

The 12th Infrastructure Consortium for Africa (ICA) Annual Meeting

Plenary Meeting on 22 November 2016

Abidjan, Côte d'Ivoire

BACKGROUND PAPER

BUILDING QUALITY INFRASTRUCTURE FOR AFRICA'S DEVELOPMENT

November 2016





Preface

The 12th Annual Meeting of the Infrastructure Consortium for Africa (ICA) takes place in Abidjan, Côte d'Ivoire, on November 21st and 22nd, 2016. The focus of the Annual Meeting is “Building Quality Infrastructure for Africa’s Development”. It is hosted by the African Development Bank (AfDB)/ICA at its headquarters, and jointly organized by AfDB/ICA and Japan.

To prepare for the Annual Meeting and to provide a focus for discussions, Japan International Cooperation Agency (JICA) commissioned this background paper and the

document was prepared by Centennial Group International of Washington DC. The principal author was James Bond, with input and authoring from Catherine Kleynhoff and research assistance from Alden LeClair.

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List of abbreviations

AfDB	African Development Bank	INDC	Intended Nationally Determined Contributions (see UNFCCC)
AICD	Africa Infrastructure Country Diagnostic		
AREI	Africa Renewable Energy Initiative	IPP	Independent Power Producer
CAPP	Central Africa Power Pool	JICA	Japan International Cooperation Agency
CIF	Climate Investment Fund	KfW	Kreditanstalt für Wiederaufbau (German development bank)
CNS/ATM	Communications, navigation, surveillance/air traffic management	KM	Kilometer
COMELEC	Comité Maghrébin de l'Electricité	KPA	Kenya Ports Authority
COMESA	Common Market for Eastern and Southern Africa	KPMG	Major international financial audit/consulting company
CSP	Concentrated Solar Power	kWh	Kilowatt-hour
DFI	Development Finance Institution	LG2EP	Durban Landfill Gas to Electricity Project
DRC	Democratic Republic of Congo	MDG	Millennium Development Goals
DSW	Durban Solid Waste	MW	Megawatts
EAC	East African Community	O&M	Operations and maintenance
EAPP	Eastern Africa Power Pool	OEBK	Organisaton pour l'Équipement de Banana-Kinshasa
ECOWAS	Economic Community of West African States	PIDA	Programme for the Development of Infrastructure in Africa
EIB	European Investment Bank		
EMH	Efficient market hypothesis	PPA	Power Purchase Agreement
EPC	Engineering, procurement and construction	PPP	Public-private partnership
EPRA	Economic Policy Reform and Advocacy	PV	Photo-voltaic electricity
EPSA	Enhanced Private Sector Assistance	POTS	"Plain old telephone service"
ESIA	Environmental and Social Impact Analysis	OSBP	One stop border post
EUEP	Emergency Urban Environment Project	RAP	Resettlement Action Plan
FDA	French Development Agency	REC	Regional Economic Communities of the African Union
G7	Group of Seven Industrialized Countries	RMC	Regional Member Countries
GDP	Gross Domestic Product	SADC	Southern African Development Community
GHG	Greenhouse Gases		
GoJ	Government of Japan	SAPP	Southern Africa Power Pool
GPI	Global Procurement Initiative	SME	Small and medium enterprise
GSMA	GSM Association (mobile telephony standard)	SOE	State owned enterprise
GW	Gigawatts	STEM	Short Term Energy Market
ICA	Infrastructure Consortium for Africa	TEU	Twenty foot equivalent unit (container size)

TICAD	Tokyo International Conference of Africa's Development
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USTDA	United States Trade and Development Agency
WAPP	Western Africa Power Pool
WSS	Water supply and sanitation

ICA Plenary Meeting

Executive summary

Purpose of this paper

This paper has been prepared for the 2016 Plenary Meeting of the Infrastructure Consortium for Africa, which focuses on building quality infrastructure for Africa's development. Its intention is to provide background information, and guide participants for a better understanding of the topics to be covered the plenary meeting.

Infrastructure's role in development

Infrastructure¹ makes up a major part of investment expenditure in all countries, equivalent to roughly three to six percent of GDP per year (one-third to one-half of total public investment). Recently there has been increasing concern and debate about the performance of infrastructure—among economic policy-makers, politicians, and the public—in both developed and developing countries. On the African continent this led amongst other things to the creation of the Infrastructure Consortium for Africa (ICA) in 2005 to accelerate progress towards meeting Africa's urgent infrastructure needs.

Infrastructure is essential for development. Adequacy of infrastructure helps determine one country's success and another's failure—in diversifying production, expanding trade, coping with population growth, reducing poverty, or improving environmental conditions. Good infrastructure raises productivity and lowers production costs, but it has to expand fast enough to accommodate growth. The kind of infrastructure put in place also determines whether growth does all that it can to reduce poverty. Rural roads, for example, linking rural and urban markets, or rural water supply, will do more for inclusive growth than other infrastructure services targeting higher income populations.

Infrastructure financing and ownership have important implications for macroeconomic stability. As a countercyclical

tool, infrastructure investment can generate employment and consumer demand. Ownership arrangements (public, private, or in partnership) impact the quality of infrastructure services and availability of financing. Taken overall, persistent deficits of ports, roads, railways, airlines, and power utilities have contributed measurably to Africa's fiscal and financial instability, and have held back growth.

State of Africa's infrastructure

Africa's infrastructure endowment

Africa lacks basic infrastructure. Overall, the African continent is by all measures the least endowed region of the developing world in infrastructure, even compared to low- and middle-income countries in other regions. This is partly due to low overall GDP (because infrastructure investment is closely correlated with GDP) and partly due to Africa's geographic and historical legacies.

In 2014, Africa's infrastructure investment reached \$74.5 billion, and annual spending needs are estimated to be \$100 billion (2015 dollars) simply to maintain current endowment levels. Close to half the financing comes from governments, with the bulk of the rest made up by loans and grants from development partners. The share of private financing, at under 4% of the total, is significantly lower than in other low- and middle-income regions and is for the most part concentrated in mobile telecommunications, even though there is considerable scope for private funding of electricity (particularly generation), ports, rail and water supply. The low level of financing from the private sector reflects poor cost recovery and the perceived riskiness of investing in Africa, the latter in part due to ambivalence of governments and public opinion vis à vis private investors.

Africa's infrastructure deficit varies considerably by sub-sector. In mobile telecommunications Africa is ahead of other comparable regions, and African countries have used these

1. Defined here to include the sectors of transport, water and sanitation, power, and telecommunications.

technologies to leapfrog natural handicaps, e.g. in mobile banking. In water supply, following a major investment push over the past two decades enabled by better cost recovery, Africa is on a par with other low income countries, but improved sanitation lags. It is in the transport and in the electric power subsectors that Africa falls behind. In these two subsectors, Africa's endowments are generally significantly below those of other comparable regions.

Quality of infrastructure services in Africa

Africa's infrastructure services are of mixed quality.

Taken overall, Africa's infrastructure does not deliver services of sufficient quality for Africa's development. The ease of obtaining an electric power connection varies significantly from one country to the next, but in many African countries it takes a long time and the upfront cost for the consumer is high. Loading and unloading times at ports can often be long. Deteriorated road networks, foregone maintenance and lack of competition among transporters often increases the cost of transporting merchandise, although significant progress is underway in upgrading Africa's roads. Border crossings are still often arduous and protracted. Access to clean water and especially improved sanitation has significantly improved over the past decade, but more progress is needed. Mobile telephony on the other hand is widely available, with adequate coverage, although internet often remains erratic and costly.

Low infrastructure endowment and mixed quality of infrastructure services holds Africa back. African firms and consumers suffer both from the infrastructure deficit and from spotty infrastructure services that are often high cost, erratic, and undependable. This means that the continent has additional development hurdles to overcome. These hurdles include:

- Africa's products and services tradeable on international markets have higher costs than those exported by other regions, which reduces the international competitiveness of African exporters and limits sectors that African firms can compete in.
- Africa's domestic markets, e.g. for agricultural produce, are less developed. Local suppliers are not always able to meet demand, because electric power is not readily available or road quality is poor. Products are thus more expensive for consumers.
- Infrastructure contributes to inclusive growth; so Africa's lack of infrastructure means that the fruits of growth are not widely shared throughout the country. For example, the absence of transport linkages between rural and urban markets reduces opportunities for agriculture.
- Regional integration requires both a coordinated set of rules across the region, and physical interconnections. Regional road, rail, electricity and

Table 1: Key infrastructure statistics

Indicator	Sub-Saharan Africa	Low-income countries	Middle-income countries
Roads (km/1000 km²)			
Paved road density	49	134	461
Total road density	152	211	757
Telecommunications (lines/100 population)			
Main line density	1	1	10
Mobile density	71	57	94
Internet density	19	6	34
Electricity			
Generation capacity (MW/million population)	37	326	
Electricity coverage (% of population with access)	35	41	87
Water and sanitation (% of population with access)			
Improved water	66	66	92
Improved sanitation	30	28	65

Source: Centennial Group International 2016

communications networks are absent or weak in much of the African continent.

Definition of quality infrastructure²

Quality infrastructure incorporates elements of economic efficiency, social inclusiveness, safety and resilience, environmental sustainability as well as the convenience and comfort, seen as vital for sustainable development. The concept addresses the challenge of building infrastructure based on smarter decisions, better design and construction, innovative financing and positioning the private sector as part of the solution.

With limited financial resources in parts of Africa, but mindful of the necessity for inclusive and sustainable development, it also addresses the challenge of developing infrastructure investments that offer the best value for money. Longevity, safety and operational costs over the full project lifecycle are all taken into account, as is an investment's contribution to local human resource development.

Climate change challenges are also addressed in the concept of quality infrastructure. It is important that the green and resilient aspects of infrastructure are taken into account by using environmentally friendly technologies that emit the least greenhouse gases and provide the greatest adaptability to climate change.

Factors determining quality infrastructure

As Africa continues to invest in infrastructure to close the gap with the rest of the world, it must ensure that this investment is of high quality to achieve maximum economic impact and inclusiveness. A number of cross-cutting issues present themselves.

Cross-cutting issues

The most important cross-cutting issue for infrastructure in Africa is the **need for more overall investment**, to accelerate deployment across the continent. Without increased private financing, it is unlikely that Africa can close its infrastructure gap. More private ownership and operation of Africa's infrastructure will be needed. This will also contribute to quality by improving operations and maintenance, and thus enhancing the quality and sustainability of the associated infrastructure service.

Additional key issues identified as important for Africa to build quality infrastructure are:³

Economic efficiency

Economic efficiency relates to both how well the initial investment is carried out – getting the best return on infrastructure investment, and ensuring that the technology chosen is the appropriate one given specific country and consumer circumstances – and how well the subsequent physical asset is operated and maintained. During the planning and construction phase this will involve, inter alia: (a) ensuring appropriate technology choice and project design; (b) suitable ownership and management arrangements and financing; (c) efficient and competitive procurement; and (d) proficient construction management. Following commissioning it will involve: (a) operational efficiency and strong maintenance capacities; (b) minimized environmental burdens and social costs. The plenary will allow participants to deepen their appreciation for the impact the right choice of financing, partners, and technology can have to maximize the benefits of initial investments. They will also get a better sense for the trade-offs between these choices.

Inclusiveness

Inclusiveness of the infrastructure investment relates to the degree to which the infrastructure service associated with the fixed asset leads to the benefits of economic growth reaching the broadest possible segment of the population. This will involve: (a) improvement of welfare and economy of residents, including the poor; (b) promotion of well-balanced development between rural and urban areas; (c) gender considerations; and (d) dismantling natural or artificial barriers within the country. Participants will have a deeper understanding of the complex issues pertaining to the improvement of the welfare and economy of the residents, promotion of well-balanced development between rural and urban, as well as gender considerations.

Safety, resilience and sustainability

Safety and resilience relates to how well the infrastructure asset is able to perform under a wide range of climatic and other outcomes. Safety and resilience have particular

2. Source: ICA annual Report 2015.

3. Source: *Quality Infrastructure Investment Casebook*, the Government of Japan (Ministry of Foreign Affairs; Ministry of Finance; Ministry of Economy, Trade and Industry; Ministry of Land, Infrastructure, Transport and Tourism; Ministry of Internal Affairs and Communications; JICA).

resonance in Africa given the very significant effects of climate change expected in these countries. In particular, it focuses on: (a) resilience against natural disasters, including those stemming from climate change; and (b) ensuring safety in use and operation as well as security in and around construction sites.

Sustainability encompasses two core themes: the degree to which the infrastructure asset minimizes its environmental and social impact on the region and country in which it is located, and the degree to which its financing, operation and maintenance ensures its own prolongation and replacement at the end of its economic life. Issues for consideration include: (a) harmony with the environment; (b) minimized negative impact on communities, particularly the poorest; (c) maintaining high performance and optimized operation; (d) continuity of management; and (e) effective maintenance and asset replacement at the end of its economic life.

Participants will strengthen their knowledge of options available for the deployment of climate resilient infrastructure. They will also get a deeper understanding of the many dimensions of sustainability: social and environmental impact, financing, continuity of management, and adequacy of maintenance of infrastructure assets.

Subsector issues

Transport

The transport sector ties together the national fabric and links producers and consumers to the broader world. Key sector-specific issues relate to (a) the need for transport infrastructure to work at a regional rather than national level, notably focusing on **transport corridors** that link international markets to centers of population; (b) using transport infrastructure to maximize the **inclusiveness of development** by opening up isolated areas; and (c) using infrastructure investment to its fullest to ensure rational urban development, through **mass transit** options.

Electricity

Electricity underpins development of productive activities in the economy, and promotes inclusive growth through the services it provides to the poor. The most important issues in the sector are: (a) insufficient investment due to **poor cost recovery**, due both to inadequate tariffs and to low collection rates, particularly from the public sector. This has made the sector unattractive to private investors, so that unlike other

regions, it has remained mainly under public ownership and management; (b) **technology choice** in the investment decision. New technological options have become economically attractive, notably small scale renewables such as PV-based solar home systems and mini-grids, wind, geothermal and run-of-the-river hydro. Investment decisions should be taken based on least cost solutions over the full life-cycle of the asset.

ICT

Mobile telephony is an African success story. Voice and SMS communications have been seized upon by Africa's population to underpin broad areas of economic activity, from obtaining agricultural pricing information to mobile banking. But mobile data usage still remains low because of its high relative cost and because of current low penetration of smartphones (although this is evolving). The most important issue in the ICT area relates to **quality of internet connectivity**, where bandwidth is low, services are often erratic, and prices are high, due often to inadequate competition.

