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# Côte d'Ivoire's Infrastructure

## A Continental Perspective

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## Abstract

Infrastructure contributed 1.8 percentage points to Côte d'Ivoire's annual per capita GDP growth over the mid-2000s before conflict began to erase the country's infrastructure and its growth contributions. Raising the country's infrastructure endowment to the level of the region's middle-income countries could boost the growth rate by a further 2 percentage points.

Private sector contracts signed in the 1990s resulted in improved operational performance and funding for investments in the water, power, transport, and ICT sectors. Impressively, those contracts survived the crisis and delivered uninterrupted service. But private investment flows have decreased since the mid-2000s.

Côte d'Ivoire's most pressing infrastructural challenge will be to regain the financial equilibrium needed to restore a reliable energy supply. Reestablishing the prominence of Abidjan's port will require investments in terminal capacity and road and rail infrastructure upgrades on hinterland linkages. The underfunding of road maintenance and poor sanitation are additional challenges.

Côte d'Ivoire's annual infrastructure spending was $750 million in the mid-2000s, with going to power sector operations and maintenance. If the underpricing of power and other inefficiencies (valued at $200 million annually) were eliminated, the country's annual infrastructure funding gap would amount to $1 billion, and infrastructure goals could be reached within 20 years.

Côte d'Ivoire has relatively good prospects for bridging its funding gap by raising public investment from its low current level, choosing more efficient technologies, and harnessing additional private investment for infrastructure.


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Produced by the Research Support Team

# Côte d'Ivoire's Infrastructure: A Continental Perspective

***Vivien Foster and Nataliya Pushak***

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Infrastructure contributed 1.8 percentage points to Côte d'Ivoire's annual per capita GDP growth in the mid-2000s. Raising the country's infrastructure endowment to that of the region's middle-income countries could boost annual growth by a further 2 percentage points per capita.Côte d'Ivoire made major strides with respect to infrastructure during the 1990s. As a result, the country has broad-reaching national backbones in the road, energy, and ICT sectors, and relatively high levels of household coverage for utility services. However, much ground was lost to conflict in the mid-2000s. Very little investment has taken place in the last fifteen years, leading to recent power shortages, the deterioration of the road network, and the deceleration of progress on safe water access

Côte d'Ivoire was a pioneer with respect to private participation in infrastructure in Africa. This was possible, in part, because of the country's commitment to charging cost-recovery prices for infrastructure services and thereby helping to assure their commercial viability. Building on the early success with SODECI in the water sector, private sector contracts for power generation, power distribution, and railways were signed in the 1990s. These arrangements resulted in improved in operational performance, and in some areas (ICT, power generation, and water) significant funding for investments. Most strikingly, the contracts were robust during the crisis period, delivering uninterrupted supplies. Yet the level of private investment has tailed-off in recent years, and outside of telecommunications no major new deals have been struck.

Côte d'Ivoire's most pressing challenge will be to regain the financial equilibrium needed to restore a reliable energy supply. Reestablishing the prominence of Abidjan's port will require investments in terminal capacity, as well as road and rail infrastructure upgrades on hinterland linkages. The underfunding of road maintenance must also be addressed. Another challenge lies in sanitation, as it is currently unlikely that the country will meet the associated Millennium Development Goal.

Addressing Côte d'Ivoire's infrastructure deficit will require sustained expenditure of $2.4 billion per year over the next decade. Almost half of that amount relates to the power sector, and much of the remainder to the water and sanitation MDGs. At 10 percent of GDP in 2008, this level of effort is significantly lower than that required by neighboring countries and significantly below what China has expended in recent years.

Côte d'Ivoire's spending on infrastructure was around $0.75 billion in the mid-2000s, or less than 5 percent of GDP, about half of what many neighboring West African countries have been devoting to infrastructure. The majority of spending has gone to the power sector, almost all of it for operations and maintenance, leaving little for capital expenditure. Public investment in infrastructure has been particularly low, with the bulk of recent investments being funded either by the private sector (ICT) or by households (on-site sanitation).

Inefficiencies impose significant additional costs throughout the infrastructure sectors. By far the most serious inefficiency is underpricing of power, which creates financial losses of around $0.2 billion annually. If all inefficiencies were eliminated, the remaining funding gap would amount to $1.0 billion annually.

Relative to other West African neighbors, Côte d'Ivoire has good prospects for bridging its funding gap, whether by allocating additional public funds toward infrastructure or harnessing further private investment. Careful technological choices could reduce the funding gap by half. Under business as usual,

Côte d'Ivoire could take many decades to reach the infrastructure targets. However, if inefficiencies were addressed, the goals could be reached within 20 years, even without increased spending.

# The continental perspective

The Africa Infrastructure Country Diagnostic (AICD) has gathered and analyzed extensive data on infrastructure across almost all African countries, including Côte d'Ivoire. The results have been presented in reports covering different sectors of infrastructure (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 Côte d'Ivoire, allowing the country's infrastructure situation to be benchmarked against that of its African peers. A social and economic crisis in Côte d'Ivoire has crippled its growth trajectory, which had been that of a middle-income country. It will therefore be compared to low-income countries (fragile and non-fragile groups) and middle-income countries, as well as immediate regional neighbors in West Africa.

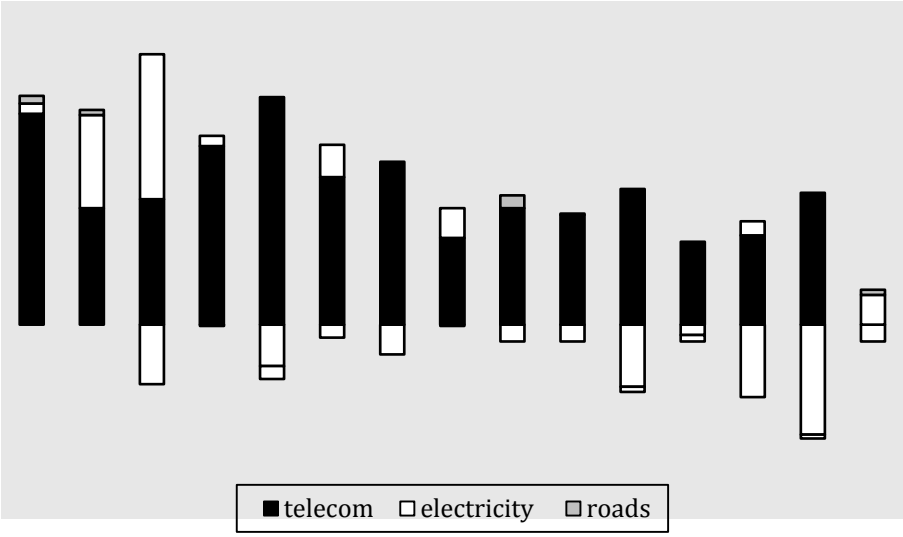
The study presented several methodological issues. First, because of the cross-country nature of data collection, a time lag is inevitable. The period covered by the AICD runs from 2001 to 2006. Most technical data presented are for 2006 (or the most recent year available), while financial data are typically averaged over the available period to smooth out the effects of short-term fluctuations. Second, the indicators and analyses were standardized to ensure that comparisons across countries were consistent. As a result, 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

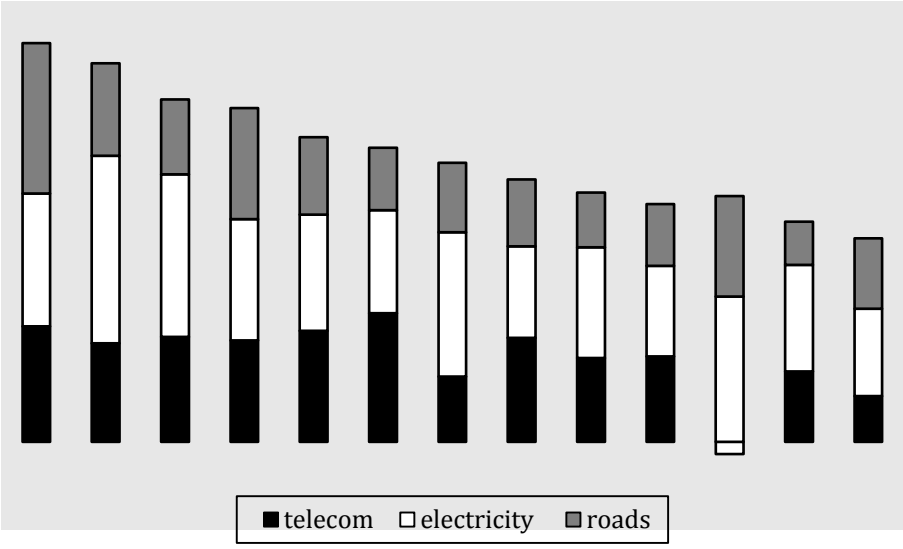
During the five years from 2003 to 2007, Côte d'Ivoire's economy grew at an average annual rate of 1.5 percent, considerably lower than the 2.1 percent recorded in the previous decade. Infrastructure contributed 1.3 percentage points to per capita economic growth over this period. This contribution came mainly from the ICT revolution, while deficient power infrastructure held growth back by 0.3 percentage points. Simulations suggest that if Côte d'Ivoire's infrastructure could be improved to the level of the African leader—Mauritius—annual per capita growth rateswould increase by 1 percent, from 1.3 to 2.3 percent (figure 1).

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

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




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




Source: Calderon 2009.

# The state of Côte d'Ivoire's infrastructure

Côte d'Ivoire's population is concentrated in the southwest and southeast of the country. Almost a quarter of the population lives in the economic capital city of Abidjan (figure 2a). However, the bulk of the mining activity is located in the central and northern part of the country (figure 2b). The northern area is sparsely populated, and nearly 4 out 5 persons living there were below the poverty line in 2008 (Government of Côte d'Ivoire PRSP 2008).

Compared with many other African countries, Côte d'Ivoire has relatively well-developed infrastructure backbones. It has a recognizable national grid for power and a national ICT backbone (figure 3). The northern regions of the country, despite having lower population densities than the rest of the country, are connected via backbones with the rest of the country. Côte d'Ivoire's infrastructure backbones (including road, rail, power, and ICT) are generally integrated with those of neighboring Burkina Faso, but not with those of the neighboring coastal countries of Ghana and Liberia. However, the key road artery to Burkina Faso has deteriorated to poor condition.

This report begins with a review the main achievements and challenges in each of Côte d'Ivoire's major infrastructure sectors (table 1). Thereafter, the financing of Côte d'Ivoire's outstanding infrastructure needs will be discussed.

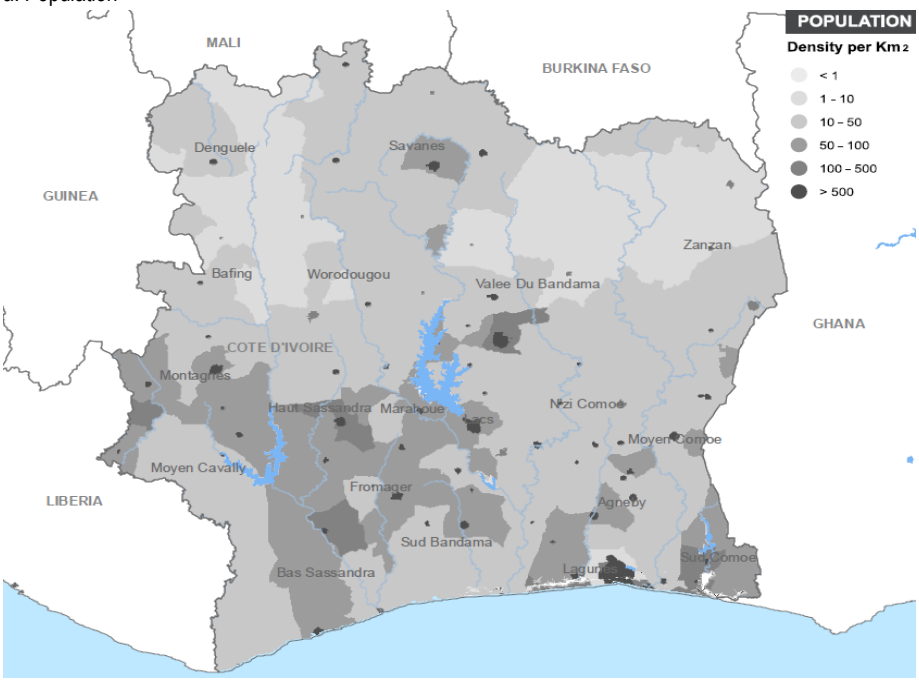
**Table 1 Achievements and challenges in Côte d'Ivoire's infrastructure sectors**

| | Achievements | Challenges |
|---|---|---|
| Air transport | Good airport infrastructure | Improving safety and security standards |
| ICT | Highly competitive mobile market with very high levels of penetration | Establishing competitive access to submarine cables<br>Extending GSM signal and Internet coverage into rural areas |
| Ports | Port of Abidjan has the potential to be a regional maritime hub | Expanding capacity to deal with traffic growth Moving ahead with institutional reform |
| Power | Well-developed power system and established regional power exporter<br>Longstanding and successful experience with private participation | Expanding generation capacity to improve reliability of power supply<br>Addressing growing financial shortfall due to under-pricing of power |
| Railways | The rail concession (SITARAIL) has boosted traffic and performance | Rebalancing financial structure of the railway concession<br>Finding alternative funding for rehabilitation backlog |
| Roads | Second generation road sector institutional reforms are in place | Securing adequate funding for road maintenance and rehabilitation |
| Irrigation | | Expanding irrigated area and rehabilitating abandoned perimeters |
| Water and sanitation | Longstanding and successful "affermage" (lease contract) has expanded access and boosted performance | Adjusting tariffs to stem growing hidden costs of utility<br>Raising access to improved sanitation |

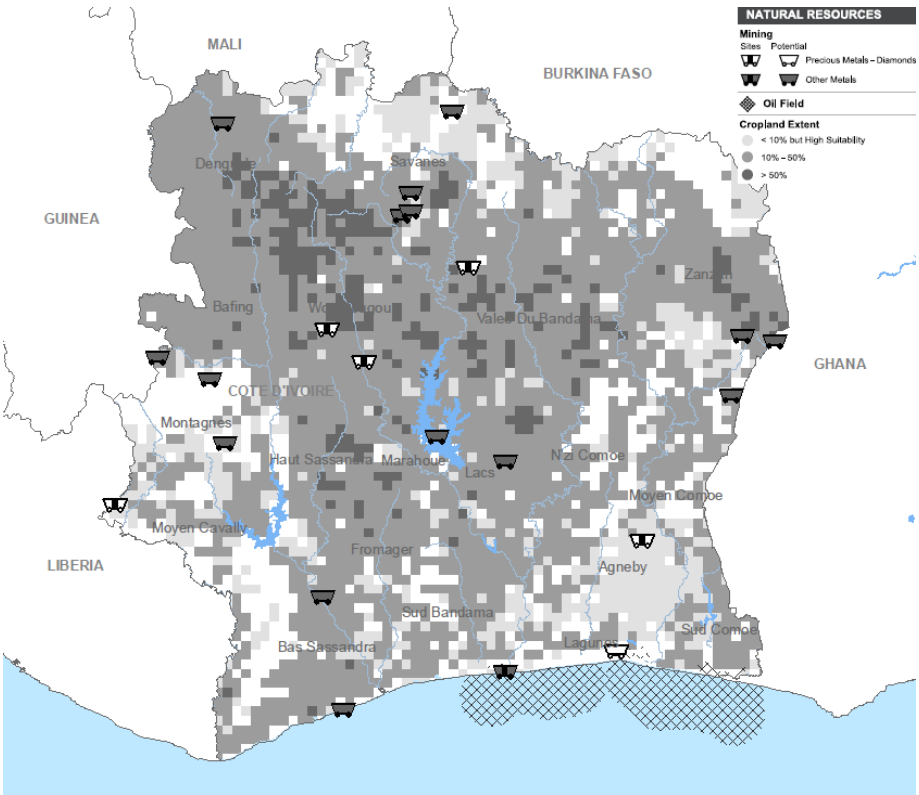
Source: AICD.

