



COUNTRY REPORT

# Kenya's Infrastructure: A Continental Perspective

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MARCH 2010

**Africa's Infrastructure** | *A Time for Transformation*

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## About AICD and its country reports

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

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

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

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

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

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

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

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

The data underlying AICD’s reports, as well as the reports themselves, are available to the public through an interactive Web site, [www.infrastructureafrica.org](http://www.infrastructureafrica.org), that allows users to download customized data reports and perform various simulations. Many AICD outputs will appear in the World Bank’s Policy Research Working Papers series.

Inquiries concerning the availability of data sets should be directed to the volume editors at the World Bank in Washington, DC.



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## Synopsis

Infrastructure contributed half a percentage point to Kenya's annual per capita GDP growth over the last decade. Raising the country's infrastructure endowment to that of the region's middle-income countries could boost annual growth by more than 3 percentage points per capita.

Having made significant progress in infrastructure through the mid-2000s, Kenya boasts infrastructure indicators that are higher than those of most other low-income countries in Africa though still far below those of Africa's middle-income countries. A modernized ICT sector now offers 90 percent of the population access to a GSM cell phone signal. Institutional reforms in the power sector have reduced the burden of subsidies on the public by about 1 percent of GDP. A successful public-private partnership in air transport has helped to make the country's airline one of the top three carriers in Sub-Saharan Africa. Jomo Kenyatta International Airport is a key international gateway to Africa. The establishment of a sound system for funding road maintenance should pay long-term dividends by reducing the cost of road travel to the economy.

Kenya's greatest infrastructure challenge lies in the power sector, where a further 1,000 megawatts of generating plant will be needed over the next decade—a doubling of current capacity. A second challenge is to increase terminal capacity at the Port of Mombasa and to strengthen the port's road and rail interfaces to improve the efficiency of operations. Low levels of access to household services are also a major concern. Kenya has moved backwards with respect to the Millennium Development Goals in water and sanitation, and living conditions in Nairobi's slums are particularly poor.

Addressing Kenya's infrastructure deficit will require sustained expenditures of almost \$4 billion per year over the next decade, about 20 percent of GDP. That share is about what China has spent in recent years, but it would pose a huge challenge for Kenya's economy. The amount needed is split fairly evenly between investment and operations, on the one hand, and maintenance, on the other. Almost half of the total relates to the achievement of the Millennium Development Goals for water supply and sanitation and a further quarter to improving the reliability and availability of electrical power.

As of 2006, Kenya needed an additional \$2.1 billion per year, or 11 percent of GDP, to meet its projected infrastructure needs. That gap could be halved if more efficient technologies were used to meet infrastructure targets in the transport and WSS sectors. Even if Kenya were unable to close the infrastructure funding gap, it could meet the posited infrastructure targets by eliminating inefficiencies and extending its target horizon from 10 years to 18 years.

## The continental perspective

The Africa Infrastructure Country Diagnostic (AICD) has gathered and analyzed extensive data on infrastructure across almost all African countries, including Kenya. The results have been presented in reports covering different areas 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 Kenya, allowing the country's infrastructure situation to be benchmarked against that of its African peers. Given that Kenya is a relatively well-off low-income country that aspires to become a middle-income country, two sets of African benchmarks will be used to evaluate Kenya's situation. Detailed comparisons will also be made with immediate regional neighbors in the East African Community.

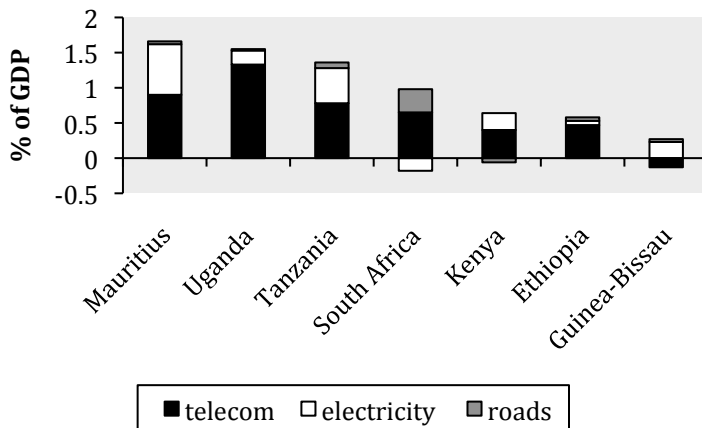
Several methodological issues should be borne in mind. First, because of the cross-country nature of data collection, a time lag is inevitable. The period covered by the AICD runs from 2001 to 2006. Most technical data presented are for 2006 (or the most recent year available), while financial data are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

## Why infrastructure matters

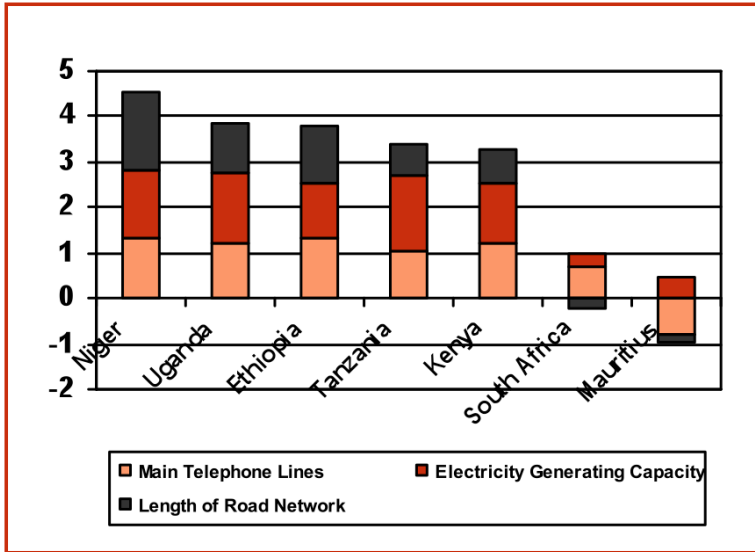
During the five years from 2003 to 2007, Kenya's economy grew at an average annual rate of 5.3 percent, much better than the 2.3 percent recorded in the previous decade. Notwithstanding this improvement, current growth levels still fall short of the sustained 7 percent per annum needed to meet the Millennium Development Goals. Less than half of 1 percent of East Africa's improved per capita growth performance during the 2000s can be credited to improved structural and stabilization policies (Calderon 2008); by contrast, almost 1 percent is related to improvements in the country's infrastructure platform. Most of the boost was due to Kenya's ICT revolution, while poor roads proved to be a drag on growth. Simulations suggest that if Kenya's infrastructure could be improved to the level of the African leader—Mauritius—annual per capita growth rates would be 3.3 percent higher than they are at present. A substantial share of that impact would come from improvements in the power sector alone (figure 1).

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

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



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

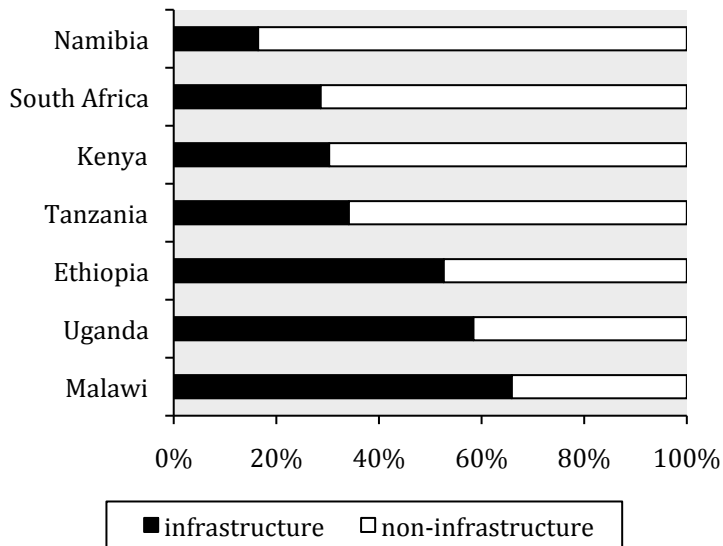


Source: Calderón 2009.

Evidence from enterprise surveys suggests that infrastructure constraints are responsible for about 30 percent of the productivity handicap faced by Kenyan firms (figure 2), with the remainder being due to poor governance, red tape, and financing constraints. Power is the infrastructure constraint that weighs most heavily on Kenyan firms, with transport a close second.

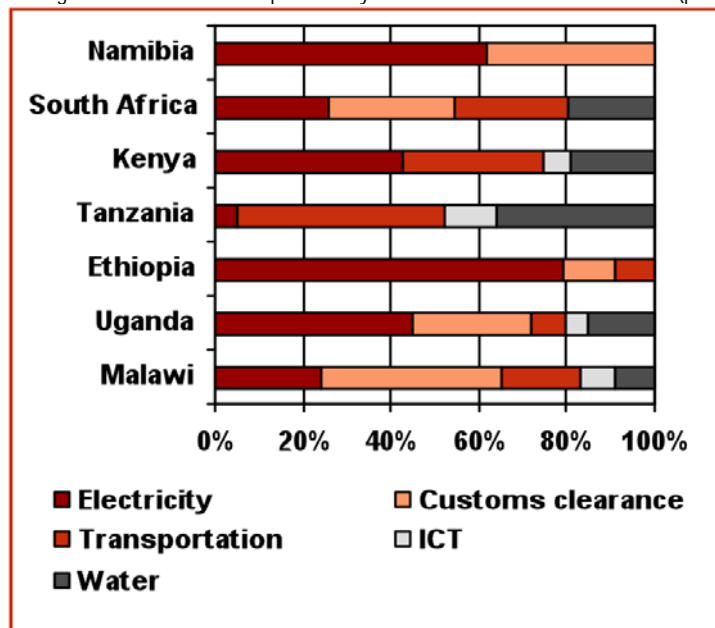
Figure 2. Infrastructure deficits hold back firms' productivity

a. Weight of infrastructure deficits among all factors that sap business productivity (percent)





b. Weight of various sectors in productivity deficit attributable to infrastructure (percent)



Source: Escribano and others 2009.

## The state of Kenya's infrastructure

Kenya's population and agricultural activity are heavily concentrated in the southern half of the country, along the corridor linking Mombasa to Nairobi and then on to Kisumu and into Uganda. Kenya's infrastructure backbones—including the country's principal road artery and its major power transmission and fiber optic backbones—have followed this route (figure 3). The northern half of the country, by contrast is sparsely populated and characterized by fragmentary infrastructure coverage. Kenya's infrastructure networks are largely isolated from those of its neighboring countries. While there are some transport links with Uganda and Sudan, road connections with Ethiopia, Tanzania, and Somalia are of very low quality, while power and ICT backbones are not yet integrated across frontiers.

