WPS5813

Policy Research Working Paper 5813

Angola's Infrastructure

A Continental Perspective

Nataliya Pushak
Vivien Foster

The World Bank
Africa Region
Sustainable Development Unit
September 2011

Policy Research Working Paper 5813

Abstract

Infrastructure made a net contribution of around 1 percentage point to Angola's improved per capita growth performance in recent years, despite unreliable power supplies and poor roads, which each holding back growth by 0.2 percentage points. Raising the country's infrastructure endowment to that of the region's middle-income countries (MICs) could boost Angola's annual growth by about 2.9 percentage points.

As a resource-rich, postconflict country, Angola has shown an exceptionally strong commitment to financing the reconstruction and expansion of its infrastructure. It has recently expanded its generation capacity, embarked on an ambitious multibillion-dollar road rehabilitation program, begun to make investments aimed at easing congestion at the Port of Luanda, and embarked upon an ambitious rehabilitation program for urban water systems.

Numerous challenges remain, however. Angola needs to upgrade its electricity transmission and distribution infrastructure, expand its urban water-supply system, improve efficiency at the Port of Luanda, and make policy and regulatory adjustments across the board. Angola presently spends around $4.3 billion per year on infrastructure, with $1.3 billion lost to inefficiencies. After taking sectoral allocations and inefficiencies into account, a modest funding gap of $115 million per year remains, which could be largely eliminated by focusing on lower-cost water and sanitation options. Angola's infrastructure needs are manageable relative to its fast-growing economy, as long as the country can address inefficiencies.

This paper is a product of the Sustainable Development Unit, the Africa Region. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at vfoster@worldbank.org.

Angola's Infrastructure: A Continental Perspective

Nataliya Pushak and Vivien Foster

Acknowledgments

This paper draws on contributions from sector specialists from the Africa Infrastructure Country Diagnostic Team; notably, Heinrich Bofinger on air transport, Carolina Dominguez-Torres on water and sanitation, Michael Minges on Information and Communication Technologies, Alberto Nogales on roads, Nataliya Pushak and Cecilia M. Briceño-Garmendia on public expenditure, Rupa Ranganathan on power and ports, and Alvaro Federico Barra on spatial analysis.

The paper is based on data collected by local consultants and benefited greatly from feedback provided by colleagues in the relevant World Bank and IFC country teams; notably, Kai-Alexander Kaiser, Ricardo Costa Gazel, Isabel Marques De Sa, and Fares Khoury.

Contents

List of figures

List of tables

Synopsis

Infrastructure made a net contribution of around 1 percentage point to Angola's improved per capita growth performance in recent years, despite unreliable power supplies and roads each holding back growth by 0.2 percentage points. Raising the country's infrastructure endowment to that of the region's middle-income countries (MICs) could boost annual growth by about 2.9 percentage points.

As a resource-rich postconflict country, Angola has shown an exceptionally strong commitment to financing the reconstruction and expansion of its infrastructure, which was severely damaged and neglected during the country's long civil war. The end of the war coincided with soaring oil prices, bringing in the necessary petroleum revenues to fund such a reconstruction effort. A financing agreement with China, backed by future petroleum revenues, further expanded the resource envelope for investment. Thus, in the space of a few years, Angola has expanded its generation capacity by 400 MW (a 50 percent increase), embarked on an ambitious multibillion-dollar road rehabilitation program, begun to make investments aimed at easing congestion at the Port of Luanda, and begun the rehabilitation program for urban water systems. All these are significant steps.

Numerous challenges remain, however. Many of them involve going beyond investment to strengthen and optimize the policy and institutional environment for infrastructure provision.

Despite the expansion of power-generation capacity, deficient transmission and distribution infrastructure prevents electricity from flowing to customers, and the reliability of supply remains very poor. A complex web of subsidies and operational deficiencies makes Angola's power sector among the least efficient in Africa, hemorrhaging resources equivalent to 1.6 percent of gross domestic product (GDP).

Angola's water utilities have been unable to cope with burgeoning urbanization to a point where about 40 percent of the urban population relies on largely untreated water supplied by vendors. This has disastrous public health consequences, leaving Angola with one of the highest rates of diarrheal disease in the world. For reasons that seem difficult to justify, Angola's utility tariffs are among the highest in Africa, at $2.30 per cubic meter of water, while vendors charge $4–$20 for untreated supplies.

Serious congestion problems at Angola's main international gateway—the Port of Luanda—have made its facilities so costly and frustrating to use that traffic is increasingly diverting to Walvis Bay in Namibia, more than 2,000 kilometers distant.

Addressing Angola's infrastructure challenges and providing a basic infrastructure platform within the course of a decade would require sustained expenditure of $2.1 billion per year over the next decade. Some 70 percent of the required spending is associated with capital investments, with the remaining 30 percent is needed for operational and maintenance spending. Almost one-third of the total spending needs are related to the power sector, followed by the water supply and sanitation sectors. The effort that Angola would need to make to meet its infrastructure needs is equivalent to 7 percent of its GDP, significantly below the average for Sub-Saharan Africa (14.5 percent).

Angola already spends around $4.3 billion per year on infrastructure, equivalent to 14 percent of its GDP. Spending is about double estimated needs due to the fact that the government is pursuing an

accelerated program of infrastructure reconstruction and hence is spending a massive $2.9 billion a year in that sector alone. As a result, Angola's capital spending on infrastructure is heavily skewed toward transport, which accounts for some 70 percent of the total. In contrast to many of its peers, and reflecting buoyant petroleum revenues, Angola's infrastructure investment is predominantly funded by domestic fiscal resources. China is by far the most significant source of external finance, with only modest private capital inflows and negligible overseas direct investment (ODA).

Remarkably, some $1.3 billion is being lost to inefficiencies of various kinds, equivalent to almost 5 percent of GDP. By far the largest culprit is the power sector, which hemorrhages $700 million annually, primarily as a result of massive underpricing ($475 million) as well as some other factors. The underexecution of capital budgets is also exceptionally high in Angola, at $573 million annually, and primarily reflects difficulties in the implementation of the country's huge road investment program (accounting for $401 million of this total). By taking suitable policy measures, Angola could recapture these lost resources for investment in its infrastructure.

Given the urgent pressure to reconstruct Angola's infrastructure platforms, there is some evidence that decisions have not always been optimal. For example, the expansion of generation capacity has not been matched by reinforcements in transmission and distribution that would allow the power to flow through to end users. And the scale of Angola's road investment program seems to have outstripped the implementation capacity of the key sector institutions. There is also evidence that the water and sanitation sector may not yet have received as much attention as it deserves.

After taking sectoral allocations and inefficiencies into account, a modest funding gap of $115 million per year remains, almost entirely relating to the achievement of the Millennium Development Goals (MDGs) for the water and sanitation sector. Nevertheless, this funding gap could be largely eliminated by focusing service expansion on lower cost water and sanitation options. Furthermore, with such a high spending envelope overall, there looks to be some scope for the reallocation of resources toward water and sanitation.

While Angola's infrastructure reconstruction needs are large in absolute terms, they look manageable relative to the size of the country's fast-growing economy. Moreover, Angola has amply demonstrated its commitment to channeling significant volumes of petroleum rents toward infrastructure development. Consequently, Angola is one of a very few African countries that does not face a significant infrastructure funding gap, as long as the country is able to make headway in reducing its massive efficiency gap. In the medium term, Angola could potentially attract much more private finance for infrastructure than it has to date, thereby helping to liberate public funds for other pressing social needs.

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 Angola. The results have been presented in reports covering different areas of infrastructure—information and communication technology (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 Angola, allowing the country's infrastructure situation to be benchmarked against that of its African peers. Given that Angola is a low-income resource-rich country, two sets of African benchmarks will be used to evaluate Angola's situation: fragile low-income countries and resource-rich countries. Detailed comparisons will also be made with immediate regional neighbors in the Southern African Development Community (SADC).

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 for Angola runs from 2005 to 2009. But financial data for comparator countries typically cover an earlier period, 2001–06, and are averaged to smooth out fluctuations, while technical data are reported for 2006. Second, in order to make comparisons across countries, it was necessary 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.

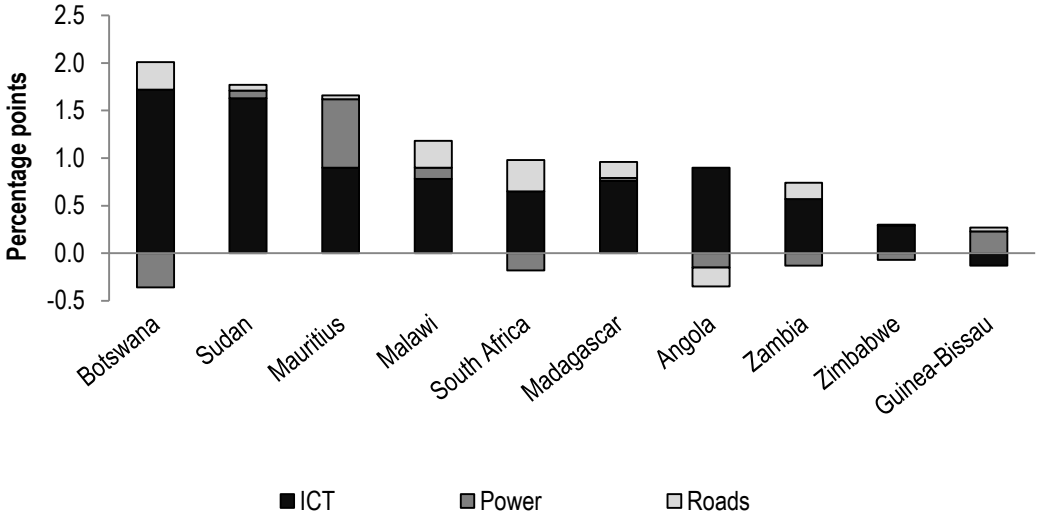
Why infrastructure matters

In recent years, Angola's economy has been among the fastest growing in Africa. Looking ahead, the country's GDP is projected to rise by 6.5 percent in 2011, with oil-sector growth of 3.8 percent and non-oil-sector growth of 8.1 percent (IMF 2011). A 27-year war that ended in 2002 ravaged the country and destroyed most of its economic infrastructure. Many roads, rails, and bridges were mined and obliterated; surviving infrastructure is dilapidated after years of neglect. Following the war's end, the government turned its attention to the reconstruction of the country. And indeed, for the period 2003 to 2007, improvements in infrastructure added 1 percentage point to the per capita growth rate, which is substantial even if not as high as many countries in Africa (figure 1a). This boost to growth came predominately from the ICT revolution. Meanwhile, Angola's road and power sectors held back the per capita growth rate by 0.2 percentage points each over the same period.

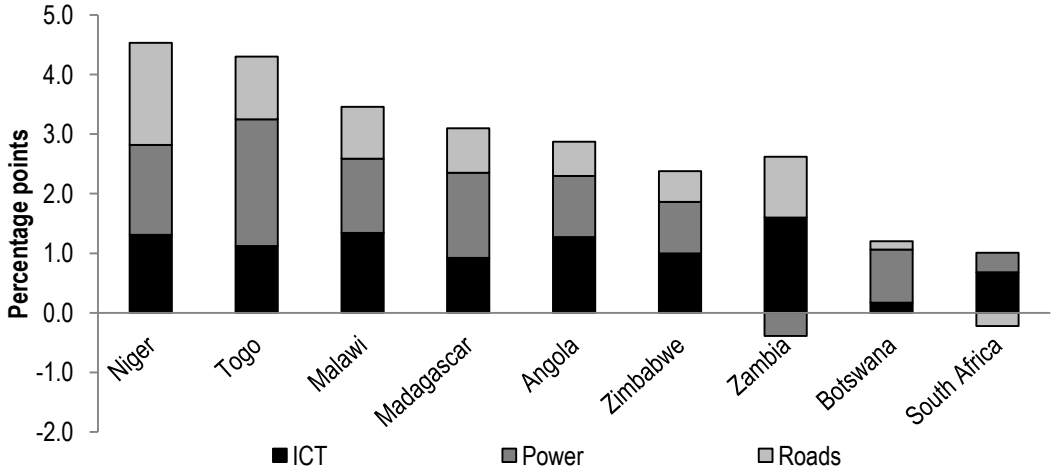
Looking ahead, simulations suggest that if Angola's infrastructure could be improved to the level of the African leader, Mauritius, annual per capita growth rates would be 2.9 percentage points higher than they are at present. This impact would come from an increase in power-generating capacity and improved road infrastructure (figure 2b).

Figure 1. Infrastructure's contribution to annual per capita economic growth, actual and potential

a. Infrastructure's contribution between 2001 and 2005



b. Potential contributions



Source: Calderón 2009.

The state of Angola's infrastructure

Angola's population of around 18.5 million is unequally distributed across the country. The most densely populated areas surround the capital Luanda and a handful of other major cities. Overall, the coast and the southern and eastern parts of the country are less populated than the interior highlands (figure 2a). The spatial distribution of population is influenced by the presence of vast natural resources and agricultural potential. Angola's interior highlands (figure 2c), abundant in water resources, are well suited for agriculture. The south and southeast are dry savanna; the far north is covered by rain forest. Angola's oil fields are located in the coastal region in the north and west. Angola is rich in various

minerals that are found in the western and central parts of the country (figure 2d). The distribution of Angola's infrastructure networks broadly follows the pattern of population and natural resource distribution, with a greater density of transport, power, and ICT infrastructure along the western half of the country (figure 2e, 2f, 2g, 2h).

Angola has quite an extensive road network. The main links in the western half of the country appear to be in reasonable condition, while roads on the eastern side are sparser and more dilapidated. In terms of regional integration, Angola's most salient international road corridor connects the country to the Democratic Republic of Congo (DRC) and Zambia in the east, although the infrastructure is in poor condition.

Angola lacks anything that could be described as a national power grid, let alone regional interconnections. There are a number of isolated power systems, with minimal local transmission links, although a backbone is planned to link the main power assets in the north and south of the country. Angola's national fiber-optic backbone is already much further developed than its power grid, linking up all the major towns on the western side of the country. Hydraulic infrastructure and irrigation is conspicuously absent.

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

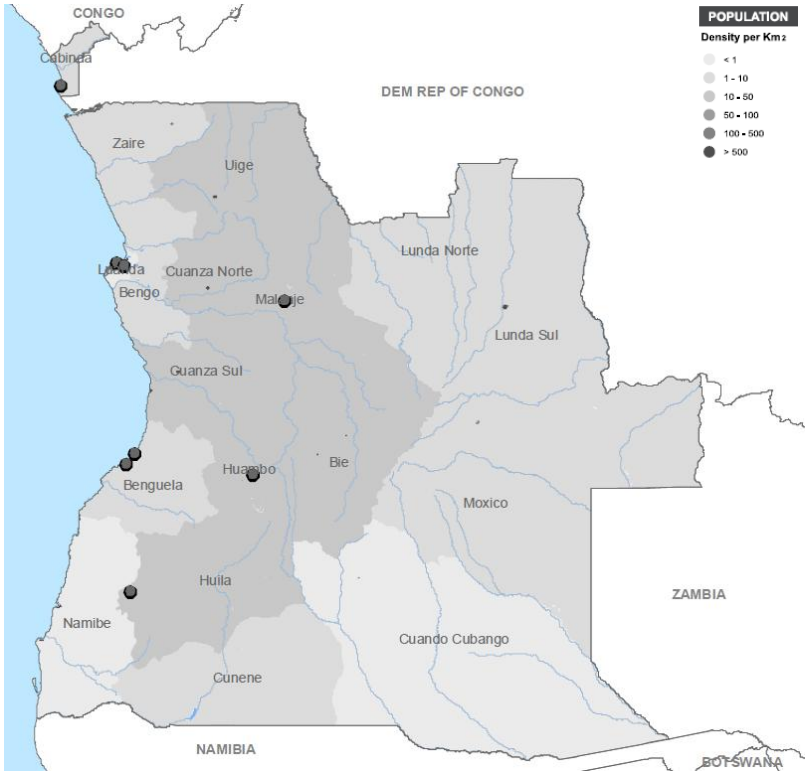
Table 1. The achievements and challenges of Angola's infrastructure sectors

	Achievements	Challenges
Air transport	Significant growth in seats.	Increasing competition in the sector. Improving safety oversight.
ICT	Improved access to ICT. Sector reform.	Increasing competition in the sector. Increasing internet penetration.
Power	Major expansion in generation capacity and rehabilitation of existing power assets. Decreased delay in connecting to grid.	Increasing low power access rates. Improving power supply reliability. Decreasing cost of connecting to grid. Developing transmission infrastructure. Raising tariffs to cost recovery level. Improving operational efficiency of utilities.
Ports	Recent expansion and rehabilitation.	Decreasing congestion. Boosting efficiency and performance.
Rails	A number of railways exist.	Rehabilitating 70 percent of the rails. Increasing freight and labor productivity. Introducing private participation.
Roads	Huge investment program.	Improving quality and density of roads. Establishing operational road fund and fuel levy. Improving the condition of regional corridor, as well as delays and cost of border crossing.
Water and sanitation	Reduced reliance on open defecation.	Decreasing high rates of water-borne disease. Improving water supply systems. Improving efficiency of the utilities. Raising tariffs to cost-recovery levels.

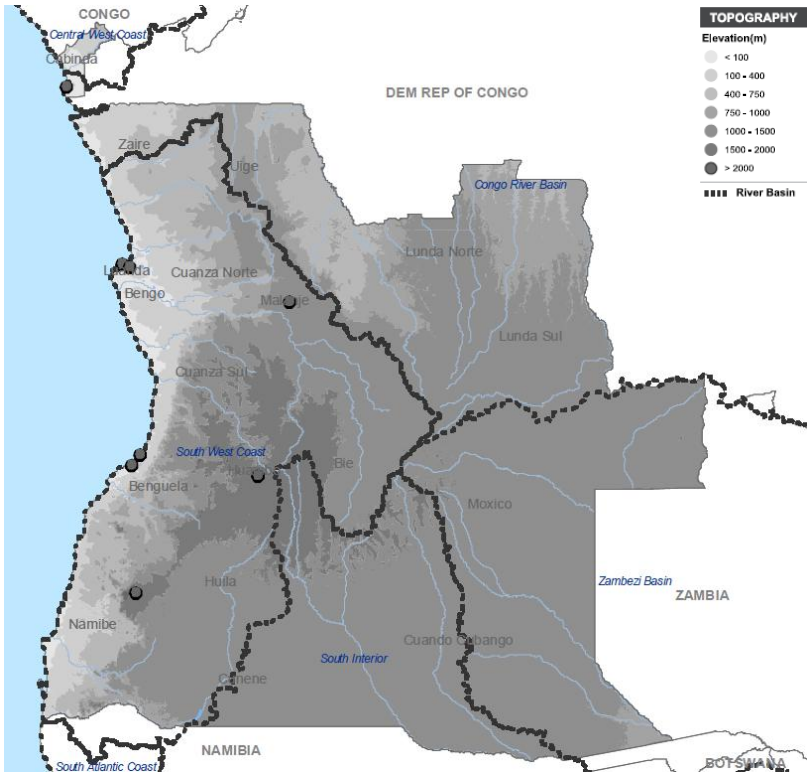
Source: Authors' own elaboration based on findings of this report.
Note: ICT = information and communication technology.

