Overview

Africa's Infrastructure: A Time for Transformation

The Africa Infrastructure Country Diagnostic is an unprecedented attempt to collect comprehensive data on the infrastructure sectors in Africa—covering power, transport, irrigation, water and sanitation, and information and communication technology (ICT)—and to provide an integrated analysis of the challenges they face. Based on extensive fieldwork across Africa, the following main findings have emerged:

- Infrastructure has been responsible for more than half of Africa's recent improved growth performance and has the potential to contribute even more in the future.
- Africa's infrastructure networks increasingly lag behind those of other developing countries and are characterized by missing regional links and stagnant household access.
- Africa's difficult economic geography presents a particular challenge for the region's infrastructure development.
- Africa's infrastructure services are twice as expensive as elsewhere, reflecting both diseconomies of scale in production and high profit margins caused by lack of competition.
- Power is by far Africa's largest infrastructure challenge, with 30 countries facing regular power shortages and many paying high premiums for emergency power.
- The cost of addressing Africa's infrastructure needs is around $93 billion a year, about one-third of which is for maintenance—more than twice the Commission for Africa's (2005) estimate.
- The infrastructure challenge varies greatly by country type—fragile states face an impossible burden and resource-rich countries lag despite their wealth.
- A large share of Africa's infrastructure is domestically financed, with the central government budget being the main driver of infrastructure investment.
- Even if major potential efficiency gains are captured, Africa would still face an infrastructure funding gap of $31 billion a year, mainly in power.

- Africa's institutional, regulatory, and administrative reforms are only halfway along, but they are already proving their effect on operational efficiency.

Finding 1: Infrastructure Contributed over Half of Africa's Improved Growth Performance

Africa's growth improved markedly in the last decade. African countries saw their economies grow at a solid 4 percent a year from 2001 to 2005. Resource-rich countries, which have benefited from rising commodity prices, demonstrate the highest growth rates. Growth overall still falls short of the 7 percent needed to achieve substantial poverty reduction and attain the Millennium Development Goals (MDGs), however. Infrastructure, significant in Africa's economic turnaround, will need to play an even greater role for the continent to reach its development targets.

Across Africa, infrastructure contributed 99 basis points to per capita economic growth from 1990 to 2005, compared with 68 basis points for other structural policies (Calderón 2008). That contribution is almost entirely attributable to advances in the penetration of telecommunication services. The deterioration in the quantity and quality of power infrastructure over the same period retarded growth, shaving 11 basis points from per capita growth for Africa as a whole and as much as 20 basis points for southern Africa.

The growth effects of further improving Africa's infrastructure would be even greater. Simulations suggest that if all African countries were to catch up with Mauritius (the regional leader in infrastructure) per capita growth in the region could increase by 2.2 percentage points. Catching up with the Republic of Korea would increase per capita growth by 2.6 percentage points a year. In Côte d'Ivoire, the Democratic Republic of Congo, and Senegal, the effect would be even larger.

In most African countries, particularly the lower-income countries, infrastructure emerges as a major constraint on doing business, depressing firm productivity by about 40 percent (Escribano, Guasch, and Pena 2008). For most countries, the negative effect of deficient infrastructure is at least as large as that of crime, red tape, corruption, and financial market constraints. For one set of countries, power emerges as the most limiting factor by far, cited by more than half the firms in more than half the countries as a major business obstacle. For a second set, inefficient functioning of ports and associated customs clearance is equally significant. Deficiencies in transport and in ICTs are less prevalent but substantial in some cases.

Infrastructure not only contributes to economic growth, but it is also an important input to human development (Fay and others 2005). Infrastructure is a key ingredient for achieving all the MDGs. Safe and convenient water supplies save time and arrest the spread of a range of serious diseases—including diarrhea, a leading cause of infant mortality and malnutrition. Electricity powers health and education services and boosts the productivity of small businesses. Road networks provide links to global and local markets. ICTs democratize access to information and reduce transport costs by allowing people to conduct transactions remotely.

Finding 2: Africa's Infrastructure Lags Well behind That of Other Developing Countries

On just about every measure of infrastructure coverage, African countries lag behind their peers in the developing world (Yepes, Pierce, and Foster 2008). This lag is perceptible for low- and middle-income countries in Sub-Saharan Africa relative to other low- and middle-income countries (table O.1). The differences are particularly large for paved roads, telephone main lines, and power generation. For all three, Africa has been expanding stocks much more slowly than other developing regions; so unless something changes, the gap will continue to widen.

To what extent does Africa's current deficit date to a low starting point for infrastructure stocks? Africa started out with stocks that were generally not very different from those in South or East Asia in the 1960s for roads, in the 1970s for telephones, and in the 1980s for power. The comparison with South Asia,

which has similar per capita incomes, is particularly striking. In 1970, Sub-Saharan Africa had almost three times the generating capacity per million people as South Asia. In 2000, South Asia had left Sub-Saharan Africa far behind—with almost twice the generation capacity per million people. Also in 1970, Sub-Saharan Africa had twice the main-line telephone density of South Asia, but by 2000, the two regions were even.

Since 1990, coverage of household services has barely improved (figure O.1, panel a). Africa is unlikely to meet the MDGs for water and sanitation. Moreover, on current trends, universal access to these and other household services is more than 50 years away in most African countries (Banerjee, Wodon, and others 2008). Even where infrastructure networks are in place, a significant percentage of households remains unconnected, suggesting that demand-side barriers exist and that universal access entails more than physical rollouts of networks. As might be expected, access to infrastructure in rural areas is only a fraction of that in urban areas, even where urban coverage is already low by international standards (Banerjee, Wodon, and others 2008) (figure O.1, panel b).

Table O.1 Africa's Infrastructure Deficit

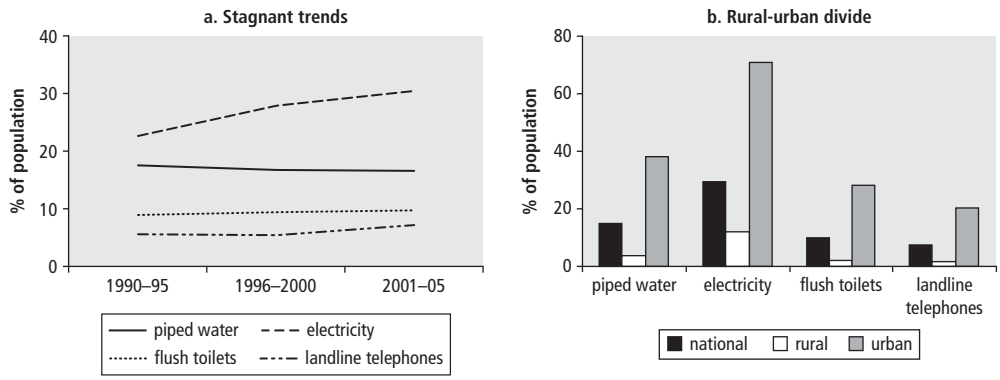
Normalized units	Sub-Saharan Africa low-income countries	Other low-income countries
Paved-road density	31	134
Total road density	137	211
Main-line density	10	78
Mobile density	55	76
Internet density	2	3
Generation capacity	37	326
Electricity coverage	16	41
Improved water	60	72
Improved sanitation	34	51

Source: Yepes, Pierce, and Foster 2008.
Note: Road density is measured in kilometers per 100 square kilometers of arable land; telephone density in lines per thousand population; generation capacity in megawatts per million population; electricity, water, and sanitation coverage in percentage of population.

Finding 3: Africa's Difficult Economic Geography Presents a Challenge for Infrastructure Development

Relative to other continents, Africa is characterized by low overall population density (36 people per square kilometer), low rates of urbanization (35 percent), but relatively rapid rates of urban growth (3.6 percent a year), a relatively large number of landlocked countries (15), and numerous small economies. A further complication is that the continent experiences particularly high hydrological variability, with huge swings in precipitation across areas, seasons, and time, which climate change is likely to exacerbate.

Figure O.1 Access to Household Services



Source: Banerjee, Wodon, and others 2008.

Africa's atomized nation-states are reflected in the region's fragmentary infrastructure networks. Sub-Saharan Africa comprises 48 nation-states, many of which are very small. The bulk of those countries have populations of fewer than 20 million and economies smaller than $10 billion. International frontiers bear little relation either to natural features (such as river basins) or to artificial features (such as cities and their accessibility to trading channels, such as ports). Intraregional connectivity is therefore very low, whether measured in transcontinental highway links, power interconnectors, or fiber-optic backbones. Most continuous transport corridors are concerned with providing access to seaports, whereas the intraregional road network is characterized by major discontinuities. Few cross-border interconnectors exist to support regional power exchange, even though many countries are too small to produce power economically on their own. Until recently, the whole of East Africa lacked access to a global submarine cable to provide low-cost international communications and Internet access. The intraregional fiber-optic network is also incomplete, but growing rapidly. Because of their geographic isolation, landlocked countries in particular suffer from the lack of regional connectivity.

Both the spatial distribution and rapid migration of Africa's population create major challenges for reaching universal access. In rural areas, over 20 percent of the population lives in dispersed settlements where typical population densities are less than 15 people per square kilometer; hence, the costs of providing infrastructure are comparatively high. In urban areas, population growth rates averaging 3.6 percent a year are leaving infrastructure service providers severely stretched. As a result, urban service coverage has actually declined over the last decade, and lower-cost alternatives are filling the resulting gap (Banerjee, Wodon, and others 2008; Morella, Foster, and Banerjee 2008). In addition, population densities in African cities are relatively low by global standards and do not benefit from large economies of agglomeration in the provision of infrastructure services. As a result, the costs of providing a basic infrastructure package can easily be twice as much as in other developing cities (Dorosh and others 2008).

Africa's water resources are abundant, but because of an absence of water storage and distribution infrastructure, they are grossly underused. Therefore, water security—eliable water supplies and acceptable risks from floods and other unpredictable events, including those from climate change—will require a significant expansion of water storage capacity from the current 200 cubic meters per capita (Grey and Sadoff 2006). In other parts of the world, such capacity is in the thousands of cubic meters. The cost of expanding water storage is extremely high in relation to the size of Africa's economies, suggesting the phasing of investments, with initial focus on achieving water security for key growth poles.

Water also needs to be distributed for agricultural use. In a handful of countries, only 7 million hectares are equipped for irrigation. Although the irrigation-equipped area is less than 5 percent of Africa's cultivated area, it produces 20 percent of the value of agricultural production. An additional 12 million hectares could be economically viable for irrigation as long as costs are contained (You 2008).

