

# Sierra Leone's Infrastructure

## A Continental Perspective

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## Abstract

Infrastructure development in Sierra Leone contributed about half a percentage point to the economy's per capita growth rate in 2003–07. But if Sierra Leone could upgrade its infrastructure to the level of the best performer in Africa, per capita growth rates could be boosted by more than three percentage points.

After nine years of peace, economic activity is flourishing at every level in Sierra Leone. But the 11-year civil war destroyed the country's infrastructure, and rebuilding the road network and ports while improving the electrical, water, and telecommunications infrastructure is proving difficult.

Looking ahead, expanding electrification is a top priority because current access levels, at only 1–5 percent of the urban population and 0 percent in rural areas, are

impeding other development. The water and sanitation sector faces similar challenges, as only 1 percent of the rural population has access to piped water.

Sierra Leone has been spending about \$134 million annually on infrastructure in recent years. About \$66 million is lost each year to inefficiencies. Comparing spending needs against existing spending and potential efficiency gains leaves an annual funding gap of \$59 to \$278 million per year. If savings from greater efficiency could be fully captured, Sierra Leone would not meet its posited infrastructure targets for another 30 years.

Sierra Leone needs to make difficult decisions about the prioritization of infrastructure investments and must think strategically about bundling and sequencing investments for maximum returns.

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# Sierra Leone's Infrastructure: A Continental Perspective

*Nataliya Pushak and Vivien Foster*

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## Synopsis

Infrastructure has contributed significantly to the growth of West African economies during the past decade. In Sierra Leone, infrastructure added only around 0.51 percentage points to the *per capita* growth rate over 2003–07. Similarly to other countries in the region and the rest of the continent, the boost to historic growth came predominately from the ICT (Information and Telecommunications Technology) revolution while power-sector deficiencies and poor roads held back growth. However, infrastructure could contribute more in the future than it has in the past. If Sierra Leone could upgrade its infrastructure to the level of the best performer in Africa, per capita growth rates could be boosted by more than three percentage points.

After nine years of peace, economic activity is flourishing at every level in Sierra Leone. Political stability, high government accountability, good governance standards, and streamlined tax reform helped Sierra Leone to become a bright success story, turning the country into the easiest and quickest place to start business in West Africa (ICA/WBG 2011). Sierra Leone's image in the eyes of investors is strengthened as the country ranked as one of the top five countries in Africa for investor protection.

Sierra Leone's 11-year civil war destroyed the country's infrastructure. Much effort was put into rebuilding and modernizing infrastructure networks, but it proved to be a difficult task. Resolving bottlenecks that the poor state of infrastructure poses on economic and social development will take Sierra Leone a long time and much coordinated effort. Sierra Leone expanded its hydropower capacity by building the 50-megawatt Bumbuna hydropower plant. This significantly reduced the cost of power production. Since Bumbuna has been operational, power tariffs fell from \$0.41 to \$0.31 per kilowatt-hour. Progress has been made in terms of improving operational efficiency. Development of the power sector is high on the governmental agenda, but it will take long time to achieve given the low starting base. Around 20 percent of the urban population has access to piped water. Community-led total sanitation (CLTS) approaches that bring improved sanitation to whole communities have proved to be a success. Sierra Leone has the beginning of a national road network, has prospects for regional connectivity, and has established a Road Fund. The country has made good progress in securing donor financing for road reconstruction, and important projects in the sector are underway. The port of Freetown, badly damaged during the war, has undertaken essential rehabilitation works and sound reform foreseeing increased private participation. Sierra Leone used wireless communications to leapfrog its ICT development, its number of mobile subscriptions going from just 6,000 in 2000 to 1.4 million by 2009 for a penetration rate of one quarter of the population.

Looking ahead, the country faces a number of critical infrastructure challenges. Perhaps the most daunting of these challenges lies in the power sector, the poor state of which retards development of other sectors. Access to power is very low, at around 1 to 5 percent in urban areas, and is nonexistent in the countryside. The country's installed power-generation capacity is around 13 megawatts per million people, which is lower than what other low-income and fragile states have installed. The entire existing power infrastructure is concentrated in the western part of the country, and even with the functioning of

the Bumbuna power plant, only half the suppressed demand for Freetown, let alone that for the rest of the country, is being met.

Regardless of recent reduction in tariffs, Sierra Leoneans still pay some of the highest tariffs in Africa. In 2010, Sierra Leoneans paid three times as much for power as did residents of African countries that relied on hydropower. Making investments in more cost-effective power generation options is therefore an important strategic objective for Sierra Leone, without which further electrification will simply be unaffordable for the wider population.

Water service is increasingly unreliable in the urban areas, and performance of Sierra Leone's water utilities is poor. The lack of sanitary facilities is one of the major contributory factors to Sierra Leone's exceptionally high maternal- and child-mortality rates. Only one percent of the rural population has access to piped water.

The overall state of road infrastructure is poor. The current fuel levy is not sufficient to cover maintenance, not to mention extensive rehabilitation, of roads. Sierra Leone would need to triple its annual rehabilitation expenditure in order to complete road rehabilitation in a five-year period. This would mean raising fuel levies and improving the transparency and fairness of the tax, while still relying on donor and governmental finance. Sierra Leone would need to provide better access to its main airport at Freetown, currently reachable only by ferries. The country's port system needs both new investments and rehabilitation.

Addressing Sierra Leone's infrastructure challenges will require a sustained expenditure of \$258–478 million per year. This is based on achieving an illustrative set of infrastructure targets, and considers only public infrastructure needs without taking into account the private infrastructure needs of the concessions associated with the mineral, forestry, and agriculture industries. A range is given because different technologies and standards can be used to meet these targets, with significant impact on costs. Water, transport, and power have the largest weight in this overall price tag. This cost looks daunting relative to the 2009 GDP of around \$1.9 billion, but less so relative to the country's vast mineral and natural-resource wealth.

In recent years, Sierra Leone has been spending some \$134 million a year on infrastructure when all sources public and private, budget and off-budget are borne in mind. This is equivalent to 10 percent of GDP—an average level of effort compared to other African countries, though still only about half of the approximately 20 percent of GDP that China has spent on infrastructure in recent years. About 70 percent of total infrastructure spending has been investment, and more than half has gone to the transport sector. Official development assistance (ODA), provided by the member countries of the Organisation for Economic Co-operation and Development (OECD), is by far the largest source of investment finance, followed by private investment; while domestically funded public investment has been lower. A further \$66 million has been lost to inefficiencies, mainly due to high power losses and the underrecovery of costs in roads and water, and it should be possible to recapture at least part of these resources through careful policy choices.

Comparing spending needs against existing spending and potential efficiency gains leaves an annual funding gap of \$59 to \$278 million per year, most of it associated with water, power and transport. Once again, the range of the gap depends on the technology choices. The overall savings from selecting optimal



technology choices could reduce the funding gap by three quarters. While the funding gap is large relative to the economy, there are a number of options for making it more manageable.

The first observation is that this shortfall need not be entirely funded by the public sector. Sierra Leone has already established a strong track record on Foreign Direct Investment, and has in recent years captured 1.4 percent of GDP as private investment for infrastructure (essentially all for the ICT sector). Although not all components of the required infrastructure platform are suitable for private finance (in particular not roads, water or sanitation), other components may be (for example, in ICT, power generation, and ports).

The second observation is that a number of large multinational companies have taken on the country's numerous mineral, forestry, and agricultural concessions, and are themselves investing heavily in the necessary transport and energy platforms to support their operations. Sierra Leone has a policy of ensuring that such investments are done in such a way as to benefit the broader national economy, and hence could potentially contribute to meeting the overall need.

Nevertheless, given the size of the funding gap, Sierra Leone will likely need to consider a period longer than a decade to reach the illustrative infrastructure targets here outlined. If the efficiency potential could be fully captured, Sierra Leone could meet the posited targets in about 30 years. However, under business-as-usual assumptions on spending and efficiency, it would take much longer for Sierra Leone to reach these goals.

In the medium term, therefore, Sierra Leone needs to make difficult decisions regarding the prioritization of infrastructure investments. For that reason, the nation must have a clear understanding of how infrastructure contributes to its national-development and poverty-reduction strategies to provide a clear and objective basis for prioritization. Recent work on the identification of key development corridors for the country could help to support such decisions. Where resources are limited, there is a danger in spreading infrastructure investments too thin to make a real economic and social impact, and the need to think strategically about bundling and sequencing investments for maximum returns.

## **The continental perspective**

The Africa Infrastructure Country Diagnostic (AICD) has gathered and analyzed extensive data on infrastructure in more than 40 Sub-Saharan countries, including Sierra Leone. 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 Sierra Leone allowing the country's infrastructure situation to be benchmarked against that of its African peers. The report provides a general overview of the state of the economic infrastructure sectors in Sierra Leone. Given that Sierra Leone is at present fragile low income country, two sets of African benchmarks will be used to evaluate Sierra Leone's situation: fragile low income countries and non-fragile low income countries. Detailed comparisons will also be made with immediate regional neighbors in the Economic **Community of West African States** (ECOWAS) countries.

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 for countries for which data was collected in the first phase of the project. For some of the countries, considered phase 2 countries like Sierra Leone, data collection began later. In the particular case of Sierra Leone, data is collected predominately for the 2007–2009 period. Most technical data presented are typically 2006 for the benchmarks, while financial data for comparator countries are 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.

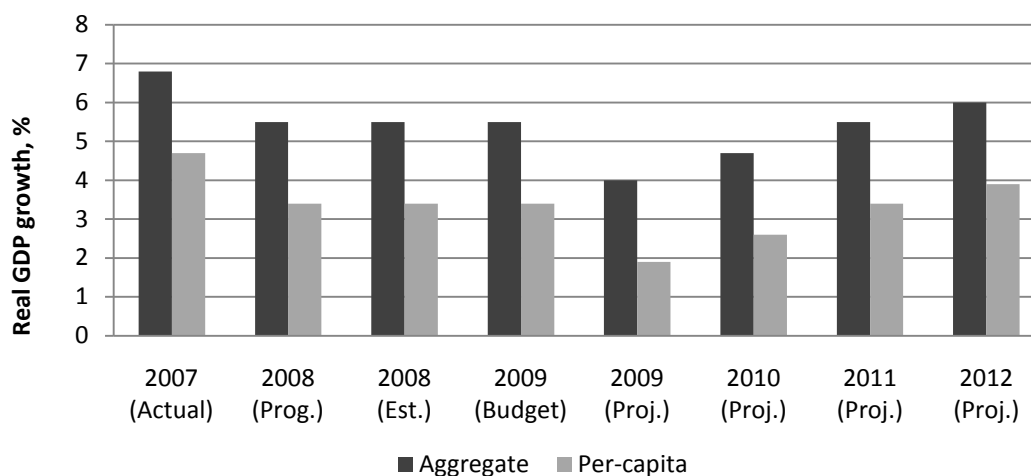
## **Why infrastructure matters**

In common with the rest of the continent, Western Africa's growth performance improved markedly in the 2000s.. The overall improvement in per capita growth rates has been estimated at 1.19 percentage points, of which 1.12 percent is attributable to better structural policies and 0.88 percent to improved infrastructure, with stabilization policies and external factors retarding growth by 0.81 percent.

Since the end of the 11-year civil war in 2002, Sierra Leone's economy expanded at annual average rate of close to 10 percent, led by agriculture, construction, services, and mining. Though the global economic crisis led to an almost 40 percent reduction in demand for diamonds—Sierra Leone's main export item—the economy continued to grow, albeit at a slower rate, and is expected to rebound (figure 1). Such strong performance is to a great extent a result of sound economic and fiscal policies, and good performance of the key sectors. In addition, recently discovered off-shore oil reserves<sup>1</sup> and iron deposits are likely to further boost the economy, once commercially explored.

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<sup>1</sup> Expectations about a boost in the real sector were heightened with news about the prospects of potential oil reserves in the deep-water offshore area within the Sierra Leone-Liberia basin. Anadarko Petroleum Corporation, a United States oil firm which made the discovery indicated that the new well - called Venus - is one of more than 30 identified prospects across 10 blocks offshore of Sierra Leone, Liberia, Ivory Coast and Ghana. This was positive news for the country going forward and has significant potentials to increase Sierra Leone's revenues (Bank of Sierra Leone, Annual Report 2009).

**Figure 1. Sierra Leone's economy is projected to rebound**


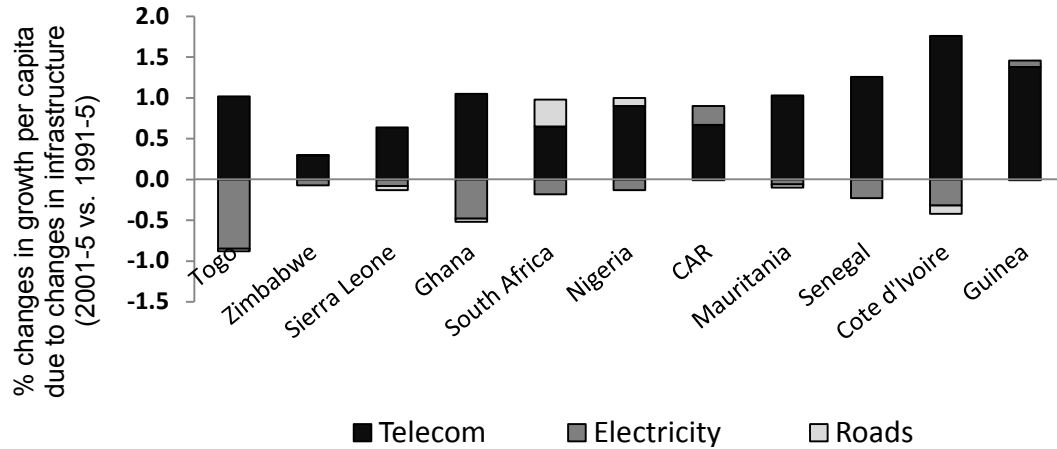
Sources: International Monetary Fund and World Bank staff estimates and projections; World Bank 2010.

Notes: The GDP estimates are provisional and remain subject to review.

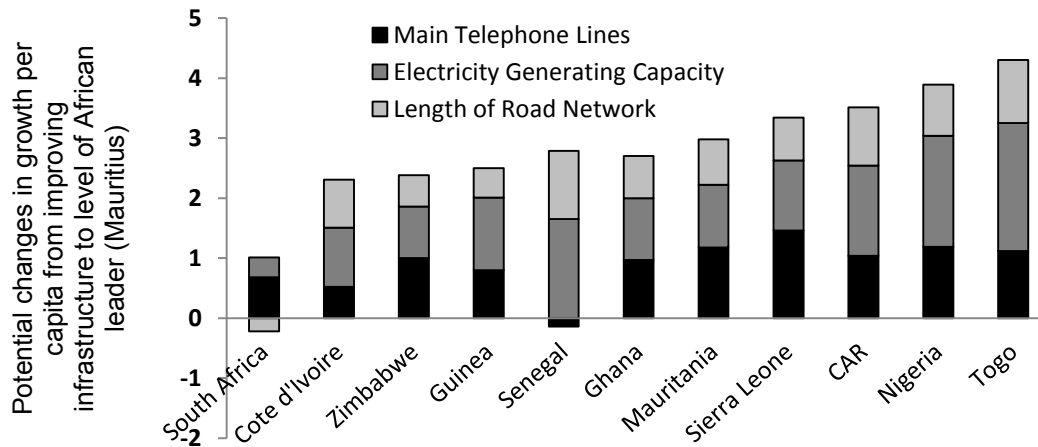
Despite improvements in infrastructure, Sierra Leone added only 0.51 percentage points to the per capita growth rate from 2003 to 2007—much less than most other countries in the region or many other fragile countries. But like other African countries, the boost came predominately from the ICT revolution, while power-sector deficiencies and poor roads held back per capita growth by 0.08 and 0.05 percentage points respectively (figure 2a). Looking ahead, simulations suggest that if Sierra Leone's infrastructure could be improved to the level of the African leader—Mauritius—annual per capita growth rates would be 3.34 percentage points higher than they are at present. This impact would come from improvements not only in ICT, but also from increase in power-generating capacity and better road infrastructure (figure 2b).

**Figure 2. Infrastructure's low contribution to growth in Sierra Leone could be much greater**

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



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



Source: Calderon 2009.

## The state of Sierra Leone's infrastructure

Sierra Leone's population of 5.7 million is sparsely distributed across the country, with more densely populated urban areas surrounding the major cities, and very lightly populated areas in the north. More than 60 percent of the population lives in rural areas. Poverty is high at around 70 percent of the population (figure 3a, b). Sierra Leone has mountains in the east, while the rest of the country is divided between plateau, hills, and coastal mangrove zones (figure 3c).

Sierra Leone enjoys an advantageous geographical location and is endowed with a wealth of natural resources including minerals—, such as diamonds, bauxite and rutile—forests, fresh water, fertile lands, a natural harbor, and potential off-shore oil reserves. The favorable climate and land resources provide for

vast agriculture potential (figure 3d). At present, agricultural activity is concentrated in the north, while the south has significant unexploited potential.

However, transport infrastructure is presently inadequate to support agriculture (figure 3f). Most of the public infrastructure was either damaged or allowed to dilapidate during the years of civil war. Nine years after the war, Sierra Leone has only the beginning of national road network, with the main artery connecting the nation with neighboring Guinea and Liberia in plans, and still in poor condition along many sections. The roads network is in dire need of rehabilitation and new investments, particularly in rural areas. The southeastern part of the country appears to have pockets of population not covered by any major infrastructure network. In addition, the development of Sierra Leone's mining sector requires adequate infrastructure to support it. Despite its comparatively small size, the country has impressive mining potential. The revival of the mining sector in Sierra Leone so far was largely limited to reopening of the existing mines and tapping already proven reserves. New investments into the sector are highly desirable, and contingent on infrastructure facilities, many of which could potentially be developed by mining companies themselves and could bring broader benefits to the rural economy. CT coverage is quite good (figure 3g), but a lack of power has slowed sector development—it is often more problematic in Sierra Leone to charge a phone than to pay for telecom services. Sierra Leone's is not connected to an international fiber-optic cable, but plans to become connected in the near future, and currently has a microwave link to Guinea.

Sierra Leone has the beginnings of a national power grid, with a single transmission line connecting Freetown to the hydro plant at Bumbuna along one of the country's main potential mining corridors. The planned Cote d'Ivoire–Liberia–Sierra Leone–Guinea (CLSG) line that the WAPP (West African Power Pool) would lay is a high-voltage transmission line along the coast connecting Sierra Leone to Guinea, Liberia, and ultimately Côte d'Ivoire.<sup>2</sup>

Although Sierra Leone is water abundant country (figure 3h), the system of water and sanitation is in disarray and cannot meet the mounting pressures of a rapidly growing urban population, much less expanding coverage to rural areas. Growing mining and agriculture sectors also put pressure on existing water resources. There is significant use of irrigation along the coast and to the north of the country. The extensive river network has significant hydroelectric potential, though the county experiences a succession of wet and dry seasons, which would limit the extent of firm energy.

