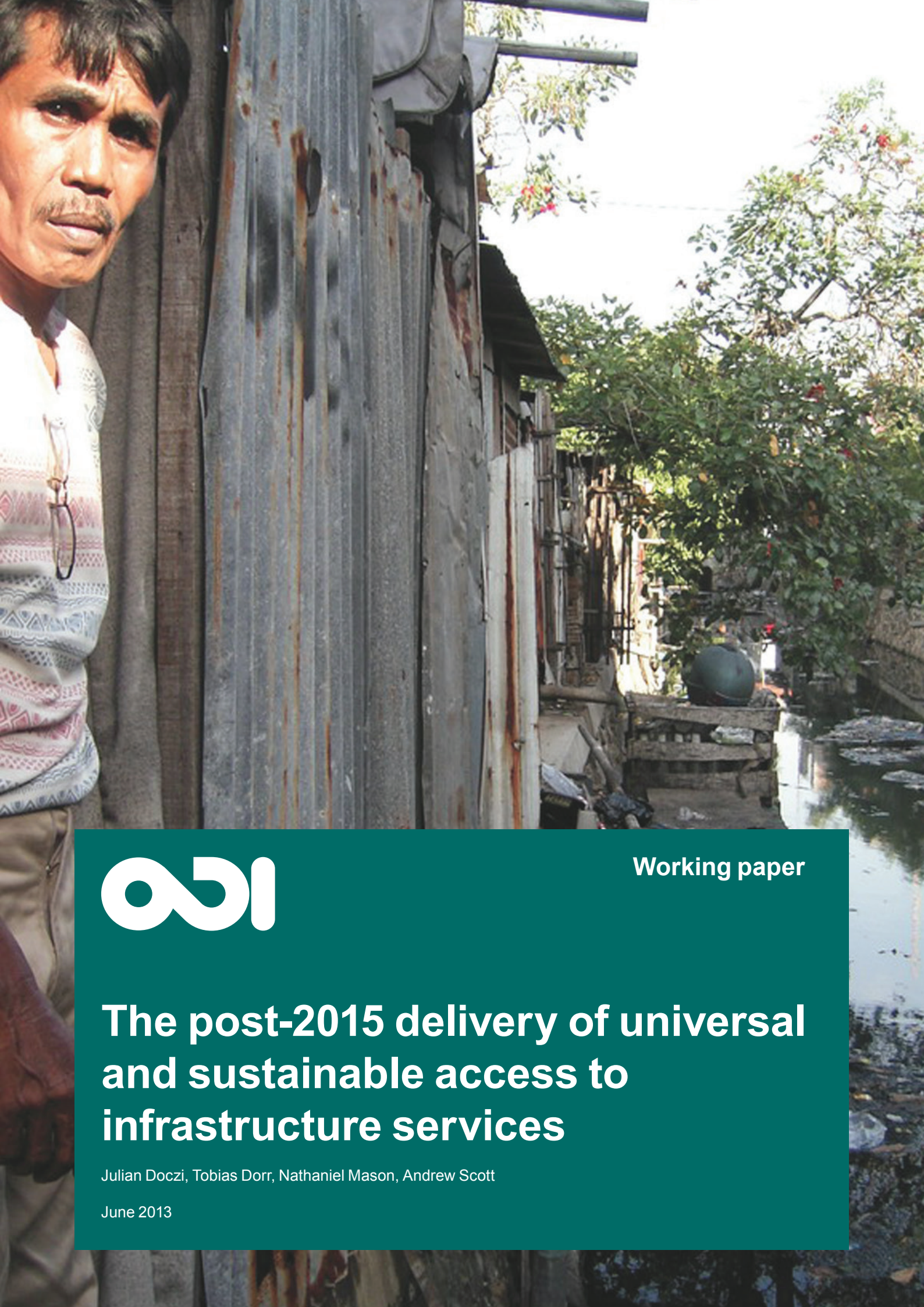

Working paper

The post-2015 delivery of universal and sustainable access to infrastructure services

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Abstract

Many of the proposals for post-2015 goals and targets appear ambitious, but what would it take to achieve them? This paper assesses what is needed to achieve goals for universal and sustainable access to infrastructure, specifically water, energy and transport. Using illustrative goals and targets, the paper reviews the development challenges in each sector, and what will be necessary to overcome the barriers to universal and sustainable access to water, energy and transport infrastructure services, in the areas of governance, finance, capacity development and environmental protection. The paper ends with general conclusions about infrastructure in the post-2015 development agenda.

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Abbreviations

ADB	Asian Development Bank
AICD	Africa Infrastructure Country Diagnostic
AMCOW	African Ministers' Council on Water
ASEAN	Association of Southeast Asian Nations
ASI	Avoid-shift-improve
BAU	Business as usual
BCR	Benefit-cost ratio
BNEF	Bloomberg New Energy Finance
BRT	Bus rapid transit
FIA	Fédération Internationale de l'Automobile
GHG	Greenhouse gas
GLAAS	Global Analysis & Assessment of Sanitation & Drinking Water
GEA	Global Energy Assessment
GWP	Global Water Partnership
HLP	High-Level Panel on the Post-2015 Development Agenda
IEA	International Energy Agency
IFRTD	International Forum for Rural Transport and Development
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
IWA	International Water Association
IWRM	Integrated water resources management
JMP	Joint Monitoring Programme

LIC/MIC/HIC	Low/middle/high-income country
LVRR/HVR	Low-volume rural road / High-volume road
MDG	Millennium Development Goals
MGI	McKinsey Global Institute
mtoe	Million tonnes of oil equivalent
OECD	Organisation for Economic Co-operation and Development
ODA	Overseas Development Assistance
O&M	Operation and maintenance
PPP	Public-private partnership
RPS	Renewable portfolio standard
SDG	Sustainable Development Goal
SDSN	Sustainable Development Solutions Network
SE4All	Sustainable Energy for All
SEM	Sociétés d'Economie Mixtes
SIWI	Stockholm International Water Institute
SWA	Sanitation and Water for All
UBA	Umwelt Bundes Amtes
UITP	International Association of Public Transport
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
UNESCAP	United Nations Economic & Social Commission for Asia-Pacific
UNICEF	United Nations Children's Emergency Fund
VIP	Ventilated improved pit latrine
WASH	Water supply, sanitation and hygiene
WHO	World Health Organization
WRM	Water resources management
WSP	Water and Sanitation Programme of the World Bank
WSS	Water supply and sanitation
WSUP	Water and Sanitation for the Urban Poor

Executive Summary

Numerous proposals and suggestions for specific goals and targets have been put forward in debate about the post-2015 development agenda. Many appear ambitious, but what would it really take to achieve them? Most of the goal proposals do not explore this question. Suggestions for goals and targets for infrastructure recognise the importance of access to infrastructure services for poverty reduction, the role of infrastructure in enabling social development and economic growth, and the environmental effects of infrastructure. This paper considers what will be necessary to achieve goals for universal and sustainable access to infrastructure, specifically water, energy and transport. The box below presents the goals and targets considered in the paper. The water and energy goals reflect proposals that have been made by others, while the transport goal and targets have been formulated for the purposes of this paper. The paper highlights changes that will be necessary to achieve the post-2015 goals in the areas of governance, finance, capacity development and mitigation of environmental effects.

Goals for universal and sustainable access to infrastructure

Achieve universal access to water and sanitation.

- Provide universal access to safe drinking water at home, and in schools, health centres, and refugee camps
- End open defecation and ensure universal access to sanitation at school and work, and increase access to sanitation at home by x%
- Bring freshwater withdrawals in line with supply and increase water efficiency in agriculture by x%, industry by y% and urban areas by z%
- Recycle or treat all municipal and industrial wastewater prior to discharge

Sustainable energy for all by 2030.

- Ensure universal access to modern energy services
- Double the rate of improvement in energy efficiency
- Double the share of renewable energy in the global energy mix

Realise universal access to sustainable transport mobility.

- The number of the urban and rural poor for whom transport accessibility problems severely restrict access to employment and essential services is eradicated by 2030
- The proportion of victims from traffic-related accidents is cut by half by 2030 compared to 2010
- Reduce greenhouse gas emissions from passenger and freight transport by 40% by 2030, compared to 1990 levels
- Double the share of public transport users by 2030

Water

For SDGs, a holistic view of the water sector is required, giving equal attention to drinking water supply, sanitation and hygiene, water resources management, and wastewater management and quality. With over 768 million people still lacking access to improved drinking water, over 2.5 billion still lacking access to improved sanitation, over 4.1 billion still lacking access to wastewater treatment, and substantial degradation of water quantity and quality, it is clear that the water sector, in both developing and developed countries, merits inclusion in the post-2015 development agenda.

The principal barrier to improved access is weak governance, especially lack of political will. Other barriers include lack of investment to extend and sustain basic services, the capacity of practitioners in the water sector, and the ability of the natural environment to tolerate extreme pressure on water resources from use and pollution. Although there has been a recent increase in high-level political commitment to the sector (for example, in terms of the recognition of the human right to water and sanitation), this has not yet led to visible change on the ground. A better understanding of the differing interests and incentives of the stakeholders in water and sanitation is needed, in order to understand where, when and how governance reforms can succeed, including operational and fiscal decentralisation, anti-corruption efforts, private sector engagement, bureaucratic incentives, and new legal frameworks.

Lack of adequate finance is often cited as a key reason for poor water sector services in the developing world, though the overall cost of achieving universal access to a minimum basic level of water and sanitation service is substantially lower than the cost burden of maintaining and expanding advanced services in the developed world. Governments, donors, service providers and households all have a role to play in financing improved access and water resources management, and expanded wastewater treatment. Tackling the huge inefficiencies in developing country sector spending, and appropriately balancing the necessary financial inputs from different stakeholders, could significantly contribute to raising enough money for universal and sustainable access. The focus should thus be on seeking more equitable, efficient and better-governed finance.

Universal access will require qualified and motivated practitioners on the ground, though water sector capacity is often sorely lacking in many developing countries, especially at the local level. Low wages and poor working conditions in many public sector agencies result in a drain of qualified water sector staff to the private sector or to the developed world. This is intimately tied to low political commitment and investment in the sector, where limited human resources have limited capacity to finance and govern the sector. Similarly, potential capacity development solutions (such as more support to educational institutes, more training activities in small towns and rural areas, and more support to professional knowledge-sharing networks) will only be sustainably achieved at scale alongside improvements in political will and investment, using an incremental approach to sectoral financing and training.

The environmental implications of achieving universal access to water sector services will depend largely on service levels used to achieve universality. For all but a handful of the most water scarce countries, the water needed to meet the drinking and hygiene needs of unserved populations is equivalent to less than 1% of total available renewable water. Water scarcity should thus not be used as a general excuse for failure to meet essential human needs. At the same time, more localised water scarcity can arise, including from household demand in developed and emerging economies with higher levels of service. For the majority of countries, to balance demand with available water requires explicitly defining and protecting environmental requirements, not only in terms of water quantity, but also with regard to the quality, timing and distribution of water flows. Freshwater ecosystem services are increasingly acknowledged as vital to society and economies, but there is significant work to be done to quantify their value and to understand in more detail how far they have been damaged by historical approaches to water management. Meanwhile, water interventions should minimise disruption to environmental flows, with a greater role for ‘natural’ infrastructure such as wetlands, smarter re-use and recovery of resources from wastewater, and a focus on managing

demand through productivity improvements, in a way that reinforces rather than compromises rural livelihoods.

Energy

Though there has been progress in improving access to modern energy services, 1.3 billion people do not have access to electricity and 2.7 billion do not have clean and safe energy for cooking. Without additional effort, the number of people without access in 2030 will still be at this level (IEA, 2011; SE4All, 2013). Global greenhouse gas emissions from energy account for about two-thirds of total emissions and continue to rise, but must be reduced to mitigate climate change. This can be achieved through greater use of renewable energy and improved energy efficiency. The barriers to scaling up access and the use of renewables are inter-related, including policies and regulations, finance, and the capacity of governments and service providers.

National policy frameworks will be key determinants of progress towards a sustainable energy for all goal. Access to modern energy requires dedicated policies and targets in developing countries (currently lacking in most, while policies on cooking energy are lacking in nearly all), and targeted measures to enable affordability for the poor in both developed and developing countries. Coherent, consistent and sustained national policies are required to encourage investment in renewable energy, including mitigation of risks for the private sector and the reform of fossil fuel subsidies. Energy efficiency can be advanced through regulations and standards.

Achieving the goal of sustainable energy for all will mean overcoming finance barriers for the full range of different energy users and service providers, with diverse energy needs in widely varying contexts. A combination of public finance and investment by the private sector will be necessary to reach all three targets. The investment required to achieve universal access to modern energy services represents a significant order of change from current levels (by one estimate, five times the investment), but equivalent to only 3% of total global energy investment (IEA, 2011). For the poorest households, credit, subsidies and cash transfers can be used to enable access. Investment in renewables needs to increase, and would be stimulated if carbon taxes or effective carbon markets were used to reflect the environmental costs of fossil fuel consumption.

A sustainable energy for all goal will require significant scaling up of the capacity to design, implement and operate energy systems, especially in renewable energy and particularly in developing countries. This capacity, including skills to operate mini-grid and off-grid systems, smart grids, and the direct use of renewable energy in industry, needs to be enhanced well before 2030 if the goal is to be achieved. Capacity is also required to raise awareness and measure progress.

Achieving a sustainable energy for all goal would be consistent with the 2°C climate change objective, but would not be sufficient to achieve it. Universal access to modern energy services would increase energy consumption by poor households, giving rise to a less than 1% increase in greenhouse gas emissions. Universal access would also have a significant positive impact on the health status of poor households, particularly of women and children.

Transport

Investment in transport infrastructure and services is likely to have a significant impact on poverty and more generally on economic growth, productivity and employment. Transport's importance goes beyond a question of mobility, by providing connectivity and social benefits. By one estimate, 900 million people have inadequate access to road transport (Roberts et al., 2006), but data on access to transport are limited. The poorest are often neglected by service providers, and in urban areas access is affected by affordability. With road traffic causing 1.3 million deaths a year, the majority in developing countries, road safety is a major concern for future transport sector development. The transport sector is a major source of greenhouse gas emissions and particulate air pollution, especially in urban areas. Policies for transport are often

inadequately implemented, with planning and regulations imposed from above. The development of more equitable sustainable transport systems is constrained by capacity and knowledge.

Achieving a sustainable transport goal requires coherent national transport policies, with more intermediate and long-term perspectives, which encourage private investment. Transparent governance is required to eradicate the corruption which is found in the sector. However, accessibility for the poor in rural areas requires localised solutions and decentralised planning, while in urban areas public transport systems can be encouraged and made affordable through the adoption of lower-cost options. Improving road safety and reducing traffic pollution require policy commitment and the enforcement of standards, as well as changes in planning.

Connecting the unconnected would cost a fraction of total transport investment requirements (Carruthers et al. (2009) estimate 14% of infrastructure investment in Sub-Saharan Africa), and the investment to achieve universal access to transport services would be financially possible. However, the poorest countries would need to devote a higher share of GDP than developed countries. The bulk of the required expenditure on transport is for maintenance and improving the resilience of transport systems. With appropriate policies, private investment could be used for high-value roads and public finance for low-value rural roads, and maintenance covered by revenues from users, through road funds, for example. The Global Road Safety Fund could support investment in road safety in developing countries.

Capacity to plan and operate equitable and sustainable transport services will be required in all countries to achieve the goal. This includes the strengthening of user groups and transport operator groups, and adoption of avoid-shift-improve (ASI) strategies which seek to avoid journeys, reducing transport demand, to shift users to more environmentally sustainable modes of transport, and to improve fuel efficiency. Capacity for road maintenance also needs to be expanded.

A sustainable transport goal would contribute to reduction of global greenhouse gases and particulate air pollution. This would help mitigate climate change and have a significant positive impact on health. Road safety measures would also improve overall health status.

There are clearly strong grounds for the inclusion of infrastructure-related goals and targets in the post-2015 development framework. Infrastructure services enable economic growth and human development, and affect environmental sustainability. Achieving universal access to infrastructure services will be a necessary condition for achieving the eradication of absolute poverty. It is likely, in any case, that the fundamental principles of the post-2015 development agenda – equity and sustainability – will guide the future development of infrastructure. The widely varying challenges facing different countries in providing access to water and sanitation, energy and transport, suggest that each country will need to set infrastructure targets appropriate to their own condition, but consistent with these common principles.

To achieve universal and sustainable goals and targets for water, energy and transport, “business as usual” will not be enough. It will require sustained political commitment and investment at levels considerably higher than at present, though in amounts that are relatively small in relation to the total expected investment in each sector. Service users, public finance and the private sector will all have a role to play, enabled by national policies and regulations.

Environmental sustainability will be an important consideration for the post-2015 development of infrastructure services. The additional consumption by poor households arising from achievement of universal access would not, however, have a significant environmental effect. Growing consumption of infrastructure services by middle and higher income groups will have a significant effect on the sustainability of resources.

1 Introduction

Publication in May 2013 of the report by the High-Level Panel on the Post-2015 Development Agenda marks a milestone in the process towards agreement of a post-2015 development agenda. So far, the debate has focused on the shape of the post-2015 framework, on fundamental principles and on the goals and targets it should contain. There have been numerous proposals and suggestions for specific goals and for sets of goals, not least those put forward by the High-Level Panel (HLP) itself. In some cases, detailed suggestions for indicators have also been made, though debate about indicators and country strategies to achieve post-2015 goals will take place in earnest when the framework itself is closer to agreement. Dialogue about the goals will continue under the Open Working Group, which has set a schedule for discussions to February 2014.

Many of the goals and targets proposed appear ambitious, even aspirational. But are they achievable? If they are ambitious – and the High-Level Panel recommends that they should stretch – what would need to happen to achieve them? Most of the goal proposals do not explore this question in any detail. As the focus of debate about possible goals and targets shifts in locus from the High-Level Panel to the Open Working Group, it is useful to begin examining what will be required to achieve them. This will help bring about a fuller understanding of what is being proposed by specific goals and targets, will help recognise the likely challenges to achieving them, and will help thinking about their formulation for the post-2015 goal framework. It is also useful, even before any goals are agreed, to consider implementation at this stage, given the transformative changes implied by many of the proposals and the preparations that will be necessary for such change to be realised.

In this paper we consider what will be necessary to achieve some illustrative infrastructure goals, specifically goals on water, energy and transport. Both general infrastructure topics and various sectoral issues have featured in the post-2015 debates over the past year. This is partly the result of greater recognition amongst development policy-makers that access for the poor to a range of infrastructure services will be necessary to eradicate poverty. This recognition is itself partly the result of analysis of infrastructure's contribution to the Millennium Development Goals (MDGs) by those involved in infrastructure development, in response to omissions in the MDG framework (e.g. Leipziger et al., 2004). But there is recognition of the importance of infrastructure amongst broader audiences. The My World survey, for example, has found access to water and sanitation to be one of the top 10 priorities for the post-2015 agenda amongst all groups. Respondents from Africa also included better transport and roads, and reliable energy at home.

Infrastructure is also recognised for its effects on the natural environment, globally and locally. Climate change caused by greenhouse gas emissions from energy consumption, including fuel consumption for transport, presents one of the greatest global challenges. Air and water pollution affect the health and productivity of millions of people. Infrastructure is clearly relevant to the post-2015 concept of Sustainable Development Goals (SDGs).