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

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

	Achievements	Challenges
Air transport	Leading regional airline Major air hub for Africa	Relieve capacity constraints at Jomo Kenyatta International Airport Achieve U.S. Category 1 security clearance
ICT	Major institutional reforms Very high GSM coverage	Strengthen competition to bring down prices Ensure competitive international gateway
Ports	Major regional shipping hub	Substantial investment to ease capacity issues Institutional reforms to increase efficiency
Power	Major institutional reforms	Improve reliability through new investment

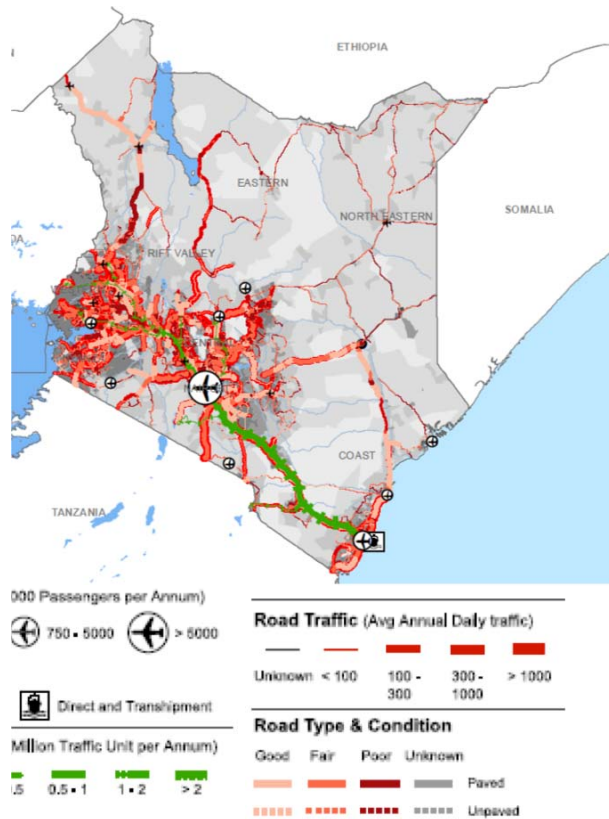
## KENYA'S INFRASTRUCTURE: A CONTINENTAL PERSPECTIVE

	Achievements	Challenges
	Cost-recovery pricing Large efficiency gains by KPLC	Bring down costs of power supply
Railways	Strategic regional rail corridor	Revisit design of rail concession
Roads	Sound road fund in place	Major rehabilitation backlog Improve quality of public investment
Urban infrastructure		Very low levels of access to services High rates of tenancy and insecure tenure
Water resources	Water-resources-management authority in place	Increase water storage capacity Increase irrigated area by 50 percent Strengthen WRM and river-basin institutions
Water and sanitation	Major institutional reforms	Address underpricing of water Cut distribution losses

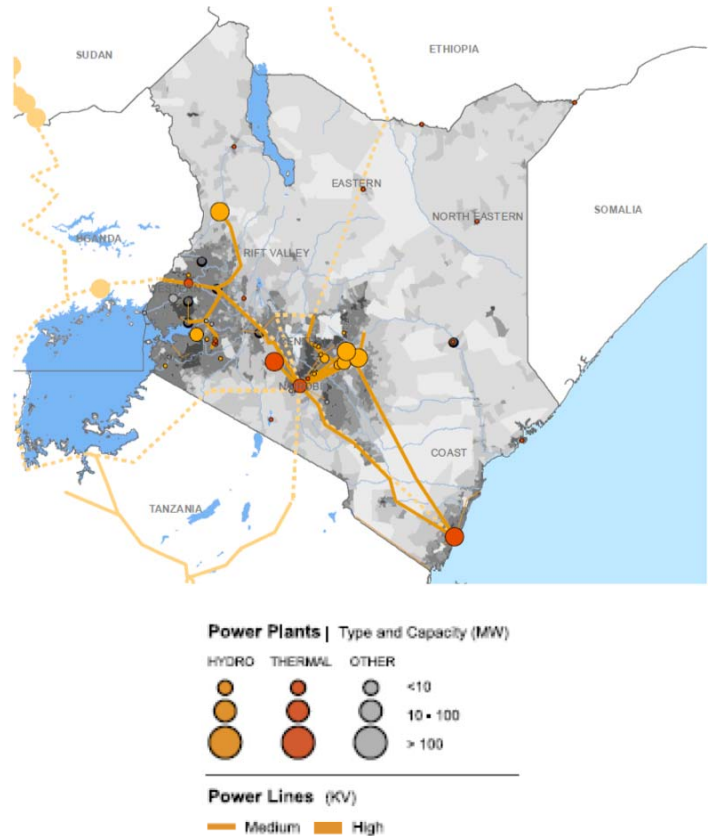
Source: AICD.

Figure 3. Kenya's infrastructure networks follow population density

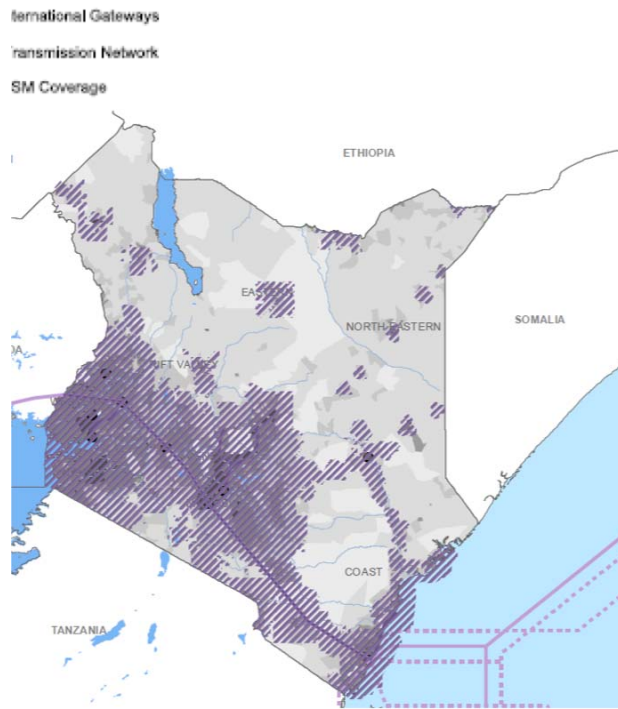
a. Roads



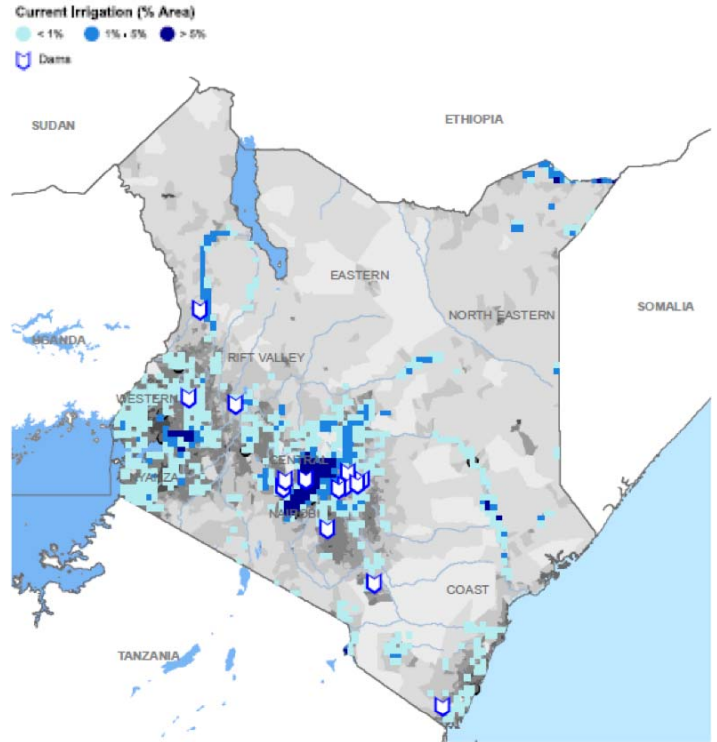
b. Power



(c) ICT



(d) Water



Source: AICD Interactive Infrastructure Atlas for Kenya downloadable from [http://www.infrastructureafrica.org/aicd/system/files/ken\\_new\\_ALL.pdf](http://www.infrastructureafrica.org/aicd/system/files/ken_new_ALL.pdf)

## Roads

### Achievements

The length of the trunk network is more than adequate. Even if Kenya's road density indicators look relatively low by some standards, the trunk network provides basic regional and national connectivity, linking the capital to the coast, to international border crossings, and to provincial capitals in the interior (table 2).

Kenya has established a sound system for funding road maintenance. The country has made great strides with institutional reforms. The country's road fund meets most of the good practice design criteria. Moreover, the fuel levy is set at a level (around \$0.12 per liter) adequate to fund the country's road maintenance requirements, and the associated revenues are indeed being fully captured by the sector.

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

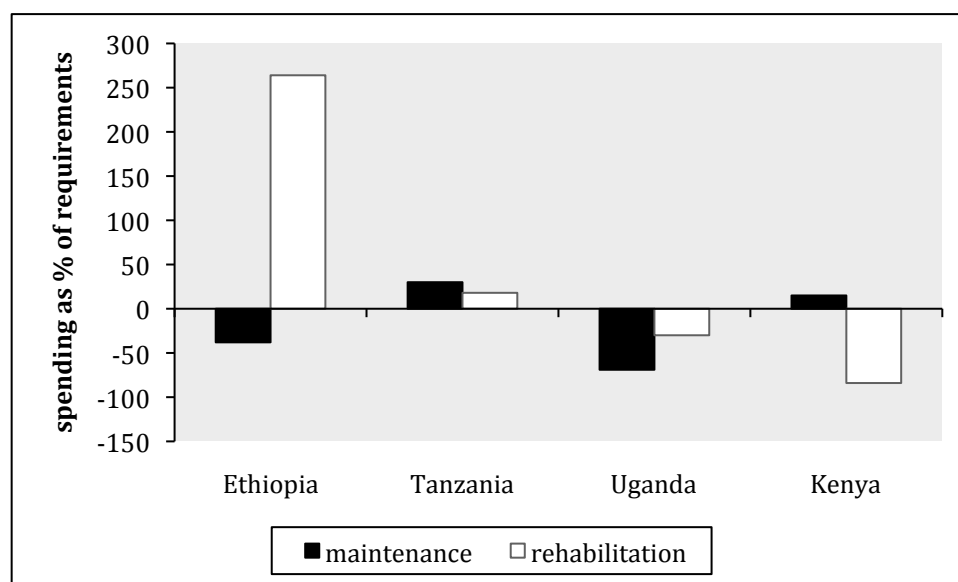
	Unit	Low-income countries	Kenya	Middle-income countries
Paved road density	km/1000 km <sup>2</sup> of arable land	86.6	152	507.4
Unpaved road density	km/1000 km <sup>2</sup> of arable land	504.7	930	1,038.3
GIS rural accessibility	% of rural population within 2 km of all-season road	21.7	32	59.9
Paved road traffic	Average annual daily traffic	1,049.6	1,108	2,786.0
Unpaved road traffic	Average annual daily traffic	62.6	38	12.0
Paved network condition	% in good or fair condition	80.0	84	79.0
Unpaved network condition	% in good or fair condition	57.6	63	58.3
Perceived transport quality	% firms identifying roads as major business constraint	23.0	37	10.7

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

### Challenges

Nevertheless, the country faces a huge rehabilitation backlog that must be addressed before the trunk network can be considered to be in a maintainable condition (figure 4). As of 2006, levels of capital spending for the roads sector—at around 1 percent of GDP—were low by regional standards and fell substantially short of what would be needed to clear the rehabilitation backlog in a reasonable period of time. There is a need for a one-time push on road sector investment to remedy this situation.