Water

While transport, electricity and telecommunications infrastructure supports country competitiveness and trade, and also (perhaps to a lesser extent) inclusive growth, provision of safe water and sanitation is directly responsible for reducing poverty and supporting inclusive growth. Key issues in the sector are: (a) **access to improved water** remains inadequate, particularly in rural areas; (b) **improved sanitation** (septic tanks and improved latrines) reaches less than 20 percent of Africa's population, and less than 10 percent in rural areas.

Initiatives underway

Africa is currently undergoing a large number of exciting initiatives that address the constraints outlined above, among which:

- **G7 Ise-Shima Principles for Promoting Quality Infrastructure Investment.** This initiative was elaborated at the G7 meeting in Japan in May 2016 and is made up of a number of principles, including ensuring effective governance, reliable operation and economic efficiency in view of life-cycle costs, as well as safety and resilience against natural disasters, terrorism and cyber-attack risks.

- **Expanded partnership for quality infrastructure by Government of Japan (GoJ).** In May 2015, the government of Japan announced the Partnership for Quality Infrastructure with the aim of promoting cooperation and collaboration with other development partners that align with the concept's approach.
- **Phase 3 of The Enhanced Private Sector Assistance (EPSA).** At TICAD VI, the African Development Bank (AfDB) and Japan announced a US \$3 billion private sector development initiative to boost growth and reduce poverty in Africa. The resources will focus on, among other things, infrastructure, notably transport and energy. The need for investment in quality infrastructure that connects Africa was highlighted by Japan's Prime Minister, Shinzo Abe.
- **New Deal on Energy for Africa 2016-2025** is a partnership-driven effort with the aspirational goal of achieving universal access to energy in Africa by 2025. The aim is to develop a Transformative Partnership on Energy for Africa – a platform for public-private partnerships for innovative financing in Africa's energy sector.
- **Global Infrastructure Facility** (managed by the World Bank). Multilateral development banks including the World Bank are working with commercial lenders, institutional investors and other development partners to set up a facility embracing the quality infrastructure approach that would examine and address the roadblocks to infrastructure development/
- The **Japan-Africa TICAD VI** meeting held in Nairobi over August 27-28, 2016 elaborated key principles relating to advancing Africa's sustainable development agenda based on quality and empowerment ("TICAD VI Nairobi Declaration").⁴ This important initiative underpins Japan's very significant future investments in Africa (approximately \$30 billion, under public-partnerships) through measures centering on developing quality infrastructure, building resilient health systems and laying the foundations for peace and prosperity.

The initiatives below, while having a positive impact over all components of quality, have been singled out because of their focus on one specific component.

Economic Efficiency

- **Global Procurement Initiative: Understanding Best Value (GPI)** is a program supported by US Trade and Development Agency dedicated to assisting public officials in emerging economies to better understand the total cost of ownership of goods and services for infrastructure projects. The GPI helps public procurement officials establish practices and policies that integrate life-cycle cost analysis and best-value determination in a fair, transparent manner.
- **Maintenance of road corridors; performance based contract experience and private sector involvement.** The recommendations of the African Union Commission on the Road Maintenance Strategy were adopted in 2014 (Malabo summit). The chart on Road Safety was adopted in 2016 (Addis Ababa Summit). The AUC is organizing regional workshops to help ratification at country-level and accelerate deployment.
- **One-Stop Border Post (OSBP) Source Book.** First published in 2011, the OSBP Source Book project was an initiative of the Transport Sector Platform of the ICA and was funded by the Japan International Cooperation Agency (JICA), as lead development partner of the Platform, in close cooperation with the East African Community. The second edition of the OSBP Source Book was completed in May 2016, officially launched in August during TICAD VI, and will be uploaded onto the NEPAD and ICA websites.

Inclusiveness

- **New Deal on Energy for Africa 2016-2025** is a partnership-driven effort with the aspirational goal of achieving universal access to energy in Africa by 2025. To drive and achieve this goal, the African Development Bank is working with governments, the private sector, and bilateral and multilateral energy sector initiatives to develop a platform for public-private partnerships for innovative financing in Africa's energy sector.
- **The Africa Renewable Energy Initiative (AREI)** is a transformative, Africa-owned and Africa-led inclusive

4. See: "TICAD VI Nairobi Declaration", http://www.mofa.go.jp/af/af1/page3e_000543.html A summary of Japan's measures for Africa at TICAD VI for "Quality and Empowerment" are available at: <http://www.mofa.go.jp/mofaj/files/000183835.pdf>.

effort to accelerate and scale up the harnessing of the continent's significant renewable energy potential. The Initiative is set to achieve at least 10 GW of new and additional renewable energy generation capacity by 2020, and mobilize the African potential to generate at least 300 GW by 2030.

Safety, Resilience and Sustainability

- **Readiness for promoting climate resilient infrastructure development in Africa.** This initiative is designed to enhance capacity of participating Regional Member Countries and Regional Economic Communities of the African Union to develop a pipeline of adaptation projects and to help them mobilize resources from climate funds, notably from the UNFCCC sponsored Green Climate Fund. The main objective of the project is to enhance partnership, readiness and capacity for climate-resilient infrastructure development in the region.
- **The Global Road Safety Facility (GRSF),** a global partnership program with the mission to help address the growing crisis of road traffic deaths and injuries in low and middle-income countries (LMICs). GRSF provides funding, knowledge, and technical assistance designed to scale-up the efforts of LMICs to build their scientific, technological and managerial capacities.

Building quality infrastructure in Africa—the way forward

For its development, Africa needs more infrastructure, and of better quality. Economic growth and social inclusiveness are highly correlated with quality infrastructure services, and Africa's low endowment and mixed quality hold the continent back. More overall investment requires seeking out new sources of financing; and better operation and maintenance of infrastructure stocks to achieve better infrastructure services requires a new approach to building, operating and maintaining infrastructure assets.

Options relating to sources of financing have been covered in a prior Plenary Meeting of the ICA. This paper reviews issues and options relating to building, operating and maintaining infrastructure assets. Below are a number of key issues for consideration.

Building quality infrastructure

Better planning and design. Building quality infrastructure will require improvements in planning and design, from initial surveys of user needs to a wide review of different technical and technological options. Infrastructure quality is significantly enhanced by high quality planning, in which users and potentially affected communities play an active part. This planning must take into account impacts of the proposed project on the environment and on local communities.

Better procurement and construction. Once the optimal project design has been identified, realization of a quality infrastructure installation will occur only if procurement and construction management are well executed. Quality is significantly enhanced by transparent, competitive procurement of goods and services, and by a management structure that minimizes interfaces between sub-contractors and has appropriate risk-sharing with them to minimize delays and cost overruns.

Better operations and maintenance. Once the infrastructure asset has been commissioned, the quality of the associated infrastructure services will depend on how well the installation is operated and maintained. Ensuring sufficient funding for operations, and particularly for maintenance, is key to delivery of quality infrastructure services. For revenue-generating infrastructure (electricity, ports, rail, toll roads, water supply, and ICT) this requires tariffs that cover costs, and efficient billing and collection by the utility or company. Inclusiveness is enhanced by the introduction of lifeline tariffs. For non-revenue generating infrastructure (roads), effective public sector budgeting is essential.

Action agenda

African policy makers need to consider both how to increase overall funding for infrastructure investments to close the infrastructure gap, and how to improve the quality of infrastructure investment, operations and maintenance. To improve **economic efficiency**, increase **inclusiveness**, and enhance **safety, resilience and sustainability**, African governments and infrastructure practitioners must focus on three sets of actions:

- **Building quality into the infrastructure life-cycle of planning, procurement and construction, and operations and maintenance.** Concepts of quality must be built into infrastructure projects from the very start, and continue throughout the project life-cycle, including operations and maintenance. Key design

and operational principles must be based on economic efficiency; inclusiveness; and Safety, resilience and sustainability.

- **Ensuring adequate financial resources for infrastructure operations and maintenance.** African infrastructure is critically underfunded because of inadequate tariffs, poor billing and collection, and inadequate government budgeting. African infrastructure practitioners and governments have to ensure that the sector is in financial equilibrium, otherwise Africa will never be able to close its infrastructure gap. This involves, in particular, greater private sector involvement in the sector.
- **Sharing and disseminating information and best practice.** Finally, the crucial concept of quality infrastructure must be disseminated throughout the continent. Furthermore, that procurement guidelines at country level as well as those of multilateral development institutions need to be revised, notably to exclude investments in sub-optimal infrastructure which negatively affect the sustainable development of the African continent.

Building quality infrastructure for Africa's development

Infrastructure's Role in Development

Infrastructure¹ makes up a major part of investment expenditure in all countries, equivalent to roughly 3 to 6 percent of GDP per year (one-third to one-half of total public investment). Recently there has been increasing concern and debate about the performance of infrastructure—among economic policy-makers, politicians, and the public – in both developed and developing countries. On the African continent this led amongst other things to the creation of the Infrastructure Consortium for Africa (ICA) in 2005 to accelerate progress towards meeting Africa's urgent infrastructure needs.

Infrastructure is essential for development. Adequacy of infrastructure helps determine one country's success and another's failure in diversifying production, expanding trade, coping with population growth, reducing poverty, or improving environmental conditions. Good infrastructure raises productivity and lowers production costs, but it has to expand fast enough to accommodate growth. The kind of infrastructure put in place also determines whether growth does all that it can to reduce poverty. Rural roads, for example, linking rural and urban markets, or rural water supply, will do more for inclusive growth than other infrastructure services targeting higher income populations.

How does infrastructure impact economic development?

Infrastructure contributes to economic growth by increasing the marginal productivity of private capital, which translates into higher growth. At the microeconomic level, this occurs through:

- **Lower costs of production.** Infrastructure improves profitability, levels of output, income, and employment, particularly for small-medium scale enterprises.

Infrastructure also has an impact on the costs and service quality in international trade, which determines competitiveness in export and import markets. Finally, it has an impact on domestic transaction costs and access to market information.

- **Structural impacts on demand and supply.** Infrastructure contributes to diversification of the economy—in rural areas, for example, by facilitating growth of alternative employment and consumption possibilities. Infrastructure (especially telecommunications and electric power) provides access to applications of modern technology in many sectors (e.g. banking or healthcare), with possibility of leap-frogging historical handicaps. It is also key to the economy's ability to adjust the structure of demand and output in response to changing price signals.

Infrastructure also contributes to raising the quality of life and increasing the inclusiveness of growth in the economy by:

- **Creating amenities in the physical environment**—such as cleaner water, land and air; and by providing spatial order to human settlements and public works. Improvements in infrastructure are central to the quality of life and enjoyment gained from both the natural and man-made (built) environment, especially in urban areas.
- **Providing outputs**—such as transportation and communication services, which are valued by consumers in their own right as consumption goods; and by contributing to improved personal health and wellbeing, and national integration. Inclusiveness is enhanced by good maintenance of the asset (which leads to lower costs) and to the introduction of lifeline tariffs (see paragraph 70 below).
- **Connecting people to markets**—transportation and communications services allow people in remote

1. Defined here to include the sectors of transport (roads, rail, ports, airports); water and sanitation; electric power; and telecommunications (fixed line communications, mobile, internet).

rural areas to integrate into the economic fabric of the country and increases their economic opportunities.

The **financing of infrastructure and the ownership arrangements** have important implications also for macro-economic stability. As a countercyclical tool, infrastructure investment can generate employment and consumer demand in both the short and the longer term (when the investment is well chosen). However, the way infrastructure investment, operations and maintenance are financed can also contribute to internal and external imbalances, for example, when investments are made by government and financed by unsustainable external debt. But overall, in Africa, the absence of infrastructure, such as persistent deficits of roads, railways, airlines, and power utilities, has contributed measurably to fiscal and financial instability and has held back growth.

State of Africa's Infrastructure

Africa's infrastructure endowment

Africa lacks basic infrastructure. Overall, the African continent is by all measures the least endowed region of the developing world in infrastructure, even compared to low- and middle-income countries in other regions. This is partly due to low overall GDP (because infrastructure investment is closely correlated with GDP) and partly due to Africa's geographic and historical legacies.

In 2014, Africa's infrastructure investment reached \$74.5 billion,² and annual spending needs are estimated to be around \$100 billion (2015 dollars) simply to maintain current endowment levels. Close to half the financing comes from governments, with the bulk of the rest made up by loans and grants from development partners. The share of private financing, at under 4 percent of the total, is significantly lower than in other low- and middle-income regions and is for the most part concentrated in mobile telecommunications, even though there is considerable scope for private funding of electricity (particularly generation), ports, airports, rail and water supply. The low level of financing from the private sector reflects poor cost recovery and the perceived riskiness of investing in Africa, this latter in part due to ambivalence of governments and public opinion vis à vis private investors.

Africa's infrastructure deficit varies considerably by sub-sector. In mobile telecommunications Africa is ahead of other

comparable regions, and African countries have used these technologies in innovative ways to leapfrog natural handicaps, e.g. in mobile banking. In water supply, following a major investment push over the past two decades enabled by better cost recovery for utilities, Africa is on a par with other low income countries, but improved sanitation lags. It is in the transport and in the electric power subsectors that Africa falls behind. In these two subsectors, Africa's endowments are generally significantly below those of other comparable regions.

Quality of infrastructure services in Africa

Countries in Africa are far from homogeneous, and their infrastructure problems and solutions are not everywhere the same. Worldwide analysis shows that the correlation of infrastructure stocks with income is strong and compelling³, and in this regard Africa's low infrastructure endowment is above all a reflection of its low GDP per capita income levels. However, infrastructure performance across countries – that is, the delivery of services related to physical infrastructure stocks (transport services, communication services, delivery of quality electricity and water services) – is generally not strongly related to income levels. Some countries with low infrastructure endowments deliver relatively good infrastructure services with these endowments, whereas other countries with greater amounts of physical infrastructure may deliver far poorer infrastructure services. Deploying quality infrastructure, the subject of this meeting, is intimately bound up with the quality of infrastructure services delivered.

On the African continent, not only are physical endowments of infrastructure low, but the quality of services provided by this infrastructure is often mediocre. Performance of infrastructure is often poor: high cost, erratic, and undependable. Africa has a mixed record of deploying quality infrastructure.

Low infrastructure endowment and mixed quality of infrastructure services holds Africa back. African firms and consumers suffer both from the infrastructure deficit and from spotty infrastructure services that are often high cost, erratic, and undependable. This means that the continent has additional development hurdles to overcome. These hurdles include:

3. Indeed, cross-country and time series analyses demonstrate that per capita GDP and infrastructure stocks rise in almost lock step across the world: an increase of 1 percent in per capita GDP is met by an increase of 1 percent in infrastructure stocks. It is not clear, however, what the causality mechanism is. Source: World Bank, World Development Report 1994: "Infrastructure and Development."