There remains a question for the continuing post-2015 debate about whether there should be specific infrastructure goals and targets, and indeed what infrastructure covers. The various

proposals made so far take different approaches. One of the earliest, the Bellagio proposals, included a goal on "quality infrastructure for access to energy, transportation and communication". Bellagio combined access to water with access to food in one goal (Bates-Eamer et al., 2012). More recently, the Sustainable Development Solutions Network (SDSN) has suggested a target covering infrastructure under what might be called their rural and urban goals, and targets for clean energy under a separate climate change and energy goal (SDSN, 2013). The UN Global Compact has suggested goals on water and sanitation, energy and "infrastructure and technology" (UN Global Compact, 2013). The HLP report suggests goals for water and sanitation, and sustainable energy, and under the goal for jobs and growth a target on "universal access to financial services and infrastructure such as transportation and ICT" (HLP, 2013). These differing treatments of infrastructure arise because access to infrastructure can be seen as a means to an end – poverty reduction and sustainable development – rather than an end in itself (Scott and Seth, 2012). Infrastructure enables the achievement of social and economic development objectives, for example, by facilitating access to health services and improving the quality of these services. Infrastructure (water, energy, transport, communications) allows access to markets and increases the productivity of farmers and manufacturers. Though infrastructure will be necessary to achieve post-2015 goals, some kinds of infrastructure might be seen as sufficiently important for poverty eradication and sustainable development to warrant specific infrastructure goals.

It is useful, therefore, to discuss the achievability of infrastructure goals because of their relevance to the achievement of post-2015 goals in general. Implementation will entail substantial expenditure on fixed capital investment, will have implications for the sustainability of natural resources, and will help determine progress on goals such as jobs, income and health. The purpose of this paper is to contribute to the debate about post-2015 goals generally, and about infrastructure goals and targets particularly. The paper suggests goals and targets for water, energy and transport, drawing from proposals that have already been put forward in the post-2015 debate. Communications and housing infrastructure have been less extensively discussed to date, making it more difficult to assess what would be required to meet communications and housing targets.

The goals and targets for water, energy and transport suggested in the paper are illustrative of the kind of goals and targets that might be set for infrastructure, and are included here to enable discussion of what will be required to achieve them, and thus to achieve all goals by 2030. Our premise is that universality, equity and sustainability will be principles underpinning all goals. In the chapters that follow, we look at the existing barriers preventing access to infrastructure and what will be necessary to overcome these barriers to achieve water, energy and transport goals, in terms of governance, finance, capacity development and environmental protection. Some general conclusions are presented in the final section.

2 Water

Written by Nathaniel Mason and Julian Doczi

2.1 The challenge

With numerous proposals already made on how water might be included in the post-2015 agenda, this chapter takes the water goal and targets suggested by the High-Level Panel as its point of departure. The chapter does not generate any new data, but synthesises and compiles existing data in potentially new ways. The chapter offers suggestions on how universal and sustainable access to water and sanitation can be achieved – with sections on governance, finance, capacity development and natural resources. Following the typology used in the Thematic Consultation on Water in the post-2015 Agenda,[5] as well as the targets suggested by the High-Level Panel on the Post-2015 Development Agenda (HLP), the paper goes beyond questions of access to drinking water supply and sanitation in two ways. Firstly, the chapter also considers what would be needed to manage water resources in the first place, in particular to bring water withdrawals more into line with availability and to improve water efficiency in various sectors. Secondly, the chapter also assesses what we will need to do to achieve universal recycling or treatment of wastewater – a key consideration if the quality of the resource is to be conserved for different uses. In this way, the chapter aims to take a holistic view of the 'water sector', giving equal attention to water supply, sanitation and hygiene, water resources management and wastewater management and water quality.

Access to drinking water supply and sanitation was included as a target in the existing MDG framework, though progress has been slow, particularly for sanitation. The statistics are stark and stubbornly unchanging, with 768 million people still relying on unimproved drinking-water sources[6] in 2011 and 2.5 billion people still using unimproved sanitation,[7] with over 1 billion of these still practicing open defecation (WHO & UNICEF, 2013). While no targets were previously created for hygiene, water resources management or wastewater and water quality, the little data that exists likewise suggests similarly poor performance across these sub-sectors and around the world. A recent paper by Baum et al. (2013), for example, estimates that over 4.1 billion people worldwide still lack even basic wastewater treatment, regardless of whether their household sanitation system is 'improved' or not.

The individual and societal costs are only beginning to be quantified. A recent global estimate – solely for water supply and sanitation services – found economic losses at ~$260 billion US$ per annum and a global benefit-cost ratio (BCR) of improving water supply and sanitation interventions at 4.3:1 (Hutton, 2012). Likewise, older work by the Stockholm International Water Institute (SIWI, 2005) estimated a positive BCR for water resources management investments as well, though it gave a huge range in possible ratios, from 2:1 to 200:1.

[5] www.worldwewant2015.org/water

[6] The MDG process defined 'improved' drinking-water as: piped water on premises, public taps / standpipes, tube wells / boreholes, protected dug wells, protected springs, and rainwater collection.

[7] 'Improved' sanitation was similarly defined as: flush / pour-flush toilets to a piped sewer system, septic tank, or pit latrine; ventilated improved pit latrines (VIPs); pit latrines with a slab; and composting toilets. Facilities that are shared between two or more households are excluded and are deemed 'unimproved'.

Continued lack of progress in the face of clear economic benefits implies fundamental barriers. The first – and most crucial – of these is weak governance, especially the lack of political interest in the sector and the will to invest in it. Rather than catalysing action, the importance of water, and sanitation, to human health, livelihoods, ecosystems and economic productivity means that while everyone has an interest in water issues, these interests are often at odds or fragmented. Policy prescriptions and blueprints have helped drive improvements in a few instances, but are insufficient to address the huge diversity of contexts, actors and scales around which water challenges play out. The issue of governance interacts closely with three other key barriers: the lack of adequate investment to meet the relatively modest costs of extending and sustaining basic services for all, let alone the much higher costs of enhanced service levels and sustaining existing services; the generally low capacity of sector institutions to manage new funds or govern in innovative ways; and the ability of the natural environment, and freshwater ecosystems, to tolerate the extreme pressure we are putting on water resources through use, pollution and other disturbances such as fragmentation of aquatic habitats. We will discuss each in further detail below, and attempt to offer some potential ways forward.

2.2 A post-2015 water goal

The High-Level Panel proposes a dedicated goal on water, to 'Achieve universal access to water and sanitation' (Goal 6 in the panel's example goals and targets), which is underpinned by four targets that focus on drinking water supply, sanitation, water resources management, and wastewater:

- **6a.** Provide universal access to safe drinking water at home, and in schools, health centres, and refugee camps
- **6b.** End open defecation and ensure universal access to sanitation at school and work, and increase access to sanitation at home by x%
- **6c.** Bring freshwater withdrawals in line with supply and increase water efficiency in agriculture by x%, industry by y% and urban areas by z%
- **6d.** Recycle or treat all municipal and industrial wastewater prior to discharge

As such, the HLP's proposed goal on water goes considerably beyond the existing MDG target, which covers only drinking water supply and sanitation: 'To halve, by 2015, the proportion of people without sustainable access' to 'safe drinking-water' and 'basic sanitation'.

However, the fact that drinking-water supply and sanitation services have had their own MDG target means that these particular infrastructure services already have an established architecture for monitoring progress. Some would argue, moreover, that these services have received considerably more finance and political attention as a result. They have also had a head-start in the development of target and indicator proposals for a post-2015 development framework in comparison to energy and transport. At the level of the water sector, this effort has mainly been led by the Joint Monitoring Programme (JMP), a collaboration between WHO and UNICEF that produces annual status reports on countries' efforts to increase coverage. The thinking on targets for water supply and sanitation emerging from the JMP-led consultation (WHO & UNICEF, 2013) is visible in the HLP's target proposals, with a few important differences. Firstly, the JMP-led consultation proposals make a conscious effort to add hygiene to the scope, by including targets on access to handwashing facilities and menstrual hygiene management facilities. Secondly, the proposals from the JMP-led consultation define their targets in relation to specific service levels. This is important for considering what is needed to achieve targets, because governance, capacity, and especially financing needs, as well as environmental impacts, will vary a lot depending on whether the aim is to achieve universal access to a basic minimum, or to a more sophisticated, level of service. As such, the targets proposed by the JMP-led consultation aim for achieving universal access to 'basic' drinking water supply and ending open defecation by 2030, as well as increasing access to 'improved' drinking-water supply and achieving universal access to 'adequate' sanitation by 2040. What these service levels would mean in practice is defined in Box 1. In the light of these nuances, the HLP's drinking water target 6a

should therefore be interpreted as requiring an initial focus on achieving access to a 'basic' minimum level of water supply in the home and other relevant locations. For the HLP's sanitation target (6b) the focus should be interpreted as being on ending open defecation in the first instance, as well as progressively increasing access to a minimum 'adequate' form of sanitation in the home.

Box 1: Proposed definitions for 'basic', 'intermediate' and 'adequate' water supply and sanitation in the JMP-led post-2015 proposed sectoral targets.

Basic drinking-water supply:

- Use of an improved drinking-water source*
- ≤ 30 minute water collection round trip

Intermediate drinking-water supply at home:

- Use of an improved drinking-water source on premises*
- Available in acceptable quantities for at least 12 of the past 14 days
- Water quality of < 10 cfu (colony-forming units) of *E. coli* per 100mL

*for urban areas this excludes protected dug wells and protected springs, which are more vulnerable to contamination than piped supplies and boreholes

Adequate sanitation at home:

- Use of an improved sanitation facility at home
- Shared between five households or less

Source: WHO & UNICEF, 2013.

Both the targets proposed by the JMP-led consultation and those proposed by the HLP emphasise a progressive reduction in inequalities and a focus on the poorest and most disadvantaged. In view of similarities, the HLP goal offers a useful and coherent package under which to discuss what is needed in terms of governance, financing, capacity and managing environmental impacts. Nevertheless, the important subtleties introduced by the JMP-led consultation targets should also be kept in mind.

The targets proposed by the JMP-led consultation make some reference to broader sustainability questions in relation to water resources, namely 'safe excreta management' and delivery of all services in 'a progressively environmentally sustainable manner'. But the focus is ultimately aligned with the current MDG water supply and sanitation target (and with finishing this task): the immediate human development concern of reducing the mortality and morbidity associated with inadequate water supply and sanitation services. With the increased emphasis on environmental sustainability apparent in the post-2015 agenda, the HLP's targets 6c and 6d reflect increasing interest in incorporating broader aspects of conservation and sustainable management and use of water resources.

Thinking through what we would need to achieve the HLP's proposed target 6b on water resources management in practical terms shows that there are various different implications. The wording of the initial part of target 6b emphasises achieving a balance between withdrawals and

overall availability of water. For some countries, which have abundant water resources but minimal infrastructure with which to put these to productive use, the target might actually mean increasing withdrawals. For other countries where water resources are already developed and used beyond what is sustainable, it would mean reducing withdrawals. This is one of the key issues for integrating water resources management in a post-2015 framework, and for maintaining universal applicability while respecting country context. Another important point to note is that efforts to bring water withdrawals in line with supply would have to take into account the needs of ecosystems if the system is to be sustainable. This is implicit rather than explicit in the HLP's target 6b, but in practice it would require defining and maintaining a context-specific 'headroom' for environmental flows (i.e. the volume, quality and timing of water required to sustain freshwater ecosystems and associated ecosystem services). The second part of the HLP's proposed target 6b emphasises increasing water efficiency in various sectors. This is a conceptually and technically challenging area, not least because water, unless it evaporates, is rarely actually 'wasted' – it often ends up being used downstream in a river catchment or basin. Nonetheless, reducing the overall amount of water needed to produce a given output – often referred to as 'water productivity' – can play a role in reducing cost and environmental impact (in terms of energy consumed to store, move and treat water, as well as in terms of the water resource itself).

The HLP's target proposal 6d focuses on wastewater recycling and treatment. It is worth noting, however, that another important aspect considered in the post-2015 'World We Want' Thematic Consultation on Water is 'water quality' more generally. This is an important distinction because a number of major water quality challenges do not arise from point-source discharges of wastewater, but from 'diffuse' pollution, particularly associated with land-use. Diffuse pollution from agriculture is a major source of phosphorous and nitrogen, causing eutrophication and anoxia in sea- and freshwater. Work on planetary boundaries has identified critical disturbances in the phosphorous and nitrogen cycles, with risks of 'tipping points' particularly for phosphorous (Rockström et al., 2009; Carpenter and Bennett, 2011). Looking to other goals, if eliminating hunger requires more food to be grown, we may expect further increase in disturbances to these key biogeochemical flows. While these issues are therefore outside the scope of the HLP targets, they need to be kept in mind if universal access is to be achieved sustainably.

Taken together, the HLP target proposals 6c and 6d imply a significant increase in the infrastructure (built and natural) and institutional capacity needed to allocate and utilise water resources for environmental and societal wellbeing.[8]

Under each of the following sections on governance, finance, capacity and environmental aspects, the HLP's target proposals are the main point of reference in terms of assessing what is required. However to provide a structure to the analysis, the targets are clustered under three broad headings. These headings reflect the internal organisation of the water 'sector' and have been used to divide the three streams within the post-2015 Thematic Consultation on Water:

- Drinking water supply, sanitation and hygiene, referred to with the acronym 'WASH'. HLP targets 6a and 6b relate to WASH
- Water resources management, referred to with the acronym 'WRM'. The HLP's target 6c relates to WRM
- Wastewater management and water quality. The HLP target 6d corresponds to this area, but emphasises the wastewater dimension more explicitly.

[8] The HLP's target wording omits an important dimension of water resources management, namely the management of hydrological extremes. While this is unquestionably an important consideration, especially with climate change, we have been unable to include it within the scope of this paper. It is to be hoped that hydrological extremes would form an important part of how disaster risk and/ or climate change are integrated into the post-2015 agenda.

2.3 Achieving universal and sustainable access

2.3.1 Governance

A strong narrative within the water sector characterises governance issues as *the* principal challenge. The 2006 Human Development Report, *Beyond Scarcity: Power, poverty and the global water crisis*, argued that 'politics, not finance, technology and economics, still holds the key to progress' (UNDP, 2006, p.59). The sentiment, expressed at the beginning of a decade's countdown to 2015, has been widely echoed for developed and developing countries alike (OECD, 2011; World Bank, 2010). At the same time, there is surprisingly little empirical evidence about what works: what water-related governance reforms lead to improved outcomes, in what contexts.

Water supply, sanitation and hygiene

In the case of WASH services, a recent attempt to understand sector reform trajectories across 32 countries in sub-Saharan Africa found some evidence that certain broad processes had helped a few countries extend access to water supply and sanitation faster than others. These included: a clearly stated, country-led vision; progressive integration with core-government systems; and increased harnessing of local (including small-scale) private sector capacity. But because of the time-lag between reforms and outcomes, attributing causation is difficult. Factors largely 'external' to the sector also appear to be associated with better performance – particularly political stability (AMCOW, 2011).

This thinking is reflected in the Sanitation and Water for All (SWA) partnership between governments, donors, civil society and multilateral organisations – formed with an explicit objective of universal, and sustainable, access (SWA, 2013). At its heart is the notion that country governments need to assume political leadership for building country-led, accountable services, and their development partners need to support them. The UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS), a biennial assessment helping to track progress on SWA, finds that all 74 countries surveyed 'have made some form of political commitment to sanitation and drinking-water since 2010', such as service provision targets. Most, however, are found to be failing to meet these commitments. The GLAAS report goes on to review other core institutional functions, which are assumed to follow from political commitment and accountability: adoption of national policies; establishment of sector planning and coordination processes; and decentralisation. The findings suggest that while several reforms have advanced on paper, there is some way to go before they are effective in practice. For example, operational decentralisation is still often inhibited by a lack of fiscal decentralisation. While many of the sampled countries have recognised the human right to water (80%) and some the human right to sanitation (50%), few countries have established criteria for ensuring equity in investment planning, e.g. by targeting low-income areas. This is an important consideration if universal access is desired, and is linked to the financing question (UN-Water and WHO, 2012).

Progress in governance reforms for sanitation is perceived to be lagging behind drinking-water in almost all instances. This has long been attributed to a lack of public and political attention, especially in urban areas, where communities are less coherent (making awareness-raising and mobilisation more difficult) and many other infrastructural challenges compete for government attention. Despite the fact that an excreta-free environment is a clear public good, investment in sanitation is often assumed to be a household responsibility (at least in developing countries), even though household demand for sanitation may be latent. Consequently, governance reform for sanitation is not just about strengthening sector leadership, but also about increasing capacity for effective promotion and market development across numerous actors, including the domestic private sector, especially in urban areas. Meanwhile, within government, sanitation often falls between the remits of ministries for health, water and environment. Despite the incoherence affecting sanitation, however, it may be possible to exploit windows of opportunity at the individual level, while working towards more significant change in institutions as a whole. Evidence from Maharashtra in India suggests that to translate political buy-in into operational

action, it is important to build incentives for bureaucrats, making it clear that a career in sanitation can lead to recognition and promotion (WSP, 2012).

Insights such as this mark an increasing pragmatism in WASH governance. Recognition is emerging that, while reform blueprints are useful to structure broad partnerships and to monitor progress at a high level, the reality is usually messy. As such, there is greater need to understand the interests and incentives that condition the space in which governance reforms can, and cannot, succeed. Ways of approaching these questions, such as political economy analysis, are beginning to be applied in the WASH sector (WSP, 2012; Harris et al., 2012).

Polarised debates about the respective roles of public and private actors have also taken a more pragmatic turn. In urban contexts, many of the remaining unserved population live in informal and peri-urban settlements, where utilities often have reduced political, financial and technical capacity to extend their networks. While public utilities have struggled to serve these populations, wholesale privatisation has also not usually provided a solution (Marin, 2009). More innovative approaches emphasise engagement across numerous fronts, such as: increasing operational and financial efficiency to free up resources and raw water (WSUP, 2011); engaging and supporting local, small-scale private operators to offer enhanced services; and designing appropriate regulation, whether through a dedicated agency or careful contractual design (WSUP, 2013).

Water resources management

In the case of WRM, the paradigm of Integrated Water Resources Management (IWRM) has emerged over the past few decades as a response to the cross-sectoral nature of water resources. IWRM emphasises institutions and processes for 'coordinated development and management' of water alongside other resources (GWP, 2010). Proponents have been careful to frame it as a moving target, for which blueprints do not exist (GWP-TAC, 2000). As in the WASH sector, however, international monitoring of IWRM tends to imply a check-list of prerequisites, including mechanisms (e.g. commissions, councils) for groundwater, transboundary waters, and river-basin management at different scales (UNEP, 2012). For some, this means that a loose and abstract concept morphs into a prescriptive blueprint (Molle, 2008). While political economy analysis and related approaches are beginning to be applied in WASH, they are less visible in WRM.