**Figure 2 Côte d'Ivoire's population, topography, natural resources, and poverty**

a. Population

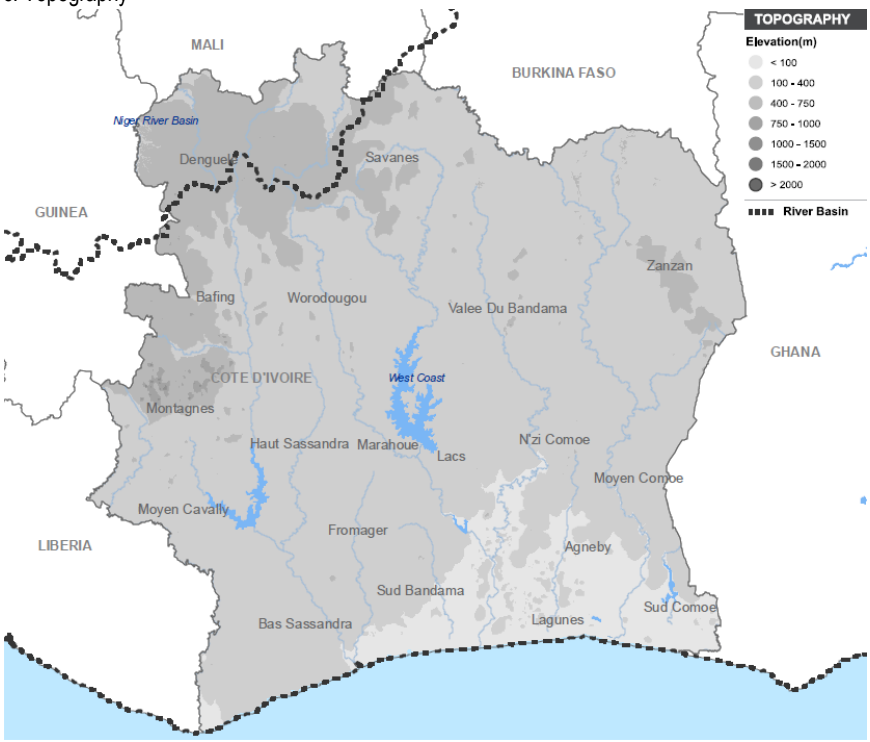



b. Natural resources

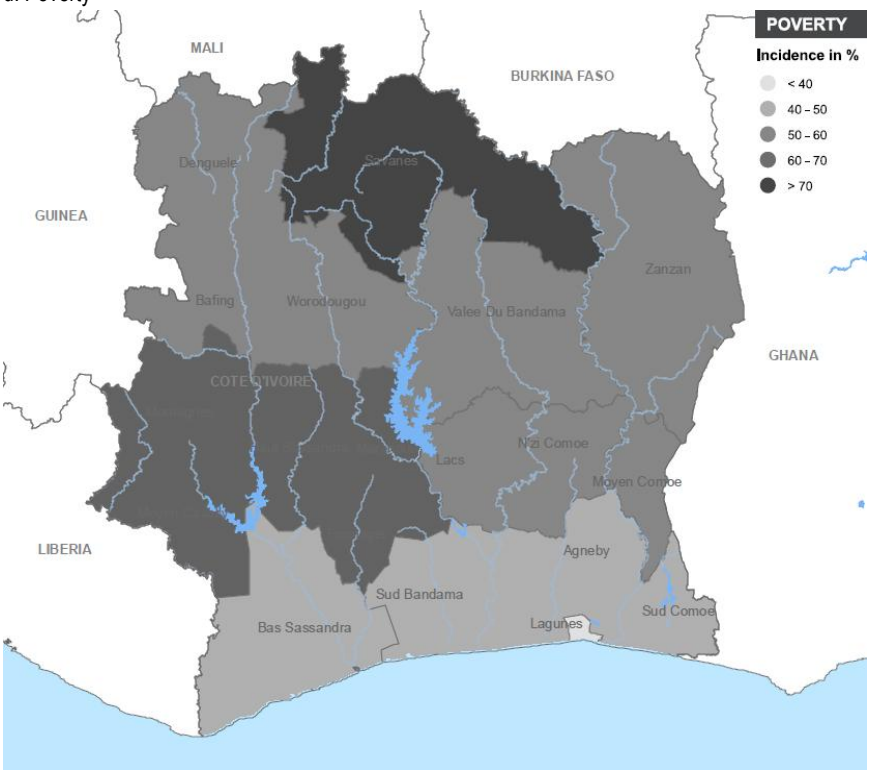



Source: AICD Interactive Infrastructure Atlas for Côte d'Ivoire downloadable from http://www.infrastructureafrica.org/aicd/system/files/civ_new_ALL.pdf

c. Topography



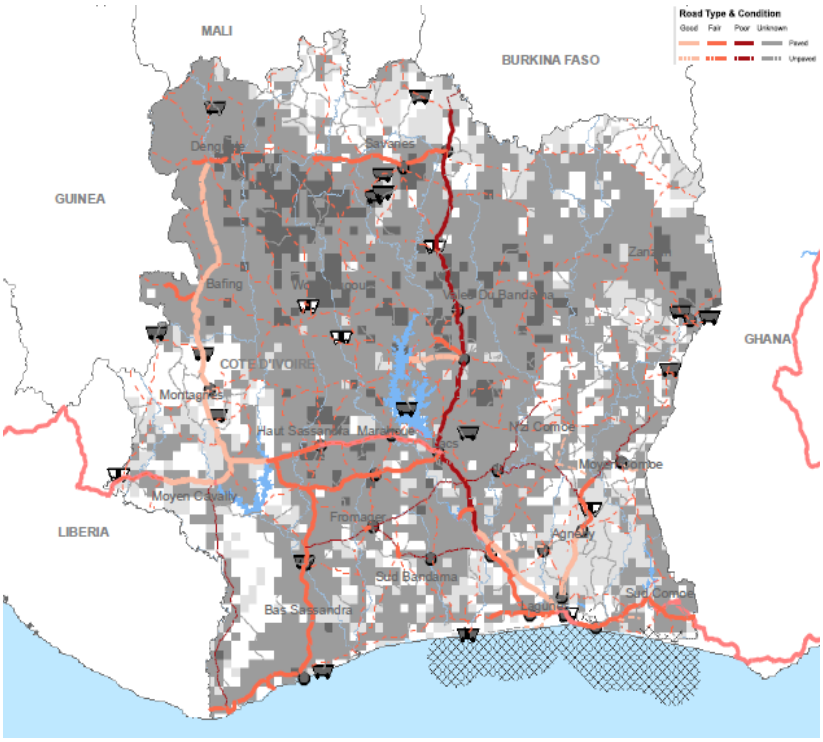

d. Poverty



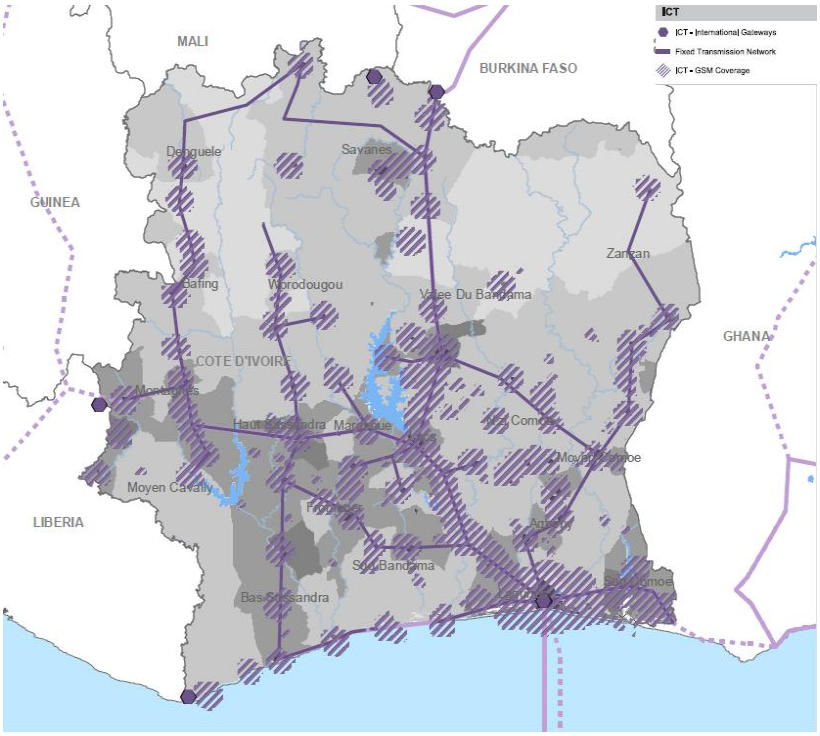

Source: AICD Interactive Infrastructure Atlas for Côte d'Ivoire downloadable from http://www.infrastructureafrica.org/aicd/system/files/civ_new_ALL.pdf

**Figure 3 Côte d'Ivoire's infrastructure networks**

a. Roads

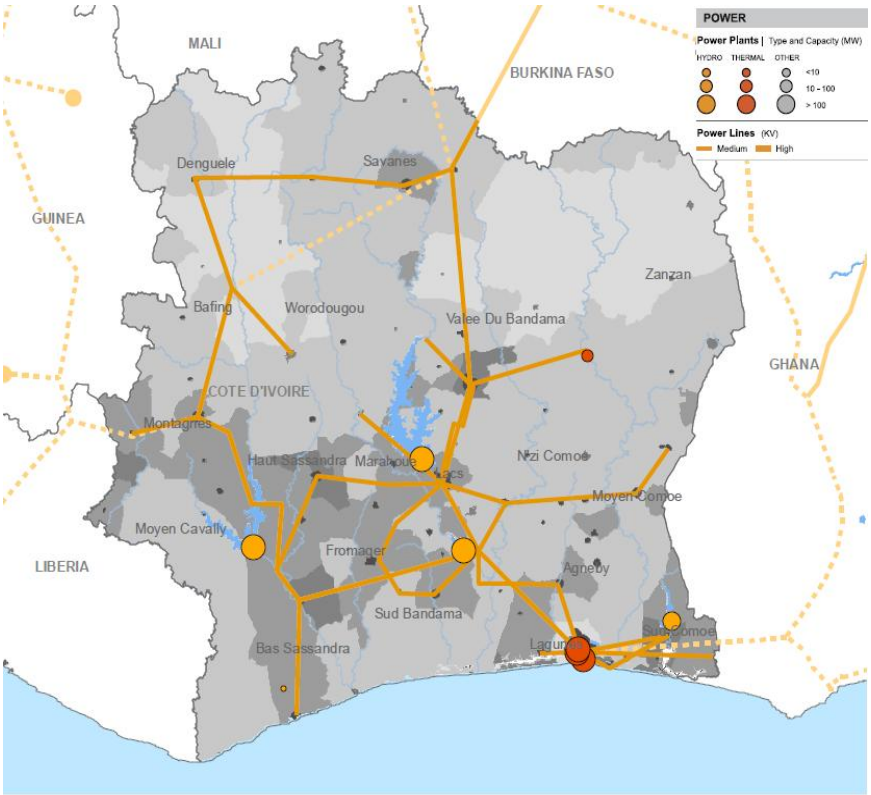



b. ICT

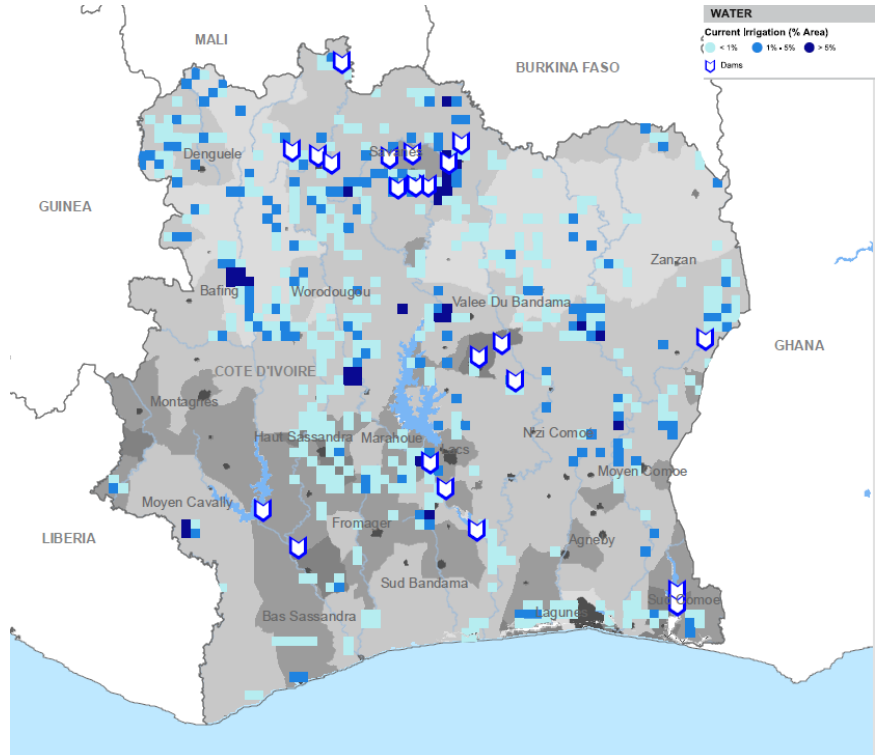



Source: AICD Interactive Infrastructure Atlas for Côte d'Ivoire downloadable from http://www.infrastructureafrica.org/aicd/system/files/civ_new_ALL.pdf

c. Power




d. Water




Source: AICD Interactive Infrastructure Atlas for Côte d'Ivoire downloadable from http://www.infrastructureafrica.org/aicd/system/files/civ_new_ALL.pdf

## Roads

### Achievements

At first sight, Côte d'Ivoire's road density looks relatively low by African standards (table 2). However, an analysis of the road network suggests that the primary and secondary networks provide sufficient connectivity to link the capital cities, secondary towns, and international borders.

Like many other African countries, Côte d'Ivoire has made significant progress with second generation road sector reforms. It has established both a Road Fund and a Road Agency. Yet the Road Fund does not conform to best practice design criteria. In particular, the fund has no clear legal basis, nor is there provision for direct transfer of Road Fund resources to the Road Agency. In contrast to many other African countries that spread Road Fund resources across the main, rural, and urban networks, Côte d'Ivoire allocates 90 percent of Road Fund resources to the main road network and the balance to urban roads. The rural network does not benefit from the Road Fund.

**Table 2 Côte d'Ivoire's road indicators benchmarked against Africa's low- and middle-income countries, mid 2000s**

| | Unit | Low-income countries | **Côte d'Ivoire** | Middle-income countries |
|---|---|---|---|---|
| Total road network density | km/1000 km$^2$ of arable land | 133 | **82** | 318.4 |
| Classified road density | km/1000 km$^2$ | 88.2 | **80** | 278.4 |
| GIS Rural accessibility | % of rural population within 2 km from all-season road | 23.1 | **32.2** | 31.5 |
| Paved road traffic | average annual daily traffic | 1,287.7 | **843** | 2,558.3 |
| Unpaved road traffic | average annual daily traffic | 38.5 | **47** | 74.7 |
| Paved network condition | % in good or fair condition | 86.2 | **79.9** | 82.0 |
| Unpaved classified network condition | % in good or fair condition | 55.8 | **73.0** | 57.6 |
| Perceived transport quality | % of firms identifying transport quality as major business constraint | 27.6 | **38.2** | 18.2 |
| Overengineered | % of main road network over-engineered | 29.6 | **24.0** | 18.4 |
| Underengineered | % of main road network under-engineered | 13.5 | **2.6** | 20.0 |

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

### Challenges

The Road Fund is supported by a fuel levy, which as of 2006 was set at $0.05 per liter. This is far below the estimated $0.15 per liter needed to fully maintain and rehabilitate the country's classified road network.As a result, as in other neighboring West African states, road sector spending in Côte d'Ivoire falls far short of what is needed to catch-up with the neglect of the recent past and to maintain the network once it is restored to good condition (figure 4). According to simulations, Côte d'Ivoire needs to spend about $48 million per year to fund proper maintenance activities. When rehabilitation and other capital spending needs are added, the total estimated requirement for the network at present stands at around $85 million a year.During the crisis period, road sector spending all but collapsed (table 3). Since 2005, Côte d'Ivoire has managed to gradually step-up its resource mobilization for the sector, even if the capacity to spend those resources has lagged somewhat behind. In the year 2009, realized spending reached almost

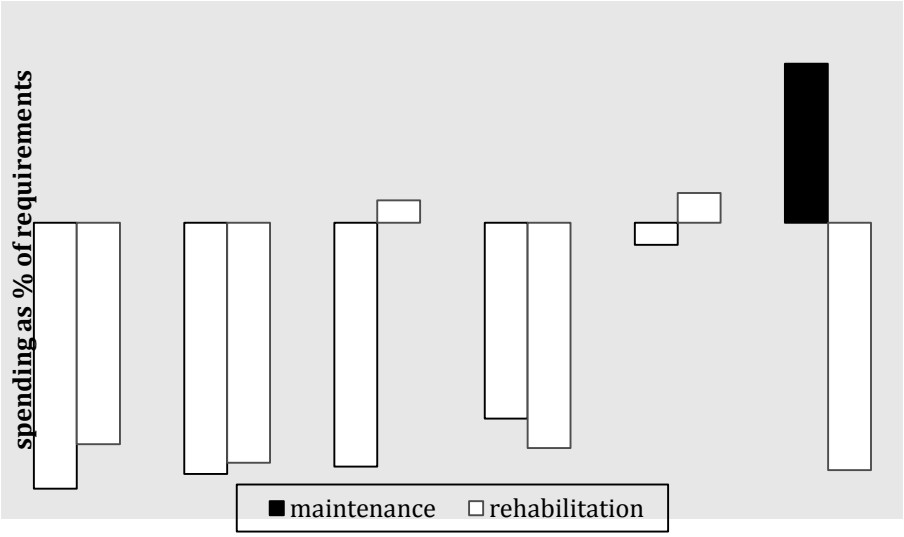
$23 million. However, even this still falls well short of the required $30 million for *routine* maintenance alone, and is barely a quarter of the $84 million needed to cover routine and periodic maintenance plus the rehabilitation backlog.