2. Source: ICA.

Box 1: Importing and exporting are costly in Africa

To import a 20-foot container in Sub-Saharan Africa:

- Average cost: \$2,793
- Average time: 38 days

To import a 20-foot container in Singapore:

- Average cost: \$440
- Average time: 4 days

For the 16 landlocked countries in Africa, the cost of trading is 50 times higher and the volumes of trade are 60% lower than in African coastal countries.

Source: The Infrastructure Consortium for Africa (2015)

- Africa's products and services tradeable on international markets have higher costs than those exported by other regions, which reduces the international competitiveness of African exporters and limits sectors that African firms can compete in.
- Africa's domestic markets, e.g. for agricultural produce, are less developed. Local suppliers are not always able to meet demand, because electric power is not readily available or road quality is poor. Products are thus more expensive for consumers.
- Infrastructure contributes to inclusive growth; so Africa's lack of infrastructure means that the fruits of growth are not widely shared throughout the country. For example, the absence of transport linkages between rural and urban markets reduces opportunities for low-income agricultural producers.
- Regional integration requires both a coordinated set of rules across the region, and physical interconnections. Regional road, rail, electricity and communications networks are absent or weak in much of the African continent, which has limited the impact of regional integration initiatives.

Factors Underlying Deployment of Quality Infrastructure

As Africa continues to invest in infrastructure to close the gap with the rest of the world, it must ensure that this investment is of high quality to achieve maximum economic impact and inclusiveness. Among the issues relating to infrastructure in Africa the most important cross-cutting theme is the need for more overall investment, to accelerate deployment across the continent. It should be noted that the private sector only contributes 4 percent of infrastructure financing currently in Africa, and without increased private financing, it is unlikely that the continent can close its infrastructure gap. However, as the critically important cross-cutting issue of

overall investment needed for African infrastructure was discussed in the paper commissioned by ICA and prepared by the World Bank,⁴ it will not be addressed further in this paper, which will focus on determinants of quality infrastructure only.

What is quality infrastructure?

Concept of quality infrastructure

The term **quality infrastructure** must be understood the sense of delivering infrastructure services to the economy and to society at large that demonstrate excellence and are valued highly, i.e. services that contribute to growth, to social inclusiveness and to safekeep of environmental assets, including national, regional and global. The concepts underlying deployment of quality infrastructure incorporate elements of economic efficiency, social inclusiveness, safety and resilience, and environmental and social sustainability, seen as vital for sustainable development, that will be further expanded below. These elements come to play throughout the life-cycle of the infrastructure asset, both during the planning and construction phase, and subsequently during the operations and maintenance phase. The challenge is to build, operate and maintain infrastructure based on smarter decisions, better design and construction, innovative financing, and positioning the private sector as part of the solution.

With limited financial resources in parts of Africa, but mindful of the necessity for inclusive and sustainable development, concepts of quality also address the challenge of developing infrastructure investments that offer the best value for money. Longevity, safety, operational costs and quality of services delivered over the full project life-cycle are all taken into account, as is an investment's contribution to local human resource development.

4. The World Bank: Africa's Infrastructure - A Time for Transformation, 2010

Climate change challenges will need addressed in the concept of quality infrastructure. It is important that the green and resilient aspects of infrastructure are taken into account by using environmentally friendly technologies that emit the least greenhouse gases and provide the greatest adaptability to climate change.

Project life-cycle

Project life-cycle. As concepts of quality come to play throughout the project life-cycle it is important to define what this is. There are many different versions of infrastructure project life-cycle, but typically, project developers include three major phases: (a) pre-investment phase; (b) investment phase; and (c) post investment phase.⁵ (It should be noted that international financial institutions often have their own definition of the project cycle based on their internal processing steps.⁶) Economic efficiency, inclusiveness, safety, resilience and sustainability come into play in all phases of the project life-cycle.

- The **pre-investment phase** of the life-cycle comprises initial project identification; project preparation; project feasibility studies including the project's environmental and social impact analysis (ESIA); financial structuring; and project approval.
- The **investment phase** typically includes detailed design and engineering; procurement and tendering; and project construction and commissioning. Increasingly, these steps are included in one overall Engineering, Procurement and Construction (EPC) contract.
- The **post-investment phase** includes plant operation; maintenance; and ex-post monitoring and evaluation. Further details relating to the project life-cycle are provided in Annex II to this report, and the influence of the three quality criteria at each stage of the cycle in Annex I.

Infrastructure services and the impact of technology choice

Service content of infrastructure. The economic literature⁷ pertaining to infrastructure informs us that the quality of

services delivered for a given level of physical infrastructure stock depends on intangible elements—the “service content.” These relate to levels of skills and human capacity, the efficiency of public administration, and the service focus of the business environment. For example, the ease of obtaining an electric power connection can vary significantly from one country to the next irrespective of the density of electric power networks, and in countries with more extensive electricity networks, it is not necessarily easier to obtain a connection. The cost of transporting merchandise on a road network is not simply a function of the road density of the country; informal roadblocks will significantly degrade the quality of transport services by increasing cost and time for the transporter. The service quality therefore embodies elements that go beyond the planning and construction phase of the asset.

Technology choice. A critically important factor in the quality of infrastructure services is technology choice; in particular, choosing technologies appropriate to country circumstances, managerial capacity, and user needs. Specific examples of such appropriate technologies in Africa are mobile telephony, which has better corresponded to the communication needs of Africa's population than fixed line communication. In the electric power sector, new renewable technologies such as solar electricity allow for a new paradigm of electric power delivery (mini-grids or solar home systems) rather than traditional grid delivery through an incumbent monopoly utility. In urban transport, hybrid systems involving mini-buses, linking to large buses or rail, are making inroads into traditional transport service delivery models. It should be noted that in some cases, earlier technology choices can constrain later choices. Also, evidence points to the fact that the African continent has had more success with technologies that use decentralized approaches and multiple operators (e.g. in mobile telecommunications) than with more centralized approaches.

Overall, it should be noted that astute adoption of new and appropriate technologies permits very significant possibilities for poorly endowed countries, because of the ability to leapfrog the older technologies prevalent in more developed countries. Thus, decision-makers should be sensitive to the technological choices of infrastructure-related decisions.

5. Sources: “Project Management”, Adrienne Watt, BC Open Textbook, British Columbia Ministry of Advanced Education; “The Infrastructure Project Development Cycle”, Renato Reside, June 2007 (USAID/EPRA)

6. For example, see World Bank: http://elibrary.worldbank.org/doi/abs/10.1596/978-1-4648-0484-7_project_cycle.

7. For example, see Metropolitan Infrastructure and Capital Finance, Gregory K. Ingram, Zhi Liu and Karin L. Brandt, Lincoln Institute of Land Policy, 2013.

Determinants of Infrastructure Quality

The key issues identified as important in the deployment of quality infrastructure are provided below:⁸

Economic efficiency

Definition

Economic efficiency is perhaps the most important determinant of infrastructure quality. In its simplest sense, economic efficiency can be defined as **achieving maximum economic and social benefit with minimum use of resources.**⁹ Efficiency relates to both how well the initial investment is executed prior to commissioning, and how well the subsequent physical asset is operated and maintained once the infrastructure asset is commissioned and enters into service. A focus on economic efficiency throughout the project life-cycle will significantly contribute to improving the quality of Africa's infrastructure services.

In practice, investment choice under economic efficiency requirements involves economic and financial analysis of the project to estimate benefits and costs relating to the investment. To compare different options, conventional project economic analysis is used, based on **discounted cashflow** and **internal rate of return**, with the discount rate set at the social cost of capital. To determine outcomes, inputs and outputs should be priced at social levels, and external costs and benefits need to be included as well. For example, projects emitting GHGs should include these external costs imposed on the global community, using a widely accepted shadow price for CO₂ (see para. 82 below). Such economic analysis is fraught with difficulty due to the complex nature of the

8. Source: Quality Infrastructure Investment Casebook, the Government of Japan (Ministry of Foreign Affairs; Ministry of Finance; Ministry of Economy, Trade and Industry; Ministry of Land, Infrastructure, Transport and Tourism; Ministry of Internal Affairs and Communications; JICA)

9. In economics, efficiency is concerned with the optimal production and distribution of scarce resources. The most common definition has been used in this paper, but there are several other definitions of efficiency: (a) productive efficiency occurs when the maximum number of goods and services are produced with a given amount of inputs, i.e. on the production possibility frontier; (b) allocative efficiency occurs when goods and services are distributed according to consumer preferences; (c) X inefficiency occurs when firms (e.g. monopolies) do not have incentives to cut costs, therefore a firm's average cost may be higher than necessary; (d) efficiency of scale occurs when the firm produces on the lowest point of its long run average cost; (e) dynamic efficiency refers to efficiency over time; (f) social efficiency occurs when externalities are taken into consideration and occurs at an output where the social cost of production equals the social benefit; (g) technical efficiency is the optimum combination of factor inputs to produce a good; (h) Pareto efficiency occurs where resources are distributed such that it is not possible to make one party better off without making another party worse off; and (i) distributive efficiency allocating goods and services according to who needs them most. Finally, the efficient market hypothesis (EMH) is an investment theory that states that securities markets, when efficient, cause existing securities prices to incorporate and reflect all relevant information.

Economic efficiency is defined as achieving maximum economic and social benefit with minimum use of resources.

Economic efficiency is important over the entire life-cycle of the asset.

assumptions, so increasingly it is carried out using the government's own risk-free borrowing rate as proxy for the social cost of capital, and actual tariffs (if appropriate) as a proxy for the value of the infrastructure service to the consumer.

Obstacles to Economic Efficiency and Remedial Actions

Across Africa, there are many examples of infrastructure projects that do not demonstrate economic efficiency. The most important causes, and remedial actions, are given below.

Pre-investment phase. During **project identification**, economic efficiency comes to play in the choice of which strategic option best responds to infrastructure needs of the users, i.e. economic agents and the broader community. The option chosen will influence the quality of the service over the entire life of the asset, and in many cases influence the direction the sector takes subsequent to the investment. For example, the choice of a grid-connected thermal power plant rather than a solution based on PV mini-grids or solar home systems will infer a different investment program in electricity transmission and distribution, and a different structure for the entire sector. A flawed review of consumer needs may lead to the wrong choice of technology, sub-optimal design or misaligned dimensioning of the asset, and occurs right at the start of the pre-investment phase during project identification.

Similarly, during the **financial structuring** of the project, the choices taken will influence the overall lifetime cost of the asset and ownership arrangements. For example, choosing a financing source from commercial lenders offshore rather than domestic financing leaves future project cashflows vulnerable to currency swings, which could dramatically increase the lifetime cost in the case of currency devaluation.

It is important to underline that the concept of economic efficiency relates to greater productivity for users through the infrastructure service delivered, rather than the narrow concept of the technical efficiency of the asset alone. For example, a distributed renewable energy project, despite low technical efficiency, may deliver more appropriate infrastructure services to users than a centralized plant (e.g. combined cycle gas turbine) that has a higher technical efficiency, and

therefore would be more efficient at the user level. However, it should be noted that due to the dynamics of project planning and preparation, it can be difficult to change options once a range of stakeholders (financiers, engineers, government officials) have become invested in the initial design.

To avoid poor choice of investment option, it is customary for the relevant authority responsible for the project to retain independent advisors to review outputs of the main work team during initial project identification, preparation, feasibility studies and financial structuring. The independent advisors can comment on the validity of options chosen, to ensure that all possibilities have been explored.

Investment phase. Many capital intensive infrastructure investment projects demonstrate sub-optimal procurement and construction, for a number of reasons. Historically, infrastructure **procurement** has been a source of corruption in both industrial and developing countries, although anecdotal evidence points to a decline in recent years of such events. Corruption during procurement and construction can be minimized through the creation of an independent procurement panel and transparent competitive bidding processes, e.g. with public opening of sealed bids, and public disclosure of bid review results including scoring.

During **construction**, the choice of contracting arrangements (General Contractor, number and nature of procurement packages) can have a significant impact on the ultimate quality of the physical asset. Construction risks such as budget over-runs and delays, that add to overall project cost and deteriorate quality, are influenced by contracting arrangements. Inefficiency during construction generally results from interface effects between different sub-contractors, who depend on each other for their output but may not be adequately coordinated. Such inefficiencies can be very significantly reduced by retaining a General Contractor to oversee and coordinate all construction works, particularly if in addition, payment takes the form of lump-sum where the General Contractor and sub-contractors are responsible for cost over-runs, and therefore have an incentive to ensure good coordination. Increasingly, the steps in the investment phase are contained in one overall Engineering, Procurement and Construction (EPC) contract.

Operations and maintenance. During the operational phase of the infrastructure asset, economic efficiency comes to play at both the physical and financial levels. At the physical level, good **operating procedures** and regular **maintenance**, including preventive maintenance, will

maximize the useful life of the asset and the quality of the service it provides. The most egregious cases of inefficiencies during post-investment stem from inadequate maintenance. In the case of revenue-generating infrastructure sectors (electric power, ports, rail, water supply and sanitation, ICT) this is often because the operating entity does not have the financial resources to fund adequate maintenance, due to tariffs that are below cost, as well as poor cost recovery by the utility itself (weak billing and collection). In the case of non-revenue generating activities (notably roads) inadequate funding may be due to weaknesses in government budgeting, both in terms of allocation and execution.

The quality of operations and maintenance is significantly enhanced by involving the private sector, as investor and/or operator. Such involvement can be (a) as a stand-alone investor, e.g. and Independent Power Project (IPP) selling power under a Power Purchase Agreement (PPA) to the transmission/distribution company); as a joint investor with government in a Public-Private Partnership (PPP) under concession or affermage contractual arrangements. Worldwide experience shows that involving the private sector, if their remuneration is linked to the quality of operations over the long term, produces much better outcomes. In this regard Sub-Saharan Africa is behind other regions of the developing world, although some very interesting and successful cases have taken place, e.g. Senegal water supply and sanitation, Cote d'Ivoire electric power supply, IPPs in Togo and Rwanda, and others.

In conclusion, **fully funding infrastructure services** to ensure adequate operations and maintenance is critically important to ensure that the economic and social returns predicated by the initial investment are realized. Tariff setting, billing and collection, government budgeting for infrastructure operations and maintenance, and greater involvement of the private sector should receive a significantly greater degree of attention from African infrastructure practitioners.

