Infrastructure services post-2015

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Executive summary

Over the last two decades more than 2 billion women and men have benefited from gaining access to improved infrastructure services. However, large numbers of people in developing countries still lack access to basic infrastructure services. Business as usual scenarios suggest that in 2030 the numbers without access will be just as large as they are today. This continued lack of access will constrain achievement of any development goals agreed for the post-2015 period. Given the previous neglect of the importance of infrastructure for economic growth and human development, it will be important to consider whether and how infrastructure should be incorporated into the post-2015 goal framework. This paper reviews progress towards infrastructure targets under the Millennium Development Goals (MDGs) (where there is one), trends in access to infrastructure services and key issues for infrastructure in achieving the post-2015 goals.

One of the targets for the Environmental MDG (No. 7) is to halve by 2015 the proportion of people without sustainable access to safe drinking water and sanitation. The latest estimates indicate that the target for drinking water has already been achieved at a global level, but there has been limited progress towards the sanitation target. 605 million people will still lack access to clean drinking water by 2015, and 2.5 billion people lack improved sanitation.

Though the drinking water target in the MDG's is under the environmental goal, the target does not reflect total water consumption and the sustainability of water resources overall. Water supply and use does not fit exclusively into either productive activity or social welfare, and the relationship between access to water and other dimensions of poverty is not addressed by the current MDGs. For post-2015, there is recognition of the need for a more holistic assessment of drinking water supply and water resources.

There is broad consensus on the need for targets in the post-2015 framework for universal and equitable access to sustainable drinking water and improved sanitation. Separate targets for water supply, sanitation and hygiene have been suggested. The shortcomings of the current MDG water target suggest that future targets should include factors such as accessibility, affordability, availability, safety and non-discrimination to address human rights aspects and equity issues. At the same time, the targets need to reflect the other aspects of water infrastructure services, such as water productivity, and water resource management and resilience.

The only MDG target related to communications infrastructure is under MDG 8, though there are numerous examples demonstrating the links between information and communications technologies (ICTs) and the other MDGs. Increasing demand for ICTs, coupled with technological advancements and falling real prices has made it possible to increase access to ICTs, with penetration of mobile phones reaching 76% of the world’s population. ICT adoption remains uneven between and within countries, and between different technologies, however.

The MDG target to achieve a significant improvement in the lives of at least 100 million slum dwellers by 2020, unlike other MDG targets, is an absolute number. To some extent it overlaps with the targets for MDG 7 on water and sanitation. The slums target has been achieved, but the actual number of slum dwellers increased from 767.7 million in 2000 to 827.6 million in 2010. For the post-2015 framework, the challenge of improving the lives of slum dwellers calls for targets to reflect secure land tenure, access to affordable land, the supply of basic services (such as water and electricity) and provision of housing loans and finance to slum dwellers.

Access to energy is not in the current MDGs, but is recognised as a prerequisite for achieving the eight goals. Targets for access to energy have been proposed, but never agreed internationally. More than 20% of the world’s population lack access to electricity, and 2.7 billion lack adequate cooking fuels and technologies. By 2030 the number of people using traditional cook stoves will increase to 3 billion.

The Sustainable Energy for All (SE4All) initiative has become a focus for debate about international policy on energy access, and encompasses three overarching objectives for 2030: (a) ensure universal access to modern energy services, (b) double the rate of improvement in energy efficiency, and (c) double the share of renewable energy in the global energy mix. These objectives combine human development and environmental sustainability.

The MDGs do not include specific references to transport and mobility, though transport infrastructure contributes to achieving the MDGs. The Rural Access Index estimated that 900 million people worldwide do not live within two kilometres of an all-season road. In some countries the great majority of people do not have access to all-weather roads. Though the role of transport infrastructure in economic growth, poverty alleviation and development is recognised, transport is generally seen as an enabler for achieving MDGs.

Though the various infrastructure sectors are treated differently in the current MDG framework they all contribute to progress towards the MDGs. Many of the challenges for the development of infrastructure services, and debates about how to address them, are common across the different sectors.

The lack of or inadequate infrastructure is a constraint on economic growth, one reason for renewed interest in infrastructure in development policy. However, the evidence base for the development impact of infrastructure is limited and evaluations of infrastructure projects have shown that the poor are often the last to benefit from increased access. Infrastructure projects and programmes often do not have an explicit, specific access or poverty reduction objective.

In the past the main concern about the environmental sustainability of infrastructure services was the environmental impact of large-scale infrastructure projects. More recently the effects of climate change upon infrastructure services and the effects of infrastructure services on climate change have become the focus. Climate change will affect the cost, reliability and quality of infrastructure services, which are themselves a significant source of greenhouse gas emissions. A challenge for the post-2015 goal framework will be how to achieve the dual objectives of increased levels of access to infrastructure services (quantity and quality) and reduced or avoided emissions.

The expansion of infrastructure services associated with increasing incomes and population growth may satisfy demand for one kind of infrastructure service, but increase pressure on increasingly scarce natural resources (e.g. water and forests) that are required for another infrastructure service. The design of infrastructure, technology to increase the efficiency of resource use, and behavioural change to reduce demand, can mitigate these effects.

The post-2015 goal framework will need to deliver universal access to infrastructure services, environmentally sustainable (and climate compatible) infrastructure services and infrastructure services that support economic growth. There are three types of barrier to achieving the necessary scaling up infrastructure services: finance, capacity and policy.

The gap between current levels of investment and what will be required to achieve development goals is large, and greatest in the electricity (power) and water and sanitation sectors. For energy alone, the investment needed is five times greater than current levels. Historically, the public sector has been responsible for financing most infrastructure investment in developing countries. The private sector has provided 25-30%. Large-scale private companies are being looked to deliver the substantial additional investment that is required, and more attention is being given to using ODA to leverage this. Private sector infrastructure service providers, however, tend to focus on middle income countries with larger consumer markets and rapidly growing economies.

Low-income households spend a significant proportion of their disposable income on infrastructure services (e.g. for energy and communications) and a significant proportion of their time securing these services (water and fuel collection). Part of the affordability challenge therefore is how to substitute more efficient and better quality infrastructure services for those currently used.

In relation to capacity, the complexity, scale and public goods nature of infrastructure investments call for a degree of planning and involvement on the part of governments, national and local. Large-scale infrastructure frequently requires acquisition of land and resources and the displacement of people and businesses. Scaling up access to infrastructure services will require adequate institutional and technological capability to design and implement infrastructure projects, as well as capacity to operate, repair and maintain services.

Construction and pricing in the infrastructure sectors is often subject to political acceptability, with short-term political agendas, including rent seeking, often driving the nature and direction of these debates. At the national level, a clearly defined policy framework will be a necessary basis for scaling up of infrastructure investment and increasing access. Equally important is the political will behind these energy objectives.

The structure and make-up of the post-2015 framework is unclear at present. The number of goals and how they are defined (as outcomes or outputs, MDGs or Sustainable Development Goals (SDGs)) will be critical factors that shape the eventual framework of goals, targets and indicators, and thus determine how the role of infrastructure services to poverty eradication and sustainability is reflected in it.

The various proposals for goals and targets for infrastructure services in the post-2015 framework that have been made so far contain a number of common principles. There is a degree of consensus that how goals are achieved matters. The post-2015 framework therefore needs to have targets for infrastructure services which incorporate principles of equity, accountability and sustainability, through goals and targets which reflect universal access, the quality of service, the form of governance and environmental impact.

There is also a sense that the post-2015 targets should be able to reflect different geographic, cultural, and socio-economic contexts, taking account of differences between countries in terms of energy needs and levels of development. National determination of minimum standards would suggest the setting of global goals which provide a common vision and ambition, rather than specific goals giving firm commitments. Targets and indicators for infrastructure services could be associated with such global goals. Internationally agreed SDGs, for example, might require infrastructure-related national targets and indicators (e.g. relating to the sustainability of water resources of consumption of energy).

A more fundamental question is whether infrastructure services warrant explicit infrastructure goals, targets and indicators. Infrastructure services are in demand for what they enable people to do, i.e. as enablers of growth, connectivity, and achievement of health, education and other economic and social objectives. Should goals and targets be based on these primary needs or the secondary demand for infrastructure services? As in the MDGs, some infrastructure services may be considered a higher priority and so justify specific goals and targets themselves.

Infrastructure services are likely to feature at the level of targets and indicators in the post-2015 framework, which may be determined nationally. The potential variation in standards and targets between countries is likely to present challenges for cross-country comparisons and global assessments of progress.

1 Introduction

The adoption of the Millennium Development Goals (MDGs) and development of the associated targets and indicators, generated debate about the contribution of different areas of economic and social activity to achievement of the Goals (UNDP, 2003; UN Millennium Project, 2005). The role of infrastructure in general and of different infrastructure sectors in meeting the MDGs was part of this (Leipziger et al., 2003; Willoughby, 2004; Rockström et al., 2005). There was broad agreement that the MDGs cannot be met without investment in infrastructure, but this investment is not a sufficient condition.

Public investment in infrastructure in developing countries decreased during the 1990s, mainly as a consequence of structural adjustment to reduce budget deficits, and did not start rising again until the mid-2000s (Briceño-Garmendia et al., 2004). Over the same period, the proportion of official development assistance (ODA) allocated to (economic) infrastructure declined, from 23% in 1995 to 12.3% in 2003 (OECD Stat. Extracts). The focus on social and human development which gave rise to the MDGs, which adoption of the MDGs reinforced, was one influence on this trend. Negative perceptions of the impacts of large infrastructure projects also contributed to the lower priority given to infrastructure.