Figure 2. Angola's infrastructure networks align with population density and natural resource concentrations

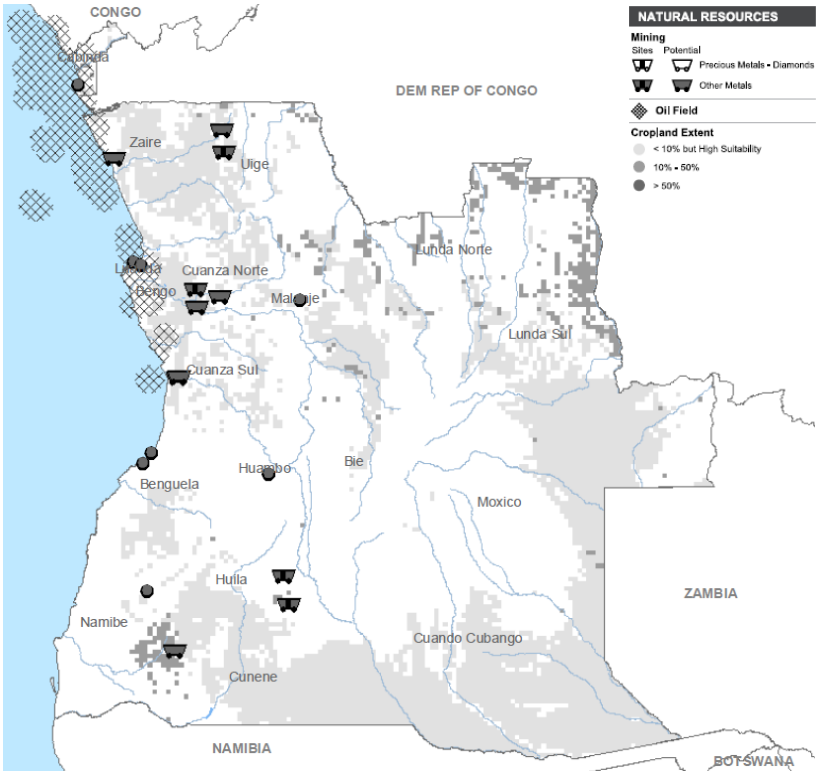
a. Population



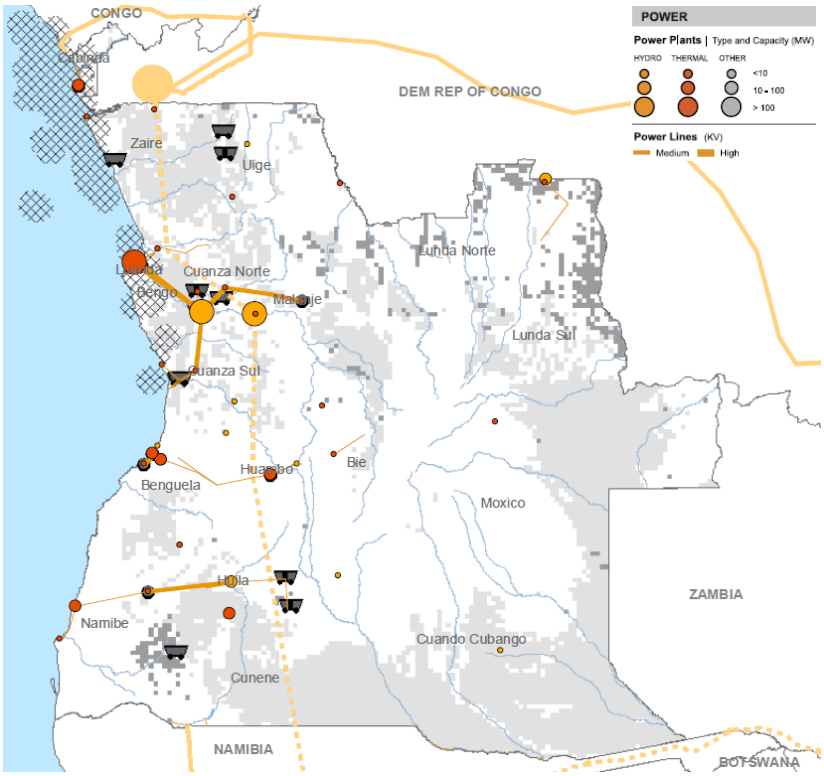
b. Topography



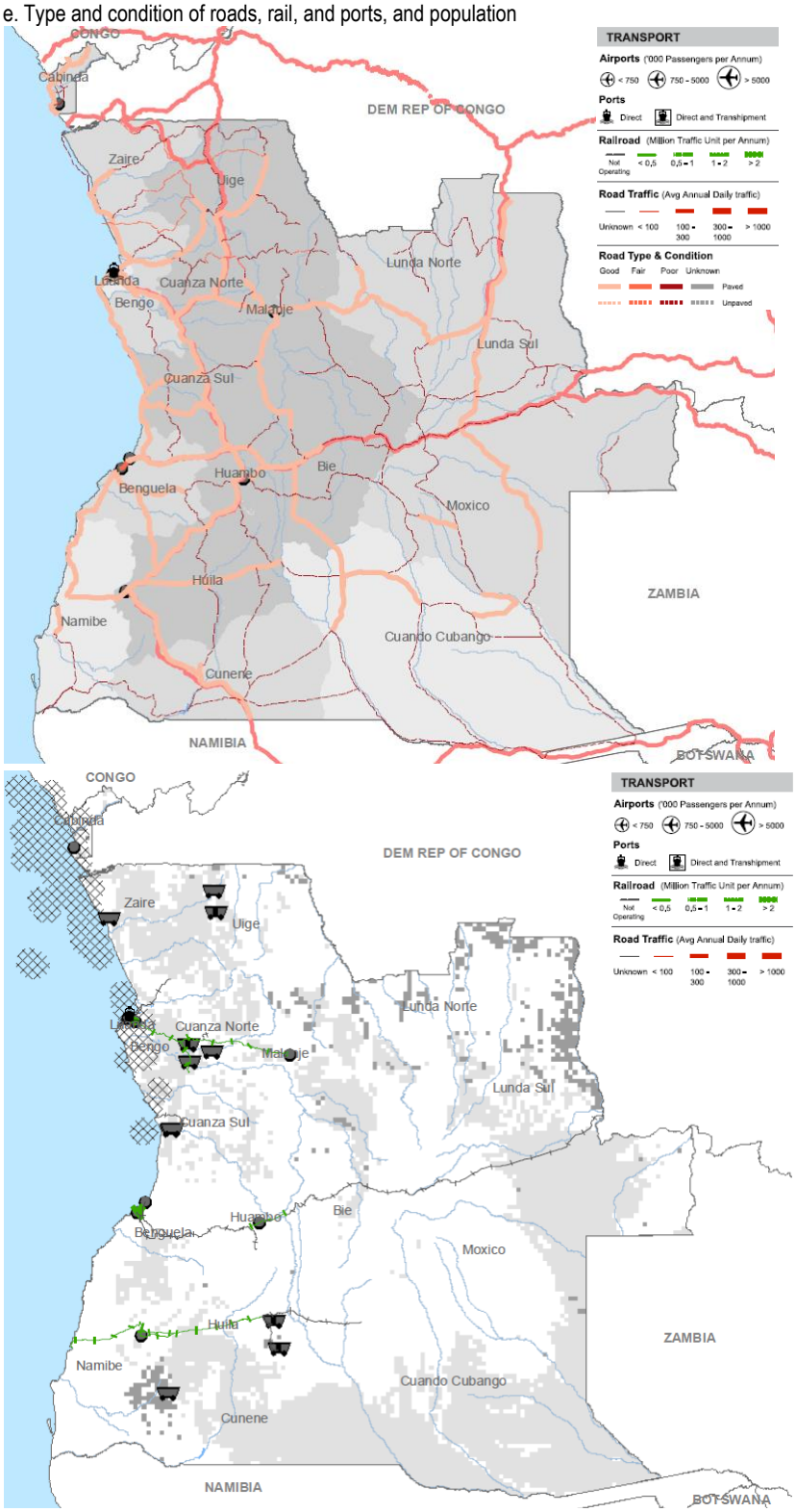
c. Natural resources



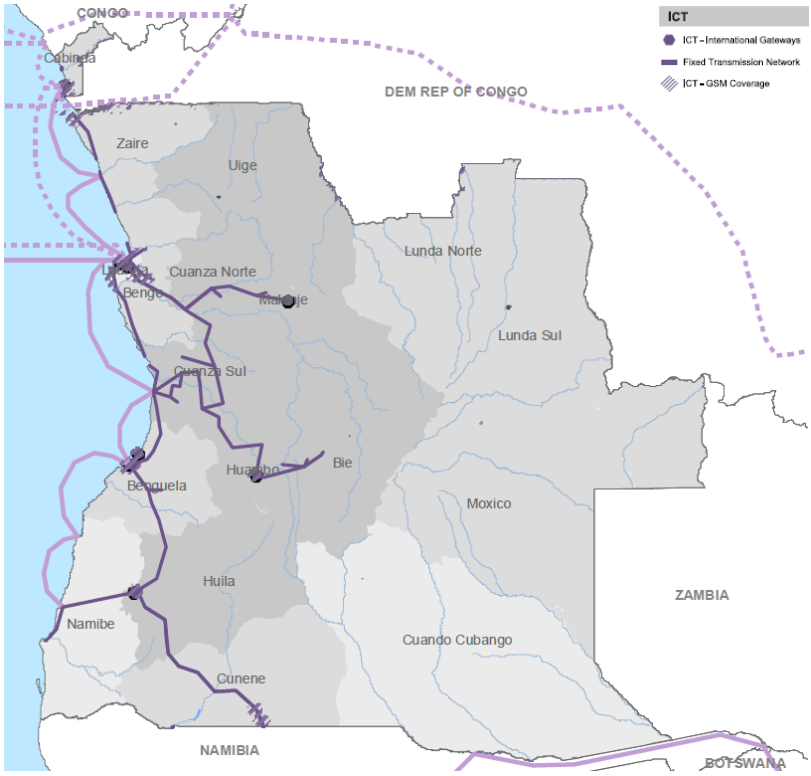
d. Power, and natural resources



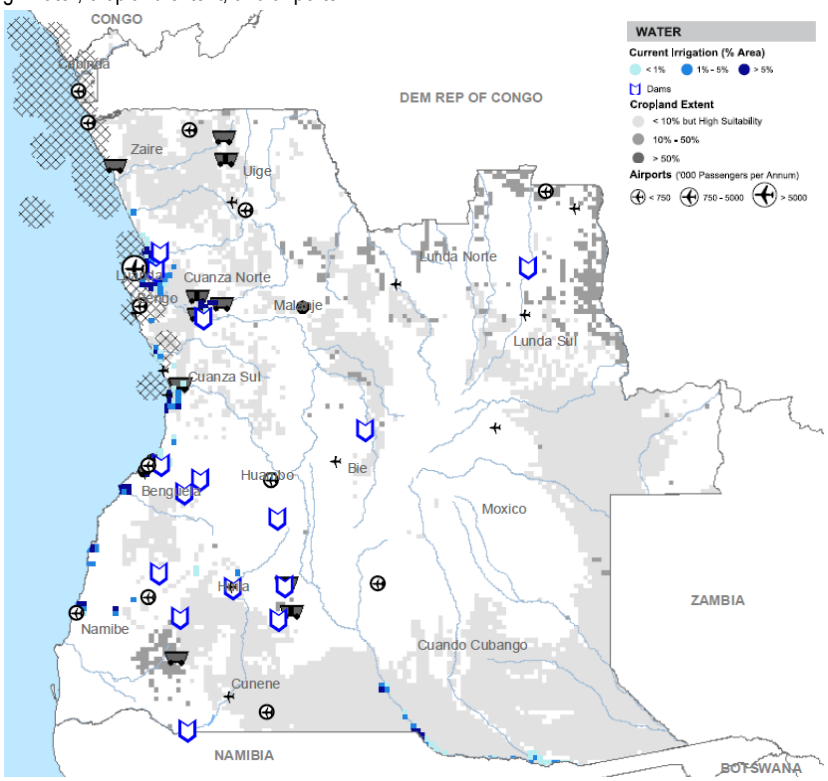
e. Type and condition of roads, rail, and ports, and population



f. ICT and population



g. Water, cropland extent, and airports



Source: AICD Interactive Infrastructure Atlas for Angola (www.infrastructureafrica.org/library/doc/698/angola-interactive-infrastructure-atlas).

Power

Achievements

Angola has been making substantial investments in the power sector since 2002 to restore and reconstruct the infrastructure that was destroyed during the civil war. Recent estimates from Empresa Nacional de Electricidade (ENE)—Angola's major power-generating company—indicate that these investments led to an increase in generation capacity from around 830 MW in 2002 to over 1,200 MW in 2008 (World Bank 2010a) (table 2). In terms of per capita generating capacity, Angola fares better than the average African fragile state or resource-rich country. Angola has 70 MW per million people compared to resource-rich or low-income fragile countries, which have only 43 or 46 MW per million people, respectively (table 1).

Furthermore, a relatively high share of Angola's generation capacity is actually operational. In 2008 almost 1,000 MW or 80 percent of the installed power generation capacity was operational. This is higher, on average, than resource-rich countries, where roughly 66 percent was operational and generating power. Thus, Angola has been able to rapidly ramp up its power production over the past decade. This increased generation and operational capacity facilitated a 13 percent average annual growth in power production between 1999 and 2008. As of 2008 around 4,133 GWh of power was produced, a steep increase compared to 1999 production levels of 1,295 GWh (World Bank 2010a).

The delay involved in obtaining an electricity connection has fallen dramatically since 2007. Investment climate surveys in 2007 reported that firms encountered delays of over two months in Luanda and over six months in other parts of Angola in order to obtain a new electricity connection (World Bank 2007b). But Angola has achieved tremendous progress in this area—firms in 2010 recorded only a seven-day delay, on average, in obtaining a power connection (World Bank 2010b).

Challenges

But increased investments in power infrastructure have not necessarily translated into widespread electrification. As of 2008 only a little more than 30 percent of Angola's population benefited from access to power, lower than the 46 percent average for the nation's resource-rich African peers. No disaggregated data are available on the levels of rural versus urban access in Angola (World Bank 2010a), but it is known that Luanda consumes around two-thirds of the nation's electricity, suggesting relatively high access in the urban and peri-urban areas of the capital. Further, at least 85 percent of Luanda's municipalities indicate that they use electricity for lighting, corroborating that the availability of electricity in urban areas is high (World Bank 2005). It is estimated that about half of the connected residential consumers in Luanda are served by informal providers who pay a bulk tariff of around US$0.04 cents per kilowatt-hour to the utility and resell to consumers at approximately three times this price. Given the limited attention given to rural electrification to date, rural access can be expected to be quite low.

Table 2. Benchmarking Angola's power infrastructure

	Units	Angola	Low-income, fragile	Low-income, nonfragile	Middle-income	Resource rich
Access to electricity, national	% of population	30	15	33	50	46
Installed generation capacity per capita	MW per million people	70	46	20	799	43
Firms that find power a constraint for business	% of firms	46	67	52	31	56
Firms with own generator	% of firms	68	33	41	18	63
Outages per year	days	36	11.1	41	5.6	15
Outages, value lost, annually	% of sales	13	5	6	2	7
Collection rate, reported by utility, electricity	% of billing	42		92	91	70
Cost-recovery ratio, historical	%	15	85	89	85	97
Revenue per unit	US cents per KWh	2.5	3	14	13	13
System losses	% of generation	18–23	24	24	20	52
Total hidden costs	% of revenue	375	544	69	0	168

		Angola	Predominantly hydropower	Other developing countries
Effective power tariff	Residential at 100 kWh	3.72	10.27	5.0–10.0
Effective power tariff	Commercial at 100 kWh	4.88	11.73	
Effective power tariff	Industrial at 50.000 kWh	4.88	11.39	

Source: Data for aggregates for low-income, middle-income, and fragile states based on data for 2005 unless indicated otherwise (www.infrastructureafrica.org/tools/data). Data for access to electricity, installed and operational capacity, collection rate, and system losses provided by World Bank specialists (2011). Data on revenue per unit, cost recovery, and hidden costs based on information from World Bank (2010a). Firms that find power to be a constraint taken from World Bank (2007b). Value lost and outages per year is from enterprise surveys and is from World Bank (2010b).

Note: kWh = kilowatt-hour; MW = megawatts

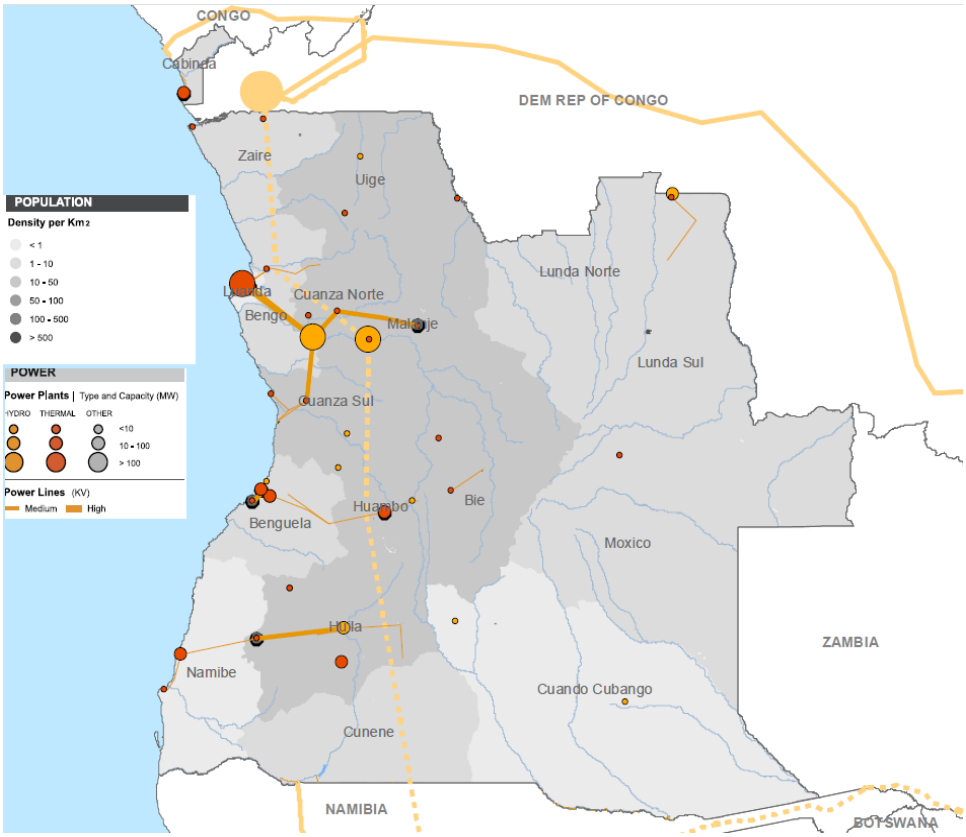
Additionally, even though power availability has improved, service continues to be relatively unreliable, with growing recourse to emergency rentals to safeguard supply. Despite the steep growth in power production, World Bank investment climate surveys in 2007 reported that around 84 percent of firms experience power outages, lasting around 21 hours, on average 8 times a month. Large firms indicated a more acute problem, with at least 16 outages a month; the manufacturing sector overall was the worst affected. The problems were reportedly worse outside Luanda (World Bank 2007b). In 2010 results from the enterprise showed marginal improvement, with Angolan firms enduring a modestly better 6 outages a month lasting around 14 hours (World Bank 2010b). Overall 36 days were spent without electricity, twice the time endured by other resource-rich African countries.