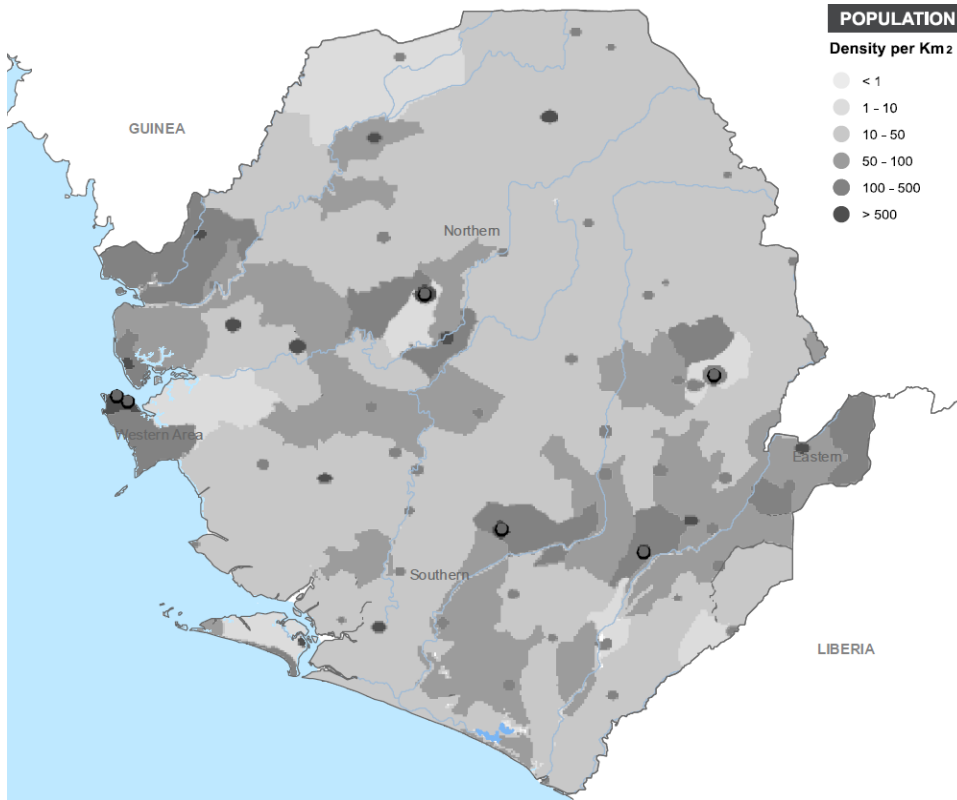
This report begins by reviewing the main achievements and challenges in each of Sierra Leone's major infrastructure sectors, with the key findings summarized below (table 1). Thereafter, attention will turn to the problem of how to finance Sierra Leone's outstanding infrastructure needs.

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<sup>2</sup> <http://www.eu-africa-infrastructure-tf.net/activities/grants/wapp-interconnector.htm>

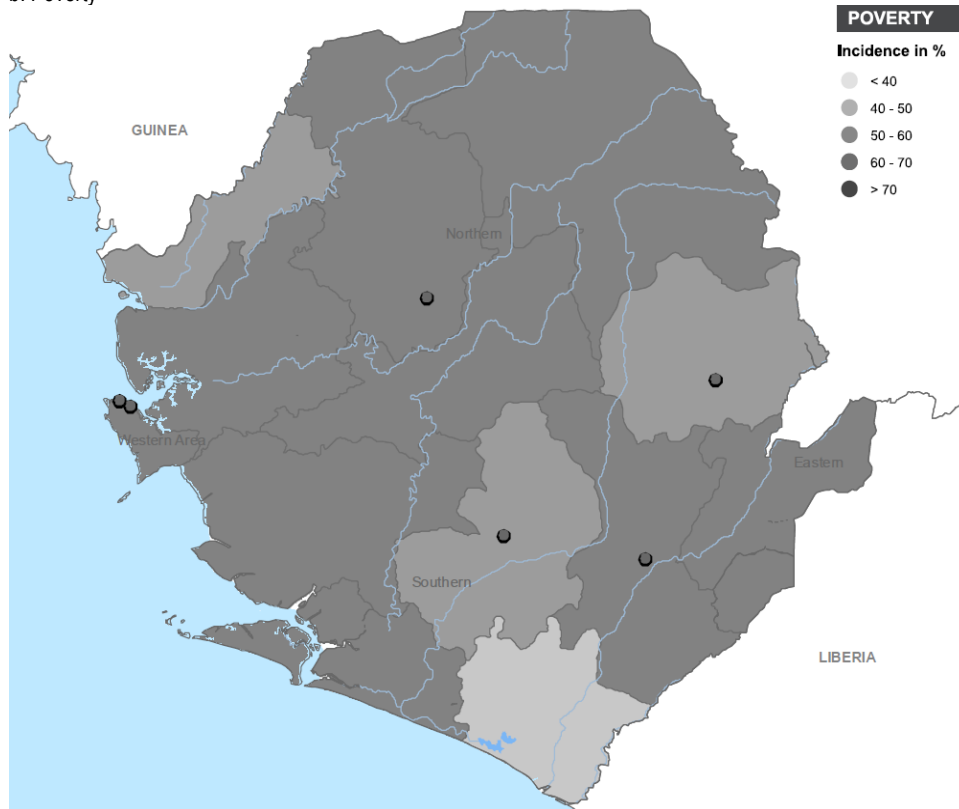
Figure 3. Sierra Leone's infrastructure follow mineral resources and population