The downward trend in ODA for infrastructure has reversed the last decade, reaching 17% of total ODA in 2008-09 (approximately the level in 1998-99). ODA commitments for infrastructure increased from about $22 billion in 2006 to about $40 billion in 2010 (OECD Stat. Extracts), with the largest increases in energy and transport (150% and 97%, respectively).

Over the last two decades large numbers of women and men have benefited from gaining access to infrastructure services, especially in China and India. Between 1990 and 2008 around 2 billion people gained access to electricity (GEA, 2012), and over the same period, 2 billion gained access to safe drinking water (United Nations, 2012). Mobile telephone penetration in developing countries reached 79% in 2011 (ITU, 2011). Nevertheless, large numbers of low-income families remain without access to basic infrastructure services. Business as usual scenarios suggest that in 2030, at the end of the next 15-year period of international development goals, the numbers without access will be just as large as they are today. This continued lack of access will likely hold back achievement of any development goals agreed for the post-2015 period.

It will be important, therefore, to consider the role of infrastructure during the formulation of the goals to succeed the current MDGs. Because of earlier neglect of its importance for economic growth and its role in human development, combined with the need to address climate change, infrastructure is back on the development agenda. Infrastructure has been identified by the World Bank, for example, as critical for transformational change to achieve economic growth and transition to more sustainable development pathways (World Bank, 2012). In the light of this changed view of infrastructure, and of the proposal for Sustainable Development Goals (SDGs), the question that this paper addresses is whether and how infrastructure should be incorporated into the post-2015 goal framework.

This paper has been prepared following a desk study, including a review of literature about infrastructure in relation to the MDGs and development generally, and draws from a roundtable discussion hosted by ODI on 24 May 2012. In the next section there is a brief review of different infrastructure services under the existing MDGs, progress towards targets that have been agreed, and remaining challenges in each sector. This is followed by a discussion of general infrastructure challenges, and the final section discusses infrastructure questions for the post-2015 agenda.

2 Progress and trends in access to infrastructure services

2.1 Overview

There is no universally accepted definition of what comprises infrastructure. According to Wikipedia the term infrastructure usually refers to "the technical structures that support a society, such as roads, water supply, sewers, electrical grids, telecommunications, *and so forth*." (Emphasis added.) For the World Bank infrastructure is transport, water, energy and information and communications technology (World Bank, 2011). In addition to the usual sectors of water, energy, transport and communications, in this paper we include urban housing, because there is a related MDG target and in order to reflect the growing importance of the urban physical environment during a period of rapid urbanization. We should also note that the emphasis of the study is on infrastructure services rather than physical infrastructure. It is what buildings and machinery do, or enable people to do, that contributes to poverty reduction, not their physical presence.

For each infrastructure sector, we review progress towards the relevant MDG target (where there is one), trends in access to infrastructure services and key issues for achieving the MDGs and post-2015 goals.

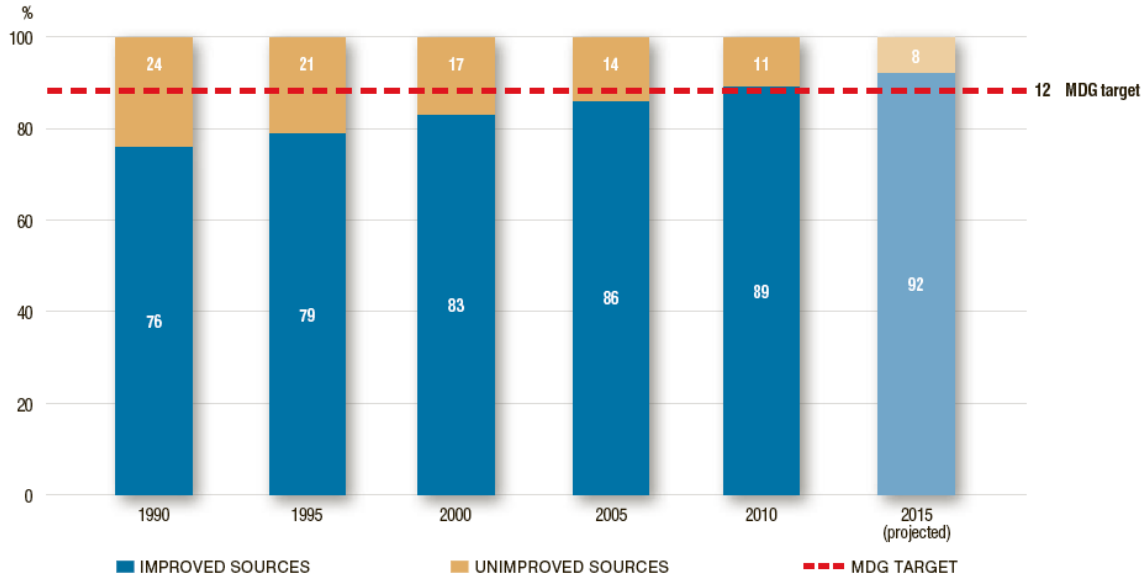
2.2 Water

One of the targets under MDG 7 (Ensuring environmental sustainability) is to halve by 2015 the proportion of people without sustainable access to safe drinking water and sanitation. Separate indicators were adopted for drinking water and sanitation, specified as the proportion of people using improved water sources or sanitation facilities.

Action to realise the water target has seen significant success. According to the latest estimates from the UNICEF/WHO Joint Monitoring Programme, the MDG target for drinking water has already been achieved at a global level. Regionally, Latin America and the Caribbean, Eastern Asia and South-Eastern Asia have met the target. The latest figures (2010) show that 6.1 billion people (i.e. 89%) globally now have access to improved water sources, with 3.6 billion people getting drinking water from piped connections. India and China together accounted for almost half of the population that gained access to clean drinking water between 1990 and 2010. China improved the proportion with access to improved water supplies from 67% in 1990 to 91% in 2010, and India from 69% to 92%. In sub-Saharan Africa the number of people with access to drinking water increased twofold from 251 million in 1990 to 524 million in 2010, reaching 61% of the population (WHO and UNCEF, 2012).

Despite these impressive results, as depicted in Figure 1, 605 million people will still lack access to clean drinking water by 2015 (WHO and UNICEF, 2012). In most regions access to drinking water in rural areas lags behind progress in urban areas. In 2010, a total of 130 million urban residents and 655 million rural inhabitants lacked proper drinking water facilities (WHO and UNICEF, 2012). In sub-Saharan Africa the urban poor are six times more likely to rely on unimproved drinking water than the richer urban class inhabitants (United Nations, 2011).

Figure 1: Drinking water the MDG target has been reached



Source: WHO and UNICEF, 2012.

Though official statistics reflect better water coverage in urban areas than in rural areas, in many cities the quantity, quality and affordability of water in low-income urban settlements falls short of acceptable standards. Improved water provision in the world's urban areas was reported to be as high as 95% in 2002, but this statistic presents an overly optimistic picture since "improved" provision of water does not always mean that the provision is safe, sufficient, affordable or easily accessible. Use of the proxy 'access to improved water sources', to assess progress on safe drinking water in both urban and rural areas has been criticised for its inability to measure the quality of water services (i.e. safety, quantity, reliability, distance to source, equitable access).

The relationship between access to water and other dimensions of poverty is not addressed by the current MDGs. Water can be an economically productive asset, and investments in water infrastructure to meet people's production as well as household needs, can achieve greater impact in terms of their health and livelihoods (Cleaver et al., 2005; Smits, 2012; Joshi 2004, as cited by Slaymaker et al., 2007). Improved access to drinking water can lead to time savings, which could be utilised for productive activities, and reduce the burden on women and girls. The total global time savings that would be achieved from meeting the MDG target have been estimated at 4 billion working days a year (Hutton and Haller, 2004), as cited in Slaymaker et al. 2007). Improvements in infrastructure for water resources management and water storage can both strengthen climate resilience and improve general water productivity. Though the negative impacts associated with large dams (displacement, ecosystem disruption, methane emissions) are well-documented (World Commission on Dams, 2000; Tortajada et al., 2012), infrastructure for hydropower can produce benefits in terms of economic development and poverty alleviation through secure water supplies for household, agricultural and industrial usage (Sanctuary and Tropp, 2005).

Water supply and use is integral to a wide range of development interventions and does not fit exclusively into either productive activity or social welfare. Sectoral boundaries and institutional fragmentation make co-ordination of the water sector difficult (Slaymaker et al. 2007; Moriarty and Butterworth, 2003), and assessment of the impacts of water sector investments is made complicated to measure and often dependent on ancillary measures in other sectors such as health and education. There is, however, recognition of the need for a more holistic assessment of drinking water supply at global, regional and national levels (WHO and UNICEF, 2011; Schäfer et al., 2007).

Though the drinking water target in the MDG's appears under the environmental goal, the target does not reflect total water consumption and the sustainability of water resources overall. Over 70% of global water consumption is for agricultural production. Increases in incomes and population will put increased pressure on water resources, with greater numbers of people living in areas experiencing water stress.