Figure 4. Kenya is not spending enough to catch-up with its road rehabilitation backlog



Source: Gwilliam and others 2009.

However, systemic issues affect the country's public investment system. These will need to be addressed to ensure that any major scale-up in capital expenditure is cost-effective. Road investments have been characterized by low rates of budget execution (only about 60 percent of the 2006 budget was spent), cost overruns of as much as 80 percent over engineering estimates, and lengthy delays that tend to

double the implementation period. Furthermore, inadequacies in the system for supervising construction contracts have cut quality and shortened the life of public works. The government has taken steps to improve capital budget execution ratios, and it is hoped that the establishment of the new National Construction Authority will improve the quality of public works.

Beyond the trunk network, accessibility falls off. About 30 percent of Kenya's population lives within two kilometers of an all-weather road—well above the benchmark for low-income countries, but only half the level found in middle-income countries. The clustering of Kenya's population along the Mombasa-Nairobi-Kisumu corridor makes it comparatively easy to achieve significant increases in rural accessibility by improving the quality of the existing rural network, without adding hugely to the length of the classified network. When making the necessary improvements, it will be important to ensure that road investments are spatially synchronized with other interventions aimed at raising agricultural productivity. The need to provide a basic level of connectivity for the north of the country should also be taken into account.

## Rail

### Achievements

Kenya's rail corridor is of strategic importance to the region. Linking the port of Mombasa to Nairobi and continuing onward into Uganda, it is a key conduit for bulk freight, easing pressure and providing additional capacity along the northern corridor (table 3). Owing to deterioration of the infrastructure, freight traffic on the rail corridor has declined to less than 1 million tons per year and handles less than 6 percent of the cargo passing through the northern corridor that links Kenya, Uganda, Rwanda, Burundi, the Democratic Republic of Congo, parts of Tanzania, southern Sudan, and Ethiopia.

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

	Kenya (KRC)	South Africa (SPOORNET)	Malawi (CEAR)	Tanzania (TRC)	Tanzania- Zambia (TAZARA)	Uganda (URC)	Zambia (RSZ)
Concessioned (1)/ state-run (0)	0	0	1	0	0	0	1
Traffic density, freight, 1,000 ton-km/km	690	5,319	112	510	460	815	379
<b>EFFICIENCY:</b>							
Staff: 1000 UT per staff	185	3,037	204	228	300	181	452
Coaches: 1000 passenger-km per coach	1,015	596	1,285	3,157	3,120	NA	2,772
Cars: 1000 ton-km per wagon	200	925	212	692	502	166	180
Locomotive availability in %	44.8	—	89.9	74.2	25.2	69.5	31.2
<b>TARIFFS:</b>							
Average unit tariff, freight, US cents/ton-km	3.8	—	5.8	4.0	3.0	15.2	3.9
Average unit tariff, passenger, US cents/passenger-km	0.6	—	1.0	1.6	1.1	2.3	0.8

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

Through a combination of track rehabilitation and improved operational performance it should be possible to boost traffic volumes to 5–10 million tons per year, which should be enough to accommodate

demand growth during the next decade. Efficiency indicators from the early 2000s show a relatively poor performance compared with other railways of the region.

### **Challenges**

Kenya's rail concession is distressed. In 2006, Kenya (together with Uganda) awarded a rail concession to the Rift Valley Rail Company. More than half of Sub-Saharan Africa's rail corridors have now been awarded as concessions, and the accumulated experience shows that concessions can have an immediate impact on operational performance. But because of strong competition from road freight railways never seem to generate enough revenue to support private financing of track rehabilitation. As a result, track rehabilitation typically ends up being financed by international financial institutions. In the case of Kenya, however, not even the operational improvements have been forthcoming owing to the absence of an experienced rail operating company in the private consortium. The contract is now in distress because of the failure of the concessionaire to finance anticipated track rehabilitation. There is an evident need to revise the concession and ensure the incorporation of a more experienced operator so that at least the potential operational benefits can be secured. With respect to track rehabilitation, it is not realistic to expect private finance. Alternative public sector forms of finance should be sought on the basis of a modest but well-targeted investment plan.

There is an urgent need to improve the rail-port interface. In the context of improvements in the rail corridor, particular attention needs to be paid to improving multimodal transfers between the port and the rail corridor, which has become a major bottleneck in the movement of freight. Kenya's major port, Mombasa, handles more than 16 million tonnes of cargo annually. That number is projected to increase to 30 million tonnes a year by 2030. The port is congested because of inadequate capacity, exacerbated by the low capacity of rail and road transportation from the port. To relieve the port's congestion, it was proposed that it operate on a 24-hour schedule. Construction of a new terminal is planned. These changes will put even more pressure on traffic in the Mombasa-Nairobi-Kampala corridor. The main highway from Mombasa to Nairobi and on to Kampala is already clogged with freight transport. Improvements in the Mombasa-Nairobi-Kampala rail network aimed at increasing freight traffic are needed urgently.

### **Ports**

#### **Achievements**

Mombasa is one of the largest and busiest ports in Africa. With almost 0.5 million TEUs (20-foot equivalent units) and 3.7 million tons of cargo handled each year, Mombasa is the second-largest port in Sub-Saharan Africa after Durban in terms of tonnage and containers handled. With Dar Es Salaam, it is one of the key trading centers for the East Africa region. The port is also a natural transshipment center for East Africa, with 27,288 TEUs of inbound transshipment and approximately the same amount outbound per year. However, Mombasa is straining to maintain that role because of significant capacity constraints. In terms of performance indicators, Mombasa fares relatively well compared with other ports in eastern and southern Africa. However, its container crane productivity, at 10 containers per hour, is far behind Dar Es Salaam (20) and Durban (15).

## Challenges

Easing Mombasa's capacity constraints will require substantial investments. Additional berths and terminals can be accommodated at the Mombasa site, and construction is already underway. In order to make fullest use of the site, however, and to reduce bottlenecks on the landside of the port, improvements to the local road network are needed simultaneously.

Table 4. Benchmarking port indicators: Mombasa as compared with selected other ports

	Mombasa (Kenya)	Maputo (Mozambique)	Sudan (Sudan)	Dar es Salaam (Tanzania)	Cape Town (South Africa)	Durban (South Africa)	Apapa (Nigeria)
<b>CAPACITY:</b>							
Actual container handled (TEU/year)	436,671	44,000	328,690	198,472	690,895	1,899,065	336,308
Container handling capacity (TEU/year)	600,000	100,000	400,000	400,000	950,000	1,450,000	500,000
General cargo handling capacity (tons/year)	1,500,000	NA	7,500,000	8,000,000	1,100,000	NA	5,000,000
Annual liquid bulk cargo capacity (tons/year)	5,500,000	410,000	NA	2,000,000	7,500,000	NA	NA
Length of container berths (meters)	964	300	420	550	2,234	2,128	1,000
Length of general cargo berths (meters)	950	1200	2,011	1,464	2,706	200	2,307
<b>EFFICIENCY:</b>							
Average container dwell time in terminal (days)	5	22	28	7	6	4	42
Average truck processing time for receipt and delivery of cargo (hours)	4.5	4	24	5	4.8	5	6
Average container crane productivity (containers loaded-unloaded per crane hour)	10	11	8	20	18	15	12
Average general cargo crane productivity (tons loaded/unloaded per crane working hour)	20.82	11	8	20	15	25	9
<b>TARIFFS:</b>							
Average general cargo handling charge, ship to gate (US\$/tonne)	6.5	6.0	10	13.5	1.48	17.4	8
Average dry bulk handling charge, ship to gate or rail (US\$/tonne)	5	2.0	3	4.5	6.5	1.48	NA
Average liquid bulk handling charge (US\$/tonne)	NA	0.5	1	3.5	2.68	NA	1

Source: Ocean Shipping Consultants 2009.

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

TEU = 20-foot equivalent units.

Institutional reforms can also contribute significantly to easing capacity constraints. The more efficiently a port is operated, the more throughput can be accommodated within the physical capacity of its infrastructure. It is therefore critical to accompany investments with institutional reforms that increase the efficiency of port operations. A first key step would be to move toward the adoption of the internationally preferred landlord model of port management, whereby the public sector provides port

infrastructure while the private sector provides port services. A second step would be to seek greater private participation in port operation and investment. One possibility would be to try and adapt the strategic investor model, successfully used by Kenya Airways, to the port sector. Finally, given the expected development of second grain and container terminals at Mombasa, it will be very important to allow these facilities to compete with each other to create pressure for service improvements.

## Air transport

### **Achievements**

Kenya is a regional leader in air transportation. Kenya Airways is one of Africa's top three international carriers, with an extensive network across the continent and a safety record up to international standards. The success of the company is in large measure due to an innovative public-private partnership with a strategic investor—KLM—which has a minority stake in the company but is nonetheless fully responsible for management. Linked to the ascendancy of the national airline, Jomo Kenyatta International Airport in Nairobi has become one of the three main international gateways in Sub-Saharan Africa. Beyond its role as an international hub, Kenya has a domestic air transport market that is the fourth-largest in Sub-Saharan Africa (following South Africa, Nigeria, and Mozambique).

### **Challenges**

Kenyatta airport needs to address capacity constraints and security issues. While runway capacity at Kenyatta is adequate, there are shortages of terminal capacity and so-called airside infrastructure, such as taxiways and aprons that allow the runway to be utilized to its fullest potential. Indeed, the airport is currently operating well beyond its design capacity in numbers of passengers: while the airport's terminal capacity equals 2.5 million seats, actual passenger traffic is much higher, reaching 4.3 million seats in 2005 and an estimated 6.3 million seats in 2007. Investments already underway will add a new terminal to the airport and upgrade the airside infrastructure, increasing the capacity of the airport to more than 9 million passengers per year. For Nairobi to fully capitalize on these investments and strengthen its position as an international gateway for Africa, it is desirable to obtain U.S. Category 1 security clearance, which would allow direct flights to the United States. Obtaining that level of clearance will require further work on security arrangements at the airport.

It is important to leverage the benefits of the new regional regulatory framework. The East African Civil Aviation Authority was recently formed as a regional approach to strengthening regulation of the aviation sector, and the regulatory frameworks of the member countries have already been harmonized. One of the key motivations for tackling regulation at the regional level was to allow countries to pool scarce human resources in particular areas of expertise needed for oversight. To make this a reality, it will be important for countries to share responsibility for training and for providing specialized services.

## Water supply and sanitation

### **Achievements**

Kenya has recently gone through a major reform of its water sector. The government started the reform in early 2003, following the provisions of the 2002 Water Act. The Ministry of Water and



Irrigation has been reorganized into a body focused on policy issues. New sector oversight institutions—Water Services Regulatory Board, Water Services Trust Fund, Water Appeal Board, and seven water services boards (WSBs)—were established. Each WSB is mandated to appoint water services providers, legal entities contracted by WSBs. The objective is a step-by-step transfer of management and operations of water services to the WSBs. The implementation of the plan has been generally successful.

As a result, Kenya scores comparatively high in the area of institutional reform. In some cases, most notably the Athi Water Services Board (serving Nairobi and its surrounding area), the reform was accompanied by significant managerial and operational improvements. The Athi Water Services Board commenced its operations in November 2004, serving a population of 6 million. Achievements to date include improved additional water access for more than 300,000 people, appointment of 22 local water service providers with improved technical and commercial operations—among them lower water losses and greater billing efficiency. In addition, the project achieved successful institutional restructuring through implementation of a strong monitoring and evaluation framework, good corporate governance (with a solid code of ethics and diverse representation), management assistance for water service providers, and adherence to a clear commercial focus (Mwangi 2007).