Finding 4: Africa's Infrastructure Services Are Twice as Expensive as Elsewhere

Not only are Africa's infrastructure networks deficient in coverage, but the price of the services provided is also exceptionally high by global standards (table O.2). Whether for power, water, road freight, mobile telephones, or Internet services, the tariffs paid in Africa are several multiples of those paid in other parts of the developing world. The explanation for Africa's higher prices sometimes lies in genuinely higher costs, and sometimes in high profits. The policy prescriptions for the two cases are, of course, radically different.

Power provides the clearest example of infrastructure with costs genuinely higher in Africa than elsewhere. Many smaller countries have national power systems below the 500-megawatt threshold and therefore often rely on small diesel generation that can cost up to $0.35 per kilowatt-hour to run, about

Table O.2 Africa's High-Cost Infrastructure

Infrastructure sector	Sub-Saharan Africa	Other developing regions
Power tariffs ($ per kilowatt-hour)	0.02–0.46	0.05–0.10
Water tariffs ($ per cubic meter)	0.86–6.56	0.03–0.60
Road freight tariffs ($ per ton-kilometer)	0.04–0.14	0.01–0.04
Mobile telephony ($ per basket per month)	2.60–21.00	9.90
International telephony ($ per 3-minute call to the United States)	0.44–12.50	2.00
Internet dial-up service ($ per month)	6.70–148.00	11.00

Sources: Authors' estimates based on Africon 2008; Bannerjee, Skilling, and others 2008; Eberhard and others 2008; Minges and others 2008; Teravaninthorn and Raballand 2008; Wodon 2008a and 2008b.
Note: Ranges reflect prices in different countries and various consumption levels. Prices for telephony and Internet service represent all developing regions, including Africa.

twice the costs faced by larger countries typically with coal- or hydropower-based systems (Eberhard and others 2008).

High road freight tariffs in Africa have much more to do with high profit margins than high costs (Teravaninthorn and Raballand 2008). The costs for Africa's trucking operators are not much higher than costs in other parts of the world, even when informal payments are counted. Profit margins, by contrast, are exceptionally high, particularly in Central and West Africa, where they reach 60 to 160 percent. The underlying cause is limited competition combined with a highly regulated market based on *tour de role* principles, which allocate freight to transporters through a centralized queuing method rather than allowing truckers to enter into bilateral contracts with customers directly.

The high costs of international telephony and Internet services reflect a mixture of cost and profit factors. Countries without access to a submarine cable must rely on expensive satellite technology for international connectivity and have charges typically twice those in countries that do enjoy such access. Even when access to a submarine cable is secured, countries with a monopoly on this international gateway still have tariffs substantially higher than those without (Minges and others 2008).

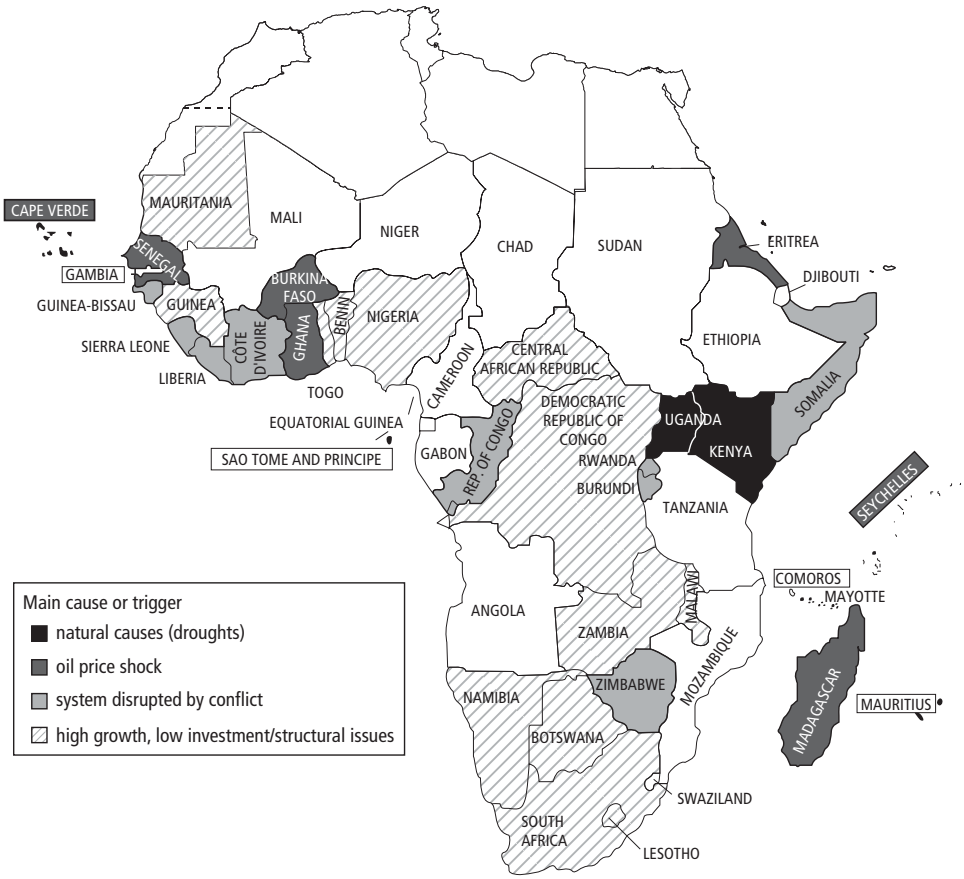
Finding 5: Power Is Africa's Largest Infrastructure Challenge by Far

Whether measured in generation capacity, electricity consumption, or security of supply, Africa's power infrastructure delivers only a fraction of the service found elsewhere in the developing world (Eberhard and others 2008). The 48 Sub-Saharan Africa countries (with 800 million people) generate roughly the same power as Spain (with 45 million people). Power consumption, at 124 kilowatt-hours per capita annually *and falling*, is only 10 percent of that found elsewhere in the developing world, barely enough to power one 100-watt lightbulb per person for 3 hours a day.

More than 30 African countries experience power shortages and regular interruptions to service (figure O.2). The underlying causes vary: failures to bring on new capacity to keep pace with the demands of economic growth, droughts that reduced hydropower in East Africa, oil price hikes that inhibited affordability of diesel imports for many West African countries, and conflicts that destroyed power infrastructure in fragile states. Africa's firms report losing 5 percent of their sales because of frequent power outages—a figure that rises to 20 percent for informal firms unable to afford backup generation. Overall, the economic costs of power outages can easily rise to 1–2 percent of GDP.

A common response to the crisis is to tender short-term leases for emergency power. At least 750 megawatts of emergency generation are operating in Sub-Saharan Africa, which for some countries constitute a large proportion of their national installed capacity. However, emergency generation is expensive at costs of $0.20–$0.30 per kilowatt-hour, and for some countries, the price tag can be as high as 4 percent of GDP. Paying for emergency leases absorbs significant budgetary resources, reducing the funds for longer-term solutions.

Figure O.2 Underlying Causes of Africa's Power Supply Crisis



Source: Eberhard and others 2008.

Finding 6: Africa's Infrastructure Spending Needs at $93 Billion a Year Are More than Double Previous Estimates by the Commission for Africa

Meeting Africa's infrastructure needs calls for a very substantial program of infrastructure investment and maintenance:

- Develop an additional 7,000 megawatts a year of new power generation capacity (about half through multipurpose water storage schemes).
- Enable regional power trade by laying 22,000 megawatts of cross-border transmission lines.
- Complete the intraregional fiber-optic backbone network and continental submarine cable loop.
- Interconnect capitals, ports, border crossings, and secondary cities with a good-quality road network.
- Provide all-season road access to Africa's high-value agricultural land.
- More than double Africa's irrigated area.
- Meet the MDGs for water and sanitation.
- Raise household electrification rates by 10 percentage points.
- Provide global systems mobile voice signal and public access broadband to 100 percent of the population.

Implementing such an ambitious program to address Africa's infrastructure needs would cost around $93 billion a year (about 15 percent of the region's GDP). Some two-thirds of this total relates to capital expenditure, and the remaining one-third to operation and maintenance

requirements (table O.3; Briceño-Garmendia, Smits, and Foster 2008).

That cost is well over twice the $39 billion of infrastructure spending estimated by the Commission for Africa report in 2005. That figure was based on a cross-country econometric study, rather than the more detailed country-level microeconomic modeling (Estache 2005). A more recent update of the cross-country model used for the Commission for Africa report came up with revised estimates in the range of $80 billion to $90 billion, much closer to those reported here (Yepes 2007).

About 40 percent of the total spending needs are associated with power, reflecting Africa's particularly large deficits. About one-third of the power investment needs (some $9 billion a year) are associated with multipurpose water storage for hydropower and water resource management. After power, water supply and sanitation and then transport are the most significant items.

Given recent escalations in unit costs, these estimates are a lower bound. Although the investment estimates here are based on the most accurate unit-cost data available, development agencies are reporting significant cost escalations on projects under implementation. For road projects, these escalations have averaged 35 percent but in some cases have been as high as 50–100 percent. Closer inspection reveals that no single factor explains this escalation. Domestic inflation, tight construction industry conditions, oil price hikes, and inadequate competition for tenders have all played their role, with the last factor by far the strongest.

The global financial crisis of 2008 can be expected to reduce demand for some types of infrastructure, but it would not hugely alter the estimated spending needs. Planning and social targets rather than economic growth drive a large share of the spending needs, for example, the transport spending needs (which are largely based on connectivity objectives) and the water and sanitation spending needs (which are based on the MDGs). The spending needs with the strongest direct link to economic growth are those for the power sector. However, because of the large investment backlog in the sector, the estimated spending needs contain a strong component of refurbishment and catch-up. Thus, even halving economic growth estimates for the region would reduce estimated power spending needs by only 20 percent. The global recession could also be expected to affect demand for ICT services, as well as trade-related infrastructure, such as railways and ports. However, the weight of these infrastructures in the total spending needs is not much more than 10 percent.