The basis for setting future water supply goals and targets is a matter of debate. Should water be regarded principally as a human right, and a rights-based approach used to set goals or targets? Or is water a provider of multiple services (drinking water, irrigation, hydropower) which contribute to human wellbeing? Or a provider of ecosystem services necessary for environmental sustainability? The view taken about water's role in human and sustainable development will affect the setting of goals and targets, resulting in a different basis of assessment and measurement of progress (Koppen, et al., 2006; Sanctuary and Tropp, 2005). Rights-based approaches, which have gained greater prominence since the Millennium Summit, might emphasise governance in goals and targets, while a more techno-managerial approach would be concerned with service delivery.

Overall, there is a general consensus within the international community on the need to have universal access to sustainable and equitable drinking water in the post-2015 framework (Brocklehurst, 2012). The shortcomings of the current MDG water target suggest that future targets should include factors such as accessibility, affordability, availability, safety and non-discrimination to facilitate human right aspects and equity issues (Slaymaker et al, 2007; Moriarty et al, 2004; Smith, 2012). At the same time, the framework of goals and targets needs to reflect the other aspects of water infrastructure services, such as water productivity, and water resource management and resilience.

2.3 Sanitation

In contrast to the water component of MDG Target 7C, there has been limited progress towards the target to halve the proportion of the population without sustainable access to basic sanitation by 2015. There are still about 2.5 billion people, one third of the world's population, who lack access to improved sanitation (United Nations, 2012). At the current rate the MDG target will be missed, and it would take until 2049 to be reached (United Nations, 2011).

Overall there are stark regional disparities in the progress that has been made since 1990. Though Northern Africa has achieved the MDG, increasing sanitation coverage from 72% in 1990 to 89% in 2008, more than 50% of the population in South Asia and sub-Saharan Africa still use unimproved or open defecation sanitation facilities (United Nations, 2011). In Eastern Asia coverage is 2.4 times higher than it was in 1990, but there has been virtually no improvement in Oceania (United Nations, 2012).

There are also significant differences between urban and rural areas, with 79% of urban dwellers using improved sanitation in 2010, compared with 47% of the rural population (WHO and UNICEF, 2012). Analysis of the trends also suggest that particularly in parts of South Asia improved sanitation has failed to reach the poorest population and has maintained high outreach within the richer communities (United Nations, 2011).

Sanitation is strongly linked to human health and general wellbeing. Lack of hygiene and access to sanitation together contribute to about 88% of deaths from diarrhoeal diseases annually, including 1.5 million diarrhoea-related deaths of children under the age of five (MDG 4). Quality of life research and happiness economics have recognised improved health, and hence sanitation, as a core driver for wellbeing (Isunju et al, 2011, UN Water, 2008).

A number of reasons lie behind the failure to make significant progress on sanitation. First, sanitation has been less of a policy priority in comparison to water supply, and other sectors. As a result, financial resources allocated for water supply have been greater than investments in sanitation (van Ginnekan et al, 2011), despite the latter's greater health benefits (WHO, 2012). A second factor affecting progress in some countries (e.g. Uganda) has been the split of responsibility for sanitation, between government departments, which leads to neglect of the sector, and between the public and private sectors, which leads to expectations about household expenditure on sanitation (WHO and UNICEF, 2011; Gutierrez, 2007; Newborne, 2008).

Thirdly, sanitation needs more than physical infrastructure to be successful. The progress of sanitation and hygiene is often linked to awareness, social factors such as prestige and personal dignity, and their influence on demand. The public health factor calls for almost universal uptake to ensure health benefits. To be successful, therefore, sanitation programmes need to be of significantly longer duration compared to water supply projects, and be integrated with education, health or urban planning interventions (ODI, 2006).

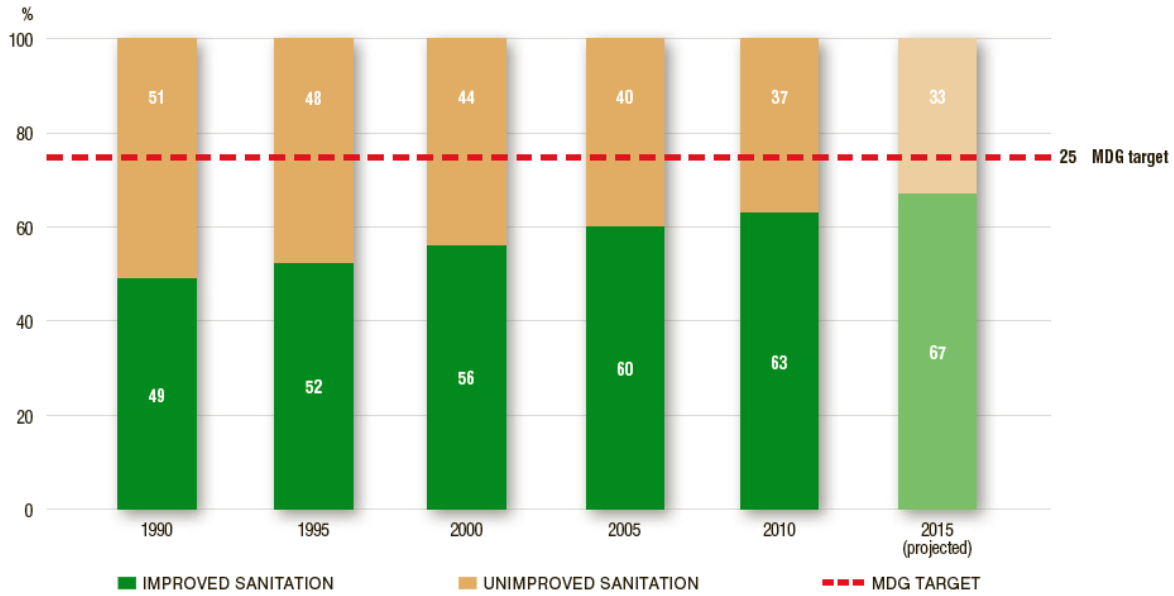
Concerns that questions of sanitation and hygiene are different from those relating to water supply and that debates around water supply are not transferable to the realities of sanitation and hygiene, have led to suggestions that water supply, sanitation and hygiene could be better served with separate policy frameworks and targets in the post-2015 architecture.

The current data sources, collection techniques and methods for analysis of the sanitation sector are also debated. Current sanitation indicators are based on technology type and do not capture the quality of sanitation service (for instance, privacy, cleanliness, environmental sustainability), which is often critical to the use of sanitation facilities. While existing monitoring systems does allow some household level analysis for water supply, this is simply not possible for assessing sanitation (Brocklehurst, 2012).

At a broad level, much like water supply, there is near unanimous agreement amongst practitioners and the international community on the need for having sanitation targets post-2015. However, due to disadvantageous starting point (in contrast with water) for sanitation, the post-2015 debates now focus on placing sanitation needs before access to clean drinking water (WHO and UNICEF, 2011).
The focus of the water and sanitation targets of the MDGs is on the expansion of coverage to those who lack access to improved services. To achieve the MDG targets, investment of an estimated $115 billion in sanitation and $30 billion in drinking water infrastructure would be required globally by 2015. To achieve universal access, as has been proposed for the post-2015 goal framework, would require an additional $217 billion for sanitation and $174 billion for drinking water (WHO, 2012).

As a result of this focus on expansion and investment expenditure, both the water supply and sanitation sectors grapple with neglect of replacement and maintenance of infrastructure to sustain existing services. In a review of expenditure in 15 countries, for example, 87% of the expenditure in the sectors was for investment, and 13% for recurrent expenditure (van Ginneken et al, 2011). Yet, the costs of operating and maintaining water and sanitation services are much greater than the investment necessary to meet the MDGs (WHO, 2012).

Figure 2: Sanitation: world is projected to miss the MDG target



Source: WHO and UNICEF, 2012.

2.4 Communications

The only MDG target related to communications infrastructure is under MDG 8 (Develop a global partnership for development): "In cooperation with the private sector, make available the benefits of new technologies, especially information and communications." In effect this target has only been about access to information and communications technologies (ICTs) and there has been little attempt to monitor other new technologies (e.g. biotechnology).

Though the target is not quantitative, and does not include a target date, the agreed indicators are 'Fixed telephone lines per 100 inhabitants', 'Mobile cellular subscriptions per 100 inhabitants', and 'Internet users per 100 inhabitants'. Since 2009, MDG reports have also included 'Fixed broadband subscriptions and mobile broadband subscriptions per 100 inhabitants.'

Increasing demand for ICTs, coupled with technological advancements and falling real prices has made it possible in recent years to increase access to ICTs. By 2010, 90% of the world's population had access to mobile cellular signal, with 76% mobile phone penetration level. Many developing counties have seen significant growth in mobile cellular subscriptions reaching penetration levels as high as 116%. In Least Developed Countries (LDCs) mobile cellular connection is 30% as compared to land line connections that are only 1%. With regard to cellular penetration in rural areas, the aim is not only to provide basic voice services but also to offer innovative information and financial services that would contribute further to achieving MDGs (United Nations, 2011).

