

SUMMARY OF BACKGROUND PAPER

# **AFRICA INFRASTRUCTURE COUNTRY DIAGNOSTIC**

## **Access, Affordability, and Alternatives: Modern Infrastructure Services in Africa**

Sudeshna Banerjee, Quentin Wodon, Amadou Diallo,  
Taras Pushak, Helal Uddin,  
Clarence Tsimpo, and Vivien Foster

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## About AICD

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



AICD will produce a series of reports (such as this one) that provide an overview of the status of public expenditure, investment needs, and sector performance in each of the main infrastructure sectors, including energy, information and communication technologies, irrigation, transport, and water and sanitation. The World Bank will publish a summary of AICD's findings in spring 2008. The underlying data will be made available to the public through an interactive Web site allowing users to download customized data reports and perform simple simulation exercises.



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



AICD is being implemented by the World Bank on behalf of a steering committee that represents the African Union, the New Partnership for Africa's Development (NEPAD), Africa's regional economic communities, the African Development Bank, and major infrastructure donors. Financing for AICD is provided by a multi-donor trust fund to which the main contributors are the Department for International Development (United Kingdom), the Public Private Infrastructure Advisory Facility, Agence Française de Développement, and the European Commission. A group of distinguished peer reviewers from policy making and academic circles in Africa and beyond reviews all of the major outputs of the study, with a view to assuring the technical quality of the work.



This and other papers analyzing key infrastructure topics, as well as the underlying data sources described above, will be available for download from [www.infrastructureafrica.org](http://www.infrastructureafrica.org). Free-standing summaries are available in English and French.

Inquiries concerning the availability of datasets should be directed to [vfoster@worldbank.org](mailto:vfoster@worldbank.org).

Africa lags well behind other developing regions in access to infrastructure services. Limited gains made in the 1990s continued in the early 2000s, and there is now clear evidence that many countries are failing to expand services fast enough to keep up with rapid demographic growth and even faster urbanization. If present trends prevail, Africa is likely to fall even further behind other developing regions, delaying universal access for a half century or more in many countries.

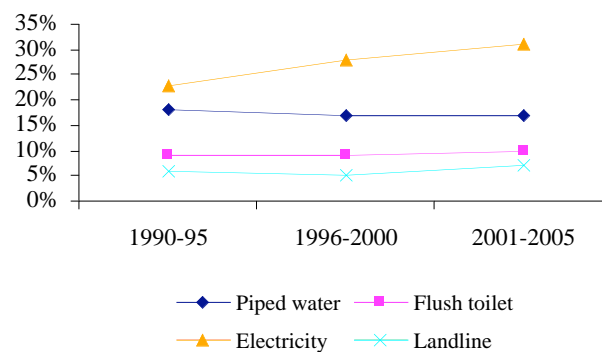
This report reviews recent trends in household access to infrastructure services and associated budgetary expenditures in Africa. It is based on a pooled database that draws upon the entire body of household surveys conducted in Africa in the last 15 years. The database includes 67 Demographic and Health Surveys (DHSs) conducted by the Measure DHS Program of MACRO International in the least-developed countries, as well as related surveys. Covering 32 countries, including 24 at more than one point in time, this collection of survey data provides a sound basis for analyzing historic trends in access to services. The report also draws on 30 household expenditure surveys of various kinds that provide information on the structure of the household budget, and in particular spending on infrastructure services. Our findings on water supply and sanitation are broadly consistent with those of the Joint Monitoring Program (JMP) managed by the United Nations Children’s Fund (UNICEF) and World Health Organization (WHO), although they are based on a different statistical method, and the JMP statistics include all African countries, whereas only a subset in Sub-Saharan Africa is covered here.

### Shrinking access to modern infrastructure services

Recent trends in access suggest that coverage of most basic services in Africa has remained stable or increased slightly since 2000 (figure 1). Trends picked up by the DHS show modest improvements in access to all services between the early and late 1990s to early 2000s. In the case of piped water and flush toilets, coverage levels in urban areas in the early 2000s are significantly below what they were in the early 1990s: 39 percent versus 50 percent for piped water, and 27 percent versus 32 percent for flush toilets.

**Figure 1 Network infrastructure services in Africa, 1990–2005**

Percentage of population with access to service (population weighted)



Source: AICD DHS/MICS Survey Database, 2007.

The overall trend is driven largely by declining access in urban areas, while the situation in rural areas has improved. Access to improved water sources has declined across the period in urban areas. Access to improved sanitation has held steady in urban Africa.