Examples of projects demonstrating high economic efficiency¹⁰

Lake Turkana Wind Power Project

Kenya has one of the highest electricity connection rates in Sub-Saharan Africa (55 percent) but the electric power system has

10. For examples of projects demonstrating features of the three components of quality, see Annex III and the Quality Infrastructure Investment Casebook, (Op. cit.).

had difficulty in keeping up with the growth in demand, and per capita consumption has remained low. Until recently the country lacked significant domestic reserves of fossil fuel and has over the years had to import substantial amounts of crude oil and natural gas for electricity production, at considerable cost. Constraints on availability of electricity have held back economic growth in the country.

Objectives. The main objective of the Lake Turkana Wind Power Project is to provide clean, reliable, low cost power by increasing Kenya's national power generation capacity to approximately 17 percent.

Description. The Lake Turkana wind power project involves the development and construction of a 300 MW wind farm. The project is located at a remote location, approximately 12 kilometres east of Lake Turkana in northwestern Kenya. The project area falls within a valley between two mountains that produce a tunnel effect in which wind streams are accelerated to high speeds. The wind farm will comprise 365 wind turbines of a capacity of 850 KW each. In addition to the Wind Turbine Generators (WTGs) and their foundations, a 33 kV electrical collector network will be constructed.

The project is constructed as an independent power project (IPP) with foreign debt and equity financing, including from the African Development Bank. The deal had a unique public-private aspect in terms of generation (private sector, by Lake Turkana Wind Project) and transmission (with the ancillary 428 km transmission line being procured and delivered by the public sector. All stakeholders worked closely together to minimize project-on-project risk.

Benefits: economic efficiency (and sustainability). Lake Turkana Wind Power Project represents the largest wind farm project in Africa. It represents a large scale demonstration of clean energy technology and will lead to the reduction of up to 736, 615 tons of CO₂ equivalent per year based on conservative estimates. It will make a significant contribution to Kenya's electric power supply system, with limited need for public financing. The project will benefit Kenya by providing clean and affordable energy that will reduce the overall energy cost to end consumers. Furthermore, the project will allow the landlocked Great Rift Valley region to be connected to the rest of the country through the improved infrastructure linked to the wind farm, including a road, fibre-optic cable and electrification. This zero-emission project will also contribute in filling the energy gap in the country, enhancing energy diversification and saving 16 million tons of CO₂ emission compared to a fossil fuel-fired power plant.

Nigeria—Lagos Metro Blue Line

With a population of over 5 million in the city and more than twice that in the state, Lagos is the largest urban agglomeration in Sub-Saharan Africa. Decades of under-investment and foregone maintenance of urban infrastructure such as roads and highways have made urban travel difficult and lengthy in the region.

Objectives. The project, a railway line, is expected to ease transport in Lagos State, home to around 10 percent of Nigeria's 160 million inhabitants. It will reduce travel time for passengers furthest from Lagos from two hours each way to around 20 minutes.

Description. The Lagos Metropolitan Area Transport Authority (LAMATA) envisioned a mass transit system for the urban that will

eventually consist of seven lines. The Metro Blue Line is the first of these. In April 2008, the Lagos State Government approved 70 billion naira for construction of the Okokomaiko-Iddo-Marina Line (Blue Line). Construction commenced in January 2010. The Blue Line will run 27.5 km from Marina to Okokomaiko, with 13 stations.

The project is a public-private partnership (PPP). Track and station infrastructure is being constructed under design-build contracts funded by the Lagos state government. The Eko Rail Consortium, a Nigerian grouping, will provide trains (purchased refurbished from Canada), control systems and fare collection under a 25-year equip-operate-maintain concession contract.

The system is under construction as a high capacity, electrically powered rail mass transit system. Most of the route will be on the surface, running east-west, in the central reservation of the rebuilt Badagry Expressway between Igbo-Elerin Road (Okokomaiko) and Iganmu. A Maintenance and Storage Facility (MSF) will be constructed at Okokomaiko. The entire Blue Line will operate over a secure and exclusive right-of-way, with no level crossings and no uncontrolled access by pedestrians or vehicles.

Benefits: economic efficiency (and inclusiveness). The project design shows that this ground-breaking PPP project fills a serious gap in transportation infrastructure in the city. It is highly innovative in its operating arrangements and financing structure. It demonstrates economic efficiency on several fronts. Refurbished equipment ensures cost-effectiveness. The innovative PPP structure ensures operational efficiency through the equip-operate-maintain concession. The tariff structure ensures sufficient cashflow to finance operations and maintenance and thus the quality of the associated infrastructure service.

Rwanda-Tanzania—Rusumo International Bridge and One Stop Border Post

Rwanda, the most densely populated country in Africa, is a rural country with about 90 percent of the population engaged in agriculture. It is landlocked and has few natural resources and minimal industry. The capital Kigali is distant from Dar es Salaam in Tanzania by 1425 km. Primary exports are coffee and tea. It has, however, one of the most attractive investment climates in Africa and significant potential to expand the economy, if transport and logistics costs can be brought down.

Objectives. The Corridor Development Initiative, one of JICA's Priority Economic Corridors in Africa, aims at region-wide industrial and infrastructure development to facilitate cross-border transactions. The project is part of the plan to increase unity among the East African Community (EAC - Tanzania, Rwanda, Kenya, Uganda, Burundi and South Sudan). The EAC believes that such unity would make the countries economically stronger and would speed up their development, particularly for the landlocked members.

Description. Under this initiative, the Rusumo International Bridge and One Stop Border Post was built in 2014 with \$29 million grant funding from JICA, to ease congestion and delays in transportation of goods. The bridge and border post opened in 2016, replacing the old one-lane bridge.

Benefits: economic efficiency. Transportation costs are significantly reduced for Rwandan importers and exporters through: (i) the construction of the bridge which eases restrictions on axle load and speed limits for vehicles; and (ii) the OSBP system which helps shorten the time needed for border-crossing procedures. This project very significantly improves international competitiveness of the Rwandan economy.

Inclusiveness

Definition

Inclusiveness of the infrastructure investment relates to the degree to which the infrastructure service associated with the fixed asset leads to economic and social benefits reaching the broadest possible segment of the population.

Inclusive development impact will involve: (a) improvement of welfare and economy of residents, including the poor; (b) promotion of well-balanced development between rural and urban areas; (c) having a positive gender impact (i.e. being gender-neutral, or preferably supporting enhanced opportunities for women); and (d) dismantling natural or artificial barriers within the country and with its neighbors.

Obstacles to Inclusivity and Remedial Actions

Obstacles to inclusiveness of infrastructure projects can be found at all stages of the investment life-cycle. The most important causes, and remedial actions, are the following.

Pre-investment phase. During **project identification**, demand studies must take into account overall reach (number of population served) and vulnerability (poverty level of population served). Inclusiveness will present difficult trade-offs, e.g. a project with higher economic return but lower inclusiveness (e.g. toll bridge under a PPP arrangement), against one with lower economic return and higher inclusiveness (publicly funded but lower capacity bridge, for example). Inclusiveness can be brought to bear in the economic analysis by providing a higher value, in the form of a shadow price, to the service delivered to low-income users. Also, cases of such trade-offs between efficiency and

Inclusiveness relates to the degree to which the benefits from the infrastructure services reach the broadest possible segment of the population.

inclusiveness can be adjudicated on the basis of coherence and alignment with national development plans.

The **feasibility study** sets out the key design features of the project and includes an assessment of the environmental and social impact of the project. Inclusiveness predicates open and public disclosure of these key documents, or at least the environmental and social assessment (and proposed mitigation measures, if any). Affected populations must have recourse to decision-makers to express their point of view on elements of project design. Typically, disclosure should be undertaken within a public consultation process with an independent moderator to ensure that the often highly technical elements of the project are adequately explained to affected populations.

Investment phase. During **procurement** and **construction**, inclusiveness can be significantly enhanced by designing procurement documents and processes to promote the use of local content. Not only does this provide labor opportunities for local workers, contracting opportunities and possibilities to supply inputs for local firms, but it also creates capacity within the local engineering and construction sector which can be useful for future projects, including in other countries. However, it should be noted that a delicate balance must be sought to ensure that goods and services provided by local firms are commensurate with their capacity, to avoid degrading the overall quality of the investment.

Operations and maintenance. During the **operations** period, the most significant obstacle to inclusiveness is the level of tariffs that poor people must pay. For those services which are fee-based (electricity, water, telecoms, etc.), the inclusiveness of infrastructure services can be significantly enhanced by careful tariff design. The dilemma and trade-off is to ensure that the infrastructure asset's long run marginal costs¹¹ are covered so as to ensure that maintenance and asset replacement are financed, while at the same time, enabling the maximum number of low income citizens to benefit from the service. In the case of electricity, water supply and ICT, for example, this can be achieved by introducing lifeline tariffs (a price below cost) for low-income consumers. Lifeline tariffs for electricity consumption exist in a number of African countries; in Kenya for example, the lifeline tariff, which applies to households consuming less than 50 kWh a month, is cross-subsidized by rates imposed on larger consumers. In Uganda, the lifeline tariff applies to poor domestic

11. Long-run marginal costs include both direct operating and maintenance costs and the replacement cost of the asset.

consumers for power consumption up to 15 kWh a month. Kenya also introduced other measures to expand access to achieve increased inclusiveness, such as a rural electrification program and a revolving fund for deferred connection fee payments (financed by donor funds).¹² However, the average of all tariffs weighted by consumption amounts must equal or exceed long run marginal cost.

Inclusiveness can be further enhanced when the infrastructure asset relies on local services during **maintenance**. Although labor opportunities will be lower than in the investment phase, contracting opportunities and possibilities to supply inputs for local firms, particularly for equipment maintenance, create real opportunities that target the development and capacity enhancement of SMEs. Services can range from basic industrial cleaning and site maintenance to more complex engineering tasks.

Maximizing the inclusiveness of infrastructure services will thus involve consultation during project preparation, participation of local actors during construction and maintenance, and lifeline tariffs during the operational phase.

Examples of projects showing a focus on inclusiveness

Kenya—Olkaria I Geothermal Power Project (Units 4 and 5)

Objectives. This project is part of a long-term plan to substantially increase Kenya's geothermal power and diversify its energy mix. It addresses the country's demand for electricity which is growing at about 5 percent a year, by adding 140 MW to the already installed 241 MW of geothermal power. (Later projects added an additional 140 MW to the national grid, thus bringing total geothermal capacity to 521 MW.)

Description. Olkaria I Power Station is owned by Kenya Electricity Generating Company (KenGen), a former parastatal company 70 percent owned by the Government of Kenya and 30 percent by private shareholders. International financiers include bilateral agencies JICA, EIB, FDA, KfW and the World Bank. The expansion provided KenGen experience and technical training in more advanced geothermal technology, including for steam exploration, well-drilling, and power plant construction and operation, and geothermal now surpasses hydro as the country's main source of power and mitigates power shortages when rains fail. Moreover, the project will help mitigate the impact of climate change by reducing or foregoing the need for fossil fuels.

Benefits: inclusiveness (and sustainability). The main features and benefits of the initiative are that it uses advanced technology

to help a power-strapped, economically booming nation develop a significant baseload, indigenous, and renewable power source. It helps meet growing electricity demand at a competitive cost. Its economic benefits include increased power generation, improved security of supply (geothermal power is unaffected by annual hydrological conditions), reduced national dependence on imported fossil fuels for electricity generation, fewer emissions associated with conventional thermal generation and additional operational flexibility with the greater Olkaria geothermal generation park.

The expansion of geothermal has had a significant impact by reducing the cost of electric power in the Kenyan economy. The project resulted in a 65 percent drop in the generating company's fuel costs, which made a substantial impact on electricity prices. Since August 2014, the cost of power to industrial and domestic consumers has fallen by more than 30 percent. The project has thus increased access for Kenya's citizens while at the same time enabling the country save billions of shillings each month by displacing an equivalent amount of mostly diesel and heavy fuel oil-fired power.

DR Congo—Matadi Bridge

The mouth of the Congo forms one of Africa's largest harbors. Matadi, the major port on the river, is located at the most inland navigable point and serves as a major import and export point for the DR Congo. (In addition to Matadi which is the furthest upriver, three other ports are located on the river: Boma and Banana in DR Congo, and Soyo in Angola.) Matadi port is located at Matadi City and is the largest port in DRC, and an important point on the arterial road connecting the outer bay with the capital Kinshasa. However, until 1974 there was no bridge over the Congo River which separates Matadi City from neighboring Congo-Brazzaville, and inhabitants have had to use ships, barges and rafts to transport goods and persons to the opposite side.

Objective. The objective of the Matadi Bridge project was to improve the lives and livelihoods of local low-income communities by providing low cost, secure access to both sides of the Congo river, and produce economic opportunities for low-income inhabitants of the region.

Description. In 1974 a Japanese ODA loan was extended to the Zaire government and Matadi bridge constructed. The bridge was commissioned in 1983. It has played an important role for more than 30 years since its completion.¹³ Matadi Bridge is a suspension bridge 722 m long with a main span of 520 m, and crosses the river just south of Matadi, carrying the main road linking Kinshasa to the coast. After passing through Matadi and over the bridge, the road continues to Boma, Muanda and Banana. Although built as a mixed rail and road bridge, there is no current rail line operating over the Matadi Bridge. Matadi is the port railhead for the 366 km long Matadi-Kinshasa Railway constructed to bypass the rapids on the river upstream. Maintenance arrangements for the bridge are based on a maintenance manual prepared by a Japanese company,

12. Amongst the extensive literature concerning tariff design and its macro impact, a useful recent work is: IMF: Energy Subsidy Reform in Sub-Saharan Africa – Experiences and Lessons (2013).

13. Source: Quality Infrastructure Investment Casebook, (Op. cit.). A grant aid project has since been implemented to reduce corrosion and a capacity-building cooperation intervention implemented to upgrade maintenance skills of OEBK engineers.

Organisation pour l'Équipement de Banana-Kinshasa (OEBK), along with long term maintenance assistance provided by this company. These maintenance arrangements have withstood the test of time and ensured that the bridge continued to function throughout the period, despite significant political and social turmoil in the country.

Benefits: inclusiveness (and economic efficiency). The Matadi Bridge opened up access to both sides of the Congo river for inhabitants of Matadi and the region. This has significantly expanded economic opportunities for poor people who can more easily market agricultural produce, for transporters who have reduced travel time and expense, and more generally for the economic activity of the entire region.