ICT adoption remains uneven between and within countries, and between different technologies. Mobile phones have seen substantial uptake in developing countries, but internet use and broadband connections less so. Overall the number of internet users has been expanding but penetration levels in developing countries and LDCs remain low, at 21% and 3% respectively as compared to 72% in developed countries (United Nations, 2011). Penetration levels are even lower in the case of fixed broadband connections which are limited to a few developing countries. In 2010 the fixed broadband penetration in developed countries reached 24.6% as compared to only 4.4% in the cases of developing countries. These figures dip even lower in the case of LDCs due to low availability and high costs. On the other hand, mobile broadband connections have made significant progress since 2005, with 143 countries providing mobile services in 2010 up from 50 in 2005. However, two thirds of mobile broadband subscriptions still lie within developed countries – with a 50% penetration level in 2010 (United Nations, 2011).

Reasons for the lack of access and non-adoption of ICTs include questions of cost and affordability, education levels and language (which limit access), limited capacity within the ICT sector to provide efficient services, and the inappropriateness of some communications services and products to the needs of low-income households.

Central to scaling up ICTs for the poorer sections of society are simplicity of the technology, the scope for high penetration rates (i.e. low cost, ease of installation), and a low human capacity requirement. Several African and Asian countries have adopted universal access in their endeavours to scale up communication technologies to the poor populations. Others are adopting open access principles to create strong regional and national ICT infrastructure (UNDP, 2005).

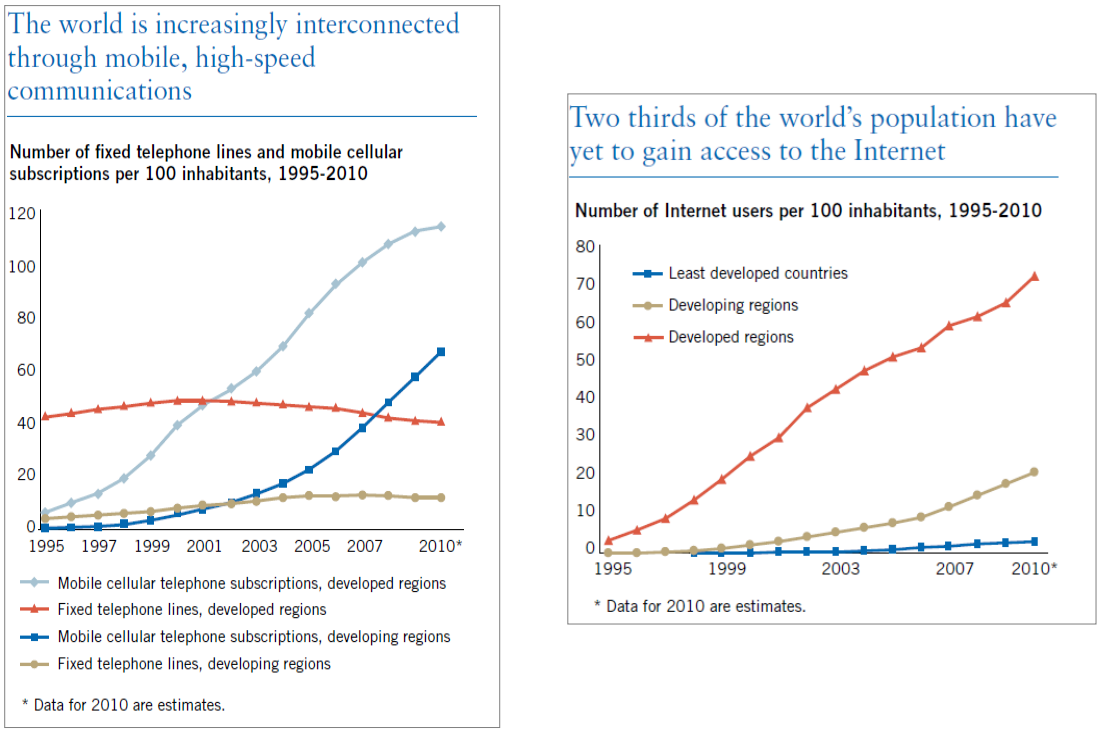
Investment in ICTs for poverty reduction has focused on closing the digital divide (disparities in access). The experience of ICTs has given rise to the suggestion that ICT policies should now shift their focus from reducing the digital divide to 'pro-poor ICT policies' (Gerster and Zimmermann, 2005). This could entail mainstreaming ICTs into poverty reduction strategies, and ensuring a pro-poor window is provided in regulations for the frequency spectrum, tariffs, and communications market (Gerster and Zimmermann, 2005).

There is broad consensus that ICTs can accelerate empowerment, security, productivity and opportunities, and numerous examples demonstrate links between ICTs and the MDGs related to poverty alleviation, health, education, gender equality, environmental sustainability and partnerships (Gerster and Zimmerman, 2005; UNDP, 2005; Heeks, 2005). Mckinsey's estimate that ICTs account for 1.9% of GDP in some developing countries (Nottebohm, et al., 2012). Heeks (2005) identifies five kinds of impact:

- ***Connecting the excluded***: providing information and other livelihood assets including social capital that were previously unavailable.
- ***Disintermediation***: cutting out the gatekeepers who prevent access to resources and services, or who charge rents for such access.
- ***Digital production***: enabling those in low-income communities to become producers of digital content, and to develop ICT-based productive livelihoods.
- ***Digital innovation***: enabling those in low-income communities to appropriate technology to such an extent that they start to do new things with it.
- ***Collective power***: enabling communities to bring the power of the group to bear in the service of economic or socio-political agendas.

These impacts lend themselves to the idea of a future connectivity goal proposed by Manning (2011) and CIGI (2011).

Figure 3: Increased access to ICTs



Source: United Nations, 2011

2.5 Urban housing

The MDG target to have achieved a significant improvement in the lives of at least 100 million slum dwellers by 2020, falls under MDG 7 on environmental sustainability. Progress on this slums target has been significant. A total of 227 million people worldwide moved out of slums to more durable and less crowded housing between 2000 and 2010, exceeding the MDG target by 2.2 times and 10 years ahead of schedule.

These MDG target figures, however, are deceptive since the actual number of slum dwellers increased from 767.7 million in 2000 to 827.6 million in 2010, and the MDG target has been criticised for its lack of ambition in addressing the challenge of the world's growing slum population as well as for its lack of reference to key issues such as security of tenure and participatory planning (Garau et al. 2006; Payne 2005; UN-Habitat 2006; Langford 2011).

There are regional differences in the progress made. In Africa, the living conditions of 24 million slum dwellers improved between 2000 and 2010. Asia succeeded in moving 172 million people out of

slums during the decade, including 125 million in the two countries of China and India. In 2010 the highest slum prevalence was in sub-Saharan Africa, where 62% of the urban population lives in slums, compared with 31% in South and South-East Asia. In conflict ridden countries the proportion of the urban population has increased from 64% in 2000 to 77% in 2010.

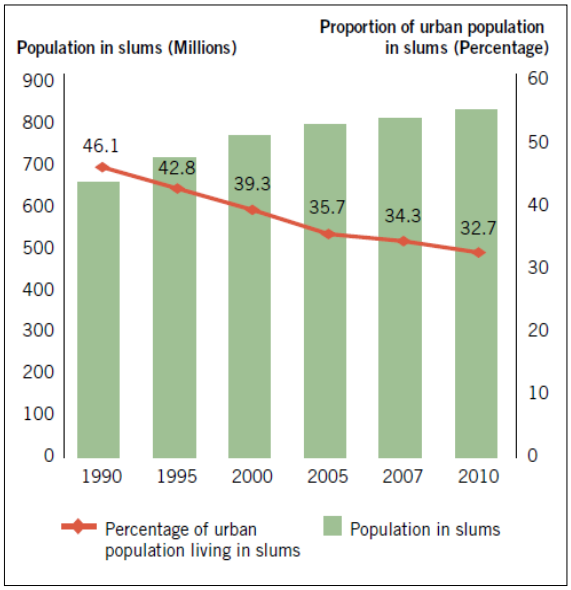
The indicator for measuring progress to the slums target is the proportion of the urban population living in slums. This is defined as the urban population living in households with at least one of four characteristics: (i) lack of access to improved water supply; (ii) lack of access to improved sanitation; (iii) overcrowding (3 or more persons per room); and (iv) dwellings made of non-durable material (MDG Monitor; Millennium Development Goals Indicators website).

Unlike the other MDG targets, the slums target is an absolute number and the way it has been defined introduces an overlap with other targets for MDG 7 on water and sanitation. Since the target was established, UN-Habitat has developed a definition of a slum household that also includes access to water and sanitation, along with security of tenure, durability of housing and sufficient living area. (UN-Habitat, n.d.)

Cities in developing countries will account for at least 95% of growth in the world's urban population, housing 4 billion people by 2030, with 2.66 billion in Asia and 748 million in Africa. Intermediate (meta-) cities are expected to grow more rapidly and ultimately house more people than 'mega-cities.' This suggests the need for a twin track approach, to improve the lives of existing slum dwellers and to plan for future urban population growth.

Meeting the challenge of improving the lives of slum dwellers requires socio-political-economic frameworks that span secure land tenure, access to affordable land, supply of basic services (such as water and electricity) and provision of pro-poor housing loans and finance to slum dwellers (Garau et al. 2006). Improving governance and recognizing the rights of slum dwellers in urban land plans and ultimately creating communities would help address some of these issues. Such 'preventative' approaches and local strategies have the potential of avoiding significant costs at later developmental stages.