a. Population

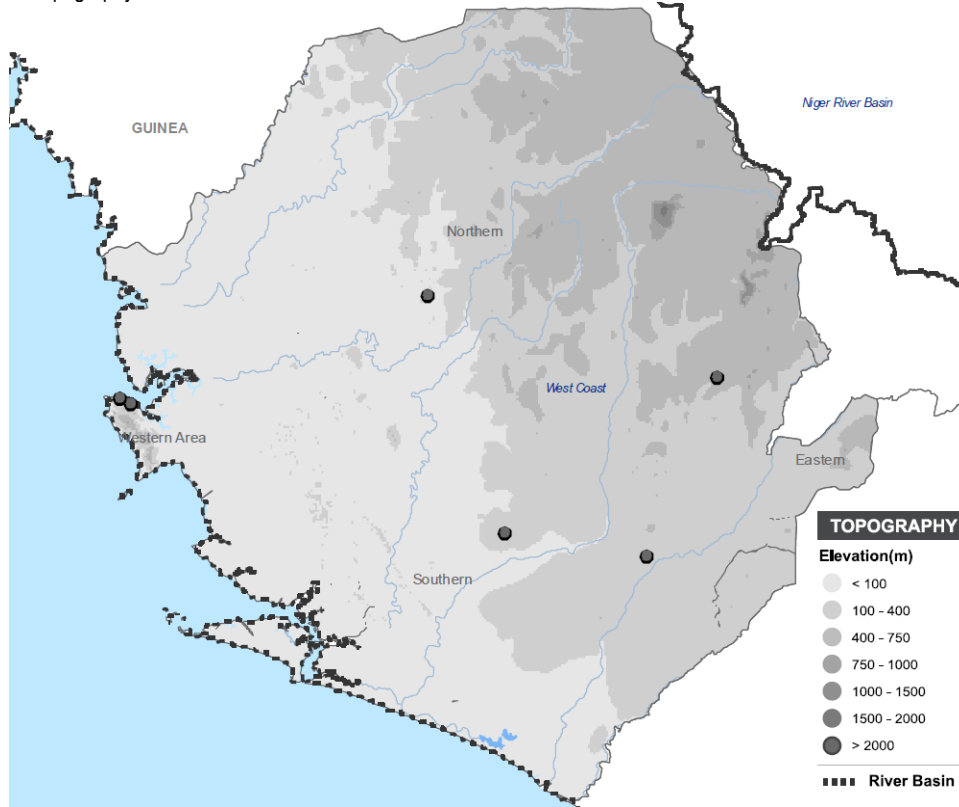


# SIERRA LEONE'S INFRASTRUCTURE: A CONTINENTAL PERSPECTIVE

b. Poverty

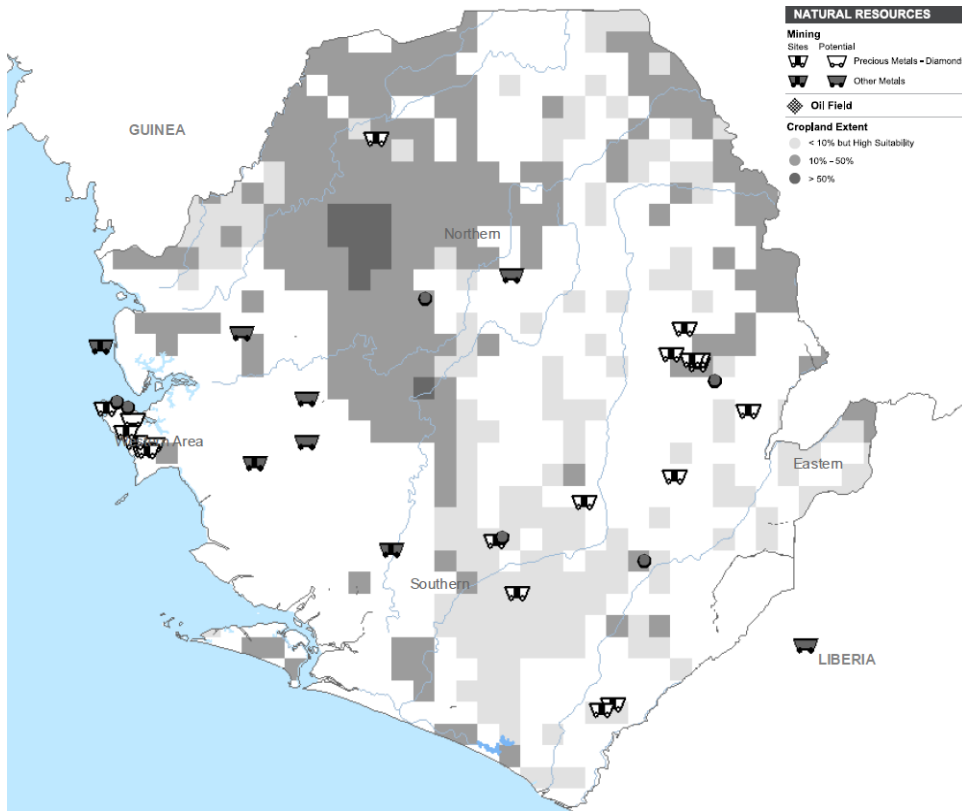


c. Topography

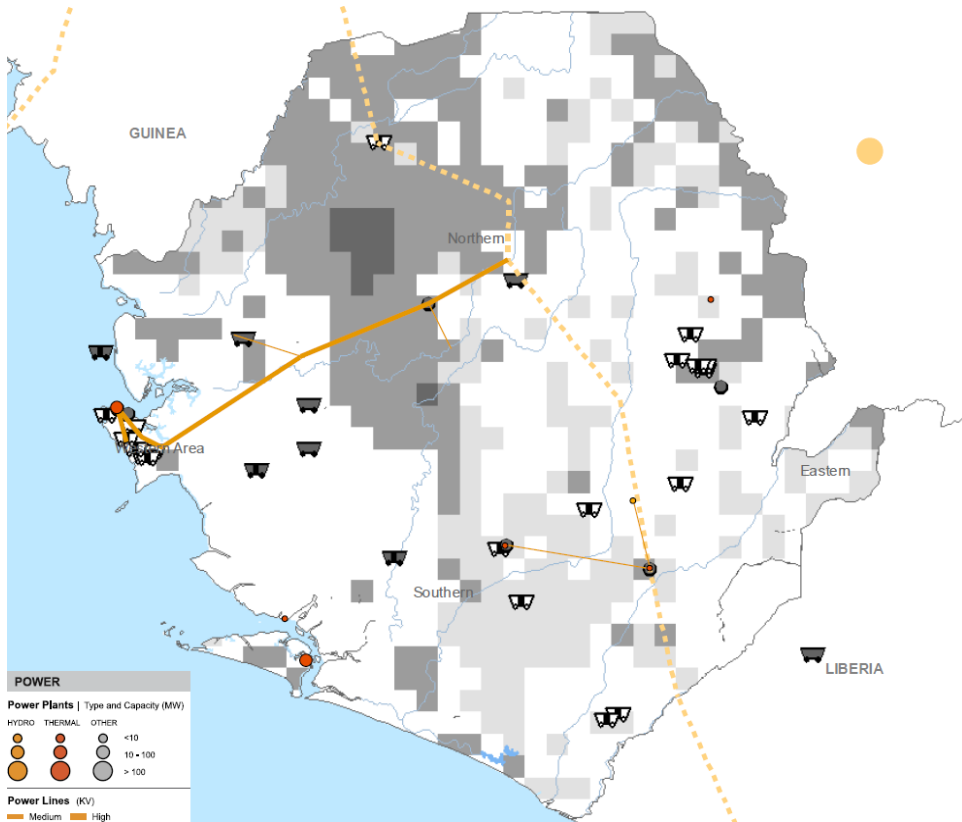


# SIERRA LEONE'S INFRASTRUCTURE: A CONTINENTAL PERSPECTIVE

d. Natural resources and crop field extent



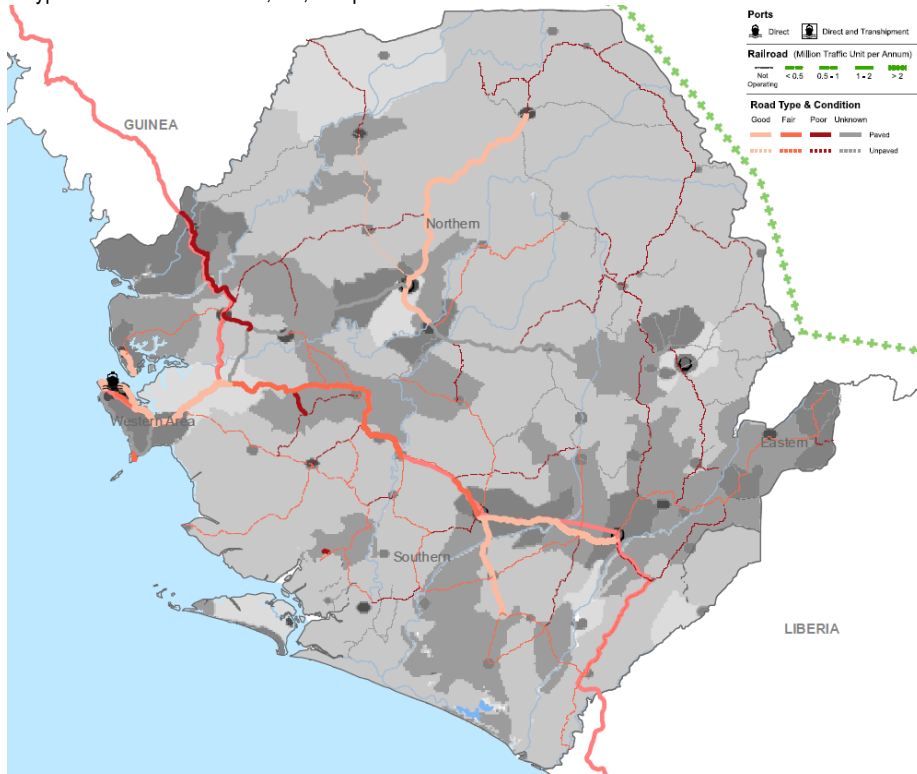
e. Power



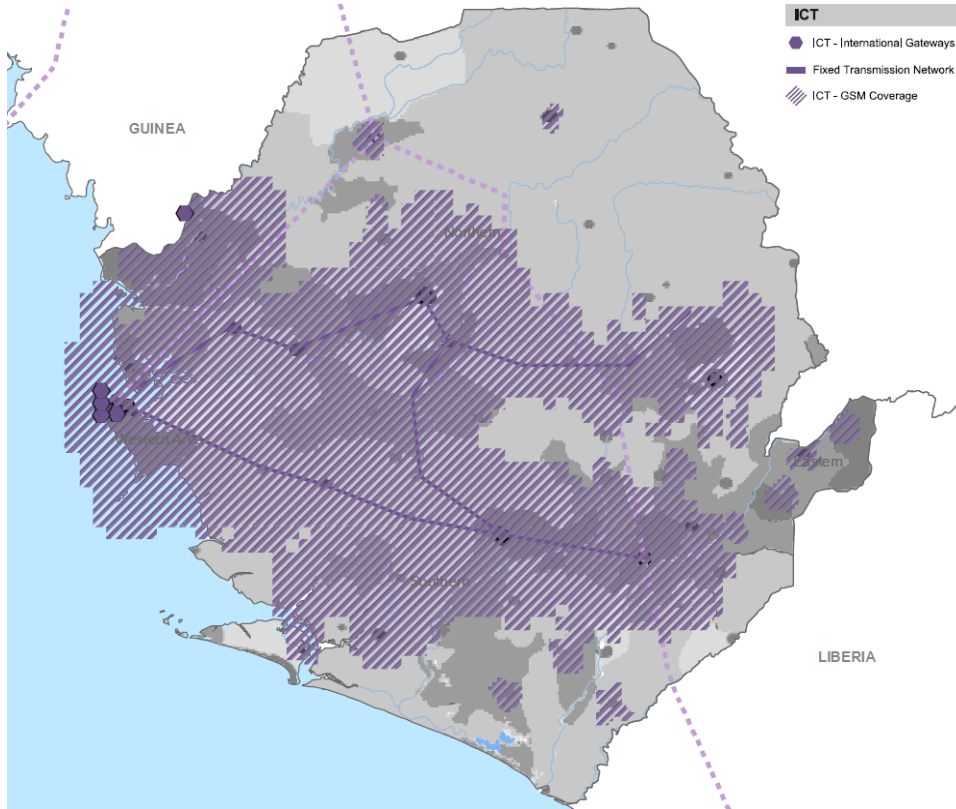


# SIERRA LEONE'S INFRASTRUCTURE: A CONTINENTAL PERSPECTIVE

f. Type and condition of roads, rail, and ports

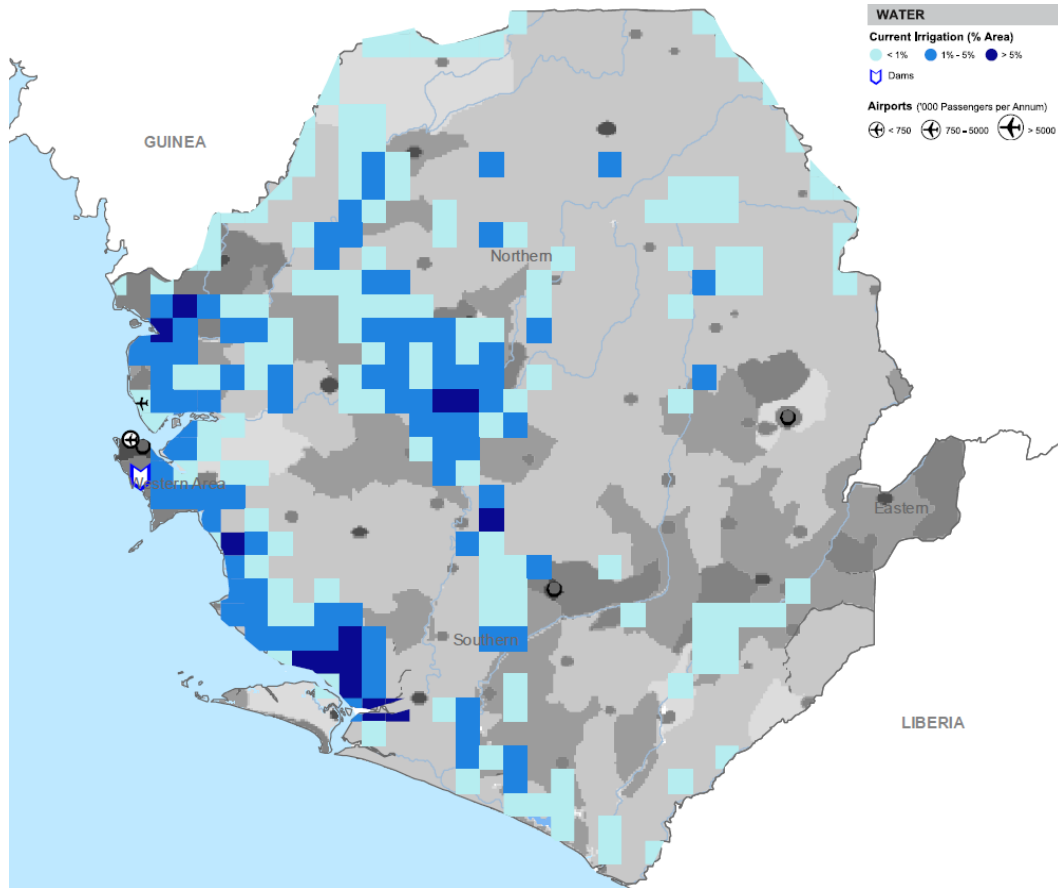


g. ICT



# SIERRA LEONE'S INFRASTRUCTURE: A CONTINENTAL PERSPECTIVE

## h. Water and airports



Source: AICD Interactive Infrastructure Atlas for Sierra Leone downloadable from <http://www.infrastructureafrica.org/library/doc/770/sierra-leone-interactive-infrastructure-atlas>

**Table 1. Achievements and challenges in Sierra Leone's infrastructure sectors**

	<b>Achievements</b>	<b>Challenges</b>
Air transport	Steady growth in all market segments Relatively high competition	Improving airport accessibility, aircraft age and safety
ICT	Strong increase in access to mobile communications External financing	Implementing legal and regulatory reform Increasing Internet penetration Connecting to regional broadband cable
Power	Hydro power generation capacity added New power strategy in place Power utility NAP preparing for privatization	Obtaining needed new investments Increasing rural access to power Implementing legal and regulatory reform Improving cost recovery Improving operational efficiency Integrating with WAPP
Ports	Ports system in place Reform is underway	Providing new investments and rehabilitation Improving port accessibility from inland
Roads	Road fund is established Reform is underway Rehabilitation is underway	Establishing national connectivity Raising fuel levy to cost-recovery levels Ensure road access to high-value agriculture lands
Water resources	Well endowed with water resources	Coping with increase in population and water usage
Water and sanitation	The National Water and Sanitation Policy is in place.	Overhauling urban water infrastructure Investing in new water and sanitation facilities Reducing inefficiencies of utilities Providing rural and suburban access to water and sanitation

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

## **Power**

### **Achievements**

Sierra Leone has significantly expanded its generating capacity. In late 2009, when the 50 megawatt Bumbuna hydropower plant became operational, it almost doubled Sierra Leone's existing installed capacity and changed the power-generation mix. Prior to Bumbuna, Sierra Leone had only 27 megawatts of conventional thermal generation (box 1), keeping costs relatively high. The advent of hydropower generation in Sierra Leone almost halved the costs of power production. Historically, the average cost of producing power in Sierra Leone was approximately \$0.27 per kilowatt-hour, and due to escalating oil prices, it had further increased to as much as \$0.35 per kilowatt-hour in 2007. After introduction of Bumbuna hydro plant, however, average power-production cost in 2009–10 decreased to \$0.13–0.17 per kilowatt-hour, which is comparable to that of other African countries (figure 4). Decreases in generation costs translated to reduction in overall power costs. *This decrease in generation shaved off* as much as \$0.14 per kilowatt-hour from the overall cost of power. Overall savings for Sierra Leone's National Power Authority (NPA)<sup>3</sup> ranged from \$2.3–4.3 million in 2009 as a result of lower direct costs of power production.

<sup>3</sup> The NPA is the vertically integrated monopoly supplier of electrical power in the Western Region.

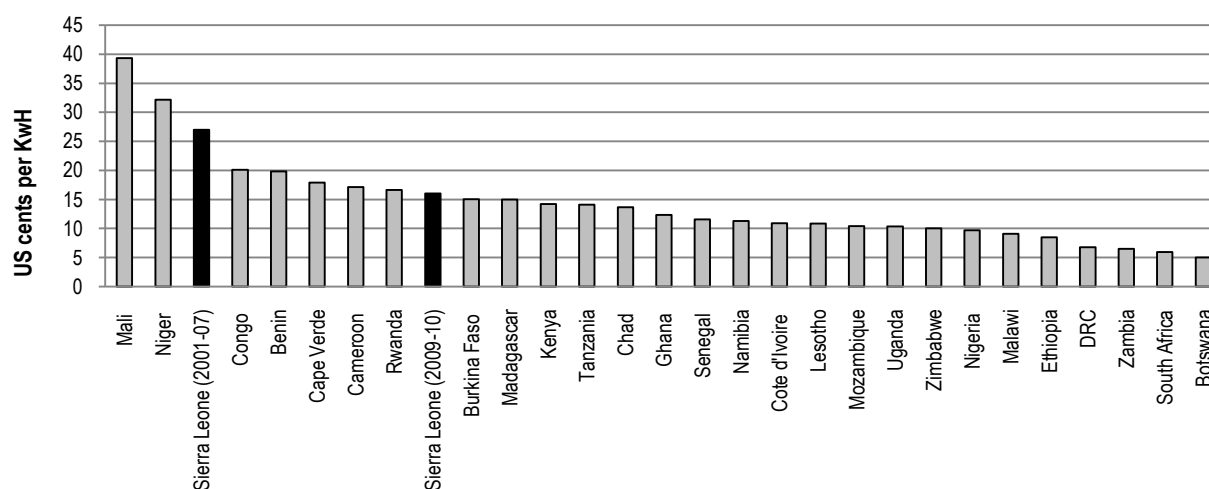
**Box 1. Landmark completion of the Bumbuna Power Plant**

Thirty years after construction began, a hydroelectric power station at Bumbuna, in Northern Province, about 200 km north-east of Freetown, was finally commissioned on November 6th, 2009. The dam and a 200-km transmission line linking the Bumbuna plant with Freetown were financed mainly by donors. The power station initially provided around 20 megawatts of power in a test phase from September 2009, and this was increased to the station's full rainy-season capacity of 50 megawatts in November (capacity will probably be less than 20 megawatts in the dry season). Contingent upon additional investment, Bumbuna's capacity can be increased to as much as 300 megawatts over the next few years, providing a much needed boost for Sierra Leone's power sector. The government expects that the dam, which has cost over \$200 million so far, will save over \$2 million per month on diesel imports alone, as businesses and residences switch over from diesel generators. The government says that the Bumbuna plant will provide cheap, reliable power, improving the business environment and supporting economic growth and poverty reduction. The new plant, along with the recent offshore oil discovery, signals a bright new era in the country's dismal energy-sector performance.

The dam's past includes a history of corruption, stealing of power cables, and delayed construction due to civil unrest, particularly during the 1991–2002 war. Successive governments had promised and failed to finish the project, so its completion is a big political success, a landmark development and a sign of progress after years of war and underinvestment. Nevertheless, Sierra Leone has far to go before power generation will be sufficient to make a tangible positive impact on economic growth and human development.

Source: Adapted from EIU 2009.

**Figure 4. Substantial reduction in the costs of power production**



Source: Briceño-Garmendia and Shkaratan 2010.

Measures to improve revenue collection have been undertaken in recent months. Two specific measures include installing pre-paid meters that ensure payment collection for power used and contracting with banks for collection of revenues, facilitating payments for customers. These improvements are major steps in changing a culture of non-payment of bills.

The government has placed a strong emphasis on improving the decrepit power infrastructure to bolster growth and create jobs. Numerous reforms have been planned under the country's credit facility (ECF, formerly known as the Poverty Reduction Growth Facility (PRGF) effort of the IMF). Under this new impetus to reform infrastructure, the government has placed emphasis on improving the financial

viability of public utilities. In addition, the government has recently passed a public-private partnership law to encourage investment and improve public service delivery (EIU 2010 and EIU 2011). The government has recently committed to encouraging multiple layers in the generation and distribution market and opening itself to private and public investors as Independent Power Producers (Davidson 2011).

### Challenges

Even with the addition of the Bumbuna plant, Sierra Leone's power-generation capacity falls short of meeting power demand. Sierra Leone's current installed capacity of 13 megawatts per million people is lower than that of other low-income and fragile states. Hydropower from Bumbuna is seasonal, producing around 50 megawatts during the wet season, but less than 20 megawatts only during the dry season. There is virtually no power generation at the Kingtom power plant due to malfunctioning of the large generators at the plant. Serious cash flow problems for NPA hindered purchase of spare parts to replace the malfunctioning units at the plant and hindered purchase of fuel required to power the diesel plants (World Bank 2007). Therefore, chronic power shortages plague the system. Existing supply meets only half the suppressed demand for Freetown, let alone the rest of the country (EIU 2009). As a result, Sierra Leone has to continue to rely on independent power producers to provide up to 40 megawatts of emergency generation.

But Sierra Leone pays high prices for this emergency generation relative to many of its neighbors. At peak 2008 oil prices, emergency generation cost \$0.23–0.34 per kilowatt-hour, including fixed charges of \$0.06 per kilowatt-hour and fuel charges of \$0.17–\$0.28 per kilowatt-hour based on international oil prices (World Bank 2007). In 2008, Sierra Leone paid as much as \$0.40 per liter more for diesel than Ghana, and \$0.12–0.13 more than Liberia and Guinea (table 3).

**Table 2. Sierra Leone pays more for fuel than most of its neighbors**

US cents/liter	1991	1998	2000	2002	2004	2006	2008
Sierra Leone	43	53		50	89	98	115
Liberia					77	85	103
Guinea	61	56	69	56	69	82	102
Ghana	43	30	19	23	43	84	90
Côte d' Ivoire	115	45	51	60	95	106	120

Source: GTZ 2010.

Power transmission and distribution systems are in the insipient stage and not able to keep up with increase in generation capacity. Sierra Leone's electricity sector is mainly composed of the western-area grid centered on Freetown. Years of civil war left provincial power systems, with the exception of the Bo-Kenema power services, in a state of disrepair. Distribution and transmission networks have not expanded along with generation capacity. While generation has increased by up to 50 megawatts with the opening of the Bumbuna plant, the distribution networks, as of the end of 2009, were only able to support 20 megawatts. Despite planned expansion of the transmission network, progress has been slow and aggravated by vandalism. Measures are needed to curb the theft of overhead and underground cables (EIU 2009).

Another problem is that electricity access rates are extremely low. Sierra Leone has one of the lowest levels of power access in Africa (table 3). Varying estimates suggest that only between 1 and 5 percent of the population has access to power in Sierra Leone (World Bank 2010 and EIU 2009). With the exception of Freetown and the townships of Bo and Kenema, where access to power is also very low relative to other countries, people of Sierra Leone are not connected to the electricity grid. Most of the population relies on paraffin and biomass for access to energy (EIU 2009).

**Table 3. Benchmarking Sierra Leone's power infrastructure**

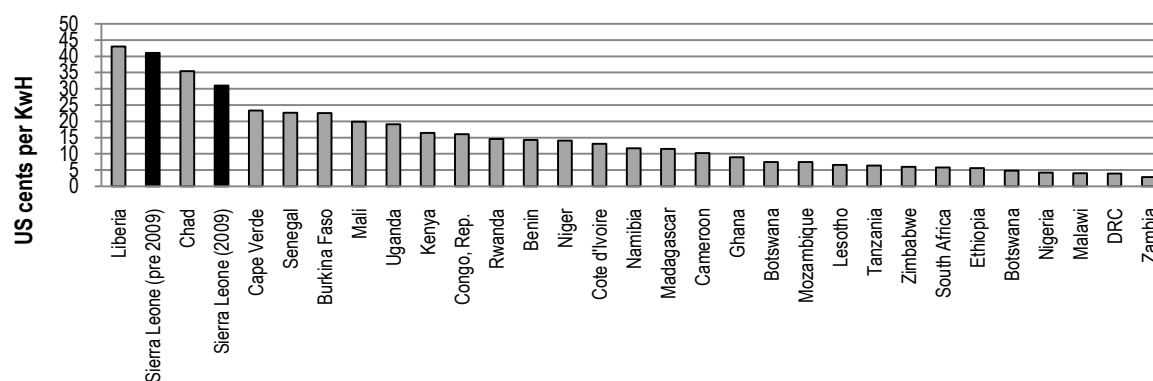
	Unit	Sierra Leone	Low-income fragile countries	Low-income, non-fragile countries	Middle-income countries
Access (national)	% of population	5	15	33	50
Access (urban)	% of population	35	57.6	86	101
Access (rural)	% of population	3.5	3.9	4	32
Installed generation capacity	MW per million people	13	46	20	799
Electricity consumption	KWH/capita	14	165	107	4,479
Power outages	Days/year	46	11.1	10	6
Value lost due to outages	% sales	6.6	5.4	6.5	1.6
Collection rate	% of billing	89	34	92	91
Cost recovery ratio	%	100	100	89	85
Revenue per unit	US cents per KWh	18	3	14	13
System losses	% generation	42	40	24	20
Total hidden costs	% revenue	451	443	69	0
Effective power tariff		Sierra Leone	Countries with predominantly hydro generation	Other developing regions	
Residential at 100 kWh	US\$ cents	0.31–0.43	10.27		
Commercial at 900 kWh	US\$ cents		11.73	5.0 – 10.0	
Industrial at 50,000 kWh	US\$ cents	0.30	11.39		

Source: Fragile and non-fragile countries' figures are as of 2005 and are calculated using the power AICD database, downloadable from <http://www.infrastructureafrica.org/aicd/tools/data>, which contains household data. For Sierra Leone, national-access data was taken from EIU 2009 and is for 2009. urban-and-rural-access data was taken from Tallapragada and Shkaratan and others (2009) and is for 2003; electricity consumption was taken from the CIA World Fact Book and is for 2007; power-outage data was taken from Rosnes and Vennemo and is for 2005; value-lost-due-to-outages data was taken from Enterprise Surveys 2009; collection-rate data was taken from World Bank 2007 and is for 2007; system-losses data is for 2009 and was taken from World Bank 2010; industrial-tariff data is for 2006 and was based on World Bank 2006; residential-tariff data is based on 2011 estimates provided by World Bank staff.

Power outages are a huge problem in Sierra Leone. The country records 46 days of power outages per year, more than four times the level observed in other low-income and fragile states in Africa. Erratic power supply in Sierra Leone has repercussions throughout the economy. Due to frequent power outages, firms lost as much as 7 percent of their sales in 2009, which is greater than in other fragile African states (table 3). Mining companies in the Mano River region reported that power was a serious constraint to their productivity and that they relied on their own generators (World Bank 2010b). Simulations suggest that inadequate power generation corroded as much as 0.10 percent of per capita growth in Sierra Leone over the past decade.

Electrical power is very expensive to the end users in Sierra Leone. While the country made impressive progress reducing its production costs, power production in Sierra Leone remains more expensive than in most other parts of Africa due to relatively high costs of hydroelectric generation and continued reliance on thermal plants. High production costs translate into high end-user tariffs. Customers paid between \$0.22 and \$0.41 per kilowatt hour<sup>4</sup> during 2002–2008 (World Bank 2005, World Bank 2007). Since the availability of cheaper power through Bumbuna in 2009, electricity tariffs decreased to \$0.31 per kilowatt-hour, which is still on the high side when compared to other African countries (figure 5).

Figure 5. Sierra Leone power tariffs are among the highest in Africa



Source: Briceño-Garmendia and Shkaratan 2010.

Sierra Leone's NPA adds significant inefficiencies to the mix. Several factors have constrained the financial health of NPA (table 4). Increases in unscheduled outages of NPA's generating capacity reduced the total power produced and consequently sales. Technical and non-technical losses of 33–45 percent during the past decade have impacted revenues. In 2010, system losses drained \$24.2 million from the revenue stream. Collection rates for the decade were on average 86 percent, but dipped precariously to 50 percent in 2008. In 2010, inadequate collection of bills deprived NPA of \$8 million of revenues. Decrepit systems led to enhanced fuel consumption, escalating operating costs. Cash flow challenges precluded necessary upgrades and replacements of depreciated assets. Further, labor costs are burdening NPA. In 2009, NPA had only around 70 connections per employee, including non-active customers, while the benchmark for developing countries is around 400 connections per employee. Underpricing of the rather expensive power in Sierra Leone is not an issue at present, however, due to the already high end-user tariffs and cheaper cost of power production as a result of addition of Bumbuna hydro generation. But the current cost-recovery situation might be subject to change as the sector undergoes significant transformations and price adjustments.

Sierra Leone's power sector also suffers from substantial hidden costs. Total hidden costs amounted to 69 percent of revenue in 2010, driven by an increase in the amount of power available, which increased the amount of power lost. This, however, represents a decrease from the previous year, as the availability

<sup>4</sup> The range is due to exchange-rate fluctuations.

of cheaper hydro power reduced underpricing (figure 6). These hidden costs drained around 1.8 percent of Sierra Leone's GDP. NPA's hidden costs are particularly burdensome considering that access rates are under 5 percent of the population. While Sierra Leone's overall burden of hidden costs is average for West Africa, its resources forgone due to power losses are the highest in the region (figure 7). And in comparison to South Africa, Africa's best performer in terms of hidden costs, Sierra Leone's hidden-costs burden is high.