Safety, resilience and sustainability

Definition

Infrastructure safety relates above all to the impact of infrastructure services on the health and well-being of its users and other members of the population. The most notable infrastructure sector where safety comes into play is transport, because of the high number of road traffic injuries and deaths worldwide (estimated at 1.24 million road traffic deaths per year), which have a major impact on individuals, communities and countries. They involve massive costs to often overburdened health care systems, occupy scarce hospital beds, consume resources and result in significant losses of productivity and prosperity, with deep social and economic repercussions.¹⁴

In terms of absolute numbers, the road-related mortality rate per capita in Africa is the highest in the world at 28.3 deaths per 100,000 people. For Sub-Saharan Africa the rate is 32.2, which is double the rate for Latin America and South East Asia and five times worse than the best performing nations in Europe, despite the fact that Africa has less than 4 percent of the world vehicle fleet. Four countries, Nigeria,

14. Source: WHO: Road safety: Basic Facts, 2014.

Safety relates to the impact of infrastructure services on the health and well-being of its users and other members of the population.

Resilience is the ability to reduce the magnitude and/or duration of disruptive events.

Sustainability is the degree to which the infrastructure asset minimizes its environmental and social impact locally, regionally and globally.

Ethiopia, South Africa, and Sudan, account for half of the road injury death toll in Sub-Saharan Africa. Moreover, this death rate has grown by 84 percent since 1990, almost twice the rate of global increase; pedestrians comprise 44 percent of road deaths, substantially more than the global average of 35 percent.¹⁵ Road traffic safety refers to the methods and measures used to prevent road users from being killed or seriously injured.

Safety in the transport sector also affects air transport. Africa reports the world's highest rate of fatal commercial aviation accidents, despite increased local and international efforts to improve air safety in the region. Although Africa represents only 3 percent of global air traffic, African air accidents account for roughly 20 percent of accidents and fatalities world-wide (those involving passenger and cargo planes designed to carry the equivalent of at least 14 passengers).¹⁶ The causes of these accidents are multiple, including poor airport design, inadequate pilot and air traffic control training, and insufficient maintenance. But an important component of air safety relates to the need for communications, navigation, and surveillance, and more generally, for air traffic management, to be undertaken at a regional rather than national level.

In other infrastructure sectors too, safety comes to play: for example, in electric power (preventing electrocution of users); and water supply and sanitation (ensuring water supply is disease and contaminant free, and avoiding contamination of sanitation into water and food supply).

Infrastructure resilience, according to the literature, is the ability to reduce the magnitude and/or duration of disruptive events. The effectiveness of a resilient infrastructure or enterprise depends upon its ability to anticipate, absorb, adapt to, and/or rapidly recover from a potentially disruptive event. Resilience is secured through a combination of activities or components; the four principal strategic components are resistance, reliability, redundancy and response and recovery. The appropriateness and cost-effectiveness of each component varies depending on the infrastructure sector.¹⁷ Resilience in infrastructure finds its roots in disaster

15. Source: World Bank Independent Evaluation Group: Making Roads Safer - Learning from the world bank's experience, 2014

16. Source: Flight Safety Foundation, an advocacy group for global aviation safety.

17. Sources: (a) US Department of Homeland Security, <https://www.domesticpreparedness.com/resilience/the-principles-of-infrastructure-resilience/>. (b) UK Cabinet Office: Introduction, Definitions and Principles of Infrastructure Resilience, as annexed to Emergencies: preparation, response and recovery, 2013.

risk management best practice,¹⁸ and therefore integrates questions of risk.

Sustainability encompasses two core themes: the degree to which the infrastructure asset minimizes its environmental and social impact locally, regionally and globally, and the degree to which its financing, operation and maintenance ensures its own prolongation and replacement at the end of its economic life.

Environmental and social sustainability includes notably the infrastructure asset's contribution to reducing GHG emissions, within the framework of the country's Intended Nationally Determined Contributions (INDCs). These are commitments made at the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP21) in Paris in December 2015, and largely determine whether the world achieves the long-term goals of the Paris Agreement, which are to hold the increase in global average temperature to below 2°C and to achieve net zero emissions in the second half of this century. At the regional and local level, environmental sustainability must minimize the impact of the project on the regional and local environment, and social sustainability minimize the impact on local populations. Where local populations are impacted, their livelihoods must be restored so they are no worse off than before the project.

Sustainability of financing, operation and maintenance of the asset itself enter into the concepts of economic efficiency outlined above and will not be further explored in this section.

Obstacles to Safety, Resilience and Sustainability, and Remedial Actions

A review of African infrastructure projects demonstrates that significantly more can be done to enhance safety for users and build more resilient and sustainable infrastructure, through better project design and execution.

Pre-investment phase. Identification of infrastructure requirements, and the subsequent choice of the optimal strategic option for the infrastructure investment, must integrate at their core the concepts of safety, resilience and sustainability.

- **Safety** must be central to the analysis of options and project choice, as well as subsequent design of the technical solution. Indeed, in many road transport projects the main aim is to reduce traffic accidents

and this then becomes the central outcome of the project.

- **Resilience** must be factored into the earliest phases of design. This will require a close analysis of potential risks (e.g. from unexpected events such as earthquakes and climate-related events) and the associated economic and social costs of each option. According to economic theory, the choice of the preferred option will be then the one that produces the best cost-benefit outcome (or the highest return), taking into account these negative events weighted by their probability. In practice, assigning the a priori probabilities to unexpected events can be problematic, hence a proxy such as obtaining quotes for premiums from insurance companies for such events are used in lieu of probabilities; or alternatively, sensitivity analysis carried out around the central case based on expected outcomes and the different results compared.
- In the case of **sustainability**, the environmental and social impact assessment (ESIA) must cover all expected impacts at the national, regional and global level. At the local and regional level, the ESIA must consider all impacts, and in the case of unavoidable impacts (e.g. a road through a national forest), offsets must be provided (i.e. an equivalent amount of land of a similar type, for use by local communities or to ensure biodiversity). In such a case, possible negative outcomes such as the use of the new road for illegal logging must be taken into account. Involuntary resettlement should be avoided to the extent possible, but if unavoidable, a Resettlement Action Plan (RAP) must be prepared outlining how resettlement will be undertaken, what alternative living arrangements provided, and how affected people's livelihoods will be restored. At the global level, climate change impacts must be integrated into economic calculation based on the costs of expected lifetime GHG emissions using a shadow price in dollars per ton of CO₂.

Investment phase. Construction of major infrastructure works can present significant health safety hazards both for workers and for the general population. Maintaining strict occupational health and safety standards during the construction phase is critical and should be included in procurement documents, with external audits and penalties for

18. See for example World Bank: Strong, Safe, and Resilient - A Strategic Policy Guide for Disaster Risk Management in East Asia and the Pacific, 2013.

contractors and suppliers of goods and services in cases of non-compliance.

Operations and maintenance. The quality of operations and maintenance has a very high impact, notably on safety. For road transport, a key outcome of the project, relating to reduced traffic accidents, can be unmet because of deferred road maintenance and deteriorated road conditions, with a very high cost to the country. In the other sectors, poorly maintained electric transmissions and distribution networks pose significant risks to populations, and contaminated water supply and sanitation systems can have very severe health consequences. Lack of maintenance can lead also to reduced **resilience** (e.g. to loss of operating margin or non-replacement of critical spare parts), as well as significant negative impacts on environmental and social **sustainability**.

To minimize all these negative impacts, it is essential to ensure that adequate maintenance is carried out. Measures relating to ensuring adequate operations and maintenance are covered in paragraph 61 above.

Examples of projects showing a focus on safety, resilience and sustainability

COMESA Aviation—Regional Communications, Navigation, Surveillance/Air Traffic Management (Improved safety outcomes)

The Common Market for Eastern and Southern Africa (COMESA) is an increasingly integrated economic trading unit, integrating the countries to the east and the south of the continent. However, air traffic management continues to be carried out at national levels, which presents heightened risks of air traffic accidents. An important component of air safety relates to the need for communications, navigation, and surveillance, and more generally, for air traffic management, to be undertaken at a regional rather than national level.

Objectives. The objectives of the project are to determine suitable technical, institutional, financial, and operational frameworks for the establishment a regional, multi-country Communications, navigation, surveillance/air traffic management (CNS/ATM) system. The project will also support implementation modalities, building partnerships needed for implementing the project including legal and financial structuring, and operationalizing the roll-out of the system at the COMESA level.

Description. The project, financed by the African Development Bank, includes the financing of a feasibility study with two major components. The main features are:

Legal and Institutional Arrangements: To secure agreement by the countries concerned to consolidate their upper airspaces into a unified single space; To build the partnerships needed for implementing the regional CNS/ATM.

Technical and Financial Feasibility: CNS/ATM studies funded by USTDA have been conducted in the SADC and EAC regions. Given that several member countries of the SADC and EAC are also COMESA member states, the present study will complement and use the experience of these two studies. It will mainly focus on the following: Assessment and evaluation of the existing air traffic management systems, and/or the existing initiatives for implementation of CNS/ATM; Identification and structuring of a possible Public - Private Partnerships for the financing and implementation CNS/ATM including operation of the new control systems. AfDB finances the whole project, i.e. UAC 5.75 million.

Benefits: safety. Unified airspace management provides significant safety benefits as navigation services will be provided in a seamless airspace. Transfer of traffic control from one service provider to another each possibly operating under different standards would be no longer necessary. Unified airspace management eliminates duplication of facilities, and results in substantial capital investment savings and enhanced safety. The improvement of Air Traffic Control services will enable the COMESA and EAC regions to be better integrated in the global aviation system.

Zambia—Nkana Water Supply and Sewerage Project (Resilience and inclusive development)

Water supply and sanitation has a very significant impact on the quality of life of low-income households. Moreover, water supply and sanitation systems are particularly vulnerable to events due to climate change as droughts or flooding can do significant harm to the integrity of WSS systems and severely degrade the quality of service for communities. Zambia, as part of its economic development and poverty reduction strategy, is seeking to increase access to clean water and improved sanitation, and improve the resilience of its WSS system.

Objectives. In the context of broad-based and pro-poor growth, the project seeks to promote inclusive growth with equitable allocation of resources to disadvantaged peri-urban areas which had not received support to improve water supply and sanitation for long. This is demonstrated by the fact that of, approximately 65 percent of the beneficiary population are the urban poor mostly living in the peri-urban areas which were previously generally poorly serviced.

Project Description. The Nkana Water Supply and Sanitation Project was one of the several ongoing developments included in the National Water Supply and Sanitation Program of the Government of the Republic of Zambia. The project covered the entire area of operation of Nkana Water and Sewerage Company (NWSC), comprising the City of Kitwe, and the towns of Kalulushi and Chambishi, all within a distance of 30 km of each other. The aim of the project was to provide continuous and satisfactory delivery of potable water to all customers within the defined consumer areas of Kitwe, Kalulushi and Chambishi, at 24 hours a day for 7 days of the week, and provide improved sanitation for all residents in these urban and peri-urban areas.

Project activities encompassed rehabilitation and expansion of climate resilient water and sewerage infrastructure including water treatment plants, wastewater treatment plants, water and sewerage

networks, sanitation and storage facilities, strengthening the Nkana Water and Sewerage Company to manage the infrastructure through training of utility staff, training of national/municipal staff, training of women and youth in artisan skill; training of women to operate and maintain water kiosks.

Benefits: resilience and inclusiveness. The project is now benefiting 704,143 people living within the three urban centers of Kitwe, Kalulushi and Chambishi with improved access to reliable water supply and sanitation services. The project has enhanced public health awareness and the reduction of the incidence of diarrhea is a reflection of the contribution of the project to improvement of the environmental health of the project areas. No major outbreak of cholera has been reported in the project area since 2012. The incidence of diseases has reduced by 43 percent from 239 cases per 1,000 people in the year 2008 to 137 cases per 1,000 in 2015. On the whole, the project improved health and standard of living of the beneficiaries, as well as economic development of the areas where mining is a major activity.

In addition, livelihood opportunities were also promoted by providing various training in construction skills e.g. building of sanitation facilities options which saw 236 community artisans trained out of which 170 were women, and 159 women were trained in business management. Community Based Enterprises such as Women's Clubs were formed and contracted to provide the services along the sanitation value chain to the project at a fee. In total, 18 Community Enterprises were established out of which 9 have females in leadership positions.

South Africa—Durban Waste-to-Energy Project (High sustainability outcomes)

As Africa increasingly urbanizes, its cities are having to deal with the consequences of increased population at every level. One intractable problem relates to management of solid waste. Solid waste requires collection and handling to avoid serious health consequences to the population. Currently solid waste, once collected, is for the most part placed in landfills. Landfill gas forms naturally as rubbish and refuse decompose over time. It mostly comprises methane (CH₄) and carbon dioxide (CO₂); usually the composition is around 50-60 percent methane and 50-40 percent carbon dioxide with approximately 1 percent of impurities (SO_x & NO_x). Methane is a high calorific clean burning gas which can be used to generate electricity. If not burned it has very significant greenhouse gas forcing properties (approximately 27 times that of CO₂ for similar volumes).

Objectives. In the Durban landfill to gas project, the objective is to collect landfill gas from two sites and use it as fuel to generate electricity to feed into the local electricity network.

Description. The genesis of the project occurred in 2003 when the World Bank initiated an assessment to identify sound environmental projects in South Africa. One of the projects they selected was to cooperate with Durban Solid Waste (DSW) in the establishment of the Durban Landfill Gas to Electricity Project (LG2EP). Over the 2003 to 2010 period DSW worked with a range of local and international stakeholders to develop and operationalize the LG2EP. Currently there are two sites which form the first landfill gas to

electricity project in Africa. The project is also the second registered Clean Development Mechanism (CDM) project in South Africa.

The Mariannhill landfill consists of a single 1 MW electricity generation unit and takes in 450 tons of refuse per day, peaking at around 700 tons. Bisasar Landfill consists of six 1MW and one 0.5 MW unit, and takes in 3 500 tons of refuse per day peaking at 5 000 tons. These components of the LG2EP are situated on one of the largest landfill sites in South Africa and is the first project of its kind in Africa, and a very steep learning curve for the municipality.

The total capital cost to date is R114m, financed with French bilateral support, with an annual operating cost R12m. The project is providing the municipality with about 3MW of electricity. The energy generated supplies up to 6 000 low income households in the municipality every day. LG2EP also generates income for the eThekweni municipality through the sale of electricity and carbon credits, to date in excess of 600 000 carbon credits. The World Bank Group's Prototype Carbon Fund has purchased approximately 337 000 carbon credits from the project.