In terms of specific institutions for WRM governance, the reform of water rights provides a test case. Water rights are especially relevant if 'universal access' is to be understood as extending beyond drinking-water to a reliable share of the water resource for purposes such as irrigation. Water rights are also likely to play an important part in reconciling withdrawals with available water resources (HLP target 6c), especially under climate variability. However, water rights are far from straightforward. In theory, a strong system of water rights, backed by a competent bureaucracy, permits defined shares of available water to be assigned and enforced (including for ecosystems). But evidence on attempts at rights formalisation suggests that care is needed. Imposing a 'modern' or formalised system of water rights on top of the complex mix of customary rights which pre-exists in many locations can advantage politically and economically powerful interests, who are better able to navigate and shape the system. This means low-income communities lose out, especially where infrastructure is insufficient to allow the allocated volume of water to be delivered to its assigned recipient at the right time and in the right volume (Mehari et al., 2009) – as is common in many irrigation schemes in developing countries. In the post-2015 context, it will also be critically important that water rights systems have the flexibility to manage climate variability and change, for example by assigning a fixed share of a variable volume, rather than a fixed volume.

In terms of increasing water efficiency or productivity (also emphasised in HLP Target 6c), water pricing is touted as a panacea. But allocations need to be defined and trusted before they can be priced, and the fact that effective water pricing necessarily entails a coherent system of water rights is often underemphasised. Pricing bulk water directly for uses such as irrigation is therefore unlikely to see rapid advances, except where there are a small number of clearly

identifiable users and there is sufficient institutional and infrastructural capacity to frame and enforce underlying rights. Incentivising water conservation in other contexts, for example where multiple small farmers pump ground and surface water privately, may need other institutional approaches. Rather than focusing on direct pricing of water, for example, it may be more effective to look to other price signals, such as the removal of subsidies for energy used for pumping.

Wastewater management and water quality

Governance in the wastewater management and water quality space has received less attention than in WASH and WRM. Ultimately, wastewater and water quality tend to be subsumed as integral parts of WASH and WRM, but then overlooked. Treatment and disposal of faecal waste and wastewater form the last, neglected components of the sanitation chain. Universal access to both water supply and sanitation will have significant impacts on the volume of waste and wastewater to be dealt with, particularly in confined urban areas. If the urban population of Nigeria currently without access to water supply were to gain access overnight to just enough water for consumption and hygiene, it would mean over a million additional m^3 in wastewater to be dealt with, every day.[9] While pit latrines and septic tanks predominate in many developing cities, it is often left to households to find their own solutions once these fill up. Meanwhile, utilities' responsibilities extend only as far as sewerage networks that serve wealthier areas (and that are often operating well above capacity, if at all). Municipal authorities may have nominal responsibility for on-site sanitation, including waste collection and disposal, but lack capacity and resources to fulfil the role.

Consequently, enhancing governance of wastewater in the context of universal access targets is not just a matter of tweaking institutions here or there (especially given the ambition of HLP target 6d to recycle or treat *all* wastewater). It will require a wholesale revision of mandates and governance arrangements. Enhancing the recovery of resources from wastewater (energy, nutrients and indeed water) is attractive from both a financial and environmental sustainability perspective. For example, further development of faecal sludge value chains in urban areas could act as an affordable wastewater management system for the poor (and even the middle class, in many cases). But making this work in practice while protecting human health will require further systemic changes, not only in formal institutions (e.g. regulation), but also in terms of informal institutions (e.g. behaviour and attitudes in relation to human waste).

Water quality in the broader hydrological environment is also arguably neglected when compared to the issue of water quantity, receiving far less 'investment, scientific support and public attention in recent decades' (UN-Water, 2012: p.94). Tackling this requires a strong regulatory framework and clear mandates for monitoring and enforcing standards – something lacking in many developing countries.

2.3.2 Finance

Alongside governance, finance – both new and more economically and socially efficient – will be a crucial contributor towards achieving universal and sustainable access to water services in the post-2015 context.

Water supply, sanitation and hygiene

At least eight useful estimates of finance needs for the water sector have been recently produced,[10] each approaching the sector with a different methodology, scope and timeframe, making them difficult to compare. These studies have estimated both baseline investment and the additional need (i.e. the finance gap) to achieve desired levels of service, with some considering only capital investment in infrastructure while others also consider O&M costs. Most have focused on investment in WASH services (or more accurately water supply and sanitation, as

[9] Based on 2013 urban water coverage data, WHO & UNICEF (2013), and WHO's 'average quantity of about 50 L/c/d' recommended to meet consumption and hygiene needs (including laundry and bathing) (WHO, 2003). The figure is not adjusted for evaporative losses or future population growth.

[10] Several older, pre-2007, estimates also exist, though they have been mainly omitted here, as it is assumed that these more recent studies would have mainly accounted for – and improved upon – these previous estimates.

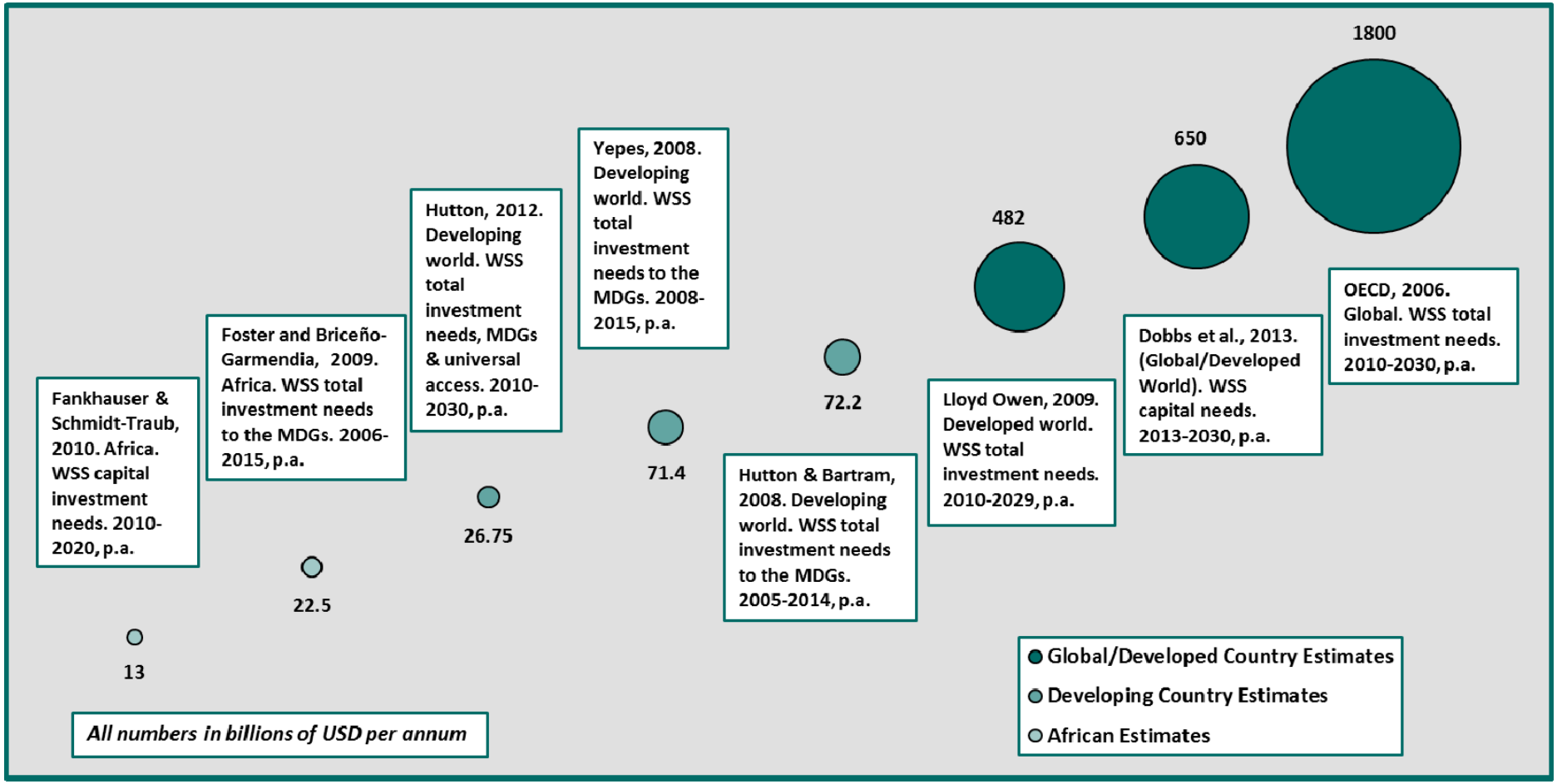
none have yet attempted to cost hygiene interventions). There has been a more limited attempt to cost WRM or wastewater management and water quality needs, as fewer data are available. The magnitudes of these studies' headline estimates are displayed in Figure 1 and detailed further in the Appendix.

Although it is risky to draw direct comparisons from Figure 1, one clear distinction is the differing orders of magnitude of investment needs presented by studies that focus solely on developing countries versus those that consider developed countries. This would suggest that the overall cost burden of universally achieving a minimum basic level of access, which will predominantly arise in the developing world, is much lower than the cost burden of maintaining and expanding advanced services in the developed world.[11] This suggests that the failure to achieve universality to date cannot be blamed solely on a global lack of finance. For example, using the Hutton (2012) and Lloyd Owen (2009) figures above, the cost burden of universality in the developing world is only 5.5% of the finance that will be needed for developed world services. Would the developed world thus be willing to sacrifice 5.5%[12] of necessary spending on their own services in order to achieve universality for the developing world? Forecasts made in 2006 put annual spending on water supply and sanitation infrastructure by developed (OECD) and emerging economies at around US$800 billion up to 2025, and US$1 trillion thereafter, again implying that these countries are already spending significant volumes on their own higher levels of service (OECD, 2006). These amounts nonetheless fall short of the upper threshold of annual spending required, US$1.8 trillion, shown in Figure 1. In a financially-constrained world, other routes will therefore need to be explored to bring to bear the finance required to achieve universal access. Overall volumes of finance and a focus on transfers from developed economies are only part of the picture. For universality to be achieved, the focus also needs to turn to the governance, equity and efficiency of this finance.

These three factors are intimately linked, with poor or inequitable financial governance often resulting in subsequently low efficiency in the usage of funds. For example, the Africa Infrastructure Country Diagnostic (AICD) (Foster and Briceño-Garmendia, 2009) estimated that nearly 75% of current African water supply sector spending was being wasted due to inefficiency. This includes wastage of funds within poorly performing government utilities (e.g. overstaffing, corruption, general mismanagement), operational inefficiencies (e.g. high non-revenue water losses from leaks and theft) and poor cost recovery from users (e.g. chronic underpricing of water tariffs, low user demand due to lack of awareness of the value of the service, or high costs of connection that preclude poorer people from joining the network and accessing cheaper, utility supplied water).

[11] That said, though, the cost figures detailed in the Appendix suggest that O&M costs for the developing world are themselves a substantial portion of current spending and future needs for these countries.
[12] Or less, if the Dobbs or OECD figures are used

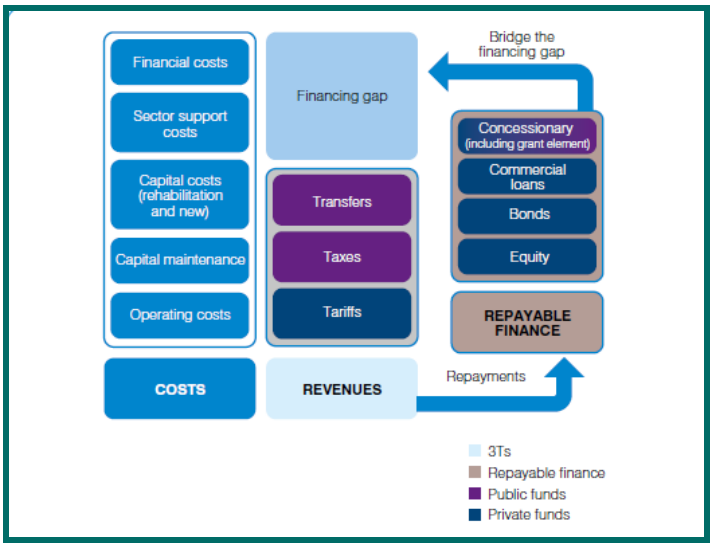
Figure 1: Summary of the major studies estimating the financing needs for water supply and sanitation (WSS) services (other cost data included in the Appendix). These studies are not easily comparable; this graphic simply serves to display their differing magnitudes, with the specific details of each described in the labels.



This is compounded by inequities in the spending that does occur. Reports like AICD and GLAAS highlight a number of compounding inequalities in both government and donor finance for the water sector, including: more spending on water supply (leaving sanitation/hygiene underfunded), more spending on capital investment (leaving O&M of existing infrastructure underfunded), more spending in stable low-income and middle-income countries (leaving the poorest, unstable countries underfunded), more spending on urban services (leaving rural areas underserved), and more spending on services for the wealthy (leaving the poorest underserved). Simply increasing financial flows would therefore not necessarily change these spending priorities, and governance changes will be needed to focus them more equitably.

Different actors – government, donors, service providers and households – each have a role to play in this aim for better financial governance, equity and efficiency. According to the OECD (2009), these goals are best brought about by these various actors through a focus on the '3Ts' for financial management in the water sector – taxes, transfers and tariffs. It emphasises that the right balance of government taxes, donor aid transfers and service provider tariffs / other forms of user finance can achieve sustainable cost recovery (i.e. closing the finance gap) while still being affordable. Trémolet and Rama (2012) then highlight that any remaining financial gap can be bridged via repayable or innovative finance from public or private sources, as displayed in Figure 2.

Figure 2: Summary of the main financial costs and sources of revenue for the water sector. Image from the GLAAS (UN-Water and WHO, 2012).



The issue of how much households should contribute to the cost of water services via tariffs and related payments is highly contentious. There is, however, an increasing recognition that user payment for water *services*, if not for the water itself, is essential if the enormous overall costs are to be met. At the same time, striking an appropriate balance between the 3Ts must not overlook the key issue of user affordability and demand for the services. The fundamental point is that the first two 'Ts', taxes and transfers, can essentially act as subsidies to relieve otherwise unaffordable tariff burdens on poorer households. This can be done both via general subsidies for all users (e.g. taxes and transfers to fund bulk water supply development, since the infrastructure's long lifetime would make it unfair to charge only to current users) or via specific subsidies targeted at the most disadvantaged (e.g. taxes and transfers to reduce connection fees, administrative paperwork, and usage tariffs for the poorest households). Economies of scale mean that, in urban areas, it is often far more affordable to obtain water via a household connection than through the numerous sorts of water-resellers, from tanker trucks to street hawkers. There are thus arguments for focusing subsidies on helping poor people to connect to the piped network in the first place, rather than subsidising consumption of piped water (Komives et al., 2005). Of course, addressing affordability (as a pre-requisite for universal

access) also requires strong customer relations and marketing, to ensure that users are aware of these various incentives and suitably motivated / empowered to pursue them (a complex and challenging undertaking in and of itself).

Likewise, striking the appropriate balance must not overlook the indirect costs that accompany repayable finance. As the OECD (2009) cautions, although private sector repayable finance can play an important role in bridging short-term finance gaps, this support is rarely unconditional or free. It inevitably brings about other costs to the public sector in terms of the private sector's need to be repaid or to be provided with a return (e.g. via public-private loan guarantees), sourced from one or a combination of the '3Ts'. Of course, while this may make these activities more expensive overall, it nonetheless enables activities to occur that might not have happened otherwise.

Water resources management

Generating cost estimates for the WRM sector has been particularly challenging. This is because the level of infrastructure required for water resource development – and therefore the required finance – largely depends on the development strategies of the sectors that rely on these water resources, such as energy, food (irrigation), flood defence, and so on. Thus, the only feasible method of costing WRM investment needs at global level would be a bottom-up assessment, which would be extremely challenging. All countries' specific spending priorities, from agriculture to climate change adaptation, would need to be assessed and the required water resource development and management extrapolated. Historic spending trajectories from developed countries might also inform assessment of future investment needs, assuming relatively similar hydrological contexts. Unsurprisingly, perhaps, this exercise has not yet been undertaken convincingly at the required scale. In terms of the HLP's WRM target proposal, specifically, it might be assumed that water efficiency savings across various sectors would generate savings, rather than costs. McKinsey (2011) for example estimates that tackling municipal water leakage could generate US$167 billion in savings, while more efficient irrigation techniques could generate US$115 billion. Such numbers for water efficiency should, however, be treated with care, again on the basis that unless it evaporates, water apparently 'lost' is likely to be put to other productive uses downstream, including sustaining ecosystem services.

Wastewater management and water quality

The costs of wastewater management provide one reason why the developed world / global estimates in Figure 1 are so much higher than the estimates for developing countries. The assumption made for most of the estimates for developing country investment needs is that the sanitation technology mix is unlikely to depart radically from what has been used to date: i.e. an emphasis on on-site forms of sanitation, rather than centralised, networked sewers which dominate in developed countries. The HLP ambition to include a target on treating or recycling all wastewater prior to discharge, however, implies that both networked and on-site sanitation waste will need to be managed. If a target of this nature is retained in the post-2015 development framework, it will require urgent work to estimate the size of these costs, and how they could be met. The mix of technologies does not necessarily have to follow the developed world model, reliant on high-cost centralised sewerage that often mixes storm-water and wastewater. Alternatives, including collecting excreta from pit latrines for composting, as well as small decentralised sanitation systems, will need to be explored, especially in urban areas. The possibility of resource recovery and wastewater recycling may also help to offset some of the costs. Nonetheless, it is highly unlikely that wastewater management will become cost-neutral, and the magnitude of investment needs should therefore be assessed as a priority.

2.3.3 Capacity development

Although tackling the issues of governance and finance would create much stronger momentum towards universal access, it is inevitably the quality of the practitioners – the sector's capacity – that will bring about change on the ground. Universal and sustainable access will never be achieved without skilled and satisfied human resources to advocate for water issues in their local communities; to build, operate and maintain infrastructure and services; to pioneer new research

and knowledge management; and to appropriately apply and use governance principles and new finance flows.

Water supply, sanitation and hygiene

The most recent assessment of capacity development and human resource needs is incorporated in UN GLAAS (UN-Water and WHO, 2012). It found that the majority of surveyed developing countries face human resource constraints – especially for sanitation and hygiene promotion – with a significant lack of data on key indicators for this topic. For example, ~50% of surveyed governments reported a lack of data on how many water sector staff were in place in their country. Likewise, only 40% of surveyed governments reported sufficient human resources to maintain urban drinking-water systems and only 20% for rural drinking-water systems. Only 18% reported sufficient human resources to meet rural sanitation needs. Additionally, 50% reported that women make up less than one-tenth of their professional WASH staff, indicating that a greater focus on inclusion is also critical. Countries generally reported that this lack of supply-side technicians and skilled labourers was a key barrier to sustainable service delivery. These types of national-level surveys may, however, simplify the local realities and inequalities within countries, so their data must be used with care.

Water resources management

The most recent assessment of capacity development needs for WRM was performed within the UN-Water IWRM status report (UNEP, 2012). Its findings were less detailed than those of the GLAAS, but nonetheless estimate that only 35% of surveyed governments (a global survey this time, including developed countries) have an advanced level of capacity development activity on IWRM issues – a figure which included activities to assess capacity needs, capacity development programmes, and other training and education programmes. As in WASH, one-third of the governments surveyed also reported inadequate inclusion of all stakeholders in WRM processes, including a consideration of gender mainstreaming initiatives.