**Table 4. Large hidden costs corrode revenues from NPA**

	Power billings (GWh/year)	System losses (%)	Collection ratio (%)	Cost recovery benchmark (US\$/kWh)	Average revenue (US\$/kWh)	Average effective tariff (US\$/kWh)	Total hidden costs (US millions/ year) (% revenues)	
2003	69	33	93	0.30	0.24	0.22	12	74
2004	53	33	99	0.30	0.23	0.22	9	69
2005	33	33	90	0.34	0.29	0.22	8	81
2006	29	38	89	0.47	0.23	0.29	11	161
2007	28	29	89	0.48	0.18	0.29	9	178
2008*	—	42	50	—	—	0.41	—	—
2009*	73	45	88	0.44	0.21	0.36	21	141
2010*	226	45	88	0.28	0.21	0.31	33	69

Source: World Bank 2005; World Bank 2007; NPA data; and World Bank staff estimates

Note: — = data not available. \* due to conflicting data sources estimates must be interpreted with caution.

**Figure 6. Underpricing and network losses have been major challenges at different periods for NPA**

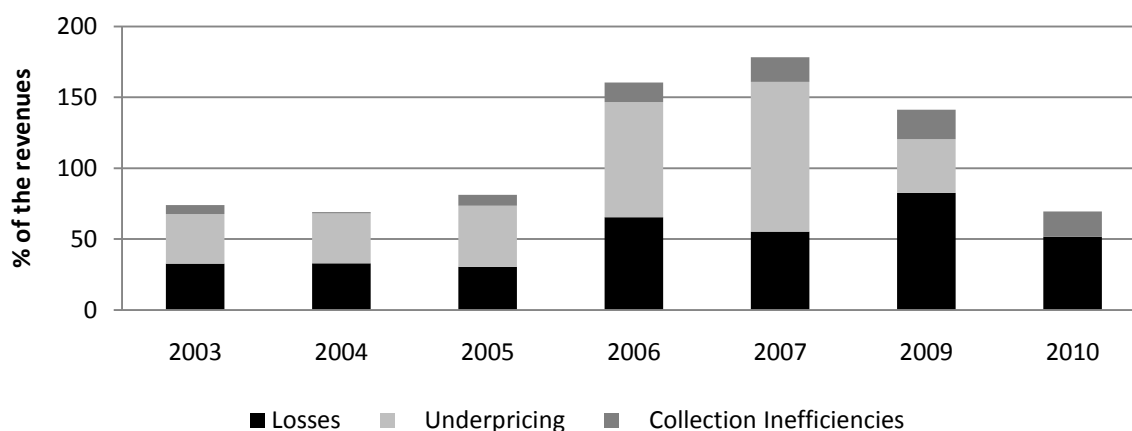
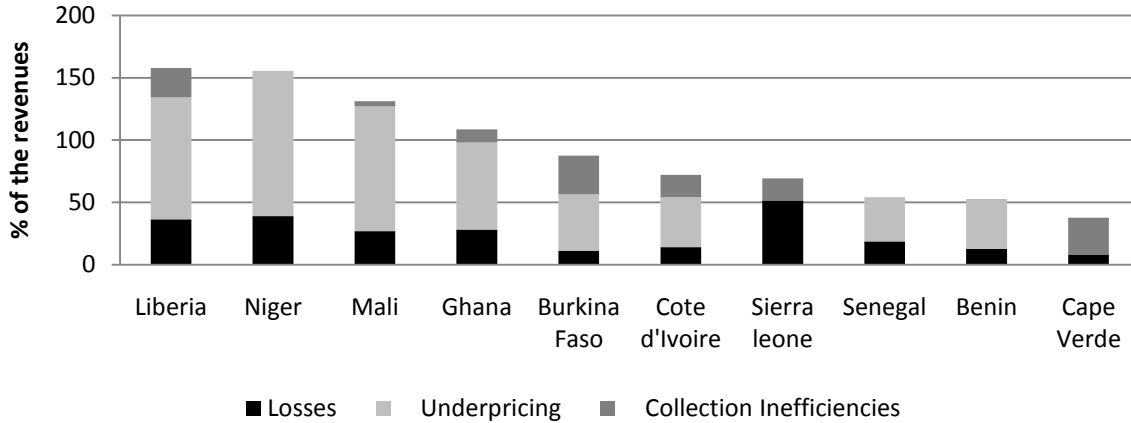


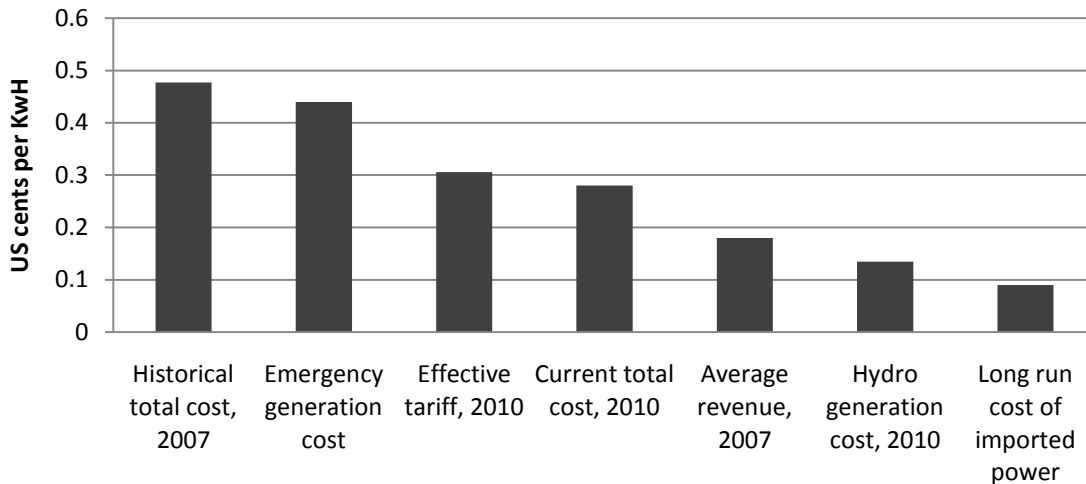


Figure 7. Sierra Leone's share of revenues forgone due to power losses is the highest in West Africa



Long-run cost recovery in Sierra Leone is still questionable in light of the high costs associated with emergency generation and low average revenue. The already high end-user power tariffs can cover the total cost of power production only if sufficient and reliable hydropower supply is secured. If, however, the need to rely on emergency thermal generation continues into the future, it will inevitably make cost recovery vulnerable to high generation costs and fluctuations in fuel prices (figure 8). Cost reduction is contingent upon expanding hydropower resources, increasing the customer base, and securing sustainable revenue flow, as well as exploring the option of importing power from other countries in West Africa.

Figure 8. Sustainable cost recovery for Sierra Leone in the medium term is still a difficult proposition



Imported power is an attractive option to address the growing demand and increase access in Sierra Leone. Assuming power-trade expansion, Sierra Leone could work to finalize the development of a transmission network linking the nation with Côte d'Ivoire and Guinea. To make this scenario a reality, Sierra Leone would need to develop over 600 megawatts of interconnector capacity. Côte d'Ivoire is one of West Africa's largest power exporters with a reputation as a reliable supplier in the WAPP today, providing Burkina Faso and Guinea with 1.8 terawatt-hours. Exploratory discussions with Côte d'Ivoire could therefore help Sierra Leone to identify feasible trading possibilities. In the long term, Sierra Leone could also import power from Guinea, which has abundant low cost hydropower and an export potential

of 17.4 terawatt-hours. A second long term option for Sierra Leone, under trade stagnation scenario, is the expansion of hydropower within Sierra Leone to produce as much as 1,200 megawatts. But Sierra Leone's hydropower is more costly than Guinea's. In addition, seasonality of hydropower production in Sierra Leone necessitates thermal power backup, further increasing total power generation costs.

## **Transport**

Sierra Leone relies on roads, river and maritime transport, and air transport. The country has several ports, one major and nine smaller airports, and two heliports. Sierra Leone Government Railway ceased to operate in 1974 and its reopening is currently not viable.

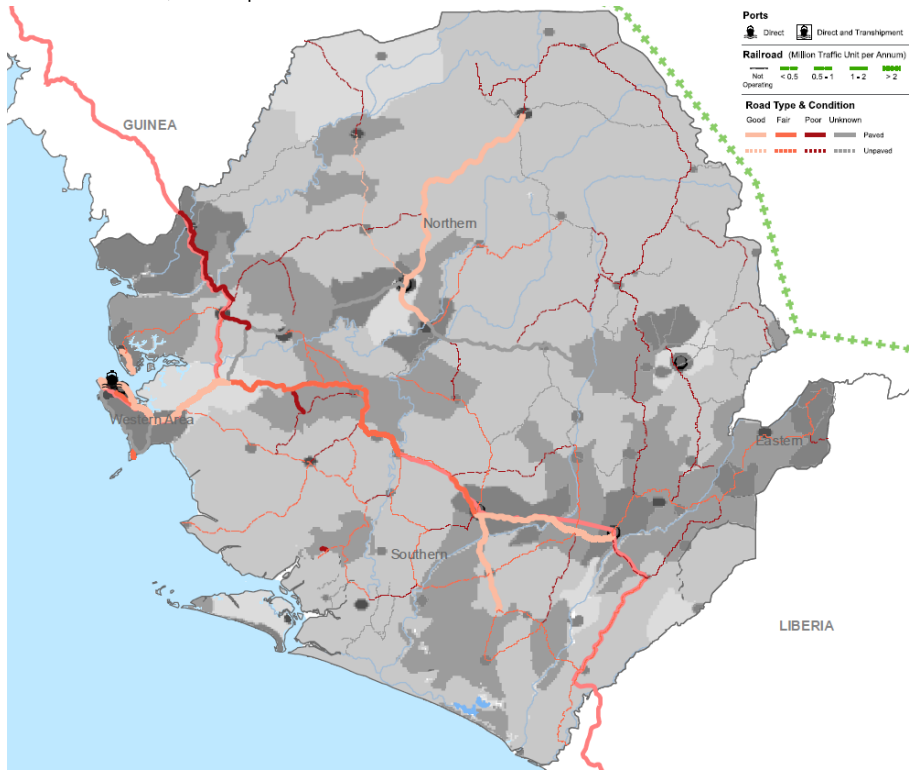
## **Roads**

### **Achievements**

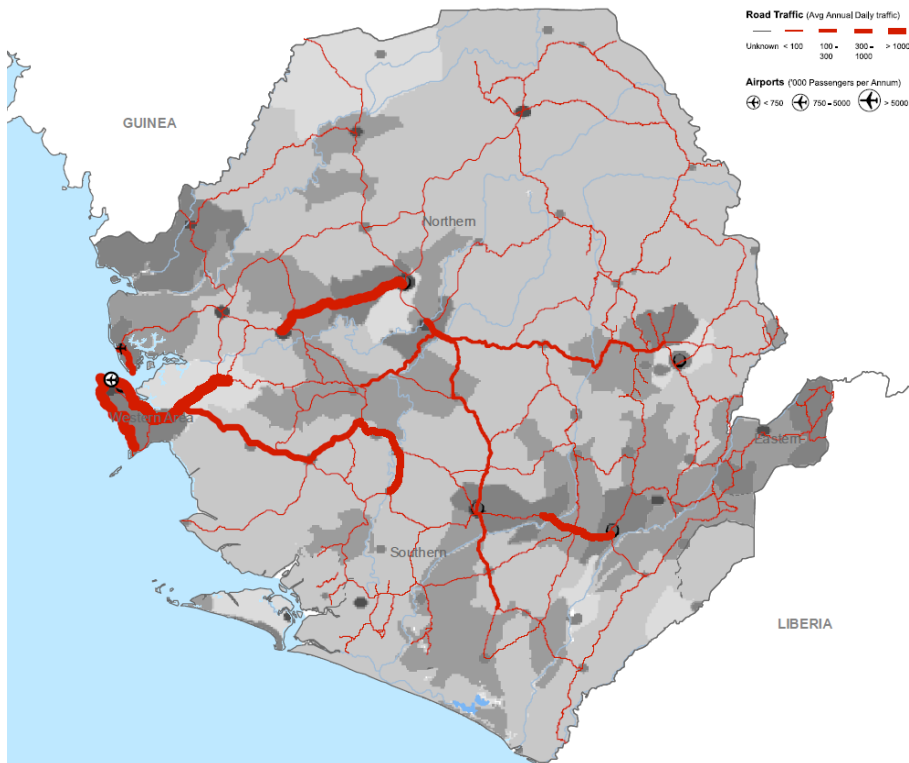
Sierra Leone has an interconnected road network in place, albeit much of it is not in maintainable condition. Of its total 11,999-kilometer length, the classified network (primary, secondary and tertiary) accounts for 71 percent or 8,555 kilometers. Of the remainder, 3,000 kilometers are in urban networks and 444 kilometers are unclassified. Most traffic is concentrated near Freetown and a few other major towns (figure 9). Forty percent of the classified network is in poor condition, and around half of the rural roads are in poor condition (table 5). Only 8 percent or 951 kilometers of classified and urban roads are paved. Traffic levels are comparatively low, particularly for unpaved roads. The low traffic levels can be attributed to high fuel costs, poor road condition, and high poverty incidence; fuel and cars are unaffordable for the majority of population. Despite low traffic levels, Sierra Leone's road usage is growing slightly, as the country recorded a 7.4 percent increase in total number of registered vehicles during 2009, according to Sierra Leone's Roads and Transport Authority.

Figure 9. Sierra Leone roads type and condition versus road traffic

a. Type and condition of roads, rail and ports



b. Road traffic, and airports



Source: AICD Interactive Infrastructure Atlas for Sierra Leone downloadable from [www.infrastructureafrica.org](http://www.infrastructureafrica.org).

**Table 5. Sierra Leone road indicators benchmarked against Africa's low- and middle-income countries**

Indicator	Unit	Low-income, fragile countries	Resource-rich countries	Sierra Leone	Middle-income countries
Classified road network density	km/1000 km <sup>2</sup> of land area	96	98	<b>119</b>	278
Total road network density [a]	km/1000 km <sup>2</sup> of land area	145	128	<b>126</b>	318
GIS Rural accessibility	% of rural pop within 2 km from all-season road	32	20	<b>21</b>	31
Main road network condition [b]	% in good or fair condition	55	68	<b>60</b>	86
Rural road network condition [c]	% in good or fair condition	56	61	<b>52</b>	65
Classified paved road traffic	Average Annual Daily Traffic	843	1,408	<b>1,150</b>	2,451
Classified unpaved road traffic	Average Annual Daily Traffic	55	54	<b>33</b>	107
Primary network over-engineering	% of primary network paved with 300 AADT or less	47	15	<b>69</b>	18
Perceived transport quality [d]	% firms identifying transport as major business constraint	32	27	<b>30</b>	18

Source: AICD Road Sector Database on 40 Sub-Saharan African Countries accessed June 2010.

- a. Total network includes the classified and estimates of unclassified and urban networks.
- b. Main network for most countries is defined as result of adding the primary and secondary networks.
- c. Rural network is generally defined as the tertiary network and does not include the unclassified roads.
- d. Source is World Bank-IFC Enterprise Surveys on 32 Sub-Saharan Africa countries.

Sierra Leone established a Road Fund in 1992 to ensure maintenance and rehabilitation of public roads throughout the country. Since 2009, the government has made progress improving the legislation governing the Road Fund, and separation of the Road Fund from the Sierra Leone Roads Authority is intended by 2013. The Road Fund spent about \$15.3 million annually on road maintenance for the 2004–09 period, with efforts increasing in recent years. The Road Fund's spending on new investment and rehabilitation averaged \$0.5 million annually for the 2007–09 period. This capital spending, coupled with \$8.5 million of road investments channeled through the government (during 2007–09), brings the total public capital flowing to the road network to an annual average of \$9 million.

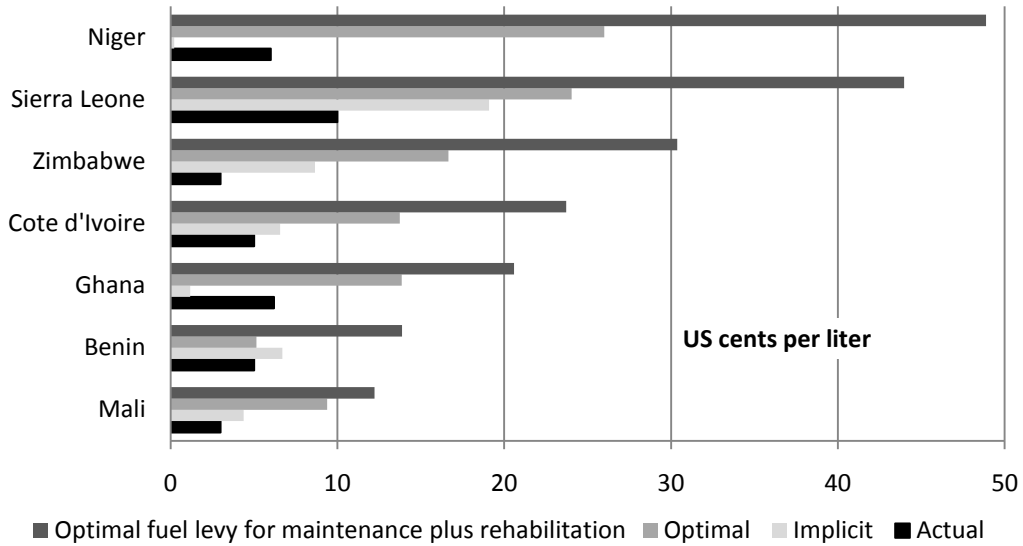
### Challenges

Setting the fuel levy at a high enough level to fund road maintenance has been difficult for Sierra Leone. According to a United Nations Development Program (UNDP) report, the fuel-levy rate reached \$0.10 per liter in 2010. Although this rate was approved in 1998, it took years to implement. The government's intention is to increase the rate to \$0.16 per liter 2012 (UNDP 2010). This new rate will be in line with current Road Fund spending on road maintenance (figure 10), but will be as hard to attain as the previous levy increase.