**Table 3 Estimated needs and realized spending on road maintenance and rehabilitation in Côte d'Ivoire**

| $ millions | Estimated needs | Spending plans | Resources mobilized | Realized spending |
|---|---|---|---|---|
| 2002 | 57.4 | 0.6 | 0.7 | 0.0 |
| 2003 | 68.8 | 0.7 | 0.7 | 0.0 |
| 2004 | 75.7 | 2.7 | 3.7 | 0.7 |
| 2005 | 75.8 | 1.9 | 13.1 | 6.6 |
| 2006 | 76.5 | 49.0 | 19.4 | 5.5 |
| 2007 | 83.5 | 39.4 | 25.0 | 30.0 |
| 2008 | 89.3 | 34.0 | 26.5 | 18.4 |
| 2009 | 84.7 | 30.9 | 27.1 | 22.5 |
| Cumulative | 611.8 | 159.2 | 116.2 | 83.7 |

Source: Fonds d'Entretien Routier, 2010.

**Figure 4 Côte d'Ivoire is not spending enough to catch up with its road rehabilitation backlog**




Source: Gwillliam and others 2009.

The lack of road rehabilitation and maintenance has particularly damaging implications on the main north-south artery of the country linking Abidjan to Ouagadougou, which is a sea corridor of great strategic significance supporting international trade for land-locked Burkina Faso. Maintenance of the corridor has been neglected since the beginning of the crisis, and it is now in poor condition and needs rehabilitation (figure 3a). This portion of Côte d'Ivoire's national road network is essentially a regional public good essential to support the trade of the landlocked hinterland countries , and its condition therefore has serious implicationseven beyond national borders.

Rural access to roads is also a concern. According to the rural accessibility index, about 32 percent of Côte d'Ivoire's rural population live within two kilometers of an all-season road. This percentage is

relatively high by African standards, but only about half what would be found elsewhere in the developing world. Simulations suggest that given the spatial distribution of the country's population, having 100 percent of the rural population within 2 kilometers of an all-season road would require about 40,000 kilometers of all season roads. This is about twice the length of the existing classified network and would require a huge investment in rural roads. A more targeted approach would be to prioritize access in areas of high agricultural productivity. Simulations suggest that a well maintained network of 20,000 kilometers could provide access to land responsible for 80 percent of agricultural production value. At the same time, this would raise the rural accessibility index to around 50 percent.

Beyond physical road infrastructure, road freight transport services in Côte d'Ivoire face a number of non-physical barriers. Unless these issues are resolved, any improvements in road network infrastructure will not deliver their full potential economic benefits. First of all, police agents extract significant bribes from travelers along the national road network. A recent study estimates the total annual value of these bribes at between $ 200 million and $290 million per year, of which about a quarter comes from freight traffic and the remaining three-quarters from passenger traffic. The high level of bribes in Côte d'Ivoire diverts some regional transit traffic to other gateways (such as Lomé and Tema). On the Abidjan –Lagos corridor, the average bribe per truck is $88 per 100 kilometers on the Ivorian section compared with $12 per 100 kilometers in Ghana. Road harassment not only adds costs and unpredictable delays to the transport of goods, but it also incites transporters to overload their truck to compensate for the cost of the bribes. Lax enforcement of the charge load per axle accelerates deterioration of the road network. Until the prevalence of bribery is addressed, Côte d'Ivoire will remain uncompetitive as a regional transit corridor for West Africa.

Road freight tariffs in Western Africa are $0.08 per tonne-kilometer,which is very high by global and African standards. Throughout the developing world, road freight tariffs are typically between $0.01 and $0.04 per ton-kilometer, and in Southern Africa they are $0.05 per ton-kilometer. High profit margins of the order of 100 percent in West Africa can explain a large part of this difference. The underlying cause of these high profit marginsis limited competition combined with restrictive market regulations based on "tour de role" principles, which involve centralized allocation of freight on a queuing system preventing truckers from entering directly into bilateral contracts with customers, and thereby limiting the annual mileage of vehicles, and eliminating incentives for vehicle upgrading.

## Rail

### Achievements

Côte d'Ivoire and Burkina Faso jointly own Sitarail, a transnational railway. The line was one of the first in Africa to be awarded as a concession to the private sector in 1995 and is a key conduit for transport of bulk freight to and from landlocked Burkina Faso. Between 2000 and 2005, Sitarail and the other West African railway concession—Transrail—were by far the strongest performing concessions on a wide range of operational indicators, including productivity of labor, locomotives, and rolling stock. Traffic density on Sitarail was close to 500,000 tonne-kilometers per route-kilometer, which was by far the highest in the region (although still low in absolute terms). Between 1995 and 2000, during the first

five years of the concession, the volume of freight almost tripled from 300 million to 800 million tonnes annually.

**Table 4 Railway indicators for Côte d'Ivoire and selected other countries, 2000–05**

| Railway | TRANSRAIL | SITARAIL | GRC | NRC | OCBN |
|---|---|---|---|---|---|
| Country | Mali/Senegal | Burkina Faso/ Côte d'Ivoire | Ghana | Nigeria | Benin |
| Concessioned (1) / State run (0) | 1 | 1 | 0 | 0 | 0 |
| Freight Traffic Density (1000 tonne-km/km) | 318 | 494 | 242 | 15 | 148 |
| Productivity | | | | | |
| Labor (1,000 traffic units per employee) | na | 481 | 84 | 37 | 40 |
| Carriage (1,000 passenger-km per carriage) | na | 862 | 416 | 737 | 900 |
| Wagon (1,000 net tonne-km per wagon) | 804 | 1020 | 458 | 59 | 74 |
| Locomotive (million traffic units per locomotive) | 40 | 35 | 7 | 13 | 3 |
| Tariffs (Aver. Unit Tariff) | | | | | |
| Passenger (US cents/passenger-km) | 2.2 | 3.3 | 2.4 | na | 2.0 |
| Freight (US cents/tonne-km) | 3.3 | 5.5 | 4.4 | na | 5.8 |

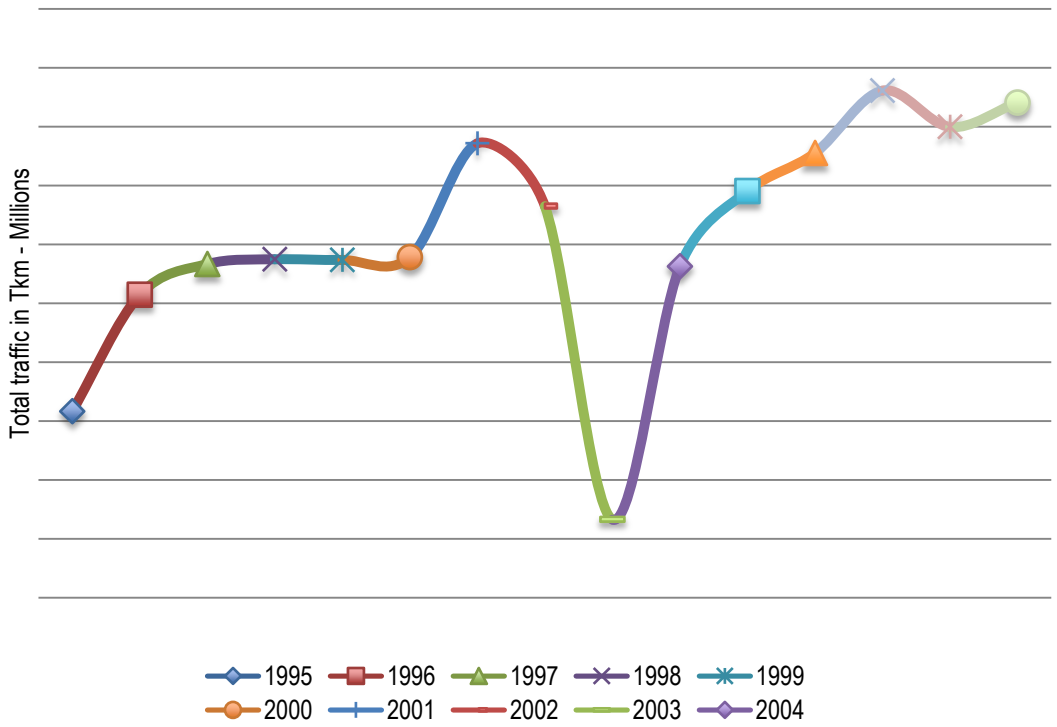
Source: Bullock 2009, derived from AICD railways database downloadable from http://www.infrastructureafrica.org/aicd/tools/data
— = data not available.

### Challenges

The crisis that erupted in 2002 severely affected rail freight traffic volumes, and by 2003 traffic volumes had fallen to 100 million tons (figure 5). Following special security measures, traffic volumes recovered quickly even before the peace accord of 2007, and since 2006 they have exceeded their earlier peak, which was reached in 2001.

More recently, theSitarail concession has entered into a dispute with the authorities, due to the failure of the concessionaire to finance anticipated track rehabilitation. As a result, only half of the planned five year investment program of $12.4 million has been delivered. This problem has been widespread across Sub-Saharan African rail concessions. Due to the relatively low volume of freight traffic and competition from the road sector, it is rarely possible for rail networks to earn sufficient revenue to finance track rehabilitation. In the case of Sitarail, it is likely that the original forecasts made at the time of the award of the concession overestimated the likely freight traffic flows and underestimated the extent of the investment need. More recently, spending needs for the concession for 2008 to 2020 have been estimated to be $132 million for track rehabilitation and $99 million for rolling stock—a total of $231 million. This is roughly three times the revenue of the concession in 2009 and can therefore only be met with public finance.

**Figure 5 Evolution of SITRARAIL's freight traffic over time**




Source: AICD 2006; WB/AfDB 2009.

## Ports

### Achievements

The port of Abidjan is important to the West African region. Until 2002, Abidjan was becoming a regional hub for trade. But after the crisis erupted, major shipping lines began to use Spanish or North African ports to service the West Africa coast instead. Since 2007, however, traffic volumes have begun to rise, and conditions at the port have been returning to normal. Abidjan may yet play the role of a regional hub.

Côte d'Ivoire has reached outto landlocked neighbors that are key strategic clients for the port of Abidjan. In particular, Côte d'Ivoire created a strategic north-south corridor linking its landlocked neighbors of Burkina Faso, Mali, and Niger. The port of Abidjan has opened offices in each of these countries to facilitate interactions with clients. Furthermore, Abidjan is now exempt from the war zone tax that had been imposed by international shipping lines on ships traveling to Côte d'Ivoire.

The private sector has been an important participant in port activities in Abidjan, primarily through concessions for the container and ore terminals. Private sector expertise has helped to significantly improve container handling performance. The terminal operator claims that each of its ship-to-share cranes are consistently achieving 35 moves per hour. Cargo handling performance at the port's ore terminal has recently been upgraded to 600 tonnes per hour with the introduction of new equipment.

Overall, the efficiency and performance of the port of Abidjan compare favorably with those of its neighbors, but the port is relatively costly to use (table 5). In addition the port has started the specialization of its quays while reaching international volumes of traffic. In April 2010 it issued $50 million in bonds to modernize its equipment.

**Table 5 Benchmarking port indicators: port of Abidjan compared with other West African ports**

| | Abidjan Côte d'Ivoire | Freeport of Monrovia Liberia | Cotonou Benin | Tema Ghana | Apapa Nigeria | Dakar Senegal | Lome Togo |
|---|---|---|---|---|---|---|---|
| **CAPACITY:** | | | | | | | |
| Containers handled ('000s TEU/year) | **500** | 50 | 158 | 471 | 336 | 306 | 460 |
| General cargo handled ('000s tons/year) | | | 1,100 | 7,900 | 3,400 | 6,109 | |
| **EFFICIENCY:** | | | | | | | |
| Container dwell time - average (days) | **12** | 15 | 12 | 25 | 42 | 7 | 13 |
| Truck processing time for receipt and delivery of cargo (turn-round time) - average (hours) | **2.5** | 5.5 | 6 | 8 | 6 | 5 | 4 |
| General cargo vessel pre-berth waiting time - average (hours) | **2.9** | 2.5 | 48 | 9.6 | 36 | 24 | |
| General cargo vessel stay (turnaround time) - average (hours) | **2.2** | 3 | 48 | 48 | 40.8 | 60 | |
| Container crane productivity* (container per hour) | **18** | | | 13 | 12 | | |
| General cargo crane/gang productivity - average (tones per hour) | **16** | 16 | 15 | 13.5 | 9 | | 22.5 |
| **TARIFFS:** | | | | | | | |
| General cargo handling charge, ship to gate - average ($/tonne) | **260** | 200 | 180 | 168 | 155 | 160 | 220 |
| Dry bulk handling charge, ship to gate or rail - average ($/tonne) | **13.5** | 10.5 | 8.5 | 10 | 8 | 15 | 9 |
| Liquid bulk handling charge –average ($/tonne) | **5** | 4 | 5 | 3 | | 5 | 5 |

Source: Mundy and Penfold 2009.

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

TEU = 20-foot equivalent units.

### Challenges

As traffic in the port of Abidjan increases, expansion, specialization, and modernization will have to be on the port's agenda. In 2008 the port initiated a project to add major new deepwater container capacity at Île Boulay, thereby promoting the port's role as a major transshipment hub for West Africa. When the project is complete, the port of Abidjan will be able to handle up to three million containers per year, or about six times recent levels. Also on the agenda is the construction of a bridge connecting the port directly to the northern highway and bypassing the center of Abidjan, which will improve the port's connecting landside infrastructure.

The port will also have to address the fragmented nature of labor unions, which complicates labor negotiations. With 14 different syndications, a strike by one union can significantly prejudice the work of

the port.Reform of the unions into one body or a structure that makes negotiations with the employer side simplerwould improve port efficiency.

## Air transport

### Achievements

Côte d'Ivoire has the fourth-largest regional air transport market in the ECOWAS area (table 6). Abidjan has emerged as a minor sub-regional hub for air transport. Many of the African francophone countries have daily or close to daily flights to and from there. The strongest air transport links are with Accra in neighboring Ghana. Competition in the international market is quite strong, with a Herfindahl index of less than 10 percent. The aircraft fleet serving the country has undergone important changes in recent years with a shift towards smaller sizeand more modern aircraft.

### Challenges

The demise of Air Afrique and the Ghanaian and Nigerian flag carriers in the early 2000s hit Côte d'Ivoire's air transport market particularly hard. Overall air traffic in Côte d'Ivoire fell from 1.8 million seats in 2001 to 1.2 million seats in 2007 (figure 6a). Intra-African traffic fell most steeply. In addition, connectivity has fallen. In 2001, there were flights out of Abidjan to 45 different cities, but that total had dropped to around 30 by 2007 (figure 6b). Furthermore, the country lacks a domestic air transport market. While air traffic was still declining in 2007 in Côte d'Ivoire, neighboring countries saw their air traffic rebounding. In particular Accra airport in Ghana surpassed Abidjan airport traffic.

Airport platforms do not require upgrading in the medium term, but airport facilities and services could be improved to attract more traffic. Like many other African countries, Côte d'Ivoire continues to face significant safety and security issues in air transport. Côte d'Ivoire failed the FAA/IASA Audit—meaning that it does not meet international standards for safety oversight—and none of its carriers have passed the IATA/IOSA Audit.