Table O.3 Overall Infrastructure Spending Needs for Sub-Saharan Africa
$ billions annually

Infrastructure sector	Capital expenditure	Operation and maintenance	Total spending
ICT	7.0	2.0	9.0
Irrigation	2.9	0.6	3.4
Power	26.7	14.1	40.8
Transport	8.8	9.4	18.2
WSS	14.9	7.0	21.9
Total	60.4	33.0	93.3

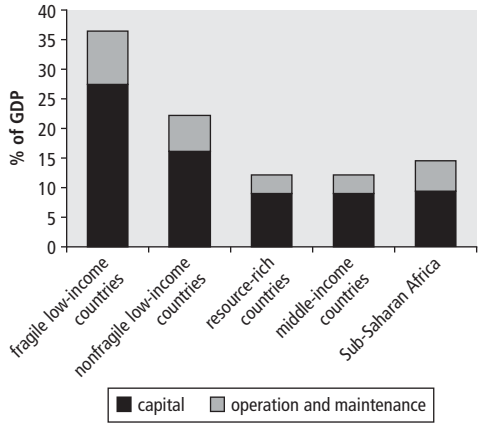
Source: Authors' estimates based on Banerjee, Wodon, and others 2008; Carruthers, Krishnamani, and Murray 2008; Mayer and others 2008; Rosnes and Vennemo 2008.
Note: Column totals may not add exactly because of rounding errors. ICT = information and communication technology; WSS = water supply and sanitation.

Finding 7: The Infrastructure Challenge Varies Greatly by Country Type

The infrastructure challenge differs markedly across African country groups (Briceño-Garmendia, Smits, and Foster 2008). Because of the widely varying circumstances, distinguishing among middle-income countries (like Cape Verde and South Africa), resource-rich countries with economies heavily reliant on petroleum or mineral revenues (like Nigeria and Zambia), fragile states emerging from conflict (like Côte d'Ivoire and the Democratic Republic of Congo), and the remaining low-income countries that are neither fragile nor resource rich (like Senegal and Uganda) is helpful.

By far the most daunting infrastructure challenges are those facing the fragile states (figure O.3). The recent conflicts affecting these countries usually resulted in the destruction

Figure O.3 Burden of Infrastructure Spending Needs



Source: Briceño-Garmendia, Smits, and Foster 2008.
Note: Figures refer to investment (except public sector) and include recurrent spending. Public sector covers general government and nonfinancial enterprises.

or dilapidation of their (already modest) national infrastructure platforms. In the Democratic Republic of Congo, about 50 percent of infrastructure assets need rehabilitation. The fragile states' infrastructure spending needs are especially large, particularly when measured against the size of their economies. Such countries would, on average, need to devote 37 percent of their GDPs to infrastructure spending to build a solid infrastructure platform. With their difficult environments, they attract relatively little external financing, capturing only 10 percent of overseas development assistance and 6 percent of private capital flows allocated to infrastructure. In addition to their huge financing burden, the fragile states do not use their current resource envelope well; they underspend on maintenance and have inefficient service providers.

Nonfragile low-income countries need to allocate, on average, about 23 percent of their GDPs to build and sustain a basic infrastructure platform, a level difficult to envisage in practice. Therefore, these countries will have to make difficult choices about the prioritization of their infrastructure investments, and most of them have a long way to go in improving the efficiency of operating existing infrastructure.

The resource-rich countries are, in principle, much better placed to meet their infrastructure spending needs, though in practice they have not tended to do so. Resource-rich countries could meet their infrastructure spending needs for a more manageable price tag of about 12 percent of GDP. Moreover, the large royalty payments they received during the recent commodity boom provide a ready source of finance. Yet resource rich-countries actually lag nonfragile low-income countries in their infrastructure stocks and spend less on infrastructure. They have been devoting their added wealth not to infrastructure development but to paying off debts. The governance challenges in a resource-rich environment may thus prevent the transformation of wealth into infrastructure.

Meeting the infrastructure needs of the middle-income countries looks to be much more manageable. These countries should be able to meet their infrastructure spending needs with 10 percent of GDP. They are also much stronger in asset maintenance and institutional efficiency. Their more urban populations also facilitate network rollout.

Finding 8: A Large Share of Africa's Infrastructure Is Domestically Financed

Existing spending on infrastructure in Africa is higher than previously thought, amounting to $45 billion a year when budget and off-budget spending (including state-owned enterprises and extrabudgetary funds) and external financiers are taken into account. The latter include the private sector, official development assistance, and financiers that do not belong to the Organisation for Economic Co-operation and Development (OECD). As much as two-thirds of this overall spending is domestically sourced: $30 billion of annual spending is financed by the African taxpayer and infrastructure user, and a further $15 billion is from external sources (table O.4).

The public sector remains the dominant source of finance for water, energy, and transport in all but the fragile states. Public investment is largely tax financed and executed through central government budgets, whereas the operating and maintenance expenditure is largely financed from user charges and executed through state-owned enterprises. Current levels of public

Table O.4 Infrastructure Spending on Addressing Sub-Saharan Africa's Infrastructure Needs
$ billions annually

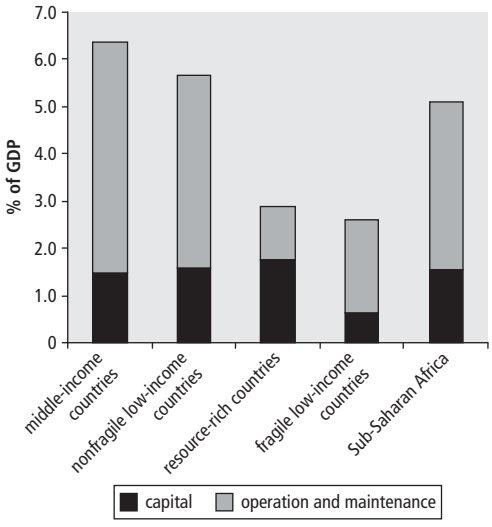
	Operation and maintenance	Capital expenditure					
Infrastructure sector	Public sector	Public sector	ODA	Non-OECD financiers	Private sector	Total	Total spending
ICT	2.0	1.3	0.0	0.0	5.7	7.0	9.0
Power	7.0	2.4	0.7	1.1	0.5	4.6	11.6
Transport	7.8	4.5	1.8	1.1	1.1	8.4	16.2
WSS	3.1	1.1	1.2	0.2	2.1	4.6	7.6
Irrigation	0.6	0.3	—	—	—	0.3	0.9
Total	20.4	9.4	3.6	2.5	9.4	24.9	45.3

Source: Briceño-Garmendia, Smits, and Foster 2008.
Note: Based on annualized averages for 2001–06. Averages weighted by country GDP. Figures are extrapolations based on the 24-country sample covered in AICD Phase 1. Totals may not add exactly because of rounding errors. ICT = information and communication technology; ODA = official development assistance; OECD = Organisation for Economic Co-operation and Development; WSS = water supply and sanitation. — Not available.

finance are substantially higher relative to GDP in the low-income states, typically absorbing 5–6 percent of total GDP (figure O.4). In absolute terms, however, spending remains very low, no more than $20–$30 per capita a year (Briceño-Garmendia, Smits, and Foster 2008).

Looking only at investment, one finds that official development assistance, private participation in infrastructure, and non-OECD financiers together exceed domestically financed public investment (Briceño-Garmendia, Smits, and Foster 2008). The private sector is by far the largest source, on a par with domestic public investment. Much smaller, but still significant, capital flows are provided by official development assistance and, to a lesser extent, non-OECD financiers, such as China, India, and the Arab states. The focus differs markedly in each case. Official development assistance makes an important contribution to water and transport, particularly in fragile states. Non-OECD finance is significant in energy and rail, especially in resource-rich countries. Private participation in infrastructure is heavily concentrated in ICT.

Figure O.4 Infrastructure Public Spending as a Percentage of GDP



Source: Briceño-Garmendia, Smits, and Foster 2008.

Finding 9: After Potential Efficiency Gains, Africa's Infrastructure Funding Gap Is $31 Billion a Year, Mostly in the Power Sector

Addressing a wide range of inefficiencies could make the existing resource envelope go much further—to the tune of $17 billion a year. This is Africa's major infrastructure efficiency gap (Briceño-Garmendia, Smits, and Foster 2008).

First, some countries are allocating more resources to some areas of infrastructure than would appear to be warranted (Briceño-Garmendia, Smits, and Foster 2008). This "excess expenditure" amounts to $3.3 billion a year overall. The largest share of this excess expenditure relates to public spending on ICT infrastructure that the private sector could provide, particularly in middle-income countries.

Although some of this "overspending" may be justified by phasing or sequencing, at least part of these resources could possibly be reallocated to underfunded sectors. A need exists to monitor infrastructure expenditure more closely against identified needs and priorities and considering expected economic returns.

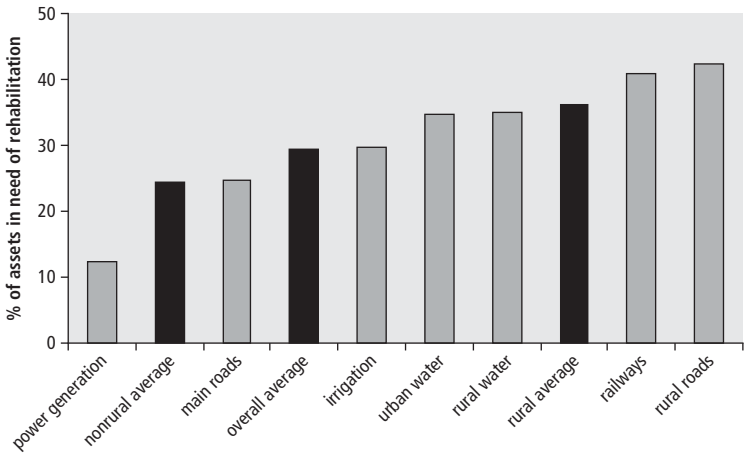
Second, African countries are typically executing only about two-thirds of the budget allocated to public investment in infrastructure (Briceño-Garmendia, Smits, and Foster 2008). Put differently, public investment could in theory increase by 30 percent without any increase in spending, simply by addressing the institutional bottlenecks that inhibit capital budget execution. Changes include better planning of investment projects, earlier completion of feasibility studies, more efficient procurement processes, and a move to medium-term multiyear budgeting. Increasing capital budget execution to 100 percent could capture an additional $1.9 billion a year in public investment.

Third, on average, about 30 percent of the infrastructure assets of a typical African country need rehabilitation (figure O.5). This share is even higher for rural infrastructure and for countries affected by violent conflict. The rehabilitation backlog reflects a legacy of underfunding maintenance, a major waste given that the cost of rehabilitating infrastructure is several times higher than the cumulative cost of sound preventive maintenance. For example, spending $1 on road maintenance provides a savings of $4 to the economy. So some reallocation of resources from investment to maintenance may be warranted, particularly in low-income countries with very low maintenance spending. For roads, an estimated $2.4 billion of capital spending on rehabilitation could have been avoided with sound preventive maintenance.