Access to infrastructure services is more limited in Africa than in any other region of the developing world. Official estimates suggest that electricity is available to little more than 20 percent of Africa’s population, versus 33 percent in South Asia, the next-lowest region. Access to an improved water source is 56 percent (versus 78 percent in East Asia), while access to a piped water connection is just 12 percent. Access to improved sanitation, at 37 percent, is comparable to that in South Asia, but well behind the 50 percent reported for East Asia. Moreover, access to a flush toilet (connecting to a sewer or septic tank) is only 6 percent.

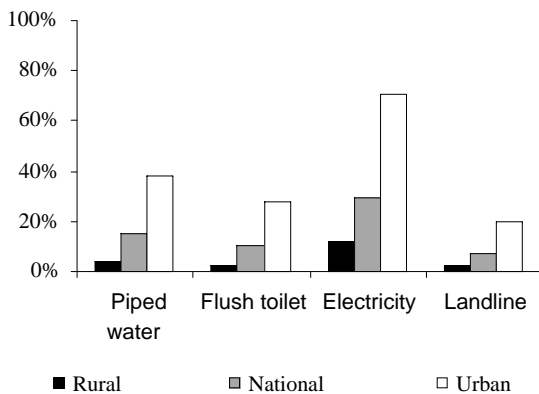
Telecommunications is the exception to the general pattern of stasis or decline. In telephone density (landlines and cellular telephones), Africa is somewhat ahead of South Asia, with 64 versus 56 subscribers per thousand people. Landline coverage increased dramatically to reach more than 7 percent of households in the early 2000s, while cellular telephones came from nowhere to reach 10 percent of households today. Except in South Africa, almost all cellular telephones in Africa are first telephones, as opposed to second telephones for households that already have landlines.

Coverage rates in urban areas are an order of magnitude higher than those in rural areas (figure 2a). In fact, Africa’s low overall access rates are partly explained by negligible service coverage in rural areas, where the bulk of the population still resides. When broader measures of improved water and sanitation are considered, the discrepancies are still large and stark. Thus, about 63 percent of the urban population has access to an improved water source, compared with about 14 percent of the rural population. Moreover, about 42 percent of the urban population has access to improved sanitation versus about 7 percent of the rural population.

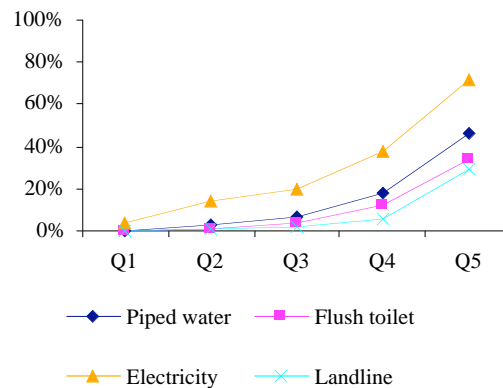
Figure 2 Patterns of access to modern infrastructure services in low-income countries of Africa

Population-weighted average, percent, latest available year

(a) By geographic area



(b) By asset quintile



Source: AICD DHS/MICS Survey Database, 2007.

Access to modern infrastructure services is almost entirely confined to the upper-income quintiles (figure 2b). In the first three quintiles of the wealth distribution, access to modern infrastructure services is well below 10 percent, access for the fourth quintile is typically 10–40 percent, while access for the richest quintile is typically 30–50 percent. The implication is that around 80 percent of those currently connected to modern infrastructure services are in the top 40

percent of the distribution of wealth. In most countries, moreover, inequality of access has increased over time, suggesting that new connections have tended to go predominantly to more affluent segments of the population.

In contrast to the general concentration of service among the wealthy, a handful of countries stand out as having reached significant levels of access to electricity (5–15 percent) among the poorest quintile. They are Gabon (17 percent), Nigeria (10 percent), South Africa (10 percent), Ghana (8 percent), and Republic of Congo (5 percent). It is striking that even among the top quintile, coverage is far from universal and highly variable across countries, ranging from around 20 percent in Chad and Central African Republic to almost 100 percent in Cote d' Ivoire, Gabon, Namibia, South Africa, and Zimbabwe.

That only a minority even of rich households has access to the full suite of modern infrastructure services poses the question of whether access rates are limited by what is locally available. The latter seems to be the case in Africa. Only 10 percent of all households have access to both piped water and electricity. Just 1 percent of households have piped water, electricity, a flush toilet, *and* a telephone.

### What is keeping access low?

Despite isolated successes, the fact remains that the trendline of service coverage is static or modestly increasing for the region as a whole. A number of explanations can be identified.