Wastewater management and water quality

Assessments of human resources in respect of wastewater management and water quality are very limited, beyond what can be extrapolated from reports relating to WASH and WRM. The most relevant reports from Corcoran et al. (2010) and UNEP et al. (2004) only discuss capacity development issues anecdotally, though they suggest that weak capacity is a substantial problem within this sub-sector for many countries. UNEP's Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA) has likewise been providing training to municipal wastewater managers since 2003 (GPA, 2013), acknowledging this capacity development need. As mentioned earlier though, much more research and engagement by key stakeholders will be needed to further develop this sub-sector if progress is desired towards its potential post-2015 target, especially in emerging and urbanising economies, where wastewater management will be increasingly important.

Cross-cutting capacity development considerations

While the precise functions of water professionals may differ between WASH, WRM and wastewater management, they frequently work together and need to have expertise across all three domains. Consequently there are a number of cross-cutting considerations for capacity development in relation to the water sector as a whole.

An IWA assessment in 2011 (Cavill et al., 2011) highlighted, for example, that local governments – especially in small towns and rural areas – suffer the most from poor human resources, due to low salaries, few benefits, and poor working conditions. In general, it notes that the decentralisation of water sector governance to local governments has rarely been accompanied by a sufficient transfer of human (and financial) resources, often leaving these critical stakeholders unable to perform well on water sector issues. Likewise, the private sector, NGOs and donors have tended to attract the best water sector talent, both locally and internationally. The report also discusses how graduates often lack the practical/technical experience required for water sector jobs, due in part to inadequate coordination between the

industry and education institutes. The assessment thus recommended, *inter alia*: more support for education institutes (including those offering continuing professional education); more work experience opportunities for students; addressing the gender imbalance in water sector staff; more coordination between education and industry to ensure a focus on the skills required for water sector asset management and O&M; and a stronger focus on capacity development activities in small towns and rural areas.

Capacity development constraints interact closely with financial ones. The UN GLAAS found that 'inadequate budget' was the most frequently-cited reason offered by governments for their water sector human resource problems. However, the OECD (2009) highlights a critical dilemma with this statement: that an agency's absorptive capacity for additional finance depends fundamentally on the capacity of its staff to manage this finance. The World Water Development Report 2012 notes that there are thus no 'one size fits all' strategies to tackle this conundrum. However, an approach of 'strategic incrementalism' may be appropriate in many contexts, where iterative action could be taken to step up staff capacity while similarly stepping up financial flows (WWAP, 2012). Box 2 gives an example of this kind of approach in developing Rwanda's rural water supply and sanitation capacity.

Another valuable approach to capacity development across the water sector is the development and use of formal or informal knowledge networks. Many of these types of networks already exist and perform various knowledge-sharing and training functions, as reviewed by Luijendijk and Lincklaen-Arriëns (2009), including: the Global Water Partnership (global); the UNDP Cap-Net network for capacity development in IWRM (global); the Global Environment Facility's International Waters Learning Exchange and Resource Network (IW:LEARN) (global); the Sustainable Sanitation Alliance (SuSanA) (global); the Asia Pacific Water Forum (APWF) (regional); the Africa Water Utilities Partnership (AWUP) (regional); and the Collaborative Knowledge Network Indonesia (CKNet-INA) (country-level). Knowledge-sharing tools that bring different actors together, such as water operator partnerships (WOPs), are also useful for this purpose and can help transfer knowledge from high capacity stakeholders to lower capacity ones. These types of social learning are recommended in the WWDR as a key way forward, especially if doing so via greater use of information and communications technologies (ICT) (e.g. knowledge sharing through e-learning courses).

Box 2: Strategic incrementalism in Rwanda's rural water supply and sanitation sector

From the aftermath of the genocide, Rwanda progressively developed national capacity for its rural water supply and sanitation sector, within both the private sector and government. Iterative programmes of investment by development partners, both using and strengthening country systems for planning, expenditure management and implementation, supported this endeavour. Commencing with a sector policy in 1998 that embedded core principles, including community management and local cost recovery, the policy has been revised to take account of changes – for example, in 2004, to reflect the national programme of decentralisation. The original 1998 policy provided a basis for a US$20 million project from the World Bank (2000-2007), which helped to develop the implementation capacity of the rural water supply and sanitation unit within government. Small piped systems formed a major technology platform for the project, necessitating significant work to support local communities in taking charge of the day-to-day management of these systems, and to build district-level oversight capacity. Local private contractors were also engaged to carry out around US$10 million worth of works.

The result was a tenfold increase in rates of service delivery, jumping from 60,000 more people served per year to 600,000. The progressive investment in the country's own sector capacity at different levels permitted a countrywide sector programme to be developed with funding from numerous donors. The World Bank ultimately acceded to the government of Rwanda's preference to receive budget support, including via poverty reduction support credits for water.

Source: AMCOW (2011)

2.3.4 Environmental effects

When it comes to environmental sustainability, there may at first sight appear to be a tension between the drinking-water target – which implies increased water use – and the other targets – which aim to maintain the sustainability of water use. But as is so often the case, the environmental implications depend not so much on the targets themselves, but on *how* they are achieved. Firstly, the resource implications of increasing access to drinking-water (HLP target 6a) depend, fundamentally, on levels of service. Secondly, the HLP's WRM target proposal (6c) aims to conserve the resource and *may* free up water for ecosystems if their needs are factored into the water resource availability in a given context. But for many poorer countries, the first concern to increase water productivity is to develop infrastructure to store, withdraw and convey water, potentially increasing pressure on water resources. Finally, the HLP's target on wastewater (6d) presents fewer tradeoffs in relation to environmental sustainability, but it should not be ignored that treating wastewater requires energy and other resources.

Water supply, sanitation and hygiene

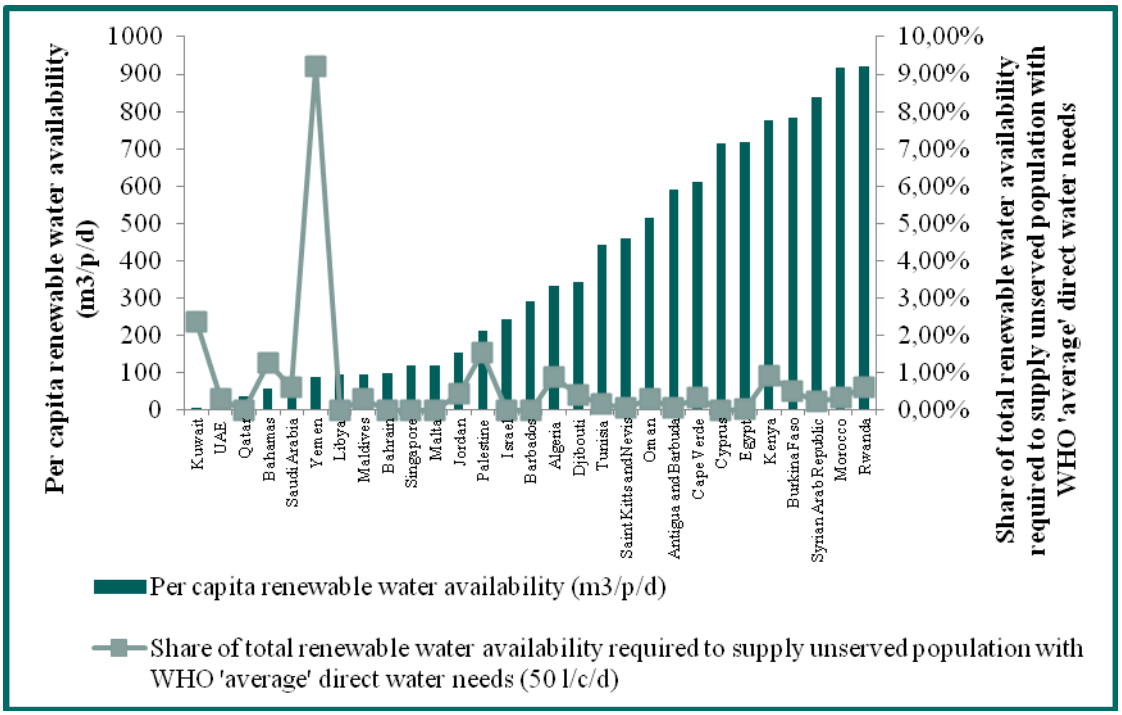
In purely volumetric terms, achieving universal access to water supply is unlikely to place a significant burden on available water supplies in most countries. The volume of water required to meet 'average' direct needs (drinking and hygiene, including laundry and bathing) is estimated by the WHO at 50 litres per person per day (L/p/d), or around 18 cubic metres per year (Howard and Bartram, 2003). This requirement is consistent with the Human Right to Water (UN, 2012a). The most widely accepted threshold at which a country faces water scarcity is below 1000 cubic metres of renewable water available per person. According to FAO data, this comprises 29 countries, the majority being Gulf or small-island states. Country-level figures on water availability are notoriously problematic, and local instances of physical water scarcity are possible even in 'wet' countries. Nonetheless, as shown in Figure 3, providing the unserved population with enough water for drinking and hygiene would require less than 1% of total available renewable water in the majority of these countries. The countries and territories which stand out as exceptions are Kuwait, the Bahamas, Yemen, and Palestine, where the water needed

to meet the unserved population's minimum basic drinking and hygiene needs equates to more than 1% of renewable available water . Yemen is a highly water-scarce country, with total per-capita renewable water availability of less than $100m^3$/p/y or c.250L/p/d. This volume must satisfy all uses besides household consumption, including much more water-intensive activities like irrigated agriculture. At the same time, nearly half the population currently lacks access to safe drinking-water. Of course, the 'unserved' population will be accessing some volume of water, often inadequate in both quantity and quality, in an attempt to meet their basic survival needs. But the ultimate position must be that, even in these water-scarce countries, water allocations to other activities (notably agriculture) will need to be reduced in order to meet the essential (drinking and hygiene) needs of their unserved population, while safeguarding a minimum quantity for ecosystems.

Higher levels of service may mean that reducing domestic water demand assumes greater importance, relative to the industrial and agricultural sectors. Household demand in the UK, for example, is as high as $100m^3$/p/y (Consumer Council for Water, 2013; upper threshold for single person household). But demand is significantly influenced by the convenience of different service levels. The JMP-led post-2015 consultation on WASH suggests the threshold for 'basic' drinking-water by 2030 should be defined as being from an improved source within a thirty-minute round-trip. Households depending on such sources would need to expend considerable labour even to acquire the 50L/p/d recommended for consumption and hygiene needs. It would therefore be unfair to view universal access to 'basic' drinking water through the prism of water availability, or to frame it as a tradeoff between the needs of people and the environment.

The environmental implications of achieving universal access to sanitation depend on how the waste is collected and disposed of. The vast majority of people in developing countries who do have access to sanitation are not connected to sewerage networks and instead rely on on-site technologies, such as pit latrines and septic tanks. The JMP consultation proposals do not signify a change in this regard, and it is therefore likely that, for cost reasons, on-site sanitation would feature substantially in efforts to achieve universal access to 'adequate' sanitation by 2040. On-site sanitation systems, however, fill up over time. In areas of higher population density, the issue of how faecal waste is collected and disposed of is therefore pressing. Often, whether it is emptied into the sewage system or disposed directly into ditches, streams and lakes, it ends up untreated in the freshwater environment. Even with basic conventional treatment, sewage can contain sufficient nitrogen and phosphorous to cause aquatic eutrophication. But diffuse sources, notably application of fertilisers to agriculture, are also a significant contributor to eutrophication, and the relative contribution of different sources of water pollution to eutrophication and 'dead zones' in lakes and oceans is difficult to assess. The alternative to universal access to adequate sanitation is continuing widespread open defecation, which poses much higher risks to human health. Similarly to water supply, universal access to sanitation should therefore not be viewed, in and of itself, as a net environmental pressure.

Figure 3: Per capita water availability and percentage of total availability required to meet drinking and hygiene needs of the unserved population in 'water scarce' countries



Source: FAO 2013, WHO and UNICEF 2013

Water resources management

The HLP's target proposal on WRM will also require a major reorientation away from past practice. The quantities of water required to sustain economies are significant, meaning that an individual's total 'water footprint' extends well beyond the 50L/p/d needed for drinking and hygiene.[13] Water footprinting is conceptually challenging, and impacts depend on what type of water is applied to what use, and where. That said, per capita water footprints have been estimated at country level as ranging from c.500 m^3/p/y (DRC) to almost 4000 m^3/p/y (Mongolia) (Mekonnen and Hoekstra, 2011). While generally higher in developed countries, a few developing countries exhibit very high water footprints, attributed to low water productivity – lots of water being used to produce a relatively modest amount of goods and services.

In terms of reducing overall water use and safeguarding the required quantity for ecosystems, agriculture is often the first consideration. This is because agricultural uses generally 'consume' significantly more water than other uses (over 90% of consumptive use (World Bank, 2010)). Consumptive use means that the water is not available for other uses immediately downstream – for example if it evaporates or is degraded to the extent that it cannot be used. The distinction between consumptive and non-consumptive water use is critical when thinking about water productivity and releasing water for ecosystem needs. Non-consumptive use of water to grow crops in an irrigation scheme might be reduced by lining the canal network to reduce seepage. But other users downstream, including ecosystems, are often reliant on the water from such apparently inefficient losses. Techniques such as conservation agriculture, which relies on principles such as minimising soil disturbance and maintaining permanent soil cover, can help reduce evaporative losses (consumptive use), as well as improving infiltration of rainfall to the

[13] According to the Water Footprint Network 'The water footprint of an individual, community or business is defined as the total volume of freshwater used to produce the goods and services consumed by the individual or community or produced by the business' (Hoekstra et al., 2011).

soil and reducing soil erosion (an important water quality consideration). Conservation agriculture is also applicable in dryland contexts where irrigation is not economically feasible or environmentally sustainable (WWAP, 2012). From a universal access standpoint, it will nonetheless be important to ensure that any broad narrative about increasing water productivity or efficiency does not become an excuse to reallocate water away from smallholders and poor people with water-dependent livelihoods, towards more advanced users such as commercial farms and industry. This will require capacity development, infrastructure, finance and linking poor rural communities to markets, in order to iteratively increase the capacity of low-income communities to access and productively use this water.

The negative implications for ecosystems of human interventions extend beyond the quantity of water they remove from water bodies, to quality, temporal and spatial impacts. As an example, an impounding dam designed to mitigate flood risk and facilitate diversion of water for irrigation can alter water availability downstream. But it can also disturb water temperatures downstream through abrupt releases of hotter or colder water; disrupt natural variation in flow on which key biotic processes rely (such as fish spawning); and fragment river corridors, isolating aquatic species with consequences for gene pool and population size (Vörösmarty et al., 2010). The complexity of environmental water requirements is only now being acknowledged, but adds to the argument that the historic 'hard path' of water resources management, dependent on heavy infrastructure and a centralised approach (Wolff and Gleick, 2003), must be revisited. Building an alternative paradigm is perhaps the central task for water resources management post-2015, including enhanced recognition of ecosystem services both as requiring protection through WRM, and contributing important WRM functions (such as enhanced flood regulation and water quality benefits offered by wetlands).

Wastewater management and water quality

The environmental considerations arising from a target on universal treatment of wastewater extend well beyond water resources, to land and energy: biogas as a substitute for fossil fuels and/or biosolids in place of synthetic fertilisers. The HLP's emphasis on wastewater recycling as an alternative to simple treatment and return to the environment is also important: nutrient-rich wastewater is already widely used for irrigation, especially across the informal economy in many developing countries. The challenge is to ensure that the health risks are appropriately managed. This is partly a technical matter – reducing pathogens to safe levels is possible with relatively simple methods, while the removal of organic compounds and toxic metals is more complex, especially for the chemically-complex mixed flows generated by urban areas. That said, managing such risks is also a matter that depends significantly on human capacity, governance, and behaviour and attitude change. This is an aspect of water management where, with a significant departure from current practice, a current net environmental and financial cost could be turned into a net benefit.

Chapter 2: Summary of Key Messages

Access to drinking water supply and sanitation were included as targets in the MDGs. In addition to completing this unfinished business, there is a growing consensus for the need to take a broader perspective and to include post-2015 targets on water resource management, wastewater management and water quality.

A better understanding of the differing interests and incentives of the various political stakeholders in water and sanitation is needed, in order to understand where, when and how governance reforms can succeed.

The overall cost of universally achieving a minimum basic level of service to water and sanitation is substantially lower than the cost burden of maintaining and expanding advanced services in the developed world. The emphasis should thus be on seeking more equitable, efficient and better-governed finance.

The necessary capacity development will only be sustainably achieved at scale alongside similar improvements to political will and investment, using a stepwise, incremental approach to sectoral financing and training.

The environmental implications of achieving universal access to water sector services will depend largely on service levels used to achieve universality. Available data imply that water scarcity should not be used as a general excuse for failure to meet essential human needs.

3 Energy

Written by Andrew Scott

3.1 The challenge

The use of energy is a critical factor in poverty reduction, and access to modern energy[14] has long been recognised as a prerequisite for achieving the current MDGs. Access to energy allows people to cook, heat their homes, use information and communications technologies, and benefit from better health and education services. Access to energy enables people to earn a living, widens their livelihood options and strengthens resilience in the face of economic, social and environmental change.

There is a strong correlation between energy consumption and per capita income, though this relationship is weaker at higher levels of per capita energy consumption and income. Energy is also linked to economic growth. Lack of energy and unreliable energy supply are a constraint on economic growth, and changes in energy prices impact on growth, especially for energy importing countries.

Energy consumption has an impact on the natural environment. Energy from fossil fuels accounts for around two-thirds of global greenhouse gas emissions and is thus a principal cause of climate change, which threatens particularly the lives and livelihoods of people in developing countries. Energy consumption also contributes to deforestation and is a source of air pollution which affects health and causes millions of premature deaths a year.

Between 1990 and 2008, around 2 billion people gained access to electricity (IEA, 2011). Total electricity consumption increased by more than 50% during the same period. Per capita energy consumption increased in most countries, and at a faster rate in developing countries than in industrialised countries. Nevertheless, 1.3 billion people still have no access to electricity and a similar number have only intermittent access. In addition, 2.7 billion people do not have clean and safe energy for cooking, which is the single most important use of energy in developing countries. Unless policies change and additional action is taken, there will still be 1 billion people without electricity in 2030 and the number without modern energy for cooking will be the same as it is today (IEA, 2012).

Greenhouse gas emissions from energy grew by 25% between 1990 and 2005, and they have continued to increase. In 2012 global energy-related emissions reached a record high of 31.6 Gt, an increase of 1.4% over the previous year (IEA, 2013). However, investment in renewable energy has increased and more than half of this increase is in developing countries. By the end of 2011, renewables accounted for more than 25% of global electricity generation capacity. In low-income countries, renewable energy sources provide more than half of total primary energy supply and a higher proportion of electricity than in industrialised countries. Nevertheless, under

[14] Modern energy is defined here as electricity and clean-burning cooking fuels and technologies.

the IEA's New Policies Scenario[15], the share of total final energy consumption from renewables globally is expected to increase from around 18% in 2010 to around 21% in 2030. Total energy consumption would rise by 29%, and fossil fuels will remain the dominant source of energy. Renewable electricity rises from 20% to 29%. Under this scenario, however, the world is not on track to achieve the agreed objective of a maximum 2°C temperature increase. This would require renewables to make up 50% of electricity by 2030.