Fourth, Africa's power and water utilities present very high inefficiency in distribution losses, undercollection of revenues, and overstaffing (figure O.6). Utilities typically collect only 70–90 percent of billed revenues, and distribution losses can easily be twice the technical best practice. According to household surveys, about 40 percent of those connected to utility services do not appear to be paying for them, a share that rises to 65 percent for a significant minority of countries. Undercollection is also a problem for some of Africa's road funds (Gwilliam and others 2008). State-owned telecommunication incumbents employ roughly six times the number of employees per connection than do privately operated enterprises in developing countries. For ICT, countries retaining state-owned incumbents are often incurring significant losses from overstaffing that average 0.2 percent of GDP. Similarly, though to a lesser extent, overemployment in power and water utilities ranges from 20 percent to 80 percent over benchmarks in other developing areas. Overall, the revenues lost through these inefficiencies can easily exceed the current turnover of the utilities by several multiples. For power, these losses are also material at the national level, absorbing 0.5 percent of GDP on the Sub-Saharan African average, or $3.4 billion annually (Briceño-Garmendia, Smits, and Foster 2008). For water, the absolute value of the inefficiencies is smaller, with the average amount accounting for 0.2 percent of GDP, or $1 billion a year.

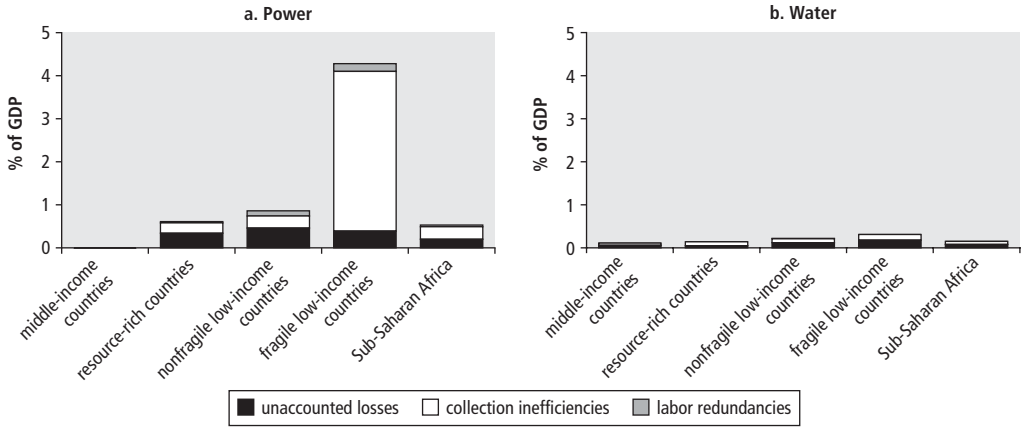
Fifth, underpricing of infrastructure services is substantial. Although African infrastructure charges are high by international standards, so are the infrastructure costs. Even relatively high tariffs can fail to cover more than the operating costs. The revenues uncollected because of underpricing of power and water amount to

Figure O.5 Rehabilitation Backlog



Source: Briceño-Garmendia, Smits, and Foster 2008.

Figure O.6 Hidden Costs of Utility Inefficiencies



Source: Briceño-Garmendia, Smits, and Foster 2008.

as much as $4 billion a year on aggregate, an implicit subsidy for infrastructure consumers, and that is without taking into account sizable subsidies to large industrial customers that cannot be so readily quantified (Briceño-Garmendia, Smits, and Foster 2008). Because of the very regressive access to infrastructure services in Africa, about 90 percent of those who have access to piped water or electricity services belong to the richest 60 percent of the population (see figure O.9, panel a; Banerjee, Wodon, and others 2008). Thus, better-off households largely capture any subsidy to residential services. In fact, targeting is so deficient that a completely random process for allocating subsidies across the population would perform three times better at reaching the poor.

The overall funding shortfall for meeting Africa's infrastructure needs is given by the difference between estimated infrastructure spending needs and a potential resources envelope that includes existing spending and the potential efficiency gains. Even if all these efficiency gains could be fully realized, a funding gap of about $31 billion a year would remain (table O.5). This gap can be addressed only by raising additional finance or alternatively by adopting lower-cost technologies or less ambitious targets for infrastructure development.

Looking across sectors, about 60 percent of the funding gap relates to power (figure O.7, panel a). The remainder relates to water and irrigation. There is no significant funding gap for ICT or transport.

Looking across countries, the dollar amount of the funding gap split evenly across income groups. Although the largest financing gaps relate to capital investment, shortfalls in funding for operation and maintenance are substantial, particularly in fragile states. If the infrastructure financing gap is expressed as a percentage of GDP, the level of difficulty involved in closing the gap becomes immediately apparent. The burden associated with the infrastructure financing gap is insurmountable for fragile states. They would need to spend an additional 25 percent of GDP on infrastructure to eliminate their infrastructure deficits. Relative to the size of economies, by far the largest financing gaps are in the energy, transport, and water sectors of fragile states (figure O.7, panel b).

As shown, the size of the funding gap for low-income countries in particular is probably more than they could conceivably raise through available funding channels. For this particularly challenging group of countries, additional measures may need to be taken.

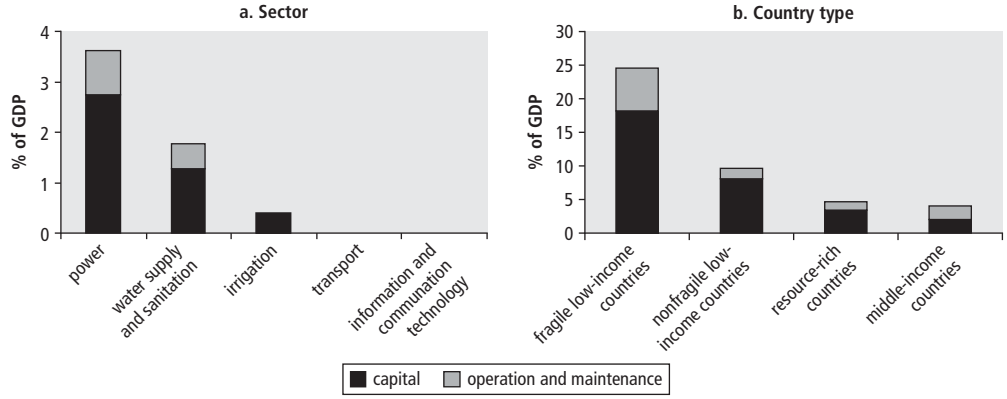
One option is to extend the time horizon for the proposed investment program. Simulations suggest that low-income countries could achieve the proposed investment targets within a period of 20 years without increasing existing spending envelopes, *as long as* they

Table O.5 Finding Resources: The Efficiency Gap and the Funding Gap
$ billions annually

Item	Electricity	ICT	Irrigation	Transport	WSS	Cross-sector gain	Total
Infrastructure spending needs	(40.8)	(9.0)	(3.4)	(18.2)	(21.9)	n.a.	(93.3)
Existing spending	11.6	9.0	0.9	16.2	7.6	n.a.	45.3
Efficiency gap	6.0	1.3	0.1	3.8	2.9	3.3	17.4
Gain from raising capital execution	0.2	0.0	0.1	1.3	0.2	n.a.	1.9
Gain from eliminating operational inefficiencies	3.4	1.2	—	2.4	1.0	n.a.	8.0
Gain from tariff cost recovery	2.3	—	—	0.1	1.8	n.a.	4.2
Potential for reallocation	n.a.	n.a.	n.a.	n.a.	n.a.	3.3	3.3
Funding gap	(23.2)	1.3	(2.4)	1.9	(11.4)	3.3	(30.6)

Source: Briceño-Garmendia, Smits, and Foster 2008.
Note: ICT = information and communication technology; n.a. = not applicable; — = not available; WSS = water supply and sanitation. Parentheses indicate negative values.

Figure O.7 Infrastructure Funding Gap by Sector and Country Type



Source: Briceño-Garmendia, Smits, and Foster 2008.

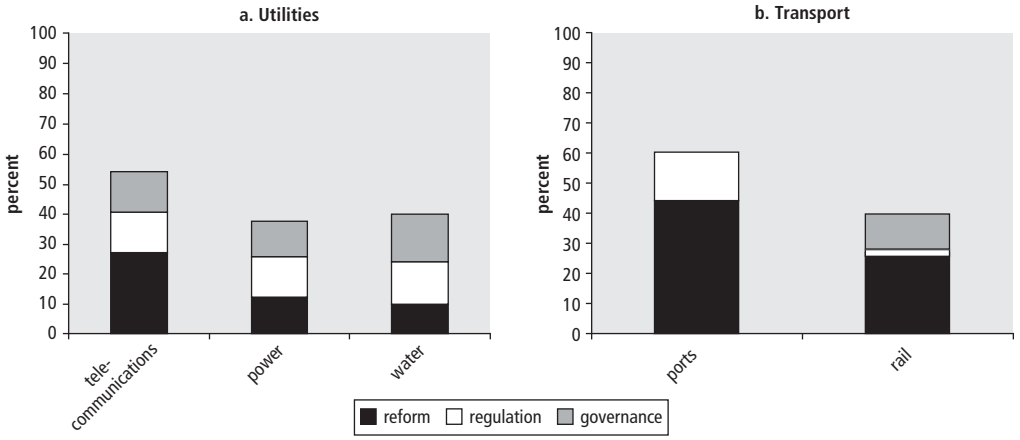
fully exploit efficiency gains. One cannot say the same of fragile states, however. They would still require a substantial increase in spending to meet the investment targets in any reasonable time frame, *even* when inefficiencies are fully captured.

Another possibility is to adopt lower-cost technologies to trim investment needs. Savings of approximately one-third of spending requirements in transport and in water and sanitation are achievable in this way, by adopting lower-cost road designs or lower-end solutions for water and sanitation (such as standposts and improved latrines). Countries face a stark trade-off between the level of service provided and the speed with which they can serve their entire population.

