the service, which suggests that Ghana has scope to increase coverage before affordability becomes a serious impediment to access. A more limited level of subsistence consumption of 25 kilowatt-hours per month for power and 4 cubic meters per month for water (which is adequate to meet a household's most basic needs) would cost $3.50 and $4.30 per month, respectively, and would be affordable to 98 percent of the population.

Figure 25. Utility bills are more affordable in Ghana than in other low-income countries



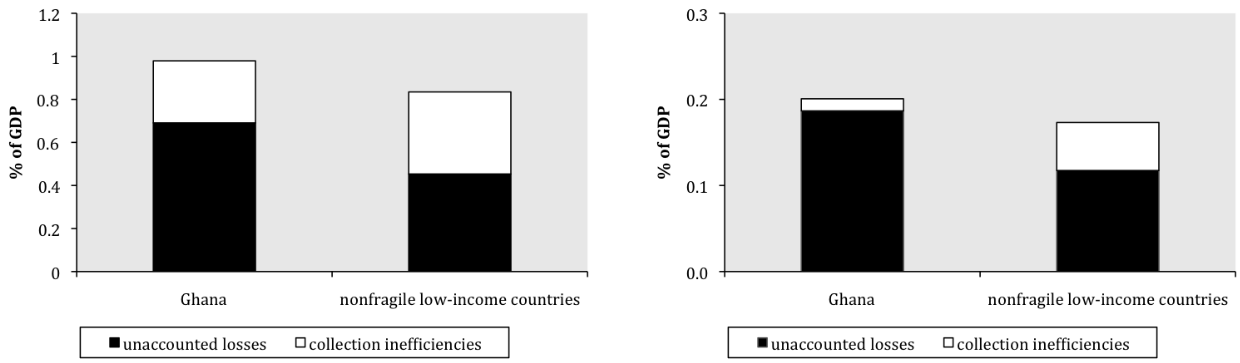
Source: Banerjee and others 2009.

Operational inefficiencies of power and water utilities in Ghana (including distribution losses, undercollection of revenues and overstaffing) generate hidden costs of $212 million a year, equivalent to 2.3 percent of GDP. The annual value of inefficiencies in the power sector ($156 million) is substantially higher than in the water sector ($56 million). The burden of utility inefficiencies in Ghana is somewhat higher than in the low-income peer group, particularly with regard to distribution losses (figure 26). In the power sector, VRA has distribution losses of 25 percent relative to a best practice benchmark of around 10 percent, while GWC has distribution losses in excess of 50 percent relative to a best practice benchmark of 20 percent.

Figure 26. Ghana's utilities are highly inefficient relative to peers

a. Uncollected bills and unaccounted losses in the power sector, as a percentage of GDP

b. Uncollected bills and unaccounted losses in the water sector, as a percentage of GDP



Source: Derived from Briceño-Garmendia and others 2009.

Annual funding gap

If Ghana realized all potential efficiency gains in its infrastructure sectors, a funding gap of $0.4 billion per year (4 percent of 2006 GDP) would remain. The gap would be divided almost equally between power and water supply (table 17). No funding gap would remain for the ICT or transport sectors.

Table 17. Funding gaps by sector

US$ millions

	ICT	Irrigation	Power	Transport	WSS	Total
Needs	(195)	(59)	(1,255)	(307)	(435)	(2,251)
Spending	394	12	275	301	204	1,186
Efficiency gains	82	1	797	76	103	1,059
Funding gap		(46)	(183)		(128)	(357)

Source: Derived from Foster and Briceño-Garmendia, AICD Flagship Report, 2009.

Note: Potential overspending across sectors is not included in the calculation of the funding gap, because it cannot be assumed that it would be applied toward other infrastructure sectors.

— = data not available.