### **Challenges**

Yet overall, Kenya's water utilities continue to generate large hidden costs. They capture barely 60 percent of the revenue stream that they need to operate effectively, a comparatively poor performance by regional standards (table 5). The main culprits are underpricing and unaccounted for water. At around \$0.40 per cubic meter, Kenya's water tariffs are substantially lower than those found in other African countries with scarce water resources. Distribution losses are typically around 40 percent, compared with 33 percent in other African low-income countries. Efficiency gains along the lines of those experienced by KPLC in the power sector need to be replicated in the water sector, not only to improve existing service but to be able to extend service to new customers. Utilities with high levels of inefficiency are not very effective at expanding service coverage.

Moreover, almost half of Kenya's population relies on surface water, and the share is growing (figure 5). This is much higher than in other African low-income countries, where only one-third of the population relies on surface water. Although access to piped water in Kenya, at 18 percent, is almost double the rates found in other low-income countries, Kenyans' access to standposts and boreholes is only about half the level observed in other low-income countries. It is the shortfalls in these intermediate modes of access that account for the relatively high prevalence of surface water usage, and suggest that Kenya has tended to focus investment on high-end solutions rather than more affordable forms of service.

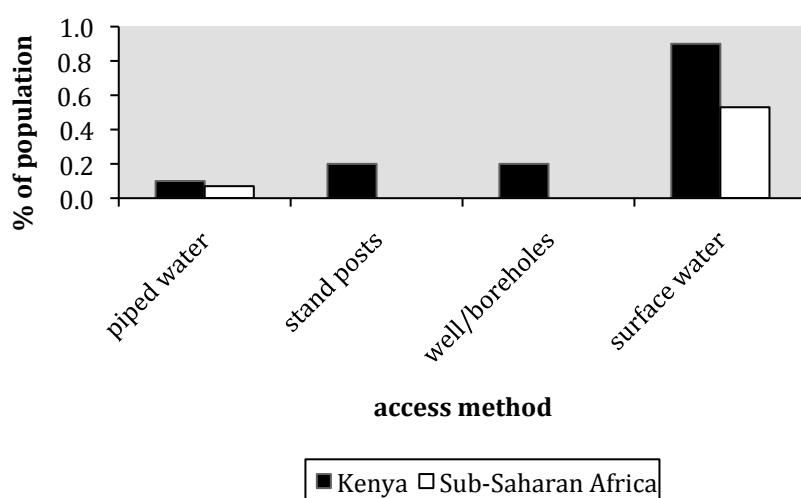
KENYA'S INFRASTRUCTURE: A CONTINENTAL PERSPECTIVE

Table 5. Benchmarking water and sanitation indicators

	Unit	Low-income countries	Kenya	Middle-income countries
Access to piped water	% pop	10.1	17.9	56.4
Access to stand posts	% pop	16.1	9.4	20.4
Access to wells/boreholes	% pop	38.3	21.6	6.3
Access to surface water	% pop	33.8	46.4	13.9
Access to septic tanks	% pop	5.3	9.0	44.0
Access to improved latrines	% pop	9.3	8.0	0.9
Access to traditional latrines	% pop	47.9	64.3	33.0
Open defecation	% pop	37.1	18.3	15.8
Domestic water consumption	liter/capita/day	72.4	63.0	Na
Urban water assets in need of rehabilitation	%	35.5	42.0	25.0
Revenue collection	% sales	96.0	95.0	99.2
Distribution losses	% production	33.0	40.0	23.1
Cost recovery	% total costs	56.0	58.0	80.6
Total hidden costs as % of revenue	%	130.0	173.9	84.9
U.S. cents per m3	Kenya	Scarce water resources	Other developing regions	
Residential tariff		38.9	60.26	
Non-residential tariff		45.7	120.74	3.0 – 60.0

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

Figure 5. Growing reliance on surface water and static trend in improved sources



Source: Gulyani, Sumila, Talukdar, and Jack 2009.

What is particularly worrisome is that whereas only 0.3 percent of the population is gaining access to some improved form of water service each year, as much as 1.05 percent of the population is moving into reliance on surface water. What this means is that between the mid-1990s and the mid-2000s, Kenya essentially moved farther away from meeting the Millennium Development Goal for water supply. A big part of the problem lies in the rural areas, where Kenya has not yet taken key measures such as establishing a rural water agency, making and implementing a rural water policy, and creating a map of rural water points. At the same time, the country made some initial progress by establishing a rural water fund and introducing a cost-recovery policy.

Kenya's position with respect to sanitation has also been deteriorating. About 64 percent of Kenya's population relies on traditional latrines for sanitation, with a further 17 percent having access to improved modes of sanitation and the remaining 18 percent practicing open defecation. The prevalence of open defecation in Kenya is about half that in other African low-income countries. But from the mid-1990s to the mid-2000s, the prevalence of open defecation in Kenya actually increased, with an additional 0.8 percent of the population adopting this practice every year, while only 0.5 percent of the population acquired improved sanitation. As in the case of water, this trend indicated that Kenya has been moving further away from meeting the Millennium Development Goal for sanitation. The experience of neighboring countries in Africa, for example Ethiopia, shows that hygiene promotion can be very effective in reducing the practice of open defecation.

## Power

### **Achievements**

Institutional reforms have led to efficiency gains of 1 percent of GDP. Kenya's power sector has gone through a number of important institutional reforms in recent years. The national power utility was unbundled into a generation and transmission utility (KenGen) and a distribution utility (KPLC). As of the early 2000s, the hidden costs associated with the distribution utility—in the form of underpricing, collection losses, and distribution losses—were as large as 1.4 percent of GDP. In the run-up to the adoption of a management contract, revenue collection improved substantially—from 81 percent in 2004 to 100 percent in 2006. Distribution losses also began to fall, though more gradually, reflecting the greater difficulty that they present. Power-pricing reforms also allowed tariffs to rise in line with escalating costs, from \$0.07 per kilowatt-hour in 2000 to \$0.15 in 2006 and to \$0.20 cents in 2008. As a result of these measures, the hidden costs of the power sector had fallen from 1.4 percent of GDP in 2001 to 0.4 percent of GDP in 2006 and were largely eliminated by 2008, reaching one of the lowest levels in Africa. This has saved Kenya more than 1 percent of its entire GDP and helped to place the sector on a firmer financial footing (figures 6–7).

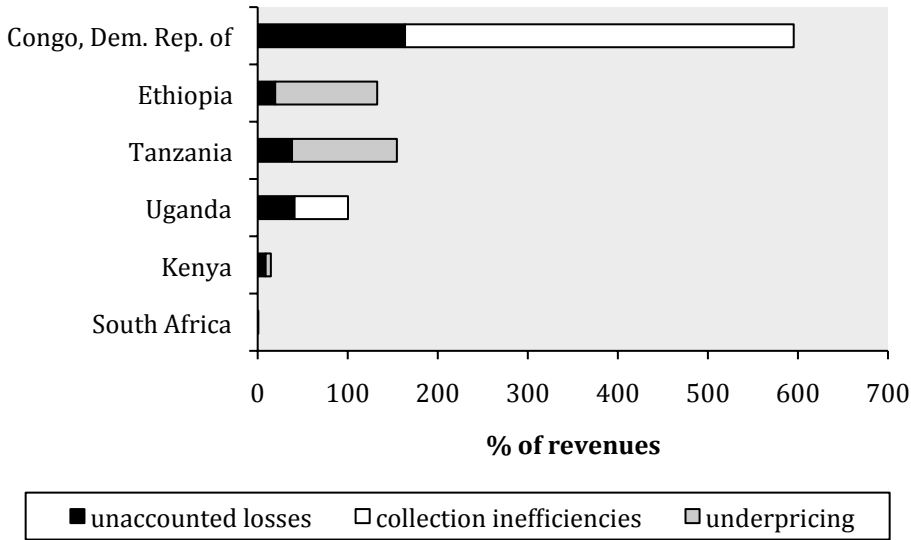
### **Challenges**

Kenya's power supply remains unreliable because generation and transmission are stretched too thin. The country's installed generation capacity is meager at only 33 megawatts per million of population—about one-tenth the average in Africa's middle-income countries (table 6). Growing demand, combined with recent droughts that have reduced the supply of hydropower, has led to frequent power interruptions, even more than in other low-income African countries (figure 8). The private sector has suffered as a

result, with 70 percent of firms feeling the need to install backstop generation and 3 percent of turnover lost to power outages. It is estimated that the burden of power outages on the economy is as high as 2 percent of GDP. To overcome the problem, Kenya will need to install an additional 1,000 megawatts of generation capacity over the next decade—a near doubling of current installed capacity. About 300 megawatts of coal and geothermal capacity are already in the pipeline. The country will also need to develop or reinforce cross-border transmission links with Ethiopia, Tanzania, and Uganda to provide access to relatively inexpensive hydropower and improve overall system security.

Figure 6. Kenya's power sector has much lower hidden costs than most other African countries

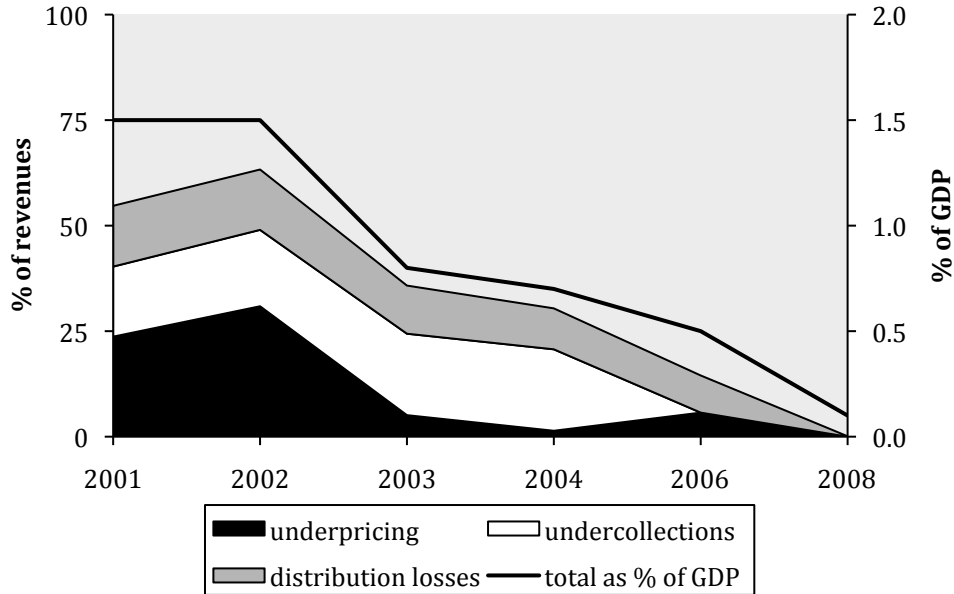
Hidden costs of power utilities in selected countries



Source: Briceño-Garmendia and others 2009.