Emissions can be reduced by decreasing the demand for energy as well as by switching to renewable sources. Improvements in the efficiency of use of energy, usually measured by energy intensity,[16] contribute to demand reduction. Energy intensity globally declined by an average of 1.2% a year during the period 1970 to 2009 (SE4All, 2012).

Amongst the challenges in the energy sector which the post-2015 agenda will need to consider are the critical barriers to scaling up access, the use of renewables and the adoption of energy efficiency measures. Watson et al. (2012) characterise the barriers to access as economic, technical, political/institutional and socio-cultural, but argue that these barriers need to be viewed in an integrated way; they are inter-related. Principal economic barriers are the high costs of investment, consumer access to finance, and limited commercial opportunities due to low incomes and dispersed populations. Technical barriers include the technical performance of equipment and the reliability of grid electricity, as well as knowledge and skills for the design, operation and use of modern energy systems. Political economy and social factors can influence energy investments and access to energy services, though Watson et al. (2012) found a limited evidence base for this type of barrier.

The barriers to scaling up the use of renewable energy, in the power sector and in end-use sectors, can be broadly classified as financial, regulatory and market-related (Beck and Martinot, 2004; IRENA, 2012). The high initial capital costs of renewable energy are balanced by low operating costs, but the financing costs can be high for large-scale investments because risks are high, and for small-scale projects transaction costs can be relatively high. The risks, which are related to long pay-back periods, can be political (e.g. uncertainty about medium-term energy or fiscal policy) or market-related (e.g. changes in competing fuel prices). These risks can be associated with regulatory and market barriers, respectively, and are related to institutional and capacity factors. Regulatory barriers can also include a lack of long-term energy planning, and project development and planning procedures. Market-related barriers include the absence or shortcomings of associated infrastructure, and fossil fuel subsidies.

Barriers to investment in energy efficiency include institutional difficulties for investors in capturing the benefits of improved efficiency and the challenge of changing behaviour and attitudes towards the use of energy.

3.2 A post-2015 energy goal

The significance of energy use for human development and environmental sustainability provides a strong case for energy to be the basis of a post-2015 development goal. The obvious starting point for consideration of a development goal or targets for energy for the period after 2015 is the Sustainable Energy for All initiative. Over the past two years debate about the role of energy in achieving poverty reduction and sustainable development objectives has been dominated by the Sustainable Energy for All (SE4All) initiative, led by the UN Secretary General. Partly in response to the absence of energy in the current MDG framework, but with an eye to the post-2015 development agenda, SE4All has formulated a goal and three targets which have been endorsed by government and civil society stakeholders. The targets combine the

[15] The New Policies Scenario takes account of relevant policy commitments and plans that have been adopted or announced by governments, even if they have yet to be implemented (IEA 2011).
[16] Energy intensity, measured in terms of units of energy per dollar of output, is the standard measure of energy efficiency at the national level. Because the structure of an economy can affect energy intensity, it is an imperfect measure of energy efficiency.

objective of poverty reduction and environmental sustainability and thus conform to the idea of Sustainable Development Goals agreed at Rio+20.

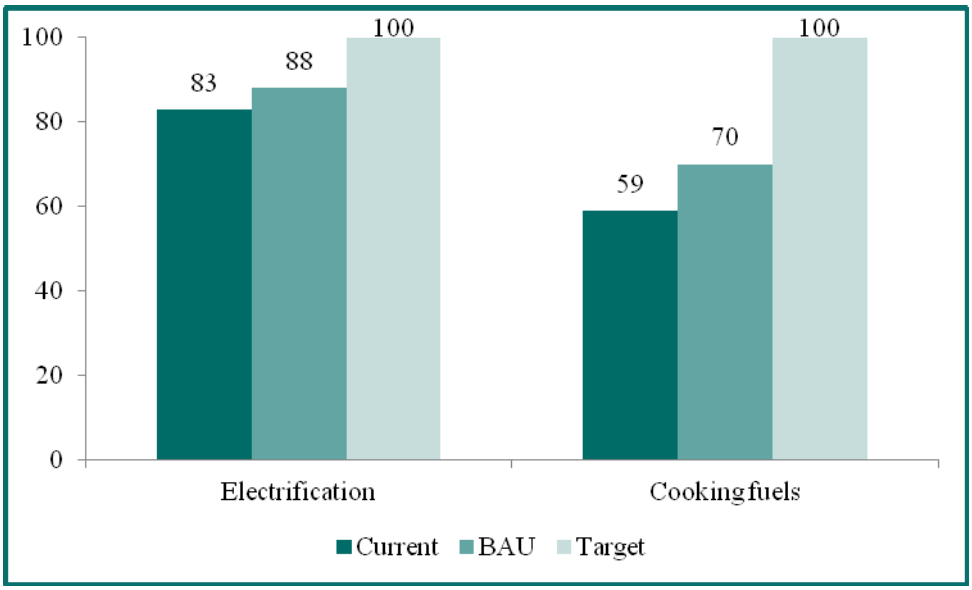
For this paper, and discussion below on what will be required to achieve a post-2015 energy goal, we adopt the SE4All goal: Sustainable energy for all by 2030. We also adopt, unchanged, the three targets:

- Ensure universal access to modern energy services.
- Double the rate of improvement in energy efficiency.
- Double the share of renewable energy in the global energy mix.

A number of other proposals for an energy goal and targets have been put forward, most of them variants of the SE4All goal. The Sustainable Development Solutions Network (SDSN), for example, combine energy for all with climate change mitigation into one goal: "Curb human-induced climate change and ensure clean energy for all". The SDSN suggest one target covering all three of SE4All's,[17] and include a target on non-energy emissions and a target on incentives to reduce emissions and promote technology transfer (SDSN, 2013).

The goal and targets of SE4All are closely echoed by the suggestion for an energy goal by the High-Level Panel. This confines the energy efficiency target to end-use sectors (i.e. it excludes energy efficiency in the power sector or in residential use) and adds a fourth target to "phase out inefficient fossil fuel subsidies that encourage wasteful consumption" (HLP, 2013). Removal of fossil fuel subsidies, already a G20 commitment, will be necessary to achieve the targets on renewables and efficiency, but it may be argued that the political challenge it presents for national governments warrants it being specifically included as a target.[18] Fossil fuel subsidy reform would need to extend beyond the consumer subsidies that are the focus of the HLP.

Figure 4: Comparison of current, expected and target access rates (%). Source: SE4All (2013).



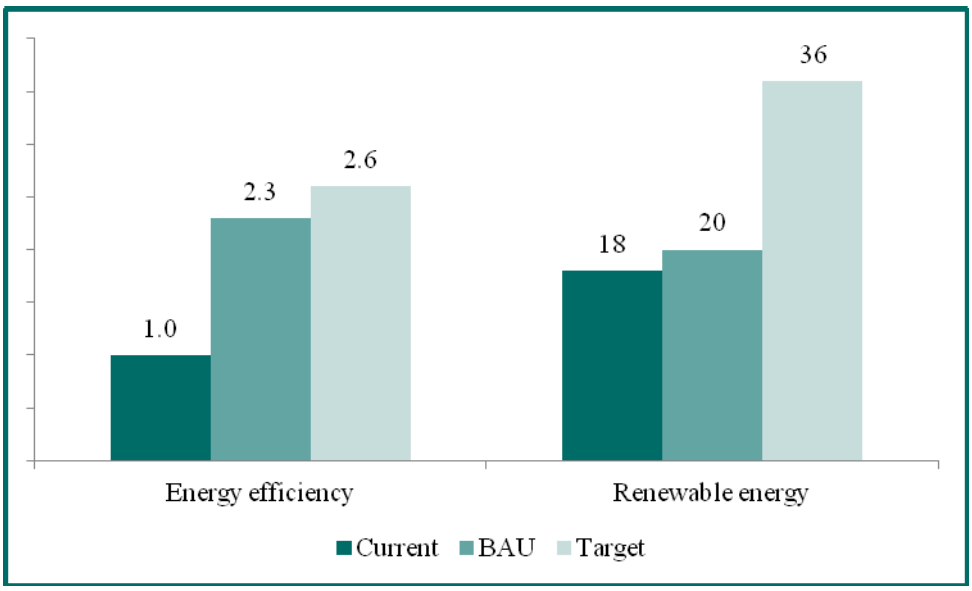
A target of universal access to modern energy services means increasing, by 2030, the proportion of the global population with access to electricity from 83% to 100%, as depicted in Figure 4, and increasing the proportion with access to non-solid fuels from 59% to 100% (SE4All, 2013).

[17] "Decarbonize the energy system, ensure clean energy for all, and improve energy efficiency, with targets for 2020, 2030, and 2050." (SDSN, 2013)

[18] The reform of fossil fuel subsidies, however, would need to extend beyond the consumer subsidies which the HLP highlights, and include subsidies for fossil fuel producers.

Access rates vary between countries and regions, and between urban and rural areas.[19] In absolute terms, the greatest numbers without access to electricity are in sub-Saharan Africa and South Asia, roughly 500 million people in both regions. The regional distribution of those without access to non-solid fuels is more even, but at 2.6 billion the number is much larger.

Figure 5: Comparison of current, expected and target clean energy levels. Source: SE4All (2013).



As illustrated in Figure 5, the target to double the proportion of renewable energy in the global energy mix means increasing the proportion from around 18% to around 36% (SE4All, 2013). Under business-as-usual (BAU) conditions, the proportion is expected to increase to 20% by 2030, making the gap to be filled by additional action 16% of total energy consumption.[20] Developing countries have a higher proportion of renewables in their current energy mix than industrialised countries, including a higher share of electricity from renewables. It will be action by the latter, therefore, that will determine achievement of the target.

Doubling the rate of improvement in energy efficiency means achieving a 2.6% annual reduction in energy intensity over the period to 2030 (SE4All, 2013). This can be achieved through a combination of technological innovation, structural change towards less energy-intensive economic output and behavioural change to reduce the demand for energy. All three approaches will be necessary, with sector-specific action and cross-sectoral efforts. Energy intensity tends to be lower in high-income countries, and the greatest potential to increase energy efficiency is in middle- and low-income countries. However, to meet the target, progress will be required in countries with high levels of energy consumption, such as the USA and China. Achieving greater energy efficiency in the industrial sector will be critical to meet the target, with the greatest potential in five sub-sectors: iron and steel, cement, chemicals and petrochemicals, pulp and paper, and non-ferrous metals.

3.3 Achieving universal and sustainable access

3.3.1 Governance

The SE4All initiative has taken a voluntary approach to commitments and a national approach to the setting of specific targets. SE4All has also suggested which actions will help ensure achievement of the goal by 2030 (see Box 2 at the end of this chapter). This voluntary approach is consistent with a framing of post-2015 global development goals that takes account of

[19] Definitions of access and what constitutes a minimum acceptable level of energy consumption also vary.
[20] This takes no account of the sustainability of traditional renewable energy use. IRENA suggests a target share of 30% if traditional biomass is excluded, making the gap 10% (IRENA, 2012).

differences in the capacities and contexts of different countries, while maintaining relevance to all countries. National policy frameworks will therefore be key determinants of progress towards a post-2015 sustainable energy for all goal.

Pachauri et al. (2013) conclude that dedicated policies will be required to achieve universal access to sustainable energy by 2030. Certainly, where there has been significant and rapid progress in providing the poor with access to modern energy (e.g. China, Brazil and Vietnam), there has been a clear policy commitment to this objective. In most cases, effective energy access policies are supported by targets, strategies and implementation plans. Around half of all developing countries have set targets for access to electricity (68 out of 140), while 17 have targets for modern fuels and 11 for improved cook stoves (Bazilian, 2013). The 61 developing countries that have opted in to SE4All have formulated, or are formulating, such targets and plans.

In industrialised countries where universal access to modern energy is well established, access policies and targets have a different emphasis. Here the challenge is inclusivity, ensuring that the poorest households can afford adequate and reliable energy (e.g. through cash transfers to those qualifying as energy poor). In middle-income countries that have reached, or nearly reached, universal access to electricity, there is often a need for further progress on access to clean fuels for cooking. In countries with high electrification rates, the challenge is to extend electricity to the poorest and most remote households, as well as to facilitate the adoption of clean fuels.

For the poorest households in developing countries, the affordability of modern energy is a barrier to access. Achievement of a universal access goal will therefore depend on policies that make energy more affordable, including through subsidies, cash transfers and financing to enable investment in cook stoves and other essential energy equipment. Consumer subsidies for energy need to be well-targeted to ensure the benefits reach the poorest households.

Coherent national policies for renewable energy and energy efficiency will be required to achieve the global target of doubling the proportion of renewables in the energy mix and increasing the rate of improvement in energy efficiency. At least 118 countries now have time-bound renewable energy targets of some kind. These are expressed variously in terms of the share of renewables in primary energy supply or final consumption, the installed capacity of a specific technology, or the share of biofuel in vehicle fuel. Policies for renewable electricity can be found in 109 countries, most commonly a feed-in-tariff or a renewable portfolio standard (RPS).[21] A range of policies are also used to encourage investment in renewable electricity and renewable heating and cooling technologies, including capital grants, tax credits and the competitive award of concessions.

To improve energy efficiency, policy frameworks focus on the regulations and standards that energy end-use sectors should meet (e.g. in buildings, vehicles and industry). The IEA (2012) advocates action to increase awareness of the gains from energy efficiency, to support investment in energy-efficient technologies and to integrate energy efficiency in decision-making throughout the economy and society. Generally speaking, the policies for more widespread adoption of measures to achieve energy efficiency and adoption of renewable energy are well known (SE4All, 2012).

Existing policies in many countries work against the objectives of Sustainable Energy for All by providing incentives to use fossil fuels (oil, gas and coal) or to use energy inefficiently, for example through direct subsidies or price controls. Globally, subsidies for fossil fuel use far outweigh subsidies for the use of renewable energy (see Section 3.3.2 below). Fuel subsidies are often introduced to enable the poor to access energy, but the majority of the benefit frequently

[21] A renewable portfolio standard, known in the UK as a Renewables Obligation, is a statutory regulation that places an obligation on electricity suppliers to source a specific proportion of their electricity from renewable energy sources.

goes to middle and higher income households.[22] Though the emissions from fossil fuel consumption by poor households are not significant for climate change, the quantities of energy consumed by subsidised non-poor households and commercial energy consumers are. Price caps on fossil fuels (which are indirect subsidies), either for power generation or final use, discourage investment in energy efficient technologies and processes. Subsidy reform will therefore be required, despite the political challenges that this presents in a number of countries. To contribute to universal access, as well as the renewables and efficiency objectives, subsidy reform will need to take account of the need to provide support to the poorest households.

Energy subsidies are politically salient because they are exploited by specific interest groups, and because they affect the disposable incomes of poor and non-poor voters. Investment in energy infrastructure, particularly large-scale infrastructure, can provide opportunities for rent-seeking, including corruption. Political economy factors can contribute to inefficiency, in both energy and management terms, including for example significant losses in the electricity system. The distribution of electricity can be used to secure political or personal advantage where accountability mechanisms and transparency are weak (Scott and Seth, 2013). Political economy factors will therefore influence achievement of equitable access to modern energy, the use of renewable energy and energy efficiency. Independent regulators, often specifically for the power sector, and effective accountability mechanisms, can mitigate political economy effects.

In developing countries, energy for cooking accounts for the largest proportion of final energy consumption, and about 9% of global total final energy consumption (SE4All, 2013). Particulate and gas emissions from cooking contribute to climate change and impose a heavy health burden. Yet, policies for this element of the energy sector are the least well developed, if they exist at all. That cooking energy is used primarily by women, and for domestic (reproductive) rather than productive uses, no doubt contributes to its neglect in policy-making. However, for universal access to modern energy by 2030, as well as energy efficiency, policies, strategies and plans will be required to deliver clean-burning fuels and cook stoves in the numbers required.

3.3.2 Finance

Finance is frequently identified as one of the key barriers to access to modern energy and to the scaling up of renewable energy. It has also been identified as a barrier to investment in energy efficiency, though such investments often generate financial returns. For low-income energy consumers, finance is a barrier because the costs for new electricity connections or for equipment prevent them from using modern energy, and because the recurring costs of energy services (e.g. monthly charges) are unaffordable. Finance for investment is a barrier for energy service providers (but poor management can also lead to a gap between operating costs and revenues). Achievement of the Sustainable Energy Goal will mean overcoming the finance barrier for the full range of different users and providers of energy services, with diverse energy needs in widely varying contexts.

[22] Recent research by the IMF concluded that the richest 20% of households in low- and middle-income countries received six times the benefit from fuel subsidies as that received by the poorest 20% (IMF, 2013).

Table 1: Estimates of costs to achieve sustainable energy for all ($ billion / year)

	Current (2010)	IEA (2011)	IEA (SE4All, 2013)	Global Energy Assessment (GEA, 2012)	GEA (SE4All, 2013)	Bazilian et al. (2011)	Pachauri et al. (2013)
Access Total	9.1	49		36-41		14-136	65-86
Electricity	9	44	45		15	12-134	12.6-17.6
Cooking	0.1	5	4.4		71	1.4-2.2	52.3-68.4
Renewables	228	278 [23]	>> 174	260-1,010	259-406	n/a	n/a
Efficiency	180		393	290-800	259-365	n/a	n/a
Total energy investment	417.1		>> 616.4		604-858		

Access

Investment to enable access to modern energy was estimated to be $9.1 billion in 2009 (IEA, 2011). Most of this was for electrification, enabling another 20 million people to gain access. Estimates of the financial cost to deliver universal access vary, depending on the assumptions made about costs and household consumption levels, and on the estimation methodology used. The IEA puts the investment cost at $48 billion each year to 2030, while other estimates range between $14 billion and $136 billion a year (Bazilian et al., 2011) (Table 1 summarises estimates). Though there might be some uncertainty about the accuracy of the investment cost estimates, it is clear that what will be required to achieve universal access by 2030 represents a significant order of change from current levels.

Most estimates consider only investment costs, but the Global Energy Assessment (GEA) (2012) and Pachauri et al. (2013) include the cost of measures to make modern energy affordable and accessible to the poorest. The operating and maintenance costs of energy services should be financed from revenues collected by service providers. However, the prices and tariffs charged by service providers, which are generally regulated by governments, may be higher than the poorest households can afford. Several mechanisms are available to make services affordable, including direct subsidies, cross-subsidies, price controls and cash transfers. The investment costs for poor households may also need to be subsidised directly or facilitated through credit schemes.[24] The proportion of households who may qualify for such support is likely to reduce over time as incomes increase, but the costs of this support must be provided by governments or other energy consumers.

The additional investment required to achieve universal access amounts to the equivalent of around 3% of total expected investment in the energy sector globally (IEA, 2011). By this comparison, the amounts involved are not huge and appear achievable. For the current providers of finance for energy access, the additional sums called for imply significant change, both in terms of the quantity of funds and what their finance is spent on. As many energy investments

[23] Estimated from $6.4 trillion figure for the period 2012-2035 (IEA, 2012)

[24] The recurring costs of modern energy for consumers can be lower than the energy expenditure of households before they gain access. Financial mechanisms to enable these savings to be used for investment would enable consumers themselves to contribute a higher proportion of the total costs of providing access.

are financed from more than one source, with different instruments and terms, how finance is bundled may also need to change.