But even this increase will not be enough to raise the fuel levy to the estimated optimal level of \$0.24 per liter. The optimal levy may not be socially feasible due to already high costs of fuel. Prices already stood at \$1.15 per liter for diesel and \$1.12 per liter for gasoline in 2008, and the proposed levy is already quite high by regional standards. The effort should be made to get the fuel levy to \$0.16 per liter, but budgetary top-up will still be needed, leaving the roads sector vulnerable to fiscal uncertainty. To lessen the adverse social and economic consequences caused by the proposed increase in fuel levy, Sierra Leone

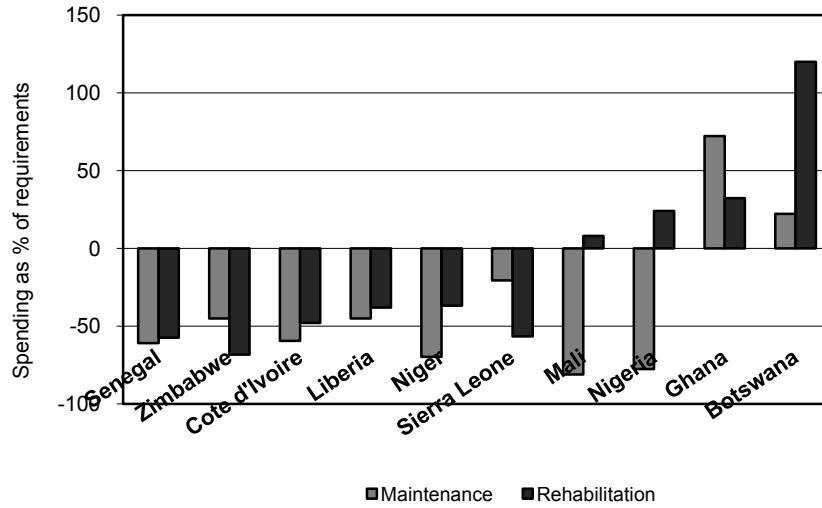
must ensure fair taxation when it comes to taxing diesel. In this vein, it is important to collect the fuel levy only from transport users, and exclude diesel used for power generation, construction, mining, and agriculture.

**Figure 10. Sierra Leone's fuel levy and public contribution fall short of maintenance and rehabilitation needs of road network**



Overall, raising funds for reconstruction of the roads is a formidable challenge. As a result of the lower-than-optimal fuel levy, the road sector remains underfunded. Based on the physical configuration and condition of Sierra Leone's infrastructure network, it is possible to estimate the resources that would be needed to clear the current rehabilitation backlog and maintain the network in good condition. Comparing recent spending against these norms confirms that Sierra Leone has not yet succeeded in securing adequate resources for road-network preservation and maintenance. But the shortfall on maintenance, although significant, is not as dramatic as that found in many other African countries. More worrying is the much larger shortfall of capital expenditure relative to rehabilitation needs, given that until the rehabilitation backlog is cleared the network will not be in a maintainable condition (figure 11). It will take Sierra Leone at least 15 years to reconstruct its roads network at the current spending level of around \$9 million per year. Put differently, Sierra Leone will need to triple its annual rehabilitation expenditure in order to complete road rehabilitation in a five-year period. Rehabilitation of urban roads, many of which had reduced to a non-maintainable condition, also remains an important task.

Figure 11. Sierra Leone's spending is not sufficient to cover maintenance and rehabilitation needs



Source: Gwilliam and others 2009.

Sierra Leone has to improve rural access roads to productive agricultural land. About 74 percent of the country's area is considered suitable for crop production, of which about 11 percent is cultivated.<sup>5</sup> Around two-thirds of Sierra Leone's population is employed in agriculture, which accounts for more than half the country's \$2 billion GDP. In addition, cocoa exports generate an important stream of hard-currency revenues. Despite this agricultural potential, the road network is a big constraint to developing the sector. Just 21 percent of the rural population lives within two kilometers of an all-season road. Commercial agriculture in Sierra Leone suffers not only from low access to roads, but also from the poor and deteriorating condition of the existing rural roads, half of which are in poor condition. The roads need new investment, particularly in the less accessible areas of the southeast. Sierra Leone would need to add about 5,000 kilometers of road in order to provide access to the land that accounts for 80 percent of agricultural value.

Sierra Leone also needs to become a part of the regional transit network. While rebuilding national road infrastructure to ensure nationwide connectivity is of paramount priority, regional interconnectivity is also very important. Sierra Leone is a bottleneck on the ECOWAS Trans-West Africa Coastal Highway. More than 80 percent of this route is completed. Most of the remaining sections of the road are in Sierra Leone as well as in Liberia and Côte d'Ivoire, the two other fragile countries. The highway will pass through Freetown, connecting its port to the regional corridor.

## Ports

### Achievements

Sierra Leone has one of the Africa's largest natural harbors, and is taking advantage of its geographical location by reconstructing its three major ports. Freetown is the major port of Sierra Leone. The port of Sherbro is designed to handle bauxite and rutile exports, and Pepel was built to facilitate the

<sup>5</sup> [http://www.eoearth.org/article/Water\\_profile\\_of\\_Sierra\\_Leone](http://www.eoearth.org/article/Water_profile_of_Sierra_Leone)

export of iron ore. Sierra Leone is rebuilding and modernizing its port system by developing plans to upgrade operational efficiency at the port of Freetown and granting African Minerals the exclusive right to rehabilitate and increase the throughput capacity of the port of Pepel.

Sierra Leone's maritime transport regulator—Sierra Leone Maritime Administration (SLMA)—was established in 2000, taking on regulatory functions previously under the jurisdiction of the Sierra Leone Ports Authority. SLMA is committed to developing an efficient, safe, reliable and competitive maritime, coastal and inland waterways system. SLMA fulfills regulatory and institutional capacity-building roles as well as a number of other tasks such as procurement and installation of navigation aids and the dredging of waterways.

Sierra Leone is moving to the landlord port model and increasing private participation. The Sierra Leone Ports Authority (SLPA) is in the process of major reform to place it on a footing where it operates in accordance with the landlord port model. This will facilitate a much greater involvement of the private sector in front-line and back-up cargo handling and storage functions, with the first major step being the concessioning of container/multipurpose cargo-handling facilities at the port of Freetown. Meanwhile, the ports of Sherbro and Pepel could benefit from foreign investment related to mining.

Benchmarking Freetown's performance on a range of standard indicators against other West African ports suggests that the port's performance, although suffering from relatively long waiting times and sub-optimal productivity, is largely in line with that of other ports in the region (table 6). In addition, port charges across all bulk types seem to be at the lower end of the West African range.

## **Challenges**

Sierra Leone's port system needs both new investment and rehabilitation. Freetown in particular suffered from physical damage during the civil war, as well as from lack of investment, maintenance, and rehabilitation. As a result, Sierra Leone is facing an enormous challenge to rebuild its port infrastructure.

Port security needs to be improved. Currently security is low, but efforts continue to be put into the implementation of effective security measures, notably at Freetown. Steps have been taken to comply with the International Ship and Port Facility Security Code (ISPS) since it became effective in 2004, including training of the security officers and installing CCTV and a security scanner.

Port accessibility is low, inflating the waiting time. Due to poor road linkages, port accessibility from the inland needs improvement. This hinders trade and development of the country's mining and agriculture sectors.

**Table 6. Benchmarking port indicators: Freetown as compared with selected other ports\***

	Freetown, Sierra Leone	Monrovia, Liberia	Cotonou, Benin	Abidjan, Côte d'Ivoire	Tema, Ghana	Apapa, Nigeria	Harcourt, Nigeria	Dakar, Senegal	Lomé, Togo
<i>Capacity:</i>									
Actual container handled (TEU/year)	45,000	50,000	158,201	500,119	420,000	336,308	7,900	331,191	460,000
General cargo handling capacity (tons/year)	7,000,000	700,000	2,500,000		8,500,000	5,000,000	2,000,000		
<i>Efficiency:</i>									
Container dwell time - average (days)	15	15	12	12	25	42		7	13
Truck processing time for receipt and delivery of cargo (turn-round time) - average (hours)	5	5.5	6.0	2.5	8.0	6.0		5.0	4.0
General cargo vessel pre-berth waiting time - average (hours)	48	3	48	3	9.6	36	38	24	
General cargo vessel stay (turnaround time) - average (hours)	12	3	48	2	48	41	46	60	
Container crane productivity* (container per hour)				18	13	12			
General cargo crane/gang productivity - average (tonnes per hour)	12	16	15	16	14	9	8		23
<i>Tariffs:</i>									
Average general cargo handling charge, ship to gate (US\$/tonne)	NA	200	180	260	168	155		160	220
Average dry bulk handling charge, ship to gate or rail (US\$/tonne)	5.5	10.5	8.5	13.5	10	8	8	15	9
Average liquid bulk handling charge (US\$/tonne)	3.3	4	5	5	3			5	5

\* Data for the Freeport of Monrovia relate to 2008, but no data were available for the Port of Buchanan.

Source: Ocean Shipping Consultants 2009.

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

TEU = 20-foot equivalent units.

## Air transport

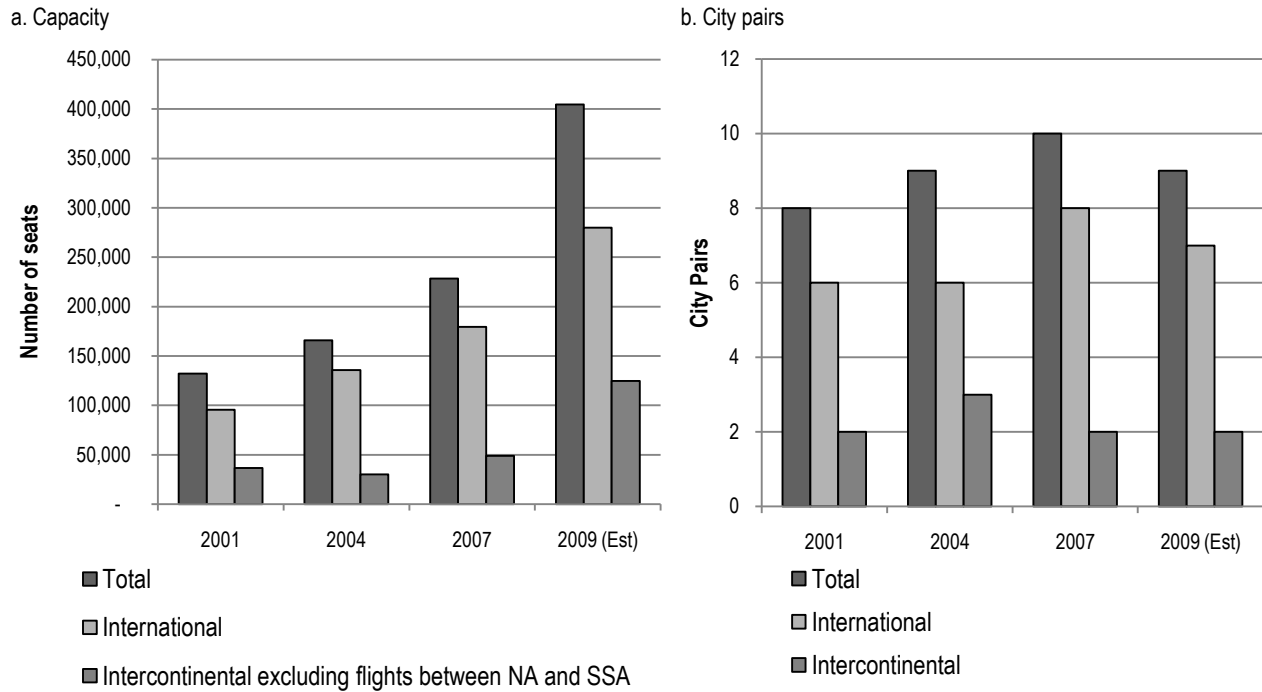
### Achievements

Sierra Leone has shown steady growth in all segments of the air-transport market (figure 12). Continued growth from 2001 to 2009 defies the trend for the rest of West Africa, which witnessed a collapse between 2001 and 2004 after the demise of Air Afrique and others. The most likely explanation is that Sierra Leone's capacity was depressed during the civil war, and therefore as services were reestablished there was no prior peak from which to decline. Air Afrique did not serve the country in



2001, and when Ghana Airways stopped services, Kenyan Airways and Slok Air (originally from Nigeria but now from the Gambia) quickly replaced and augmented the capacity that had disappeared. Because nine carriers provided a relatively evenly balanced set of seat capacities, the Herfindahl index shows the sector to be somewhat more competitive (table 7). This may be the result of there being no domestic carrier; due to the size of the country all scheduled services are international and intercontinental.

**Figure 12. Evolution of capacity and city pairs in Sierra Leone**



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

Note: As reported to international reservation systems.

### Challenges

Airport accessibility needs to be improved. Sierra Leone's main airport at Freetown is an island, requiring passengers to take ferries to reach the mainland.

Aging aircraft and air safety also pose a concern. The average age of aircraft serving Sierra Leone is high; close to half of the total aircraft are obsolete. The aircraft age may be related to the carrier playing the largest role: Slok Air. As Kenyan and other carriers add capacity, the ratio may improve. But safety oversight, according to the last International Civil Aviation Organization audit, is in need of much improvement on all levels.

**Table 7. Benchmarking air-transport indicators for Sierra Leone and selected other countries**

Country	Sierra Leone	Liberia	Guinea	Côte d'Ivoire	Guinea Bissau	Senegal
<i>Traffic (2007)</i>						
Domestic seats (seats per year)	n.a.	n.a.	n.a.	n.a.	n.a.	127,244
Seats for international travel within Africa (seats per year)	179,629	121,445	205,916	851,003	46,566	1,259,410
Seats for intercontinental travel (seats per year)	48,893	40,040	111,462	297,891	20,280	1,231,358
Seats available per capita	0.039	0.044	0.034	0.060	0.039	0.218
Herfindahl index – air transport market (%)	16.66	24.31	20.48	9.75	50.69	11.64
Quality:						
Percent of seat km in newer aircraft	54.9	32.9	95.1	90.8	100.0	98.3
Percent of seat km in medium or smaller aircraft	67.1	90.0	37.8	46.8	0.0	38.1
Percent of carriers passing IATA/IOSA Audit	0	0	0	0	0	50
FAA/IASA Audit Status	No Audit	No Audit	No Audit	Failed	No Audit	No Audit

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

Note: All data as of 2007 based on estimations and computations of scheduled advertised seats, as published by the Diio SRS Analyzer. This captures 98 percent of world-wide traffic, but a higher percentage of African traffic is not captured by the data. The Herfindahl-Hirschmann index is a commonly accepted measure of market concentration. It is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers. A HHI of 100 indicates the market is a monopoly, while a lower the HHI the more diluted is the market power as exerted by one company/agent.

n.a. = not applicable.

## Water resources

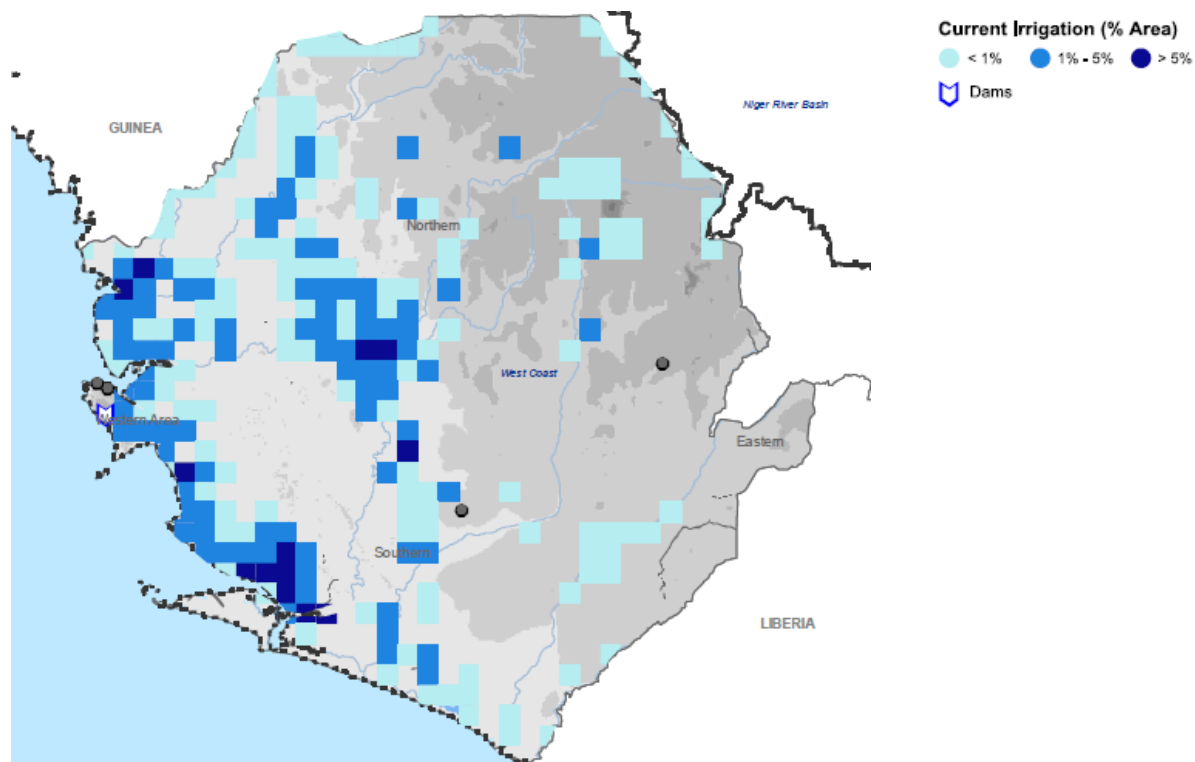
Sierra Leone is well endowed with water compared to other West African countries. The country is considered water-abundant as it has 30,960 cubic meters per capita per year of renewable water resources, one of the highest in Sub-Saharan Africa. Sierra Leone can be divided into twelve river basins, of which five are shared with Guinea and two with Liberia. The most important ones, from west to east, are the Kolente (Great Scarcies), Kaba, Rokel, Pampana (Jong), Sewa, Moa, and Mano. With rainfall ranges from 1,900 to 4,000 millimeters per year, averaging 2,526 millimeters per year, Sierra Leone is one of the most humid countries in Africa.

But population growth, urbanization, and industrialization put pressure on water supply. Sierra Leone's population growth (at 3.4 percent annually) put a significant pressure on water resources, which adds to the effects of climate variability on water availability. Demand for drinking water has increased over time, in particular due to the increasing rate of urbanization (at 4 percent annually). About 30 percent of the rural population obtains its water from surface sources, including rivers and ponds. Need for agricultural production adds to the stress. The industrial sector is also growing. Given the wide range of conflicting uses (agriculture, water supply, and industry), it is essential to have a clearly defined basis for allocating water rights among sectors so as to maximize their development impact. Beyond large-scale storage investments, the development of small-scale irrigation projects would do much to alleviate rural poverty and enhance the resilience of rural livelihoods.