Figure 7. KPLC pricing and management reforms have saved Kenya more than 1 percent of its GDP

Reduction of hidden costs in power sector, 2001–08



Source: Derived from Briceño-Garmendia and others 2009 and more recent data provided by World Bank country staff.

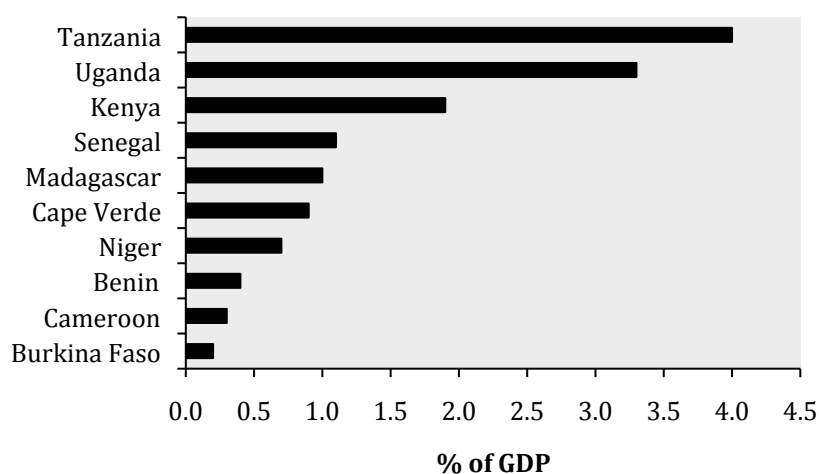
Table 6. Benchmarking power indicators

	Unit	Low-income countries	Kenya	Middle-income countries
Installed power generation capacity	MW/mil. people	24.4	33	796.2
Power consumption	kWH/capita	99.5	146	4,473
Power outages	Day/year	40.6	53	5.6
Firms' reliance on own generator	% consumption	17.7	15	0.5
Firms' value lost due to power outages	% sales	6.1	3	0.8
Access to electricity	% population	15.4	18	59.9
Urban access to electricity	% population	71	51	83.7
Rural access to electricity	% population	12	4	33.4
Growth access to electricity	% population/year	1.4	1	1.8
Revenue collection	% billings	88.2	98.7	99.9
Distribution losses	% production	22.1	18.1	15.7
Cost recovery	% total cost	90.0	108.0	125.7
Total hidden costs as % of revenue	%	121.2	15	3.5
U.S. cents	Kenya	Predominantly hydro generation	Other developing regions	
Power tariff (residential at 75 kWh)	12.7	10.27	5.0 – 10.0	
Power tariff (commercial at 900 kWh)	21.7	11.73		
Power tariff (industrial at 50,000 kWh)	19.0	11.39		

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

Figure 8. Power outages continue to tax the Kenyan economy

Economic cost of power outages in selected countries



Source: Eberhard and others 2009.

As new capacity comes on stream, prices of power will eventually fall. Power tariffs in Kenya, currently at \$0.20 per kilowatt-hour, are comparatively high. This is entirely appropriate at present, given that the country is able to meet current demand only by relying on emergency generation that costs around \$0.25 per kilowatt-hour. Fortunately, however, the high present tariff does not represent the long-run marginal cost of power sector development in Kenya. As long-term investments are put in place, the country will secure access to more cost-effective power sources, and the costs of supply could gradually come down to around \$0.13 per kilowatt-hour.

## Water resources

### **Achievements**

Kenya has already established a water resource management authority, but further institutional strengthening is required to make it effective. Wringing the maximum benefit from water resource investments and resolving conflicts among competing water uses depend on the right institutional framework. Over the next several years the water resource management authority should be made fully functional, while catchment area advisory committees and water user associations in the areas of potential conflict are established and water charges are introduced to provide operating funds. In the longer term, a coordinated infrastructure investment program, combined with greater cooperation with neighboring countries and downstream Nile countries, will be essential to a water-secure Kenya.

### **Challenges**

Extreme hydrological variability is a major drag on the economy. Kenya is a country characterized by overall water scarcity (650 cubic meters per capita per year), but also by a very high degree of hydrological variability. This is manifested in frequent droughts and floods that seriously affect the productivity of the agricultural sector, costing the economy more than two percentage points of GDP growth each year, on average. For example, it is estimated that the overall cost of the El Niño flood of 1997–98 led to damages that cost the economy \$1.4 billion, while the La Niña drought of 1998–2000 generated losses amounting to a further \$2.4 billion.

Kenya will need to invest substantially in storage capacity to achieve water security. The country's current storage capacity is only 124 cubic meters per capita, compared with 750 cubic meters per capita in South Africa. The exact amount of storage needed to achieve water security is not yet known, but the costs of reaching a reasonable level are likely to be high. By way of illustration, doubling current storage capacity to 248 cubic meters per capita would entail investments of about \$6 billion.

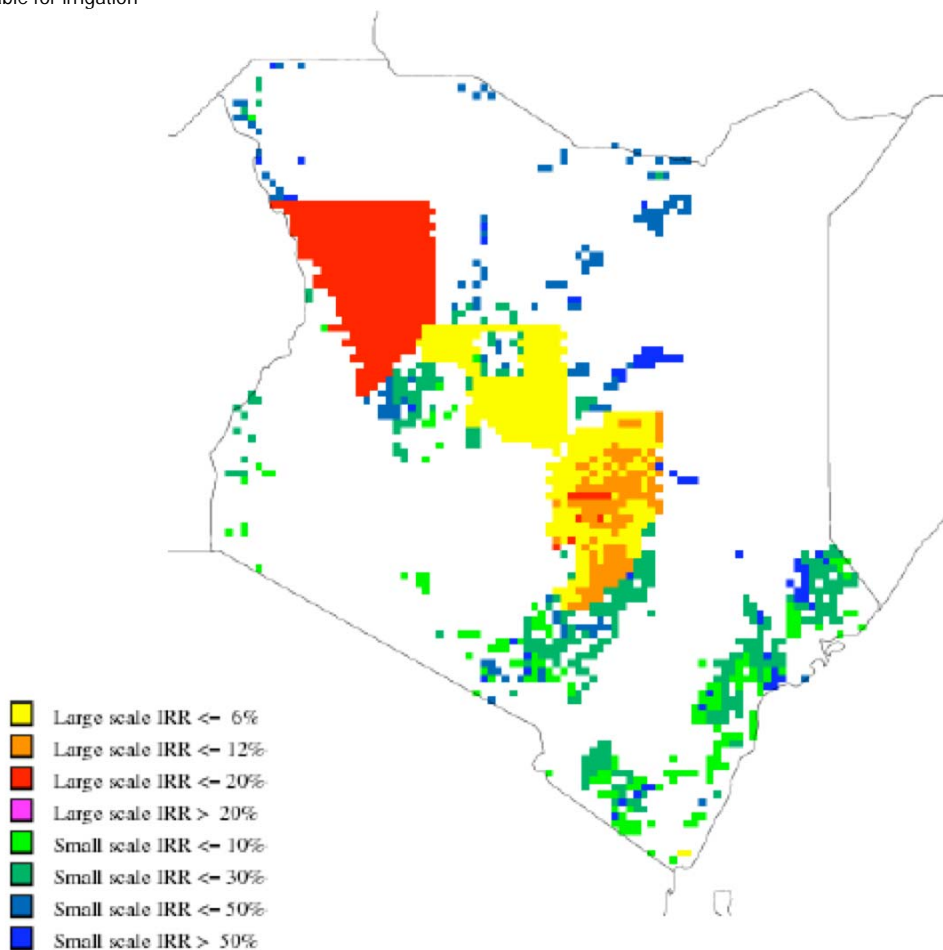
The best way to develop water storage is through multi-purpose schemes, usually anchored in hydropower generation. However, Kenya has already developed its most attractive hydropower resources. The next series of power investments in the country are expected to involve thermal and geothermal resources; they will not contribute to increasing the country's storage capacity. Given the importance of achieving water security, it may be necessary to incorporate non-power-related benefits into the appraisal of future hydropower investments.

The country's current irrigated area could be increased by 50 percent with good economic returns. At present, Kenya irrigates only some 100,000 hectares of agricultural land, barely 2 percent of the country's

cultivated area. Simulations suggest that, with a threshold internal rate of return of 12 percent, it would be economically viable to develop a further 55,000 hectares of land for irrigation. Almost all of this area lies downstream from existing dams that are not yet being exploited for irrigation. The job could be done by investing \$109 million in the extension of water-distribution infrastructure to serve land lying downstream from these dams. The exact location of the areas viable for irrigation can be seen in figure 9. There are also profitable opportunities for small scale irrigation, particularly along the coastal strip.

Figure 9. Irrigation schemes could be viable in many new locations

Areas viable for irrigation



Source: You and others 2009.

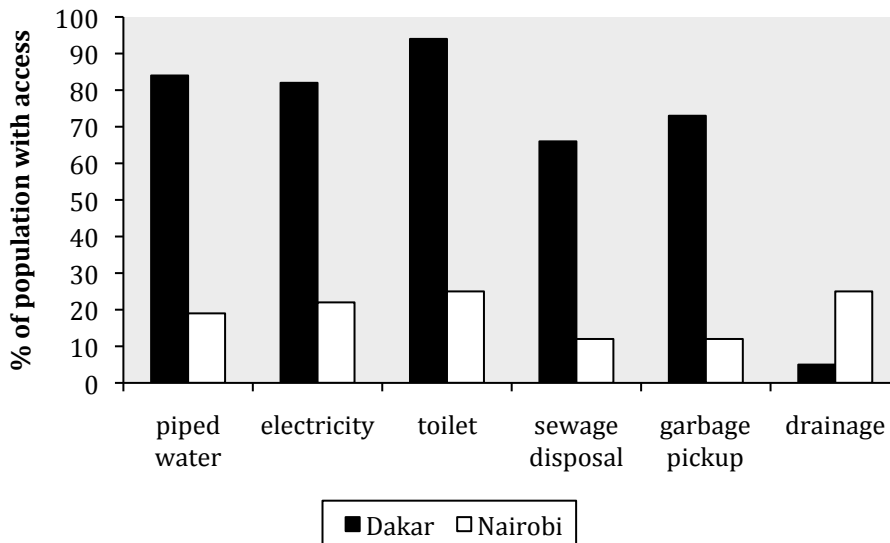
Insufficient coordination of trans-boundary resources is one of the major reasons for Kenya's water crisis. Kenya shares more than half of its water resources with neighboring countries. Cooperative management of those resources, and of flood water, is critical for Kenya's water resource sustainability. Kenya has begun to engage in joint programs on some key shared resources through the Nile Basin Initiative and the East African Community, but this cooperation must be further strengthened to provide greater benefits for the countries involved.

## Urban infrastructure

### Challenges

More attention needs to be paid to urban infrastructure, particularly in slum areas. A two-way comparison between the slums of Nairobi and Dakar provides some important insights. In Nairobi, slum residents have substantially higher levels of education and employment than in Dakar, but this does not translate into better living conditions. Only 3 percent of Nairobi's slum residents have access to a home with solid walls and a power and water connection, compared with 74 percent in Dakar. Taking a closer look at all aspects of infrastructure provision, coverage for Dakar residents was found to exceed 70 percent versus only 20 percent for Nairobi residents. The only exception was drainage services, where Nairobi residents were significantly better off (figure 10). The explanation lies in contrasting tenure arrangements in the two cities: 92 percent of Nairobi's slum residents are tenants, and turnover is high. Because settlements are informal, neither landlord nor tenant has much incentive to invest in housing improvements. In Dakar, on the other hand, tenants are just 25.8 percent of the residents, while ownership of buildings (without land) is 13.7 percent and ownership of both land and buildings is 57.6 percent, making the population more stable over time and providing residents with the possibility of gradually investing to improve the quality of their homes.