Benefits: sustainability (and inclusiveness). The project has very significant sustainability effects, as well as promoting inclusiveness. It has improved the air by reducing the amount of landfill gas released into the atmosphere at the landfill and by displacing electricity from the grid and reducing the negative effects of coal transport and coal mining (e.g., dust and acid mine drainage). It also lessens the risk of dangerous methane gas concentrations and reduces nearby residents' exposure to landfill odor.

Initiatives and Programs Contributing to Quality Infrastructure

Africa is currently undergoing a large number of initiatives that address the infrastructure constraints outlined above. Some of these are broad, addressing the entire array of issues relating to quality infrastructure, while others are more focused, on one of the three issues outlined in this paper.

General Initiatives

- **G7 Ise-Shima Principles for Promoting Quality Infrastructure Investment.** This initiative, elaborated at the G7 meeting in Japan in May 2016, is made up of five principles: (a) ensuring effective governance, reliable operation and economic efficiency in view of life-cycle costs as well as safety and resilience against natural disasters, terrorism and cyber-attack risks; (b) ensuring job creation, capacity building and transfer of expertise and know-how for local communities; (c) addressing social and environmental impacts; (d) ensuring alignment with economic and development strategies including climate change and environment at national and regional levels; and

(e) enhancing effective resource mobilization including through PPPs.

- **Expanded partnership for quality infrastructure by Government of Japan (GoJ).** In May 2015, the government of Japan announced the Partnership for Quality Infrastructure with the aim of promoting cooperation and collaboration with other development partners that align with the concept's approach.
- **The Enhanced Private Sector Assistance Phase 3 (EPSA).** At TICAD VI, the African Development Bank (AfDB) and Japan announced a US \$3 billion private sector development initiative to boost growth and reduce poverty in Africa. The resources will focus on, among other things, infrastructure, notably transport and energy. The need for investment in quality infrastructure that connects Africa was highlighted by Japan's Prime Minister, Shinzo Abe.
- **Global Infrastructure Facility** (managed by the World Bank). Multilateral development banks including the World Bank are working with commercial lenders, institutional investors and other development partners to set up a facility embracing the quality infrastructure approach that would examine and address the roadblocks to infrastructure development such as design and management of projects, best practice in the building and maintenance of infrastructure and what, beyond environmental and social impact assessments, makes for a good DFI intervention in the project preparation process.
- It should be noted that during the **Japan-Africa TICAD VI** meeting held in Nairobi over August 27-28, 2016, key principles were established relating to advancing Africa's sustainable development agenda based on quality and empowerment ("TICAD VI Nairobi Declaration").¹⁹ This important initiative underpins Japan's very significant future investments in Africa (approximately \$30 billion, under public-partnerships) through measures centering on developing quality infrastructure, building resilient health systems and laying the foundations for peace and prosperity. This focus from a major development partner, which aligns with ongoing priorities of multilateral development

banks like the African Development Bank and the World Bank on the core principles of building quality infrastructure, provides a platform on which a new infrastructure paradigm for Africa can be built based on the core principles underlying quality.

Component-Specific Initiatives

The initiatives below, while having a positive impact over all components of quality, have been singled out because of their focus on one specific component.

Economic Efficiency

- **Global Procurement Initiative: Understanding Best Value (GPI)** is a program supported by US Trade and Development Agency dedicated to assisting public officials in emerging economies to better understand the total cost of ownership of goods and services for infrastructure projects. The GPI helps public procurement officials establish practices and policies that integrate life-cycle cost analysis and best-value determination in a fair, transparent manner. Adopting these standards improve governments' capacity to make better-informed decisions that take into account all relevant costs of goods and services over their entire life cycle. Ethiopia has received assistance under the program.
- **Maintenance of road corridors; performance based contract experience and private sector involvement:** The recommendations of the African Union Commission on the Road Maintenance Strategy were adopted in 2014 (Malabo summit). The chart on Road Safety was adopted in 2016 (Addis Ababa Summit). The implementation is lagging due to the poor rate of ratification. The AUC is hence organizing regional workshops to help ratification at country-level.
- **One-Stop Border Post (OSBP) Source Book.** First published in 2011, the OSBP Source Book project was an initiative of the Transport Sector Platform of the ICA and was funded by the Japan International Cooperation Agency (JICA), as lead development partner of the Platform, in close cooperation with the East African Community. The second edition of the OSBP Source Book was completed in May 2016, officially launched in August during TICAD VI, and will be uploaded onto the NEPAD and ICA websites soon.

19. See: "TICAD VI Nairobi Declaration", http://www.mofa.go.jp/af/af1/page3e_000543.html. A summary of Japan's measures for Africa at TICAD VI for "Quality and Empowerment" are available at: <http://www.mofa.go.jp/mofaj/files/000183835.pdf>.

Inclusiveness

- **New Deal on Energy for Africa 2016-2025** is a partnership-driven effort with the aspirational goal of achieving universal access to energy in Africa by 2025. To drive and achieve this goal, the African Development Bank is working with governments, the private sector, and bilateral and multilateral energy sector initiatives to develop a Transformative Partnership on Energy for Africa – a platform for public-private partnerships for innovative financing in Africa's energy sector. The New Deal on Energy for Africa helps to unify all of the other efforts that are currently driving towards achieving the goals of universal access in Africa.
- **The Africa Renewable Energy Initiative (AREI)** is a transformative, Africa-owned and Africa-led inclusive effort to accelerate and scale up the harnessing of the continent's significant renewable energy potential. Under the mandate of the African Union, and endorsed by African Heads of State and Government on Climate Change (CAHOSCC), the Initiative is set to achieve at least 10 GW of new and additional renewable energy generation capacity by 2020, and mobilize the African potential to generate at least 300 GW by 2030. The AREI is firmly anchored in the context of sustainable development and climate change. It shows how low to zero carbon development strategies can be achieved in African countries through climate finance and means of implementation according to the principles of the UN Framework Convention on Climate Change (UNFCCC). It recognizes the critical importance of rapid expansion of energy access for enhanced well-being, economic development and the fulfilment of all Sustainable Development Goals.

Safety, Resilience and Sustainability

- **Readiness for promoting climate resilient infrastructure development in Africa.** This initiative is designed to enhance capacity to help the participating RMCs/RECs to develop a pipeline of adaptation projects and to help them mobilize resources from climate funds, notably from the UNFCCC sponsored Green Climate Fund. The main objective of the project is to enhance partnership, readiness and capacity

for climate-resilient infrastructure development in the region.

- **The Global Road Safety Facility (GRSF)**, a global partnership program administered by the World Bank, has a mission to help address the growing crisis of road traffic deaths and injuries in low and middle-income countries (LMICs). GRSF provides funding, knowledge, and technical assistance designed to scale-up the efforts of LMICs to build their scientific, technological and managerial capacities.

Examples of quality infrastructure projects

Certain examples of quality infrastructure projects are provided in Section V above (page 16 et seq.) Other ongoing infrastructure projects can provide light on how certain obstacles were addressed in real life examples. KPMG, a global audit and consulting company, recently issued a report on one hundred infrastructure projects from around the world that their independent panel, made up of independent infrastructure experts, judged as the world's most innovative, inspirational and impactful.²⁰ The report focuses on infrastructure in four key markets: mature international markets, economic powerhouses, smaller established markets, and emerging markets. A list of additional projects drawn from this report, planned, underway or recently completed, which demonstrate elements of quality, is provided in Annex III.

Building Quality Infrastructure in Africa – The Way Forward

For its development, Africa needs more infrastructure, and of better quality. Economic growth and social inclusiveness are highly correlated with quality infrastructure services, and Africa's low endowment and mixed quality hold the continent back. More overall investment requires seeking out new sources of financing; and better operation and maintenance of infrastructure stocks to achieve better infrastructure services requires a new approach to building, operating and maintaining infrastructure assets.

Options relating to sources of financing have been covered in a prior Plenary Meeting of the ICA. This paper has reviewed issues and options relating to building, operating and maintaining infrastructure assets, and below are a number of key issues for consideration.

²⁰ Source: KPMG: Infrastructure 100: World Markets Report, 2014.

Building quality infrastructure – key issues for consideration

Better planning and design

Quality infrastructure—in the sense of economic efficiency, inclusiveness, safety, resilience and sustainability—requires improvements in planning and design, from initial surveys of user needs to a wide review of different technical and technological options. Infrastructure quality is significantly enhanced by high quality planning, in which users and potentially affected communities play an active part. This planning must take into account impacts of the proposed project on the environment and on local communities.

Better procurement and construction

Once the optimal project design has been identified, realization of a quality infrastructure will only occur if procurement and construction management are well executed. Quality is significantly enhanced by transparent, competitive procurement of goods and services, and by a management structure that minimizes interfaces between sub-contractors and has appropriate risk-sharing with them to minimize delays and cost overruns.

Better operations and maintenance

Once the infrastructure asset has been commissioned, the quality of the associated infrastructure services will depend on how well the installation is operated and maintained. Ensuring sufficient funding for operations, and particularly for maintenance, is key to delivery of quality infrastructure services. For revenue-generating infrastructure (electricity, ports, rail, toll roads, water supply, and ICT), this requires tariffs that cover long run marginal costs, and efficient billing and collection by the utility or company. Inclusiveness is enhanced by the introduction of lifeline tariffs. For non-revenue generating infrastructure (roads), effective public sector budgeting is essential.

Action agenda

As noted above, African policy makers need to consider both how to increase overall funding for infrastructure investments to close the infrastructure gap, and how to improve the quality of infrastructure investment, operations and maintenance. To improve **economic efficiency**, increase **inclusiveness**, and enhance **safety, resilience**

and **sustainability**, African governments and infrastructure practitioners must focus on three sets of actions:

- **Building quality into the infrastructure life-cycle of planning, procurement and construction, and operations and maintenance.** Infrastructure practitioners across the continent must ensure that concepts of quality are built into infrastructure projects from the very start, and continue throughout the project life-cycle, from initial design and choice of appropriate technology, ownership and financing structure, procurement, construction, and finally, operations and maintenance of the infrastructure asset once it is in operation. Key design and operational principles must be based on economic efficiency; inclusiveness; and safety, resilience and sustainability.
- **Ensuring adequate financial resources for infrastructure operations and maintenance.** African infrastructure is critically underfunded because of inadequate tariffs, poor billing and collection, and underfunding in government budgets. African infrastructure practitioners and governments have to ensure that the sector is in financial equilibrium, otherwise Africa will never be able to close its infrastructure gap. This involves, in particular, greater private sector involvement in the sector.
- **Sharing and disseminating information and best practice.** Finally, the crucial concept of quality infrastructure must be disseminated throughout the continent. Furthermore, that procurement guidelines at country level as well as those of multilateral development institutions need to be revised, notably to exclude investments in sub-optimal infrastructure which negatively affect the sustainable development of the African continent.

Annex 1: Integrating quality projects criteria in the project life-cycle

Step in project life-cycle	Tasks making up step	Influence of Quality Criteria		
		Economic Efficiency	Inclusiveness	Safety, resilience and sustainability
Pre-investment Phase				
Project identification	<ul style="list-style-type: none"> • Identification of infrastructure demand • Establishing the strategic options to overcome existing or potential deficiencies • Identifying initial technological, technical, environmental, social and economic considerations • Alternative ways to accomplish the desired objectives • Identifying resources to build and operate the facilities 	<ul style="list-style-type: none"> • Choice of best option will be made on the basis of economic efficiency; i.e. best option will be the most economically efficient • Ranking of options on the basis of cost-benefit analysis and discounted rate of return 	<ul style="list-style-type: none"> • Analysis of demand and ways to accomplish desired objectives must take into account overall reach (number of population) and vulnerability (poverty level of population) 	<ul style="list-style-type: none"> • Options examined must be ranked in terms of robustness to variability, in particular climatic variability. • External environmental costs must be included in economic analysis using shadow prices
Project preparation	<p>Covers the full range of technical, institutional, financial and economic issues, including in particular:</p> <ul style="list-style-type: none"> • Potential environmental, social and gender impacts • Government policies that could influence the project's outcome • Technical, financial and institutional alternatives • Technical and financial package • Appropriate ownership arrangements and agency to manage the project 	<ul style="list-style-type: none"> • Preparation studies must be based on rigorous economic and technical analysis to ensure decisions can be made on the basis of economic efficiency 	<ul style="list-style-type: none"> • Alternatives must consider income impacts of different options 	<ul style="list-style-type: none"> • Resilience and sustainability must be judged in both technical and economic terms, i.e. capacity of managing agency and financial sustainability (recovery of user fees)
Project feasibility study	<p>In the phase, the project's overall potential viability is established. Feasibility studies typically cover:</p> <ul style="list-style-type: none"> • Demand and supply • Technical and engineering options (including in particular, technology choice) • Manpower and administrative support • Financial package including different financing options and their cost • Economic analysis, covering in particular a cost-benefit analysis to determine the social benefits and welfare outcomes of the proposed investment (and if possible, the economic rate of return of the proposed project) 	<ul style="list-style-type: none"> • Feasibility studies are essentially a detailed technical, economic and financial description of the most economically efficient option • Environmental and Social Impact Assessment (ESIA) must be prepared as part of the feasibility study 	<ul style="list-style-type: none"> • Inclusiveness predicated open and public disclosure of key elements of the project feasibility study, notably the environmental and social assessment (and proposed mitigation measures, if any) • Management Action Plans must be prepared in the case of involuntary resettlement 	<ul style="list-style-type: none"> • Project feasibility study will integrate into analysis issues relating to Safety, resilience and sustainability