Figure 4: Population living in slums and proportion of urban population living in slums, developing regions, 1990-2010



Source: United Nations, 2011

2.6 Energy

Access to energy is not included in the current Millennium Development Goals (MDGs), but is widely viewed as a prerequisite for achieving the eight goals (Modi et al., 2005; AGECC, 2010). Access to energy allows people to cook, heat their homes, use telephones, radios and televisions, benefit from better health and education facilities, and earn a living.

More than 20% of the world's population (1.5 billion people) lack access to electricity. This number reaches 70% in sub-Saharan Africa and the LDCs (Legros et al., 2009). While there have been improvements in energy access over the last two decades, gaps still remain, particularly in sub-Saharan Africa where new connections are failing to keep abreast with the expanding population (Practical Action, 2012). In a business as usual scenario, 67% of the population in the region will have no access to electricity in 2015 and as a result progress in achieving the MDGs will remain constrained (Practical Action, 2010). Projections suggest that Africa will have 698 million and Asia will have 809 million people without electricity by 2030 (Macharia et al., 2010 as cited in Practical Action, 2010).

Lack of access to modern energy is not just a question of electricity. The lack of adequate cooking fuels and technologies experienced by 2.7 billion people will also contribute to the MDG targets being missed (Egre & Milewski 2002; Katuwal & Bohara 2009; Nguyen 2007). To achieve universal access by 2030 about 150 million people annually must get access to clean cooking facilities and, if the business as usual trajectory is adopted, by 2030 the number of people using traditional cook stoves will increase to 3 billion. Indoor air pollution through use of traditional cookstoves causes 1.4 million deaths annually, leading to 30 million smoke-related premature deaths by 2030 under business as usual (Practical Action, 2012).

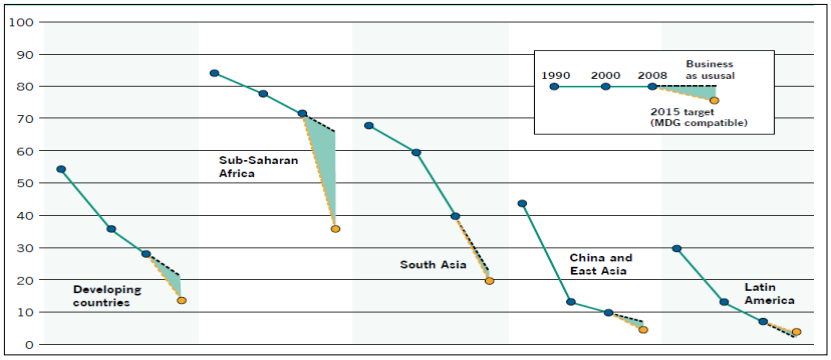
Targets for access to energy have been proposed, but never agreed internationally. The UN Millennium Project (Modi et al., 2005) produced a set of MDG-compatible targets for energy access:

- Reduce by half, between 2005 and 2015, the proportion of urban and rural households without access to adequate lighting;
- Reduce by half, between 2005 and 2015, the proportion of urban and rural households reliant on cooking methods that are not MDG-compatible; and
- By 2015, provide adequate, clean and efficient energy services to all educational and health facilities.

Access to energy or energy poverty is not the only, or even the main, concern for energy policy in developing and developed countries alike. Energy security, including ensuring the availability of enough energy to enable economic growth, and reducing greenhouse gas emissions from energy consumption are both central to national energy policies.

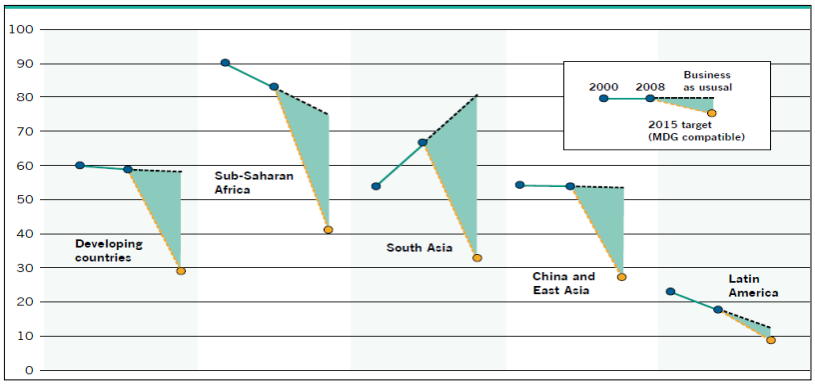
The policy focus on energy security is the result of rising oil prices, due to growing demand in emerging economies and higher costs of production, coupled with a sense of increased risks to supply as a greater proportion of energy supplies are traded across national boundaries and political insecurity affects major oil exporters. This energy security concern is less about being able to deliver energy services to people who currently lack it, and more about being able to maintain economic growth by ensuring that existing consumers, including industry and relatively well-off households, have a continued and more reliable supply. An emphasis on the energy security policy objective would not necessarily deliver improved levels of access for those who do not have it, though the economic growth it secures may do so indirectly.

Figure 5: Percentage of people without access to electricity; progress towards the MDG-compatible target



Source: Practical Action, 2010.

Figure 6: Percentage of people without access to modern fuel for cooking; progress towards the MDG-compatible target



Source: Practical Action, 2010.

The third energy policy objective, along with energy access and energy security, is tacking climate change or specifically, the reduction energy-related greenhouse gas emissions. Energy accounts for almost two-thirds of global greenhouse gas emissions. Along with higher oil prices, this is driving more investment in lower carbon and renewable energy supplies. Increasingly, even under existing market conditions, renewable energy is becoming competitive with fossil fuel energy, and in rural areas it is often the most viable option. However, fossil fuels remain dominant in the energy mix and, given the lifetime of many energy investments, there is policy debate about lock-in to a high carbon future and the need for investment in high carbon energy projects in industrialised countries and amongst donors. A route to resolve this question would be for both industrialised and developing countries to develop low carbon development long term plans to deliver green growth, build economic sustainability, and facilitate technology transfer (Doig, 2012). Unlike many existing national energy strategies, these future plans could include a specific energy access objective, and set out how different energy policy objectives are to be reconciled (Kozulj, 2010; Practical Action, 2012; UNDP, 2007).

Investment in energy access has potential to provide a positive reinforcement between climate change and the MDG objectives. The International Energy Agency (IEA) estimates that about $50 billion a year to the year 2030 would be required to provide universal access to modern energy services (IEA, 2011). Supporting policies and market based mechanisms can drive affordable clean energy solutions into rural areas to meet basic needs and stimulate income generating activities (UNDP, 2000). Local clean energy solutions can have positive effects on skilled and unskilled, short and long term, employment opportunities (Karekezi at al, 2004). Domestic use of cleaner energy technologies have been linked to direct, positive and powerful impacts on the health and workload of women and on social capital in rural communities (Thakuri, 2009).

Consequent to improved understanding of the relationship between energy and development (including the MDGs), multi-lateral agencies and governments have become more deliberate about their use of formal policy to ensure universal energy access. The United Nations Secretary General Ban Ki Moon's vision of achieving sustainable energy for all by the year 2030 has become the focus for debate about international policy on energy access. The Sustainable Energy for All (SE4All) initiative encompasses three overarching objectives for 2030: (a) ensure universal access to modern energy services, (b) double the rate of improvement in energy efficiency, and (c) double the share of renewable energy in the global energy mix (Ban Ki-moon, 2011). These objectives were endorsed by the High Level Panel on Global Sustainability but have yet to be agreed by an international body. Suggestions on having targets on access to infrastructure (i.e. water, power, transport, ICT etc.) which indirectly encompasses the issue of energy infrastructure as an MDG target have also been proposed (Manning, 2011).

2.7 Transport

The Millennium Development Goals do not include specific references to transport and mobility. Transport infrastructure (e.g. roads and bridges) and services (e.g. bus services) facilitate access to schools and hospitals, contribute to economic growth through internal and external trade, and improve income and wellbeing for people living in remote rural areas. Consequently, the contribution of transport infrastructure to achieving the MDGs has been widely recognised (Hook and Howe, 2005). Though it has been claimed that investment in transport is likely to have a higher impact on poverty and more generally on economic growth and productivity than any other kind of infrastructure development (e.g. factories, product markets) (Shenggen et al., 1999 as cited in DFID Transport Resource Centre, 2002; Ellis, 1997; Hook & Howe 2005; Sakamoto et al. 2010), there are only a hand full of studies linking transport to achievement of the MDGs (Estache, 2004; Czuczman, n.d.; Hook and Howe, 2005; DFID Transport Resource Centre, 2002).

A lack of international targets and omission from the MDGs means there has been less investment in data to assess progress in access to transport services. It has also been suggested as a reason for the transport sector to fall out from international and national debates and the broader developmental agenda therefore resulting in haphazard development (Hook, 2006).

Debate about the contribution of transport infrastructure and transport services to the MDGs began shortly after the Millennium Declaration, before the targets and indicators had been fully developed (DFID Transport Resource Centre, 2002). In 2003, the World Bank developed a Rural Access Index (RAI) as "a headline indicator which highlights the critical role of access and mobility in reducing poverty" (Roberts et al., 2006). This indicator measures the proportion of the total rural population who live within two kilometres of an all-season road. The most recent (and only) data for the RAI were published in 2006 (Roberts et al., 2006), based largely on household surveys from 2003. The RAI has not been updated since, making an international assessment of progress impossible, though more recent national survey data may exist in some countries.