Figure 10. Infrastructure services reach a larger share of the residents of Dakar than Nairobi



Source: Gulyani, Talukdar, and Jack 2009.

## Information and communication technologies

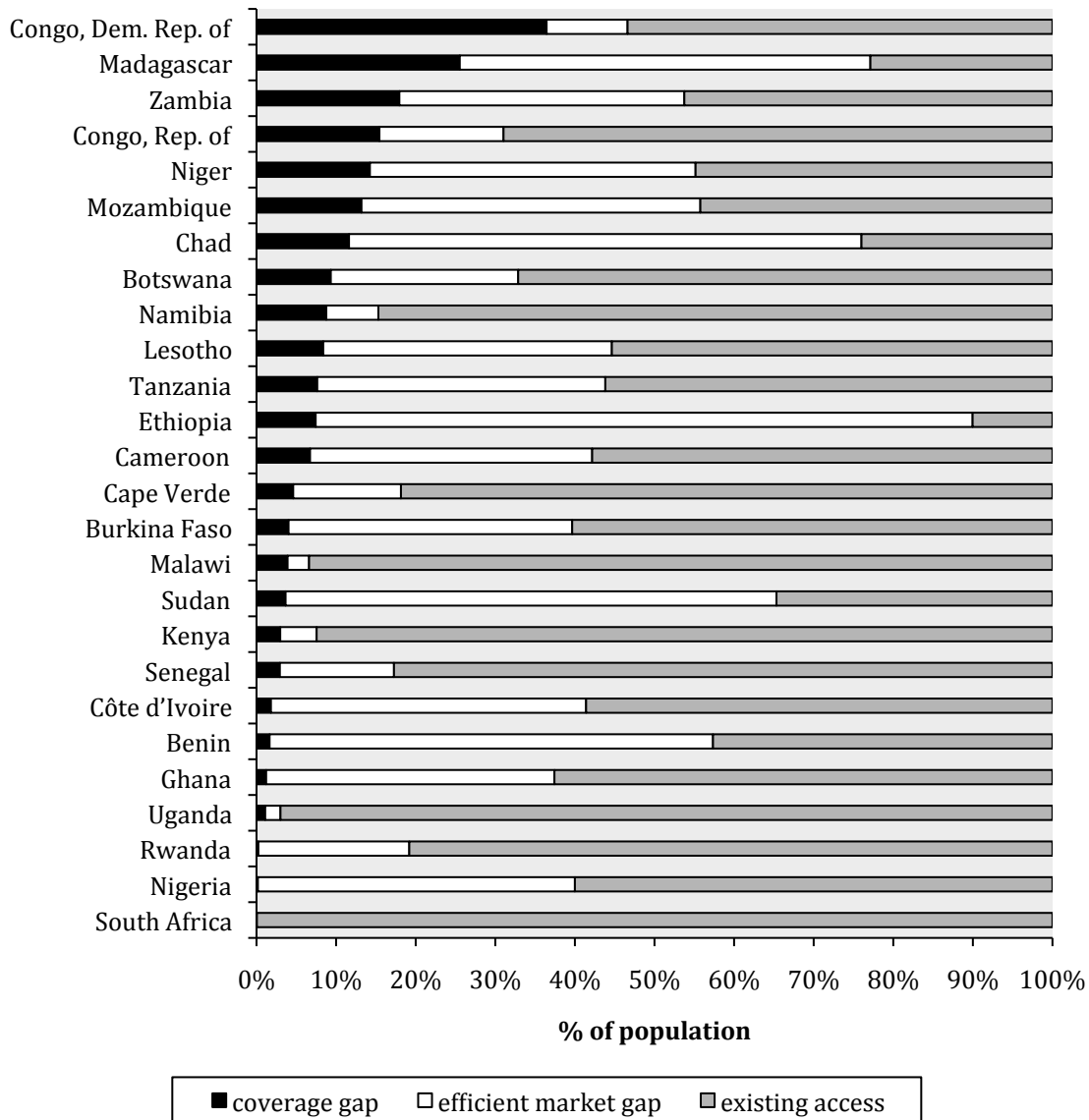
### Achievements

Kenya has made substantial progress with ICT reforms. As of 2006, the country scored around 50 percent on an index of institutional reform, which is close to the African average. More recently, Kenya has privatized its fixed line incumbent, taking the reform process one step further.



The country has achieved one of the highest rates of GSM coverage in Africa. Over 90 percent of Kenya's population lives within range of a GSM signal. This is one of the highest rates in Africa. It is likely that another seven percent could be profitably served by private operators. Only about one percent of the population would not be commercially viable to serve and would probably require some degree of public subsidy. Furthermore, about 30 percent subscribe to the service with a further 2 percent of the population being added each year (figure 11).

Figure 11. Kenya has made tremendous progress in expanding GSM coverage



Source: Mayer and others 2008.

### Challenges

Prices for ICT services in Kenya remain relatively high. Charges for fixed-line, mobile, and international calling, and for Internet access, are significantly higher in Kenya than in comparable African countries (table 7). The recent award of a fourth mobile license is beginning to exert some downward

pressure on prices, however. Given the size of Kenya's market, it may be desirable to consider introducing competition in the fixed-line services, as well. Nigeria has done so with considerable success and today is the only country in Africa where fixed-lines services are not in decline. The Nigerian experience also illustrates the willingness of private providers to invest significantly in inter-urban telecommunications backbones.

Submarine cables could substantially reduce costs as long as access is competitive (table 8). Based on experience elsewhere in Africa, the imminent completion of three submarine cable projects—EASSy, SEACOM, and TEAMS—has the potential to cut Kenya's Internet and international telecom charges at least by half. But these benefits will materialize for the economy only if there is more than one operator providing a physical point of access to the submarine infrastructure, and hence competition between alternative landing stations. Countries in which international gateways remain under monopolistic control do not experience full price reductions from increases in international connectivity, essentially because the benefits of the technology are retained as monopoly profit (table 8).

Table 7. Benchmarking ICT indicators

	Unit	Low-income countries	Kenya	Middle-income countries
GSM coverage	% population	48.2	86.2	97.2
International bandwidth	Mbps/capita	5.8	6.3	30.2
Internet	subscribers/100 people	0.1	0.3	2.0
Landline	subscribers/100 people	0.8	0.9	9.4
Mobile phone	subscribers/100 people	15.1	30.2	86.7
			Countries without access to submarine cables	Other developing regions
	Kenya			
Price of monthly mobile basket		15.9	11.12	9.9
Price of monthly fixed-line basket		21.0	13.58	—
Price of 20-hour Internet package		81.5	67.95	11.0
Price of a 3-minute call to the United States		2.00	2.59	2.0
Price of inter-Africa calls, mean		1.04	0.72	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.

Table 8. High international call charges driven both by technology and market power

US\$	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.

## Financing Kenya's infrastructure

To meet its most pressing infrastructure needs and catch up with developing countries in other parts of the world, Kenya needs to expand its infrastructure assets in key areas (table 9). The targets outlined below are purely illustrative, but they represent a level of aspiration that is not unreasonable. Developed in a standardized way across African countries, they allow for cross-country comparisons of the affordability of meeting the targets, which can be modified or delayed as needed to achieve financial balance.

Table 9. Illustrative investment targets for infrastructure in Kenya

	Economic target	Social target
ICT	Install fiber optic links to neighboring capitals and submarine cable	Provide universal access to GSM signal and public broadband facilities
Irrigation	Develop additional 55,000 hectares of economically viable large-scale irrigation	None
Power	Develop 990 MW of new generation capacity and 270 MW of interconnectors	Raise electrification to 50 percent (100 percent urban and 32 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	—	Achieve Millennium Development Goals

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

Meeting these illustrative infrastructure targets for Kenya would cost \$4 billion per year for the years through 2015. Capital expenditure would account for 72 percent of this requirement. Meeting growing demand for power and improving the reliability of power supply will require an estimated \$1 billion per year to install almost 1,000 megawatts of new generation capacity and 270 megawatts of cross-border interconnectors. The water and sanitation sector is the area with the highest spending needs: almost \$2 billion will be needed each year to meet the Millennium Development Goals, with capital expenditure accounting for three-quarters of the total. While less than the amounts needed for power and water and sanitation, requirements for transport and ICT are also high in absolute terms, amounting to around half a billion dollars a year in each case (table 10).

Kenya's infrastructure spending needs are high in absolute terms—and even more so relative to GDP (figure 12). At \$4 billion, in absolute terms, the country's needs are among the highest in Africa. Relative to the size of Kenya's economy, that spending would amount to a staggering 21 percent of 2006 GDP. Investment alone would absorb around 15 percent of GDP, comparable to what China invested in infrastructure during the mid-2000s.

**Table 10. Indicative infrastructure spending needs in Kenya for 2006 to 2015**

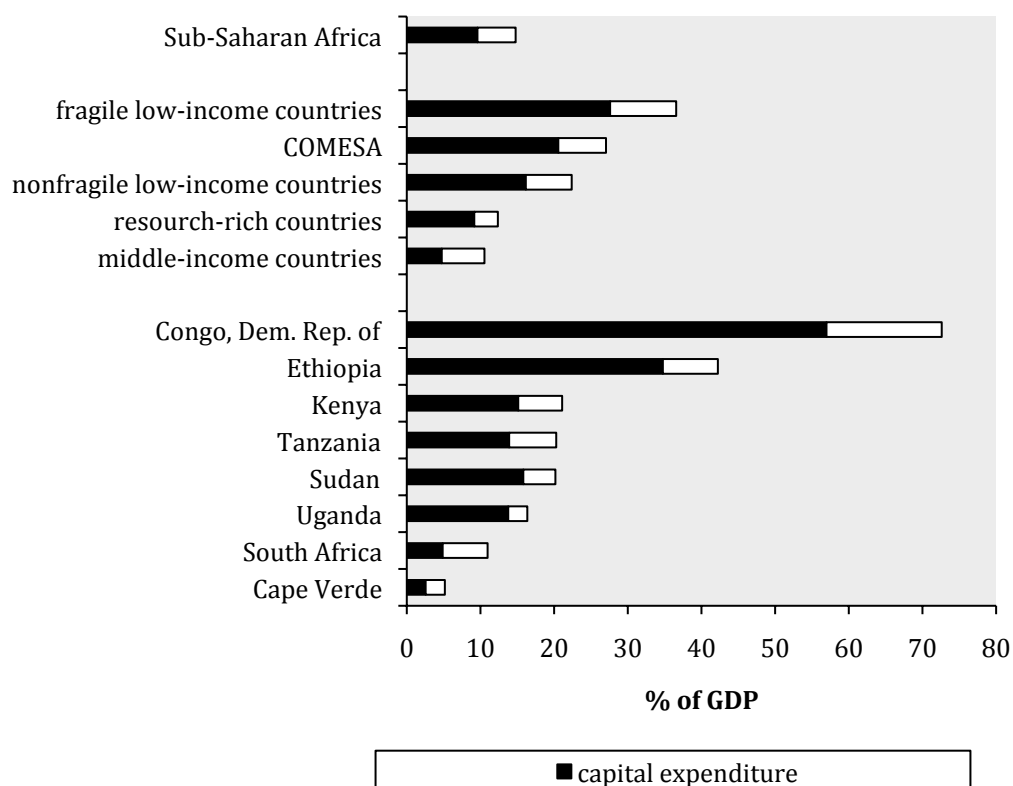
US\$ million per year

Sector	Capital expenditure	Operations and maintenance	Total needs
ICT	485	44	529
Irrigation	13	2	16
Power (trade)	745	274	1,019
Transport (basic)	232	242	474
Water supply and sanitation	1,375	555	1,930
Total	2,850	1,118	3,968

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>.