**Figure 6 Air traffic and connectivity trends for Côte d'Ivoire**

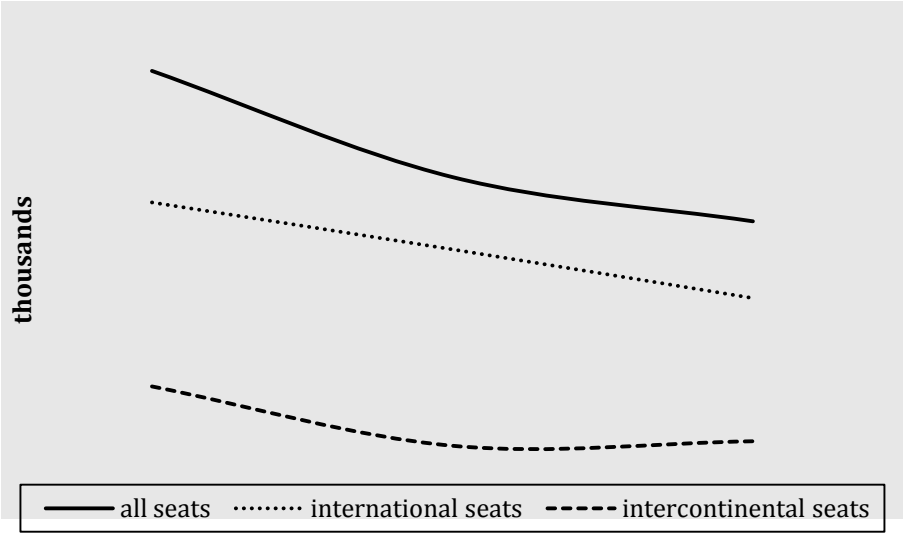


**Table 6 Benchmarking air transport indicators for Côte d'Ivoire and other West African countries**

| Country | Côte d'Ivoire | Ghana | Nigeria | Senegal | Kenya | Tanzania |
|---|---|---|---|---|---|---|
| **TRAFFIC (2007)** | | | | | | |
| Domestic Seats(millions per year) | **0+** | 0.14 | 9.30 | .13 | 2.09 | 1.87 |
| Seats for international travel within Africa(millions per year) | **0.85** | 0.91 | 1.37 | 1.26 | 3.14 | 1.27 |
| Seats for intercontinental travel (millions per year) | **0.30** | 0.83 | 2.44 | 1.23 | 2.76 | 0.59 |
| Seats available percapita | **0.06** | 0.08 | 0.09 | 0.23 | 0.28 | 0.12 |
| Herfindahl index – domestic market (%) | **-** | 100.0 | 18.0 | 100.0 | 60.5 | 31.0 |
| Herfindahl index – international market | **9.8** | 6.4 | 6.4 | 10.3 | 34.1 | 13.0 |
| **QUALITY** | | | | | | |
| Percent of seat km in medium or smaller aircraft | **52.3** | 15.7 | 29.6 | 39.3 | 23.3 | 48.6 |
| Percent of seat km in newer aircraft | **90.8** | 96.8 | 71.4 | 98.3 | 80.2 | 79.3 |
| Registered carriers on EU blacklist | **0** | 0 | 0 | 0 | 0 | 0 |
| FAA/IASA Audit Status | **Fail** | Fail | No audit | No audit | No audit | No audit |
| Percent of carriers passing IATA/IOSA Audit | **0** | 0 | 28.6 | 50.0 | 11.1 | 33.3 |

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

## Water supply and sanitation

### Achievements

According to the UNICEF-WHO Joint Monitoring Program (2010 report), access to improved water in Côte d'Ivoirestarted from a relatively high base of 76 percent. Nevertheless, progress since that date has been slow, with the access to improved water increasing only slightly to 80 percent by 2008. While the overall envelope of those with access to improved water has not moved significantly, the level of service received by those with access has improved substantially. In particular, the percentage of the population with piped water on premises almost doubled, from 22 percent in 1990 to 40 percent in 2008 (table 7).

A relatively small percentage of the population of Côte d'Ivoire relies on surface water—less than 10 percent, compared with 37 percent in the low-income benchmark group and 13 percent in the middle-income benchmark group (table 8). As of 2006, access to piped water was about twice as high in Côte d'Ivoire as the low-income benchmark, and access to stand posts was also somewhat higher. Around 50 percent of Côte d'Ivoire's population relies on groundwater compared with 40 percent in the low-income benchmark group. Overall, the country has relatively well-developed utility water.

**Table 7 Long term trends in improved water**

| | 1990 | 2000 | 2008 |
|---|---|---|---|
| Drinking Water | | | |
| Total improved | 76 | 78 | 80 |
| Piped on premises | 22 | 31 | 40 |
| Other improved | 54 | 47 | 40 |
| Unimproved | 24 | 22 | 20 |
| Sanitation | | | |
| Improved | 20 | 22 | 23 |
| Shared (unimproved) | 15 | 16 | 18 |
| Unimproved facilities | 29 | 30 | 32 |
| Open defecation | 36 | 32 | 27 |

Source: WHO – UNICEF, JMP, 2010.

**Table 8 Benchmarking water access**

| | Unit | Low-income countries | Côte d'Ivoire | | | | Middle-income countries |
|---|---|---|---|---|---|---|---|
| | | Mid-2000s | **LSM88** | **DHS94** | **MICS00** | **MICS06** | Mid 2000s |
| Access to piped water | % pop | 10.5 | 18.10 | 23.28 | 24.51 | 19.13 | 52.1 |
| Access to standposts | % pop | 16.2 | 13.70 | 23.35 | 19.00 | 22.03 | 18.9 |
| Access to wells/boreholes | % pop | 38.3 | 55.22 | 45.28 | 54.10 | 49.54 | 6.0 |
| Access to surface water | % pop | 37.4 | 13.00 | 7.69 | 7.72 | 9.20 | 13.0 |

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.

Côte d'Ivoire was a pioneer for private sector participation in the water sector. SODECI's concession contract for potable water and lease contract for sanitation dates back to 1959 and was renewed and redesigned in 1987 for a 20-year period. The 1987 contract has withstood a range of financial, economic, and political shocks. The concessionaire implemented and almost entirely self-financed the impressive gains in utility water access described above. Moreover, operational performance has been very strong. Revenue collection rates are close to 100 percent, and distribution losses are close to best practice levels, although they have risen lately from 17 percent in 2001 to closer to 23 percent in 2008 (table 9).

**Table 9 Benchmarking utility performance**

| | Unit | Low-income fragile countries | **Côte d'Ivoire** | | Middle-income countries |
|---|---|---|---|---|---|
| | | Mid 2000s | **2004** | **2008** | Mid 2000s |
| Domestic water consumption | liter/capita/day | 51.3 | | | 171.5 |
| Urban water assets in need of rehabilitation | % | 36.0 | **33.0** | | 25.0 |
| Revenue collection | % sales | 96.0 | **100.0** | **100.0** | 100.0 |
| Distribution losses | % production | 32.7 | **21.7** | **22.5** | 26.8 |
| Cost recovery | % total costs | 80.0 | **73.8** | **76.1** | 80.0 |
| Connections per employee | number | 190.7 | **352.4** | | 368.7 |
| Total hidden costs as % of revenue | % | 350.2 | **121.2** | **112.2** | 167.4 |

| U.S. cents per m$^3$ | **Côte d'Ivoire** | | Scarce water resources | Other developing regions |
|---|---|---|---|---|
| | **2004** | **2008** | | |
| Residential tariff (at 10 m$^3$) | **6.4** | | 60.26 | 3.0 – 60.0 |
| Non-residential tariff (at 100 m$^3$) | **107.2** | | 120.74 | |

* Based on DHS 1999 and MICS 2006.

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.

### Challenges

Despite SODECI's strong historical record, in recent years its financial performance has deteriorated as the real value of the tariff has eroded. The 1987 concession contract provides for tariff revisions every five years. Yet the scheduled revision for 2001 was delayed until 2004 during the recent crisis period,, and as a result the hidden costs due to under-pricing rose substantially (table 10). Currency appreciation amplified the effect of the 2004 tariff hike, and in 2008 the average effective tariff was $0.89 per cubic meter, almost double the 2001 level, but still significantly short of the full costs, which had escalated to $1.17..As a result of these tariff adjustments, the hidden costs associated with under-pricing of SODECI's services have fallen from around 0.4 percent of GDP in 2001 to less than 0.2 percent of GDP today, but still remain an issue for the sector (figure 8). As of 2001, SODECI's hidden costs were 94 percent of revenues, comparable to Ghana's water utility and among the worst in the region. By 2008, however, hidden costs had fallen to 55 percent of revenues and were among the best in the region, comparable to the water utilities of Benin and Cape Verde.

**Table 10 Evolution of hidden costs associated with SODECI**

| | Water production | Distribution losses | Collection ratio | Average total cost | Average effective tariff | Total hidden costs | Total hidden costs |
|---|---|---|---|---|---|---|---|
| | (millions of$m^3$/year) | (%) | (%) | ($/$m^3$) | ($/$m^3$) | ($ millions/year) | (% revenues) |
| 2001 | 146.1 | 17.47 | 100.0 | 0.83 | 0.45 | 45.3 | 94.1 |
| 2002 | 148.3 | 18.77 | 100.0 | 0.91 | 0.47 | 52.0 | 93.5 |
| 2003 | 156.2 | 20.25 | 100.0 | 0.92 | 0.57 | 44.0 | 72.7 |
| 2004 | 161.4 | 21.70 | 100.0 | 1.03 | 0.76 | 37.0 | 47.6 |
| 2005 | 164.6 | 21.73 | 100.0 | 1.03 | 0.76 | 37.5 | 48.5 |
| 2006 | 167.8 | 22.02 | 100.0 | 1.02 | 0.76 | 36.2 | 61.9 |
| 2007 | 170.9 | 22.32 | 100.0 | 1.01 | 0.83 | 26.5 | 39.8 |
| 2008 | 175.9 | 22.54 | 100.0 | 1.17 | 0.89 | 43.3 | 54.6 |

**Figure 7 Evolution of hidden costs in Côte d'Ivoire's water sector**

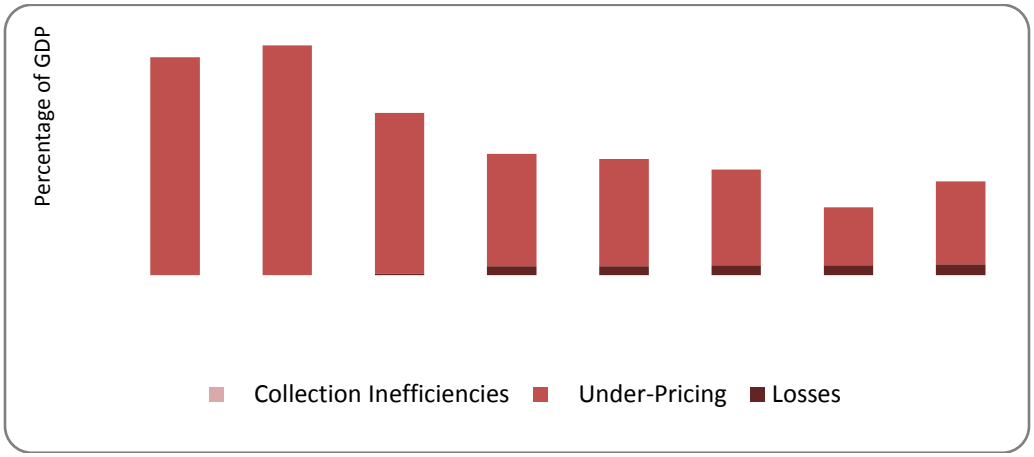
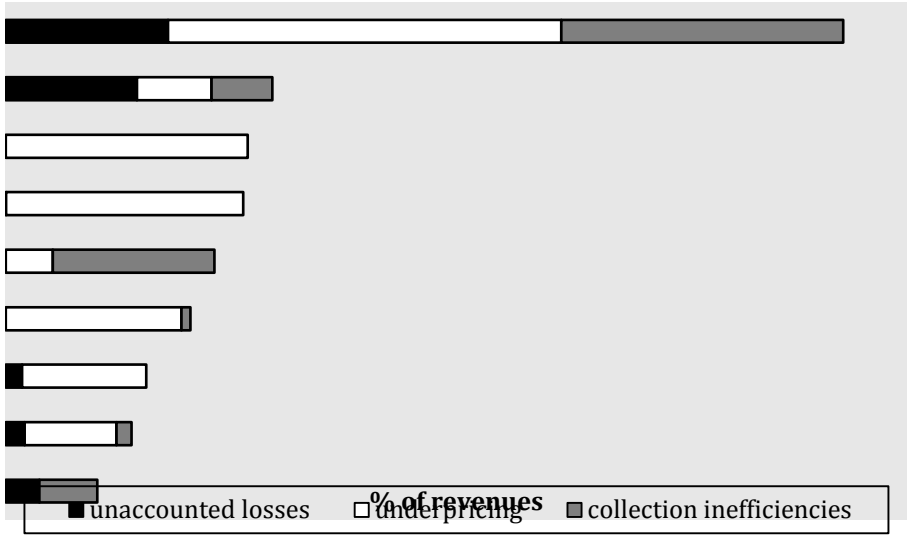



**Figure 8 Hidden costs of water utilities**



According to the UNICEF-WHO Joint Monitoring Program, Côte d'Ivoire is not on track to meet the MDG for sanitation. Based on household surveys, access to improved sanitation has been stagnant, increasing only 3 percentage points from 20 percent in 1990 to 23 percent in 2008 (table 7). Although approximately 18 percent of the population has shared access to improved sanitation facilities, this does not count towards the achievement of the MDG.A large share of the population—30 percent—still practices open defecation, although this is significantly lower than in the low-income benchmark group (table 11). Furthermore, access to flush toilets and improved latrines are four times and two as high as in the low-income group, respectively. On the other hand, use of traditional latrines is about half that found in the low-income peer group. Overall, a relatively large share of Côte d'Ivoire's population has access to higher-end sanitation solutions, albeit in many cases on a shared basis. Looking ahead, an important area for action will be to move the large share of the population that continues to practice open defecation onto the first rung of the sanitation ladder.

**Table 11 Benchmarking sanitation access**

| | Unit | Low-income countries | Côte d'Ivoire | | | | Middle-income countries |
|---|---|---|---|---|---|---|---|
| | | Mid 2000s | **LSM88** | **DHS94** | **MICS00** | **MICS06** | Mid 2000s |
| Access to flush toilets | % pop | 4.9 | 16.5 | 13.4 | 25.4 | 23.8 | 40.8 |
| Access to improved latrines | % pop | 9.9 | 13.3 | 21.7 | 15.2 | 17.8 | 1.4 |
| Access to traditional latrines | % pop | 50.1 | 24.0 | 19.5 | 26.3 | 26.4 | 30.4 |
| Open defecation | % pop | 40.3 | 46.2 | 45.3 | 31.4 | 32.3 | 14.3 |

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.

## Power

### Achievements

Côte d'Ivoire has a relatively well-developed power sector (table 12). The national power grid relies on a balanced portfolio of hydropower and gas-fired plant based on domestic hydrocarbon resources, and 71 percent of the population lives in electrified areas. Yet access to power appears to be relatively low; according to the national utility only around 20 percent of households are connected to the electricity grid, although household surveys suggest that the real value may be significantly higher. Initial connection charges remain a barrier to access  Basic indicators of installed capacity and power consumption compare favorably with the peer group for fragile states but are less than a tenth of the benchmarks for middle-income countries.

Côte d'Ivoire has been a pioneer in private sector participation in the power sector in the region. In 1990 the country awarded a concession contract for the national power utility Compagnie Ivoirienne d'Electricite, or CIE. The concession helped to improve performance and attract private investment in power generation (IPPs), and by 1999 distribution losses had been reduced to 14 percent and average outage duration to 13 hours compared to 32 hours in 1990. In 1994, the country awarded the first Independent Power Project (IPP) in Africa to CIPREL, and in 1999 it awarded the then largest IPP to Azito. Both contracts have withstood the crisis and continue to supply power effectively. Côte d'Ivoire has become a significant power exporter in the region, supplying neighboring Benin, Burkina Faso, Ghana, Mali, and Togo. That export contracts were honored during the recent period of crisis, earning the country a reputation as a reliable supplier of power. Côte d'Ivoire's future role in regional power trade will depend on developments in neighboring Guinea and Ghana. If fully developed, Guinean hydropower would be more competitive for regional trade than Ivoirian gas. Yet due to the political and economic situation in Guinea, these hydro resources may not be developed for some time to come. Gas was recently discovered in Ghana, which could change that country from a net importer to a net exporter of power, but the relative competitiveness of Ghanaian and Ivoirian gas is not yet clear. In any case, Côte d'Ivoire has a key role to play in wheeling regional electricity exchange  by taking advantage of its central position, its transmission network, and its reputation as a power exporter.