In 2009, Official Development Assistance (ODA) accounted for 14% of global investment in energy access. 34% was provided by multilateral development banks, 30% by national governments and 22% by the private sector. ODA for energy access currently amounts to about 20% of total energy ODA, and the IEA suggests this should increase to $18 billion a year. Analysis by Gualberti et al. (2012) found that 65% of energy ODA (2000-2009) went to countries with electrification rates above 75%, while countries with less than 50% electrification received 15% of the finance, but had 54% of the population without electricity. However, electrification rates are not the only possible guide for ODA disbursements. Two-thirds of the population requiring access to electricity live in just 20 countries, including four middle-income countries. India alone (electrification rate: 75% in 2010) has over 300 million people without access. A post-2015 goal on sustainable energy for all may lead donor governments to consider the priority they assign to energy access in their overall aid programme, where their support should be deployed and how ODA for energy access can be used most effectively.

The governments of developing countries invested an estimated $2.7 billion in energy access in 2009, and the private sector $2 billion. According to the IEA, investment by developing country governments and the private sector both need to increase to $15 billion a year to achieve universal access by 2030. A sustainable energy for all goal would likely lead to many national governments reconsidering the priority they assign to energy access in their overall development strategy and expenditure planning. The scale of increase suggested would also suggest they strengthen their revenue raising effort[25] and develop new financing mechanisms. For private sector actors, commercial incentives for investment in energy access will continue to be the primary consideration. The small scale of many potential energy access (and renewable energy) investments will be unattractive to some private sector investors (e.g. large pension funds). However, policy measures and appropriate financial mechanisms can be used to enhance these incentives (e.g. by reducing risks, and facilitating investment by local investors).

Renewables

Global investment in renewable energy (excluding large hydro[26]) reached its highest level ever in 2011, totalling $279 billion, though this fell by 12% in 2012 to $244.4 billion (BNEF, 2013). In developing countries, investment increased by 19% in 2012, accounting for 46% of the total. Over the period 2012-2035, the IEA estimates that a total of $6.4 trillion will be required for investment in renewables, an average of $278 billion a year under business as usual conditions. Most of this investment (94%) will be for power generation (including associated transmission and distribution infrastructure), and a small proportion for biofuels.

Historically, one of the challenges for the promotion of renewable energy has been the high initial investment cost, followed by a lengthy pay-back period. However, the operating costs of renewable energy systems tend to be low, because there is no fuel cost for solar, wind and hydropower. Fossil fuel-based systems, on the other hand, tend to have lower investment costs, higher operating costs and shorter pay-back periods. The capital costs of new renewable energy systems (wind and solar) are falling, as technologies mature and markets expand, and they become increasingly competitive with fossil fuel-based systems. The cost of finance can still be significant for renewable systems, especially where risks are perceived to be high, placing renewable energy investments at a disadvantage because most costs are incurred at the time of installation. The long pay-back period associated with many renewable energy investments adds to the risks for investors because changes to policies and regulations during the life of a project can affect returns and financial viability.

[25] In some countries, tax revenue from fuel and electricity users will increase as consumption grows.

[26] Large hydro is excluded from BNEF estimates because of contested sustainability and social development impacts. In 2012, total renewable investment including large hydro was estimated to be about $250 billion (BNEF, 2013).

The objective of doubling the proportion of renewables in the energy mix is driven by the imperative to reduce greenhouse gas emissions, which continue at high levels because these environmental costs remain externalities. If prices to energy users reflected the full costs of energy, there would be a faster transition to renewable energy. Carbon taxes or effective carbon markets (cap and trade schemes) could accomplish this, and generate revenue for governments.

Subsidies can also be used to encourage investment in renewable energy. In 2011, renewable energy subsidies totalled $88 billion.[27] Over the period 2012-2035, the IEA estimates the total amount of renewable energy subsidy will be $3.5 trillion under current policies and plans. More than 25% of this is already committed to existing capacity, highlighting the longer-term financial implications of subsidising renewable energy investments. The effectiveness of subsidies to renewable energy in some countries would be improved if fossil fuel subsidies were phased out.

Energy efficiency

Investment in energy efficiency reduces energy costs for the consumer and these savings generate a financial return,[28] which can be used to finance the investment, provided there is a suitable financing mechanism available. A large proportion of these savings are in end-use sectors.[29] The McKinsey Global Institute (2011), for example, identified energy efficiency investment opportunities in construction totalling $696 billion, in transport fuel efficiency totalling $138 billion and in the iron and steel industry totalling $145 billion. Energy intensity tends to be higher in low- and middle-income countries than in high-income countries, and 70-85% of the energy efficiency investment opportunities identified by McKinsey were in developing countries. Robust regulations and product standards, combined with financial vehicles that allow public and private sector organisations to exploit energy efficiency investment opportunities, will be required to achieve the energy efficiency target.

The finance challenge for achieving all three of the Sustainable Energy for All targets needs to be considered in relation to existing patterns of energy investment. Estimates of the total annual investment to achieve the goal targets by 2030 range between $417.1 billion and $858 billion. McKinsey has estimated the need for $12.2 trillion investment, over the period 2013 to 2030, to meet existing global energy demand (i.e. to keep pace with expected growth in incomes and population) (Dobbs et al., 2013). Attention is on the private sector to provide much of the new investment that will be necessary. How public finance, including ODA, can be used to leverage private sector investment, in addition to increasing the incentives through policy change (e.g. carbon taxes), is one of the questions for national strategies to achieve sustainable energy for all. Loan guarantees, blended finance (a combination of grants and loans), policy and foreign exchange insurance mechanisms, and equity stakes, are all options (UNEP, 2012).

3.3.3 Capacity development

The goal of Sustainable Energy for All is technically achievable, but will require significant scaling up of investment in energy services and thus in the capacity to design, implement and operate energy systems, especially in renewable energy. For all three objectives, this expanded capacity will be mostly needed in developing countries and will need to be developed well before 2030 if the goal is to be achieved.

To achieve universal access to electricity, 45% of the additional power supply is expected to be through extensions to national grids. Around 20% will be from isolated off-grid systems, and 36% from mini-grids (IEA, 2011), pointing to a move away from the current bias towards centralised grid services. Effective operation of off-grid and mini-grid systems will require capacity to manage the service, including revenue collection (for the latter), as well as technical capacity to build and install. In many cases this will call for the development of markets for

[27] Fossil fuel subsidies were over $500 billion.
[28] Investment in improved cook stoves can also be viewed as an energy efficiency measure, but only generates a financial return when fuel is purchased, rather than gathered by women and children. A low opportunity cost of women's labour contributes to under-investment in improved cook stoves.
[29] The High-Level Panel suggests an efficiency target only for end-users.

energy services, energy equipment and appliances. Innovations, such as smart-grid and smart-meter technologies, will be required to reduce operational costs, manage loads and improve efficiencies.

To achieve a doubling of the share of renewables in the global energy mix, expansion of renewable electricity generation and the use of renewable energy by end-use sectors (e.g. transport and industry) will be necessary. Under optimistic scenarios, renewable electricity, mainly from hydro, wind, solar PV and biomass, could reach 50% of total electricity generation by 2030 (IRENA, 2012). The potential varies between countries and regions. In industrial applications, a few sectors offer potential for significant use of renewable energy: chemicals, petro-chemicals, cement and iron and steel.

In the transport sector, there is technical potential to use renewable biomass for fuel, though the environmental and social implications of scaling-up biofuel use would need to be taken into account. The potential for the use of electricity, i.e. renewable electricity, for transport will present a challenge for most countries to develop the infrastructure and markets for associated goods and services.

To achieve the energy efficiency objective and overcome many of the institutional barriers, countries will need to revise and enforce standards for buildings, industrial processes and vehicles, as well as for many electrical appliances. Institutional and attitudinal barriers to energy efficiency call for the introduction of measures to raise awareness and capacity to measure and publicise progress.

The technologies needed to achieve the sustainable energy for all goal already exist, though innovation in some areas, such as electricity storage technology and smart grids, would help reduce costs and improve efficiencies. Increased public investment in energy research and development will be necessary.

3.3.4 Environmental effects

Two of the Sustainable Energy for All targets are concerned principally with reducing the environmental effects of energy use, most importantly the mitigation of climate change through a reduction of greenhouse gas emissions. Poverty eradication and the access objective are potentially in contradiction with this objective, as they entail an increase in energy consumption for the poorer sections of society.

Estimates of the total additional demand for energy implied by the universal access objective range from 167 million tonnes of oil equivalent (mtoe) to 179 mtoe (SE4All, 2012; IEA, 2012). The environmental effects of this increase will depend on how it is achieved. In their Energy for All Case, the IEA assume that 97 mtoe (54%) of this additional energy consumption will be from fossil fuels and will contribute to greenhouse gas emissions. The net effect of increased fossil fuel consumption by poor households and reduced traditional biomass consumption is estimated to be a 0.7% increase in global greenhouse gas emissions (IEA, 2012). By taking account of avoided emissions from traditional cooking fuels and the unsustainability of some traditional biomass consumption, Pachauri et al. (2013) estimate a reduction in emissions from achieving universal access. Additional energy consumption by the non-poor and their growing prosperity will have a more significant effect upon global emissions (Chakravarty and Tavoni, 2013).

Achievement of the three targets of SE4All would contribute to climate change objectives and, according to recent research, if all are achieved there would be a 66% chance of meeting the goal of keeping the global temperature rise below 2°C (Rogelj et al., 2013). By contrast, the IEA estimates that business as usual would result in a 50% chance of a 3°C temperature increase by 2100 (IEA, 2013). Rapid progress on increasing the proportion of renewables in the energy mix and on energy efficiency will be needed to avoid lock-in to an emissions trajectory incompatible with the 2°C (IEA, 2012). This points to the need for a meaningful price on carbon. Though achievement of the sustainable energy for all goal is necessary to meet the climate change goal agreed under the UNFCCC, it will not be sufficient.

The phasing out of traditional solid biomass used for cooking will have a positive impact on the health status of poor households, and particularly of women and children. Up to 4 million deaths a year can be attributed to household air pollution from unsafe and inefficient cook stoves (SE4All, 2013). A further 200,000 deaths are due to burns from cooking fires. The use of non-solid fuels instead of traditional biomass would reduce this disease burden, as well as the time and physical effort many women and girls put into gathering fuel. Improved energy efficiency in motor vehicles would contribute to reduced atmospheric pollution, which is currently a major health hazard, especially in urban areas.

Achievement of the renewables target may entail a significant increase in the production and use of liquid biofuels. Though biofuels are a renewable source of energy, they may not make a net contribution to emission reduction. Opinions also vary on the effects that expanded biofuel production might have on food production and food security for poor households.

Box 3: Sustainable energy for all – what will it take?

Access
- Invest in energy generation, including grid and off-grid.
- Expand transmission and distribution networks.
- Build markets for off-grid lighting in rural areas.
- Provide targeted subsidies for energy access.
- Focus on clean cooking solutions.
- Improve household and country-level surveys.

Efficiency
- Improve energy efficiency standards for buildings.
- Phase out untargeted fossil fuel subsidies.
- Introduce policies that put a price on carbon.
- Install smart-grid and smart-meter technologies.
- Implement urban planning that highlights energy savings through building, transport and other infrastructure.
- Public awareness campaigns on saving energy.
- Strengthen capacity to collect data on energy intensity, efficiency targets, policies and investments.

Renewables
- Establish a price for carbon.
- Phase out untargeted fossil fuel subsidies.
- Introduce policy incentives for renewable energy such as feed in tariffs, renewable portfolio standards, auctions.
- Increase capital flows and reduce risks associated with investing in renewable energy.

Source: SE4All Infographic

Chapter 3: Summary of Key Messages

Unless there is change in energy policy and practice, 1billion people will still be without access to electricity in 2030, 2.7 billion will still not have clean fuels for cooking, and energy-related greenhouse gas emissions will continue to rise.

Dedicated national policies and targets will be needed to ensure universal access to modern energy services. These are currently missing in half of all developing countries. Targets for renewable energy and regulations to promote energy efficiency will also be needed, within coherent overall national energy policy frameworks.

The investment required to achieve universal access is significantly greater than current levels, though as a proportion of total energy investment it is quite small. There will be a need for support to enable the poorest households to afford access to modern energy. Policy measures can be used to enhance the incentives for private sector investment in access, renewables and energy efficiency.

The extension of access to energy services, particularly through off-grid systems, and greater adoption of renewable energy require development of technical and organisational capacities and energy sector markets.

Universal access to modern energy services would result in a less than 1% increase in greenhouse gas emissions. By reducing air pollution, it would have a significant positive impact on the health status of women and children.

4 Transport

Written by Tobias Dorr

4.1 The challenge

Transport, unlike water, is not a recognised human right, but is nonetheless an instrumental factor to achieve many human rights, and its importance exceeds mere mobility. The sector is highly diverse in the arena of international development, ranging from infrastructure for roads and railways to institutional frameworks for public transport, to pricing and maintenance. It is a connector of economic actors to regional and international markets, and hence creates social as well as economic benefits. Weak transport infrastructure leaves nations with limited opportunities to trade goods and establish a manufacturing market. Isolation in rural areas can have detrimental impacts on farmers who will not be able to escape subsistence agriculture, which in turn critically affects the state of society and efforts on poverty reduction. Absent or degraded transport infrastructure disrupts movements and transactions, increases costs, wastes time and impedes competition, leaving behind a constrained national economy and restricted individual capabilities.

A functioning transport sector, on the other hand, can transform these challenges into a variety of possibilities to advance economy and society. Transport is at the heart of the spatial-economic evolution of any economy, and a well-functioning transport network is *sine qua non* for the competitiveness of regions and cities (Nijkamp & Rienstra, 1995; Bruinsman, 1994). According to UN Secretary General Ban Ki-moon:

> *"transport is a key building block for sustainable development. Access to goods and services through efficient means of transport and connectivity is essential for poverty reduction. In both urban and rural areas, better planning for land-use and transport systems makes a great difference in facilitating access to jobs, goods and services for men and women alike. On a global scale, it is essential to design and build transport infrastructure to make it safer and more environmentally friendly, and to minimise vulnerability to climate change and natural disasters" (Ban, 2013).*

Transport is thus central to sustainable development. Investment in transport infrastructure and services is likely to have a high impact on poverty and more generally on economic growth and productivity, including access to jobs. Improving transport services is a major development strategy.

Governance plays a major role in delivering transport services equitably to all people. Often, policies are inadequately managed, while planning, regulations and subsidies follow a top-down model. In developing countries, this leads to a disproportionately strong influence by wealthier members of society, whose priorities differ significantly from poverty-reduction efforts. As with the water and energy sectors, the political will for inclusive and sustainable transport is often lacking. Furthermore, short-term gains are often preferred over long-term projects, and new infrastructure over maintenance. The nature of a democratic political system suggests that for electoral gains, progress needs to be shown. This is more inherent to transport construction

projects than to reforms of the entire sector that could secure the private investment, long-term connectivity and maintenance required (Starley et al., 2002).

Corruption constitutes a major challenge. Historically, the transport sector has been vulnerable to fraud, which can become a main barrier to access to transport services. Corruption costs and other forms of inefficiency mean that weak governance and low capacity can increase transport project costs by between 10% and 40%, which heavily impacts the budgets of developing countries. The effects are felt by society as a whole, but the poorest people are unable to mitigate these impacts. They often do not have a voice to claim compensation for injury or wrongdoing that results from corrupt institutional systems, and so lack an opportunity to lift themselves out of poverty (World Bank, 2013).

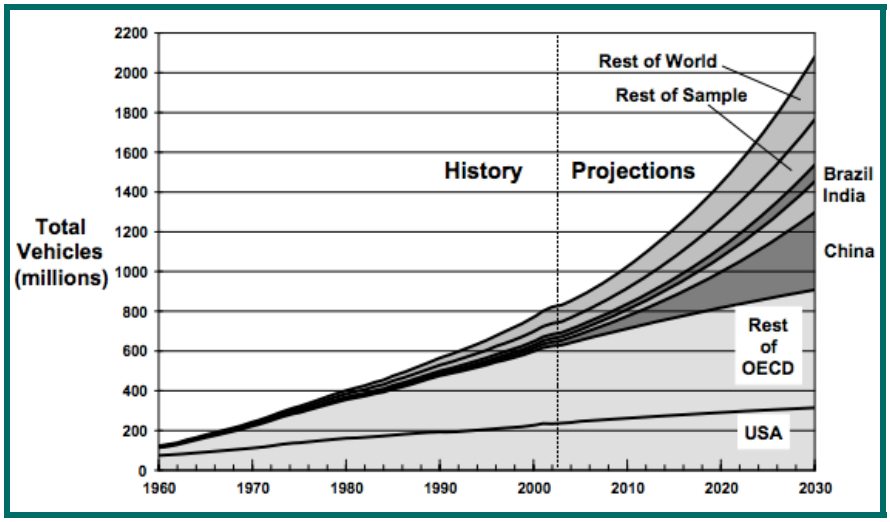
The poorest are often neglected by service providers as they bring only limited profits. In rural areas, groups might be excluded due to the lack of infrastructure, such as all-weather roads, or bus services. While there is much uncertainty over an appropriate indicator to measure connectivity, one target suggested by Carruthers et al. (2009) is to reach people on lands producing 80% of agricultural value. However, this solution would perpetuate the problem of exclusion by improving access for those with means of income, and excluding the most unfortunate last 20%. In urban areas, the existing infrastructure can still exclude large parts of the population, as transport may not be affordable or public transport may simply be insufficient for the number of people living in a given area.

Considering the expected growth of the transport sector, which predicts a doubling of the number of vehicles between 2008 and 2018 (Figure 6), with emerging economies accounting for the largest share, a lack of health and safety standards will become a major concern (Watkins, 2012a). Road traffic causes more annual 5 to 14 year-old deaths than the main diseases of HIV or malaria, and it has become a “global public health epidemic” (Watkins, 2012b). About 1.3 million people die on the world’s roads every year, and 50 million people are injured, often severely and left with disabilities. Every 6 seconds someone is killed or seriously injured on the road. The majority (60%) of these accidents occur in the developing world and the major emerging economies, mainly in Asia, which will account for half of all vehicles worldwide by 2018 (Watkins, 2012b). While road safety efforts have yielded impressive progress in many developed countries – exemplified by a halving of road fatalities in Australia over the past 25 years (ATSB, 2008) – developing countries face two challenges: growing private vehicle owner rates on the one hand and the need to implement strong legislation regarding road safety and health on the other.

Action is needed now to prevent the sector from growing any further along a business-as-usual path without appropriate standards, and to avoid the higher costs of delayed system reform. If this does not occur, especially for urban areas, the effects of unsustainable and dangerous transport will effectively impede progress towards the MDGs and post-2015 goals. It has been estimated that GDP in Asia is lowered by 2% to 5% because of death and injury resulting from traffic-related health consequences[30] (UNCDR, 2013).