Project feasibility study	<ul style="list-style-type: none"> • Environmental and social issues, including expected impacts and mitigation measures, often as a stand-alone set of documents posted publicly for consultation by affected populations • Institutional framework 		<ul style="list-style-type: none"> • Affected populations must have recourse to decision-makers to express their point of view on elements of project design
Financing negotiations and approval	<p>After the feasibility phase has been completed, the project must be examined to see if it can meet the financial, economic and social criteria set by the government for infrastructure investment expenditures:</p> <ul style="list-style-type: none"> • Cost-benefit and economic return • Sensitivity analysis of the project's outcome to variations in the values of key variables must be analyzed • Term sheet • The sources and nature of financing • negotiations with potential financial partners • Decision to proceed 	<ul style="list-style-type: none"> • As financing structures change during negotiations with financiers, certain project design elements may have to be adjusted to ensure economic efficiency (e.g. in the case that the project is developed by the private sector) 	<ul style="list-style-type: none"> • Any deviations from project feasibility study must be reviewed in the light of inclusiveness • Any deviations from project feasibility study must be reviewed to take account of Safety, resilience and sustainability issues
Financial closure			
Investment phase			
Detailed design	<p>In this point in the project cycle, preliminary design criteria will have been established, but precise expenditures on detailed technical specifications are usually not yet available.</p> <ul style="list-style-type: none"> • Details of the basic programs • Tasks allocated • Resources to be determined • Functions to be carried out along with their priorities set down in operational form • Operating plans and schedules along with contingency plans must be prepared 	<ul style="list-style-type: none"> • Detailed design, if prior steps have been carried out correctly, will make economically efficient solution more explicit 	<ul style="list-style-type: none"> • Safety, resilience and sustainability are key parameters underpinning the quality of the detailed design stage
Procurement	<p>Preparing detailed procurement packages is often part of detailed design. General Contractor will be responsible for:</p> <ul style="list-style-type: none"> • Overseeing the preparation of detailed design • Preparing procurement packages • Supervising project construction 	<ul style="list-style-type: none"> • Economic efficiency will require competitive and transparent procurement • Economic efficiency is enhanced by retaining a General Contractor on the basis of lump-sum remuneration 	<ul style="list-style-type: none"> • Inclusiveness can be enhanced by local content requirements such as using local labor or other inputs

Project management, construction and commissioning	Covers construction activities leading up to commissioning and delivery to the client: <ul style="list-style-type: none"> • Construction: General Contractor will supervise, coordinate and oversee subcontractors, carry out all planning to prevent undue delays, and implement administrative procedures • Commissioning occurs at hand-over to client 	<ul style="list-style-type: none"> • Contracts must ensure that risks of delays and cost overruns are borne by suppliers of goods and services, and General Contractor, not government, private investors or financiers. 	<ul style="list-style-type: none"> • During construction, impacts on safety and sustainability (e.g. pollution) must be minimized by appropriate health and safety standards and compliance mechanisms
Post-investment phase			
Project Operation and maintenance	Operational stage occurs following commissioning: <ul style="list-style-type: none"> • Tariff level and structure • Asset operations and management • Financial management (debt service, etc.) • Commercial management (if any), such as billing and collection • Elimination of non-technical losses • Regular maintenance scheduling and execution 	<ul style="list-style-type: none"> • Economic efficiency requires both technical capacity and financial/commercial management • Ensuring adequate maintenance, including preventive maintenance, is critical to ensuring economic efficiency • Funding maintenance will require adequate tariff levels and efficient billing and collection 	<ul style="list-style-type: none"> • Structure of tariffs can enhance inclusiveness by setting in place lifeline tariffs, etc. • Inclusiveness will be enhanced when infrastructure uses local services during operations and maintenance • Sustainability will depend on the quality of financial and commercial management. If costs are not recovered, maintenance will suffer and sustainability jeopardized
Periodic and Ex-Post Project Evaluation	Purpose is to compare the project's predicted outcome with its actual performance <ul style="list-style-type: none"> • Periodic technical and financial audits • In an ex-post evaluation, elements of success or failure are analyzed. 	<ul style="list-style-type: none"> • Assessment of degree to which economic efficiency was achieved 	<ul style="list-style-type: none"> • Assessment of degree to which inclusiveness was achieved • Assessment of degree to which safety, resilience and sustainability was achieved

Annex 2: Project life-cycle

Infrastructure projects are typically prepared and executed according to a project life-cycle (or project cycle). There are many different versions of the project life cycle, but typically, project developers include three major phases: (a) pre-investment phase; (b) investment phase; and (c) post investment phase.¹ (It should be noted that international financial institutions often have their own definition of the project cycle based on their own internal processing steps.)² Economic efficiency comes into play in all three phases of the project life-cycle.

Pre-investment phase

The pre-investment phase comprises initial project identification, project preparation, project feasibility study including environmental and social impact analysis, financial structuring, and project approval.

- **Project identification** identifying initial technological, technical, environmental, social and economic considerations of the project based on technology appropriate to country circumstances; culminating in the selection of the best set of options as initial project design based on principles of economic efficiency, i.e. achieving maximum economic and social return.
- **Project preparation** covers the full range of technical, institutional, financial and economic issues, including in particular potential environmental, social and gender impacts. An appropriate technical and financial package, and an appropriate implementing agency, chosen to manage the project. Economic efficiency will govern the choice of these different options (best technical/cost trade-off, most cost-effective and lowest risk financing package, competent

agency). A detailed economic analysis on the basis of discounted cashflow will provide the project's cost-benefit and economic rate of return. The sensitivity of the project's outcome to variations in the values of key variables must be analyzed as part of this economic analysis.

- **Project feasibility studies.** Feasibility studies cover key project parameters such as technical and engineering options (including in particular, technology choice); financial package; economic analysis covering cost-benefit analysis and economic rate of return; environmental and social issues; and institutional framework. Environmental and social issues should be contained in a stand-alone Environmental and Social Impact Assessment (ESIA). Again, economic efficiency will govern the choices made at the level of feasibility study.
- **Project financing negotiations and approval.** If the project meets financial, economic and social criteria set by the government, and financing identified, the decision can be taken to proceed.
- **Financial closure** occurs once the entire financing package (equity, debt, guarantees, overrun financing) has been agreed by the different financing parties.

Investment phase

- **Detailed design** involves preparing detailed technical and engineering specifications, defining and allocating tasks, resources and functions. This and subsequent steps may be taken by a General Contractor if this approach has been adopted. Detailed procurement bidding documents will be prepared for sub-contractors.
- **Procurement.** The General Contractor will be responsible for overseeing the preparation of detailed design and supervising project construction.

1. Sources: "Project Management", Adrienne Watt, BC Open Textbook, British Columbia Ministry of Advanced Education; "The Infrastructure Project Development cycle", Renato Reside, June 2007 (USAID/EPRA).

2. For example, see World Bank: http://eibrary.worldbank.org/doi/abs/10.1596/978-1-4648-0484-7_project_cycle.

- **Project management, construction and commissioning.** This stage covers construction activities leading up to commissioning and delivery to the client. Monitoring and supervision will be necessary to ensure that implementation is completed successfully and on time.

Increasingly, these three steps are included in one overall Engineering, Procurement and Construction (EPC) contract.

Post-investment phase

- **Project Operation.** The operational stage is when the expected project benefits start to be generated. The infrastructure asset will be transferred to the operating company or agency once all commissioning milestones have been reached.
- **Mid-Term and Ex-Post Project Evaluation.** To enhance economic efficiency of future infrastructure projects it is useful to carry out an ex-post evaluation including an audit after the construction phase. Based on this evaluation, ongoing projects may be modified and subsequent projects in the sector can be improved. Evaluation may be performed by different parties directly or indirectly involved with the project.

Annex 3: Notable infrastructure projects KPMG “Infrastructure 100” World Markets Report

KPMG, a global audit and consulting company, recently issued a report on one hundred infrastructure projects from around the world that their independent panel, made up of independent infrastructure experts, judged as the world’s most innovative, inspirational and impactful.¹ The report focuses on infrastructure in four key markets: mature international markets, economic powerhouses, smaller established markets, and emerging markets.

Assessments were based on the following criteria:

1. **Scale** – how does the scale of the project relate to similar developments in its class?
2. **Feasibility** – is the project plan feasible and sustainable?
3. **Complexity** – how challenging or complex is it to get stakeholder support?
4. **Innovation** – is there a particular challenge the project overcomes? and
5. **Impact on society** – does it improve quality of life or promote economic growth?

The value of these global infrastructure projects is estimated by KPMG to be in the region of US\$1.73 trillion.

Some of these projects are not relevant examples in the African context (e.g. Hinkley Point C, the first new nuclear power plant to be constructed in the UK in over 20 years, at a cost of US\$24 billion), or do not fall into the definition of infrastructure contained in this report (e.g. hospitals, schools or extractive industry investments such as mines and oil and gas). But for the most part this list provides useful examples of how authorities and the private sector address quality in the context of building infrastructure. Notably, the following projects from emerging economies and developing countries can be highlighted:

- **Argentina: Buenos Aires Bus Rapid Transit Corridors** journey times on key routes in Buenos Aires

have been cut by as much as 50 percent. By the end of 2015 there will be 56 kilometers of dedicated BRT lines connecting the main transport hubs in the city, benefiting 1.2 million people at a cost of just US\$25 million. (*Economic efficiency*)

- **Brazil: São Francisco River Development.** At US\$6.4 billion, the São Francisco River Irrigation project is Brazil’s largest water infrastructure project, bringing good quality water to some of the country’s poorest people. Water from the São Francisco river will be diverted to rivers in the northeast that have dried up during the arid season, via 720 kilometers of channels covering aqueducts, tunnels and reservoirs. Construction began in 2007 and is still continuing. (*Inclusiveness, resilience and sustainability*)
- **Brazil: Morar Carioca Sustainable Community Program** (the US\$4 billion) intends to upgrade the slums and associated urban infrastructure (roads, WSS etc.) of the capital, Rio de Janeiro, home to 20 percent of the city’s six million inhabitants. The program plans to retrofit the entire stock of low-cost housing and renew surrounding public spaces by 2020. Although the intention is to keep existing communities together, a small proportion of people will be relocated from areas under high risk of landslides. Funding will be entirely through public money, including the city budget, credit from the federal government, and loans from the Inter-American Development Bank (IDB). (*Inclusiveness and resilience*)
- **Brazil: São Paulo Metro Line 6**, a 16-kilometer-long metro extension, is the country’s first such project in which the private sector has participated from the very start. The new line will serve university campuses and the district of Higienópolis and is expected to carry around 640,000 passengers daily. A consortium has been selected to build and operate the

1. Source: KPMG: Infrastructure 100: World Markets Report, 2014.

US\$4 billion 25-year public-private partnership with services due to start by 2020. (*Economic efficiency*)

- **Brazil: Transcontinental Railroad** is an attempt to overcome the expense and difficulty of getting heavy cargo to port for export to Europe, the Middle East and Asia. The US\$2.9 billion project is designed to increase production of crops and ore in landlocked northeastern states of Goiás, Mato Grosso and Rondônia and also reduce the strain on the country's roads and motorways. Under a concession model, the government intends to award contracts for the construction and operation of the infrastructure of the new lines. (*Economic efficiency*)
- **Dominican Republic: Los Cocos and Quilvio Cabrera Wind Farms** will be the first such facilities in the entire Caribbean region. For an investment of US\$100 million, the farms will cut the country's imports of oil by 700,000 barrels a year at a saving of US\$20 million, as well as reducing CO2 emissions by 1,700 tonnes. (*Sustainability*)
- **EAC: The Mombasa-Kigali Railway** will link the port of Mombasa in Kenya with Tanzania and landlocked Rwanda and South Sudan, helping transport coffee, tea, other agricultural products, minerals, and machinery. Costing US\$13.5 billion, the line is to be built in sections. Multilateral institutions already have a stake in different sections of this project, with some considering the added value of integrating other types of infrastructure. (*Economic efficiency, inclusiveness*)
- **India: New Delhi Interceptor Sewage System** is designed to prevent raw sewage from flowing into and polluting the Yamuna River. The US\$323 million is designed to divert sewage to treatment plants, enabling the river's water to be used for horticulture and cleaning purposes. (*Inclusiveness, resilience and safety*)
- **India: Yamuna Expressway** (165-kilometer, six-lane highway opened in 2012) is India's longest motorway, connecting the capital New Delhi with Agra and creating a corridor for economic growth. By dramatically reducing the travel time between these two cities, the US\$1.9 billion project will have a lasting impact on users and should expand trade. As one of India's largest PPP road financing arrangements, the 36-year concession costs are subsidized by cash flows from land sales along the route. (*Economic efficiency and safety*)
- **India: Delhi Metro** (US\$2.3 billion). The project opened a decade ago and sets an example of how to carry out an effective public works program. Taking heed of the problems experienced by the Kolkata Metro – which was badly delayed and 12 times over budget – the development team utilized innovative procurement and strong project and contract management techniques. The first phase was finished on budget and almost three years ahead of schedule in 2005, followed by delivery of phase II in 2011. (*Inclusiveness*)
- **Kenya: Jomo Kenyatta Airport Terminal.** Across the border, those arriving by air in Kenya frequently complain about dilapidated facilities restricting the country's growth potential. Poor infrastructure impacts export costs and could make Kenya's products uncompetitive in the global market. The new Jomo Kenyatta Airport Terminal is part of a wider series of infrastructure investments and upgrades designed to address such shortcomings. Costing US\$654 million and with capacity for 20 million travelers. (*Economic efficiency*)
- **Morocco: Bouregreg Valley Development Project** is a strong example of redevelopment designed to impact the wider region. Cut into the banks of the Bouregreg River between the cities of Rabat and Salé in Morocco, the project is an impressively designed, large urban regeneration and development project featuring a port and marina, as well as residential, commercial, cultural and leisure spaces. The site will address growth constraints yet remain in harmony with local monuments such as a 12th-century fortress. The project is estimated at US\$1 billion and brings together five sovereign wealth funds and international financial institutions (IFIs) to finance it. (*Inclusiveness and sustainability*)
- **Myanmar: Telecommunications Upgrading.** The country's new communications network is considered vital to economic revitalization. From a low base, mobile phone penetration among the 62 million-strong population is expected to grow to around 75 percent. Built by an international consortium of NEC, NTT Communications and Sumitomo, the network will improve internet connectivity for three main

cities, using state-of-the-art technology that surpasses many developed countries. The independent Japan International Cooperation Agency provided US\$17 million in aid to assist the program, as part of an economic cooperation policy between the two nations. *(Economic efficiency)*

- **North-South Africa Corridor** is an ambitious attempt to connect eight African countries with more than 10 000 kilometers of roads, at a cost of US\$11 billion. Stretching from South Africa to Zambia and the Democratic Republic of Congo, and from Botswana to Malawi, the route will boost cross-border trade and tourism. Bidding for tenders started in mid-2014, with the overall project run by a 'tripartite' of the Common Market for Eastern and Southern Africa, the East African Community and the Southern African Development Community. Funding is likely to come from a wide variety of development partners including national governments, bilateral agencies and the World Bank. *(Economic efficiency)*
- **The New Silk Road** aims to link China to Western Europe via Kazakhstan and Russia. Over 8 400 kilometers long and costing an estimated US\$7 billion, this new economic corridor aims to open up new trade opportunities (such as solar energy) into a broader Silk Road Economic Belt. *(Economic efficiency)*
- **Russia: Moscow Central Ring Road** (US\$4.2 billion) will encircle the city, with as many as eight lanes in each direction. With a circumference of 529 kilometers, the road – due to be completed by 2018 – will become a link in a pan European highway from London to China, via Berlin and Moscow. State-owned Avtodor is responsible for executing the project under a public-private partnership and separate PPP road projects. All sections will have put the project to tender as four be operational by 2018 and international and Russian players will be responsible for the project for 30 years. *(Economic efficiency)*
- **Rwanda: KivuWatt** is a unique new 100 MW power plant on the shore of Lake Kivu, which extracts dissolved methane to generate electricity. The methane has on several occasions caused very severe accidents for the local communities. At US\$92 million, this is Rwanda's first independent power project and largest single private investment, with financing arranged by the Emerging Africa Infrastructure Fund,

African Development Bank, Netherlands Development Finance Company, BIO (the Belgian Investment Company for Developing Countries), and Belgian Development Bank. Guarantees were provided by MIGA. *(Economic efficiency, safety and sustainability)*

- **Uganda: Jinja Bridge.** As only the second crossing over the Victoria Nile in Uganda, the new Jinja Bridge will add critical capacity through an important economic corridor. The river creates a trade bottleneck in this landlocked African nation along the shores of Lake Victoria. The current crossing links the capital Kampala with the country's regions east of the Nile along the Kenya border. The new 525 meter-long, cable-stayed bridge is budgeted at US\$125 million, with the Japanese government financing 80 percent of the cost via a soft loan. A digital monitoring system will track stresses and strains to the bridge, to highlight any maintenance requirements. *(Economic efficiency, inclusiveness)*

Annex 4: The New Deal on Energy for Africa

The New Deal on Energy for Africa¹ is a partnership-driven effort with the aspirational goal of achieving universal access to energy in Africa by 2025. To drive and achieve this goal, the African Development Bank is working with governments, the private sector, and bilateral and multilateral energy sector initiatives to develop a Transformative Partnership on Energy for Africa – a platform for public-private partnerships for innovative financing in Africa’s energy sector.