First, the income and urbanization levels of the country are major drivers of access to modern infrastructure services. Middle-income countries have access rates to piped water, flush toilets and telephone landlines that are three times as high as those found in low income countries, and electricity access rates that are twice as high. More highly urbanized countries have access rates to piped water, flush toilets and telephone landlines that are twice as high as those found in less urbanized countries, and electricity access rates that are three times as high. Relatively few of Africa's countries are in the middle income, highly urbanized bracket.

Second, Africa's high demographic growth rates provide one explanation for falling levels of coverage. Demographic growth in Africa is 2.2 percent per year (compared with the next-highest rate of 2.0 percent in the Middle East and North Africa). Moreover, urban populations in Africa are growing at 3.6 percent per year (compared with the next-highest rate of 3.1 percent per year in East Asia). The analysis shows that a significant number of African countries are not increasing access rapidly enough to keep up with demographic growth, particularly in urban areas. Indeed, if historic rates of expansion continue, only a handful of countries can be expected to attain universal coverage by the year 2050.

Third, decreasing household size is a second factor that frustrates coverage expansion. There is evidence that the average household size in Africa is falling over time as incomes rise. Thus, the total number of households is actually growing even faster than the total population. (The estimated rates are 3.2 percent per year for households as opposed to 2.5 percent for population.) Thus access needs to expand by 50 percent more to maintain constant coverage rates than if household size remained unchanged.

Fourth, even within the group of low income countries, there is a wide diversity of performance with respect to coverage. Countries such as Ethiopia, Kenya, Madagascar, Mali stand out as already having relatively good rates of coverage for some services, in spite of their low levels of income and urbanization. Another set of low income countries stand out as having achieved relatively high growth rates increasing the number of connections by between 5 and 10 percent per year for services such as water and electricity. Successful examples include Burkina Faso, Mali, Chad, Ethiopia and Senegal (water), and Lesotho, Madagascar, and Burkina Faso (electricity).

Finally, gaps in the supply of services are just part of the explanation for low access. Millions of Africans living near networked services still lack access to them, either because the services are not affordable or because consumers prefer alternatives.

To identify interventions that might be capable of speeding up the rate of expansion of access, we divided the unserved urban population into two groups: (1) individuals who live close to an infrastructure network and could be reached through relatively inexpensive programs to increase service density, and (2) those who live far away from such a network and could be reached only by extending the network.

Our results are surprising. Some 70–90 percent of the urban population lives in physical proximity to piped water and electricity networks, even though coverage rates are 20–40 percentage points lower than their proximity would suggest. In other words, many people who live near the network choose not to connect to it.

### Affordability of infrastructure services

These findings suggest that affordability may be a barrier to further expansion of access. Most African households live on very modest budgets and spend more than half of their resources on food. The average African household has a budget of no more than \$180 per month; urban households are about \$100 per month better off than rural households. Household budgets range from around \$50 per month in the lowest quintile to no more than \$400 per month in the highest income quintile, except in middle-income countries, where the richest quintile has between \$600 and \$1,200 per month. Even the most affluent households spend about half of their monthly budget on food—among the poorest that share rises toward 65 percent.

Infrastructure spending—particularly on power and transport—weighs heavily on household budgets. Spending on utilities, transport, and rubbish disposal typically absorbs 10–20 percent of the household budget, and this can rise to as much as 40 percent in some countries. Electricity and transport each absorbs 5–10 percent of the household budget in most countries. Spending on water is typically no more than 5 percent of the household budget. Spending on telecommunications varies widely across countries. It is not unusual for infrastructure spending to absorb 40 percent of the *nonfood budget* of the household, and as much as 80 percent in some cases.

To test the affordability of utility services priced at a level sufficient to allow the utilities to recover their costs, we calculated the percentage of urban households that would need to spend

more than 5 percent of their income to purchase a subsistence level of any given utility service. The finding is that the countries fall into three groups. In most countries, between one- and two-thirds of the urban population would face difficulties in covering the cost of service.<sup>1</sup> In eight countries, at least 70 percent of urban households would be unable to afford a monthly expenditure of \$10 for water or electricity. Only in the remaining seven countries would most urban households be able to afford a monthly expenditure sufficient to allow the utility to meet its costs.

Given the limited means of most African households, service providers will not be able to expand services—or even to sustain them in some cases—based solely on actual and potential revenues from customers. To connect all unserved customers to water or electricity services, the average African government would have to provide a one-time capital subsidy equal to about 1 percent of GDP for 10 years on average. Some governments would have to provide twice that amount. The cost of a recurring consumption subsidy would be slightly higher than the costs of subsidizing new connections.