**Table 12 Benchmarking power indicators**

| | Unit | Fragile low-income countries | Côte d'Ivoire | | Middle-income countries |
|---|---|---|---|---|---|
| | | Mid 2000s | **2005** | **2008** | Mid 2000s |
| Installed power generation capacity | MW/mil. people | 45.7 | **58.3** | **58.3** | 798.6 |
| Power consumption | kWH/capita | 165.3 | **235.6** | **240.5** | 4,479.3 |
| Power outages* | Day/year | 11.1 | | **45.6** | 5.9 |
| Firms' reliance on own generator* | % consumption | 16.2 | | **15.1** | 10.9 |
| Firms' value lost due to power* outages | % sales | 5.4 | | **5.0** | 1.6 |
| Household connections (CIE) | % population | | | 20.0 | |
| Access to electricity (DHS 99)** | % population | 15.0 | **49.7** | | 59.9 |
| Urban access to electricity (DHS 99) | % population | 57.6 | **89.7** | | 85.2 |
| Rural access to electricity (DHS 99) | % population | 3.9 | **26.6** | | 31.8 |
| Growth in access to electricity | % population/year | 3.3 | **3.3** | | 1.5 |
| Revenue collection | % billings | 33.6 | **66.1** | **88.0** | 100.0 |
| System losses | % production | 40.0 | **17.5** | **23.4** | 10.1 |
| Cost recovery | % total cost | 100.0 | **100.0** | **80.6** | 100.0 |
| Total hidden costs as % of revenue | % | 442.5 | **62.8** | **136.5** | 0.1 |

| U.S. cents | Côte d'Ivoire | | Predominantly thermo generation | Other developing regions |
|---|---|---|---|---|
| | **2005** | **2009** | Mid 2000s | Mid 2000s |
| Power tariff (residential at 75 kWh) | **11.9** | **9.6** | 14.5 | 5.0 – 10.0 |
| Power tariff (commercial at 900 kWh) | **16.9** | **18.5** | 18.8 | |
| Power tariff (industrial at 50,000 kWh) | **10.7** | **9.3** | 14.2 | |

* Based on Enterprise Survey 2009

** Based on DHS 1999 Survey and benchmarks for nonfragile low-income countries.

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

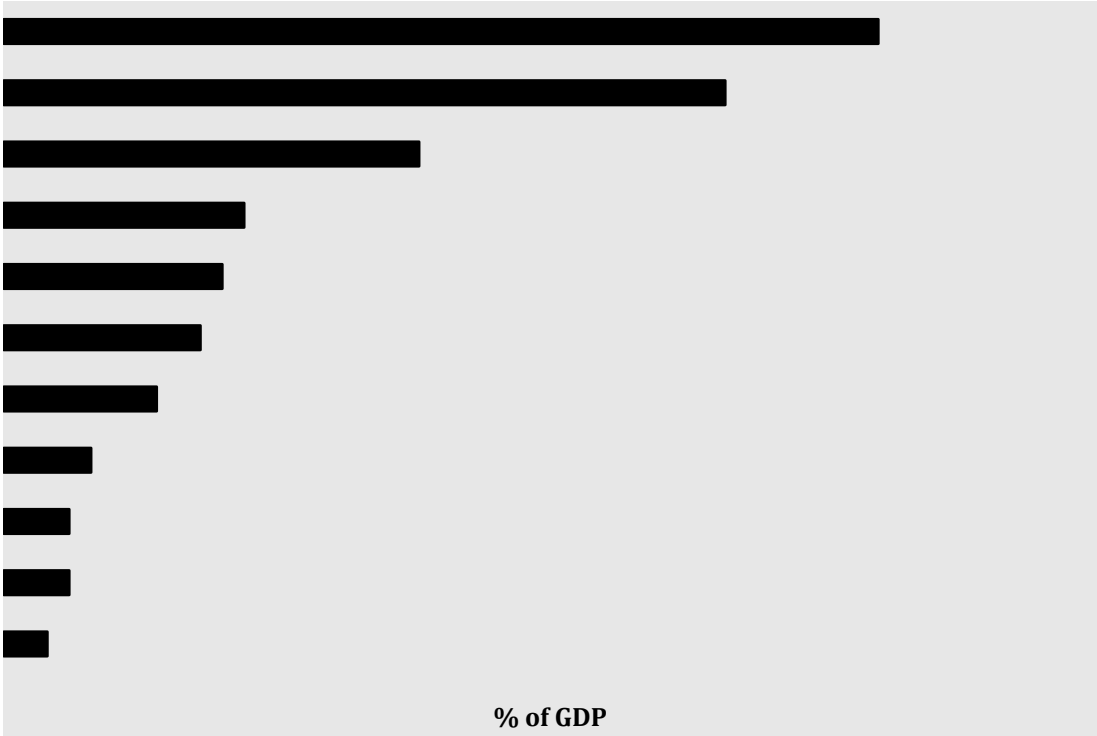
## Challenges

The power supply in Côte d'Ivoire has become unreliable in recent years. As the Ivorian economy recovers from crisis and economic growth rates are picking up again, demand for power has grown. At the same time, power sector investments were neglected during the crisis. This has led to an overall shortage of supply. Transmission and distribution networks become overloaded, and there is no capacity margin to serve growing demand, both domestically and in neighboring countries. As a result, load shedding increased from 16.6 gigawatt-hours in 2007 to 30.0 gigawatt-hours in 2009. This is still a relatively small proportion of the total load served of around 5,500 gigawatt-hours during this period. Quality of service has deteriorated, with more than 20 percent losses, 36 hours of average outage duration in 2008, and 52 hours in 2009. No country-specific information on the value of lost load was available for Côte d'Ivoire, but based on an average value for other African countries of around $2.50 per kilowatt-hour of lost load, the total cost of outages in 2009 was $75 million, or around 0.3 percent of GDP. While worrisome in absolute terms, these losses are still towards the lower end of what has been observed in

other African countries in recent years (figure 9). In response to power shortages, the government has leased 70 megawatts of emergency plant, which is estimated to cost around $0.14 per kilowatt-hour to run.

**Figure 9 Power outages lead to major economic losses**

Economic cost of power outages in selected countries




* Côte d'Ivoire figure refers to 2009 based on a value of lost load of $2.50 per kilowatt-hour
Source: Eberhard and others 2009.

CIE has improved operational performance in recent years and reduced the hidden costs of inefficiency (table 13). In particular, the collection ratio has improved from 66 percent in 2005 to 88 percent in 2009, reducing the losses associated with under-collection from $198 to $84 million per year, as the utility has again been able to collect revenues in the crisis-affected northern part of the country. System losses, which had increased significantly, have also improved recently. Notwithstanding these improvements, operational inefficiencies still cost the sector some $150 million a year.

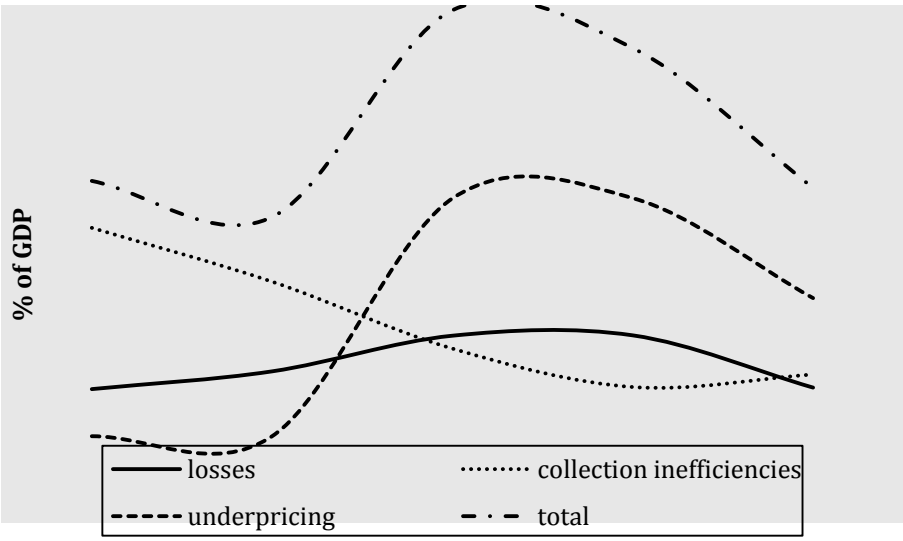
Up until 2006, CIE was charging cost recovery prices for electricity with no apparent implicit subsidies to the sector. Since 2007, however, average operating costs nearly doubled from $0.08 to around $0.15 per kilowatt-hour. Although power tariffs were increased, the adjustments were modest relative to the cost escalation. As a result,the financial deficit in the sector is now around $200-300 million per year (or 0.5 to 0.8 percent of GDP) (figure 10). Like other countries that rely on thermal power, Côte d'Ivoire has suffered from the rise in oil prices that began in 2005.

**Table 13 Evolution of hidden costs associated with CIE**

| | Load | System | Collection | Average total | Average effective | Total hidden | Total hidden |
|---|---|---|---|---|---|---|---|

| | served (GWh/year) | losses (%) | ratio (%) | cost ($/kWh) | tariff ($/kWh) | costs ($ millions/year) | costs (% revenues) |
|---|---|---|---|---|---|---|---|
| 2005 | 5,484 | 17.5 | 66.1 | 0.12 | 0.129 | 242.2 | 62.8 |
| 2006 | 5,504 | 21.4 | 72.1 | 0.12 | 0.129 | 220.7 | 57.2 |
| 2007 | 5,469 | 22.7 | 81.6 | 0.19 | 0.129 | 488.8 | 126.7 |
| 2008 | 5,627 | 23.4 | 88.8 | 0.21 | 0.139 | 526.7 | 136.5 |
| 2009 | 5,804 | 16.7 | 88.0 | 0.18 | 0.145 | 337.7 | 87.5 |

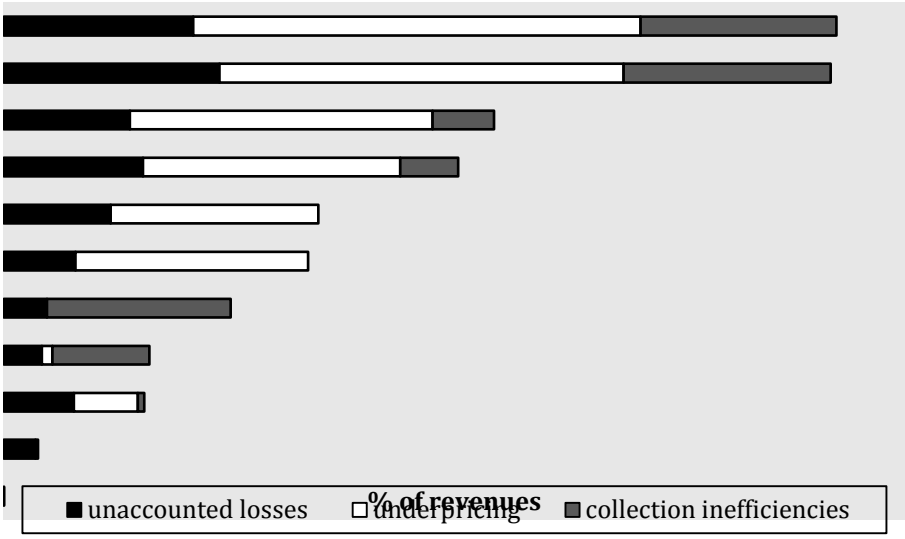
**Figure 10 Evolution of hidden costs in Côte d'Ivoire's power sector**




Overall, CIE's hidden costs in 2008 were $527 million, or 2.3 percent of GDP. That total is equivalent to 137 percent of sector revenues, which is among the highest in West Africa, though still well short of Nigeria (figure 11). By contrast, back in 2005, CIE had one of the lowest hidden cost ratios among the West African utilities at 63 percent of revenues. In 2008 hidden costs in Côte d'Ivoire were on par with those of Ghana. Yet in May 2010 Ghana imposed a significant tariff increase, which will almost cover costs.

**Figure 11 Comparison of hidden costs across West African utilities**

Hidden costs of power utilities in selected countries




Source: Eberhard and others 2009.

## Irrigation

### Challenges

The extent of irrigated agriculture in Côte d'Ivoire is very limited. According the 2005 FAO Aquastat Database, around 10,000 hectares are equipped for irrigation across the central and northern regions of the country. This represents 1.1 percent of the country's cultivated area, which is even lower than the irrigated share of cropland for Sub-Saharan Africa as a whole. Over the last 30 years, however, the irrigated area has grown relatively rapidly at 3.2 percentage points per year.

As part of the AICD, a simulation exercise explored the economic viability of expanding irrigation based either on large-scale dams or on more localized water collection systems. The 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 assumptions for the costs of irrigation development are $3,000 per hectare for schemes based on large dams and $2,000 per hectare for schemes based on localized water collection. The results are highly sensitive to these cost assumptions as well as to the assumed revenues from irrigated crops. In general, the viability of irrigation schemes depends on crops that are capable of generating in excess of $2,000 per hectare, which includesmainly cash crops and horticulture.

**Table 14 Sensitivity of irrigation potential to thresholds for economic return**

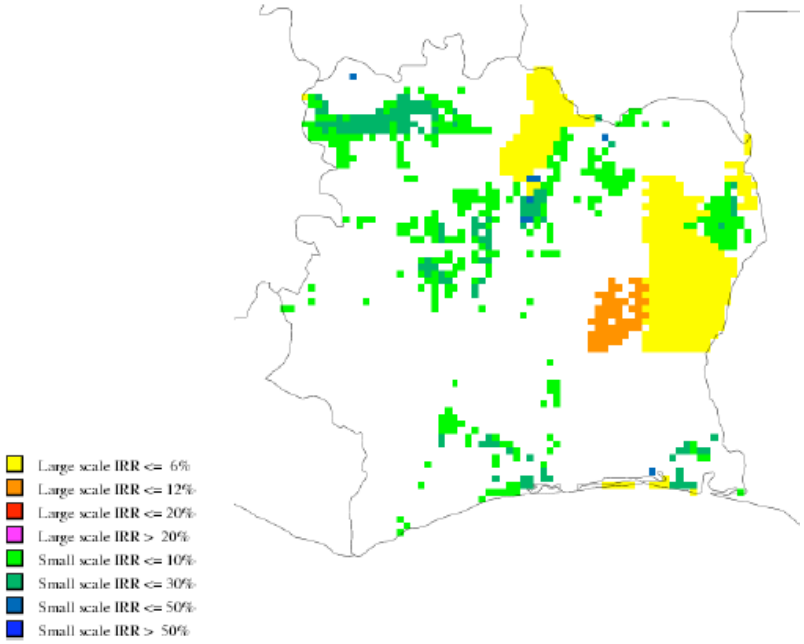
| | Potential ('000s has.) | | | Investment needs ($ millions) | | | Average IRR (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Large dam-based | Local collection | Total | Large dam-based | Local collection | Total | Large dam-based | Local collection | Total |
| IRR >0% | 455 | 185 | 639 | 887.3 | 954.7 | 1,842.1 | 2.1 | 8.0 | 5.1 |
| IRR >12% | - | 39 | 39 | - | 200.3 | 200.3 | - | 24.0 | 24.0 |
| IRR >24% | - | 12 | 12 | - | 59.4 | 59.4 | - | 40.0 | 40.0 |

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.

**Figure 12 Irrigation schemes could be viable in many new locations**

Areas viable for irrigation




Source: You and others 2009.

Based on these assumptions, as much as 639,000 hectares of land in Côte d'Ivoire may be economically viable for irrigation, more than 60 times the area irrigated today (table 14). This potential is associated with the development of large dams in the northeast of the country, and more localized schemes mainly in the northwest of the country (figure 12). The rate of return of each project varies. Looking at all schemes that have a positive net present value and hence meet the minimum criterion for economic viability,gives an internal rate of return of 5 percent**(**table 14). Taking a rate of return threshold of 12 percent reduces the viable area to around 39,000 hectares, but boosts the internal rate of return to 24 percent **(**table 14). As the threshold rate is raised above 12 percent and beyond the viable area shrinks dramatically, although the returns also become very high. The rates of return of the large dam-based schemes tend to be lower than those of localized water collection schemes.

A much more detailed study of irrigation potential in Côte d'Ivoire was conducted by the Ministry of Agriculture in 2005 and used to develop the country's national irrigation plan. The plan provides for the rehabilitation of around 3000 hectares of irrigated areas and the creation of 139,000 hectares of new irrigated areas. The total investment cost amounts to $1,657 million with an average investment cost per hectare of $11,600. Interestingly, the extent of irrigated area falls within the range that is identified in the AICD simulations, even if the assumption for the unit cost of irrigation development is several times larger. Nevertheless, the study notes that the benefits of the future irrigation investments depend on the development of the feeder road network.

## Information and communication technologies

### Achievements

Like many African countries, Côte d'Ivoire has gone through an ICT revolution during the last decade. By 2005, the country had established a partially competitive mobile market with two operators of roughly equal size and mobile phone penetration had reached9 percent, which was fairly typical for the peer group (table 15). Between 2006 and 2009, the government awarded four more mobile licenses. As a result, competition intensified, and mobile penetration had reached 51 percent by 2008. Nevertheless, the price of a representative basket of mobile services remains comparatively high by both regional and global standards at around $15 per month.

**Table 15 Benchmarking ICT indicators**

| | Unit | Low-incomefragile countries | **Côte d'Ivoire** | | Middle-income countries |
|---|---|---|---|---|---|
| | | Mid 2000s | **2005** | **2008** | Mid 2000s |
| GSM coverage | % population | 62.6 | **55.0** | **54.0** | 95.1 |
| International bandwidth | Mbps/person | 0.9 | **3.0** | **40.0** | 25.4 |
| Internet | subscribers/100 people | 0.1 | **0.1** | **3.0** | 1.5 |
| Landline | subscribers/100 people | 9.0 | **10.2** | | 34.8 |
| Mobile phone | subscribers/100 people | 8.0 | **9.0** | **51.0** | 30.6 |

| | **Côte d'Ivoire** | | Countries with access to submarine cables | Other developing regions |
|---|---|---|---|---|
| | **2005** | **2008** | Mid 2000s | Mid 2000s |
| Price of monthly mobile basket | **14.0** | **15.0** | 10.0 | 9.9 |
| Price of monthly fixed-line basket | **20.0** | **25.0** | 11.8 | n.a. |
| Price of 20-hour Internet package | **66.3** | **47.0** | 47.28 | 11.0 |
| Price of a 3-minute call to the United States | **2.0** | **0.9** | 1.44 | 2.0 |
| Price of inter-Africa calls, average | **0.6** | n.a. | 0.57 | n.a. |

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.