Finding 10: Africa's Institutional, Regulatory, and Administrative Reform Process Is Only Halfway Along

During the last decade, African states have made concerted efforts toward institutional reform in infrastructure. One could probably fairly say that the institutional reform process is halfway along (Vagliasindi and Nellis 2009). They have made progress, but few countries have a modern institutional framework for these sectors. Overall, the greatest progress has been in telecommunications, whereas transport lags furthest behind (figure O.8). The focus also varies. In telecommunications, the

Figure O.8 Scores against Indicators of Institutional Best Practice



Source: Vagliasindi and Nellis 2009.

emphasis has been on implementing sector reform, and in water on improving the governance of state-owned enterprises.

Private participation has varied enormously (Vagliasindi and Nellis 2009). Since the mid-1990s, many African countries have experimented with various forms of private participation in infrastructure, with very heterogeneous results (table O.6).

The private sector has proved willing to invest only in mobile telephones, power plants, and container terminals. The number of mobile subscribers and the share of the population receiving mobile signals increased by a factor of 10 in five years, the result of competition among private operators. Private investors have also provided significant finance for thermal power generation (3,000 megawatts) and for container terminals at ports, even if the volumes fall substantially short of requirements. Toll-road concessions are confined to South Africa; traffic volumes elsewhere are not enough to make such endeavors financially self-sustaining.

In power, water, and railways, the private sector has delivered improvements in operational performance but no new finance. The numerous concessions (and related contractual forms) covering railways, power, and water distribution have not delivered significant investment. Because of a combination of low tariffs and low volumes, none of these businesses delivers cash flows high enough to finance investment. However, these arrangements have often (though not always) been good for operational performance, even if characterized by renegotiation and premature cancellation. A growing area of experimentation is the multiyear performance-based road maintenance contract with the private sector, which shows promise in safeguarding maintenance activities and keeping costs down.

Some progress has occurred with governance reform of state-owned enterprises, where incentive-based performance contracts and external auditing seem to be paying off. Corporate governance reforms, including the establishment of a somewhat independent board of directors, are becoming more prevalent across sectors, even if few enterprises have full corporatization that includes limited liability, rate of return, and dividend policies. Performance contracts with incentives and independent external audits have become dominant features of the reform process for governance of state-owned enterprises, for both electricity and water. When combined with managerial performance incentives, these measures seem to be having a material effect on performance. The introduction of independent audits has also increased efficiency, for both electric and water utilities.

Evidence on the links between introducing an independent regulator and improving

Table O.6 Overview of Private Participation in Infrastructure

Infrastructure sector	Extent of private participation	Nature of experience	Prospects
ICT			
Mobile telephony	Over 90 percent of countries have licensed multiple mobile operators	Extremely beneficial with exponential increase in coverage and penetration	Several countries still have potential to grant additional licenses
Fixed telephony	About 60 percent of countries have divested state-owned telecommunication incumbent	Controversial in some cases, but has helped improve overall sector efficiency	Several countries still have potential to undertake divestitures
Power			
Power generation	34 independent power projects provide 3,000 MW of new capacity, investing $2.5 billion	Few cancellations but frequent renegotiations; power purchase agreements have proved costly for utilities	Likely to continue, given huge unsatisfied demands and limited public sector capacity
Power distribution	16 concessions and 17 management or lease contracts in 24 countries	Problematic and controversial; one-quarter of contracts cancelled before completion	Movement toward hybrid models involving local private sector in similar frameworks
Transport			
Airports	Four airport concessions, investing less than $0.1 billion, plus some divestitures	No cancellations but some lessons learned	Limited number of additional airports viable for concessions
Ports	26 container terminal concessions, investing $1.3 billion	Processes can be controversial, but cancellations have been few and results positive	Good potential to continue
Railroads	14 railroad concessions, investing $0.4 billion	Frequent renegotiations, low traffic, and costly public service obligations keep investment below expectations	Likely to continue but model needs to be adapted
Roads	10 toll-road projects, almost all in South Africa, investing $1.6 billion	No cancellations reported	Limited because only 8 percent of road network meets minimum traffic threshold, almost all in South Africa
Water			
Water	26 transactions, mainly management or lease contracts	Problematic and controversial; 40 percent of contracts cancelled before completion	Movement toward hybrid models involving local private sector in similar frameworks

Sources: Authors' elaboration based on Bofinger 2009; Bullock 2009; Eberhard and others 2008; Gwilliam and others 2008; Minges and others 2008; Mundy and Penfold 2008; and Svendsen, Ewing, and Msangi 2008.
Note: ICT = information and communication technology; MW = megawatts.

performance is currently mixed (Vagliasindi and Nellis 2009). Some critics argue that regulatory agencies have simply created additional risks because of unpredictable decisions, resulting from excessive discretion and overly broad objectives (Eberhard 2007). Regulatory autonomy remains elusive: in some countries, turnover among commissioners has been high, and the gap between law (or rule) and practice has been wide. For water, where the vast majority of service providers are state-owned enterprises, no evidence exists of any benefit from regulation. For power and telecommunications, some effect is discernible, but it is far from unambiguous. Weak regulatory autonomy and capacity constraints undermine the credibility of independent regulators. Most African regulatory agencies are embryonic, lacking funding and in many cases qualified personnel.

Key Recommendations

Based on these findings, one can make the following 10 key recommendations:

- Addressing Africa's infrastructure efficiency gap is a pressing policy priority with potential dividends of $17 billion a year.
- One of the most flagrant inefficiencies is the failure to maintain infrastructure assets—maintenance needs to be understood as an investment in asset preservation.
- Institutional reform remains essential for tackling utilities' operational inefficiencies, both through private participation and through governance reforms for state-owned enterprises.
- Institutional reform should also go beyond utilities to strengthen the planning functions of the line ministries and address serious deficiencies in the budgetary process.
- Reforms are needed to get full value from existing infrastructure, where widespread administrative and regulatory bottlenecks prevent facilities from being fully used.
- Regional integration can contribute significantly to reducing infrastructure costs, by allowing countries to capture scale economies and manage regional public goods effectively.
- Development of infrastructure networks needs to be strategically informed by the spatial distribution of economic activities and by economies of agglomeration.

- Infrastructure's social policy needs to be rethought, placing more emphasis on recovering costs from those who can afford it and on recasting subsidies to accelerate access.
- Achieving universal access will call for greater attention to removing barriers that prevent the uptake of services and offering practical and attractive second-best solutions.
- Closing Africa's infrastructure financing gap is critical to the region's prosperity, and the global financial crisis has only made infrastructure more relevant.

Recommendation 1: Address Africa's Infrastructure Efficiency Gap as a Pressing Policy Priority

The findings presented underscore the magnitude of inefficiency with which Africa spends its current infrastructure resources. Of Africa's overall infrastructure spending needs of about $93 billion a year, as much as $17 billion could be met simply by using existing resources more effectively.

Reaping this efficiency dividend has to be a major policy priority for the region, and efforts to scale up infrastructure finance need to be made in the context of genuine commitments to address efficiency. Pouring additional funding into sectors characterized by high levels of inefficiency makes little sense. However, postponing increases in finance until efficiency improves is not a valid option: the cost to economic growth and human development is simply too high. Rather, development partner efforts to secure additional resources for infrastructure finance must be matched by government efforts to improve their efficiency in using such resources. Parallel progress is needed on both fronts.

Moreover, investment finance is needed in some cases to allow inefficiencies to be captured (for example, where roads must be rehabilitated before they return to a "maintainable" condition or when meters must be installed to improve revenue collection). These kinds of efficiency-related investments deserve to be prioritized because of the high returns they typically bring.

The current global financial crisis only strengthens the motivation for addressing infrastructure inefficiencies. As African countries begin to feel the pinch of the global financial crisis, and as other sources of funding begin to dry up, measures to improve the efficiency of using existing resources become particularly attractive. Such measures provide an additional internal source of finance at a relatively low monetary cost. Of course, in some cases, significant investments may be needed before efficiency gains can be captured (for example, reducing distribution losses in power or water). In other cases, the economic context of the crisis may simply increase the political cost of taking such measures, such as raising cost recovery or laying off excess employees.

Potential efficiency gains take a wide variety of forms, which are developed in the recommendations that follow. Briefly, they include the following areas:

- Safeguarding maintenance expenditure to avoid wasting resources on the repeated rehabilitation of existing assets, which could save $2.6 billion a year in avoidable capital expenditure for the roads sector alone
- Reforming institutions to improve the operational performance of utilities and other service providers that are currently wasting $6 billion a year on inefficiencies such as overstaffing, undercollection of revenues, and distribution losses
- Addressing deficiencies in the public expenditure framework, where $3.3 billion a year of infrastructure resources appear to be poorly allocated across sectors and low budget execution prevents $1.8 billion a year of public investment funds from being spent
- Modernizing administrative and regulatory frameworks to reduce bottlenecks that prevent services from being provided effectively across existing infrastructure networks and impose substantial costs on infrastructure users
- Reaping the economies of scale and coordination benefits associated with regional integration, which in the case of power alone can be as high as $2 billion a year
- Securing the highest returns from new infrastructure investments by using them to secure economies of agglomeration and

to facilitate the development of productive activities along key economic corridors

- Rethinking infrastructure social policy to place more emphasis on cost recovery from those who can afford to pay, and redirecting the current $4 billion a year of subsidies to accelerate access among lower-income groups
- Reducing the costs of meeting key infrastructure targets by adopting lower-cost technologies that provide reasonable levels of service at a price that is affordable to both consumers and the government.

Recommendation 2: Make Greater Efforts to Safeguard Maintenance Spending

The traditional neglect of maintenance expenditure needs to be reversed by rethinking maintenance as asset preservation. One-third of Africa's infrastructure assets need rehabilitation, indicating that historic neglect of maintenance is endemic. For fragile states and for rural infrastructure, the share of assets needing rehabilitation is much higher. The shortfall of $0.6 billion a year in road maintenance spending is costing Africa $2.6 billion a year in avoidable capital expenditures. In fact, $1 spent on maintenance can be a savings of approximately $4 to the economy.

Thus, Africa's infrastructure financing gap is not only about raising investment capital; a substantial part of it relates to maintenance. Yet maintenance offers one of the highest returns to infrastructure spending, so it may be more helpful to think of maintenance as a kind of investment in asset preservation.

The road sector shows that maintenance can be improved through suitable institutional reforms. Since the mid-1990s, the majority of African countries have established road funds as a means of channeling road user charges to network maintenance. Countries with road funds do significantly better at raising adequate maintenance funds as long as the fuel levies paid into these funds are set high enough to provide material financing. Moreover, countries with both road funds and road agencies do significantly better in safeguarding the quality of their road networks. The use of multiyear performance-based contracts for roads has further contributed to the efficacy and efficiency of road maintenance. These findings illustrate that a combination of funding mechanisms, institutional capacity, and contractual incentives is needed to overcome the maintenance challenge.