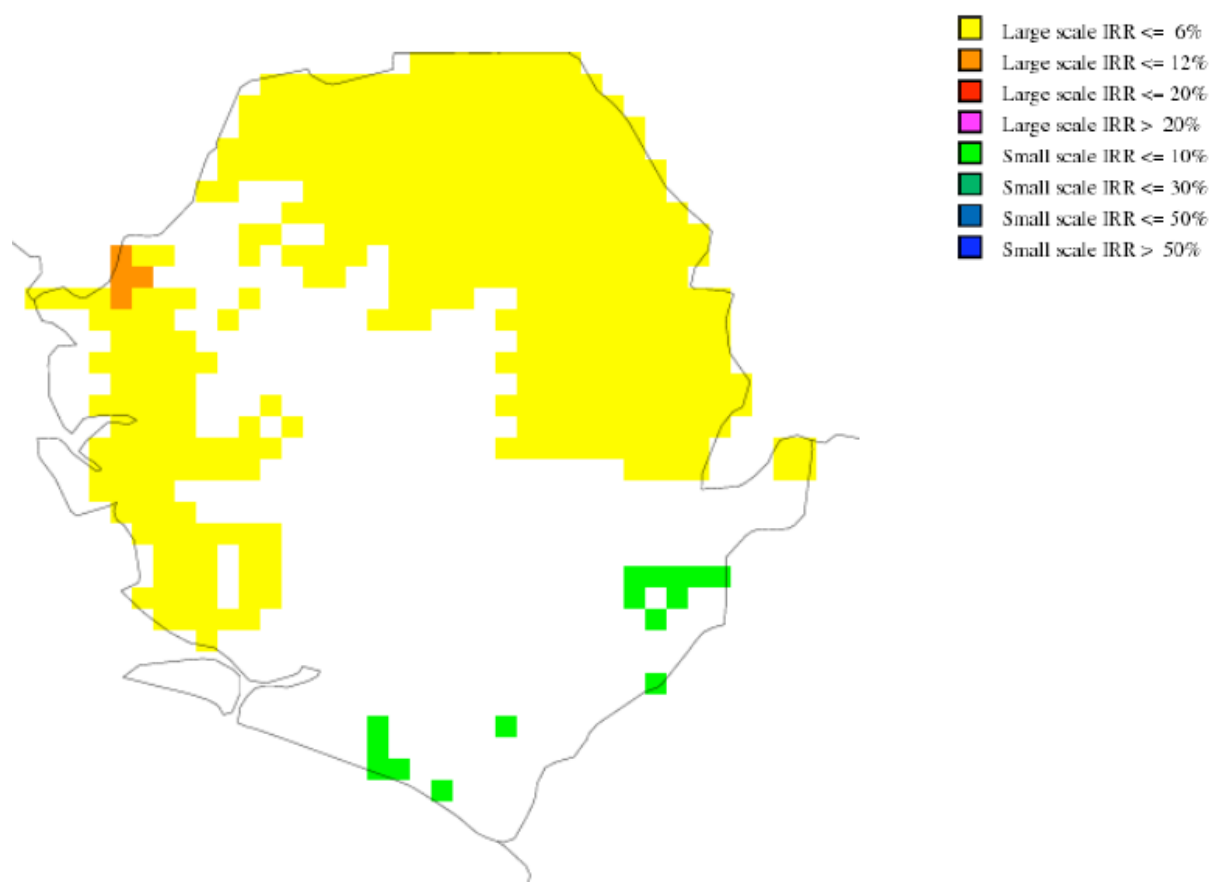
## Irrigation

As a reflection of its abundant water resources and the scarcity of irrigation infrastructure, Sierra Leone is mainly a rain-fed agricultural country. Whereas 807,000 hectares (around 11 percent of the country's area) are physically suitable for irrigation, only 29,360 hectares are equipped for irrigation, equivalent to less than 5 percent of the cultivated land in Sierra Leone. An additional 126,000 hectares of non-equipped wetlands and inland valley bottoms were cultivated, bringing the total water-managed area to 155,360 hectares (figure 13) (FAP 2005). As of 2005 Sierra Leone had only one major dam, the 68-meter-high Guma dam, a hydroelectric scheme close to Freetown. In 2009, the Bumbuna Dam was completed. There is some potential for the development of small-scale hydroelectric schemes that could also be designed to accommodate irrigated agriculture.

Figure 13. Sierra Leone's irrigation area



Irrigation does not appear to be a high-return investment for Sierra Leone. Simulations suggest that with a threshold Internal Rate of Return (IRR) of 0 percent it would already be economically viable to develop a further 16,374 hectares of land for irrigation, from which 56 percent would be developed through small-scale projects. The required investment for attaining this expansion is \$62 million (table 8). This area with irrigation potential is concentrated in the northern and western parts of the country (figure 14). In a scenario of 6-percent IRR, only 387 hectares for small-scale irrigation projects would be economically feasible to develop at a cost of \$2 million. If the threshold IRR were raised to 12 percent, neither small- nor large-scale irrigation projects would be economically viable.

**Figure 14. Sierra Leone's irrigation area potential (baseline scenario)**


Source: Map on current area, AICD Interactive Infrastructure Atlas for Sierra Leone downloadable from <http://www.infrastructureafrica.org>  
 Map on irrigation potential, You (2008: appendix 2).

Note: baseline scenario was calculated assuming investment cost of \$3,000 per hectare, a canal maintenance and water-delivery cost of 1 ¢ per cubic meter, and on-farm annual operation and maintenance costs of \$30 per hectare, and a discount rate of 12 percent

**Table 8. Sierra Leone's irrigation potential**

Cutoff (%)	Large-scale			Small-scale			Total		
	Investment, US\$ million	IRR, %	Area increase, hectares	Investment, US\$ million	IRR, %	Area increase, hectares	Investment, US\$ million	IRR, %	Area increase, hectares
0	14	4.6	7,143	48	1.0	9,231	62	2.6	16,374
6	0	0.0	0	2	0.0	387	2	0.0	387
12	0	0.0	0	0	0.0	0	0	0	0
24	0	0.0	0	0	0.0	0	0	0	0

Source: Derived from You and others (2009).

Note: Water for irrigation can be collected in two ways: through large, dam-based schemes, or through small projects based on collection of run-off from rainfall. The investment costs of large-scale irrigation development reflect only irrigation-specific infrastructure, such as distribution canals and on-farm system development. The potential for small-scale irrigation is assessed not only on the basis of agro-ecological conditions, but also in terms of market access, since irrigation is typically viable only if the increased yields can be readily marketed. The unit cost for large-scale projects is set at \$3,000/ha and for small-scale projects at \$2,000/ha.

## Water supply and sanitation

### Achievements

Sierra Leone established a National Water and Sanitation Policy in September 2008 to improve the provision of water supply and sanitation. As part of this policy, the sector has seen increasing decentralization of service. The country is undertaking a new, five-year water, sanitation, and hygiene (WASH) program to improve water and sanitation coverage nationwide. As part of WASH, the country is developing a successful community-led sanitation program, which has led to 169 communities being certified as open-defecation free and approximately 24,000 people living in open-defecation-free environments, among other results (box 2).

#### Box 2. Communities Leading the Way to Improved Sanitation in Sierra Leone

Community-Led Total Sanitation (CLTS) approaches are bringing improved sanitation to whole communities and mobilizing sanitation actors to work within a coordinated national strategy. In line with Sierra Leone's transition from supply-driven relief to longer-term development planning, these programs are augmenting local capacity while helping to strengthen communities torn apart by conflict.

CLTS is one of the methods Sierra Leone is using to rapidly increase sustainable sanitation coverage nationwide. The goal of CLTS programming is the community-wide elimination of open defecation through awareness-raising and affordable sanitation options. The role of outsiders is to guide the community to assess its sanitation situation, determine a strategy for improvement, implement the solution and develop a way to measure success.

In Sierra Leone, CLTS began as a successful pilot exercise with 28 villages at the beginning of 2008, and later was incorporated into each district's three-year rolling health plan. Implementation of CLTS rapidly accelerated in the second half of 2008 and into 2009 with NGOs and district health management teams working side by side to trigger communities throughout the country. As of June 2009, 754 communities adopted CLTS approaches, 169 communities were certified as open-defecation free, approximately 24,000 people lived in open-defecation-free environments, and CLTS was accepted by the majority of stakeholders as a viable sanitation strategy.

Over the next five years, Sierra Leone plans to scale up community-led sanitation across the country through continued community training, sanitation and hygiene marketing, strengthening of supply chains, public-private partnerships, monitoring and evaluation, and impact assessment. One of the major challenges is to change the culture of dependency fostered by subsidy- and construction-driven sanitation programs that hinder communities from taking the responsibility and leadership in designing, developing and implementing steps to improve their own community's sanitation profile. Also, as the program has been more successful in rural areas where population density is low than in urban settings, a master plan for urban sanitation needs to be developed.

*Source:* Adapted from UNICEF (2009).

### Challenges

Access to improved water and sanitation has declined steadily since 2000. Access to the safest forms of water supply and sanitation has deteriorated over time, worsening the living conditions of the Sierra Leoneans (table 9). Between 2000 and 2006 access to piped water decreased whereas access to wells and boreholes increased. In the same period, an important percentage of the population was moving away from septic tanks and improved latrines to traditional latrines.<sup>6</sup> On average, between 2000 and 2008 two percent of the population per year was getting access to wells and boreholes, while around 3 percent of

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<sup>6</sup> Traditional latrines include shared latrines. Lack of sanitary facilities and poor hygiene are major contributors to Sierra Leone's exceptionally high under-five mortality rate (267 per 1,000 live births), the highest in the world. Maternal and infant mortality are also among the highest—and in many cases are likewise attributable to poor sanitation and hygiene.

## SIERRA LEONE'S INFRASTRUCTURE: A CONTINENTAL PERSPECTIVE

the population was getting access to traditional latrines (figure 15). The lack of sanitary facilities and poor hygiene is a major contributory factor to Sierra Leone's exceptionally high maternal, infant, and child mortality rates (UNICEF 2008). Moreover, Sierra Leone has not been able to reduce its reliance on surface water, which is higher than in comparable fragile states. Reliance on open defecation has decreased only marginally, but it is expected to decrease in the upcoming years due to the implementation of WASH programs.

**Table 9. Benchmarking water and sanitation indicators**

	Unit	Fragile states	Sierra Leone		Low income countries
		Mid 2000s	2000	2008	Mid 2000s
Access to piped water	% pop	17.9	11.3	7.6	9.3
Access to standposts	% pop	9.4	16.3	13.7	17.1
Access to wells/boreholes	% pop	54.5	44.3	49.8	39.3
Access to surface water	% pop	18.1	28.1	28.3	34.2
Access to septic tanks	% pop	11.2	6	3	4.7
Access to improved latrines	% pop	29	16	8	18.3
Access to traditional latrines	% pop	36.8	55	64	38.5
Open defecation	% pop	23.1	23	24	38.3
2007					
Domestic water consumption	liter/capita/day	29.6		40	50.9
Revenue collection	% sales	94.6		77	94.1
Distribution losses	% production	31.5		40	34.8
Cost recovery	% total costs	57.2		61.4	89.5
Operating Cost recovery	% operating costs	80.1		85.8	125.2
Total hidden costs as % of revenue	%	169		297	67
		Sierra Leone	Countries with non-scarce water resources	Other developing regions	
		2007			
Average effective tariff	U.S. cents per m3	22		80	3.0 – 60.0

Source: AICD water supply and sanitation database downloadable from <http://www.infrastructureafrica.org/aicd/tools/data>.

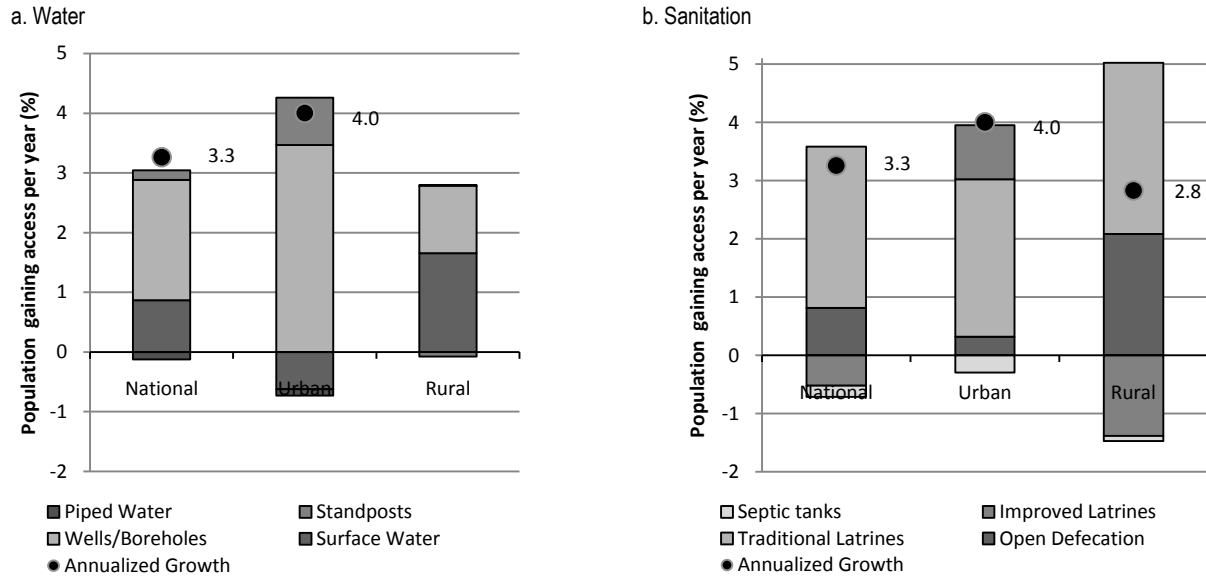
Access figures calculated by AICD using data from the 2000 Multiple Indicators Cluster Survey as published by the JMP in March 2010 and the 2008 Demographic and Health Survey

Note: A country is considered non-scarce water resources if the renewable internal freshwater resources per capita is greater than 3,000 mm. Domestic water consumption, revenue collection, distributional losses, cost recovery, and total hidden costs only reflect the values for GWVC as there is not data available for SOWALCO

— = data not available.

**Figure 15. Expansion of water and sanitation technologies at the national, urban, rural levels**

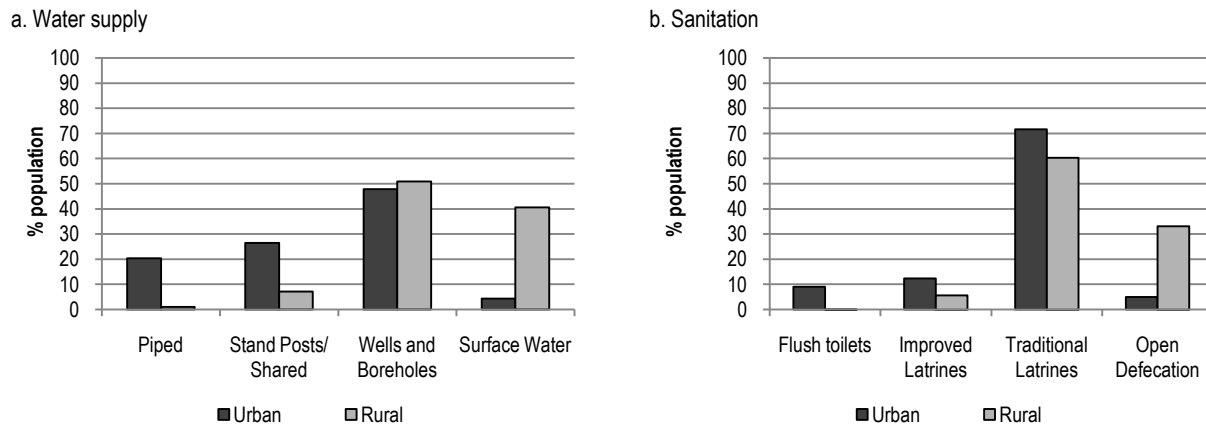
Population gaining access per year between 2000–2008



Source: Access figures calculated by AICD using data from the 2000 Multiple Indicators Cluster Survey as published by the JMP in March 2010 and the 2008 Demographic and Health Survey.

Rapid population growth (particularly in urban areas) has been an important contributor to declining access (figure 16). Between 2000 and 2008 Sierra Leone’s population grew at a pace of 3.4 percent per year, one of the highest among Sub-Saharan African countries. In urban areas, where the average population growth has been 4 percent per year, experienced important inflows of refugees who fled during the civil conflict in the 1990s.

**Figure 16. Urban versus rural access to water supply and sanitation, 2008**



Source: AICD water supply and sanitation utilities database downloadable from <http://www.infrastructureafrica.org/aicd/tools/data>. Access figures calculated by AICD using data the 2008 Demographic and Health Survey.

There is a wide disparity between urban and rural areas in access to the safest forms of water supply and sanitation. Whereas around 20 percent of the urban population has access to piped water, only 1 percent of rural counterparts have piped access. Access to standposts in urban areas is 26 percent versus less than 10 percent in rural areas (figure 15a). Similarly, whereas flush toilets are used by around 10 percent of the urban population, they are almost nonexistent in rural areas. Improved latrines are used by 12 percent of the urban population versus only 6 percent of the rural population (figure 15b). However, these figures do not reflect improvements since 2008.

The provision of water services is seriously affected by the poor performance of the Sierra Leone water utilities. The rapidly increasing population of Freetown is catered to by the Freetown water utility—Guma Valley Water Company (GVWC). The rest of Sierra Leone was supposed to be covered by Sierra Leone Water Company (SALWACO) and the Water Services department in the Ministry of Energy and Water Resources. However, SALWACO is not yet a functioning utility. As a result performance data could only be obtained from GVWC. In the case of GVWC,<sup>7</sup> the utility is struggling to cover 85 percent of its operational costs and is able to recover only 61 percent of its total costs (table 8). There is a lack of mechanism for setting tariffs to improve affordability of the service. The average effective tariff, at \$0.22 per cubic meter, is just one third of the tariff charge in countries with comparably sufficient water resources, and well below cost-recovery levels. Distributional losses, at 40 percent of production, are twice as high as those in a well-run utility, and higher than those in utilities operating in comparable fragile states. Ongoing repairs of key water-supply veins is expected to improve this situation. But the GVWC only recovers 77 percent of total billings (table 9); as a consequence, GVWC's hidden costs of inefficiencies stand at a staggering 300 percent of its revenues (figure 17).