Inadequate power supply is a huge impediment to private sector activity. In 2007 at least 68 percent of Angolan firms surveyed in the larger cities had their own generation capacity to compensate for intermittent grid supply. Outside of Luanda, 90 percent of firms owned their own generators, producing almost a third of their own power needs. Recent estimates suggest that at least 900 MW of self-generation capacity has been put in place by Angola's firms. This is not far short of ENE's generation capacity, and much higher than in many other resource-rich countries. Around 5 percent of firms' annual turnover was lost due to electricity shortages, which is typical of resource-rich countries in Africa (World Bank 2007b). In 2010 the impact of unreliable power supply was reportedly worse, such that the value lost due to erratic power supply had increased substantially to 13 percent, much higher than for the peer group (World Bank 2010b). Self-generation by firms is largely diesel-based and can cost as much as $0.40 per kilowatt-hour

(kWh) to operate in spite of the relatively low diesel prices in Angola (table 2)—or roughly twice ENE's production costs. Most of the time, self-generation is operated on stand-by mode, as a backup for frequent outages. To ensure steady supply, however, it is not uncommon to have self-generation operating continuously, thereby adding significantly to the costs of power.

Further, while the time taken to obtain an electricity connection has reduced in recent years, new connections still impose a large cost to firms in Angola. The cost for firms to obtain an electricity connection is ten times the country's per capita income. Although these costs are lower than elsewhere in Africa, they nonetheless represent a significant burden on firms (World Bank 2010c).

Figure 3. Angola's fragmented power infrastructure network



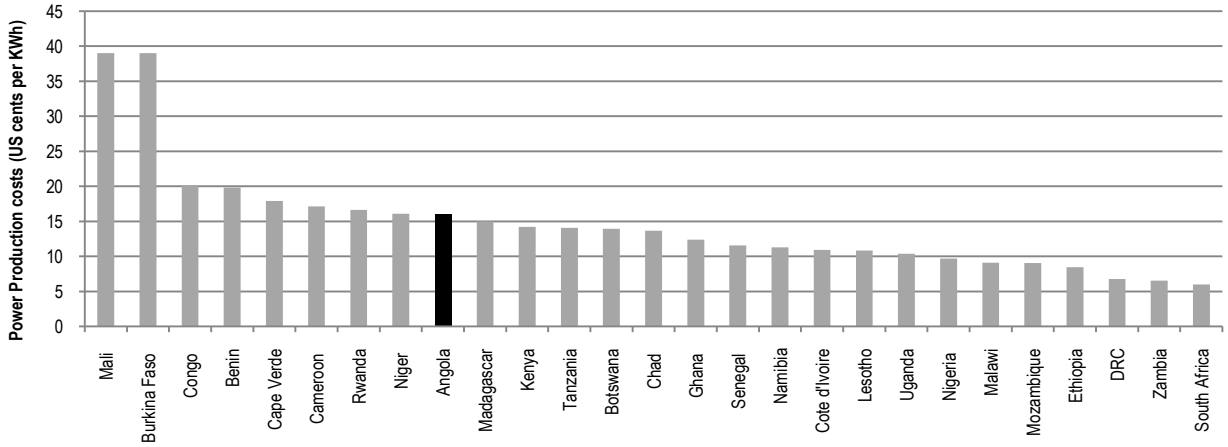
Source: AICD Interactive Infrastructure Atlas for Angola (www.infrastructureafrica.org/library/doc/698/angola-interactive-infrastructure-atlas).

Poor access and erratic power supply can be attributed to the fragmented nature of Angola's power system as well as deficiencies in existing transmission and distribution infrastructure. Angola has three major electric systems that are not interconnected, each operating independently. The north, south, and central systems each have their own networks linking generation sources to load centers (figure 3). The northern system, serving Luanda, accounts for over 80 percent of the country's generation assets, while the central and southern systems have less than 10 percent each. While blackouts are commonplace in Luanda, they are even more so in the central and southern systems. Ironically, the north actually has a surplus of energy—its blackouts are less due to lack of energy than to operational challenges associated with managing the system during peak-load periods. The absence of a national transmission backbone

prevents surplus power in the north being wheeled to the center and south of the country. This problem of regional imbalances in power supply and demand will only become more accentuated as new generation capacity comes on stream, underscoring the importance of improving the transmission network.

Power production costs, at $0.16 per kWh, are relatively high by the standards of neighboring countries in southern Africa (figure 4). The higher costs in Angola, particularly when compared to its neighbors, are partly explained by the country's reliance on oil-based generation for about 40 percent of its production, at a cost of around $0.30 per kWh.

Figure 4. The costs of power production in Angola are relatively high

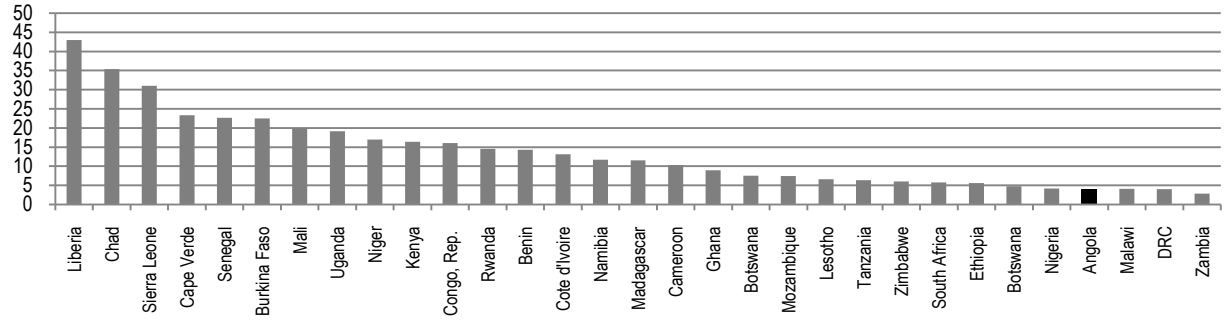


Source: Derived from Briceño-Garmendia and Shkaratan (2010-); based on data from 2005–06. Angola costs derived based on IFC staff estimates and are for 2010.

Note: DRC = Democratic Republic of Congo; kWh = kilowatt-hour.

Meanwhile, tariffs, at $0.042 per kWh, are among the lowest in Africa, covering only a small fraction of costs (figure 5). Power tariffs in Angola are low even by the standards of other hydropower-dependent countries, whose power tariffs typically stand closer to $0.10 per kWh. Angola has not revised its power tariffs since 2004. These low power prices, although meant to benefit the poor, largely subsidize the better-off minority that live in larger cities covered by the grid, while the poor remain unconnected.

Figure 5. The average Angolan consumer pays extremely low prices for power



Source: Derived from Briceño-Garmendia and Shkaratan (2010); Angola data from IFC staff estimates and for 2011.
Note: DRC = Democratic Republic of Congo.

In part due to these low tariffs, Angola's power sector faces a dire financial situation. The two central actors in the sector are the power utilities ENE and Empresa de Distribuição de Electricidade (EDEL). ENE produces power and distributes around 30 percent of it in the south and central region. EDEL buys power from ENE and distributes the remaining 70 percent in the north of the country. Both companies receive direct subsidies from government as well as implicit subsidies through low fuel prices. Angola charges very nominal prices for fuel when compared to other oil-producing nations or to its oil-importing neighbors (table 3). Recent data on the magnitude of direct subsidies are not available. But the historical record shows that the power utilities were unable to attain financial sustainability despite the major subsidies they were receiving. In 2000 ENE received a direct subsidy of $150 million plus fuel subsidies that together covered 25 percent of its costs, and *still* registered losses of over $4 million. In 2001 EDEL's revenues from sales did not cover the cost of energy purchase from ENE even after the direct subsidy from the government was included, resulting in financial losses of $15 million.

Table 3. Angola pays very little for diesel per liter compared to several oil-producing neighbors

US cents/liter	2004	2006	2008
Angola	29	36	39
Cameroon	83	107	104
Congo, Rep. of	59	67	57
Namibia	65	87	88
South Africa	80	84	45

Source: GTZ 2009.

One problem is the cumulative underpricing of energy along the production chain.

Cost-recovery challenges plague Angola's power system (table 4). ENE produces power at $0.16 per kWh. Around 70 percent of the power is sold to EDEL at a bulk supply tariff of $0.022 per kWh, recovering only 14 percent of production costs. The other 30 percent of ENE's power is distributed to customers in the central and southern areas of Angola at a price of $0.042 cents per kWh, recovering only 26 percent of the costs of production. For EDEL the cost of purchase and

Table 4. Power underpricing per kilowatt-hour (US cents per kWh)

	Cost of production/purchase	EDEL	Consumer
ENE	16	2.2	4.2
Underpricing by ENE		13.8	11.8
EDEL	7		4.2
Underpricing by EDEL			2.8

Source: AICD estimates based on World Bank (2010a) and IFC staff estimates.

transmission and distribution of power amounts to approximately $0.07 per kWh, yet the tariff charged to the final consumer is $0.042 per kWh, recovering only 60 percent of costs (table 4).

Furthermore, distribution losses are substantial. Estimates of ENE's technical and nontechnical losses are 18–23 percent. Losses are much worse for EDEL, totaling 36 percent, of which 15 percent is attributable to technical losses and 21 percent to nontechnical losses. Nontechnical losses are largely due to pilfering through illegal connections, lack of meters, and faulty billing systems. Recent estimates suggest that overall losses were reduced from 40 percent in 2006 to around 32 percent in 2010. While this represents important progress, losses remain very high in absolute terms.

Table 5. Bill collection in Angola in 2008

	ENE	% of ENE sales	EDEL
Collections from consumers (%)	71	30	68
Collections from EDEL (%)	27	70	

Source: World Bank 2010a.

In addition, the nonpayment of power bills is rampant. The pervasive culture of nonpayment found in Angola seriously impedes financial performance. The government estimates that, on average, only 40 percent of the energy generated is billed, and that only 42 percent of what is billed is collected. This collection rate is exceptionally low compared to the African peer group (table 5). While EDEL's collection performance used to be much worse than ENE's, it has improved in recent years to a point where the two companies have largely converged (table 7). Ironically, the collection ratio of what the utilities charge their end consumers, at around 70 percent, is much higher than the collection ratio between ENE and EDEL, which stands at only 27 percent (table 5). The trail of arrears between the various entities involved in the power sector starts with nonpayment by EDEL's clients, leading to nonpayment for power purchased by EDEL from ENE, leading to nonpayment of fuel purchased by ENE from the national oil company SONAGOL.

In total, inefficiencies contributed to a combined financial hemorrhage of $618 million for ENE and EDEL in 2009, with underpricing, distribution losses, and low collection ratios accounting for over $550 million of that total. Hidden costs in the power sector have been increasing steadily since 2007. ENE accounts for the lion's share of the hidden costs—almost $500 million in 2009, or 0.7 percent of GDP. The largest source of hidden costs for ENE is the underpricing of power, both to EDEL and to its own consumers. The failure of EDEL to make timely payments on its bills further augments ENE's hidden costs (table 6). EDEL's hidden costs amounted to $120 million a year in 2009, equivalent to 0.2 percent of GDP (table 7). Once again these costs are largely driven by underpricing, and to a lesser extent system losses.

Table 6. Large hidden costs associated with ENE

	Power billings (consumers + EDEL) (Gwh/ year)	System losses in distribution to consumers (%)	Collections (%)		Cost-recovery benchmark ($/kWh)	Average revenue (US$/ KWh)		Average effective tariff (US$/kWh)		Total hidden costs ($ million/ year)	Total hidden costs (% revenues)
			Consumers	EDEL		Consumers	EDEL	Consumers	EDEL		
2007	2,374	23	70	27	0.16	0.04	0.02	0.04	0.02	366	542
2008	2,920	23	70	27	0.16	0.04	0.02	0.04	0.02	450	542
2009	3,236	23	70	27	0.16	0.04	0.02	0.04	0.02	498	542

Source: Derived based on Briceño-Garmendia, Smits, and Foster (2009); Angola calculations derived from IFC staff estimates and World Bank (2010a).

Note: kWh = kilowatt-hour.

Table 7. Increasing hidden costs at EDEL in terms of monetary value

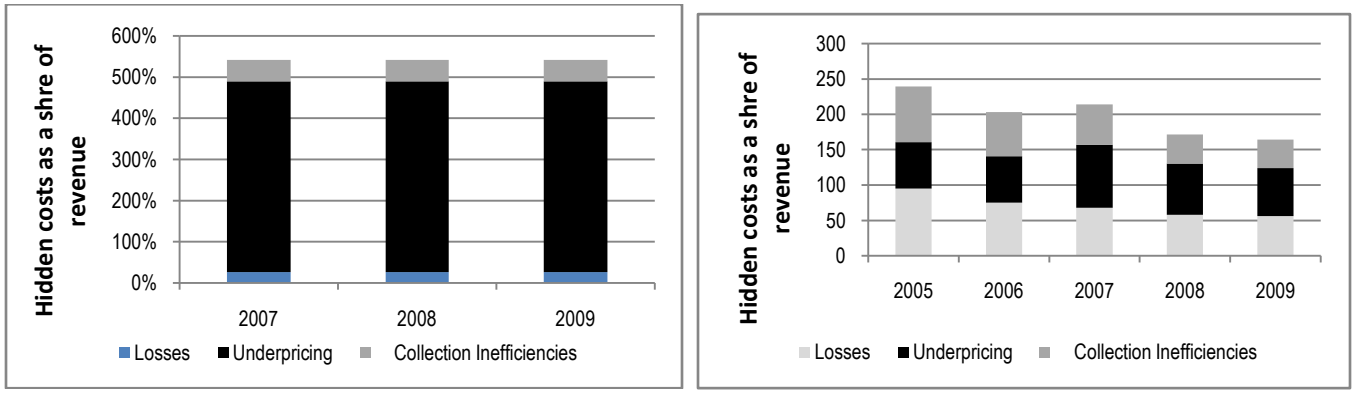
	Power billings (GWh/year)	System losses (%)	Implicit collection ratio (%)	Cost-recovery benchmark ($/kWh)	Average revenue ($/kWh)	Average effective tariff ($/kWh)	Total hidden costs ($ million/year)	Total hidden costs (% revenues)
2005	1001	46	54	0.06	0.02	0.04	59	239
2006	1252	40	61	0.06	0.03	0.04	67	203
2007	1475	36	61	0.07	0.03	0.04	91	214
2008	1814	36	68	0.07	0.03	0.04	102	171
2009	2200	36	68	0.06	0.03	0.04	120	164

Source: Derived based on Briceño-Garmendia, Smits, and Foster (2009); Angola calculations derived from IFC staff estimates and World Bank (2010a).

Note: kWh = kilowatt-hour; GWh = gigawatt-hour.

Figure 6. Massive hidden costs in the power sector in Angola

a) ENE **b. EDEL**

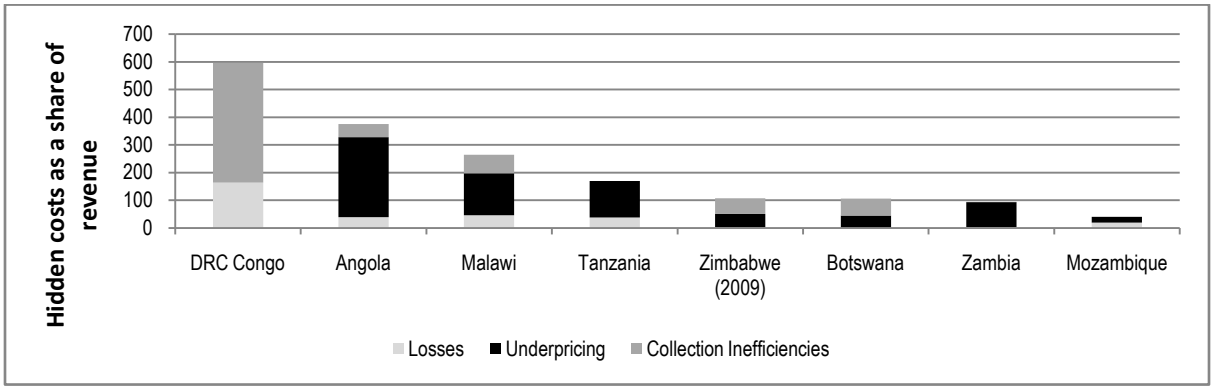


Source: AICD calculations.

The magnitude of hidden costs in Angola's power sector, at about 400 percent of revenues, is second only to the Democratic Republic of Congo (figure 7). ENE's hidden costs are 542 percent of its revenue and EDEL's hidden costs are 164 percent of its revenue (figures 6a and 6b). In the Democratic Republic

of Congo, hidden costs reach 600 percent of sector revenues, but for most other countries in the region, hidden costs rarely exceed 200 percent of sector revenues.

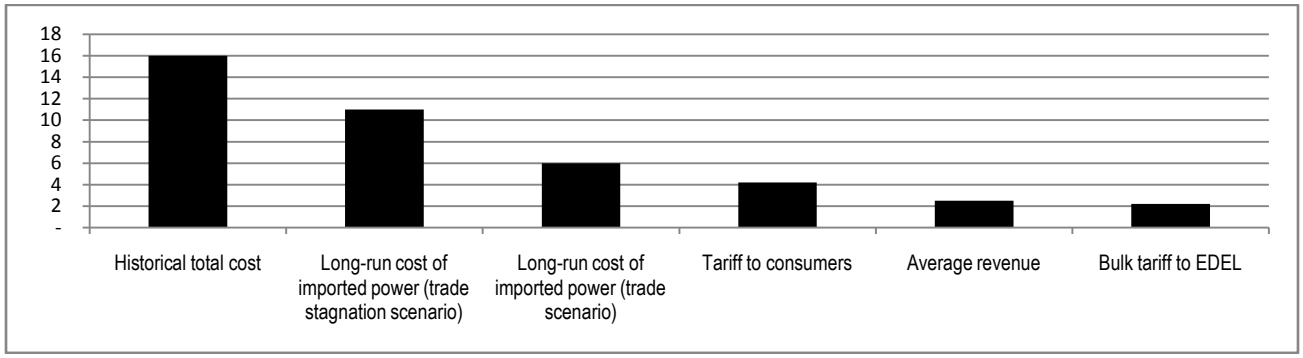
Figure 7. The hidden costs of Angola's power sector are among the worst on the continent



Source: Briceño-Garmendia, Smits, and Foster 2009.
Note: DRC = Democratic Republic of Congo.

Although Angola's power costs can be expected to fall in the medium term, today's tariffs will nonetheless need to increase if the sector is to reach financial equilibrium. Angola faces relatively high power costs as of today, but there is reason to believe these costs will fall over time. Angola still has vast unexploited hydropower potential as well as abundant gas reserves estimated at 10 trillion cubic feet (World Bank 2010a). Both of these primary sources of energy could be harnessed to produce power at a much lower cost than today. Backing up Angola's largely hydro-based system with gas-fired generation, as opposed to the current oil-fired generation, would prove to be a great deal more cost effective. In addition, as Angola develops its national power grid it will be in a position to interconnect with the Southern Africa Power Pool, opening up access to a range of other cost-effective sources of power, most notably the Inga power scheme in the Democratic Republic of Congo. Even taking all of these factors into account, Angola's long-run marginal cost of power could still be expected to amount to around $0.11 per kWh, which is almost three times today's tariffs. This points to the importance of moving tariffs on to a more sustainable trajectory.