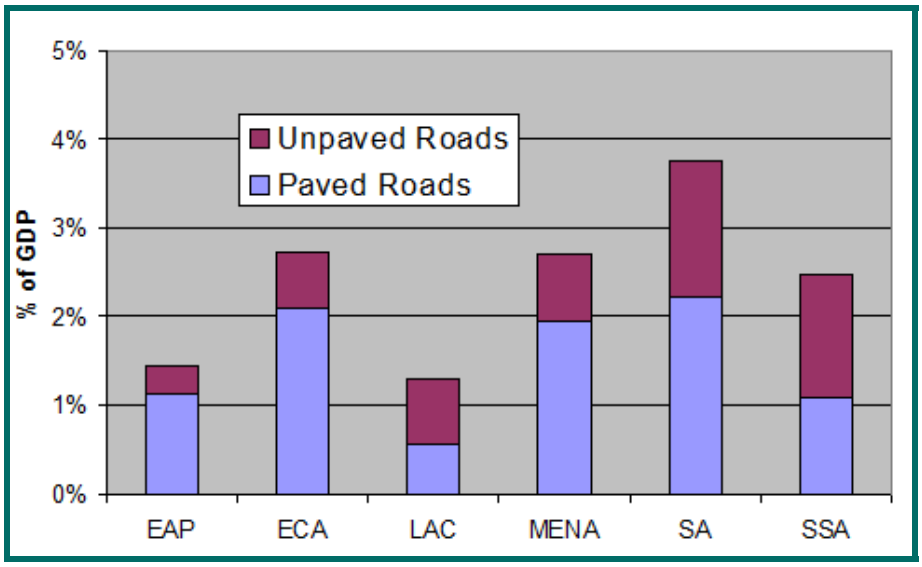
[30] Such estimates can include direct victims from accidents and indirect victims through the effects of pollution.

Figure 6: Growth in vehicle numbers to 2030. Image from Watson, 2012a.



Establishing an appropriate transport network is a major challenge, as construction and maintenance require large-scale and long-term investments. Yepes (2008) suggests that the transport sector requires the second largest investment (2.3% of GDP), after providing for a functioning electricity network (3.0% of GDP). However, the disparities between regions are significant, as is the difference between capital investment and maintenance costs, where the latter are almost four times the former. Yepes (2008) estimates the annual investment needs in the developing world to amount to $338 billion (at 2005 prices) with roads and paved streets the main expense (87%). Maintenance is much more costly than the initial investment and constitutes 79% of the total costs.

Figure 7: Annual investment needs for roads, 2008–15. Adapted from Yepes (2008).



Public funding is constrained by limited fiscal options, other expenditure commitments, high managerial and labour operating costs in the transport sector, and the need for cross-subsidies where revenues are lacking. Private funding is tied to expected revenue streams from an investment. Many rural areas, as well as disadvantaged urban areas, will not generate sufficient funds for private investment to be worthwhile. A difference in the purpose of investment in the

transport sector can obstruct public-private partnerships (PPPs). For governments, it is an end in itself, while for the private sector it is a means to an end, namely a source of profit. Because it often involves large investment, even sharing the risk is an option that the private sector can be reluctant to take (Rodriguez, 2013). In the end, the design of such projects must still ensure the affordability of the service for all users.

In government ministries, knowledge of the importance of equitable and sustainable transport and of ways to solve transport problems remains critical. Challenges are manifold, such as connecting the unconnected, making cities more sustainable in the light of urban population growth, or proposing adequate and realistic pollution standards. Providers lack the expertise on how to overcome barriers, or how they might be able to contribute to solving the problem. Often the emphasis is put on investment in connectivity, while maintenance is an even more important factor, as an absence of preventative investment could lead to high follow-up costs. Though desperately needed, only a very few cities in Asia have effectively integrated climate considerations in plans for urban development, which would combine transport, disaster risk management and energy to make a transport system more resilient to climate-related shocks. As costs are significant, such adaptive capacity is expected to be lower in sub-Saharan Africa (Cameron, 2012). Despite the potential, cooperation between developing countries so far has been the exception in the transport sector, rather than the norm. The requirements and contexts vary, but can be controlled for, and experiences would be transferable to other countries. Similarly, road user management is limited. While much is expected from the state or the private sector in providing a functioning transport service, users should change their transport habits as well.

The transport sector has significant environmental effects, including air pollution and greenhouse gas emissions. Pollution is a major problem in urban areas, in both developing and industrialised countries. Only three out of ten Asian cities meet the most lenient WHO interim target for fine particulates, which can have critical impacts for urban populations (UNCDR, 2013). Transport accounts for between 25% and 80% of local air pollutants in cities, which are the cause of, and exacerbate, respiratory illness, heart disease and cancer. Premature deaths are estimated to reach 2 million annually, 50% of which occur in developing countries (Watkins, 2012a). Stronger legislation is often lacking or not enforced.

Emissions due to freight and passenger transport are also crucial. The IEA projects that 24% of global CO_2 emissions arose from the transport sector in 2006 – two thirds coming from road transport (OECD/ITF, 2009). The IPCC expects this number to rise significantly if current patterns are kept up: its figures exceed the previously mentioned estimates and suggest that car ownership will triple to over 2 billion, trucking will quadruple, and related greenhouse gases (GHGs) will grow by 80%, by 2050 (IEA, 2009). Hence, when planning universal access to transport, sustainability is a key consideration. Sustainable transport enables more equitable access to goods and service while limiting its short- and long-term negative environmental, social and economic effects (Slocat, 2012). It will, however, be a major task to shift towards a more sustainable system that does not focus on cars as individual status symbols, but prefers the use of public transport.

4.2 A post-2015 transport goal

Transport is not included in the current MDGs, which have had a crucial impact on development progress. A subsequent lack of investment leads to there being less data available to assess progress in access to transport services. The gap of commitment results in fewer international and national debates on the importance of transport, leaving it outside of the international development agenda (Hook & Howe, 2005; Scott & Seth, 2012). As the importance of transport in development has been endorsed by the UN, as well as through Ban Ki-moon's '5 Year Action Plan' commitment, with sustainable development being one of the six key pillars supported by transport, there is good reason to put forward a sustainable development goal (SDG) on

transport. Reaching it would foster economic growth and create job opportunities at the same time (Slocat, 2012; UN, 2012b).

The Partnership on Sustainable Low Carbon Transport (Slocat) has proposed an SDG on transport related to its own focus. The goal links in particular to low-emission development, while hinting at aspects of inclusive growth (Slocat, 2012). Environmental sustainability is surely a key factor when deciding upon SDGs, but it might be argued that a transport goal should also focus on economic participation and enhanced capabilities amongst the population. In this respect, the International Forum for Rural Transport and Development (IFRTD) suggests a goal that primarily stresses the need for enhanced rural mobility (IFRTD, undated). Their proposal seeks to halve the number of those in poverty due to a lack of transport mobility.

It is evident that these two proposed transport SDGs follow the specific agendas of the respective organisations. It should, however, be in all our interests to address all aspects of sustainable transport, recognising that transport is an enabler to other development goals, and linking it only to green growth or rural accessibility could neglect other development efforts. In relation to road safety, Watkins (2012b: p.35) proposes a separate transport safety SDG and remarks that:

> *this could include specific targets for road safety, local air quality and fuel efficiency, including a goal of reducing road fatalities by 50% by 2030. This is a potential win-win scenario that will save lives, create jobs, and reduce the adverse environmental impacts of road transport. Our goal must be to make roads safe, accessible and sustainable for all.*

Not being able to access transport infrastructure, or being subject to an unsafe service, not only restricts individual mobility, but also generates substantial barriers to growth and capacity building. Moreover, despite the need to include the rurally unconnected – an undertaking of relatively low cost – infrastructure design must increasingly focus on cities, green urban transport solutions and the growing number of rural-urban migrants, who the current infrastructure leaves immobile because of affordability or poor services. The transport goal suggested here (see Box 3 below) addresses sustainability on the environmental, social, economic, political and cultural side alike.

Box 4: A transport goal

Realise universal access to sustainable transport mobility

- The number of the urban and rural poor for whom transport accessibility problems severely restrict access to employment and essential services is eradicated by 2030.
- The proportion of victims from traffic-related accidents is cut in half by 2030 compared to 2010.
- Reduce GHG emissions from passenger and freight transport by 40% by 2030, compared to 1990 levels.
- Double the share of public transport users by 2030.

This certainly is an ambitious goal with strong targets, but evidence from Slocat and others suggests reaching them should be possible. The focus here is on the road sector, as this is the most frequently used mode of transport. The current challenges are not only characterised by missing financing solutions, but by an inadequate institutional framework. Addressing these challenges can lead to a win-win situation for the public and private sector, as well as the users themselves. The specificity of targets mentioned under the Slocat proposals will constitute valuable indicators for the SDG suggested here. It is important to underline the multiplicity of

economic, safety, environmental and urban future-oriented activities involved to reach such a socially sustainable goal.

4.3 Achieving universal and sustainable access

4.3.1 Governance

In order to establish an adequate institutional framework for achieving the transport goal suggested above, policy-making needs to change fundamentally towards more intermediate and long-term planning and regulation, in developing and emerging countries in particular. Policies must become coherent and should create an environment that stimulates private sector investment. There is a need to acknowledge that connecting the unconnected is critical for poverty reduction efforts (IFRTD, undated). The Asian Development Bank (ADB) (2007) found that improving rural accessibility has a positive impact on poverty reduction, by reducing costs, establishing market links and facilitating pro-poor economic growth. The access to health and education facilities that such improvements enable enhances social development. Improvements to accessibility can also empower rural communities and strengthen local government.

While reducing isolation, the core problem, according to the ADB, is a transport sector issue, which requires the correct rural institutional development process. The lack of access to transport services is a major political issue and exceeds the mere concept of building roads. An appropriate institutional framework must provide for investment and secure projects. With it, rural people gain access to markets, services and resources, and the public and private sectors have an additional outlet for their goods and services. While this chapter mainly focuses on the road sector, it is crucial to note that the institutional frameworks provide for other means of transport, such as bicycle or waterway infrastructure as well.

To increase rural mobility, it will be necessary to thoroughly plan for public facilities and multiple mobility solutions. This can only be addressed as a local-level issue with a people-centred approach to identify specific requirements. Such a shift towards decentralisation has a significant impact on stakeholder relations and allows the people on the ground to decide what is needed (World Bank, 2012). Yet, these systems need to be linked to regional and national networks to ensure connectivity to goods and services that can be moved in and out of rural areas. Thus, an ideal transport system relies on a well-functioning link between bottom-up legislation and top-down connectivity to reduce economic distances and include society as a whole. The higher levels of a transport system, however, can operate without good rural accessibility, but not vice versa. Consequently, rural accessibility has often been neglected in transport infrastructure development (ADB, 2007). To achieve change, increased efforts are needed in quantity control (to match demand and supply) and quality control (to ensure safety for road users, as well as environmental protection). For rural transport often the main regulatory issue is how to increase service quantity (Starley et al., 2002).

Secondly, the issue of corruption is critical from the governance side. The World Bank (2013) estimates that corruption can account for 5% to 20% of the transaction costs in the infrastructure sector, which makes up 10% to 20% of the national budget in South Asian countries. This phenomenon occurs in all project cycle phases and is facilitated by a weak institutional environment that reinforces poor regulation, allowing circumvention by illegal means, such as bribery, to trespass safety standards. By addressing corruption and other inefficient activities, transport spending could potentially be reduced by 10% to 40%. This, however, requires strong governance. The South Asian region has made progress by establishing advisory committees that serve to share experience and disseminate best practices for identifying and mitigating fraud or corruption (World Bank, 2013). Such governance projects represent two-pronged anti-corruption efforts: they work within bank operations and within the economy as a whole. Official Development Assistance must address both aspects when involved in transparency initiatives, as this has the potential to cut significant amounts of unnecessary spending on transport infrastructure services. Transparency initiatives must accompany any donor pledge to credibly enforce such commitments.

Box 5: Anti-corruption efforts in India

The Indian state of Orissa developed the Governance and Accountability Action Plan under the State Roads Project, in collaboration with the World Bank. As part of the national anti-corruption agenda, this initiative includes an enhanced disclosure policy, website development and information management systems, complaints handing systems, citizen oversight and civil society involvement, as well as actions for mitigating collusion in procurement and payment fraud. The goal is to inform society and lay open expenditures and costs.

Source: World Bank 2013.

This cut in costs could benefit those who are in need of transport, in both rural and urban areas, though connecting the unconnected remains a primarily political and institutional task. Due to an expected lack of high revenues, private capital investment is unlikely, and the state must assist. Governance and economic inefficiencies, such as high profit margins caused by poor competition or barriers to trade, must be addressed to enhance mobility. While this is a problem inherent to developing countries, industrialised states also face similar challenges. In rural New Zealand, the lack of access to transport becomes problematic as soon as people cannot obtain the goods, services and activities they need to sustain themselves and their communities. Such a situation is exacerbated by depopulation due to rural-urban migration, so that the remaining groups see fewer opportunities to be effectively connected to a transport network. Outcomes are a reduced quality of living environment, deprived material wellbeing, limited social networks and reduced political participation (Fitzgerald, 2012).

In urban areas, the situation is equally critical. Seventy percent (800 million people) of the world's poor live in Asia, and about 250 million of those live in 10 growing Asian megacities – rising to an expected 300 million by 2030 (UNCDR, 2013). The Asian population increases by around 44 million persons annually. As a result, motorisation is growing rapidly, especially in emerging economies, and doubles every 5 to 7 years. Considering this growth, quick access to transport infrastructure becomes necessary, but difficult to provide. In such situations, governments should opt for public transport solutions to adequately offer service to new users. The International Association of Public Transport (UITP, undated) seeks a doubling of public transport users by 2025, and highlights several advantages. Public transport alleviates congestion, saves time, space and money, builds investment infrastructures and fosters a life-style change towards greater sustainability. Bus rapid transit (BRT) systems are an effective solution that governance and policy can endorse for implementation on a larger scale. The TransCebu system in Manila, the Philippines, for example, expected to start operations in mid-2015, merges land use and transport planning, and prioritises public transport over private vehicles (Montalbo, 2012). These options are affordable, not only in developing countries, and bear fewer risks than metro systems, but require political will from all stakeholders.

Policy commitment could reduce pollution, emissions and road accidents, and can significantly benefit poverty reduction efforts as well as economic growth. To lower its road fatality statistics, the Australian government for instance introduced improved driver licensing systems, alcohol enforcement, speed enforcement, better vehicle and safety standards, increased protection for motorists and cyclists, better road technologies and community-based road safety interventions (Faulks, undated). Such measures should also be considered for developing countries that will experience rising numbers of transport and vehicle users.

There must be commitment to and credible compliance with health and environmental standards for motorised public transport, as well as for private and commercial vehicles. The automotive industry could receive incentives to invest in cleaner technologies. As long as the paradigm is based on fossil fuels, a more sustainable transport structure will not be adopted. The EU emission standards serve as a tangible institutional example. As enforcement, German cities and

municipalities introduced environmental badges for ‘green zones’, limiting the amount of fine particulate in urban areas, which should lead to fewer cases of asthma and lung illnesses. Only ‘clean’ cars can enter the city centres, thus minimising pollution and health impacts (UBA, 2007).

The outcome of improved transport legislation should be a system that facilitates trade and allows users to access safe and environmentally-friendly services. According to the UN Almaty Declaration, transport costs are a key determinant of international trade competitiveness (UN, 2003). Indeed, a 10% drop in transport costs increases trade by 25% (Limao and Venables, 2001). Facilitating trade is thus key to improving lives, and users must be able to afford to make use of transport infrastructure. Especially in rural areas, people will be restricted on the basis of affordability. Hence, cross-subsidies, social protection measures, a better resource distribution or cash-transfer must relieve the burden for these excluded populations.

4.3.2 Finance

The greatest challenge to achieving universal access to sustainable transport is a lack of long-term financial commitment. The prevailing assumption is that connecting those not connected is too expensive to bear for developing countries, and changing towards more sustainable systems in industrialised countries is not viable. However, connecting those unconnected would constitute a fraction of overall transport investment required in sub-Saharan Africa, while the benefits would quickly exceed the costs. Construction and operation of public transport infrastructure will bring revenues to society via employment. While the institutional framework should be altered to encourage and protect investment, it is the actual investment that subsequently leads to the intended benefits. Connecting all members of a society is financially possible, but maintaining these transport links and upgrading them to be resilient is the major bulk of the finance requirement. Investment in efficiency to reduce GHGs is market-driven, but could be stimulated by subsidies and other incentives.

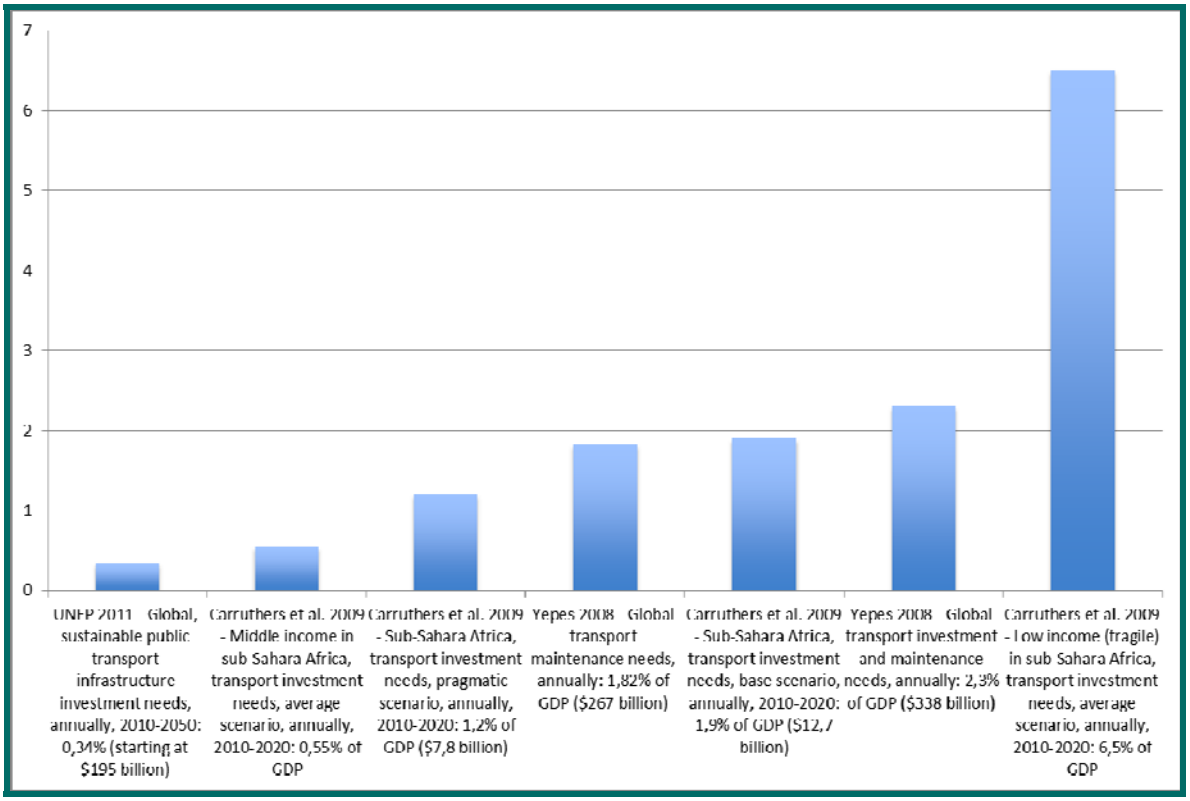
For a sustainable development goal that seeks to reduce poverty, the investment structure around the road transport system in developing countries must be designed in a pro-poor way that encourages economic activity. Such roads are usually referred to as low-volume rural roads (LVRR). Carruthers et al. (2009) highlight how countries in sub-Sahara Africa would be able to meet the baseline criteria of transport access, not ensuring, however, that this would be fully sustainable. With a focus on rural accessibility, reaching land producing 80% of agricultural value and leaving aside national and international connectivity, a road network of some 600,000 kilometres would be required – more than double what is in place currently. An urban network to connect a sufficient number of people to roads and make such a system work also requires substantial investment. Only 40,000 of the needed 120,000 kilometres of paved roads are in place, for instance. Combining these striking figures with estimates on national and international road connections, as well as adequate airports and ports, would lead to a required continuous ten-year annual investment of between $12.7 billion (1.9% of GDP), and $7.8 billion (1.2% of GDP) for the sub-Saharan region.