**Figure 12. Kenya's infrastructure spending needs are greater than those of comparable countries**

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



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

Kenya already spends a sizable amount (\$1.6 billion per year) to meet its infrastructure needs (table 11). About 65 percent of the total is allocated to capital expenditure and 35 percent to operating expenditures. Operating expenditure is entirely covered from budgetary resources and payments by infrastructure users. The largest source of funding for infrastructure investment is the private sector, which accounts for half of the total amount. The public sector and overseas development aid to Kenya

each account for a further one-quarter of current capital expenditure. Power and transport capture almost 90 percent of the resources allocated to operating expenditures. The figures for ICT operations likely changed significantly in 2007 with the privatization of Kenya Telekom. Private participation in ICT accounts for almost 90 percent of all private participation in the country's infrastructure; in power, private participation is conspicuously small.

Table 11. Financial flows to Kenyan infrastructure, average 2001 to 2006

US\$ millions per year

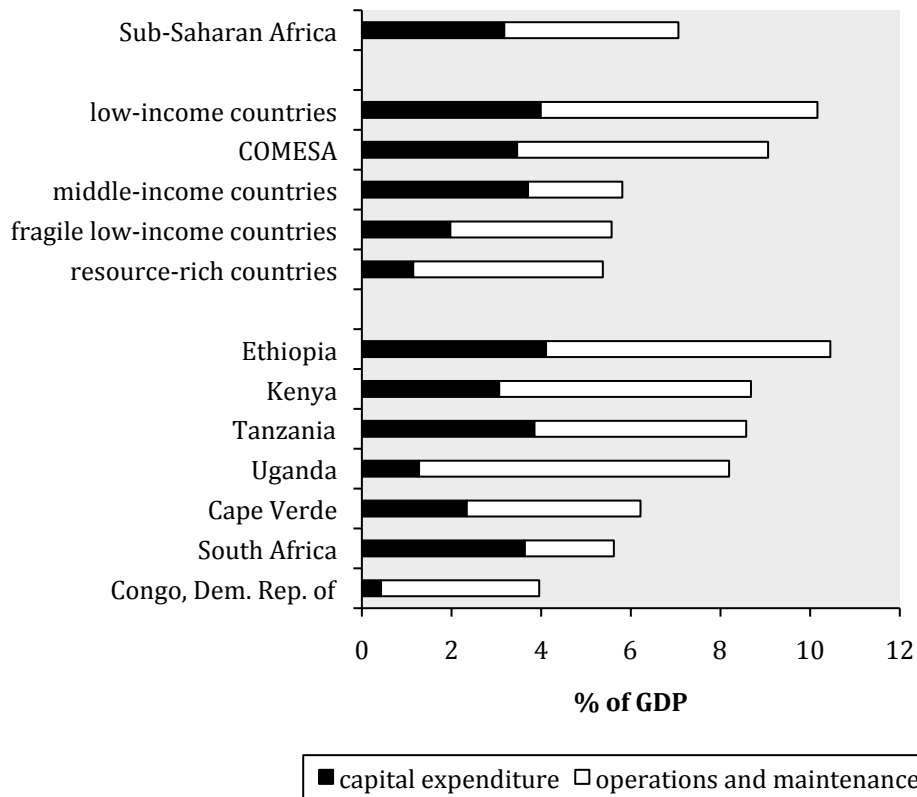
	O&M		Capital expenditure				Total spending
	Public sector	Public sector	ODA	Non-OECD financiers	PPI	Total CAPEX	
Information and communication technologies	44	36	0	0	449	485	529
Irrigation	2	0	0	0	0	0	3
Power (trade)	274	125	59	0	13	197	471
Transport (basic)	242	84	114	11	22	232	474
Water supply and sanitation	12	34	97	2	23	155	167
Total	575	278	271	13	507	1,069	1,644

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.

Kenya's current spending on infrastructure spending is also quite substantial as a share of GDP. Kenya spends 9 percent of its GDP on infrastructure, about the same as other nonfragile low-income countries (figure 13). Although this represents a substantial effort, it translates into just \$22 per capita per year in infrastructure spending. And although Kenya invests as much in infrastructure as other low-income countries in Africa, the pattern of its investments is different. Kenya's public sector invests substantially more in power but less in ICT, water, and sanitation than its African peers. For power, transport, and WSS, the pattern of finance is similar to the peer group, with a mix of public and donor finance. In the case of ICT, however, there are notable differences. Kenya relies more heavily on the private sector for ICT investments than does the peer group (figure 14).

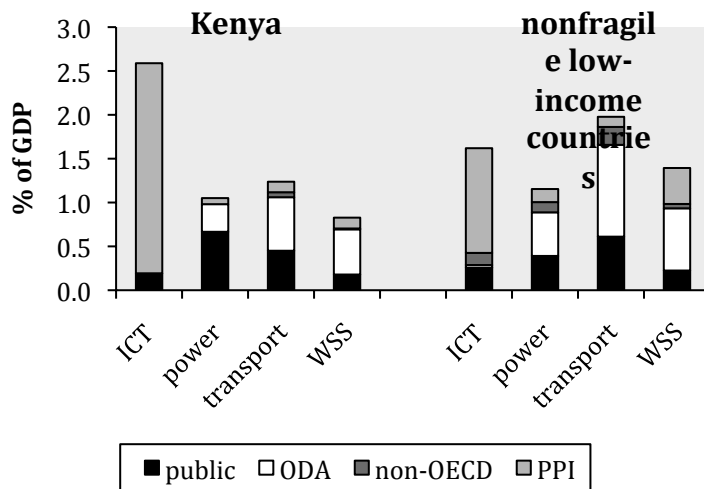
Figure 13. Spending allocated to address infrastructure needs



Source: Foster and Briceño-Garmendia 2009.

Figure 14. Kenya'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?

About \$230 million of additional resources could be recovered each year by improving efficiency (table 12). The three largest potential sources of efficiency gains are reducing distribution losses, improving cost recovery, and raising the capital-budget execution rate (that is, the share of budgeted funds that is actually spent). The two sectors that present the largest potential efficiency dividends are power and WSS.

Table 12. Potential gains from greater operational efficiency

	ICT	Irrigation	Power	Transport	WSS	Total
Under-recovery of costs	—	—	8	25	35	69
Overstaffing	n.a.	—	31	—	n.a.	31
Distribution losses	—	—	54	—	17	71
Undercollection	—	—	0	0	7	7
Undermaintenance	—	n.a.	n.a.	0	n.a.	0
Low budget execution	0	0	15	19	18	52
Total	0	0	109	44	77	230

Source: Derived from Foster and Briceño-Garmendia 2009.

— = not applicable

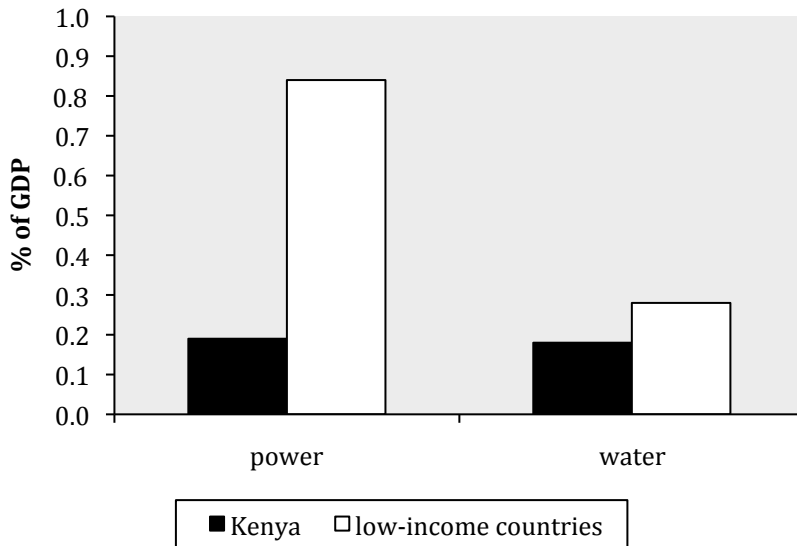
n.a. = not available

Undercharging for water and power services costs Kenya about \$70 million each year. In the water sector, it is estimated that the average total cost of producing utility water is \$0.99 per cubic meter, while the average effective tariff is only \$0.58, which covers only operating and maintenance costs. As a result, the main utilities in the sector cover only 58 percent of their costs, leaving capital investment unfunded. The associated financial burden is approximately 0.2 percent of GDP (figure 15). In the power sector, the burden of underpricing was removed in 2008, when tariffs were raised to \$0.20 per kilowatt-hour. Looking ahead to the future, the long-run marginal cost of power in Kenya could fall below that level once planned coal and geothermal plants are in place and power-trading agreements materialize. Those developments should lower prices to end users as well as easing the pressure on national budgets.

Because of inequitable access to power and water services in Kenya, subsidized tariffs are highly regressive. Kenyans with connections to the piped water network have the full capital costs of their service subsidized (implicitly or explicitly) by the state. Given that 69.4 percent of households with access to piped water are in the top quintile of the income distribution, that subsidy policy is very regressive. Although power tariffs are now aligned with costs, when they were subsidized they were similarly regressive, as 87.6 percent of households with access to the power grid are in the richest quintile (figure 16).

Figure 15. Underpricing of power and water in Kenya relatively low but still material

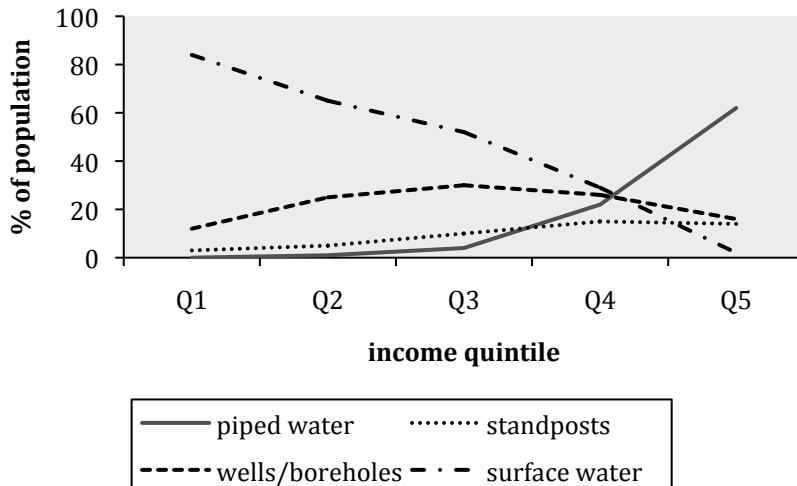
Financial burden of underpricing in 2006, as percentage of GDP



Source: Derived from Briceño-Garmendia and others 2009.