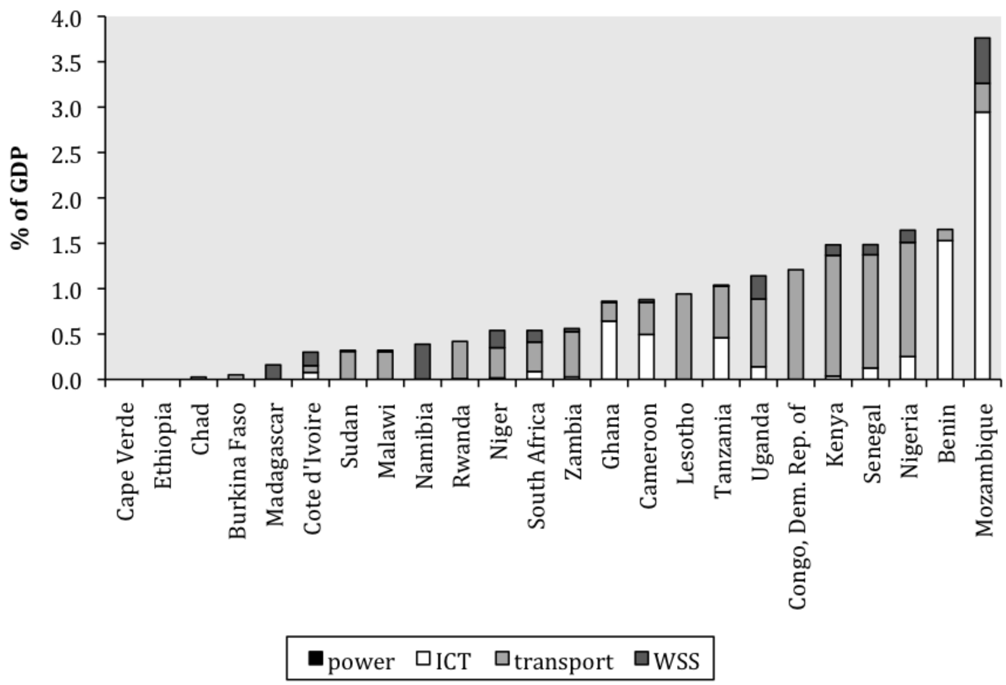
What else can be done?

The funding gap can be addressed by raising additional finance, or by adopting lower cost technologies or less ambitious targets for infrastructure development. In Ghana, there may be realistic prospects for increasing the flow of resources to infrastructure from both the public and private sectors.

First, increased oil production in the country will generate significant fiscal resources for the public sector. It is possible that some of these resources may be directed to infrastructure development, although this is not guaranteed. In Nigeria, for example, infrastructure spending decline during the oil boom of the early 2000s. Angola, on the other hand, seems to have channeled a substantial amount of its oil wealth into infrastructure.

Second, despite Ghana's relatively attractive investment climate and strong economy, Ghana has not attracted as much private finance for infrastructure as have other African peers. During the early 2000s, Ghana captured private investment commitments worth approximately 0.9 percent of GDP. While this is not a bad performance overall, many of Ghana's peers have done significantly better in this area (figure 27). Countries such as Benin, Democratic Republic of Congo, Kenya, Nigeria, Senegal, Tanzania, and Uganda have all captured between 1.0 and 1.6 percent of GDP for infrastructure investment, while the most successful country in this regard, Mozambique, has captured in excess of 3.5 percent of GDP.

Figure 27. Numerous African countries capture more private investment than Ghana



If Ghana cannot raise sufficient additional financing to close the funding gap, it may be possible to reduce the costs of meeting the specified infrastructure targets through careful choice of technology. For example, the spending needs estimates for meeting the water and sanitation MDG goals in Ghana assume that the same technology mix of higher cost and lower cost solutions will be used in the future. If instead, expansion were achieved exclusively using lower cost solutions such as standposts, boreholes, and improved latrines, the savings would be significant. The cost of meeting the MDG goal would fall by around $100 million, reducing the sector financing gap by one-half.

If Ghana were unable to raise additional finance or reduce infrastructure costs, the only way to meet the targets identified here would be to take a longer than ten years to do so. If the country were able to instantly realize all potential efficiency gains while holding spending at current levels, it could meet the identified infrastructure targets within the original target of a decade. Without tackling inefficiencies, those targets would take a total of 40 years to achieve and would not be reachable before 2050. These simulations underscore the importance of making progress on the efficiency agenda, which can advance the country by as much as 30 years toward meeting its infrastructure targets.

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This country report draws upon a wide range of papers, databases, models, and maps that were created as part of the Africa Infrastructure Country Diagnostic. All of these can be downloaded from the project website: www.infrastructureafrica.org. For papers go to the document page (http://www.infrastructureafrica.org/aicd/documents), for databases to the data page (http://www.infrastructureafrica.org/aicd/tools/data), for models go to the models page (http://www.infrastructureafrica.org/aicd/tools/models) and for maps to the map page (http://www.infrastructureafrica.org/aicd/tools/maps). The references for the papers that were used to compile this country report are provided below.

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