Donors have traditionally eschewed funding maintenance, arguing it is more sustainable for funding directly from country budgets. The argument is a good one. However, the willingness of donors to fund asset rehabilitation can create perverse incentives for countries to neglect maintenance, because governments face a choice between raising taxes today to finance maintenance or simply waiting a few years to obtain subsidized donor capital for reconstruction. In low-income, low-capacity environments where maintenance is unlikely to be forthcoming, donors may be well advised to take this choice explicitly into account in project design, rather than simply assume that maintenance will happen. One way of doing so is to choose more capital-intensive, low-maintenance technologies. Even if they represent a higher investment cost in the short run, overall life-cycle costs may be lower if reconstruction can be avoided or postponed. As donors move toward sectorwide budget support, they will have a greater opportunity to ensure that maintenance spending is adequately supported in the budget envelope. In any case, as a general principle, the establishment of a sound framework for financing maintenance should be a prerequisite for the funding of major capital programs.

Recommendation 3: Tackle Inefficiency through Institutional Reform

Since the mid-1990s, the institutional agenda has broadened and deepened (Vagliasindi and Nellis 2009). In the 1990s, the emphasis of institutional reform was on sector restructuring and private participation, transplanting to Africa experiences from other parts of the developing world. This approach yielded dramatic results in telecommunications, but elsewhere the benefits were more limited and the experiences more problematic. Even so, private finance to African infrastructure came from

nowhere to provide a flow of funds comparable in scale to overseas development assistance.

A more nuanced, less dogmatic perspective on the private sector has emerged. This perspective values private financing in mobile telephony, power generation, and ports, while recognizing its limits in roads, rail, power, and water (see table O.6). Even for infrastructure where the proven appetite for private finance is very limited, the potential contribution of the private sector to tackling costly management inefficiencies (undercollected utility revenues, low labor productivity, or neglected road maintenance) remains valuable. Indeed, the efficiency gains from such performance improvements are themselves a significant source of sector finance. Moreover, the concept of private participation has undergone significant expansion. More emphasis has fallen on the local (not international) private sector and on hybrid models that experiment with different ways of allocating responsibilities between public and private partners.

Another important way in which the institutional reform agenda has broadened is the greater focus on the quality of governance for enterprises that remain state owned (Vagliasindi and Nellis 2009). The recognition that the private sector will never be a ubiquitous service provider has come with the realization that state-owned enterprises are here to stay. Therefore, it is necessary to recommit to the difficult process of reforming state-owned enterprises.

Renewed efforts on state-owned enterprise reform should favor governance over technical fixes. Fortunately, better governance of state-owned enterprises can improve performance. Past efforts at improving utility management focused too heavily on technical issues at the expense of corporate governance and accountability. Future state-owned enterprise reforms seem justified as long as they focus on deeper institutional issues. Key measures include greater decision-making autonomy for the board of directors, more objective selection criteria for senior managers, rigorous disclosure of conflicts of interest, and more transparent, merit-based recruitment processes.

Parallel efforts can strengthen financial and operational monitoring of state-owned enterprises by their supervisory agencies, whether line ministries or ministries of finance. Transparency and accountability of state-owned enterprises depend on solid systems of financial management, procurement, and management information. Today, basic operational and financial data on firm performance are not produced, reported, or acted on. Without information or, perhaps worse, without action on what information is produced, better outcomes cannot be expected. Key measures include auditing and publishing financial accounts and using comprehensive cost-based accounting systems that allow the functional unbundling of costs and a clearer sense of cost centers. After this foundation is in place, contracting mechanisms can improve performance—within the public sector or with the private sector.

Public sector performance contracts need strong performance incentives. Initial attempts to improve African state-owned enterprises through performance contracts with their line ministry or other supervisory agency were minimally effective. Recent efforts in water (Uganda), however, have had a much more positive effect. The key feature of these contracts is to incorporate incentives for good managerial (and staff) performance and, more rarely, sanctions for failure to reach targets.

Creating effective performance incentives in the public sector can be challenging, making management contracts with the private sector a relevant option. Either expatriate or local management teams can be contracted with, each of which offers advantages. Clarity about what a contract can and cannot achieve, particularly given its short time horizons, is essential. At best, a management contract can improve performance in a handful of relatively manageable aspects of efficiency, such as revenue collection and labor productivity. It cannot solve deficiencies in the broader institutional framework; ideally, these should be addressed beforehand. Nor can a management contract raise investment finance or deliver major effects on service quality that require substantial investments or lengthy gestations.

In principle, regulation can do much; but in practice, regulation has proved difficult. Regulators have been set up across Africa, precisely

to insulate utilities from political interference while closely monitoring enterprises. Improving regulatory performance is a long-term process to be pursued where private participation and competitive pressures are significant. The challenge of establishing new public institutions in developing countries is often underestimated. Independent regulation requires a strong political commitment and competent institutions and people. Where some or all are lacking, considering complementary or transitional options that reduce discretion in regulatory decision making through more explicit rules and procedures or by outsourcing regulatory functions to advisory regulators and expert panels may be wise (Eberhard 2007).

Recommendation 4: Include Line Ministries and Budgetary Processes on the Institution Reform Agenda

Much of the emphasis of recent reforms has been on restructuring the service provider or utility, bringing in private management, applying regulatory oversight, and so on. Little attention has been given to institutional strengthening of the sector line ministries. These line ministries have responsibilities, which, if not adequately discharged, can jeopardize the functioning of the sector. They take the lead in sector planning, participate in the formulation of the public budgets, and execute investments. However, deficiencies exist in all those areas. Unless they are tackled head on, the effect of reforms on service providers will remain limited.

Stronger sector planning is needed in infrastructure line ministries to ensure that the construction of critical new assets begins early enough to come on stream when needed. Too often overlooked or debilitated during the course of sector restructuring efforts, planning is a critical sector function. It is essential to restore this vital planning capability in the line ministries and to develop sound technical methodologies for identifying and selecting infrastructure projects. More rigorous project screening can ensure that infrastructure investments are selected according to their expected returns and are appropriately sequenced and synchronized with one another and with broader development plans to maximize synergies and avoid costly bottlenecks.

A clear example is power generation. Traditionally, planning and procurement of new power infrastructure were the province of the state-owned utility. With power sector reforms and independent power producers, those functions were often moved to the ministry of energy or electricity. The transfer of skills was not always simultaneous, however, so plans were not adequately informed by the complexities on the ground. In many cases, planning has collapsed. New plants are rarely timely, thereby opening power gaps that prompt recourse to temporary power and discourage investors. When procurement is (finally) undertaken, the authorities may not take the trouble to conduct international competitive bidding. This outcome is unfortunate because a rigorous bidding process lends credibility and transparency to procurement and results in more competitively priced power.

Because domestic public spending finances the bulk of Africa's infrastructure investments, development partners need a broader view of the quality of public spending. Across the infrastructure sectors, most investments are by line ministries through the budgetary process. Shortcomings in the way the rest of the sector budget is allocated and spent may offset development finance that focuses too narrowly on specific project interventions. So donor resources are best channeled programmatically as budgetary support or through sectorwide projects, and development partners need to take a broader interest in the overall quality of public spending. Thus, infrastructure interventions must be grounded in a broader understanding of the public expenditure framework in each sector.

Ad hoc political priorities with little or no economic screening too often characterize the budgetary process. The annual budget cycle prevents adequate follow-through on the funding of multiyear infrastructure projects. When it comes to implementation, many countries have significant problems with budgetary execution, with procurement bottlenecks preventing the full budget allocations from materializing in actual spending.

Key aspects of the public expenditure framework need to be addressed. The budgeting process needs to move to a medium-term

framework and link sector objectives and resource allocations, underpinned by clear sector plans that go down to specific activities and their associated costs. The careful incorporation of maintenance in medium-term sector-planning tools can prevent the growing need for asset rehabilitation. Project appraisal should underpin the budgetary process for public investment to ensure that all investments under political consideration pass at least a minimum threshold of economic viability. Administrative processes that delay the release of budgeted funds must be overhauled, and procedures for procurement, disbursement, financial management, and accountability must be modernized and streamlined.

Water provides interesting examples of how bottlenecks in the budgetary process can prevent the use of available resources. In West Africa, the binding constraint is not the availability of budgetary resources in many instances but the capacity to disburse them in a timely fashion (Prevost 2009). In Tanzania, steep increases in budget allocations to the sector followed water's identification as a priority in the country's poverty reduction strategy, but disbursements increased at a much slower pace, thus impeding any immediately discernible effect on access (Van den Berg 2009).

Parallel improvements are also needed in the way donor finance is channeled. Given the relevance of external funds, a solid public expenditure management system for African countries requires that donors improve the predictability of their support and streamline and harmonize their procedures. In that sense, a focus on multidonor initiatives that pool funds to provide general budgetary support for a sectorwide program of interventions is preferable.

Recommendation 5: Use Administrative and Regulatory Reforms to Get Full Value from Existing Infrastructure

Africa is failing to get the full development potential even from its existing infrastructure networks. Administrative and regulatory failures create bottlenecks and prevent infrastructure assets from delivering the services they are supposed to. These problems are particularly evident in transport, where high-impact reforms are urgently needed.

Liberalizing the trucking industry can reduce the exorbitant road freight costs in Central and West Africa. The regulation and market structures of the road freight industry, not the quality of road infrastructure, are the binding constraints on international corridors (Teravaninthorn and Raballand 2008). Road freight tariffs, which can reach $0.08–$0.13 per ton-kilometer in Central and West Africa, reflect the high profit margins of trucking services (60–160 percent). The *tour de role* regulatory framework, based on market sharing and centralized allocations of freight, limits vehicle mileage and undermines incentives to improve fleet quality. The alternative is to combine free entry to the market and market pricing with regulatory enforcement of rules for quality and operating behavior. Already practiced in southern Africa, these reforms can reduce road freight tariffs to $0.05 per ton-kilometer. Without such reforms, further investments in upgrading road network quality will simply lead to higher profit margins for the trucking industry without lowering transport costs for consumers.