Figure 8. Cost recovery will remain a questionable prospect even in the future



Source: AICD calculations based on Rosnes and Vennemo (2009); IFC staff estimates; World Bank (2010a).

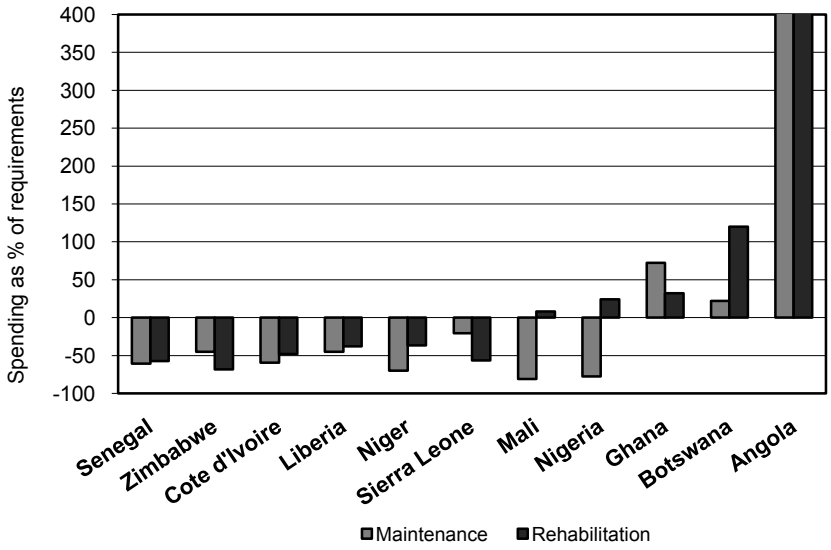
Transport

Roads

Achievements

Angola is making extraordinary efforts to reconstruct its dilapidated road infrastructure. The level of public spending on roads increased dramatically in recent years, averaging a staggering $2.8 billion over the period 2005–09. This makes Angola one of the highest spenders on road infrastructure in Africa. This spending is about four times the estimated $423 million annual longer-term requirement for road-network preservation, reflecting Angola's desire to reconstruct its road infrastructure on an accelerated timetable (figure 9). According to budget figures, as much as two-thirds of this total is classified as maintenance. This is somewhat surprising; however, the boundary between maintenance and rehabilitation activities can be a blurry one, and so this may simply reflect issues of expenditure classification.

Figure 9. Angola's spending on roads is more than sufficient to cover maintenance and rehabilitation needs



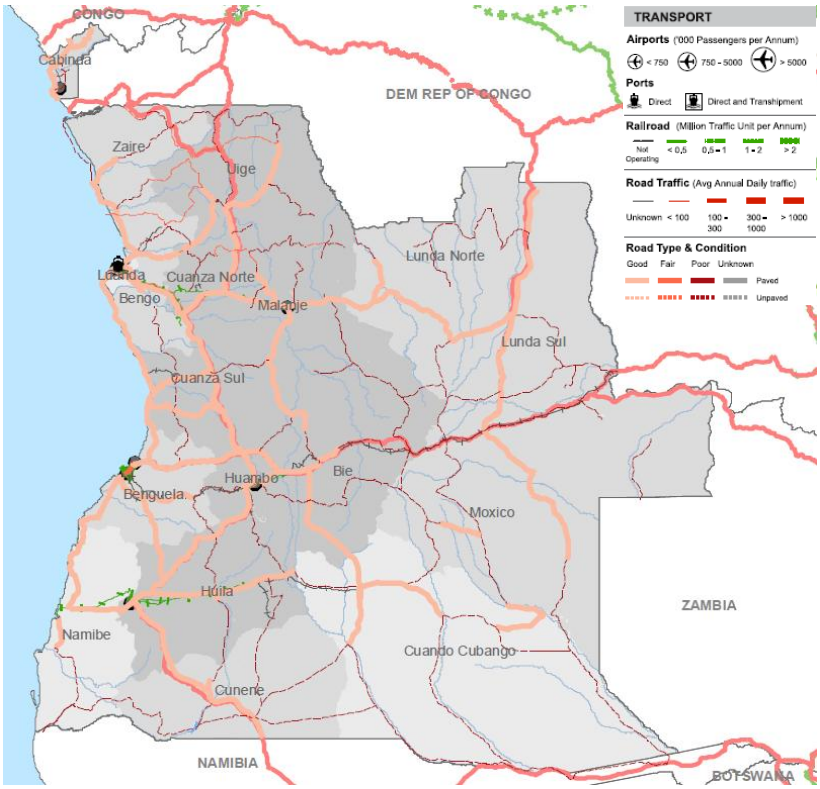
Source: Gwilliam and others 2008.

Challenges

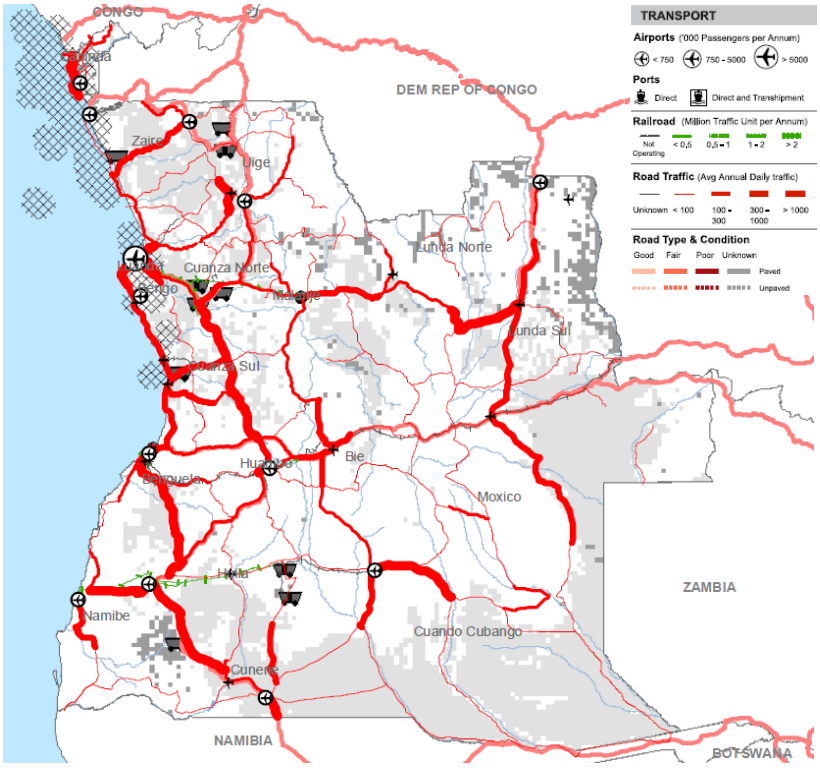
Angola's road network is in very poor condition. Angola's road network covers 62,560 km. Of this total length, the classified network (primary, secondary, and tertiary) accounts for 58 percent or 36,399 km. The rest is the urban network of 11,057 km and the unclassified network of 15,104 km. Most of the traffic is concentrated in the area surrounding Luanda (figure 10), but overall traffic levels are comparatively low (table 8). The inadequate condition of the roads caused by years of destruction and undermaintenance is one of the factors contributing to the low traffic levels. As much as 58 percent of Angola's classified network and 40 percent of its rural network is in poor condition, which is among the worst road condition statistics in Africa (figures 10 and 11). Only 17 percent of classified and urban roads are paved. Poor road quality in combination with very low road density and a lack of bridges—as many were destroyed or imbedded with mines during the war—makes some of the provincial capitals impossible to access by road. In addition, feeder roads are nonexistent in many parts of the country.

Figure 10. Angola's roads: Type and condition versus traffic

a. Type and condition of roads, rail, and ports, and population



b. Road traffic, airports, and natural resources



Source: AICD Interactive Infrastructure Atlas for Angola (www.infrastructureafrica.org).

Table 8. Angola's road indicators benchmarked against Africa's low- and middle-income countries

Indicator	Unit	Low-income, nonfragile countries	Resource-rich countries	Angola	Middle-income countries
Classified road network density	km/1,000 km^2 of land area	88	98	29	278
Total road network density [1]	km/1,000 km^2 of land area	132	128	41	318
GIS Rural accessibility	% of rural pop. within 2 km of all-season road	25	20	31	31
Main road network condition [2]	% in good or fair condition	72	68	58	86
Rural road network condition [3]	% in good or fair condition	53	61	40	65
Classified paved road traffic	AADT	1,131	1,408	884	2,451
Classified unpaved road traffic	AADT	57	54	10	107
Primary network overengineering	% of primary network paved with 300 AADT or less	30	15	42	18
Perceived transport quality [4]	% firms identifying transport as major business constraint	13	27	—	20

Source: AICD Road Sector Database on 40 Sub-Saharan African countries.

[1] Total network includes the classified and estimates of unclassified and urban networks.

[2] Main network for most countries is defined as result of adding the primary and secondary networks.

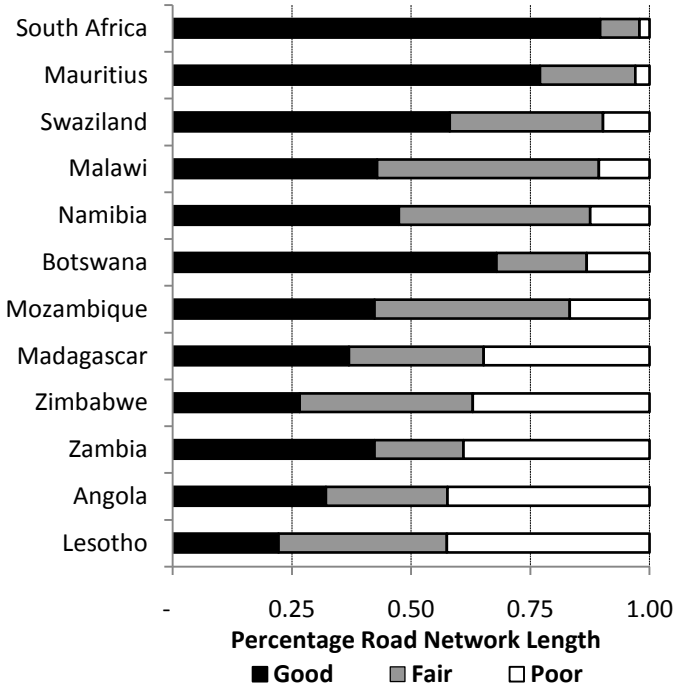
[3] Rural network is generally defined as the tertiary network and does not include the unclassified roads.

[4] Source: World Bank—IFC Enterprise Surveys on 32 Sub-Saharan Africa countries.

GIS = geographic information system; AADT = average annual daily traffic.

— = Not available.

Figure 11. The condition of Angola's main road network benchmarked against others in southern Africa



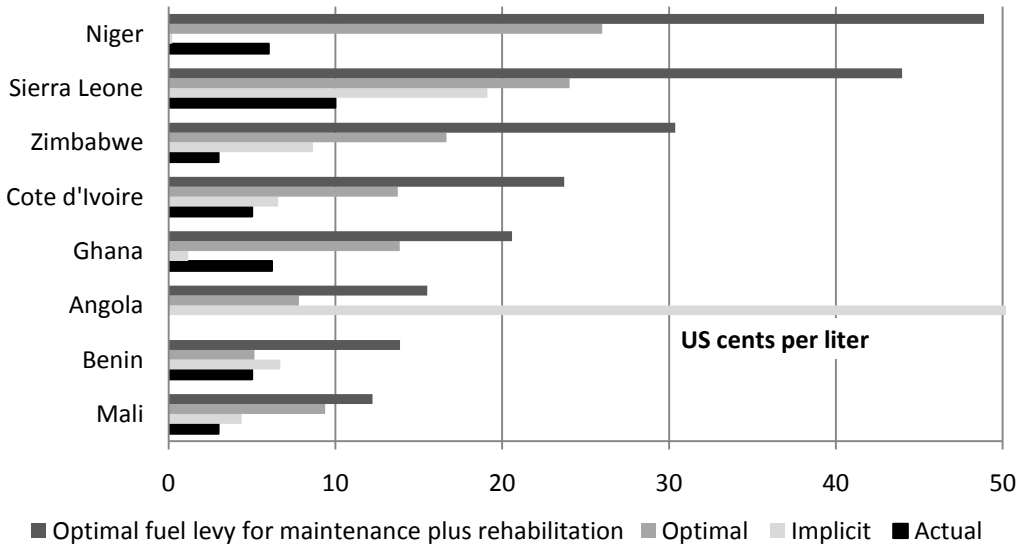
Source: AICD Road Sector Database on southern Sub-Saharan African countries.

The quality of Angola's regional road corridors is also poor, making the country's regional connectivity with the broader SADC economic area difficult. This situation both prevents Angola from developing regional trade with surrounding countries and limits surrounding countries from making greater use of the Port of Luanda (see figure 13).

Transportation represents an important bottleneck for Angola's economy. Poor road infrastructure and transport logistics slow Angola's overall economic development. Angola is one of the worst performers in the world according to the 2010 Logistics Performance Index (LPI). Its manufacturing sector depends on imports for as much as 40 percent of inputs, which can be difficult and expensive to procure given the poor quality of the roads. Moreover, around 2.1 percent of the production of manufacturing firms is lost in transit, more than in any other African country (World Bank 2007). It takes 49–53[1] days to export or import goods, among the longest times in Africa. Road access is particularly problematic for firms outside Luanda.

For all of these reasons, Angola urgently needs to establish an operational road fund. The country's current extraordinary spending on the road sector is entirely budget-financed. Such high levels of public funding are not sustainable in the long term, and there is the risk that today's heavy investments may not be adequately maintained in the future. It is therefore critical for Angola to work toward the establishment of a road fund resourced from a fuel levy and other road-user charges. The optimal fuel levy needed for long-term road-network sustainability in Angola would be on the order of $0.15 per liter of fuel, which is toward the middle of the range for African countries (figure 12). But currently, gasoline and diesel prices are heavily subsidized by the state and there is no mechanism for fuel levy collection.

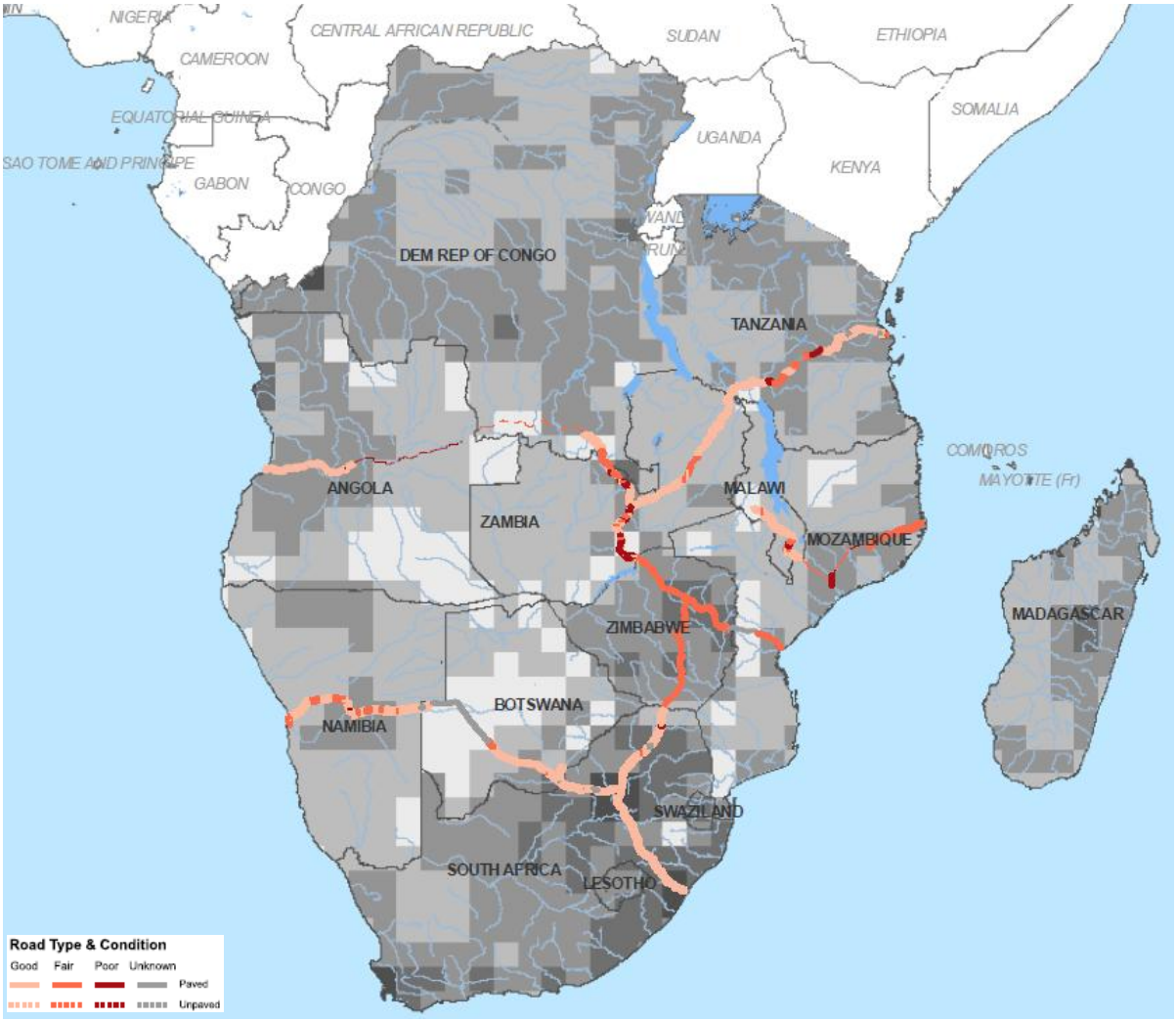
Figure 12. Angola's public contribution exceeds the maintenance and rehabilitation needs of its road network



Source: Gwilliam and others, 2008 .

[1] www.doingbusiness.org/data/exploretopics/trading-across-borders.

Figure 13. Angola's poor road conditions constrain SADC's regional connectivity



Source: AICD SADC Interactive Infrastructure Atlas (www.infrastructureafrica.org/aicd/tools/maps) .
Note: Southern African Development Community.

Rail

Achievements

Angola has three operational railways in place. The railway systems once carried 9.3 million metric tonnes of freight to Angola's ports in Namibe, Luanda, Benguela, and Amboim, before the civil war but freight levels are currently low (World Bank 2005). Similar to its other transport infrastructure, Angola's railways suffered during the 27 years of war: at present, only 30 percent of the total rail network is operating (table 9). The railways are currently under rehabilitation with support from several parties, including Chinese and Indian entities.

Table 9. Rail networks in Angola

Company	Port	Region	Lines (km) Total	Operating	% operating	Gauge (mm)
Caminhos de Ferro de Benguela (CFB)	Lobito	Central	1,333	246	18	1,067
Caminhos de Ferro de Luanda (CFL)	Luanda	Northern	479	181	38	1,067
Caminhos de Ferro de Moçamedes (CFM)	Namibe	Southern	907	425	47	1,067
Amboim	Amboim	Central	122	0	0	760
Total			2,841	852	30	-

Source: Bullock 2009.

Challenges

Angola will need to rehabilitate or rebuild the 60 percent of its current rail network that is currently out of operation. This is a tremendous task, since in many cases it requires expensive works to remove mines and complete replacement of the obsolete or deteriorated rails. In addition, the performance of existing lines is very poor. Freight density and labor productivity are low in Angola in comparison to other African countries, and will need to be tackled through institutional reform (table 10).