Côte d'Ivoire is connected to the SAT3 submarine cable, which provides good connectivity to the internet. International bandwidth has improved markedly in recent years. Yet the national

telecommunications incumbent retains monopoly control of the international gateway. As a result, internet access charges in 2008 at $47 per month were still about four times as high as those elsewhere in the developing world, even if they are typical for African countries in the benchmark group. Experience from across Africa indicates that customers only receive the full benefit of cost savings associated with submarine cable access when multiple landing stations compete (table 16). Imminent connection to a number of new submarine cable projects in West Africa that are expected to be complete in the period 2010 to 2012 should intensify competition and further reduce prices.

**Table 16 High international call charges driven both by technology and market power**

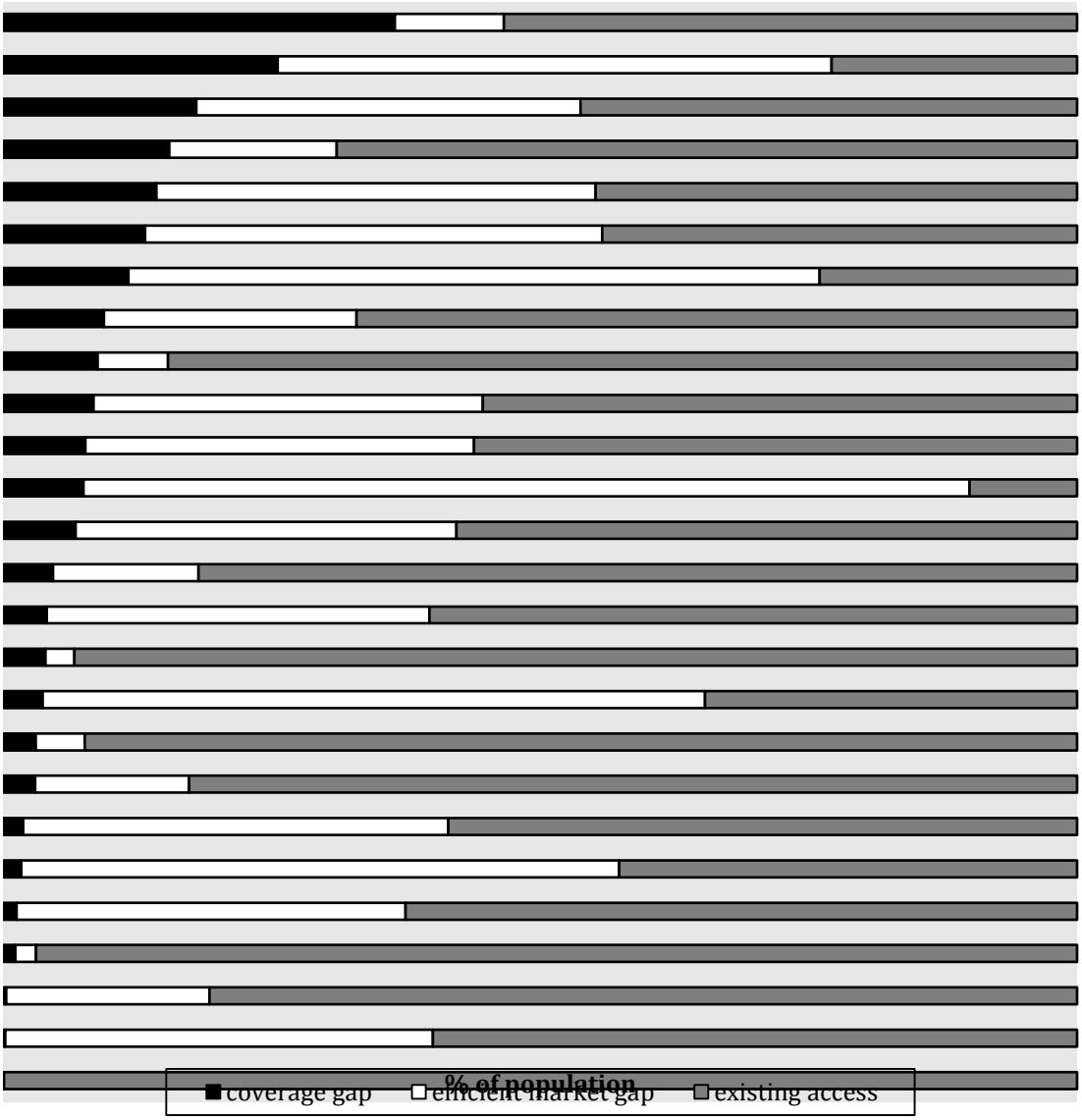
| $ | Percent of cases | Call within region | Call to U.S. | Internet dial-up | Internet ADSL |
|---|---|---|---|---|---|
| Without submarine cable | 67 | 1.34 | 0.86 | 68 | 283 |
| With submarine cable | 33 | 0.57 | 0.48 | 47 | 111 |
| monopoly on international gateway | 16 | 0.70 | 0.72 | 37 | 120 |
| competitive international gateway | 16 | 0.48 | 0.23 | 37 | 98 |

Source: Minges and others 2009.

### Challenges

During the last five years the percentage of the population in Côte d'Ivoire living within reach of a GSM signal has remained at around 55 percent. This is well below the benchmarks of 62 percent for fragile states and 95 percent for middle-income countries. Simulations conducted for the AICD suggest that close to 100 percent of Côte d'Ivoire's population could be reached with a GSM signal on a commercially viable basis, making it one of the most attractive markets in Africa (figure 13). This result is based on the assumption that 4 percent of local income in each area could be captured as revenues for voice telephony services. Even if this assumption were relaxed to only 1 percent of local income, 97 percent of the population could be served on a commercially viable basis. The disruption caused by armed conflict may have contributed to slow network rollout.

**Figure 13 Côte d'Ivoire has made substantial progress in expanding GSM coverage**

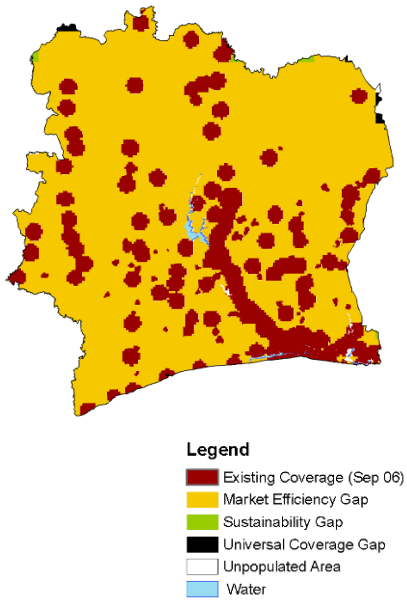



Source:Mayer and others 2008.

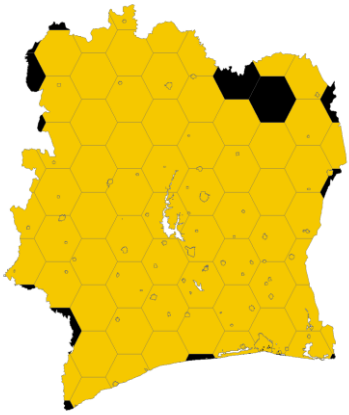
A second set of simulations explored the commercial viability of limited performance broadband services based on limited institutional use and public access telecenters using WIMAX technology. Assuming a subscription rate of 0.25 percent in rural areas and that 1 percent of local income could be captured in broadband revenues, about 95 percent of the population could be provided with such service on a commercially viable basis. Even if the spending assumption were reduced to 0.25 percent of local income, 85 percent of the population could still be served on a commercially viable basis. Those areas that would require public subsidy are confined to the far north of the country and in some pockets on the eastern and western side (figure 14).

**Figure 14 Voice and broadband are not commercially viable in isolated pockets of Côte d'Ivoire**

a. GSM voice signal




b. Limited performance broadband (WIMAX)



Note: Existing coverage relates to base year of 2006

# Financing Côte d'Ivoire's infrastructure

**T**o meet its most pressing infrastructure needs and catch up with developing countries in other parts of the world, Côte d'Ivoire needs to expand its infrastructure assets in key areas (table 17). The targets outlined in table 17 are purely illustrative, but they represent a level of aspiration that is not unreasonable. Developed in a standardized way across African countries—based on a common set of targets and costing methodologies,–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 17 Illustrative investment targets for infrastructure in Côte d'Ivoire**

| | Economic target | Social target |
|---|---|---|
| ICT | Install fiber optic links to neighboring capitals and submarine cable | Provide universal access to GSM signal and low performance public broadband facilities |
| Irrigation | n.a. | Develop additional 130,000 hectares and rehabilitate 3,000 ha (according to 2005 National Irrigation Development Plan) |
| Power | Develop 1,368 MW of new generation capacity | Raise electrification to 73 percent (100 percent urban and 46 percent rural) |
| Transport | Achieve regional (national) connectivity with good quality 2-lane (1-lane) paved road. | Provide rural road access to 80 percent of the highest-value agricultural land, and urban road access within 500 meters |
| WSS | n.a. | Achieve Millennium Development Goals, clear sector rehabilitation backlog |

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

Meeting these illustrative infrastructure targets for Côte d'Ivoire would cost $2,363 million per year for a decade. Capital expenditure would account for 71 percent of this requirement. The power sector has the highest spending needs: an estimated $963 million per year to develop 1,368 MW of new generation

capacity, strengthen transmission networks, and boost electrification. The water and sanitation sector has the second highest spending needs: $774 million will be needed each year to meet the Millennium Development Goals, with capital expenditure accounting for 66 percent of that total. Transport spending needs are $341 million per year. Spending requirements for ICT are less than for other infrastructure sectors at $119 million a year (table 18).

**Table 18 Indicative infrastructure spending needs in Côte d'Ivoire for 2006 to 2015**

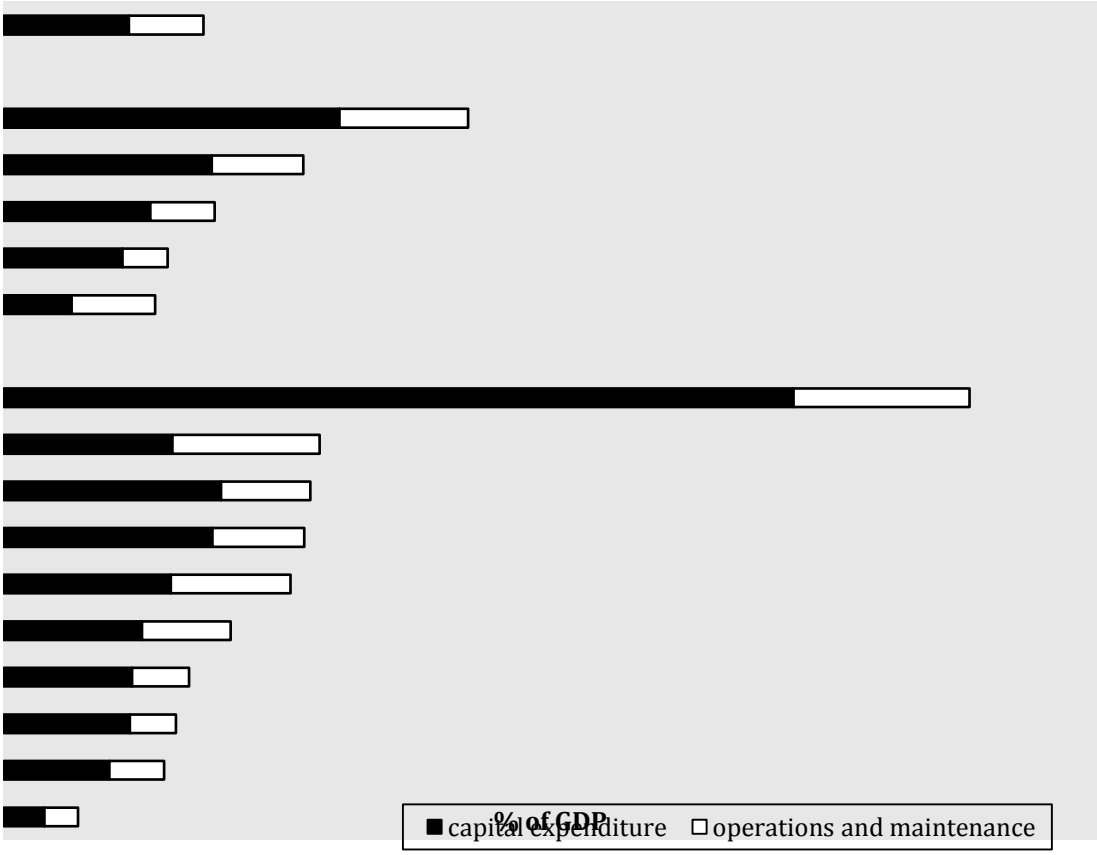
| $ million per year | Capital expenditure | Operations and maintenance | Total needs |
|---|---|---|---|
| ICT | 81 | 38 | 119 |
| Irrigation | 165 | nav | 165 |
| Power (no trade) | 724 | 239 | 963 |
| Transport (basic) | 201 | 140 | 341 |
| Water supply and sanitation | 511 | 264 | 774 |
| Total | 1,682 | 680 | 2,363 |

Sources:Mayer and other 2009; Rosnes and Vennemo 2009; Carruthers and others 2009; You and others 2009. Derived from models that are available on-line at http://www.infrastructureafrica.org/aicd/tools/models.

Côte d'Ivoire's infrastructure spending needs are high in absolute terms, but look relatively manageable when expressed in terms of GDP (figure 15). Relative to the size of Côte d'Ivoire's economy, spending needs would amount to 10 percent of GDP in 2008. By comparison, many West African neighbors would need to spend around 20 percent of GDP to meet basic infrastructure targets. Investment would absorb around 7 percent of GDP; by comparison, China invested 15 percent of GDP in infrastructure during the mid-2000s.

**Figure 13 Côte d'Ivoire's infrastructure spending needs**

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




Legend: LIC = low-income country, MIC = middle income country, ECOWAS = Economic Community of West African States
Source: Foster and Briceño-Garmendia 2009.

In the mid-2000s, Côte d'Ivoire spent $750 million per year on infrastructure (table 19). Power captures nearly 70 percent of spending, and O&M in the energy sector accounted for the majority of this total ($ 476 million per year). Capital expenditure accounts for only 34 percent of total spending[1]. Operating expenditure is entirely covered by budgetary resources and payments from infrastructure users. Strikingly, the private and household sectors accounts for 65 percent of total infrastructure investment. The largest areas of non-governmental finance are household investment in on-site sanitation facilities and private sector investment in ICT. Public investments account for another 30 percent of total investment. External financial support – whether from ODA or non-OECD financiers – is very low accounting for less than 10 percent of the total. ODA used to be a significant source of financial support for Côte d'Ivoire during the 1990s, but tailed-off during the crisis period and has only begun to resurface since 2008 (figure 16).

[1] Operating expenditure here includes payments to the various Independent Power Producers and hence includes an important element of capital depreciation.

**Table 14 Financial flows to Côte d'Ivoire's infrastructure, mid 2000s***

$ millions per year

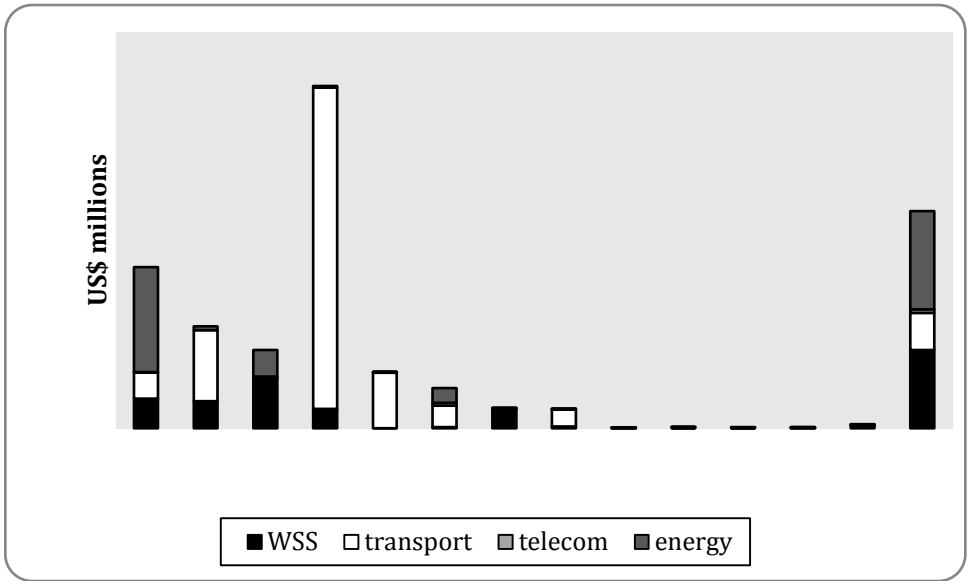
| | O&M | | Capital expenditure | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Non-governmental | | | |
| | Public sector | Public sector | ODA | Non-OECD financiers | Private sector | Households | Total CAPEX | Total spending |
| Information and communication technologies | 0 | 0 | 0 | 4 | 53 | 0 | 57 | 57 |
| Irrigation | nav | nav | 0 | 0 | 0 | 0 | 0 | 0 |
| Power | 476 | 15 | 0 | 1 | 0 | 0 | 16 | 492 |
| Transport | 26 | 50 | 3 | 10 | 14 | 0 | 77 | 103 |
| Water supply and sanitation | 2 | 2 | 1 | 1 | 0 | 92 | 4 | 6 |
| Total | 504 | 67 | 4 | 16 | 67 | 92 | 246 | 750 |

* Budget figures are annual average over period 2001/05, while SOE figures are annual average for period 2004/08.