Other headline transport indicators have been proposed to complement the RAI, including for urban populations the mean time for the journey to work, for the quality (condition) of roads, for trade-related infrastructure and for modal share (proportion of journeys by different modes of transport). The World Bank Group's infrastructure strategy uses two indicators for access to transport: motor vehicles per 1000 people and firms (%) identifying transport as a major constraint in doing business (World Bank, 2011).

Overall the RAI showed there were about 900 million people worldwide who live in isolation due to lack of access to proper road linkages. In some countries the great majority of people do not have access to all-weather roads. In Ethiopia, for example, 75% of the population lacked access to all-weather roads in 2003 (Ribeiro, et al., 2007). East and South-east Asia have shown significant progress in expanding transport infrastructure, with more than 90% of the rural population in China now connected to all weather roads within a 2 km radius. In India, 50% of all villages and towns are connected by all-weather roads, up from 39% in 1995 (UNESCAP, 2006).

Transport infrastructure includes rail, seaport and airport infrastructure, as well as roads. Infrastructure for trade has expanded rapidly, and is often seen as a source for rural and urban development that helps create employment, and improve productivity, in turn lowering transaction costs and allowing economies of scale and specialization (DFID Transport Resources Centre, 2002).

However, the impact of this form of transport infrastructure on poverty reduction is only indirect. Both political interest and ODA financing, which give priority to economic growth and poverty reduction results in a focus on improving regional, national and international trade through investments on roads and ports. Poverty reduction through transport infrastructure is thought to be through creating employment in labour intensive road construction (Sakamoto et al. 2010).

Policy and priorities for infrastructure are often influenced by wealthier members of society who give preference to motorised private transport developing intercity highways, urban roads and flyovers (Sakamoto et al. 2010). The environmental and health effects of this bias towards motorised transport in developing countries are coming under greater scrutiny. Road traffic accidents cause 1.3 million deaths every year, and further 50 million injured. The vast majority of these deaths and injuries are in developing countries and in 2004 road traffic accidents killed more 5-14 year olds than the major killer diseases such as malaria and HIV/AIDS (Watkins, 2012).

Emissions from vehicles are also a major source of air pollution and greenhouse gas emissions. The *OECD Environmental Outlook to 2050* (2012) predicts that urban air pollution will become the most significant environmental problem by 2050, the cause of 3.6 million premature deaths a year (up from 1 million today). In addition, transport accounts for around 15% of greenhouse gas emissions and is a major contributor to climate change (OECD, 2012).

Though the role of transport infrastructure in economic growth, poverty alleviation and development is recognised, transport is generally seen as an enabler for achieving MDGs. This is reinforced by the view that MDGs cannot be achieved through a single sector approach and that transport investments have impacts across sectors. Manning (2011) for instance, suggested indicators for productive sector and economic infrastructure in the post-2015 framework and proposes a formal goal for greater connectivity for transportation. The connectivity idea has been taken up by CIGI. Czuczman (n.d.) emphasises the need to establish frameworks to ensure collection of transportation data against substantive transport and poverty indicators, which could help bridge the gap between policy intent and delivery.

3 Infrastructure for sustainable development

3.1 Infrastructure for sustainable development

Though the various infrastructure sectors are treated differently in the current MDG framework they all contribute to progress towards the MDGs. Although each sector has its own characteristics, infrastructure is often treated as a single policy area, at least for investment purposes. The World Bank, for instance, has an infrastructure strategy (World Bank, 2011). The G20 convened a High Level Panel on Infrastructure Investment, which reported in October 2011, while the African Union has adopted a Programme for Infrastructure Development in Africa (PIDA), to guide infrastructure investment across the continent. Many of the challenges for the development of infrastructure services, and debates about how to address these, are common across the different sectors. In this section, therefore, we review how infrastructure in general contributes to sustainable development and the key challenges that will be faced in efforts to scale up investment in all infrastructure services to meet both the MDGs and post-2015 goals.

3.2 Growth and poverty reduction

As is clear from the previous section, as we approach the MDG target date, access to infrastructure services remains inequitable, between and within countries. Access in all infrastructure sectors is closely correlated with income and multi-dimensional measures of wellbeing. Those without access to one kind of infrastructure service, clean drinking water for example, often lack access to several kinds of infrastructure service, and this lack of access is a constraint on livelihood strategies and people's ability to escape poverty. However, access to infrastructure services does not by itself ensure that people can move out of poverty.

Conventionally economic growth has been the main justification for ODA support for infrastructure, and there is some evidence of the effect upon economic growth of investment in infrastructure. According to the World Bank, infrastructure investments have fuelled acceleration of growth and reduced income disparities. A 10% increase in infrastructure development contributes 1% growth in the long-term (Mattsson, 2012). OECD research found that an additional 1% of GDP invested into transport and communications would lead to a 0.6% increase in the growth rate (DFID, 2007). Through raising productivity by improving access to local and export markets, reducing risks for private investment and providing information, it has been suggested infrastructure's contribution to MDG1 is greater than other MDGs (Willoughby, 2004). The lack of or inadequate infrastructure as a constraint on economic growth is a large part of the rationale for renewed interest in infrastructure.

Though there are numerous examples that demonstrate how infrastructure in different sectors can contribute to poverty reduction and the MDGs, the evidence base for the development impact of infrastructure is less well documented. Anecdotal studies describe, for example, links between energy, poverty and sustainable development, but there is a gap in terms of literature that focuses on systematically quantifying the 'real' productive or developmental impacts of energy. Evidence from cost-benefit analysis in the water and sanitation sector points to a return of $4.30 for every dollar invested in combined water and sanitation services, and $5.50 for each dollar invested in sanitation alone (WHO, 2012). However, evaluations of infrastructure projects have shown that the poor are often the last to benefit from increased access, and that infrastructure projects and programmes often do not have an explicit, specific access or poverty reduction objective.

3.3 Sustainability and climate change

The environmental impact of large-scale infrastructure projects has conventionally been the main concern in debate about the environmental sustainability of infrastructure services. Tools and methods for strategic and project environmental impact assessment may differ in detail between different infrastructure sectors but essentially follow the same approach.

More recently the effects of climate change upon infrastructure services and the effects of infrastructure services on climate change have become the focus for debate. Infrastructure, which is often costly and has a long life time, will potentially be damaged by extreme weather events (e.g.

floods and cyclones), sea level rise, and changes in rainfall patterns. Temperature increases or decreases will affect operating costs (Neumann, 2009; Engineering the Future, 2011; Ryan-Collins, et al., 2011). Climate change will affect the cost, reliability and quality of infrastructure services, impacting on access and the contribution of infrastructure to the MDGs, with the poorest and most remote communities most affected.

Infrastructure services are a significant source of greenhouse gas emissions. Energy consumption accounts for about two-thirds of global greenhouse gas emissions (IPCC, 2011). The design of infrastructure (transport systems, buildings and urban planning) affects the level of emissions, and the long life time of infrastructure risks 'lock-in' to high carbon paths. Low carbon options, however, can entail higher investment costs. The challenge for the post-2015 goal framework will be how to achieve the dual objectives of increase levels of access to infrastructure services (quantity and quality) and reduce or avoid emissions. An over emphasis on mitigation could risk compromising (short-run) human development objectives for those who emit the least.

Infrastructure can also enable adaptation to climate change and strengthen resilience to extreme weather events and climate variability. For instance, infrastructure for water supplies (mainly storage and conveyance) can provide a buffer against variability in rainfall or groundwater. Modern energy services and communications infrastructure can support more diversified household livelihood strategies. The future development of infrastructure services needs to be designed to strengthen resilience and enable adaptation to climate change.

The consumption of infrastructure services has an impact upon environmental sustainability through direct consumption of natural resources as well as environmental externalities. Debate about the environmental sustainability of infrastructure has highlighted the inter-dependency of different infrastructure services and their mutual dependence on the same natural resource base. Drinking water supplies, transport and communications services, for example all require energy. The provision of energy services often requires a supply of water. The expansion of infrastructure services associated with increasing incomes and population growth may satisfy demand for one kind of infrastructure service, but increase pressure on increasingly scarce natural resources (e.g. water and forests) that are required for another infrastructure service. The design of infrastructure, technology to increase the efficiency of resource use, and behavioural change to reduce demand, can mitigate these effects.

3.4 Barriers for infrastructure services

Universal access to infrastructure services, environmentally sustainable (and climate compatible) infrastructure services and infrastructure services that support economic growth in developing countries, will all be necessary to meet post-2015 goals. Provision of the additional infrastructure investment required to deliver services to those currently without access, as well as to maintain existing services and cope with population growth, faces three types of barrier: finance, capacity and policy.

3.5 Finance

Investment in infrastructure services needs to be scaled up if the MDGs are to be met and if poverty is to be eradicated after 2015. Moreover, investment is required not just to provide services to previously unserved users, but also to meet the growing demand for infrastructure services due to population and economic growth. Replacement of fixed capital will be necessary because of years of under investment and poor management.

According to World Bank figures, annual expenditure on infrastructure, capital investment and operation and maintenance, amounted to over US$ 385 billion in 2005 in developing countries (excluding Europe and Central Asia)(World Bank, 2011). This is lower than the US$ 454 billion estimated to be required by Fay and Yepes (2003) ten years ago, and less than half of the US$ 850 billion estimated to be needed now (Table 1). Thus there is a clear financial gap for infrastructure investment, which is greatest in the electricity (power) and water and sanitation sectors (Kingombe, 2011).