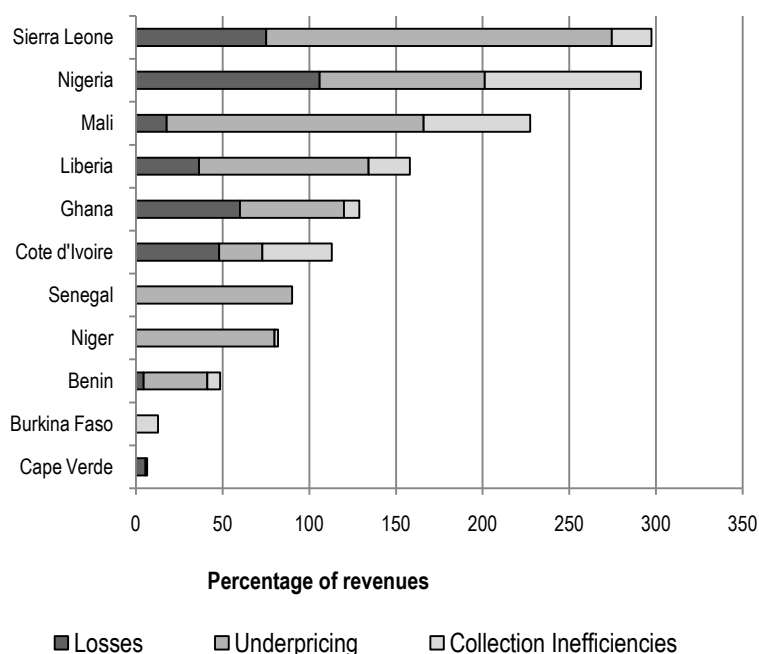
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<sup>7</sup> World Bank 2010. Restructuring paper on a proposed project restructuring of Freetown Water Supply Rehabilitation Project. Washington, April 22, 2010 GVWC's performance remains weak, reflected in slow collection efficiencies, slow consumer base, very high water losses due to water leaks, illegal connections due mainly to inadequate water distribution system. These deficiencies are the main reasons for the limited operational performance of the company to its customers in Freetown. In order to meet the demand in Freetown, GVWC will need more vigorous actions in terms of water network rehabilitation including extension of its water facilities production/distribution and much more improvement in the utility management.



**Figure 17. Freetown's water utility suffers from hidden costs of inefficiencies**

Hidden costs as percentage of revenues



Source: Derived from Briceño-Garmendia and others (2009).

Note: Hidden costs for Sierra Leone are calculated only for GVWC, a parastatal established in 1961. GVWC is responsible for the water supply of the city of Freetown and its environs.

## Information and communication technologies

### Achievements

Although Sierra Leone's mobile penetration is below the average for Sub-Saharan Africa (table 10), it is still a significant accomplishment given Sierra Leone's postconflict situation. Sierra Leone is an example of a postconflict country using wireless communications to leapfrog its ICT development. Despite a civil war and absence of a regulatory authority, several mobile operators established operations in the country in the early 2000s. The number of mobile subscriptions went from just 6,000 in 2000 to 1.4 million by 2009 for a penetration rate of one quarter of the population. The level of access to mobile communications is higher than the penetration rate given that multiple members of a household can use a single subscription. According to a 2008 household survey, 28 percent of Sierra Leonean households had a mobile phone (SSL and ICF Macro 2009). Considering that only 12 percent of households reported having electricity, recharging a mobile handset was more of a challenge than adding prepaid credits

**Table 10. Sierra Leone's ICT sector in comparative context**

		Sierra Leone	Sierra Leone	Low-income group	Sub-Saharan Africa	Sierra Leone
	Unit	2000	2008	2008	2008	2009
GSM coverage	% population under signal	11	72	56	56	76
International bandwidth	bits/capita	0.1	—	24	34	—
Internet	users/100 people	0.1	2.3	4.6	6.5	3.5
Landline	subscribers/100 people	0.4	0.4	4.6	1.5	—
Mobile phone	subscribers/100 people	0.1	18.0	28.5	33.3	24.6
		2005	2008	2008	2008	2009
Price of monthly mobile basket	US dollars	10.5	—	10.0	11.8	7.3
Price of monthly fixed line basket	US dollars	—	—	9.0	11.6	—
Price of monthly fixed broadband	US dollars	—	240	102.4	100.1	240
Price of a call to US per minute	US dollars	—	—	—	0.9	0.3
Price of an inter-Africa call per minute	US dollars	—	—	—	1.0	0.3

Source: AICD and World Bank.

Note: — = data not available.

Fixed-line operator Sierratel succeeded in rolling out a CDMA (Code Division Multiplex Access) network in 2009. The project, carried out by Chinese equipment vendor Huawei, was financed through a loan from the China Import-Export Bank and complements the operator's existing infrastructure with an extra 100,000 lines in Freetown and 14 other cities (Bank of Sierra Leone 2009).

## Challenges

Sierra Leone's ICT sector needs legal and regulatory reform. The ICT legal and regulatory environment in Sierra Leone is relatively new and faces challenges with respect to resources and institutional capacity. The Ministry of Information and Communications is responsible for sector oversight. The National Telecommunications Commission (NATCOM), established in 2006, is the industry regulator. The incumbent operator is government-owned Sierratel, and there are three other mobile operators: Lintel (Aircell), Comium, and Airtel (ex-Zain). Millicom also operated on the market until 2009 when it sold its operations to Lintel. A new fourth mobile operator owned by the investment arm of the Libyan government has been awarded a license but has not yet launched.

The regulatory environment needs additional reform and stimulus to attract needed investment. This includes allocating mobile broadband spectrum, ensuring open access to the planned ACE cable, and transparent administration of the recently established universal-service fund. The latter can be important for helping to extend mobile coverage throughout the country. Several policies inhibit efficient development of the sector and inflate the price of communications. Sierratel lacks resources to compete with the mobile operators but remains government owned despite efforts to privatize it.<sup>8</sup> Sierratel was given a monopoly over international communications in 2007, ending the right of other operators to have their own gateway. License and regulatory fees were also raised. In addition, a service tax was recently introduced. These factors raise the price of communications. The lack of electricity requires diesel generators for powering telecommunications equipment, further adding to costs.<sup>9</sup> Internet penetration is

<sup>8</sup> "Sierratel to undergo privatization to boost competitiveness." *TeleGeography's CommsUpdate*, July 28, 2010.

<sup>9</sup> Millicom (2008) reported that almost all its base stations were powered by diesel in 2007.

estimated to be around 2 percent of the population;<sup>10</sup> high prices and low levels of literacy inhibit growth.<sup>11</sup>

Sierra Leone is not connected to an international fiber-optic system and therefore depends on more costly satellite communications costing \$4,000–5,000 per month per megabit per second.<sup>12</sup> Plans are afoot to connect the country to the Africa Coast to Europe (ACE) cable running from France to the west coast of Africa.<sup>13</sup>

Internet prices are also high due to a lack of effective inter-modal competition. The fixed line network is antiquated and not capable of supporting high-speed broadband connectivity. Instead, Sierratel, as mentioned above, has pursued fixed wireless solutions using CDMA technology. A monthly subscription using its broadband EVDO (Evolution-Data Optimized) network, launched in 2009, reportedly costs \$60 per month and \$120 for the data card required to use it.<sup>14</sup> The other mobile operators provide low-speed connectivity; a capped (2-gigabyte) monthly Internet plan through the mobile network at speeds equivalent to dial-up was \$72 per month in 2010.

Sierra Leone has considerable potential for private participation in the telephony sector. In the case of mobile telephony, it is estimated that much of the population—up to 91 percent—could be reached on a commercially viable basis. This result is based on the assumption that four percent of local income in each area could be captured as revenues for voice telephony services (figure 18). Areas requiring public subsidy to achieve coverage are mainly concentrated in the north of the country (figure 19a). These considerations are important when deciding how to target resources from the country's newly established universal access fund. Unlike to Sierra Leone, other Sub-Saharan African countries like South Africa, Nigeria, and Rwanda would barely need any subsidies to reach universal service as the market would take care of providing service to all.

There is significant scope to expand limited-performance broadband across a large swathe of the country. While broadband services are still in their infancy, simulations suggest that it would be feasible to expand coverage based on limited performance WIMAX (Worldwide Interoperability for Microwave Access) technology providing telecom access for the population plus direct connections for some institutional users. This model looks to be commercially viable in all but the extreme north and south of the country (figure 19b).

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<sup>10</sup> According to the Ministry of Information and Communications (2009), there were 16,000 Internet users (excluding mobile) in 2008. However it is not clear whether that figure refers to subscribers or users. A 2008 survey by AudienceScapes found that 4 percent of the population 15 years and older used the Internet or some 125,000 people. This is two percent of the entire population.

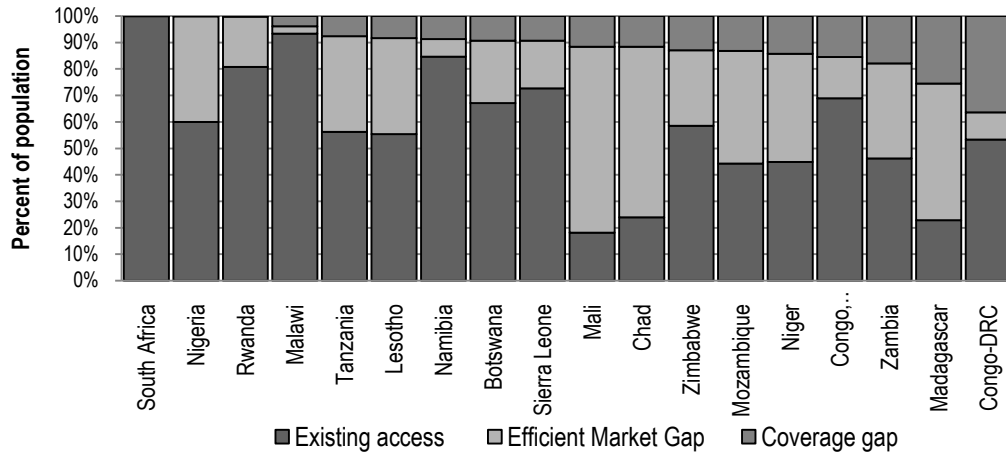
<sup>11</sup> Some 58 percent of females and 46 percent of males have no education (SSL and ICF Macro 2009: 19–20).

<sup>12</sup> “West Africa Rising: World Bank offers Internet ‘revolution’ to Sierra Leone, Liberia.” *The Christian Science Monitor*, January 25, 2011.

<sup>13</sup> A \$31 million loan from the World Bank is being used to finance fiber optic connectivity.

<sup>14</sup> [http://www.thetorchlight.com/index.php?option=com\\_content&view=article&id=2788:editorial&catid=36:local-news&Itemid=27](http://www.thetorchlight.com/index.php?option=com_content&view=article&id=2788:editorial&catid=36:local-news&Itemid=27)

Figure 18. Around 9 percent of Sierra Leone's population can be reached by GSM signal only with a subsidy



Source: Mayer and others 2008.

Existing Access represents the percentage of the population currently covered by voice infrastructure as of 3rd quarter 2006.

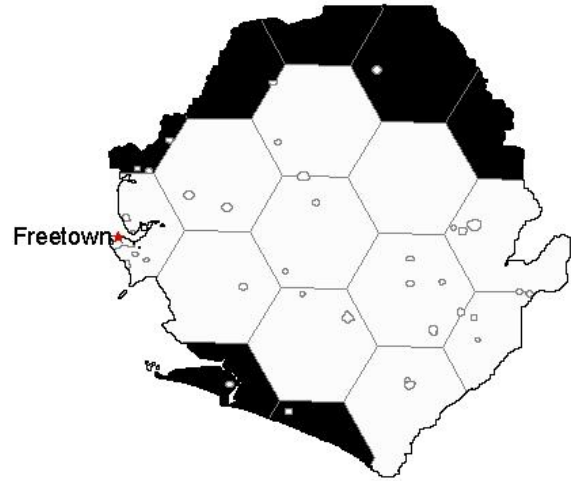
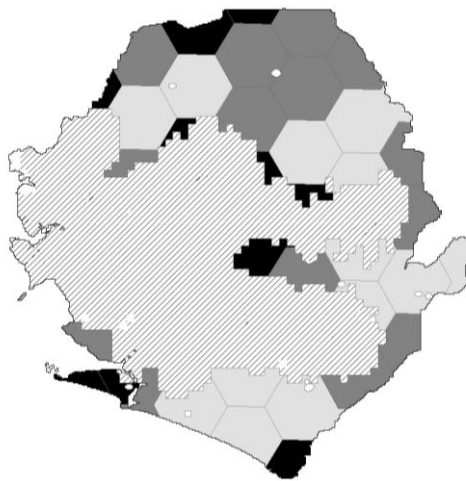
Efficient market gap represents the percentage of the population for whom voice telecommunications services are commercially viable given efficient and competitive markets.

Coverage gap represents the coverage gap—the percentage of the population for whom services are not viable without subsidy.

Figure 19. Telecom coverage in Sierra Leone

a. Voice infrastructure

b. Broadband



GSM Covered Areas  
 Efficient Market Gap  
 Sustainable Coverage Gap  
 Universal Coverage Gap

Efficient Market and Urban Areas  
 Rural Coverage Gap

Source: Mayer and others 2008.

## Financing Sierra Leone's infrastructure

To meet its most pressing infrastructure needs and catch up with developing countries in other parts of the world, Sierra Leone needs to expand its infrastructure assets in key areas (table 11). The targets outlined below are purely illustrative, but they represent a reasonable level of aspiration. 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 11. Illustrative investment targets for infrastructure in Sierra Leone**

	<b>Economic target</b>	<b>Social target</b>
ICT	Install fiber optic links to neighboring capitals and submarine cable	Provide universal access to GSM signal and public broadband facilities
Power	Develop 1 MW of new generation capacity and 661 MW inter-connectors.	Rise electrification to 50 percent (100 percent urban and 6 percent rural)
Transport	Achieve regional (national) connectivity with good quality 2-lane (1-lane) paved road.	Provide rural road access to 65 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 2008; Rosnes and Vennemo 2009; Carruthers and others 2009; You and others 2009.

Meeting these illustrative infrastructure targets for Sierra Leone would cost around \$0.5 billion per year over a decade. Capital expenditure would account for three quarters of this requirement, and the split is similar across sectors. In turn, more than 70 percent of capital spending should be invested into building new infrastructure across the board, with the exception of the transport sector where rehabilitation of existing networks is the area of predominant concern.

The highest spending needs are found in water and sanitation: it will take \$202 million per year to meet the Millennium Development Goals in this sector. The WSS sector in Sierra Leone is starved for new capital investments, which accounts for 60 percent of total needs, or \$118 million per year. Rehabilitation of the existing water and sanitation infrastructures would require another 16 percent of the total needs, and the remaining 26 percent should be spent on maintaining the systems. Another \$0.12 billion per year are needed in the transport sector annually, 74 percent of which for capital investments. In turn, most of the capital investments—around 76 percent—are needed for rehabilitation purposes. Meeting growing demand for power will require an estimated \$117 million per year to install 1 megawatt of new generation capacity and 661 megawatts of inter-connectors. Most of the capital spending—as much as 98 percent—is needed to construct new power infrastructure. While less than the amounts needed for other infrastructures sectors, requirements for ICT are also high in absolute terms, amounting to around \$39 million per year (table 12).

Overall, Sierra Leone's infrastructure-spending needs are comparatively high in absolute and GDP terms. Sierra Leone's burden of needs at 26 percent of GDP is quite high (2009 GDP was \$1.888 billion), although other countries such as Liberia, DRC, Zimbabwe, and Ethiopia have higher burdens (figure 20). Investment would absorb around 19 percent of GDP, which is even higher than the 15 percent of what China invested in its infrastructure during the mid-2000s.

**Table 12. infrastructure spending needs in Sierra Leone for 2006 to 2015**

US\$ million per year

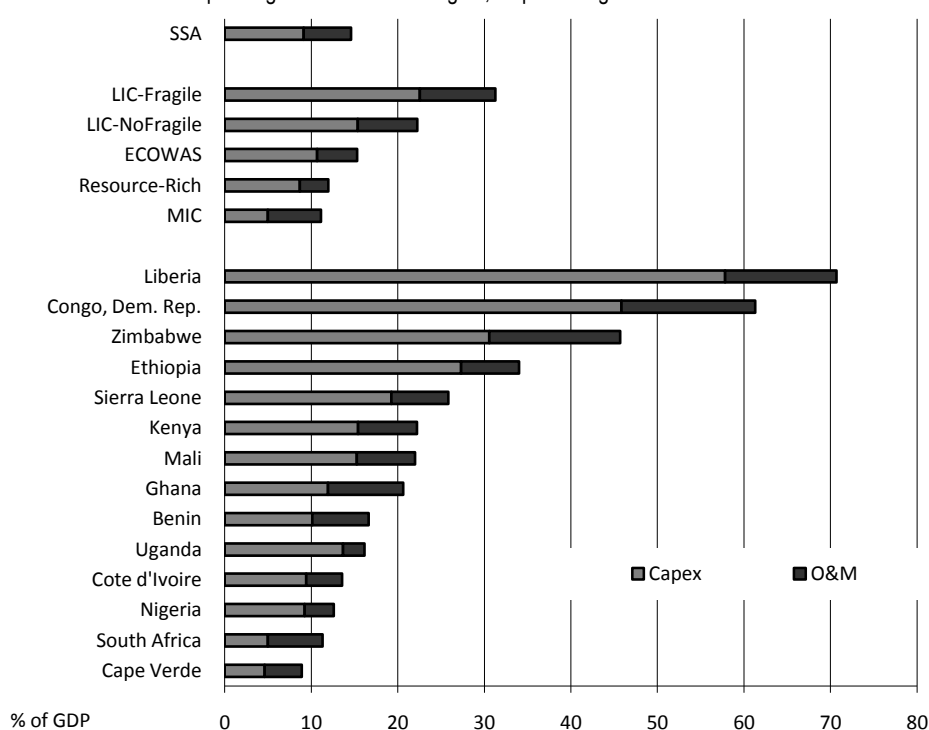
Sector	New investment	Rehabilitation	Total capital expenditure	Operations and maintenance	Total needs
ICT	29	0	29	10	39
Power	84	2	86	31	117
Transport	21	68	89	31	120
Water supply and sanitation	118	31	149	52	202
Total	252	102	354	125	478

Sources: Mayer and other 2008; 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 20. Sierra Leone's infrastructure spending needs are high relative to GDP**

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



Legend: LIC = low-income countries, MIC = middle-income countries, COMESA = Common Market for Eastern and Southern Africa

Source: Foster and Briceño-Garmendia 2009.

Sierra Leone already spends a sizable amount (\$13 million per year) to meet its infrastructure needs (table 13). Around 70 percent of the total is allocated to capital expenditure and the remaining 30 percent to operations and maintenance (O&M). Operating expenditure is entirely covered by budgetary resources, resources from state-owned enterprises, and payments by infrastructure users. Capital expenditure is funded by ODA (47 percent), the public sector (19 percent), the private sector (18 percent), and non-OECD financiers (16 percent).