One-stop border posts are essential to avoid extensive delays in transit traffic along international road corridors. Road conditions along Africa's major international corridors are good, with trucks reaching speeds of 50–60 kilometers an hour, but long delays at borders slow effective velocities to little more than 10 kilometers an hour. A journey of 2,500 kilometers from Lusaka, Zambia, to the port of Durban in South Africa takes on average eight days—four days of travel time and four days spent at border crossings. Compare that total with land border-crossing times of no more than half an hour for industrialized countries. The cost of delays for an eight-axle interlink truck has been estimated at about $300 a day. The investments to develop one-stop border facilities and to modernize customs procedures are relatively modest and would pay back in barely a year. Without such reforms, further investments in the road network will have little effect on overall transit times.

More reliable interconnection services can avoid even longer delays on international rail corridors. Locomotives from one country are generally not allowed to travel on another

country's network, mainly because of the inability to provide breakdown assistance to foreign operators. As a result, rail freight crossing borders must wait to be picked up by a different locomotive. These delays can be extensive. A journey of 3,000 kilometers from Kolwezi on the Democratic Republic of Congo border to the port of Durban in South Africa takes 38 days—including 9 days of travel time and 29 days associated primarily with loading and interchange of freight. This delay partly reflects the lack of reliable, well-maintained locomotives, but it also reflects the absence of clear contractual incentives to service traffic from a neighboring country's network. Reducing such delays would require total rethinking of contractual relationships and access rights linking the railways along the corridor. It would also likely require a regional clearinghouse to ensure transparency and fairness in reciprocal track access rights.

Slow movement of containers and cargo through Africa's ports imposes very high economic costs. Many firms cite bottlenecks at ports as their most pressing infrastructure constraint in countries as diverse as Burkina Faso, Cameroon, Malawi, Mauritius, and South Africa. Container dwell times in East and West Africa are 12–15 days, twice the international best practice of 7 days. Most delays are caused by long processing and administration times and poor handling in congested port areas, rather than by any real limitations in basic quay capacity. These delays can be very costly. One extra day in port costs more than $35,000 for a 2,200-TEU (20-foot equivalent unit) vessel in 2006 and proportionately more for larger ships. Shipping lines have responded by introducing "congestion charges": for a 20-foot container in 2006, ranging from $35 a day in Dakar, Senegal, to $420 a day in Tema, Ghana.

The solution lies in modernizing customs administration and improving efficiency of cargo handling. The two main bottlenecks within ports are loading and unloading of cargo and customs administration—both need to be addressed simultaneously. Inadequate cranes are part of the problem, but new equipment alone will not deliver better performance unless staff practices are also modernized. Ports with container terminal concessions have boosted handling rates. Modernizing customs administration requires modern information technology and associated database systems. Such soft infrastructure has traditionally been underfunded, contributing to poor port efficiency. Governance issues may also afflict customs administration.

Port and land distribution infrastructure need to be integrated. The lack of an integrated land distribution system, particularly for transit traffic, further impedes container traffic. Making the most progress are dry and liquid bulk exports, where many port facilities are privately owned and integrated within a comprehensive logistics system. Containerized trade, in contrast, is often only skin-deep. Containers are packed and unpacked near the ports, and the benefits of fully integrated multimodal transport corridors associated with container adoption are not secured. As a result, little containerized traffic moves into the landlocked hinterland, and most of those countries' imports are transported as general cargo.

Overall, the transport regulatory and administrative framework needs to promote seamless multimodal transportation networks more consciously. Transport chains can be no stronger than their weakest links, which are usually the interchanges between different modalities—such as road to rail or rail to sea. The weaknesses are partly physical, where no physical connection exists between the modes and no infrastructure is available for transshipment. However, they are also partly institutional, with responsibility for the interchanges not falling clearly to one modal agency or the other. Finally, they are partly operational, with the government collecting taxes and duties, or staff collecting bribes, slowing movements, and pushing up costs. Even at the sector policy and planning level, Africa's transport modes are too often parceled out across separate line ministries, thereby preventing a cohesive intermodal transport framework from emerging.

Recommendation 6: Pursue Regional Integration to Reduce Infrastructure Costs

Regional integration lowers costs across all aspects of infrastructure. The high cost of infrastructure services in Africa is partly attributable

to fragmentary national boundaries preventing achievement of scale economies.

In ICT, power, ports, and airports, regional collaboration essentially provides scale economies that reduce the cost of service. Most African countries are simply too small to develop infrastructure cost-effectively on their own. In ICTs, regional collaboration in continental fiber-optic submarine cables can reduce Internet and international call charges by half, relative to national reliance on satellite communications. In power, 21 countries have national power systems below the minimum efficient scale of a single plant. By sharing large-scale, cost-effective energy resources across countries, regional trade can reduce electricity costs by $2 billion a year. The traffic flows to most of Africa's national ports and airports are too low to provide the scale economies needed to attract services from major international shipping companies and airlines. Regional collaboration in multicountry hubs can help overcome this problem.

In road and rail corridors and transboundary river basins, collaborative management of these regional public goods reduces the cost. Many of Africa's infrastructure assets and natural resources are regional public goods that cut across national frontiers and can be effectively developed and maintained only through international collaboration. Road and rail corridors need to be managed collaboratively to smooth transport and trade services to Africa's 15 landlocked countries, avoiding the extensive border delays that slow international road freight to 10 kilometers an hour. Africa's 63 international river basins call for cooperative water resource management and coordinated investments to increase basin yields of food, power, and other economic opportunities, while strengthening environmental sustainability and mitigating the effects of droughts and floods.

Reaping these benefits poses numerous institutional challenges. Among them are mobilizing political will, developing effective regional institutions, setting priorities soundly, harmonizing regulatory procedures, and facilitating project preparation and finance.

Notwithstanding the economic case for regional integration, the mobilization of political will faces considerable obstacles. Regional infrastructure involves a high level of trust between countries, not least because of the implied dependence on neighbors for key resources, such as energy and water. For example, if regional power trade were pursued fully, 16 African countries would import more than half their power needs. A large share of that power would come from fragile states, such as the Democratic Republic of Congo and Guinea.

Regional institutions are needed to facilitate agreements and implement compensation mechanisms. Some countries have more to gain from regional integration than others do. As long as regional integration provides a substantial economic dividend, one should be able to design compensation mechanisms that make all participating countries better off. Benefit sharing was pioneered through international river basin treaties, such as that for Senegal, and could be applied to other regional infrastructure more broadly. Africa has an extensive architecture of regional political and technical bodies, but they have overlapping memberships, limited technical capacity, and limited enforcement powers. Nor do they currently have the capacity to implement cross-border compensation mechanisms.

Moving on regional projects that deliver quick wins is important. Because of the daunting investment agenda, better sequencing and priority setting for regional projects are needed. Political, economic, and spatial approaches have all been widely discussed. Regional projects range from bilateral cooperation on a transmission line or border post to vast and complex interventions, sometimes with a continental reach. Given the size of the challenges, starting small with projects that deliver tangible high returns and building incrementally on initial successes may be advisable.

Regulatory harmonization needs to go hand in hand with physical integration. Unless regulatory frameworks and administrative procedures are harmonized to allow the free flow of services across national boundaries, physical integration of infrastructure networks will be ineffective. Making progress on regulatory reform has a relatively low monetary cost, but it can have a very high return. A good example is the Yamoussoukro Decision: opening the skies for air transportation across Africa, it has

led to greater freedom in the negotiation of bilateral agreements.

Greater efforts are needed to facilitate preparation of complex regional projects, which are particularly costly and time-consuming to prepare. That is especially true when projects are large in relation to the size of the host economy and when they essentially depend on financing from downstream beneficiaries. They also stretch the donor financing systems that are more typically geared toward national investments.

Recommendation 7: Take a Spatial View of Infrastructure Development Priorities

Infrastructure networks are inherently spatial, both reflecting and underpinning the spatial distribution of economic activity. Infrastructure plays a key role in enabling cities to benefit from economies of agglomeration. Transport networks interconnect urban centers with each other and with international trading networks, providing the basis for exchange between the urban and rural economies. Energy, water, and ICT all enhance productivity within urban and rural spaces. Therefore, infrastructure plans and priorities should be strategically informed by a clear understanding of the spatial distribution of economic activity and potential. A clear example of this approach is the Spatial Development Initiative of the New Partnership for Africa's Development (NEPAD).

The spatial lens is a useful basis for prioritization of infrastructure investments and provides insight into cross-sectoral links. Looking at infrastructure through a spatial lens allows identification of the key bottlenecks along various trading corridors, which are typically the highest-return interventions. Cross-sectoral links also become more apparent through a spatial view, shedding light on the need for coordinating interventions across infrastructure sectors and between infrastructure and client economic sectors. An emerging literature suggests that because of synergy effects, the returns from bundling multiple infrastructure interventions in a particular spatial area (Torero and Escobal 2005) or along a given spatial corridor (Briceño-Garmendia and Foster 2009a, 2009b) are higher than those from making the same investments in a spatially uncoordinated manner. In Africa—too often—the limited infrastructure available is thinly spread out, preventing such synergies from being captured.

The urbanization process calls for a regional development perspective on infrastructure that looks at each city and its rural hinterland as an integrated economic unit. Africa is urbanizing fast, creating change that is predictable and beneficial for both urban and rural areas. Prosperity and density go together, as changes in productivity require agglomeration economies, larger markets, and better connectivity. Concentration and urbanization trigger prosperity in both urban and rural areas, and well-functioning cities facilitate the transition from subsistence agriculture by providing a large market for rural products and supporting nonfarm activities. The debate of rural versus urban development should therefore be replaced by the understanding that rural and urban development are closely linked and mutually dependent—and that economic integration of rural and urban areas is the only way to produce growth and inclusive development.

In urban areas, deficiencies in land policies and planning have become a huge impediment to extending infrastructure services. African cities are growing fast, but with insufficient infrastructure and poor institutions, most new settlements are informal and not covered by basic services. Urban planning should be strengthened to reduce sprawl, enhance densification, prevent development in precarious environmental zones, and provide the appropriate balance between public and private land to safeguard key trunk networks. Property rights must be clearly defined so that land markets can function. Cities frequently lack the financial basis to develop the infrastructure critical to their success. The local tax base, though potentially large, is typically unexploited, leaving municipalities reliant on central government transfers, which are too often inadequate or unpredictable.