Table 10. Railway indicators for Angola and selected countries, 2000–05

	CFM (Angola)	BR (Botswana)	CEAR (Malawi)	Nacala Railroad (Mozambique)	Beira Railroad (Mozambique)	Ressano Garcia Line (Mozambique)	Transnamib (Namibia)	Spoornet (South Africa)	RSZ (Zambia)	NRZ (Zimbabwe)
Concessioned (1)/ state run (0)	0	0	0	1	1	0	0	0	1	0
Freight density (1,000 tonne-km/km)	469	827	90	270	663	364	475	2,427	406	902
Passenger density (1,000 passenger-km/km)	—	—	38	103	44	44	33	60	92	166
Labor productivity (1,000 traffic units per employee)	580	722	131	710	281	—	484	3,308	502	390
Locomotive productivity (million traffic units per locomotive)	30	41	3	25	13	—	25	33	25	8
Carriage productivity (1,000 passenger-km per carriage)	4,046	2,391	1,176	3,333	750	—	—	—	3,286	—
Wagon productivity (1,000 net tonne-km per wagon)	950	987	82	260	476	—	805	913	377	195
Freight yield (US cents/tonne-km)	—	—	6	5	3	3	—	—	4	—
Passenger yield (US cents/passenger-km)	—	—	1	0.9	0.5	1	—	—	1	—

Source: Bullock 2009. Derived from AICD rail operator database (www.infrastructureafrica.org/aicd/tools/data).

Note: * With 2.5 passenger-km equivalent to 1 traffic unit, 1 tonne-km equivalent to 1 traffic unit.

— = Not available.

Ports

Achievements

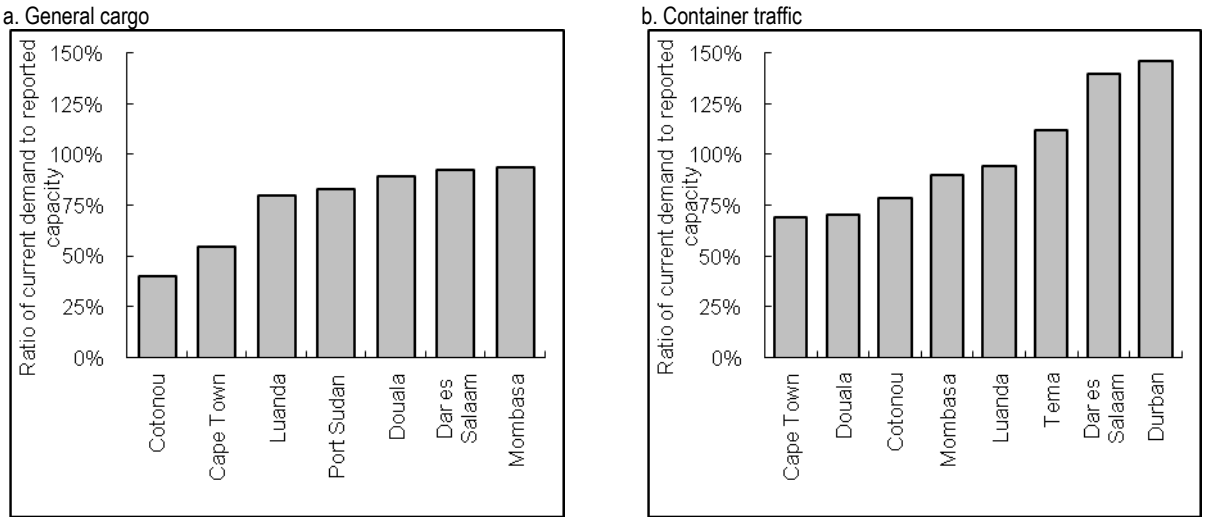
The Port of Luanda offers natural deep-sea access to Angola and serves as the nation's main route for international trade. The existing port consists of 1,150 meters of quays (six berths), with an additional five berths on a finger pier. The current draft at the port is 10.5 meters, allowing a maximum vessel size of about 30,000 deadweight tonnes. But the depth in Luanda Bay exceeds 20 meters, potentially allowing vessels larger than 150,000 deadweight tonnes to enter the bay as long as dredging activities are sustained (Nathan 2010).

The Port of Luanda is benefitting from the recent rehabilitation, expansion, and upgrading financed by a number of investors. There has been ongoing modernization of the second container terminal, operated by Sogester, at a cost of $56.5 million since July 2010. The Sogester terminal commissioned three new mobile container cranes in 2010. The port has recently acquired three new tugs to speed up the mooring and departure of vessels, and thus increase port capacity. Luanda has also begun to move ships offshore and offload cargo onto barges using ship's gear (Nathan 2010).

Challenges

Burgeoning demand over the past few years has resulted in serious congestion at the Port of Luanda, with traffic volumes increasing more than tenfold, from 30,000 to 346,000. As a major transit port not only for Angolan goods but also for the Democratic Republic of Congo, Zambia, and Zimbabwe, Luanda is one of the fastest-growing ports in Africa, witnessing a dramatic compound growth rate of around 30 percent over the past decade. This growth has created handling constraints leading to port congestion for both general cargo and container traffic (figure 14). The congestion problem is responsible for a number of the shortcomings in the port's performance, problems that can only be addressed once capacity increases.

Figure 14. Ratio of current demand to reported capacity



Source: AICD Ports Database 2008.

The Port of Luanda is notorious for long delays and poor performance relative to other ports in Africa. Container dwell times, at 12 days, are twice as long as Durban, Africa's best-performing port, and are rivaled only by ports in Mozambique that perform slightly worse. Truck cycle time, at 14 hours, is over twice as long as other southern African ports. Crane productivity is less than half that of other southern African ports.

Port-handling charges in Angola are among the highest in Africa. The container cargo-handling charge is almost five times what is charged at the Port of Mombasa (Kenya) and 25 percent higher than Durban (South Africa). Bulk cargo-handling charges are also on the higher end of what is observed in African ports.

Deterred by the lengthy delays and high prices, Angolan traffic is increasingly using the Port of Walvis Bay in Namibia as the main gateway to the sea. Walvis Bay is located 2,100 km to the south of Luanda, yet improvements in road and rail infrastructure linking the two cities have made the port more accessible to the Angolan market. The fact that port users increasingly prefer this long-distance road journey and its associated border-crossing delays is testimony to the severity of the problems facing the Port of Luanda.

Efforts that are now under way should help to ease the congestion problems at the Port of Luanda. A dry port has been developed at Viana, about 30 km inland from the port, connected by road and rail. The Viana dry port is in the process of being further expanded at a cost of about $70 million. A $136 million contract was signed in 2009 to improve road access to the port and to reclaim additional land for development around the port area. Further, a new container port is also being planned for a 2,400 hectare site, at Barra do Dande, north of Luanda, which is in the process of being cleared of land mines (Nathan 2010).

Table 11. Benchmarking port performance

	Cape Town	Durban	East London	Port Elizabeth	Walvis Bay	Luanda	Beira	Maputo	Mombasa	Dar es Salaam	Tema
Performance											
Container dwell time—average (days)	6	4	7	6	8	12	20	22	5	7	25
Truck time for receipt and delivery of cargo (hours)	5	5	2	5	3	14	7	4	5	5	8
Container crane productivity (container per hour)	18	15	8	15		7	10	11	10	20	13
Prices											
Container-cargo-handling charge ($ per TEU)	258	258	258	258	110	320	125	155	68	275	168
General-cargo-handling charge ($ per tonne)		8	8	8	15	9	7	6	7	14	10

Source: AICD Ports Database 2008.

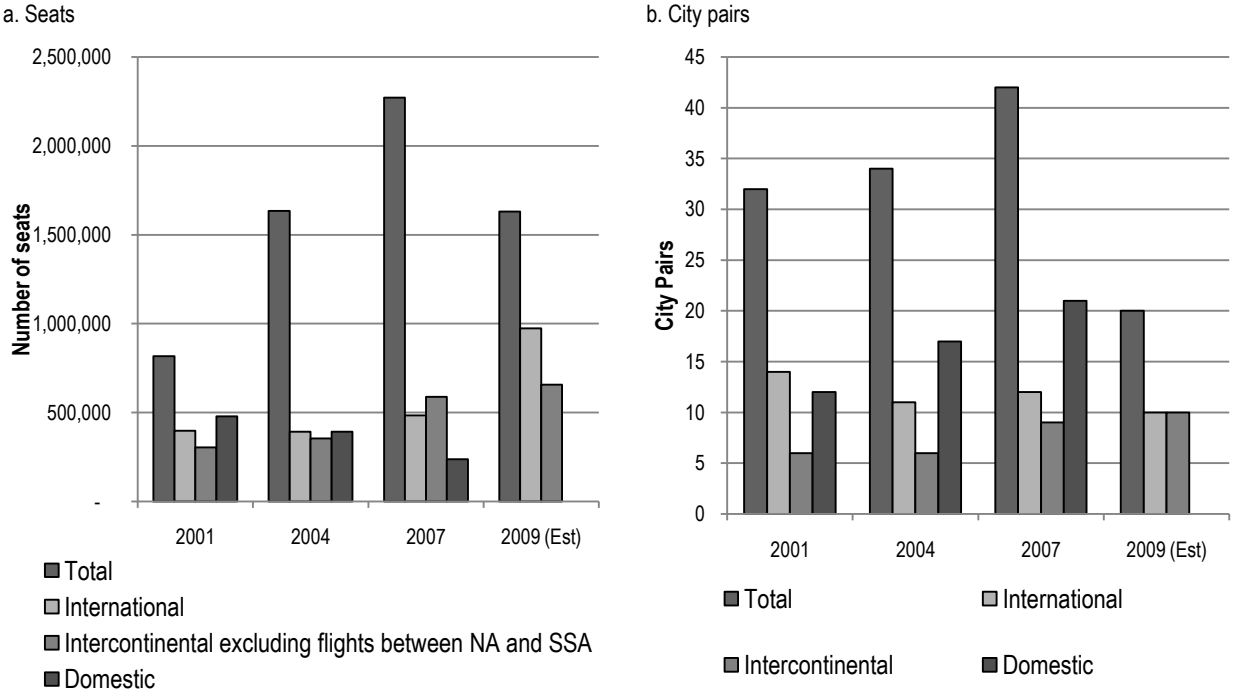
Note: TEU = 20-foot equivalent unit.

Air transport

Achievements

Angola's air transport seat capacity grew significantly between 2001 and 2007 (figure 15, table 12). The decline in capacity for 2009 may be more of a function of missing domestic capacity figures than a true slowing of growth, since both intercontinental traffic and international traffic within Africa still show growth in spite of the global recession. Angola's restructured national airline, TAAG Angolan Airlines, seems to be expanding its routes and fleet, which includes several Boeing 777s. Reflecting cultural ties, flights to Portugal and Brazil feature prominently in the country's pattern of intercontinental connectivity.

Figure 15. Evolution of seats and city pairs in Angola



Source: Bofinger 2009. Derived from AICD national database (www.infrastructureafrica.org/aicd/tools/data).
Note: As reported to international reservation systems.
NA = North Africa; SSA = Sub-Saharan Africa.

Table 12. Benchmarking air transport indicators for Angola and selected countries[2]

Country	Angola	DRC	Zambia	Mozambique	Namibia	Republic of Congo
Traffic (2007)						
Domestic seats (seats per year)	**1,199,016**	327,988	437,658	1,144,644	84,162	443,634
Seats for international travel within Africa (seats per year)	**484,179**	468,217	1,459,766	582,836	877,812	351,882
Seats for intercontinental travel (seats per year)	**588,978**	193,414	113,217	91,637	242,736	117,962
Seats available per capita	**0.134**	0.24	0.168	0.087	0.574	0.016
Herfindahl-Hirschmann Index—air transport market (%)	**33.25**	22.65	17.53	31.54	39.39	30.79
Quality						
Percent of seat-km in newer aircraft	**59.7**	74.7	63.8	57.0	79.0	73.3
Percent of seat-km in medium or smaller aircraft	**13.9**	39.3	50.6	42.5	28.3	40.5
Percent of carriers passing IATA/IOSA Audit	**1 (as of 2009)**	0	0	100.0	100.0	0
FAA/IASA Audit Status	**No audit**	Failed	No audit	No audit	No audit	No audit

Source: Bofinger 2009. Derived from AICD national database (www.infrastructureafrica.org/aicd/tools/data).

Note: 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. An HHI of 100 indicates the market is a monopoly; the lower the HHI, the more diluted the market power exerted by one company/agent.

FAA = U.S. Federal Aviation Administration; IASA = International Aviation Safety Assessment; IATA = International Air Transport Association; IOSA = IATA International Safety Audit; DRC = Democratic Republic of Congo.

Challenges

There is relatively limited competition in the air transport sector. The dominant position of the national carrier TAAG keeps the Herfindahl-Hirschmann Index for Angola's air transport market relatively high. But this is not to suggest that Angola relies on TAAG alone. Namibian carriers also provide much of the capacity.

Rather than capacity or competition, Angola's biggest challenge in the air transport sector is safety oversight. All airlines from Angola are on the European Union (EU) blacklist, with exceptions for specified 777s and one 737 operated by TAAG. The latest International Civil Aviation Organization (ICAO) audit results still show significant room for improvement, with Angola being below international averages in nearly all categories except primary aviation legislation.

[2] All data are as of 2007, based on estimations and computations of scheduled advertised seats, as published by the Diio SRS Analyzer. This captures 98 percent of worldwide traffic, but a percentage of African traffic is not captured by these data.

Water supply and sanitation

Achievements

Angola has made important progress in reducing reliance on open defecation. In 2007, 24 percent of the population practiced open defecation compared to 49 percent in 2001. Even though the improvement has been significant, the percentage is still high, at almost twice the level of middle-income countries (MICs) (table 13).

Table 13. Benchmarking water and sanitation indicators

	Unit	Resource-rich countries	Angola		Middle-income countries
		Mid-2000s	2001	2007	Mid-2000s
Access to piped water	% pop	13	13	18	52.1
Access to stand posts	% pop	12	14	10	18.9
Access to wells/boreholes	% pop	47	39	31	6.0
Access to surface water [1]	% pop	27	34	40	13.0
Access to septic thanks	% pop	13	17	31	40.8
Access to improved latrines	% pop	37	18	22	1.4
Access to traditional latrines	% pop	22	16	21	30.4
Open defecation	% pop	28	49	24	14.3
			2005	2009	
Domestic water consumption	liter/capita/day	115	75	56	154
Revenue collection	% sales	60	85	44	100
Distribution losses	% production	40	62	61	27
Cost recovery [2]	% total costs	67	81	72	81
Operating cost recovery	% operating costs	94	114	100	145
Labor costs	connections per employee	96	25	34	369
Total hidden costs as % of revenue	%	194			140

		Angola		Low-income, water-scarce resources	Other developing regions
		2005	2009		
Average effective tariff	U.S. cents per cubic meter	120	230	60–120	3–60

Source: Demographic and Health Survey 2006/7 and AICD water and sanitation utilities database (www.infrastructureafrica.org/aicd/tools/data).

Note: Access figures from the 2001 Multiple Indicator Survey and 2007 Malaria Indicator Survey.

[1] Surface water includes rivers, lakes, and ponds in the vicinity as the main source of water supply, as well as other nonimproved sources of water such as water from vendors and rain water.

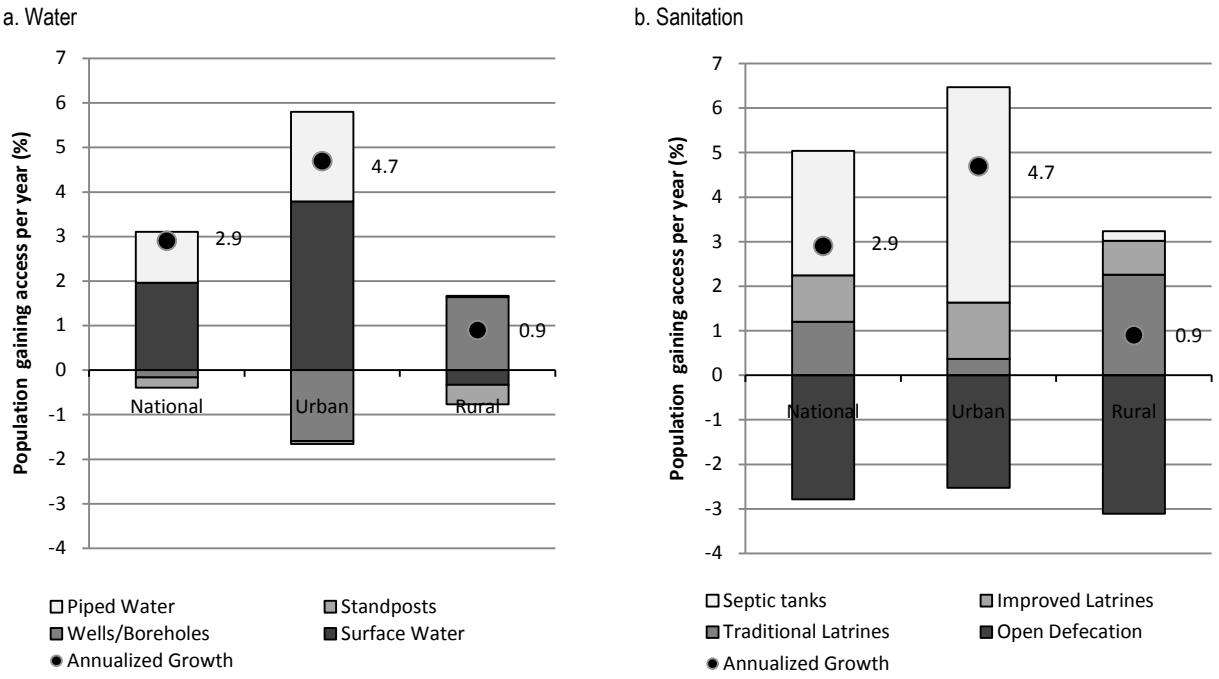
[2] Cost recovery is estimated based on the assumption of a capital cost of 40 cents per cubic meter.

The reduction in open defecation has been achieved by the expansion of higher-end forms of sanitation in urban areas and traditional latrines in rural areas. Access to septic tanks almost doubled between 2001 and 2007, from 17 to 31 percent. In urban areas about 4.8 percent of the population has been gaining access to septic tanks each year, an exceptionally high rate of expansion that mirrors the country's rapid urbanization process (figure 16b). The use of improved latrines increased from 18 percent

to 22 percent over the same year (table 13), particularly in urban areas. Use of traditional latrines also increased from 16 to 21 percent between 2001 and 2007, mostly in rural areas, where 2.2 percent of the population has been gaining access to this form of sanitation each year (figure 16b).

Figure 16. Angola has made important progress in the sanitation sector but not in the water supply sector

Population gaining access per year, 1998–2006



Source: WHO Joint Monitoring Program 2010, from the 2001 Multiple Indicator Survey and 2007 Malaria Indicator Survey.

Challenges

Angola still has the highest rate of diarrheal disease in the world, with 114 years of life lost to diarrheal diseases for every 1,000 Angolans. In 2006 a cholera epidemic hit Luanda, affecting 23,000 people and causing almost 300 deaths (LUPP 2007). Contaminated water, inadequate storm-water drainage, deficient operation of the limited sewer system, and high reliance on open defecation have resulted in high—and steadily increasing—rates of water- and excreta-related diseases (USAID 2009). The situation is particularly bad in periurban informal settings and in refugee camps, where more than a million internally displaced persons still reside.