Sierra Leone's existing spending amounts to almost 10 percent of 2009 GDP (figure 21). This represents a moderate level of effort, somewhere between average spending burdens for low income fragile and low income non-fragile countries. Relative to its peer group, Sierra Leone is much more reliant on ODA for capital funding in power, transport, and water sectors. Sierra Leone's investment effort on all sectors, except water and sanitation, is substantially higher than the respective average for other LIC fragile countries (figure 22). The largest share of total spending goes to transport (45 percent), followed by power (27 percent), and ICT (17 percent). Only 12 percent of total funding is channeled to WSS, the sector with the highest spending needs. In addition, investments into the water sector in Sierra Leone are almost exclusively financed by ODA.

**Table 13. Financial flows to Sierra Leone's infrastructure**

US\$ millions per year

	O&M		Capital expenditure				Total spending
	Public sector	Public sector	ODA	Non-OECD financiers	PPI	Total CAPEX	
ICT	0	0	0	5	17	23	23
Power	13	7	12	4	0	23	36
Transport	21	9	25	6	0	39	60
WSS	7	1	8	0	0	9	16
Total	40	17	45	15	17	94	134

Source: Derived from Foster and Briceño-Garmendia 2009.

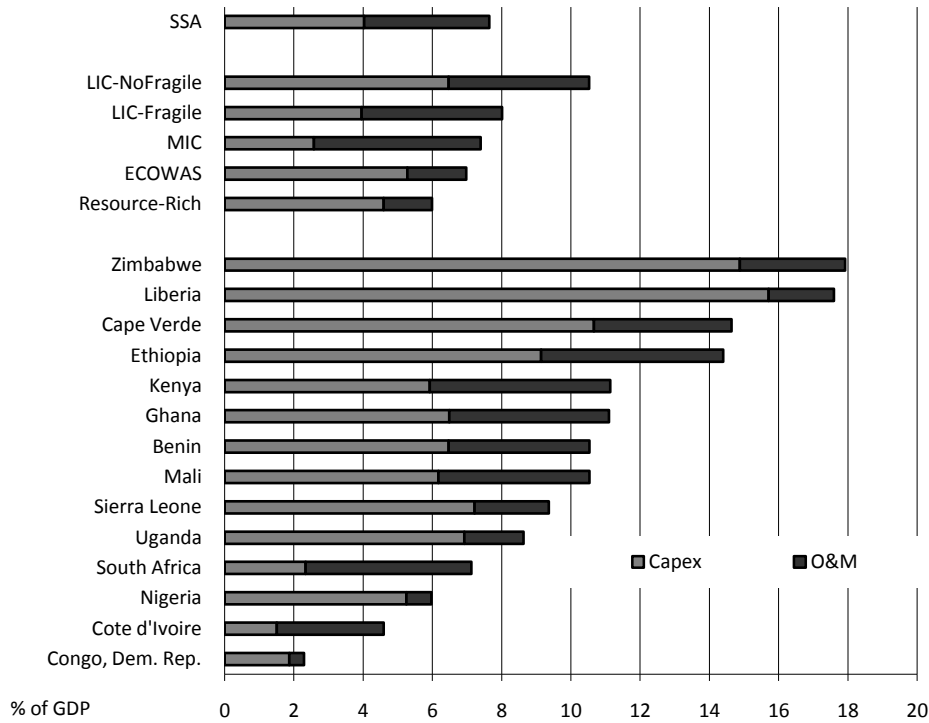
Note: The public sector figures are averages of actual spending for 2007–09, in the case of government data. In the case of SOEs, the average spans 2004–08 and in some cases 2004–09. Funding from external financiers is averaged over the 2002–07 period.

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.

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

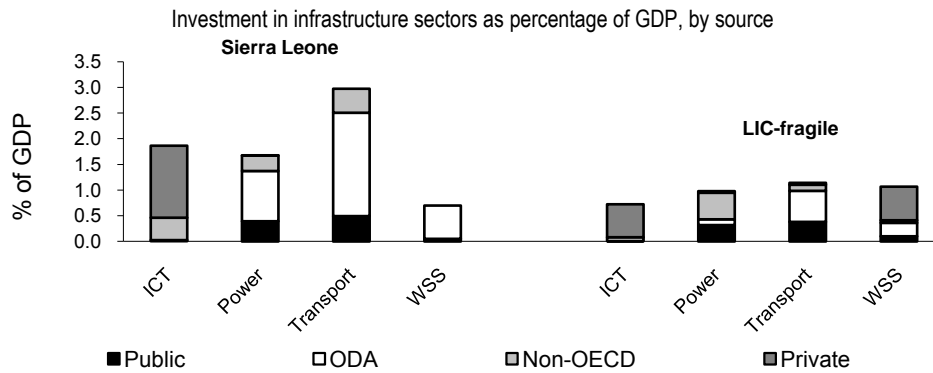
About \$66 million of additional resources could be recovered each year by improving efficiency (table 14). The most vexing problem is curbing distribution losses in power and underrecovery of costs in roads and water. Reducing distributional losses could save \$3 million in water and \$16 million in power annually. Every year up to \$19 million is lost due to under charging for services. A better-aligned road-fuel levy could bring in an additional \$11 million for roads, and raising water tariffs would capture in additional \$8 million. Collection of bills for water and power services needs to be improved. Sierra Leone is losing \$0.9 million per year on water and \$8.3 million on power due to undercollection of bills for the services. Overstaffing in the power parastatal is quite significant. Cutting the staff levels to economically viable benchmarks could save an estimated \$2.4 million on power. Improving execution of budgeted governmental funds in roads could translate into \$6 million of additional financing for the roads sector and \$1.4 million for the power sector annually. Looking across sectors, the power sector can benefit the most from tackling identified inefficiencies, followed by the road and water sectors.

Figure 21. Sierra Leone's existing infrastructure spending is average



Source: Derived from Foster and Briceño-Garmendia 2009.

Figure 22. Sierra Leone's pattern of capital investment in infrastructure differs from that of comparator countries



Source: Derived from Briceño-Garmendia and others 2009.

Note: Private investment includes self-financing by households.



**Table 14. Sierra Leone's potential gains from greater operational efficiency**

	ICT	Power	Transport	WSS	Total
Underrecovery of costs	n.a.	0.0	11.2	7.6	18.8
Overstaffing	—	2.4	n.a.	—	2.4
Distribution losses	n.a.	24.2	n.a.	2.9	27.1
Undercollection	n.a.	8.3	—	0.9	9.2
Low budget execution	0.0	1.4	6.6	0.0	8.0
Total	0.0	36.3	17.8	11.4	65.5

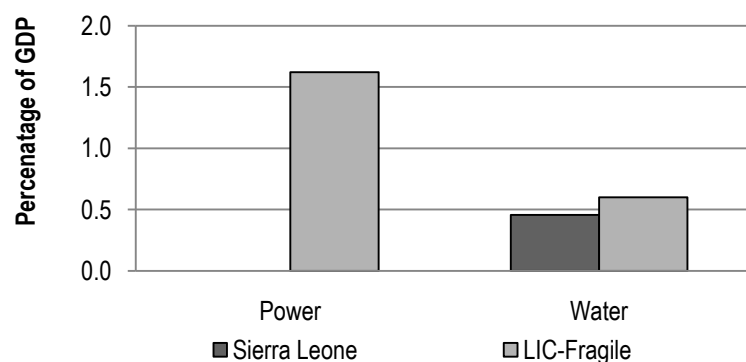
Source: Derived from Foster and Briceño-Garmendia 2009.

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

Underpricing of power and water in Sierra Leone is less burdensome than in other low-income fragile countries. There does not appear to be a cost-recovery problem in Sierra Leone in the power sector as of 2010. In the water sector, as of 2007, Guma Valley Water Company's average tariffs stood at \$0.22 per cubic meter versus estimated \$0.65 per cubic meter average cost recovery tariff. The macroeconomic burden of 0.5 percent of GDP is comparable to what is found in other fragile states (figure 23).

**Figure 23. Underpricing of power and water is less burdensome in Sierra Leone than in comparator countries**

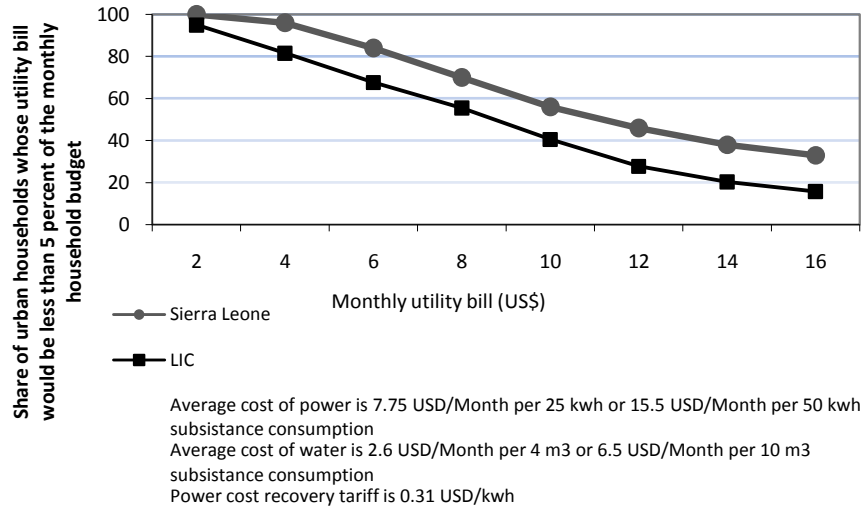
Financial burden of underpricing as percentage of GDP



Source: Derived from Briceño-Garmendia and others 2009.

How affordable are cost-reflective tariffs? With a tariff of \$0.31 per kilowatt-hour and a monthly subsistence consumption of 50 kilowatt-hours, the associated utility bill comes to \$15.50 per month. Based on the distribution of household budgets in Sierra Leone, monthly utility bills at these levels would be affordable by less than 40 percent of the population (figure 24). However, 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 Sierra Leone has scope to increase coverage before affordability would become a serious impediment. Strikingly, a more limited subsistence-consumption level of 25 kilowatt-hours per month for power—which is sufficient to meet the most basic needs—would cost \$7.80 per month and would be affordable to half of the population. Subsistence consumption of four cubic meters per month for water would cost \$2.60 per month and would be affordable for most of the population.

Figure 24. Affordability in Sierra Leone better than in other low income countries, but access to services is very low

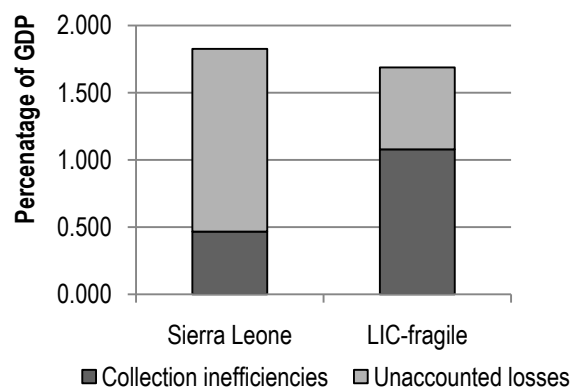


Source: Banerjee and others 2009.

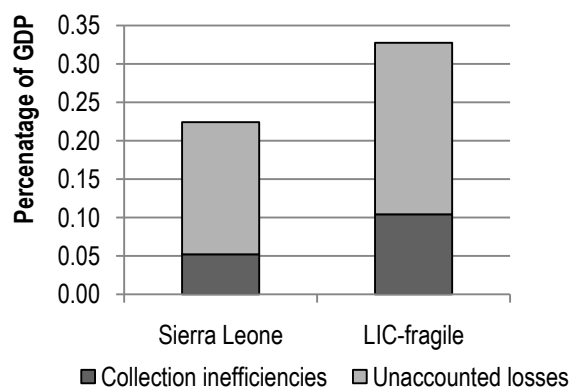
Operational inefficiencies of power and water utilities cost Sierra Leone a further \$39 million a year, equivalent to 2.2 percent of GDP. The annual value of inefficiencies in the power sector (at \$35 million) is significantly higher than of the water sector (at \$4 million). Both power utility NPA and water utility GVWC can benefit from reducing distributional losses and improving bill collection. NPA's 2010 distributional losses of 45 percent are more than four times higher than the best-practice 10 percent benchmark, and result in \$24 million in potential savings. Non-revenue water in the water sector stood at 40 percent of total water production in 2007, twice the best-practice benchmark of 20 percent. Non-revenue water inefficiencies cost Sierra Leone about \$2.9 million a year, equivalent to 0.17 percent of GDP. The power utility collects 88 percent of its billing; if 100 percent of bills were collected, NPA could receive additional \$8 million a year. The water utility collects 77 percent of its billings, thus forsaking \$0.9 million a year. Across both power and water sectors, the burden of utility inefficiencies in Sierra Leone is lower than for the benchmark countries (figure 25).

**Figure 25. Sierra Leone's power and water utilities burden of inefficiency**

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).  
LIC = low-income countries.

## Annual funding gap

Sierra Leone's infrastructure funding gap amounts to \$278 million per year, or about 15 percent of GDP, once inefficiencies are captured. Every infrastructure sector is facing funding gap (table 15). By far the biggest funding gap, even after accounting for efficiency potential, is found in the water sector, followed by that in power, transport, and ICT.

**Table 15. Funding gaps by sector**

US\$ millions					
	ICT	Power	Transport	WSS	Total
Spending needs	(39)	(117)	(120)	(202)	(478)
Existing spending	23	36	60	16	134
Efficiency gains	0	36	18	11	66
Funding gap	(17)	(45)	(42)	(174)	(278)*

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 cannot be assumed that it would be applied toward other infrastructure sectors.

— = data not available.

\* Assuming complete fungibility across sectors

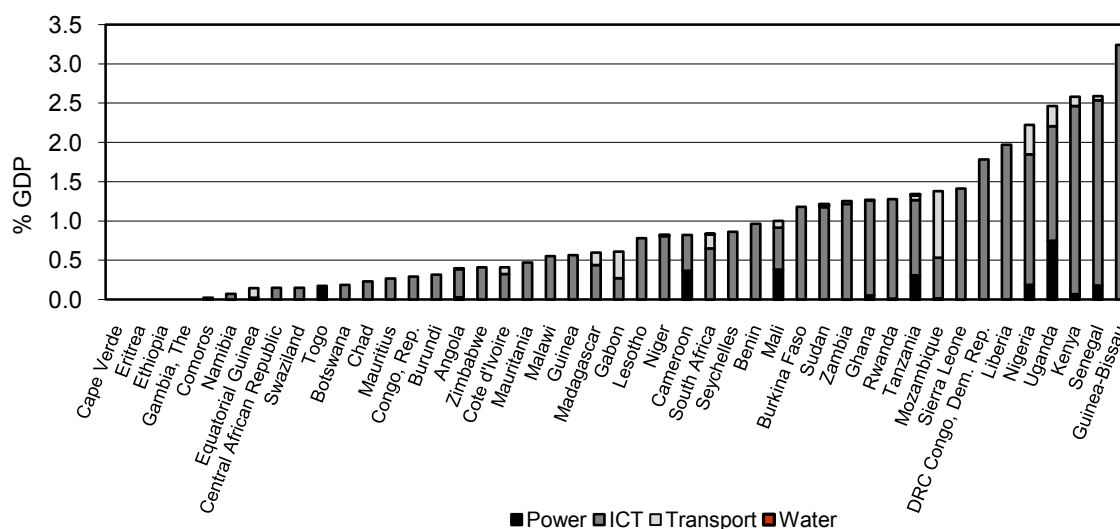
## What else can be done?

The remaining funding gap can be addressed only by raising additional finance or, alternatively, by adopting lower-cost technologies or less-ambitious targets for infrastructure development. Sierra Leone may have realistic prospects for increasing the flow of resources to infrastructure, and to power and water in particular, both from the public and private sectors.

Sierra Leone has attracted significant private finance into infrastructure in comparison with its African peers, but there is room for improvement. Over the early 2000s, Sierra Leone captured private

investment commitments worth around 1.4 percent of GDP, predominantly in the ICT sector. Many of Sierra Leone peers have done significantly worse in this area (figure 26). On the other hand, many countries have done better, and some have attracted private investors not only to ICT but also to other sectors such as transport and power. Countries such as DRC, Liberia, Nigeria, Uganda, Kenya, and Senegal have all captured between 1.8 and 2.5 percent of GDP. For Sierra Leone, private investments into roads and power are in the pipeline, and expectations for increased private participation are high. The country made great progress in improving the investment climate since 2007, reducing business-registration time from one week to two days, cutting registration costs by more than half, simplifying business taxes, and offering better investor protection. In addition, China which is already financing the ICT sector, may be interested in funding other areas of infrastructure. Beyond conventional private investment, Sierra Leone also has the possibility of leveraging infrastructure investments by current and potential future mining concessionaires for the broader benefit of the economy. Doing so will require the development of clear national plans for infrastructure development, and the integration of these plans within the process of designing and negotiating mining concession contracts.

Figure 26. Sierra Leone needs to attract more private investments beyond the ICT sector



Selecting optimal technology choices could reduce the funding gap by three quarters. Adopting lower-cost technologies could substantially reduce the cost of meeting infrastructure targets, and reduce the funding gap. If Sierra Leone could strategically expand its power trade to import from Côte d'Ivoire and eventually Guinea via the CSLG line,<sup>15</sup> it could reduce the resource deficit of the power sector, lowering power needs from \$117 million per year to \$65 million per year and leading to savings of \$52 million annually. Meeting the Millennium Development Goals for water supply and sanitation with lower-cost technologies than previously used (such as standposts, boreholes and improved latrines) could reduce the associated price tag from \$202 million to \$90 million 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 \$120 million to \$64 million. The overall savings from these

<sup>15</sup> Cote d'Ivoire, Sierra Leone, Liberia, Guinea (CSLG) Transmission Interconnector.

measures would amount to \$220 million or as much as 72 percent of the country's total infrastructure funding gap, underscoring the importance of technology choices (table 16).

**Table 16. Savings from innovation**

	Before innovation, US\$ millions	After innovation, US\$ millions	Savings, US\$ millions	Savings as % of sector funding gap	Savings as % of total funding gap
Power trade	117	65	52	73	17
WSS, appropriate technology	202	90	111	64	36
Roads, appropriate technology	120	64	57	134	19
Total	439	219	220	72	72

Sierra Leone will likely need to consider a period longer than a decade to reach the illustrative infrastructure targets here outlined. If the efficiency potential could be fully captured, Sierra Leone could meet the posited targets in about 30 years with current spending levels. However, under business-as-usual assumptions on spending and efficiency, it would take much longer for Sierra Leone to reach these goals.

Within the overall funding envelope, Sierra Leone must carefully prioritize infrastructure investments. Given the magnitude of the country's funding gap and time required to address multifaceted power, water, and transport sector needs, 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 establishing, in the first place, power transmission and distribution lines in order to capitalize on increased power-generation capacity and reduce the grip of insufficient power supply on other infrastructure sectors and overall economic and social development.

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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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## 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 communications 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 as many of the remaining African countries as possible.

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.