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.

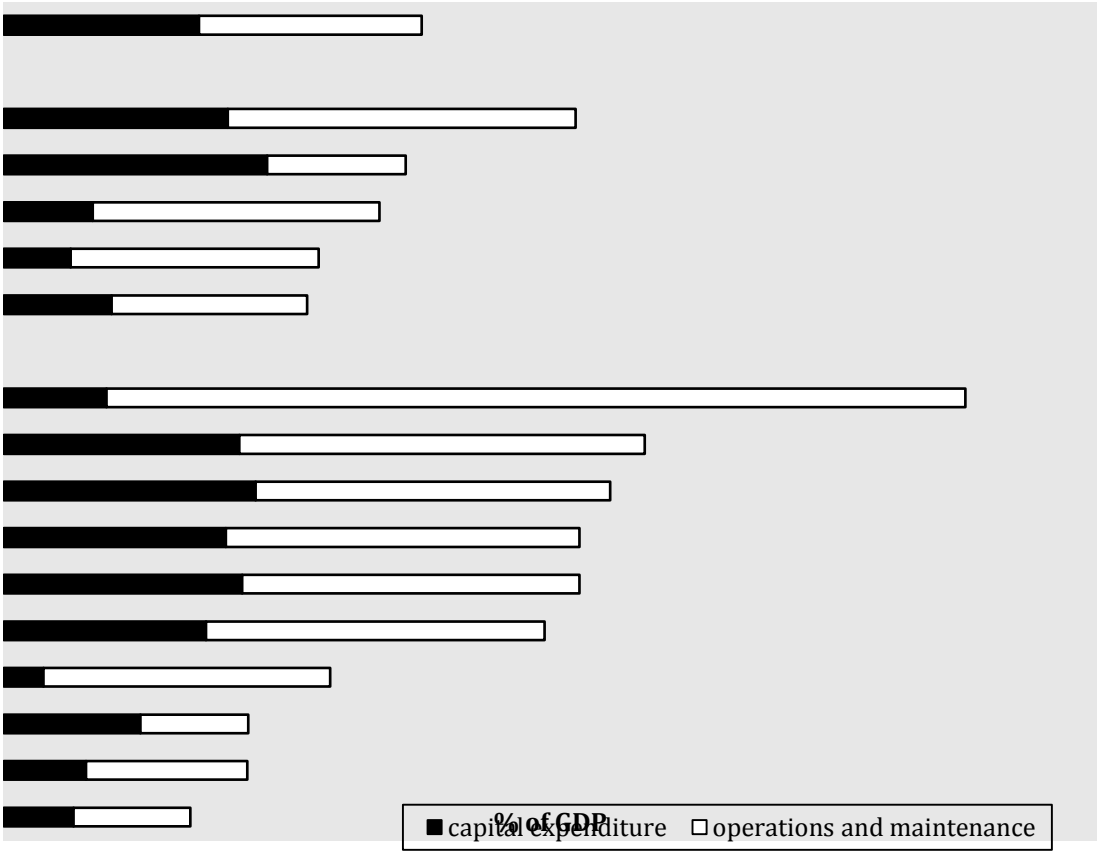
**Figure 14 ODA flows between 1995 and 2008**




Source: OECD 2010.

Côte d'Ivoire's current spending on infrastructure spending is comparatively low as a share of GDP —around 5 percent of GDP, or only $35 per person per year. By comparison, other low-income countries in West Africa spend around 10 percent of GDP on infrastructure (figure 17). This effort translates into only $35 per capita per year in infrastructure spending. Furthermore, the pattern of investment is different in Côte d'Ivoire than in other low-income countries in Africa (figure 18). Côte d'Ivoire's public sector invests more in transport and less in power than its African peers. For all sectors, Côte d'Ivoire receives much less ODA financing than the peer group.

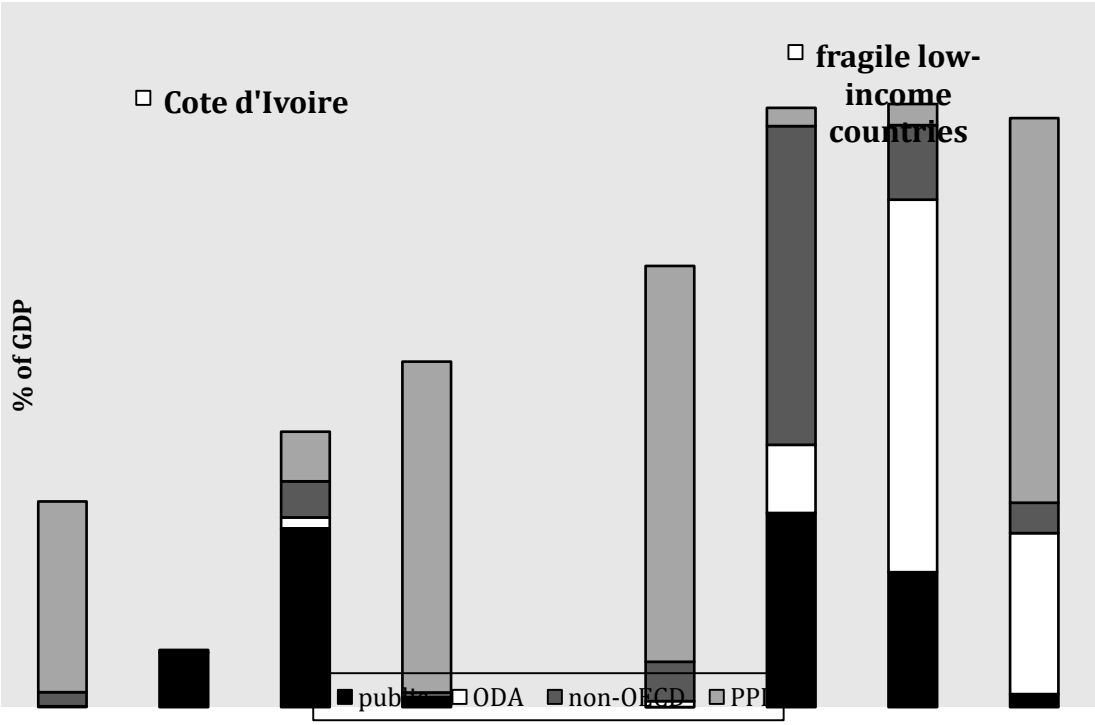
**Figure 15 Spending allocated to address infrastructure needs**




Source: Foster and Briceño-Garmendia 2009.

**Figure 16 Côte d'Ivoire's pattern of capital investment in infrastructure differs from that of comparator countries**

Investment in infrastructure sectors as percentage of GDP




*Source*: Derived from Briceño-Garmendia and others 2009.

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

Inefficiencies throughout the infrastructure sectors cost Côte d'Ivoire as much as $477 million per year (table 20). Improving efficiency would therefore have a significant benefit. The largest potential source of efficiency gains is improving cost recovery, particular in the power sector. Under-charging for power services costs Côte d'Ivoire about $190 million each year.The estimated average total cost of power is $0.18 per kilowatt-hour, while the average effective tariff is $0.15 per kilowatt-hour, which covers only operating and maintenance costs. As a result, the utility covers only 83 percent of costs, leaving capital investments underfunded. The associated financial burden is approximately 0.8 percent of GDP.

**Table 20 Potential gains from greater operational efficiency**

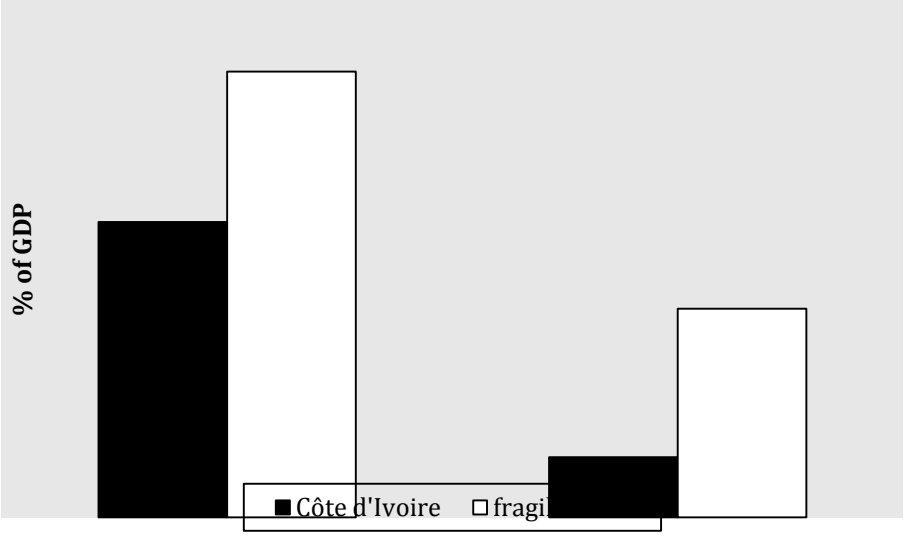
| | ICT | Irrigation | Power | Transport | WSS | Total |
|---|---|---|---|---|---|---|
| Under-recovery of costs | - | n.a. | 188 | 32 | 38 | 258 |
| Overstaffing | n.a. | - | 42 | n.a. | 0 | 42 |
| Distribution losses | - | - | 132 | n.a. | 5 | 137 |
| Under-collection | - | n.a. | 14 | 16 | 0 | 30 |
| Low budget execution | 0 | n.a. | 0 | 7 | 3 | 10 |
| Total | 0 | 0 | 376 | 55 | 46 | 477 |

Source: Derived from Foster and Briceño-Garmendia 2009.
— = not applicable; n.a. = not available.

In the water sector, the estimated average total cost of producing utility water is $1.17 per cubic meter, while the average effective tariff is only $0.89, which covers operating and maintenance costs but makes only a partial contribution to capital costs. As a result, the water utility covers only 76 percent of costs. The associated financial burden is approximately 0.2 percent of GDP. Although the burden of under-pricing for both power and water is very substantial, it is nonetheless lower than what is found elsewhere in Africa (figure 19).

**Figure 17 Underpricing of water in Côte d'Ivoire**

Financial burden of under-pricing in 2008-2009, as percentage of GDP

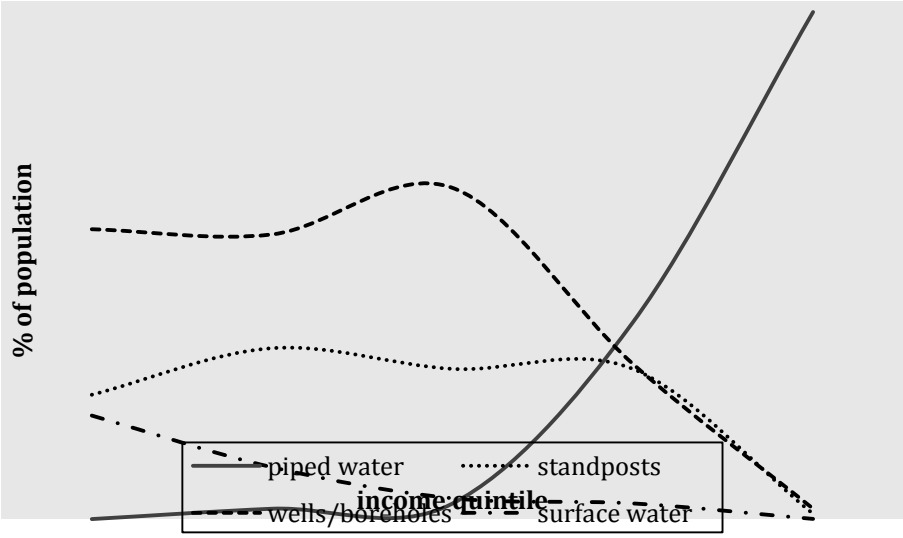



*Source*: Derived from Briceño-Garmendia and others 2009.

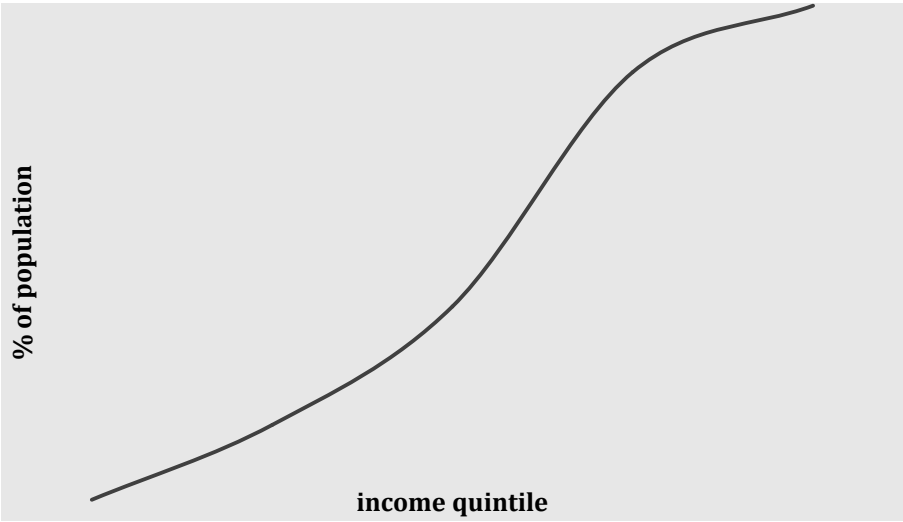
Like in many other African countries, access to power and piped water is much greater among the rich in Côte d'Ivoire than among the poor (figure 20). As a result, the highest income quintile receives the greatest benefit from subsidized tariffs. Recent empirical analysis shows that poor households capture only about half their fair share of power and water subsidies in Côte d'Ivoire based on a measure of distributional incidence.While this is slightly better than in other African countries, it is a poor performance in absolute terms (figure 21).

**Figure 18: Consumption of infrastructure services in Côte d'Ivoire is highly differentiated by budget**

a. Mode of water supply, by income quintile



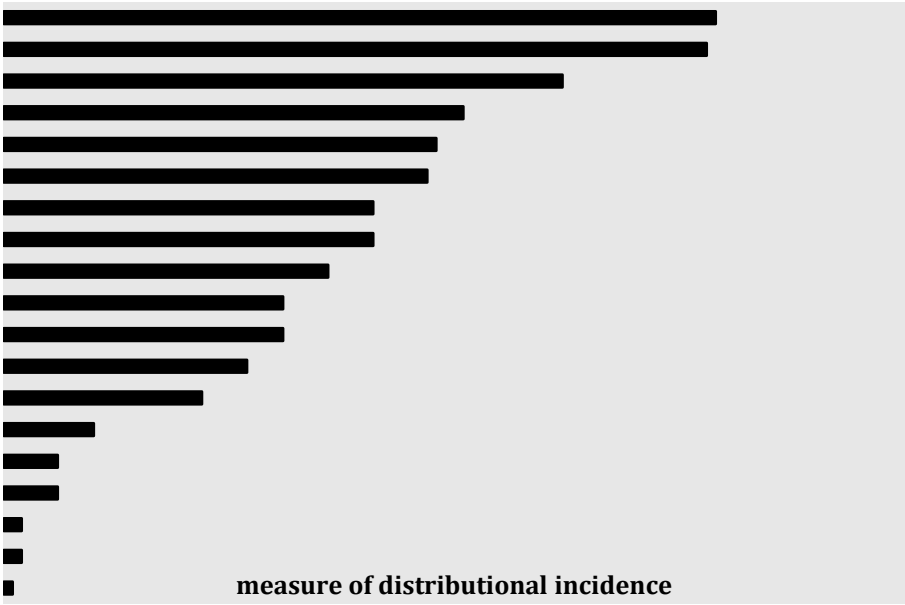

b. Prevalence of connection to power grid among population, by income quintile



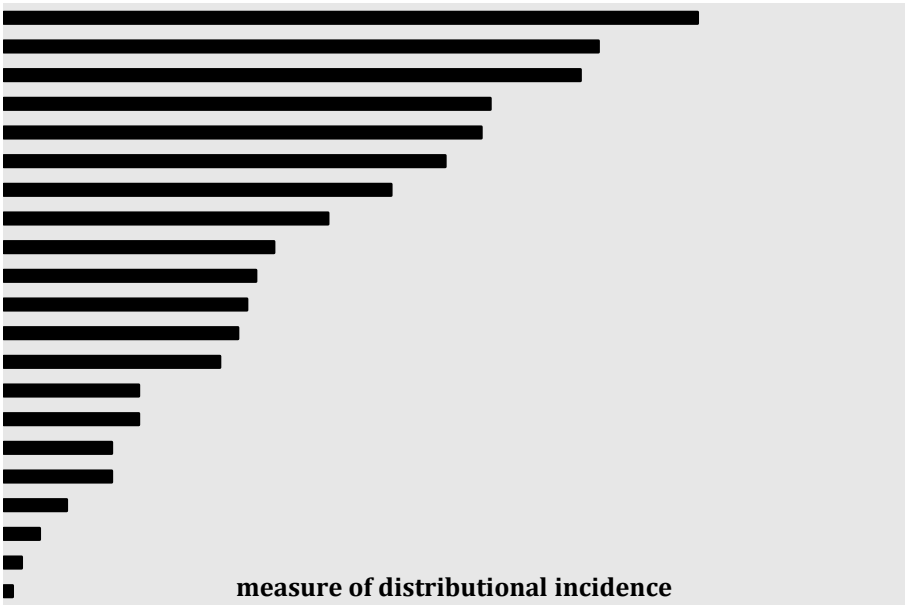

Legend: Q1 – first budget quintile, Q2 – second budget quintile, etc.
Source: Banerjee and others 2009.