Some of the necessary subsidies are already being paid—but not efficiently. Existing consumption subsidies for electricity and water appear to be poorly targeted in African countries. This is because poor households tend to live in areas without electricity and water service; thus it is impossible for them to benefit from the subsidies. In addition, even where access to the network is available to the poor, many remain unconnected, often because the cost of connecting to the network and purchasing the equipment required for electricity and water use is too high.

The traditional “inverted block tariff” structures used in many countries are particularly poorly targeted. First, these tariff structures spread subsidies to all households connected to the network, so that even those who consume high amounts of electricity benefit from a subsidy for the part of their consumption that falls in the lower blocks of the tariff structure. In addition, the lower blocks tend to be too generous in terms of consumption (in kWh per month) to target the poor well. And finally, the differences in unit prices between the various blocks may not be large enough.

Nonpayment for infrastructure services is as a major issue, even among affluent households. Among those reporting access to piped water, electricity or telephone services, close to half did not report paying a bill during the month of the service. While nonpayment rates tend to be higher among the poorer segments of the population, 20 percent of the top quintile report not paying for electricity, and 40 percent of the top quintile report not paying for water.

Even if subsidies could be better targeted and collection rates improved, the ability of African households to pay for infrastructure services is almost certainly not sufficient to permit providers to expand services without additional capital and operating subsidies.

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<sup>1</sup> By our best estimates, most households in most countries should be able to afford monthly charges of around \$2 for any given infrastructure service, but charges of \$10 a month are prohibitive for the majority.

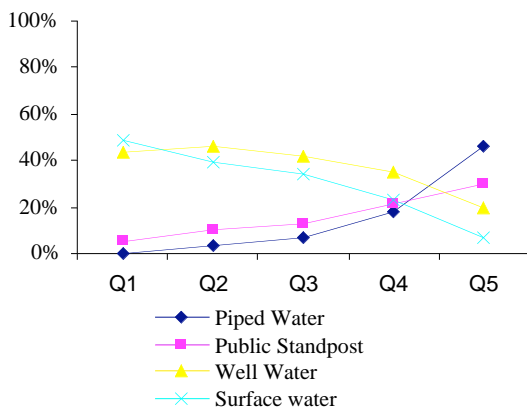
### Alternative ways of meeting infrastructure needs

With networked infrastructure services unavailable or too costly, millions of African households will continue to resort to traditional alternatives to modern infrastructure services. It is important that policy makers understand these alternatives. In some cases, promoting greater use of second-best alternatives may be a good way to expand access in an affordable way. Some second-best options are viable substitutes for networked services but even access to these second-best alternatives is still comparatively skewed toward the upper-income groups, indicating substantial room for growth in access to these forms of service.

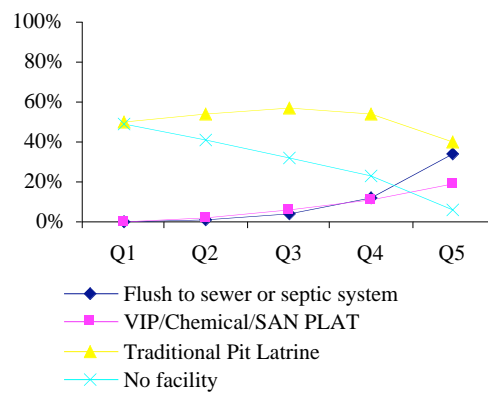
Figure 3 Patterns of access to alternative water and sanitation services

Population-weighted average, percent, latest available year

(a) Water



(b) Sanitation



Source: AICD DHS/MICS Survey Database, 2007.

Among the main alternatives to household connections to piped water are standposts and water vendors, particularly in urban areas, and wells and boreholes, which predominate in rural areas. The coverage of standposts—at 16 percent for our sample and around 27 percent of the urban population—is only slightly higher than the coverage of private piped-water connections. While somewhat more equitably distributed than piped-water connections, public standposts are still regressive in their pattern of incidence. About 37 percent of African households rely on wells and boreholes for their water supply, a share that is relatively constant across the income distribution. Those with no other alternative must resort to surface water of questionable quality—this amounts to 30 percent of the population overall and about 50 percent of the poorest.