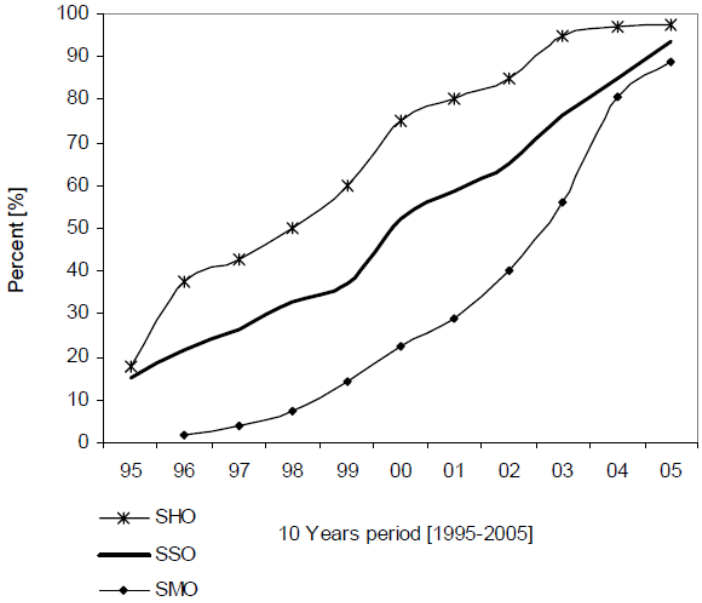
Angola's urban population is growing at an increasingly fast rate (4.7 percent per year), and the current piped and stand-pipe water supply and management system cannot keep up with the demand for domestic water consumption. This gap is increasingly being filled by private water vendors selling largely untreated water. The supply of water from tankers rose from 10 percent of the population in 2001 to 37 percent in 2007 (figure 17). Indeed, in periurban areas of Luanda, 70 percent of residents purchased their water from water vendors. This water is extremely expensive, with prices varying from \$4/m^3 close to the distributional area of the water tank to \$20 in more distant areas (Cain, Daly, and Robson 2002), leading to a significant increase in the number of small-scale operators (figure 17). Most of the water comes from the ANGOMENHA filling station and is untreated, posing serious health risks. Tanker drivers who buy

the ANGOMENHA water are expected to stop at the small water-treatment station for chlorine treatment at a cost of $0.10/m^3, but there is no enforcement system in place (Development Workshop—Angola, 2007). The water trucks then sell the water to an estimated 10,000 fixed-point water vendors, primarily households that have built water-storage tanks; these households in turn sell the water to the rest of the population (Keener, Luengo, and Banerjee 2009).

Due to its largely untreated nature, water from vendors counts as surface water (table 13). This accounts for statistics showing a growing reliance on surface water in Angola, increasing from 34 to 40 percent between 2001 and 2007. Again, this was mainly driven by the trend in urban areas, where the use of surface water grew from 22 to 39 percent; in fact the share of the urban population moving to surface-water reliance each year was as high as 3.8 percent (figure 16a).

Figure 17. Evolution of water truck operators

Cumulative increase in the number of small scale operators between 1995 and 2005



Source: Development Workshop—Angola 2007.

Note: SHO = small-scale high-size operator; SSO = small-scale single operator; SMO = small-scale medium-size operator;.

Most urban centers in Angola are served by precarious water supply systems unable to cope with rapid urbanization. Most of these systems were damaged during the war and have suffered from lack of proper maintenance. On average 34 liters per capita per day are provided to urban residents, but in fact the distribution ranges from about 80 liters per capita per day in the most privileged areas to 3 liters per capita per day in the poorest (World Bank 2008). This situation should begin to improve in the near future, since the government is investing heavily to rehabilitate treatment facilities, pumping stations, transmission mains, and distribution networks in major urban areas throughout Angola, and working on parallel institutional reforms to make the sector more sustainable (World Bank 2008).

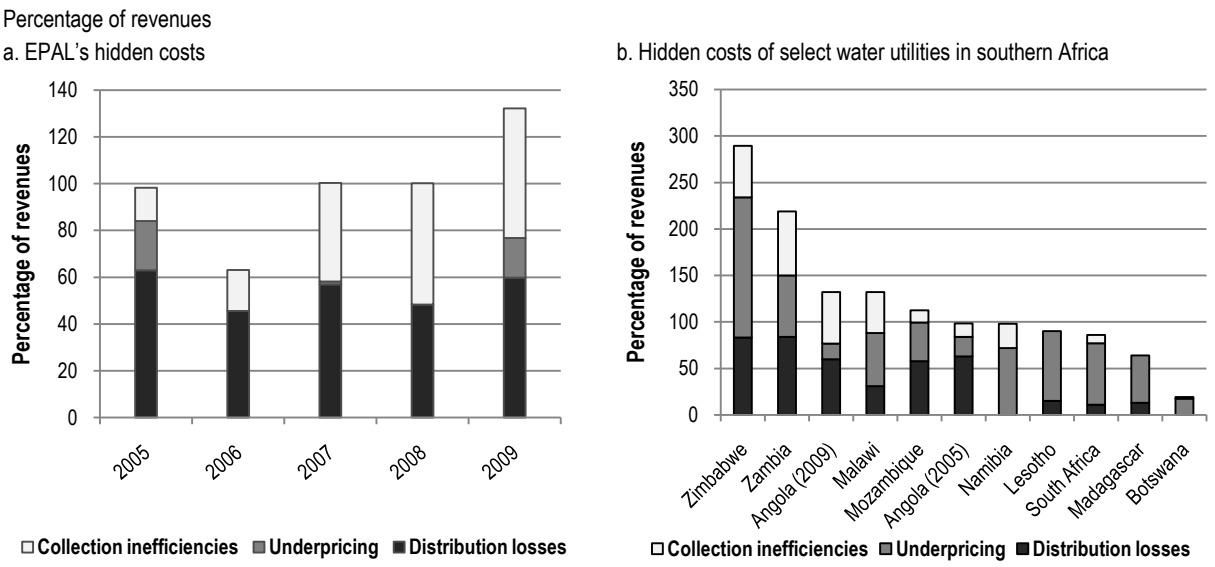
Luanda's utility provider, Empresa Provincial de Agua de Luanda (EPAL),[3] is struggling with aging infrastructure built to support a much smaller population. The utility's deteriorating performance puts it well behind those in other resource-rich countries. The water supply system in Luanda was built in colonial times for a population of 500,000 people, yet by 2007 Luanda's population was estimated to be over 5 million. Utility water consumption per capita between 2005 and 2009 decreased from 75 to 56 liters per day. Even so, putting Luanda well ahead of the national average for water consumption.. Revenue collection dropped from 85 percent of the billings in 2005 to 44 percent in 2009, below the 60 percent average for resource-rich countries (table 1). Whereas distribution losses remain stagnant, at around 60 percent of production, they are well above the average 40 percent for utilities in resource-rich

[3] Empresa Pública de Água de Luanda.

countries and three times above the international benchmark of 20 percent. EPAL revenues covered only 72 percent of total costs in 2009 vis-à-vis 81 percent in 2005. Despite an increase in connections per employee from 25 in 2005 to 34 in 2009, EPAL's labor productivity is just one-third of the average for utilities in resource-rich countries and well behind the international benchmark of 200 connections per employee.

The burden of EPAL's inefficiencies has increased over time. By comparing key performance indicators of the utilities for which data are available against those of a well-performing utility or norm, we are able to quantify—in monetary terms—the key inefficiencies affecting each utility. Here three types of hidden costs are considered: first, utilities unable to collect 100 percent of their bills (collection inefficiencies); second, utilities incurring losses on their water distributional network above the norm of 20 percent of production (losses); and, third, utilities whose average effective tariffs are not enough to cover the cost of producing a cubic meter of water (underpricing). On this basis, the hidden costs of EPAL grew from 98 percent of revenues in 2005 to 132 percent in 2009. The largest source of hidden costs were high distributional losses, followed by low collection rates. In absolute terms this represents an almost threefold increase in losses, from $45 million in 2005 to $125 million in 2009 (table 14). When compared to the performance of other southern African utilities, EPAL's hidden costs are among the highest in the region (figure 18).

Figure 18. Benchmarking the hidden costs of EPAL against those of selected countries in southern Africa



Source: Derived from Banerjee and others (2008b) and Briceño-Garmendia, Smits, and Foster (2009).

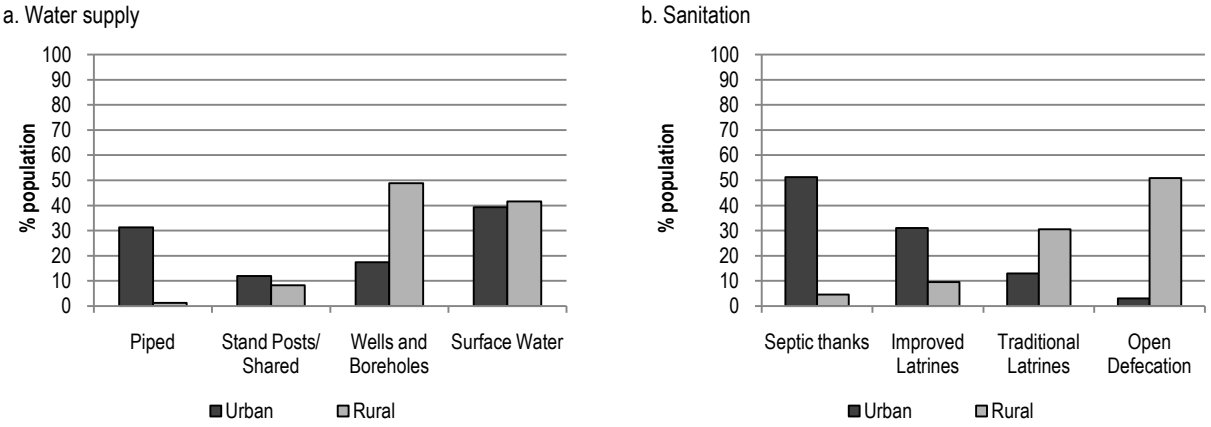
In the rural context, water supply is provided mainly by wells and boreholes that do not guarantee the provision of safe water. Around 50 percent of rural dwellers are supplied by water coming from 4,000 wells and boreholes countrywide (figure 19). Many of these are not working due to shortages of spare parts or fuel for pumps (USAID 2009). Low rural-road accessibility and the slow process of clearing mines left over from the civil war make it harder to develop rural water supply systems. The government has launched an ambitious rural strategy aimed at increasing water supply coverage to periurban and rural areas to 80 percent by 2012.

Table 14. Evolution of operational indicators associated with EPAL

	Water delivered (million m^3/year)	System losses (%)	Collection ratio (%)	Average total cost ($/$m^3$)	Average effective tariff ($/$m^3$)	Total hidden costs ($ million/year)	Total hidden costs (% revenues)
2005	99	62	86	1.5	1.2	45	98
2006	100	60	82	1.3	1.5	37	63
2007	94	65	58	2.4	2.3	77	100
2008	98	60	48	2.5	2.5	100	100
2009	105	61	45	2.7	2.3	125	132

Source: Derived from Briceño-Garmendia, Smits, and Foster (2009).
Note: Total cost is estimated based on the assumption of a capital cost of 40 cents per cubic meter.

Figure 19. Urban versus rural access to water supply and sanitation, 2007



Source: AICD water supply and sanitation utilities database (www.infrastructureafrica.org/aicd/tools/data).
Note: Access figures calculated by AICD using data the 2007 Malaria Indicator Survey.

Information and communication technology

Achievements

Access to ICT has improved markedly since the end of Angola's civil war in the early 2000s. Mobile penetration rose from less than 1 subscriber per 100 people in 2000 to almost 50 subscribers per 100 people in 2009. Fixed-telephone access has risen marginally, but this is offset to some extent by the development of wireless access (table 15) (Narain 2009).

Angola has made reforms to its telecommunications sector. The Ministry of Telecommunications and Information Technology is responsible for overall sector oversight, while the Angolan Institute of Communications (INACOM), created in 1999, is the industry regulator. Two mobile operators have been licensed: Movicel, an Angolan firm, and Unitel, partly owned by Portugal Telecom, which entered the market in April 2001. In addition to the incumbent, four fixed-line operators have been licensed (Mercury, Nexus, Mundo Startel, and Wezacom).

Table 15. Benchmarking ICT indicators

		Angola 2000	Angola 2008	Lower-middle-income group 2008	Sub-Saharan African region 2008	Angola 2009
GSM coverage	% population under signal	—	31	77	56	31
International bandwidth	bits/person	0.1	20	153	34	—
Internet	users/100 people	0.1	5.3	13.9	5.1	6.4
Landline	subscribers/100 people	0.5	0.6	13.6	1.5	0.7
Mobile phone	subscribers/100 people	0.2	39.9	28.5	33.3	48.5

US dollars	Angola 2005	Angola 2008	Lower-middle-income group 2008	Sub-Saharan African region 2008	Angola 2009
Price of monthly mobile basket	12.45	11.8	8.4	11.8	11.32
Price of monthly fixed-line basket	—	21.1	4.8	11.6	20.3
Price of monthly fixed broadband	—	119	31.4	100	77
Price of a call to the United States per minute	1.2	1.3	—	0.8	1.2
Price of an inter-Africa call per minute	—	1.4	—	1.0	1.3

Source: Adapted from Angola Telecom, Inacom, Unitel, AICD, and World Bank ICT at-a-Glance.
— = Not available.

Challenges

Despite sector reforms, the actual level of competition remains low. Mobile competition is limited; the two operators providing service use two different technologies (CDMA[4] in the case of Movicel and GSM[5] in the case of Unitel), making it more costly for subscribers to switch networks because of the need to purchase new equipment. While there is a high *de jure* level of competition in the fixed-line market, in reality, the new operators have delayed getting off the ground. Despite being licensed years back, they have only recently started to provide services. Movicel spun off from Angola Telecom in 2010, with 80 percent sold to investors (Almeida 2009). Meanwhile, Angola Telecom remains fully government owned. The impact of limited competition is apparent in pricing: Angola's ICT tariffs are above both the Sub-Saharan African and lower-middle-income group averages (table 15, bottom).

Angola's domestic backbone consists of microwave, VSAT,[6] and as of recently fiber-optic cable. The first phase of the national fiber-optic backbone linking 18 provincial capitals through 6,000 km of fiber-optic cable is scheduled to be concluded in 2011 (*Macaohub*, November 17, 2010). A notable feature of the domestic backbone is the 1,800-km ADONES portion stretching along the country's Atlantic coastline (WFN Strategies 2009). Angola was one of the few African countries to obtain access to an international undersea fiber-optic cable when it connected to the South Atlantic 3 (SAT-3) cable in 2002. Despite this, Internet access prices have remained high, in part due to Angola Telecom's monopoly over the cable. The country is slated to connect to two more cables in the near future: the Africa Coast to Europe (ACE) cable and the West Africa Cable System (WACS). A consortium made up of the country's

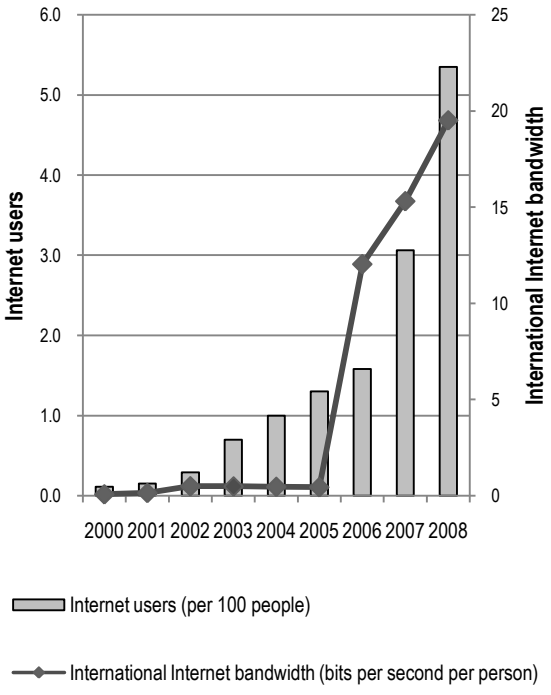
[4] Code division multiple access.
[5] Global system for mobile communications.
[6] Very small aperture terminal.

leading operators has reportedly been established for developing the connection to undersea cables, which presumably will enhance open access (*TelecomPaper*, June 5, 2009).

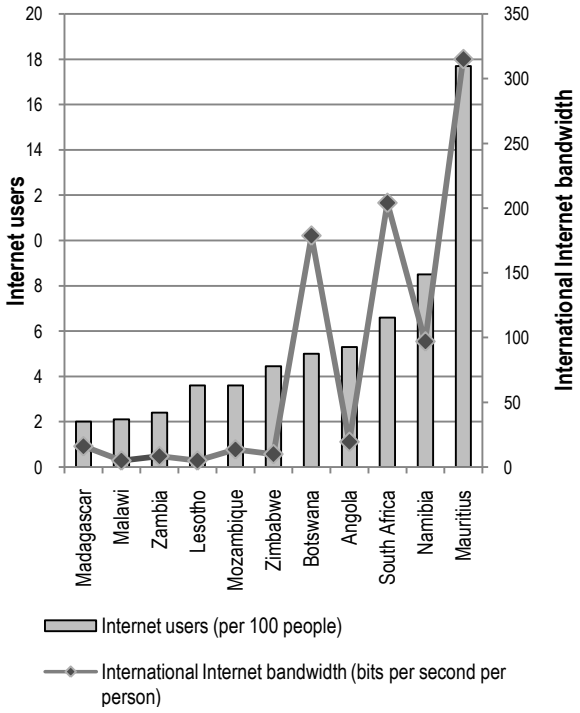
Internet penetration in Angola is average for the southern African region (figure 20). There are no official data on the number of Internet users in Angola. But according to the government, there were some 300,000 subscribers in 2008; assuming 3 users to a subscription, this amounts to about 900,000 users or 5.4 percent of the total population.[7]

Figure 20. Angola's Internet market benchmarked against southern African peers

a. Internet service trends, Angola, 2000–08



b. Internet service trends, southern Africa, 2008



Source: Minges 2008.

Several of the new fixed-line operators have launched WiMAX[8] networks, which, along with Angola Telecom's ADSL[9] service, provides a degree of fixed broadband competition. Movicel recently launched a GSM network that should enhance intermodal competition in the mobile market.[10] It is likely that it will also launch mobile broadband based on HSDPA[11] technology to complement its high-speed wireless EV-DO[12] network. Unitel has also launched mobile broadband services. Given these developments and the availability of international access through up to three undersea fiber-optic cables in the near future, the prognosis for Angola's broadband infrastructure is positive. The government will need to enhance

[7] Conselho de Ministros, "Programa Executivo do Sector para 2009," Resolução n.º 33/09 de 7 de Maio.
[8] Worldwide interoperability for microwave access.
[9] Asymmetric digital subscriber line.
[10] www.consuladogeral-angola.hk/sub/Press/Press_2010_1201_3.html.
[11] High-speed downlink packet access.
[12] 1x Evolution-Data Optimized.

competition to lower prices and spread availability so that access to high-speed Internet is not limited to companies and well-off individuals.