**Figure 19 Electricity and Water Subsidies That Reach the Poor**

a. Electricity




b. Water

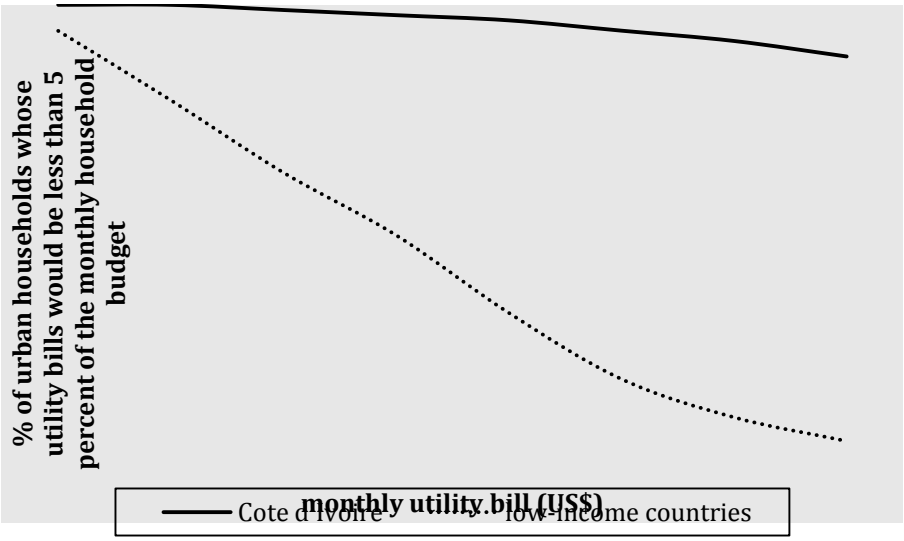



*Sources*: Banerjee and others 2008b; Wodon and others 2007a, 2007b.
*Note*: A measure of distributional incidence captures the share of subsidies received by the poor divided by the proportion of the population in poverty. A value greater than 1 implies that the subsidy distribution is progressive (pro-poor), because the share of benefits allocated to the poor is larger than their share in the total population. A value less than 1 implies that the distribution is regressive (pro-rich).

How expensive would utility bills be if tariffs reflected costs? For power, a monthly subsistence consumption of 50 kilowatt-hours at a cost recovery tariff of $0.18 per kilowatt-hour would translate to a utility bill of $9 per month. In the case of water, with a cost recovery tariff of $1.17 per cubic meter and a

monthly subsistence consumption of 10 cubic meters, the associated utility bill would come to $11 per month. Based on the distribution of household budgets in Côte d'Ivoire, these monthly utility bills for power and water would be affordable by 99 and 85 percent of the population, respectively (figure 22). In fact, the share of the population that could afford the service is much higher than the share of the population that already has the service, suggesting that Côte d'Ivoire has scope to increase coverage at cost-reflective tariffs before affordability would become a serious impediment. Even then, consumption of 25 kilowatt-hours per month for power and 4 cubic meters per month for water, which meets the most basic needs, would cost $4.5 and $4.7 per month, respectively, and would be affordable to close to 100 percent of the population. By comparison, household incomes are lower elsewhere in Sub-Saharan Africa, and affordability of cost recovery tariffs is therefore a much more serious problem (figure 22).

**Figure 20 Affordability in Côte d'Ivoire much better than in other low income countries**

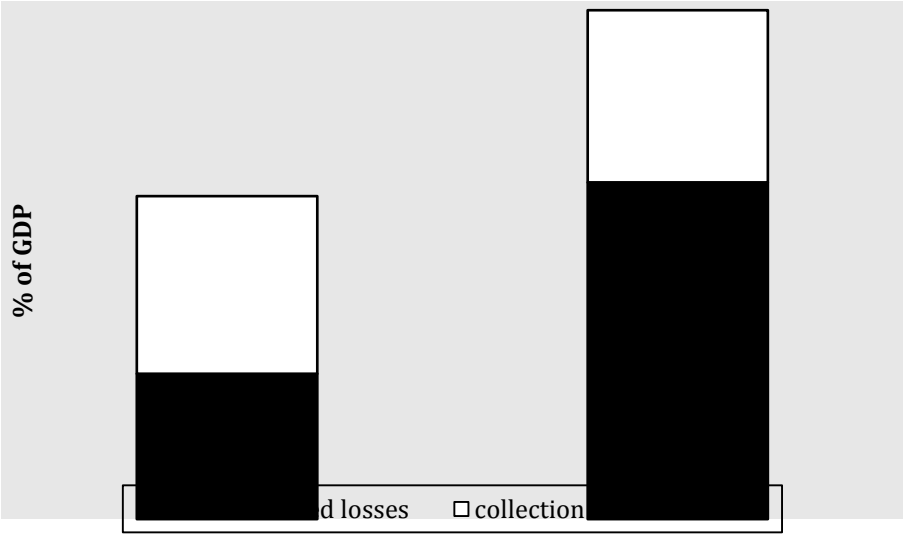



Source: Banerjee and others 2009.

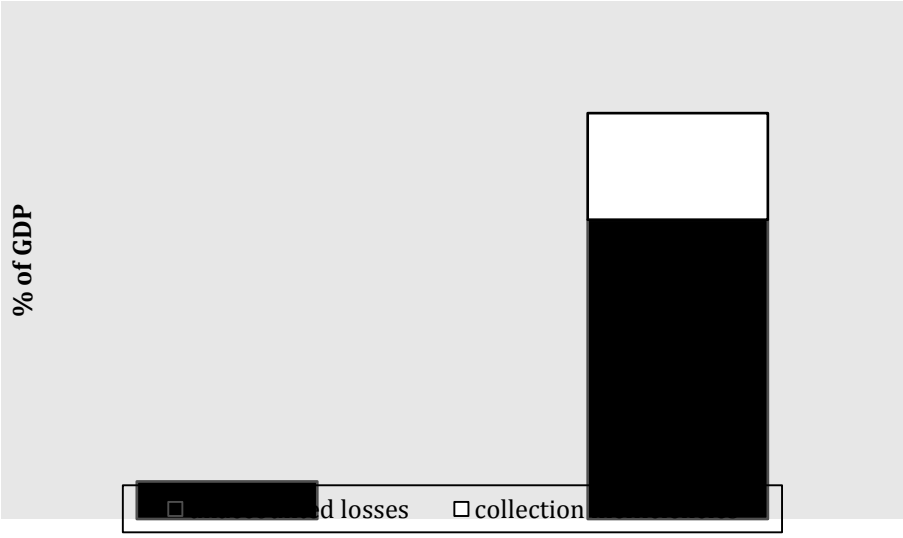
Operational inefficiencies of power and water utilities cost Côte d'Ivoire a further $194 million a year, equivalent to 0.83 percent of GDP. The annual value of inefficiencies in the power sector ($189 million) is substantially higher than for the water sector ($5 million). The burden of utility inefficiencies in Côte d'Ivoire is lower than for the benchmark countries, particularly in the case of water (figure 23). Under-collection of revenues and distribution losses are the main sources of inefficiencies in the power sector. CIE collects only 88 percent of its billings and has distribution losses of 16 percent, compared with a best practice benchmark of around 10 percent. In the water sector, SODECI has distribution losses of only 22.5 percent, compared with a best practice benchmark of 20 percent, and manages to collect close to 100 percent of billings.

**Figure 21 Côte d'Ivoire's utilities are 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

Excluding the cost of the inefficiencies described, Côte d'Ivoire's infrastructure funding gap amounts to $1,048 million per year, or about 6 percent of GDP. The funding gap in water amounts to around $543 million per year and accounts for almost 60 percent of the total funding gap (table 21). Most of the rest of the gap is found in the transport and irrigation sectors, where an additional $193 and $165 million is needed, respectively, to meet the country's development goals. The reason the power sector funding gap is relatively small is thatthere is substantial scope to increase cost recovery through tariffs and to reallocate operating expenditures towards investment.

**Table 21: Funding gaps by sector**

$ millions

| | ICT | Irrigation | Power | Transport | WSS | Total |
|---|---|---|---|---|---|---|
| Spending needs | (119) | (165) | (963) | (341) | (774) | (2,363) |
| Existing spending* | 57 | Nav | 492 | 103 | 185 | 599 |
| Efficiency gains | 0 | 0 | 380 | 45 | 46 | 471 |
| Funding gap | **(62)** | **(165)** | **(91)** | **(193)** | **(543)** | **(1,048)** |

* traced to needs

Source: Derived from Foster and Briceño-Garmendia 2009.

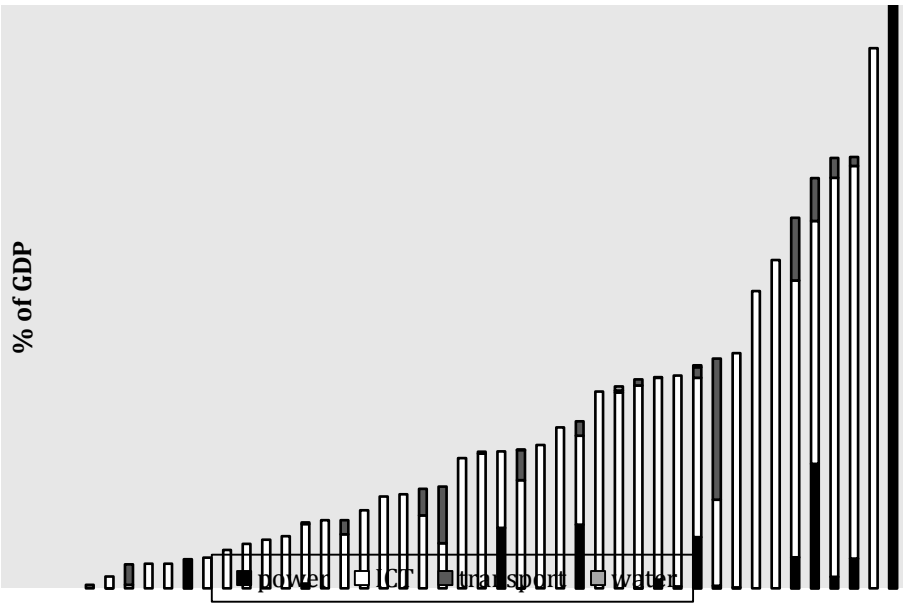
Note: Potential overspending across sectors is not included in the calculation of the funding gap, because it would not necessarily be applied toward other infrastructure sectors.

## What else can be done?

The funding gap can be addressed in two ways. First, Côte d'Ivoire may be able to increase the flow of resources to infrastructure both from the public and private sectors. Public spending on infrastructure has been relatively low compared to many neighboring countries. Therefore, there may be scope for reallocation within the overall budget, and the HIPC initiative may be a source of extra funding once the country overcomes the crisis.

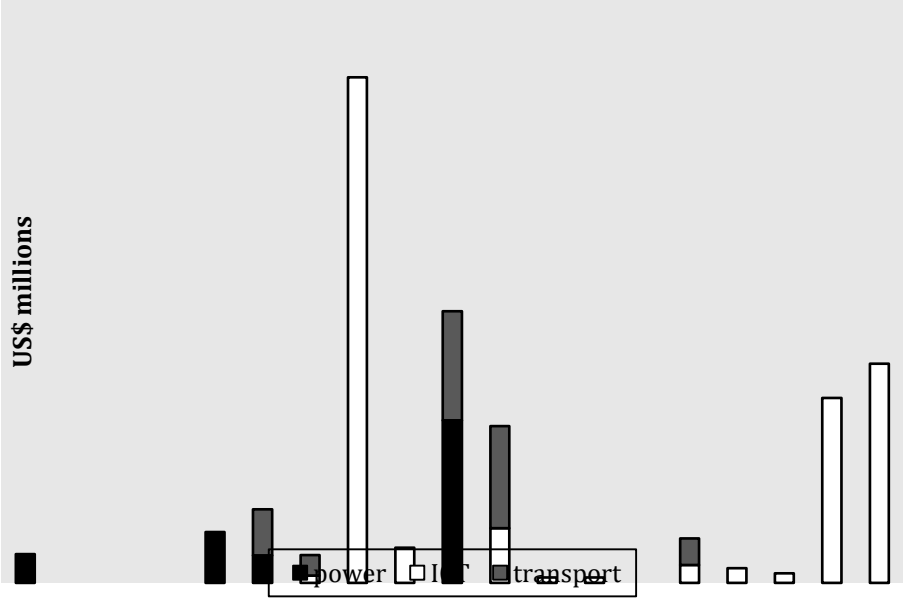
Furthermore, since the onset of the crisis, Côte d'Ivoire has not attracted as much private finance for infrastructure as other African peers. Between 2002 and 2007, private investment commitments in Côte d'Ivoire were less than 0.5 percent of GDP per year. By comparison, Benin, Democratic Republic of Congo, Kenya, Nigeria, Senegal, Tanzania, and Uganda each captured between 1.0 and 2.5 percent of GDP, while Guinea-Bissau—the most successful country in this regard—has captured more than 3.0 percent of GDP (figure 24). On the other hand, prior to the crisis, Côte d'Ivoire was a pioneer with private participation in infrastructure and did many of its major transactions during the period 1994 to 2000 (figure 25). Given the country's strong and successful track record with private participation, there must be significant potential to revive private investment in the future.

**Figure 22 Numerous African countries capture more private funds than Côte d'Ivoire, 2002-07 average of PPI disbursements***




*calculated as PPI commitments smoothed out over 3 years

**Figure 23 PPI commitments to Côte d'Ivoire over 1990-2008 period**




Source: World Bank and PPIAF, PPI Project Database. (http://ppi.worldbank.org), in current $ millions

Côte d'Ivoire can also address the funding gap by adopting lower cost technologies or choosing less ambitious targets for infrastructure investment. Côte d'Ivoire could make substantial savings from appropriate technological choices in a number of areas, including power, roads, and WSS. First, further development of regional power trading under the WAPP would reduce Côte d'Ivoire's power needs. This would reduce the annual infrastructure funding gap by as much as $0.1 billion a year. Second, the

spending needs estimates for meeting the water and sanitation MDG goals in Côte d'Ivoire are based on the assumption that the same technology mix that exists today will be used. If access were instead expanded exclusively using lower cost solutions—such as stand posts, boreholes, and improved latrines—the cost of meeting the MDG goal would fall from $0.77 to $0.53 billion annually, saving $0.23 billion. Finally, by adjusting road paving standards, the cost of meeting connectivity targets for road network development could fall from $0.34 to $0.22 billion annually—an annual saving of $0.13 billion. If all of these measures were fully adopted, the savings would amount to $0.5 billion a year, which would eliminate half of the funding gap (table 22)

**Table 22: Potential savings from innovations**

$ millions

| | Before innovation | After innovation | Savings | Savings as % of sector funding gap | Savings as % of total funding gap |
|---|---|---|---|---|---|
| Power trade | 963 | 825 | 138 | 152 | 15 |
| WSS appropriate technology | 774 | 527 | 248 | 46 | 27 |
| Roads appropriate technology | 341 | 215 | 126 | 65 | 14 |
| Total | 2,078 | 1,566 | 512 | 56 | 56 |

If Côte d'Ivoire is unable to raise additional finance or reduce infrastructure costs, the only way to meet its infrastructure targets would be to take longer than a decade to do so. If the country were to make all possible efficiency gains overnight while holding spending at current levels, it could meet the identified infrastructure targets within 20 years. Without tackling inefficiencies and addressing the maintenance and rehabilitation backlog, reaching those targets could take much longer. The simulation results underscore the importance of making progress on the efficiency and maintenance agenda.

Within the overall funding envelope, it will be very important to carefully prioritize infrastructure investments. Given the magnitude of the country's funding gap, it will not be feasible to resolve all pending infrastructure issues at once. Some of the most pressing challenges include: expanding power generation capacity and affordable electricity access while addressing the growing financial shortfall; securing enough funding for road maintenance and rehabilitation; consolidating the regional hub position of Abidjan port; and addressing the serious sanitation deficit.

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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 in the table below.

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AICD
AFRICA INFRASTRUCTURE
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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.