Large agricultural sectors and rural economies remain central to economic growth and poverty reduction in Africa. Yet the access of rural populations to infrastructure is extremely low. Rural roads and irrigation systems are together perhaps the most pressing of rural

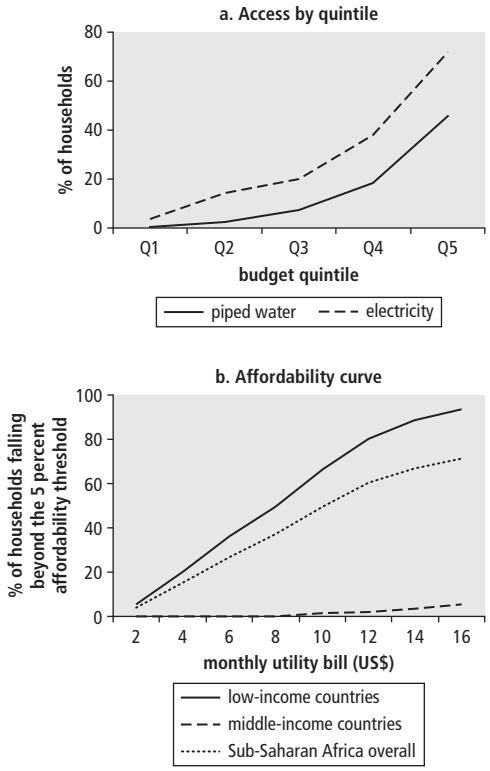
infrastructure needs. The two go hand in hand, and their development should follow the value of agricultural land and the spatial proximity to urban markets. ICT has made huge strides in expanding rural access, with one in two rural Africans now in range of a global systems mobile signal. This platform can contribute to agricultural productivity through simple text-message extension services, through bulletins on agricultural market prices and meteorological conditions, and as a vehicle for financial transactions. The possibilities are only just beginning to be explored.

Recommendation 8: Rethink Infrastructure Social Policy

Although Africa's infrastructure services are relatively expensive, costs remain even higher than prices, and this lack of cost recovery has major detrimental effects. Underpricing infrastructure services is costing Africa $4.2 billion a year in forgone revenues. In addition, because of inequitable access to infrastructure services, these subsidies are highly regressive, largely bypassing the poor (figure O.9). The underrecovery of costs impairs the financial health of utilities and slows the pace of service expansion.

Concerns about affordability are usually the pretext for underpricing services but do not bear much scrutiny (figure O.9). A subsistence-level monthly utility bill priced in cost-recovery terms typically amounts to $6–$10 a month. In the middle-income countries, bills of this magnitude do not appear to present an affordability problem anywhere across the income spectrum. Nor do bills of this magnitude pose affordability issues for the more affluent groups in low-income countries, the main ones to enjoy access to services. Affordability would become a binding constraint in low-income countries only when service coverage starts to exceed 50 percent. Only in the poorest of countries, and those with exceptionally high infrastructure costs, does full cost recovery seem unachievable for today's more affluent consumers. Even in these cases, operating cost recovery should be a feasible objective, with subsidies limited to capital costs. Simulations suggest that raising tariffs to cost recovery would have only minimal effects on poverty rates in most cases.

Figure O.9 Access to and Affordability of Household Services



Source: Banerjee, Wodon, and others 2008.
Note: Q1 = first (or poorest) budget quintile; Q2 = second budget quintile; Q3 = third (or middle) budget quintile; Q4 = fourth budget quintile; Q5 = top (or richest) budget quintile.

The affordability of services depends not only on prices, but also on the type of payment arrangements that are made available to consumers. Prepayment (pioneered in the mobile telephone sector) can help households budget their consumption and reduce revenue risks for operators. The same approach is technologically feasible for electricity, and a growing number of power utilities are adopting it.

Subsidies are important, but subsidy design needs major rethinking, with a sharper focus on subsidizing connections, which can be more equitable and effective in expanding coverage. The affordability problems with connection charges are often much more serious than those with use-of-service charges. Moreover, the absence of a connection may itself be a good targeting variable for identifying

disadvantaged households, although less so in a low-access environment where coverage may be far from universal, even among affluent households.

An important test of the coherence of a subsidy policy is to see whether it would be affordable for the country under universal access. The existing underpricing of utility services that benefit just a small minority costs many African countries as much as 1 percent of GDP. As countries move toward universal access, that subsidy burden would increase proportionately, rapidly becoming unaffordable for the national budget. Countries should thus consider how the cost of any proposed subsidy policy would escalate as coverage increases. This test of the fiscal affordability of a subsidy is an important reality check that can prevent countries from embarking on policies that are simply not scalable and will keep coverage low.

Recommendation 9: Find Practical Ways to Broaden Access to Infrastructure Services

Universal access to infrastructure services remains distant for most African countries. The vast majority of African households today lack access to modern power, piped water, sewerage, and even all-season roads that service their communities. The very slow progress in expanding this access since the mid-1990s suggests that universal access to infrastructure is more than 50 years away for most countries in Africa.

This situation calls for a different approach to expanding modern infrastructure services and for greater attention to second-best alternatives. Business as usual will not bring about the acceleration of infrastructure access that Africa needs. Moreover, even if access can be accelerated, many people will have to continue to rely on alternatives to modern infrastructure services for many years to come. Therefore, infrastructure social policies in Africa need to give greater thought to improving and expanding second-best alternatives.

In expanding modern infrastructure networks, closer attention should be paid to the demand side of the equation. The mobile telephone revolution has clearly demonstrated that Africa can widely and rapidly adopt modern infrastructure services. Low charges for initial connection make market entry affordable. Prepayment schemes eliminate credit risk and give customers full control over their spending. Services are well tailored to customer demands. Other network services, notably power and water, have tended to view access as a matter of simply rolling out new networks, overlooking the fact that even where networks are available, the hookup rates are relatively low. They need to pay greater attention to demand-side issues that prevent customers from making connections: connection charges that are much higher than household incomes, as well as tenure and urban development issues. The most cost-effective way to increase access for many utilities may be through densification programs that increase hookups to existing networks by using greater community outreach to understand better the demand side of the market.

Second-best alternatives can be fine-tuned to provide feasible and attractive infrastructure services to those otherwise unserved. The vast majority of those without access to modern infrastructure services rely on traditional alternatives, such as candles, wells, or unimproved latrines. Although doing the job, these traditional alternatives tend to be inconvenient, inferior, or unsafe. Second-best solutions, such as street lighting, solar lanterns, standposts, and improved latrines, would provide households with superior services at a cost that is somewhat higher than the traditional alternatives but still falls far short of modern services. Puzzlingly, these second-best solutions are not very prevalent in Africa, and even where they exist, they tend to be available primarily to the more affluent.

A key problem seems to be the public-good nature of many of these solutions (such as standposts and street lighting), which makes it difficult for service providers to recover costs and greatly complicates the administration of the facilities. Effective institutional arrangements must be found to support implementation of these alternatives. Another problem is that some of these alternatives, although cheaper, may simply not be cheap enough to be widely affordable.

Recommendation 10: Close the Infrastructure Funding Gap

Notwithstanding the importance of all these efficiency measures, a substantial infrastructure financing gap of $31 billion a year remains. Such a large shortfall looked daunting even before the onset of the global financial crisis.

As of year-end 2007, many factors had converged to bring about rapid and sustained increases in all major sources of external finance for African infrastructure. Following the Gleneagles Summit, OECD development assistance placed greater emphasis on supporting African infrastructure. Official development assistance flows almost doubled, from $4.1 billion in 2004 to $8.1 billion in 2007. The resurgence of economic growth on the continent led to an upswing in private participation. Since the late 1990s, private investment flows to Sub-Saharan infrastructure almost tripled, going from about $3 billion in 1997 to $9.4 billion in 2006/07 (about 1.5 percent of regional GDP). In addition, non-OECD countries—notably China and India—began to take a growing interest in financing infrastructure within a framework of South-South cooperation. Their commitments rose from almost nothing in the early 2000s to finance about $2.6 billion of African infrastructure annually between 2001 and 2006. Although disbursements tend to lag commitments by several years, if the record commitments of 2007 are fully honored, the disbursements of external finance for African infrastructure may continue to increase over the next few years.

In the absence of any offsetting measures, domestic infrastructure spending would likely fall, compromising economic recovery and deepening poverty. The existing gap of $31 billion a year could widen further as public budgets are squeezed, external capital flows decline, and consumer ability to pay user charges is eroded. The ability to construct new infrastructure, address regional bottlenecks, and maintain existing assets would be severely reduced. In Latin America during the 1990s, some 50 percent of the fiscal compression to balance the public books came from cuts in infrastructure spending. In Indonesia following the Asian crisis, public investment in infrastructure fell from 7 percent of GDP to 2 percent. Growth in Latin America and Asia was compromised in a "lost decade."

Many countries, ranging from China and India to Argentina and Mexico, have used infrastructure-based fiscal stimulus in times of economic crisis. If well targeted to addressing key economic bottlenecks and complemented by policy reforms, infrastructure investments can pave the way for the later resurgence of economic growth. Furthermore, some kinds of public works contracts are labor intensive, creating short-term employment to alleviate poverty. Although Africa could benefit from such a program, the continent does not have the means to finance it without external support. Estimates suggest that a $50 billion stimulus package would be needed to offset the impact of the economic crisis on Africa, and that focusing such a package on infrastructure investments would have the largest short-term effect on GDP growth, boosting projections for 2010 to 4 percent, compared with the postcrisis 1.7 percent. In the long term, Africa would see a permanent increase of 2.5 percent of GDP (ODI 2009).

Any increase in donor finance for African infrastructure should pay particular attention to the power sector and to the fragile states. Donors have neglected power since the 1990s. Although the private sector can contribute to funding power generation, donors will still need to scale up substantially to address the current crisis in the sector. This scale-up was already under way before the onset of the crisis, with donor commitments that first topped $1 billion a year in 2005 reaching a peak of $2.3 billion in 2007. Fragile states stand out as receiving less than their fair share of donor finance for infrastructure. Given the magnitude of the financing gap that these countries face relative to the size of their economies, as well as the importance of infrastructure in regenerating their development, a case exists for channeling incremental donor resources in their direction.

Some of Africa's larger low-income countries have the potential to raise a significant amount of local finance for infrastructure if suitable instruments can be developed. In a handful of African countries, domestic capital markets are beginning to look wide and

deep enough to provide significant volumes of infrastructure finance, Nigeria being the most salient example (Irving and Manroth 2009). However, most of this finance takes the form of relatively short-maturity commercial bank lending, often not the best suited for infrastructure projects. A need exists to further develop corporate bond markets and to create regulatory conditions for greater participation by institutional investors in funding infrastructure investments.

Note

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