Financing Angola's infrastructure

To meet its most pressing infrastructure needs and to catch up with developing countries in other parts of the world, Angola needs to expand its infrastructure assets in key areas (table 16). The targets outlined in table 16 are purely illustrative, but they represent a level of aspiration that is not unreasonable. Developed in a standardized way across African countries, they allow for cross-country comparisons of the affordability of meeting targets that can be modified or delayed as needed to achieve financial balance.

Table 16. Illustrative investment targets for infrastructure in Angola

	Economic target	Social target
ICT	Install fiber-optic links to neighboring capitals and submarine cable.	Provide universal access to GSM signal and public broadband facilities.
Power	Develop additional 2,028 hectares of large-scale and 305 hectares of economically viable small-scale irrigation.	n.a.
Transport	Develop 8 MW of new-generation capacity and 2,120 MW interconnectors (no-trade scenario).	Increase electrification to 24.1 percent (42.4 percent urban and 9.1 percent rural).
WSS	Achieve regional (national) connectivity with good-quality 2-lane (1-lane) paved road.	Provide rural road access to 42 percent of the highest-value agricultural land, and urban road access within 500 meters.

Source: Mayer and others 2009 ; Rosnes and Vennemo 2009; Carruthers, Krishnamani, and Murray 2009; You and others 2009.
Note: WSS = water supply and sanitation; ICT = information and communication technology; GSM = global system for mobile communications. n.a. = Not available.

Meeting these illustrative infrastructure targets for Angola would cost around $2 billion per year over a decade. About 70 percent of this total relates to capital expenditure, and the remaining 30 percent to operating expenditure, suggesting that Angola's priority should be investment, though it must not neglect to maintain its assets. In the case of transport and irrigation, investment consists primarily of asset rehabilitation, whereas for other infrastructure sectors investment should be focused on expanding the asset base.

The largest share of spending needs relates to the power sector, followed by water and sanitation and transport. The power sector requires sustained spending of $785 million annually due to major capital investment needs. The second-highest needs are in the water and sanitation sector, with annual spending needs of $574 million needed to meet the MDGs (table 17).

Table 17. Infrastructure spending needs in Angola, 2006–15

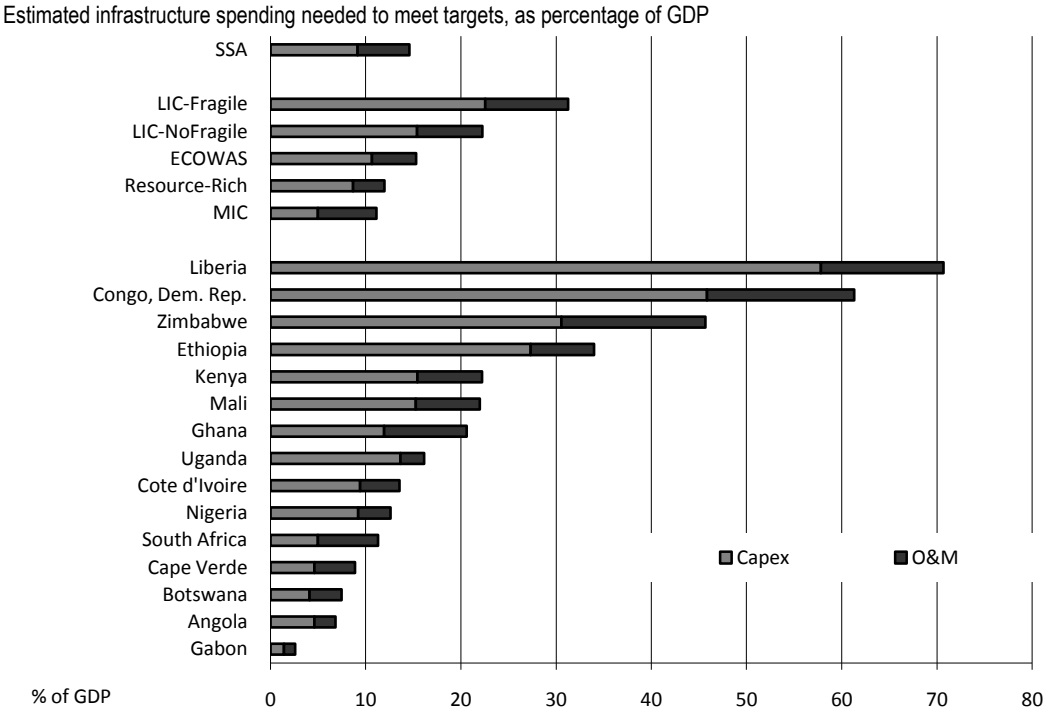
$ million per year

Sector	New investments	Rehabilitation	Total capital expenditure	Operations and maintenance	Total needs
ICT	169	0	169	119	288
Irrigation	1	16	16	2	18
Power	558	50	608	177	785
Transport	107	156	263	160	423
Water supply and sanitation	233	128	361	213	574
Total	1,067	350	1,417	671	2,088

Source: Mayer and others 2009; Rosnes and Vennemo 2009; Carruthers, Krishnamani, and Murray 2009; You and others, 2009. Derived from models that are available online at www.infrastructureafrica.org/aicd/tools/models.
Note: WSS = water supply and sanitation; ICT = information and communication technology.

While Angola's infrastructure spending needs are comparatively high in absolute terms, they look manageable relative to the country's burgeoning GDP. Expressing infrastructure spending needs as a percentage of GDP gives a sense of the economic burden involved in providing adequate infrastructure. For Angola, this burden amounts to no more than 7 percent of GDP, much lower than most other African countries (figure 21). Infrastructure investment would absorb around 5 percent of GDP—only around one-third of what China invested in infrastructure during the mid-2000s.

Figure 21. Angola's infrastructure spending needs are comparatively low relative to GDP



Source: Foster and Briceño-Garmendia 2009.

Note: LIC = low-income country; MIC = middle-income country; ECOWAS = Economic Community of West African States; SSA = Sub-Saharan Africa; GDP = gross domestic product; O&M = operations and maintenance; CAPEX = capital expenditure.

Angola already spends a sizable $4.3 billion per year to meet its infrastructure needs (table 18). Around 57 percent of the total is allocated to operations and maintenance, while the remaining 43 percent is capital expenditure. Operating expenditure is entirely covered from budgetary and state-owned enterprise (SOE) resources, and payments by infrastructure users. Seventy-four percent of capital expenditure is funded by the public sector, though significant shares of capital investments are provided by the private sector (7 percent) and financiers other than member countries in the Organisation for Economic Co-operation and Development (OECD) (18 percent). Official development assistance (ODA) for infrastructure is negligible (2 percent).

Table 18. Financial flows to Angola's infrastructure

$ million per year

	O&M	Capital expenditure					
	Public sector	Public sector	ODA	Non-OECD financiers	PPI	Total CAPEX	Total spending
ICT	97	102	2	40	110	253	350
Irrigation	2	5	0	0	0	5	7
Power	295	184	6	81	9	280	575
Transport	1,815	1,026	10	127	3	1,166	2,981
WSS	233	22	16	70	0	109	341
Total	2,442	1,339	34	318	121	1,813	4,255

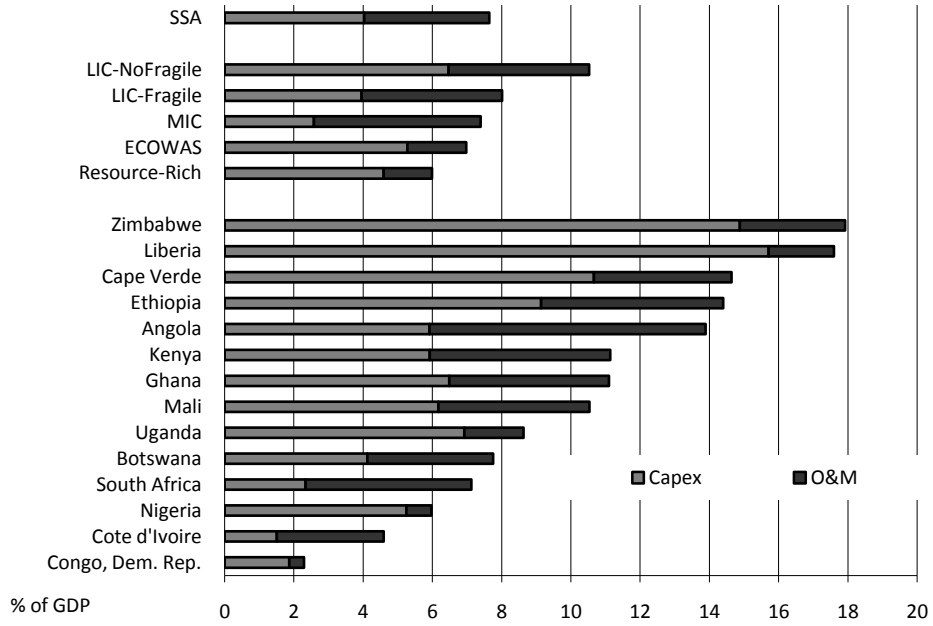
Source: Derived from Foster and Briceño-Garmendia (2009).

Note: 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; WSS = water supply and sanitation; ICT = information and communication technology.
The public sector figures are averages of actual spending for 2007–09 in the case of government data. In the case of state-owned enterprises (SOEs), the average spans over 2004–08 and in some cases 2004–09. Funding from external financiers is averaged over the 2002–07 period.

Angola's existing spending amounts to almost 14 percent of its 2005 GDP (figure 22). This represents quite a high level of effort, well above the averages for the country's regional peer groups. While total spending is high, the balance between investment and operating expenditure is unusual. While Angola's capital spending of 6 percent of GDP is almost on par with its resource-rich peers, its operating expenditure at 8 percent of GDP is several times the level found in other resource-rich countries.

Angola's pattern of capital investment in infrastructure differs from that of comparator countries. It is heavily skewed toward transport (taking 70 percent), leaving much smaller shares for power (14 percent), ICT (8 percent), and water supply and sanitation (8 percent). Relative to its peer group, Angola is much more reliant on public funding for capital investments for the transport, power, and ICT sectors. The level of recent public investment in the transport sector is particularly high. Non-OECD financing is important across the board in Angola. Private sector investment has been limited to the ICT sector, while other resource-rich countries have received private flows also to other infrastructure sectors. Angola's investment efforts in ICT, power, and water supply and sanitation are lower than the respective average for resource-rich countries. By contrast, investment in transport is substantially higher (figure 23).

Figure 22. Angola's existing infrastructure spending is quite high

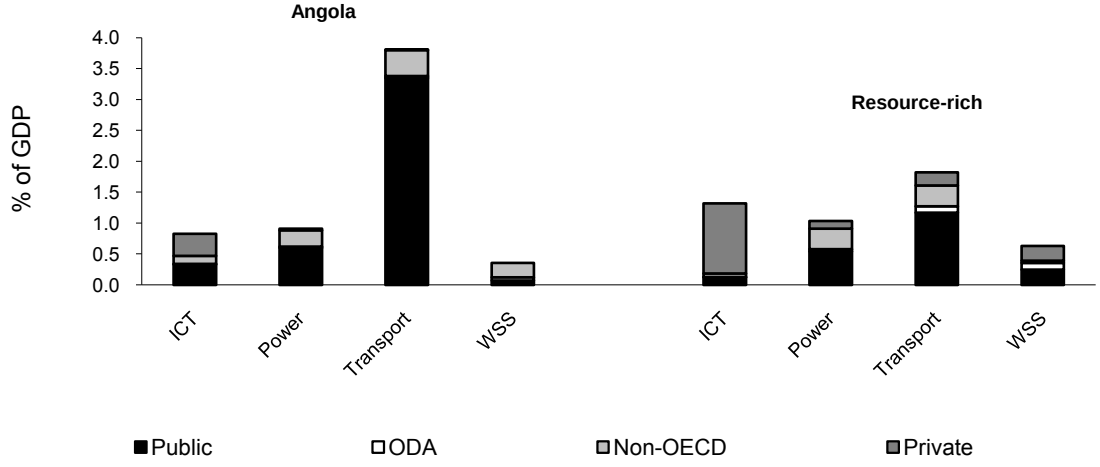


Source: Derived from Foster and Briceño-Garmendia (2009).

Note: LIC = low-income country; MIC = middle-income country; ECOWAS = Economic Community of West African States; SSA = Sub-Saharan Africa; GDP = gross domestic product; O&M= operations and maintenance; CAPEX = capital expenditure.

Figure 23. Capital investment in infrastructure in Angola and comparator countries

Investment in infrastructure sectors as percentage of GDP, by source



Source: Derived from Briceño-Garmendia, Smits, and Foster (2009).

Note: Private investment includes self-financing by households.

ODA = official development assistance; OECD = Organisation for Economic Co-operation and Development; ICT = information and communication technology; GDP = gross domestic product; WSS = water supply and sanitation

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

As much as $1.3 billion of additional resources—equivalent to almost 5 percent of Angola's GDP—could be recovered each year by improving efficiency (table 19). The largest source of inefficiency is low capital budget execution, leaving $573 million allocated to infrastructure unspent each year. Given the magnitude of the road-sector investment program currently under way in Angola, which amounts to an average of $2.9 billion annually, it makes sense that budget execution would be an issue. The second serious source of inefficiency is underrecovery of costs in the power sector, which drains a further $475 million a year. Distribution losses and collection inefficiencies across both the power and water sectors are also substantial, together absorbing $252 million each year.

Table 19. Angola's potential gains from greater operational efficiency

	ICT	Irrigation	Power	Transport	WSS	Total
Underrecovery of costs	—	n.a.	475	n.a.	16	491
Overstaffing	n.a.	—	n.a.	—	n.a.	n.a.
Distribution losses	—	—	65	—	57	122
Undercollection	—	n.a.	78	n.a.	53	131
Low budget execution	78	0	92	401	3	573
Total	78	0	709	401	128	1,317

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

Note: WSS = water supply and sanitation; ICT = information and communication technology.

— = Not available.

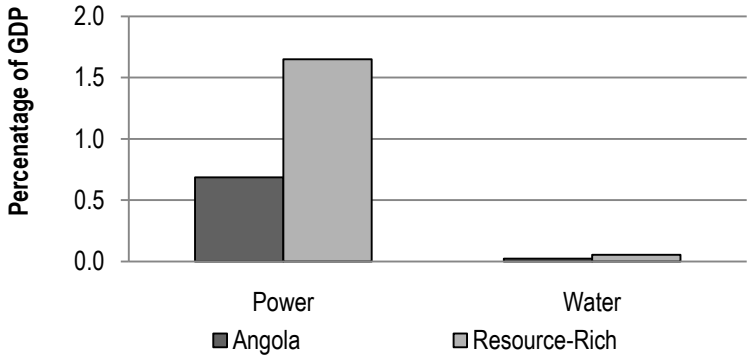
n.a. = Not applicable.

Underpricing of power and water in Angola is less burdensome than in other low-income, fragile countries in GDP terms. Nevertheless, it is very high in absolute terms and remains a huge problem for Angola. Both power utilities, ENE and EDEL, charge tariffs of $0.042/kWh, recovering barely a quarter of the full costs of power production estimated at $0.16/kWh. Furthermore, there is a huge subsidy implicit in the bulk-supply tariff at which ENE sells power to EDEL. Overall, the hidden costs due to undercharging in Angola's power sectors amount to 0.7 percent of GDP. In the water sector, as of 2009, EPAL's average tariffs stood at $2.3/$m^3$ versus the estimated $2.7/$m^3$ average cost-recovery tariff. But given the relatively small reach of the water utility, the macroeconomic burden, at 0.02 percent of GDP, is relatively small (figure 24).

Cost-recovery tariffs for power look to be affordable to a majority of the population. With a tariff of $0.16/kWh and a monthly subsistence consumption of 50 kWh, the associated utility bill comes to $8 per month in Angola. Detailed information on the income distribution of Angolan households was not available. But based on the distribution of household budgets in other Sub-Saharan low-income countries (LICs), one can conclude that monthly power utility bills at these levels would likely be affordable to around 60 percent of the population (figure 25). A more limited level of subsistence power consumption of 25 kWh/month—enough to meet only the most basic needs—would cost $4 per month and would be affordable to 80 percent of the population. Given that only 30 percent of the population has access to electricity, it would appear that Angola has scope to increase electricity coverage at cost-recovery prices before affordability becomes a serious impediment.

Figure 24. Underpricing of power and water in Angola and other low-income, resource-rich countries

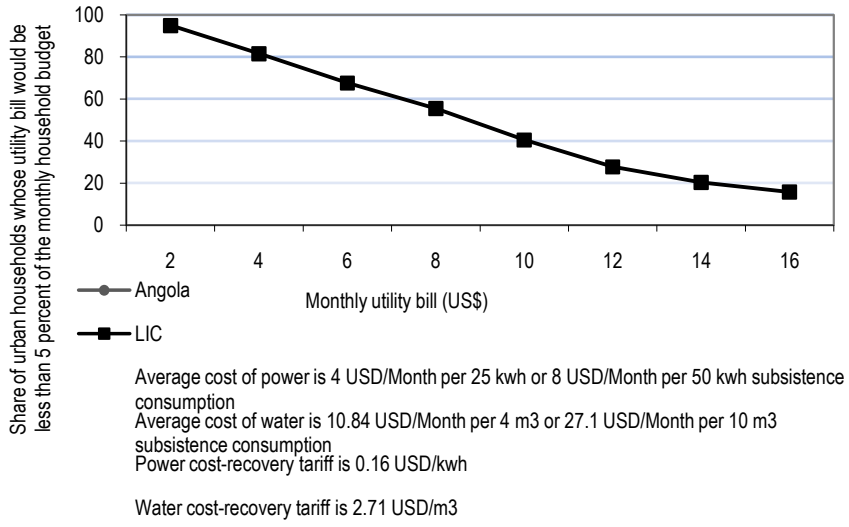
Financial burden of underpricing as percentage of GDP



Source: Derived from Briceño-Garmendia, Smits, and Foster (2009).
Note: GDP = gross domestic product.

Water costs are so exorbitantly high that cost-recovery tariffs could present affordability problems; therefore the policy priority should be the reduction of costs. While Angola has some of the lowest power tariffs in Africa, its water tariffs are among the highest in Africa. Angola's water tariffs at \$2.30/m^3 are more than double those found in most other African countries, and second only to Cape Verde, whose costs of \$3–\$5/m^3 are more understandable due to the archipelago's high energy costs and heavy reliance on desalination. Achieving full cost-recovery would entail raising tariffs to \$2.7 /m^3. At these prices, it would cost \$27 to consume 10 m^3/month, which would be affordable to less than 20 percent of the population. A more limited level of subsistence consumption of 4 m^3/month for water would cost \$10.8 per month, which would still be affordable to only 40 percent of the population. These findings suggest that for the water sector, the priority needs to be reducing costs rather than raising tariffs.

Figure 25. Affordability of water and power

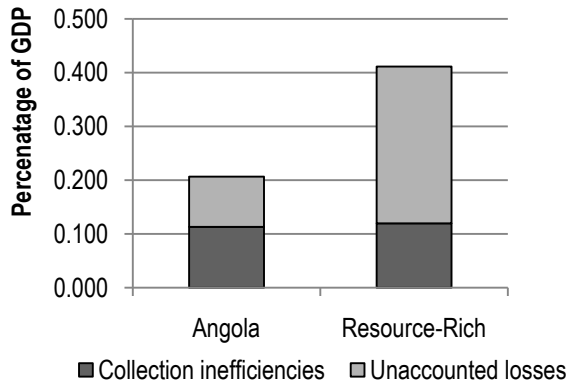


Source: Banerjee and others 2009.
Note: LIC = low-income country; kWh = kilowatt-hour.