There are three sources of finance for infrastructure, public finance from governments, official development assistance (ODA), and the private sector. Historically, the public sector has been responsible for financing the majority of infrastructure initiatives in developing countries. Over the last 15 years the private sector has provided only 20-25% of the financial investment in the developing countries, falling to 10% in the case of Africa (Estache, 2007). Recent World Bank figures show that in 2005 the private sector accounted for 31% of total expenditure on infrastructure investment, operation and maintenance in developing countries (excluding Europe and Central Asia) (World Bank, 2011). Private sector infrastructure investment in 2005 was heavily skewed towards the telecommunications sector, especially in sub-Saharan Africa where the sector accounted for almost 89% of private sector infrastructure investment.

Support for infrastructure investment is a challenge for developing country governments with limited resources and often lacking adequate financial channels and institutions to deliver infrastructure financing. Improved and innovative funding mechanisms will be required. These might include funds from new sources, including the carbon market and new development actors, such as China, whose support for infrastructure in Africa went up from $7 billion in 2002 to $27 billion in 2009 (Kingombe, 2011).

Table 1: Infrastructure Investment

	AFR	EAP	ECA	LCR	MNA	SAR
Annual infrastructure spending (2005; billion, US$)	45.3	207.0	n.a.	43.5	43.8	46.0
- of which, ICTs	9.0					
Electricity	11.6					
Transport	16.2					
WatSan	7.6					
Irrigation	0.9					
- of which, Capital	24.9					
O&M	20.4					
Annual investment and maintenance needs (billion, US$)	93.3	406.7	n.a.	81.2	78.5	191.1

Source: World Bank, 2011; Kingombe, 2011.

One of the main challenges is the most appropriate use of ODA. More attention is being given to using ODA to leverage private sector investment, shifting from a lending culture to an enabling culture 'crowding in' increased private capital (G20 Cannes Summit, 2011). There are a number of ways in which this can be achieved, such as strengthening national policy and institutional frameworks, developing sector specific strategies and national goals, and risk reduction or guarantee instruments.

Despite the historically small proportion of infrastructure investment from the private sector, large-scale private companies are being looked to to deliver the substantial additional investment that is required. Medium and small-scale businesses, local and foreign, can also play a part, but tend to be overlooked. There are, however, disparate views on whether private sector investments in infrastructure have positively influenced its development. While private financing has in some places lowered government's burden to build new infrastructure and increased operating efficiency (Estache and Fay, 2007), there is some evidence that private sector participation particularly in the water sector does not benefit the poor (Wateraid and Tearfund, 2003). This finding suggests that private sector participation can improve water services for the poor only if there is strong political will, good governance frameworks and active NGO participation.

Cost recovery, capital cost and external risks are barriers to private sector participation in infrastructure in low income countries. A significantly lower rate of return is found than in developed countries (i.e. 3% in developing countries versus 14% in the US) (Kingombe, 2011). Low sovereign credit ratings which limit access to financial markets (Sheppard et al, 2006 as cited in DFID, 2007) combined with political and regulatory risks are also factors influencing private investment. Private sector infrastructure service providers tend not to serve low-income consumers because the returns are unattractive and middle income countries with larger consumer markets and rapidly growing

economies attract more private investment than low-income countries (Clark Annez, 2006 as cited in DFID, 2007; World Bank, 2005, 2006 as cited in DFID 2007; Wateraid and Tearfund, 2003).

For the users of infrastructure, affordability is a core concern and the cost of infrastructure services can put some of the most commonly used technologies out of the reach of the poor. For example, extending energy services in rural areas through grid or off-grid schemes such as solar home systems or micro-hydro solutions typically requires an investment beyond the means of poor households (Claassen & Pelser 2007; Katuwal & Bohara 2009). Though a bias towards large-scale infrastructure schemes, in both public and private investment strategies, is driven by perceived economies of scale and a desire to minimize transaction costs, low-income households are often the last to benefit from access through large-scale schemes. In the design and planning for infrastructure there is rarely full consideration of all the technical options, which might include decentralised and distributed infrastructure services, to ensure the needs and priorities of different social groups are met. However, delivering infrastructure services to the rural and remote poor bears a higher cost. Subsidies, including cross-subsidies, and innovative tariff and financing mechanisms can be used to extend access to low-income households. Productive uses of infrastructure services are also advocated as a means to enable consumers to afford them (though the effectiveness of this approach is a matter of debate).

Low-income households do spend a significant proportion of their disposable income on infrastructure services (e.g. for energy and communications) and a significant proportion of their time securing these services (water and fuel collection). The IFC estimates that the poor spend a total of $37 billion a year on inefficient and low quality lighting and cooking energy, which could be used to pay for improved services (IFC, 2012). This often a question of financing investment costs rather than operating costs. Part of the affordability challenge therefore is how to substitute more efficient and better quality infrastructure services for those currently used.

3.6 Capacity

The complexity, scale and public goods nature of infrastructure investments call for a degree of planning and involvement on the part of governments, national and local. Large-scale infrastructure frequently requires acquisition of land and resources and the displacement of people and businesses. The operation and management of infrastructure services to deliver social as well as private benefits requires regulation and sometimes support from public finances. Weaknesses in the accountability of planning and decision-making for infrastructure services can result in them being less inclusive than they could be, though mechanisms to ensure public participation in decision-making and the accountability of decision-makers are regarded as best practice in voluntary guidelines such as the infrastructure section of the OECD's *Promoting Pro-Poor Growth: Policy Guidance for Donors* (2006).

Corruption is well documented in the water, electricity and transport sectors (Boehm and Polanco, 2003; Alouche and Finger, 2002 as cited in Estache, 2007). According to Transparency International "public works and construction are singled out by one survey after another as the sector most prone to corruption."(Transparency International website) Corruption can be attributed primarily to two factors, firstly, large scale infrastructure projects provide scope for large profit margins, and secondly, service providers see this as an opportunity to for rent-seeking.

The recent Multilateral Development Bank Working Group on Infrastructure found that "mismanagement and corruption contribute to significant financial losses (estimated at 10 to 30% of a project's value) during construction projects" (Bosshard, 2012). The World Commission on Dams found that "decision-makers may be inclined to favour large infrastructure as they provide opportunities for personal enrichment not afforded by smaller or more diffuse alternatives" (Bosshard and Hildyard, 2008). Corruption can thus both drive up the cost of initial investment and affect access rates and the quality of services. On the other hand, corruption in some instances has also increased local access rates, through illegal electricity connections for example.

Scaling up access to infrastructure services will require adequate institutional and technological capability to design and implement infrastructure projects, as well as capacity to operate, repair and maintain services. Capacity to manage services and collect revenues can affect the financial viability of infrastructure services. Inadequate capacity, such as low numbers of engineers and technicians, constrains the expansion of services and affects their quality and reliability. The MDGs' focus on expansion of facilities has resulted in lower priority being given to the operation and maintenance of infrastructure in the political agenda (Estache, 2007).

3.7 Policy

Since the 1990s infrastructure development has been lower in the political (and therefore financial) agenda of developing countries than other sectors such as health and education which have specific MDGs. However, recently there has been renewed interest in infrastructure, but a clearly defined policy framework is a necessary basis for scaling up of infrastructure investment and increasing access. Equally important is the political will behind these energy objectives.

Construction and pricing in the infrastructure sectors is often subject to political acceptability, with short-term political agendas often driving the nature and direction of these debates. Given the large consumer coverage, there is often immense political pressure to keep the tariffs low or subsidies in place, which can result in efficiency losses, limited funds for expansion and maintenance of assets, and continued dependence on fossil fuels. A volatile economic and governance environment caused by political interference in the infrastructure sector has kept private industry interests in this sector low (DFID 2007; Briceño-Garmendia, 2004).

4 Infrastructure in the post-2015 framework

Debate about the post-2015 goal framework is now well underway. It is unclear yet what the eventual framework will look like and how closely MDG-type (human development) goals will be linked to or combined with Sustainable Development Goals (SDGs). Over the next year, the work of the High Level Panel on the Post-2015 Development Agenda and of the Intergovernmental Working Group on SDGs will help resolve these questions. The process to reach international agreement on the framework, however, will require at least the three years to 2015.

Broadly speaking, at this early stage, three approaches to the goals have been put forward, described by Melamed (2012) as the Christmas tree, the Jigsaw and the Bullseye:

- The Christmas tree approach entails a goal for each specific issue, i.e. one goal for each kind of infrastructure service and possibly for sub-sectors (access to PCs, the Internet and mobile telephones rather than ICTs in general, for example).
- The Jigsaw consists of a framework with a number of core goals (e.g. sustainable energy) and associated specific targets (access to electricity, access to modern cooking fuels).
- The Bullseye approach focuses on a single goal, such as 'the eradication of absolute poverty', for which access to infrastructure services may be necessary but is not explicitly targeted.

These different approaches amount to a spectrum, ranging from a single goal to numerous goals. The number of goals and how they are defined (as outcomes or outputs) will be critical factors that shape the eventual framework of goals, targets and indicators. A combination of human development goals and goals focused on environmental sustainability could result in a long list of goals and become Christmas tree-like, if all the suggestions made so far are taken into consideration. As the number of goals increases, however, the potential for failure to reach international agreement and the potential for dilution of effort to achieve goals increases.