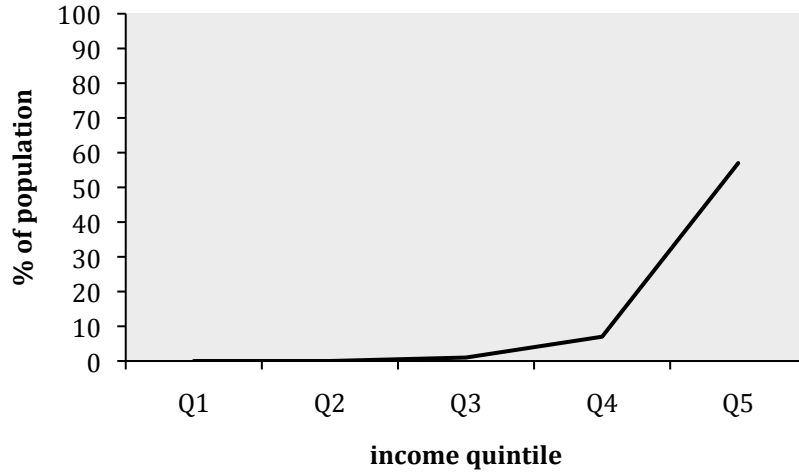
Figure 16. Kenyans' consumption of infrastructure services is highly differentiated by budget

(a) Mode of water supply, by income quintile





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



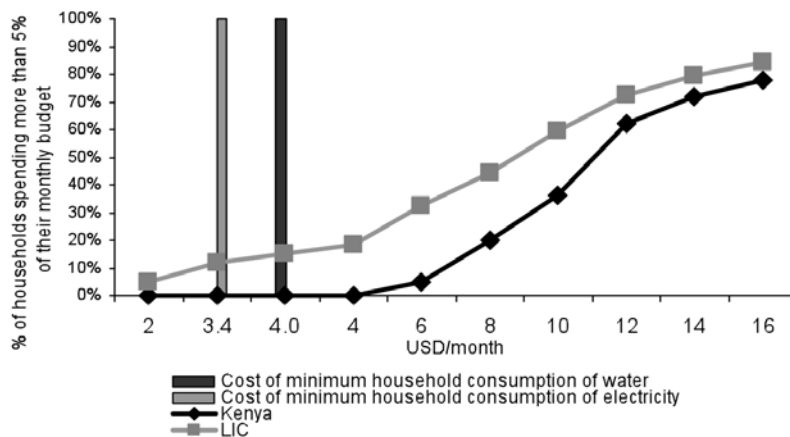
Legend: Q1 – first budget quintile, Q2 – second budget quintile, etc.

Source: Banerjee and others 2009.

Interestingly enough, in Kenya, those with access to electricity and power (and many of those without access) do not face major affordability problems. To evaluate the social feasibility of raising power and water tariffs toward cost-recovery levels, we set an affordability threshold of 5 percent of the household budget. On this basis, and using data on the size of family budgets, figure 17 illustrates the percentage of Kenyan households that would be unable to afford monthly utility bills at the level indicated on the x-axis. The great majority of Kenyans could afford a monthly bill of \$4, whereas \$14 would be beyond the reach of 70 percent of Kenya's households.

Purchasing a subsistence consumption bundle at cost-recovery prices would be affordable for the vast majority of Kenyan households. A cost-recovery tariff of \$0.14 per kilowatt-hour for power and a subsistence consumption of 25 kilowatt-hours per month—which is enough to power two 100-watt light bulbs for four hours per day—amounts to a monthly power bill of \$3.50, which would be affordable for almost 90 percent of the Kenyan population (figure 17).

Figure 17. Those with access (and many of those without access) do not face major affordability problems.



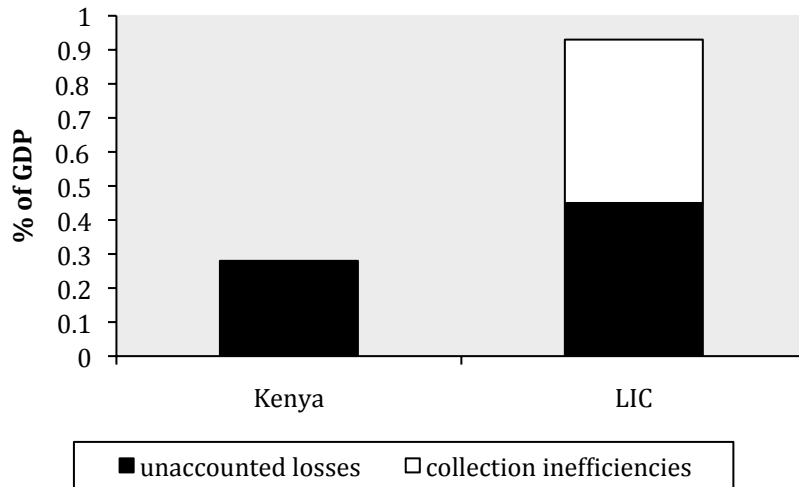
Source: Banerjee and others 2009.

At current tariff levels of \$0.20 per kilowatt-hour the subsistence bill would be \$5.00, which is affordable for almost 80 percent of the Kenyan population. Taking a cost-recovery tariff of \$0.99 for water and a subsistence consumption of 4 cubic meters per month—which amounts to an absolutely minimal consumption of 25 liters per capita per day for a family of five—the monthly water bill would be \$4. The graph indicates that purchasing a subsistence consumption bundle of this kind at cost-recovery prices would be affordable for the vast majority of Kenyan households. (Because the two bars reference the actual cost of the services, they are represented as vertical lines.) Indeed, even doubling physical consumption to less-modest levels, thereby raising the monthly utility bills to around \$8, would result in affordability problems for only about 20 percent of the population. This analysis suggests that, given the level of household budgets in Kenya and the costs associated with utility services, affordability issues do not appear to be a major concern except for the very poorest Kenyans—and certainly not for the higher-income households that enjoy access to the service today.

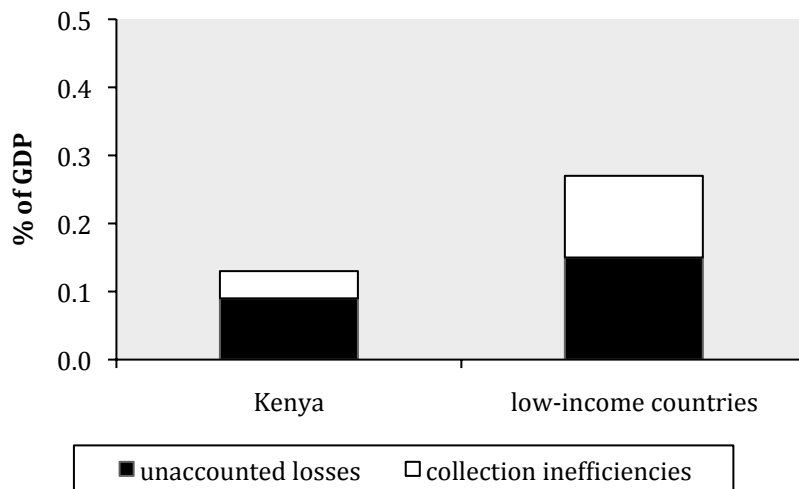
Distribution losses of power and water utilities cost Kenya a further \$70 million a year. Kenya's power and water utilities are relatively more efficient than utilities in neighboring countries and low-income peers (figure 18). Power utilities in Africa's nonfragile low-income countries waste resources equal to almost 1 percent of GDP on average, about five times as much as in Kenya, where KPLC maintains cost-recovery tariffs and has achieved a high rate of collection of bills. Most of the resources wasted by Kenya's utility are associated to distribution losses, likely an indication of an overstretched transmission network. KPLC reports transmission and distribution losses of 18 percent, almost double the best-practice benchmark of 10 percent. As a result, KPLC's operational inefficiencies absorb 0.3 percent of GDP. In the case of the water sector, and in contrast to many other African countries, bill collection is not a conspicuous concern. However, at NWASCO, unbilled water use stands at 40 percent, more than double the best-practice standard of 20 percent. Thus, NWASCO's operational inefficiencies absorb 0.1 percent of GDP.

Figure 18. Kenya's power and water utilities are more efficient than those in other low-income countries

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, Smits, and Foster 2009.

Kenya's infrastructure loses about \$52 million each year because capital budgets are not fully spent. This problem affects the transport, WSS, and power sectors in almost equal degrees, leading to lost investments of the order of \$15–20 million per year in each of these sectors. For example, capital-budget execution rates in Kenya's road sector stood at only 60 percent in 2005–06. While this represents a substantial improvement from the 40 percent rate recorded in 2001–02, it still falls well short of the 80 percent level achieved elsewhere in Africa.

### Annual funding gap

Kenya's infrastructure funding gap amounts to \$2.1 billion per year, or about 11 percent of GDP. More than 80 percent of the country's entire funding gap is found in the WSS sector, where the shortfall

is \$1.7 billion (table 13). Most of the rest of the gap is found in the power sector, where an additional \$439 million is needed to meet the country's development goals.

**Table 13. Funding gaps by sector**

US\$ millions						
	ICT	Irrigation	Power	Transport	WSS	Total
Spending needs	529	16	1,019	474	1,930	3,968
Existing spending	529	3	471	474	167	1,644
Efficiency gains	0	—	109	44	77	230
Funding gap	0	—	439	44	1,686	2,094

Source: Derived from Foster and Briceño-Garmendia 2009.

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

— = data not available.

### What else can be done?

The funding gap can be addressed only by raising additional finance or, alternatively, by adopting lower-cost technologies or less-ambitious targets for infrastructure development. The size of the gap forces Kenya to be realistic about targets and to be very deliberate about how it spends the relatively limited resources available.

Adopting lower-cost technologies could substantially reduce the cost of meeting the posited infrastructure targets, and halve the size of the funding gap. For example, meeting the Millennium Development Goals for water supply and sanitation with lower cost technologies than previously used (such as stand posts, boreholes and improved latrines) could reduce the associated price tag from \$1.9 billion to \$1.0 billion each year. Similarly, meeting transport connectivity standards using lower cost road surfacing technologies (such as single surface treatment) could reduce the associated price tag from \$0.47 billion to \$0.25 billion. The overall savings from these measures would amount to \$1.1 billion or more than half the country's infrastructure funding gap; underscoring the importance of technology choices.

If Kenya had no means of raising additional finance for infrastructure, the only way to meet the targets here identified would be to take a longer period of time than the decade contemplated at the outset of this exercise. If the country were to make efficiency gains while holding spending at current levels, it could meet the identified infrastructure targets in 18 years—that is, it would reach the targets by 2026. Without tackling inefficiencies, the those targets would not be reached for several decades.

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. Hence the need to identify priorities. The foregoing analysis of achievements and challenges suggests the importance of prioritizing key infrastructure interventions for the economy, such as improving the port of Mombasa and expanding generation capacity.

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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](http://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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