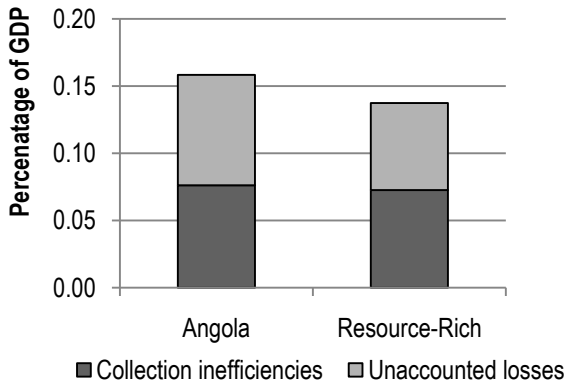
The operational inefficiencies of power and water utilities cost Angola a further $252 million a year, equivalent to 0.4 percent of GDP. The annual value of inefficiencies in the power sector (at $143 million) is higher than that in the water sector (at $109 million). Both power utilities, ENE and EDEL, and the water utility EPAL, can benefit from improving bill collection and reducing distributional losses. In 2009 ENE collected only 27 percent of its billings to EDEL and only 70 percent of its billing to end users. EDEL reported collecting 68 percent of its billings to consumers. EPAL managed to collect only 45 percent of its billings for water services. If all utilities were able to collect 100 percent of billings, they would receive an additional $131 million per year—$78 million in power and $53 million in the water sector. ENE lost 23 percent of power distributed to end users in 2009, while EDEL's distributional losses stood at 36 percent. When compared to the best-practice benchmark of 10 percent, the overall distribution losses result in $65 million in annual potential savings. Nonrevenue water in the water sector stood at a high 61 percent of total water production in 2009, three times the best-practice benchmark of 20 percent. Nonrevenue water inefficiencies cost Angola about $57 million a year, equivalent to 0.08 percent of GDP. In the power sector, the burden of utility inefficiencies in terms of GDP in Angola is lower than for the benchmark countries, but in water, the burden is slightly higher (figure 26).

Figure 26. The burden of inefficiency carried by Angola's power and water utilities

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



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



Source: Derived from Briceño-Garmendia, Smits, and Foster (2009).

Annual funding gap

Angola's infrastructure funding gap amounts to $115 million per year, or about 0.4 percent of GDP, once efficiencies are captured. Most of the gap is found in the water and sanitation sector (table 20). Most of the other sectors do not face any funding gap once all inefficiencies are taken into account. But in the power, water, and ICT sectors there is some potential for redistributing spending between capital and operating expenditure. As noted above, transport spending substantially exceeds the benchmark level established here, due to a government preference for accelerating reconstruction of the national road network. The remaining funding gap is very small relative to the size of Angola's economy, and could easily be filled by a modest reallocation of resources from the transport to the water and sanitation sector; particularly in view of the low budget execution in the transport sector. Furthermore, the funding gap for water and sanitation could be eliminated simply through a greater reliance on lower-cost technologies

than previously used (such as stand posts, boreholes, and improved latrines) for meeting the MDGs, thereby saving $165 million annually.

Table 20. Funding gaps, by sector

$ millions

	ICT	Irrigation	Power	Transport	WSS	Total
Needs	(288)	(18)	(785)	(423)	(574)	(2,088)
Spending*	266	7	457	423	322	1,474
Within sector reallocation	22	0	118	0	20	160
Potential efficiency gains	78	0	709	401	128	1,317
Funding gap	**—**	**(11)**	**—**	**—**	**(104)**	**(115)**
Across sectors reallocation potential	62	0	0	2,558	0	2,620

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.

WSS = water supply and sanitation; ICT = information and communication technology.

* traced to needs.

— = Not available.

What else can be done?

While Angola's infrastructure reconstruction needs are large in absolute terms, they look manageable relative to the size of the country's fast-growing economy. Moreover, Angola has already amply demonstrated its commitment to channeling significant volumes of petroleum rents toward infrastructure development. A significant expansion in power generation capacity has taken place, and a huge road investment program is currently under way. Consequently, Angola is one of a very few African countries that does not really face any significant infrastructure funding gap.

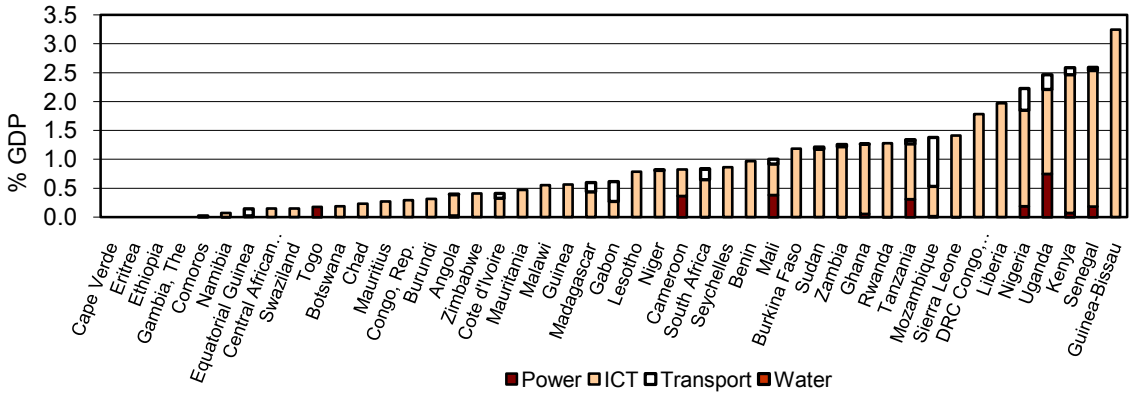
But this conclusion is contingent on Angola capturing the sizeable $1.3 billion of resources that are each year being lost to inefficiency, equivalent to almost 5 percent of GDP. Two policy measures alone would suffice to capture the bulk of these resources, and deserve priority attention. The first is the increase of power tariffs toward cost-recovery levels. The second is an easing of the pace of the road-sector investment program to reduce the problem of underexecution of budgetary resources.

Given the urgent pressure to reconstruct Angola's infrastructure platforms, there is some evidence that decisions have not always been optimal. For example, the expansion of generation capacity has not been matched by reinforcements in transmission and distribution that would allow the power to flow through to end users. And the scale of Angola's road-investment program seems to have outstripped the implementation capacity of the key sector institutions. There is also evidence that the water and sanitation sector may not yet have received as much attention as it deserves.

In addition, Angola's considerable achievements in infrastructure expansion over the past few years have been almost entirely funded from public investment, with significant support from non-OECD financiers. Angola has only captured about 0.4 percent of GDP in private investment for infrastructure, compared with numerous African peers that have managed to capture 1–3 percent of GDP in private investment (figure 27). Given the size and vibrancy of Angola's economy it ought to be feasible in the

medium term to attract a more significant volume of private finance, particularly in the energy sector (for the development of a gas-fired plant), thereby helping to liberate public funds for other pressing social needs.

Figure 27. Angola needs to attract more private investment, in particular beyond the ICT sector



Source: PPI Database, World Bank, 2010.
Note: GDP = gross domestic product; ICT = information and communication technology.

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 Angola could strategically expand its power trade, this would reduce the resource deficit of the power sector, lowering power needs from $785 million per year to $485 million per year, leading to savings of $300 million annually. Similarly, meeting transport connectivity standards using lower-cost road-surfacing technologies (such as single-surface treatment) could reduce the associated price tag from $423 million to $241 million. The overall savings from these measures would amount to $647 million, and would eliminate Angola's funding gap (table 21).

Table 21. Potential savings from innovation

$ millions

	Before innovation	After innovation	Savings	Savings as % of sector funding gap	Savings as % of total funding gap
Power trade	785	485	300	no gap	260
WSS appropriate technology	574	409	165	158	143
Roads appropriate technology	423	241	183	no gap	158
Total	1,783	1,135	647	no gap	562

Source: Derived from Carruthers and others, 2009 and Banerjee and others, 2008
Note: WSS = water supply and sanitation.

It will likely be necessary for Angola to consider planning for a period longer than a decade to reach the illustrative infrastructure targets here outlined. If the huge efficiency potential could be fully captured, Angola could meet the posited targets today, assuming current level of spending. But under business-as-usual assumptions of spending and efficiency, it will take up to 20 years for Angola to reach these goals.

Bibliography and references

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 (AICD). All of these can be downloaded from the project Web site: www.infrastructureafrica.org. For papers go to the document page (www.infrastructureafrica.org/aicd/documents), for databases to the data page (www.infrastructureafrica.org/aicd/tools/data), for models go to the models page (www.infrastructureafrica.org/aicd/tools/models), and for maps to the map page (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.

General

AICD (Africa Infrastructure Diagnostic). *Africa's Infrastructure: A Time for Transformation*. www.infrastructureafrica.org.

Foster, Vivien, and Cecilia Briceño-Garmendia, eds. 2009. *Africa's Infrastructure: A Time for Transformation.* Paris and Washington, DC: Agence Française de Développement and World Bank.

Financing

Briceño-Garmendia, Cecilia, Karlis Smits, and Vivien Foster. 2009. "Financing Public Infrastructure in Sub-Saharan Africa: Patterns and Emerging Issues." AICD Background Paper 15, Africa Region, World Bank, Washington, DC.

Growth

Calderón, César. 2009. "Infrastructure and Growth in Africa." Policy Research Working Paper 4914, World Bank, Washington, DC.

Escribano, Alvaro, J. Luis Guasch, and Jorge Pena. 2010. "Assessing the Impact of Infrastructure Quality on Firm Productivity in Africa." Policy Research Working Paper 5191, World Bank, Washington, DC.

Yepes, Tito, Justin Pierce, and Vivien Foster. 2009. "Making Sense of Africa's Infrastructure Endowment: A Benchmarking Approach." Policy Research Working Paper 4912, World Bank, Washington, DC.

Information and communication technologies

Almeida, Henrique. 2009. "Angola Sells 80 pct of Telecoms Group Movicel." *Reuters*, July 30. http://in.reuters.com/article/2009/07/30/angola-movicel-idINLU58752720090730.

Ampah, Mavis, Daniel Camos, Cecilia Briceño-Garmendia, Michael Minges, Maria Shkaratan, and Mark Williams. 2009. "Information and Communications Technology in Sub-Saharan Africa: A Sector Review." AICD Background Paper 10, Africa Region, World Bank, Washington, DC.

Macaohub. 2010. "Provincial Capitals of Angola Linked by Fibre Optic Cable in 2011." November 17. www.macauhub.com.mo/en/news.php?ID=10506.

Mayer, Rebecca, Ken Figueredo, Mike Jensen, Tim Kelly, Richard Green, and Alvaro Federico Barra. 2009. "Connecting the Continent: Costing the Needs for Spending on ICT Infrastructure in Africa." AICD Background Paper 3, Africa Region, World Bank, Washington, DC.

Narain, Divya. 2009. "Mundo Startel Expands WiMAX Services in Angola." *TMCnet*, August 4. http://africa.tmcnet.com/topics/othercountries/articles/61312-mundo-startel-expands-wimax-services-angola.htm.

TelecomPaper. 2009. "Govt, Private Operators Launch Angola Cable Joint Venture." June 5. www.telecompaper.com/news/govt-private-operators-launch-angola-cable-joint-venture.

WFN Strategies. 2009. "WFN Strategies to Supervise Maintenance of the ADONES Cable System." Press Release, June 29. www.wfnstrategies.com/pressroom.php.

Irrigation

Svendsen, Mark, Mandy Ewing, and Siwa Msangi. 2008. "Watermarks: Indicators of Irrigation Sector Performance in Africa." AICD Background Paper 4, Africa Region, World Bank, Washington, DC.

You, L., C. Ringler, G. Nelson, U. Wood-Sichra, R. Robertson, S. Wood, G. Zhe, T. Zhu, and Y. Sun. 2009. "Torrents and Trickles: Irrigation Spending Needs in Africa." AICD Background Paper 9, Africa Region, World Bank, Washington, DC.

Power

Eberhard, Anton, Vivien Foster, Cecilia Briceño-Garmendia, Fatimata Ouedraogo, Daniel Camos, and Maria Shkaratan. 2008. "Underpowered: The State of the Power Sector in Sub-Saharan Africa." AICD Background Paper 6, Africa Region, World Bank, Washington, DC.

EIU (Economic Intelligence Unit). 2010. *Niger Country Report.* November 2010 Report, Economic Intelligence Unit, London.

Foster, Vivien, and Jevgenijs Steinbuks. 2009. "Paying the Price for Unreliable Power Supplies: In-House Generation of Electricity by Firms in Africa." Policy Research Working Paper 4913, World Bank, Washington, DC.

GTZ (Deutsche Gesellschaft für Internationale Zusammenarbeit). 2009. *International Fuel Prices 2009*. 6th ed. Eschborn, Germany: GTZ.

Rosnes, Orvika, and Haakon Vennemo. 2009. "Powering Up: Costing Power Infrastructure Spending Needs in Sub-Saharan Africa." AICD Background Paper 5, Africa Region, World Bank, Washington, DC.

Briceño-Garmendia, Cecilia and Shkaratan, Maria. 2010. "Power Tariffs: Caught between Cost-Recovery and Affordability." Policy Research Working Paper forthcoming, World Bank, Washington DC

World Bank. 2010a. *Angola: Electricity Dialogue*. Back to the Office Report, World Bank, Washington, DC, March 15–26.

———. 2010b. *Angola Enterprise Surveys 2010*. www.enterprisesurveys.org/ExploreEconomies/?economyid=142&year=2009.

———. 2010c. "Getting Electricity: A Pilot Indicator Set from the Doing Business Project." http://doingbusiness.org/data/exploretopics/getting-electricity.

Transport

Bofinger, Heinrich C. 2009. "An Unsteady Course: Growth and Challenges in Africa's Air Transport Industry." AICD Background Paper 16, Africa Region, World Bank, Washington, DC.

Bullock, Richard. 2009. "Off Track: Sub-Saharan African Railways." AICD Background Paper 17, Africa Region, World Bank, Washington, DC.

Carruthers, Robin, Ranga Rajan Krishnamani, and Siobhan Murray. 2009. "Improving Connectivity: Investing in Transport Infrastructure in Sub-Saharan Africa." AICD Background Paper 7, Africa Region, World Bank, Washington, DC.

Curtis, Barney. 2009. "The Chirundu Border Post: Detailed Monitoring of Transit Times." SSATP Discussion Paper No. 10, Regional Integration and Transport—RIT Series, Africa Region, World Bank, Washington, DC.

Gwilliam, Ken, Vivien Foster, Rodrigo Archondo-Callao, Cecilia Briceño-Garmendia, Alberto Nogales, and Kavita Sethi. 2008. "The Burden of Maintenance: Roads in Sub-Saharan Africa." AICD Background Paper 14, Africa Region, World Bank, Washington, DC.

Kumar, Ajay, and Fanny Barrett. 2008. "Stuck in Traffic: Urban Transport in Africa." AICD Background Paper 1, Africa Region, World Bank, Washington, DC.

Nathan Associates. 2010. *Definition and Investment Strategy for a Core Strategic Transport Network for Eastern and Southern Africa*. Draft Report prepared for the World Bank, Washington, DC, as of October 2010.

Ocean Shipping Consultants, Inc. 2009. "Beyond the Bottlenecks: Ports in Africa." AICD Background Paper 8, Africa Region, World Bank, Washington, DC.

Water resources

Irrigation

Svendsen, Mark, Mandy Ewing, and Siwa Msangi. 2008. "Watermarks: Indicators of Irrigation Sector Performance in Africa." AICD Background Paper 4, Africa Region, World Bank, Washington, DC.

You, L., C. Ringler, G. Nelson, U. Wood-Sichra, R. Robertson, S. Wood, G. Zhe, T. Zhu, and Y. Sun. 2009. "Torrents and Trickles: Irrigation Spending Needs in Africa." AICD Background Paper 9, Africa Region, World Bank, Washington, DC.

Water supply and sanitation

African Ministers' Council on Water (AMCOW). 2010. *Country Status Overviews on Water Supply and Sanitation 2010*. Regional Synthesis Report, August 2010, Addis Ababa

Banerjee, Sudeshna, Vivien Foster, Yvonne Ying, Heather Skilling, and Quentin Wodon. 2008a. "Cost Recovery, Equity, and Efficiency in Water Tariffs: Evidence from African Utilities." AICD Working Paper 7, Africa Region, World Bank, Washington, DC.

Banerjee, Sudeshna, Heather Skilling, Vivien Foster, Cecilia Briceño-Garmendia, Elvira Morella, and Tarik Chfadi. 2008b. "Ebbing Water, Surging Deficits: Urban Water Supply in Sub-Saharan Africa." AICD Background Paper 12, Africa Region, World Bank, Washington, DC.

Cain, Allan, Mary Daly, and Paul Robson. 2002. "Basic Service Provision for the Urban Poor: The Experience of Development Workshop in Angola." IIED Working Paper 8 on Poverty Reduction in Urban Areas, Human Settlement Program, IIED, London, UK.

Development Workshop—Angola, 2007. *Luanda Informal Water Sector Study Service Provision for the Peri-Urban Poor in Post-Conflict Angola*. Draft Report, Luanda.

Keener, Sarah, Manuel Luengo, and Sudeshna Banerjee. 2009. "Provision of Water to the Poor in Africa: Experience with Water Standposts and the Informal Water Sector." AICD Working Paper 13, Africa Region, World Bank, Washington, DC.

Luta Contra Pobreza Urbana (LUPP). 2007. "Community Model for Household Sanitation: Good Practice in the Musseques of Luanda." LUPP Good Practice Series, LuandaMorella, Elvira, Vivien Foster, and Sudeshna Ghosh Banerjee. 2008. "Climbing the Ladder: The State of Sanitation in Sub-Saharan Africa." AICD Background Paper 13, Africa Region, World Bank, Washington, DC.

USAID (United States Agency for International Development). 2009. *Angola: Water and Sanitation Profile*, Washington DCWHO (World Health Organization) Joint Monitoring Program (JMP). 2010a. "Angola Estimates for the Use of Improved Drinking-Water Sources." www.wssinfo.org/resources/documents.html.

———. 2010b. "Angola Estimates for the Use of Improved Sanitation Facilities." www.wssinfo.org/resources/documents.html.

World Bank. 2008. *Project Appraisal Document on a Proposed Credit in the Amount of SDR 35 million (US$57.0 Million Equivalent) to the Republic of Angola for the Water Sector Institutional Development Project.* Report No: 42864-A0, June 26.

Other

IMF (International Monetary Fund). 2011. Angola: Fourth Review under the Stand-By Arrangement, Request for Waivers of Nonobservance of Performance Criteria, Request for Waivers of Applicability of Performance Criteria, and Request for Modification of Performance Criteria. IMF Country Report No. 11/51, February 2011, Washington DC.

World Bank. 2005. Private Solutions for Infrastructure in Angola. Public-Private Infrastructure Advisory Facility. Washington, DC: World Bank.

———. 2007a. Angola Country Assistance Evaluation. Report No: 39829, Country Evaluation and Regional Relations, Independent Evaluation Group, October 1.

———. 2007b. Angola: Investment Climate Assessment. Report No: 44314-AO, Regional Program for Enterprise Development (RPED), Finance and Private Sector (AFTFP), Africa Region, October.

AICD
AFRICA INFRASTRUCTURE
COUNTRY DIAGNOSTIC

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, 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.