The New Deal on Energy for Africa helps to unify all of the other efforts that are currently driving towards achieving the goals of universal access in Africa. It focuses on five key principles: raising aspirations to solve Africa’s energy challenges; establishing a Transformative Partnership on Energy for Africa; mobilizing domestic and international capital for innovative financing in Africa’s energy sector; supporting African governments in strengthening energy policy, regulation and sector governance; and increasing the African Development Bank’s investments in energy and climate financing.

What does the New Deal aim to achieve?

To reach the goal, Africa must achieve four targets:

- increase on-grid generation to add 160 GW of new capacity by 2025
- increase on-grid transmission and grid connections that will create 130 million new connections by 2025, 160 per cent more than today
- increase off-grid generation to add 75 million connections by 2025, 20 times what we have today
- increase access to clean cooking energy for around 130 million households.

Why the New Deal?

Over 645 million Africans have no access to electricity. Power consumption per capita in Sub-Saharan Africa is the

lowest of all continents, currently estimated at 181 kWh per annum, compared to 6,500 kWh in Europe and 13,000 kWh in the United States.

Energy-sector bottlenecks and power shortages are estimated to cost Africa some 2-4 percent of GDP annually, undermining economic growth, employment creation and investment. Companies in Tanzania and Ghana are losing 15 per cent of the value of sales as a result of power outages. South Africa’s economic growth has been hobbled in recent years by severe electricity generation capacity constraints and frequent ‘load-shedding’

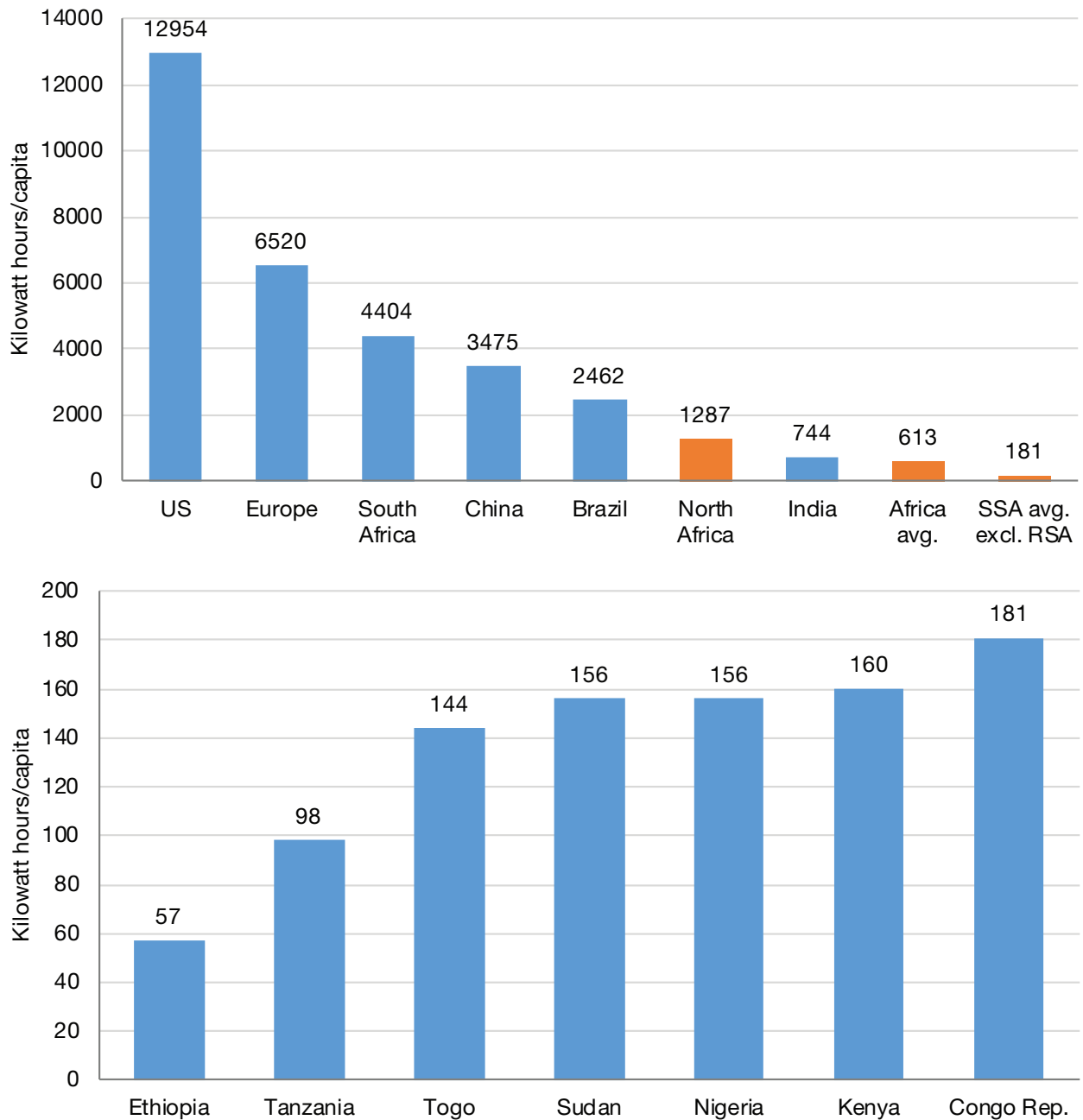
An estimated 600,000 Africans (mostly women and children) die annually due to indoor air pollution associated with the use of fuel wood for cooking. Children under-perform for lack of electricity, since over 90 percent of Africa’s primary schools lack electricity. Lives are at risk in African hospitals, as life-saving equipment and services lie unused because of lack of electricity.

Africa’s poorest people are paying among the world’s highest prices for energy. A woman living in a village in northern Nigeria spends around 60 to 80 times per unit more for her energy than a resident of New York City or London.

While a number of programmes and projects exist (and more are emerging), the lack of sufficient innovative and appropriate financing, of bankable projects, of appropriate policy and regulatory environments, of pricing incentives and of coordination severely limits the scale and speed at which energy is provided to the continent.

At the same time, Africa is rich in energy resources. The continent has well over 10 TW of solar potential, 350 GW of hydroelectric potential, 110 GW of wind potential and an additional 15 GW of geothermal potential. This does not even include coal and gas, which can still provide some of its cheapest electricity. Africa cannot power its homes and businesses unless it unlocks this huge renewable energy potential, and combines it with conventional energy to

1. Source: African Development Bank: The New Deal on Energy for Africa, 2016.

Figure A1: Major markets power consumption and power consumption in selected SSA countries

light up and power the continent. Energy is the engine that powers economies.

What will underpin the New Deal?

The New Deal is built on five inter-related and mutually reinforcing principles.

1. Raising aspirations to solve Africa's energy challenges

The New Deal calls on partners to raise aspirations and mobilize political will and financial support to solve Africa's

energy challenges. This is a pre-requisite for achieving the UN's Sustainable Development Goals (SDGs) agreed in New York in September 2015, and for implementing the global climate change deal reached at the UN summit ('COP 21') in Paris in December 2015.

2. Establishing a Transformative Partnership on Energy for Africa

The New Deal will be implemented through a partnership designed to provide a platform for coordinated action

amongst partners (private and public) and for innovative financing. The Partnership will unlock Africa's energy potential, and eventually foster a transition to low carbon energy futures. It will help reduce duplication and pool resources to achieve economies of scale in Africa's energy investments.

3. Mobilizing domestic and international capital for innovative financing in Africa's Energy sector

To achieve universal access by 2025, innovative mechanisms are required to mobilize an additional USD 40-70 billion annually in domestic and international capital. This is a significant increase on the USD 22.5 billion invested in the sector in 2014. Achieving this scale of energy financing requires that collective action be taken by all stakeholders – public and private – to create enabling conditions for financial flows, to develop bankable projects, to reform utilities, and to enhance African countries' absorptive capacities.

4. Supporting African countries in strengthening energy policy, regulation and sector governance

The New Deal will build on and further scale up the Bank's investments in the "soft" infrastructure of national governments and institutions, to enhance energy policies, regulations, incentive systems, sector reforms, corporate governance, and transparency and accountability in the energy sector.

5. Increasing the African Development Bank's investments in energy and climate financing

Over the past five years, the African Development Bank has invested some USD 6 billion in the energy sector. Under the New Deal, the Bank will ramp up its investments to provide finance and guarantees, co-financing and syndication.

Between 2016 and 2020, the Bank will invest about USD 12 billion and leverage about USD 50 billion in public and private financing for investments in the energy sector. In addition, it will triple its climate finance to about USD 5 billion per annum, and leverage about USD 20 billion in private and public sector investments in climate mitigation and adaptation by 2020.

How will the New Deal work?

Building on the five principles, the development of the New Deal has focused on identifying and overcoming the obstacles to universal access.

To make major strides towards delivering these programmes, the New Deal addresses seven strategic themes, each of which is supported by a series of flagship programmes that the Bank will launch.

1. Setting up the right enabling policy environment

Advising and supporting governments on setting up efficient sector regulation and governance, focusing on cost reflective tariffs, building credible counter-parties, and ensuring appropriate risk allocation.

2. Enabling utility companies for success

Offering technical assistance to utilities for restructuring (privatization and concessions) and operations improvement (loss reduction and revenue recovery).

3. Dramatically increasing the number of bankable energy projects

Aggregating project development capital, and channeling it through highly capable private sector organizations which are involved in world-class project development, including private sector financing and legal institutions.

4. Increasing the funding pool to deliver new projects

Scaling up the pool of finance that will be used to create greater leverage on the financial markets, by buying down certain categories of risk for the private sector.

5. Funding 'bottom of the pyramid' energy access programmes

Increasing the availability of financing to promote the development of both on- and off-grid project organizations.

6. Accelerating major regional projects and driving integration

Identifying major regional projects, particularly those with regional interconnections included in their mandate, and systematically driving them to completion.

7. Rolling out waves of country-wide energy 'turnarounds'

A central theme tying all elements together is the systematic implementation of full-country turnaround programmes. The Bank will coordinate major development institutions to launch end-to-end energy system turnarounds, in close collaboration with the Head of State, Minister of Energy and Minister of Finance in each country. These programmes will include energy system planning, restructuring of the national regulatory environments, matching donors to targeted interventions, and bringing in the private sector to drive development of capacity and connections.

What makes the New Deal different?

The New Deal will coordinate action across all existing programmes focused on the African energy sector. There are a number of different African energy programmes

currently underway. The New Deal is a Coordinated Action Programme (CAP).

It is designed to work with and build on the existing and emerging initiatives, to achieve impact at scale and at speed.

The New Deal will act as a central coordination point for all of the initiatives that are currently underway, but which are not always fully aligned with each other.

The New Deal is resource-neutral and technology-neutral. The New Deal is energy resource neutral and technology neutral. It will work with countries to develop their comparative energy resource advantages without bias,

in renewables and non-renewables alike. The transformation of existing energy systems is critical, but it requires pragmatic choices that harness the comparative resource advantages of countries to meet economic development needs, while at the same time reducing the rate of growth in greenhouse gas emissions. The New Deal aims to achieve a relative decoupling of energy access from carbon dioxide emissions through massive investments in renewable energy, cleaner technologies in the non-renewables sectors, and energy efficiency measures.

Box A1: Some existing energy partnerships

- Arica Renewable Energy Initiative (AREI)

Launched at COP21 in 2015 with a commitment of at least USD 10 billion for Renewable Energy investments in Africa by the G7 countries between 2015 and 2020. It will deliver at least 10 GW of new and additional renewable energy generation capacity by 2020, and aims to mobilize the African potential to generate at least 300 GW by 2030.

- Power Africa

A transaction and partnership-driven model launched by US President Barack Obama in 2013, Power Africa's goals are to add 60 million new electricity connections and generate 30 GW of new generating capacity by 2030.

- Sustainable Energy for All (SE4All)

Launched by UN Secretary-General Ban Ki-moon in 2011, the SE4All programme aims to achieve three main goals by 2030:

ensuring universal access to modern energy services; doubling the global rate of improvement in energy efficiency; and doubling the share of renewable energy in the global energy mix.

- Electrification Financing Initiative (ElectriFI)

The Electrification Financing Initiative (ElectriFI) is an EU initiative, launched during COP21, to support electrification investments that will lead to new and improved connections, with strong features for scalability. ElectriFI aims to support different business models, utilities and mini-grids.

- African Energy Leader's Group (AELG)

Launched in January 2015, it brings together political and economic leaders at the highest level to drive the reforms and investment needed to end energy poverty and sustainably fuel the continent's economic future. The secretariat is hosted by AfDB.