In a few countries, water vendors play a significant role in urban water supply, supplying around 4 percent of the urban water market; and in Mauritania that share exceeds 30 percent. Interestingly, even though water vendors charge higher unit prices for water, those purchasing water from vendors do not necessarily spend more on buying water than those purchasing water from the public utility—they simply lower the quantity they consume. In many cases, overall spending levels are similar; where they differ those purchasing from vendors are just as likely to spend more or less per month relative to the clients of the utilities.



The overall prevalence of improved latrines (such as VIP, chemical, or SAN PLAT) in Africa, at around 8 percent of the population, is scarcely higher than the prevalence of flush toilets and is equally concentrated in the upper-income segments of society.

Several countries stand out as having 30–50 percent of their populations covered by flush toilets or improved latrines. Even in those countries, however, about half of the population relies on traditional pit latrines, by far the most widely used form of sanitation in Africa. In Malawi, Tanzania, and Uganda as much as 80 percent of the population is served by traditional pit latrines. As with boreholes, the share of the population using pit latrines is relatively constant across the income distribution, but, in some countries, a large share of the population lacks even that form of sanitation. In Benin, Burkina Faso, Chad, Niger, and Togo, more than 80 percent of the rural population lacks any form of sanitation.

The sharing of water and sanitation facilities among multiple families is common in urban areas. At least 16 percent of urban households share their water supply facilities with other households, while more than 40 percent typically share their toilet facilities.

The average African household spends 45–50 minutes per day collecting water from sources outside the household. The time spent collecting water has remained almost unchanged over the last 15 years. Most African households that lack private water connections live within one kilometer of their water source. In the case of urban households, the average distance is estimated to be just over 500 meters, while in the case of rural households the average distance is closer to one kilometer. Some 20 percent of urban households and 30 percent of rural households live more than one kilometer from their water source.

The vast majority of the population cooks with traditional solid fuels and relies on kerosene for lighting. For cooking, around 80 percent of the population relies on wood, charcoal, or a substitute. Although reliance on traditional fuels is significantly higher in rural areas (close to 93 percent of households), their use in urban areas remains quite high (more than 70 percent of households in many cases).

More than half of the African households dump, burn, or bury their household waste. Only 10 percent of households (but about 30 percent of urban households) have access to an advanced waste collection option such as collection by the government, a private company, or a nongovernmental organization.

## Conclusions and policy directions

Despite the overall decline in African's access to water and sanitation particularly in the urban areas since 2000, a significant number of countries have succeeded in expanding coverage by an annual average of 5–10 percent, a rate fast enough to make substantial coverage gains within a reasonable time frame. Further investigation is warranted to explain what determines their superior performance.

The finding that a significant share of the unserved urban population lives close to infrastructure networks but chooses not to connect suggests the need for greater efforts on the

demand side—and that extending networks is not a sufficient condition for achieving higher access. The low uptake rate of services in African cities means that the financial and economic return to prior network expansion has been much lower than might be expected, leaving a relatively small customer base to cover the fixed costs of a relatively expensive network. It is therefore necessary, once the phenomenon of low uptake is thoroughly understood, to accompany further expansion with demand-side measures explicitly designed to reduce uptake barriers, such as subsidization of connection charges, which tend to be high relative to household incomes and no doubt play a role in the low uptake of available services. Urban development factors, such as insecure household tenure, may also be playing an important role, discouraging both supply and demand.

Low incomes represent an absolute constraint on the rate of expansion of modern services. The average African household has little more than \$30 per month to spend on all utilities and transport. Utility bills on the order of \$6 per month for a service such as water or power may be affordable for most households in all but the poorest countries, but once bills reach \$10 per month they are unaffordable for a substantial share of the population.

The fact that most Africans rely either on alternatives to networked infrastructure services or simply do without services altogether has important implications. Given the slow rate of growth in coverage for many services in many countries, this situation is likely to persist for years. For that reason, in addition to focusing on improving the performance and expanding the ambit of formal providers of modern infrastructure services, it is important to consider what might be done to improve the lot of the unserved through alternative services. There is clearly substantial potential for second-best options such as standposts and improved latrines to reach a larger share of the population.

While the results reported above provide insights into the nature of household usage of infrastructure services in Africa, they also raise many questions that cannot be immediately answered. Why is the variance in access so high across countries, even within the same income band? Why is the variance in access so high across services, and how is it that a new service such as cellular telephony made such major inroads so quickly?

To find answers to many of these questions, it is necessary to dig deeper into the institutional organization and the performance of service providers in each country. Such an analysis is already underway in other components of the Africa Infrastructure Country Diagnostic. When all the work has been completed, it will be possible to revisit the findings of this study and make greater sense of the variations that have been observed.