If it is desirable to have a smaller number of goals, the shape of the framework, the hierarchy of goals, targets and indicators, will determine how the role of infrastructure services to poverty eradication and sustainability is reflected in it. To assess how the contribution of infrastructure services might be captured it is useful, first, to review what has already been proposed.

Under the auspices of the WHO-UNICEF Joint Monitoring Programme (JMP), two working groups have begun to explore the measurement of progress in the areas of water and sanitation (and another two are looking at hygiene and cross-cutting WASH issues). Their work is still very much in progress and it is focused on the question of measurement, but each group has drafted a preliminary goal and suggested targets (see Table 2 below). Water and sanitation would have separate goals or targets, and these would reflect the quality of service as well as the number of people with access. There is a suggestion of different targets for different income groups, and that different dates might be used for the different targets.

Table 2: Post-2015 infrastructure goals proposed so far

Infrastructure sector	***Source***	***Post-2015 Goal***
Energy	Sustainable Energy for All Initiative	Universal access to modern energy services, by 2030. Doubling the rate of improvement in energy efficiency, by 2030. Doubling the share of renewables in the global energy mix, by 2030.
Water	WHO/UNICEF Joint Monitoring Programme Working Group	Safe and sustainable drinking water accessible for all, without discrimination Target 1: By 2030, Everybody has equitable access to improved, safe and sustainable drinking water source at home. Target 2: By 2030, halve the proportion of the population who do not have an improved (including disadvantaged group), safe and sustainable water supply at home. Target 3: By 2030, everyone has equitable access to a basic water [sanitation and hygiene] services in their schools and health facilities Target 4: Water [sanitation and hygiene] services are delivered in a financially, operationally institutionally, and environmentally sustainable manner. (Slaymaker, 2012)
Sanitation	WHO/UNICEF Joint Monitoring Programme Working Group	Universal use of sustainable (sustained?) sanitation services that protect public health and dignity Target 1. By 2025, no one practices open defecation Target 2. By 2030, the poorest fifth of the population uses an adequate sanitation facility Target 3. By 2030, the excreta of 50% of households is fully Managed (safely stored transported and adequately treated before use) Target 4. By 2025, everyone uses adequate sanitation in schools and health facilities (Hutton, 2012)
Transport and Communications	CIGI	Connectivity for access to essential information, services and opportunities.
Urban housing	UN-Habitat submission to Rio +20	Halve the proportion of people living in slums at the city level by 2030, and prevent the formation of new slums.

The SE4All initiative of the UN Secretary General, which is currently setting the agenda for development co-operation and energy, has three broad objectives: universal access to modern energy services; doubling the rate of improvement in energy efficiency; and, doubling the share of renewable energy in the global energy mix, all to be achieved by 2030. An Agenda for Action has been drawn up and numerous (voluntary) commitments to action made, but there are no specific global targets beyond the three objectives themselves. Instead, the SE4All initiative envisages national-level targets, determined by the (developing) countries which have committed to SE4All's objectives. SE4All combines both human development (universal access) and environmentally sustainable development (renewables and efficiency) objectives, providing a possible model for a bridge between human development and environmental sustainability in other sectors.

UN-Habitat's submission to the Rio +20 conference included a proposal for a two-part target to halve the proportion of people living in slums at the city level by 2030 and to prevent the formation of new slums (UN-Habitat, 2012). This target would contribute to a much broader goal of promoting cities that are environmentally sustainable, socially inclusive and economically productive. Other targets for this overall sustainable cities goal would also be infrastructure related (water, sanitation, waste management, energy and transport). Though the goal takes a visionary approach, and like SE4All combines human development and environmental dimensions, the targets appear to be less ambitious than the universal access objectives proposed for water, sanitation and energy.

Specific proposals for ICTs and transport in the post-2015 framework have so far not been put forward as separate goals. The International Telecommunications Union (ITU) has embarked on a review of ICT targets, but this will not be ready to contribute to the process of developing the framework before mid-2013. ICTs and transport, however, both feature in the Connectivity goal proposed by the Centre for International Governance Innovation (CIGI). This builds on a suggestion by Manning (2011) and embraces communications, transport, energy and financial services. The argument is that "Connectivity is an ingredient for economic growth: it allows rural dwellers to reach cities and markets; ensures functioning of day-to-day business; and provides access to markets, government services, and information and knowledge." (CIGI/ICRC, 2011) Connectivity has also been seen as desirable for itself as well as for the economic and social outcomes it enables.

A number of common principles appear in these various proposals for goals and targets for infrastructure services in the post-2015 framework. There is a degree of consensus that how goals are achieved matters, as well as whether they are achieved, and therefore that the post-2015 framework needs to have targets for infrastructure services which incorporate principles of equity, accountability and sustainability. These echo underlying principles which have been suggested for education and health goals (Schweitzer et al., 2012; Burnett and Felsman, 2012). For infrastructure services, this means that universal access, the quality of service, the form of governance and the environmental impact of the service should all be reflected in the goals and targets.

The UN-led Sustainable Energy for All Initiative has already secured a degree of support for the objective of universal access to modern energy services by 2030. Universal access to clean drinking water and to improved sanitation, have been proposed by the JMP working groups. Universal access to infrastructure services is being advocated on the grounds of equity for those whose development is disadvantaged by lack of access, but also because it is seen as achievable, if still ambitious. In the case of water, it is also a question of ensuring people's recognised economic and social rights are met.

The adoption of universal access would entail, at the very least, guaranteeing a minimum standard of living for everyone, including a minimum standard of access to infrastructure services. Though there has been debate under the current MDGs about what minimum standards of access or levels of service should be, and who should determine them, there is general agreement that universal access cannot be narrowly defined by proximity to physical infrastructure. Targets should include qualitative aspects of access, such as quality, acceptability, accessibility and affordability.

In the proposals for infrastructure-related goals and targets there is also a sense that the standards, and therefore post-2015 targets, should be able to reflect different geographic, cultural, and socio-economic contexts. The Sustainable Energy for All Initiative, for example, argues that for access to energy services these standards should be determined for each country by the national government. This is to take account differences between countries in terms of energy needs (which are affected by geography and climate) and levels of development.

While universality, in the sense of the goal framework being applicable to all countries is proposed, differentiation in the post-2015 targets to reflect differing contexts along with the principles of national determination of development priorities and of common but differentiated responsibilities, point to the national determination of minimum standards and targets. This also suggests the setting of global goals which provide a common vision and ambition, rather than specific goals giving firm commitments.

The principle that people should be empowered to participate in the decision-making that affects them calls for their inclusion in planning for infrastructure, and transparency and accountability in the operation of infrastructure services. A separate post-2015 goal for governance is a possibility that would cover this. The CIGI, for instance, has proposed a goal on "Empowerment of people to realize their civil and political rights." CIGI/ICRC (2011) and Sachs (2012) have also suggested a governance goal. Targets and indicators for the governance of infrastructure services could be associated with such a goal, but a more practical approach would be the adoption of more generic participation, transparency and accountability targets and indicators, and to regard the governance of infrastructure services as one aspect of governance under a broad governance goal. For infrastructure services, governance could also be captured in the definition of infrastructure access standards.

The development and use of infrastructure services have an impact upon the environment locally and globally, and potentially therefore a bearing on achievement of SDGs. The use of all forms of infrastructure entails the consumption of natural resources, while choices about infrastructure

development (e.g. renewable energy v. fossil fuels, irrigation techniques) affect the environmental impact of infrastructure services. As with governance, the environmental sustainability of infrastructure services could be reflected in access standards and in infrastructure-specific indicators. Internationally agreed SDGs might require infrastructure-related national targets and indicators (e.g. relating to the sustainability of water resources of consumption of energy).

Beyond the question of how infrastructure-related goals and targets should reflect key principles of the post-2015 framework, there remains the more fundamental question whether infrastructure services warrant explicit infrastructure goals, targets and indicators. The limited specific mention of infrastructure in the current MDGs is partly a consequence of infrastructure being seen as an enabler of economic growth and human development. With the exception of water, infrastructure services are in demand for what they enable people to do, i.e. as enablers of growth, connectivity, and achievement of health, education and other economic and social objectives. Similarly, the introduction of sustainability and SDGs into the post-2015 framework, raises the question whether infrastructure services are a means to achieve broad resilience and environmental sustainability goals, or should have their own sustainability targets.

For the post-2015 framework, therefore, the question is whether goals and targets should be based on these primary needs or the secondary demand for infrastructure services. As in the existing framework, some infrastructure services may be considered a higher priority for growth, human development or environmental sustainability, and so justify specific goals and targets themselves. This may be because they are regarded as fundamental (e.g. water, which is also a recognised human right) or because of neglect in the past (e.g. energy). Though the resources that people consume when they use infrastructure services may feature in some of the global post-2015 goals, infrastructure itself is more likely to feature at the level of targets and indicators. Since these are likely to be determined nationally, to suit local circumstances, there is potential for variation between countries in the extent to which, and how, infrastructure services are reflected in national targets. Though appropriate to meet national needs, in the absence of agreed minimum standards, such differences are likely to present challenges for cross-country comparisons and global assessments of progress.

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