Connecting the unconnected would be a small part (14%) of the costs, while investing in maintenance requires substantially more commitment (40%). This aspect is often neglected in LICs and MICs. Considering that every $1 spent on preventing road damage saves $3 to $4 in repair works, maintenance is the key to be able to benefit from transport connectivity in the long run. It contributes to reliable transport at reduced costs, as there is a direct link between road condition and vehicle operating costs. An improperly maintained road can also represent an increased safety hazard and hence cause more accidents, which accelerates human and property costs (Carruthers et al., 2009).

Robust analysis, however, has indicated that the poorest countries must invest most into transport infrastructure, compared to the more stable states. The poorest countries have to cover the biggest burden, with low-income countries on average needing to invest 4.5% of GDP, while upper middle-income countries would have to invest less than 1% of GDP (Yepes, 2008). Figure 8 depicts various estimates of the proportion of GDP that should be invested in transport. In

extreme cases, such as Liberia, required investment could be well over 30% of annual GDP to reach a similar target. Evidence from Asia and Latin America is much more scarce, but a revision of data from the Rural Accessibility Index (Roberts et al., 2006), that features only a limited number of countries from 2006, shows that rural access is much higher in both regions (65.5% and 57.6% respectively) than in the African sub-continent (36.5%). This indicates that the question of rural access to transport is of particular importance for African governments, not considering the quality of roads and the availability or sustainability of any services. In an urban environment, UNEP (2011) estimates that a continuous reallocation from 2010 to 2050 of 0.34% of global GDP annually (starting at $195 billion) is needed to establish a sustainable public transport infrastructure that could cut the number of road vehicles by one third and boost transport sector employment by 10%, while having large potential for economic growth. In essence, the funds needed to establish a functioning transport infrastructure – which in this case mostly comprises roads – is a heavy burden on countries facing substantially different economic, social and environmental challenges.

Figure 8: Comparison of investment and maintenance needs for transport infrastructure (% GDP)



There has been much discussion as to who should invest in expanding, upgrading, operating and maintaining transport sector infrastructure. The main divide lies between public (funding and provision) and private (financing and operating) investments. The intentions of public and private sector actors differ, transport being a means to another end for the public sector, but being an end in itself for the private sector. Both sectors will need to work together effectively to achieve the goal of universal and sustainable access. One view is that the state should cover most costs via government interventions because of market imperfections, due to the absence of competition and incomplete information (Amonya, undated), and because the outcomes of a market economy are inequitable (Fokkema & Nijkamp, 1994). However, when considering the commercial and economic value of each project, private investment can become attractive. Amonya assesses the option of covering the costs of high-volume roads (HVR) by the private sector. He suggests that sub-Saharan African governments would need to increase road spending threefold to reach the MDGs, but with the help of private sector finance, this goal could more

easily be reached. It becomes problematic when taking into account that private sector investment relies on strong equity and debt markets, which are difficult to access in sub-Saharan Africa. Hence, boosting domestic markets, for which strong institutional policies are needed, could provide the necessary stimulus. Amonya also finds that private transport investment depends on the projected return on investment, which realistically for the transport sector means that only the HVRs would attract such financial sources. Such private sector investment and the resulting economic activity could create fiscal space for the development of LVRRs by the government (Amonya, undated). Because private companies aim for a planned return on investment, they are reluctant to invest into a rural environment of political, financial, construction, operational and commercial risks that might not recover the costs (Nijkamp & Rienstra, 1995). In such cases, a public-private partnership (PPP) might be an option.

A PPP is a contractual agreement that could share risks, ensure innovation and push the financing side of high cost projects. Past PPP investments in the Asia-Pacific region amounted to $120 billion, which is minor compared to total investment. A PPP can still be constrained by inadequate advocacy, regulatory and legislative weaknesses, poor management capacity, a constrained ability to meet equity and debt financing, and a need for increased private sector capacity (UNESCAP, 2011). The key is to split the costs between funding and operating. In the transport sector, a franchising system with the transport authority being the franchiser and a private operating company being the franchisee could bring the intended outcome. The latter pays the former to use the infrastructure, so that both parties could gain from this arrangement, as happened in France (Box 5). Such solutions could provide an example for other countries in a similar situation. That said, they might only be appropriate for HVRs, because it is unlikely that such cooperation would be endorsed by the private sector for LVRRs. Additionally, PPPs can be an alternative to risky private sector investments in urban public transport. This way, infrastructure could be provided while the service is run by a private or a public-private enterprise.

Box 6: French highway PPP

During the 1960s, the French government addressed the backwardness of its motorway network by giving out private concessions via auctions, to introduce private capital investment in the transport sector. Today, those routes are known as the toll roads, financed by the Sociétés d'Economie Mixtes (SEM) as joint ventures of the French government and private parties. In any case of project failure, debt is guaranteed by the state, which minimised the risks for private investors but guaranteed their participation. Yet, the network is legally owned by the state and the tariff structure is decided by the SEM, with central government approval needed.

Source: Nijkamp & Rienstra, 1995; Marcou, 1993; Teravininthorn & Raballand, 2008

In addition, road funds mainly target the expenditure on transport infrastructure maintenance, which needs to be doubled by 2030, compared to 2010. In the case of sub-Saharan Africa, Addo-Abedi (undated) finds that road investment is not a high government priority, but maintenance has improved under road fund support. Such funds can be the sum of road user charges and can cover all follow-up costs. In combination with domestic funds, it has even been argued that the transport system could become fully self-sustaining. For example, in India, based on the Central Road Fund Act, every litre of petrol and high-speed diesel is charged an additional Rs.2.00. The money is being used for maintenance and expansion of transport infrastructure, and is distributed according to a pre-defined scheme. In the Philippines, a national law requires owners to pay an annual flat rate per vehicle according to type and weight. Similar to India, the allocation of funds supports road services, but also road safety and pollution control (UNESCAP, 2011).

Making transport safer also incurs costs. The Commission for Global Road Safety has estimated that $2 billion would be necessary over the next 10 years to translate the Global Plan for the Decade of Action for Road Safety into results. Unfortunately, the combined level of donor aid for road safety is substantially lower, at an estimated $10 to $25 million annually. Hence, sources of finance must come from elsewhere. The Global Road Safety Fund, managed by the FIA Foundation and the WHO, provides a tool to galvanise political and financial support, providing a mechanism for bilateral donors, companies, philanthropic foundations and individuals to pool their resources to achieve the shared goal of saving lives in traffic (Watkins, 2012b). Just as the Global Health Fund played a crucial role in turning attention to diseases such as HIV or malaria, so the Road Safety Fund could trigger increased awareness, spending and efforts to safer transport. Considering that Asia's GDP is estimated to be lowered by 2.4% due to traffic-related accidents or illness, a $2 billion annual commitment to road safety could yield a considerable return on investment.

Taking into account all of these financing aspects, achieving universal access to transport services could possibly be funded by a combination of the following measures, depending on national or local context:

- Expanding HVRs and urban access could be financed by private investment, supported by public guarantors. The resulting fiscal space could enable LVRRs to be financed by the public sector, with ODA support where appropriate.
- Maintenance expenditure could be covered by national and regional road funds, which could be financed by revenue from private and commercial road users.
- The operation of services should be through private finance, stimulated by incentives for strong competition to make the system affordable.
- The Global Road Safety Fund and ODA support could cover road safety investments in low-income countries.
- Energy efficiency and more climate-friendly transport should be market-driven, and led by private companies, but might require regulations or incentives from the government.
- The affordability of services for the poorest could be assured through means such as targeted cash-transfers or direct subsidies (e.g. bus passes).

4.3.3 Capacity development

Besides investing in the institutional capacity of a country to provide adequate transport access, human resources must be developed as well. For this, people should be trained to prioritise and address rural and urban needs for access and sustainability. Assistance is needed to identify what is required and where. Priorities in the transport sector vary significantly, depending on the required investment and subsidies, from needs assessment and policy reforms to pricing support and transport efficiency questions. Often, a lack of awareness of requirements and the available solutions impedes development.

Striving for a more equitable system, which prevents more powerful members of society from shifting transport sector priorities to their own interests, would assist a sustainable transport sector. Transparency initiatives, as outlined earlier, can empower the position of the knowledgeable to strengthen democratic policy-making. Moreover, on the supply-side, providers need to have incentives to become involved in the sector. Rural communities are often a captive market for transport operators, as they can be subject to little or no choice of service providers and thus have few means of pressuring operators to change practices towards more sustainability and increased safety, or to reduce prices to achieve affordability. Communities can create user groups and increase their bargaining power when negotiating with operators or the government. Transport operator groups often control the market for transport services, but they are also able to improve transport services by adopting different operational practices. Additionally, governments and NGOs may assist with technical and business training services for the owners and users of both motorised and non-motorised vehicles (Starley et al., 2002).

There are more solutions when it comes to training people and learning from knowledge networks. North-South relationships can be based on development cooperation, but could also be founded in professional work-oriented projects that involve knowledge-sharing by companies that have a particular interest in the transport sector elsewhere. South-South cooperation and lesson-learning initiatives are growing. There is considerable potential to learn from the experience of similar countries and implement their responses. UNCTAD (2012), for instance, studied South-South and triangular cooperation in the biofuel sector in Africa and found that such solutions foster sustainable and inclusive development. The institutional framework can be similarly adapted, and a triangular facilitation by an industrialised country could promote top-quality standards that have already been developed. Collaboration between the Asian Development Bank and the Development Bank of Latin America (CAF) on sustainable urban transport led to sharing of knowledge on financial policies, co-developing geo-spatial tools and programming lending techniques (Toro, 2012). As mentioned earlier, advisory committees have been established in South Asia to curb corruption and mitigate fraud. By establishing a cross-country platform, governments are able to learn from one another independently (World Bank, 2013). There is enormous potential to acquire best-practices and support policy makers in developing as well as industrialised countries.

Moreover, international cooperation should be extended to also make use of new inter-country transport pathways, such as the opening of Burma to connect South Asia and East Asia. Such developments could potentially be lucrative investments with trickle-down effects for the entire economy, but road and railway links in Asia are already estimated to lack funds exceeding $40 billion. However, seizing such opportunities could be a means to boost the region and attract foreign direct investment. Yuwei (2012) highlights the tremendous potential for trade that lies between the different Asian regions, especially South Asia and Central and West Asia, and a functioning, linking transport infrastructure would help exploit these opportunities.

Human resources need to be trained to promote the avoid-shift-improve strategy (ASI). Avoiding relates to system efficiency and use reduction; shifting refers to non-motorised systems or public transport and more environmentally-friendly transport; and improving involves strengthening links to the fuel efficiency of both private and public users. ASI has been tested at scale and has been incorporated by multilateral organisations, such as the United Nations Environment Programme (UNEP). This approach could achieve the intended outcomes of sustainable and clean transport, with the co-benefits of enhanced safety, as illustrated by the example outlined in Box 6. It entails a reduced and avoided demand for emission-intensive transport modes, while facilitating the increased mobility of people, goods and information, and ensuring that efficient transport is devised; a shift from energy intensive and environmentally harmful modes of transport to less polluting and more efficient modes, such as public or non-motorised transport; and improved efficiency and environmental performance of transport systems by better vehicles, fuel and network operations, as well as management technologies (UNEP, 2013). The IEA estimates that embracing the ASI concept will generate financial and co-benefit savings of up to $30 trillion in vehicle and fuel expenditure, and $20 trillion in infrastructure savings (Slocat, undated). To achieve this, governments and their officials must be prepared. GIZ (undated) maps out what an ASI approach to sustainable urban mobility could look like, not only in developing but also industrialised countries. The co-benefits would be manifold, including reduced costs, less noise and congestion, lower energy imports, increased private investment, better air quality and health, higher levels of safety, and lower welfare costs.

Box 7: A practical example of ASI in India

Mani et al. (2012) propose that the auto-rickshaw could be the cornerstone of the shift and improve aspects of the ASI in India, leading to reduced emissions and improved road safety. While some prerequisites will need to be fulfilled for this, such as seatbelts, better road surface quality, and the permanent and affordable availability of the service, the potential socio-

economic benefits by far exceed investment costs and could contribute to universal access to affordable and clean transport services.

Source: Mani et al., 2012.

Additionally, capacity for transport sector maintenance must be advanced. It is only a sustainable sector if it is constantly invested in to keep it damage-free and to minimise any externality costs, such as vehicle repair or health consequences. As Carruthers et al. (2009) point out, investment would have to be continued over ten years to achieve basic needs. There is a need to realise the importance of investing in prevention instead of post-hoc activities. In Colombia, for instance, the Climate and Development Knowledge Network is supporting the incorporation of climate-resilient roads that will reduce maintenance costs after heavy-weather events. Contractors and government officials are being involved in such actions (Martínez et al., 2012). This approach has also been endorsed by the IPCC, which called for increasing efforts of planned adaptation towards climate-resilient infrastructure (Parry et al., 2007).

Finally, assessment of transport sector advancement poses a challenge on the capacity side. Measuring the impacts of rural road investments and the benefits received is already a very difficult undertaking, but understanding the outcomes of policy reform is an even greater challenge (Lombard & Coetzer, 2007). Improved measurement or acknowledgement of the activities could subsequently attract more funding, and also politically legitimise long-term solutions that do not deliver immediate outcomes. The lack of a transport MDG possibly led to hampered measurement in terms of road access, people using transport services, emitted GHGs, traffic-related victims and road damages.

4.3.4 Environmental effects

Emissions constitute a major environmental effect resulting from increased access to passenger and freight transport, yet studies show that a 40% reduction of the 1990 levels of greenhouse gas emissions is possible to 2030 (PBL Netherlands Environmental Assessment Agency, 2012). According to the IEA and the OECD, transport accounts for about 25% of global CO_2 emissions (three-quarters from cars and trucks). These shares are rising fast. Emissions from road transport have increased by 50% since 1990 and the sector is the second fastest-growing source of emissions after power generation (Watkins, 2012b). With car ownership set to triple by 2050, transport-related CO_2 emissions could increase by more than 80% by 2050 (IEA, 2009), if no energy or fuel changes are enforced. Freight activity is growing tremendously in China, India and the ASEAN countries, with considerable impacts on the environment and society. Such movements are expected to increase by 500% by 2050. In India, 63% of CO_2 emissions and 59% of particulate matter emissions come from trucks, which only constitute 5% of the total vehicles. The potential for increased health problems and environmental degradation is enormous. Strong legislation should curb heavier emissions, and incentives for the industry would encourage research and development.

Similarly, air pollution needs to decrease drastically. Vehicle emissions are a major cause of outdoor air pollution, and the WHO (2011) estimates this to be the cause of 1.3 million deaths annually – as many as road traffic victims. Some 70% to 90% of the pollutants strongly affecting human health originate from gasoline-powered vehicles. Such trends are at the heart of an environmental crisis in China, where one third of the major national cities failed air quality assessments in 2009 (UNCDR, 2013). A similar pattern can be observed in Jakarta, where it has been estimated that over one year, traffic-related air pollution resulted in the loss of 18 million days of full activity by adults – the treatment costs related to illness caused by pollution are expected to exceed 1% of the city's GDP (ADB, 2006). Of course, rural areas are not excluded from these air pollution impacts either (Mustapha et al., 2011).

Sustainability thus becomes an inevitable and favourable part of the solution to the urban transport problem, with examples including BRT systems, electric car tax reductions and free charging points, and bicycle sharing infrastructure (Penalosa, 2012). Other solutions might include urban rail, improved physical planning, car-sharing or safer walking areas, especially for women. The Dhaka Walkability Initiative studies barriers to safe walking, which remains the main means of transport for the poor and avoids emissions (Efroymson, 2012). Greenways could also serve as urban recovery areas and offer a socially more equitable space. To enforce a cleaner environment, solutions like the EU emission standards might be an example to follow. This EU legislation has dramatically reduced tailpipe emissions through a very rigid continuous reduction process over the past 20 years. The adoption of similar standards in other industrialised or developing countries could result in significant environmental and health benefits. According to UNEP (undated; with Hatfield, 2010 data), the 2002 Partnership for Clean Fuels and Vehicles achieves annual benefits amounting to $2.4 trillion and 1.2 million fewer premature deaths. While these numbers are substantial, actual measurement is subject to controversy. Stronger legislation, enforcement and accountability of such initiatives becomes key.

Overall efficiency in the transport sector must be increased. Strömberg (2012), from Scania Trucks, suggests a 'green toolbox' is needed to effectively curb emissions and make transport more environmentally and socially bearable. This should include logistics and smarter transport, driver training, vehicle technology and biofuels as the "key to decarbonise heavy transport". While biofuels have critical impacts for the environment in their agricultural production regions (e.g. deforestation), the attitude from leaders in the automotive sector indicates the start of a necessary shift. It might be that the Global Fuel Efficiency Initiative, launched by the IEA, UNEP, FIA and International Transport Forum, serves as such a 'green toolbox' by becoming a credible source of advocacy that seeks an average 50% fuel efficiency improvement by 2050. It promotes technological development, builds government capacity and advises in fiscal and consumer strategies. However, those developments are only the beginning, and much more needs to be done. Most importantly, political consensus needs to be found to commit to projects and come closer to the proposed sustainable development goal of universal access to sustainable transport.

Chapter 4: Summary of Key Messages

Access to transport goes beyond a question of mobility, providing connectivity and social benefits, as well as contributing to economic growth, productivity and employment.

Long-term planning is needed in the transport sector, with access a stated objective. In rural areas decentralised planning would be able to address localised needs, and in urban areas the emphasis should be on affordable public transport. Addressing corruption in the sector would reduce costs and enhance access.

Expenditure on the maintenance of transport infrastructure is essential, and exceeds investment, but should be covered by revenues from users. Investment to ensure universal access would be small relative to total transport investment.

Development of capacity to plan and operate equitable and sustainable transport services should include approaches to reduce journey demand, shift to more environmentally sustainable modes of transport, and improve fuel efficiency.

Improving road safety and reducing air pollution from transport would significantly improve the health status of millions of people.

5 Conclusions

There are strong grounds for the inclusion of infrastructure-related goals and targets in the framework of post-2015 development goals, and there are many advocates for their inclusion. Infrastructure services enable economic growth and human development, and they affect environment sustainability. The fundamental principles of universality, equity and sustainability, which are likely to underpin the post-2015 goals, will shape the way infrastructure goals and targets are achieved. Whether and how goals and/or targets for infrastructure generally, or for specific infrastructure sectors, will actually be included remains under debate. However, the principles of the post-2015 development agenda will guide the future development of infrastructure services in developing and developed countries.

A core element of the post-2015 agenda will be to complete and extend the MDG agenda, ensuring the eradication of absolute poverty in all countries. Achieving universal access to infrastructure services – water, sanitation and hygiene, modern energy, mobility, shelter and communications – will be a necessary condition for this. Post-2015 goals and targets for infrastructure services will need to take account of how universal access is to be achieved, locally and globally, and in particular the equitability and environmental impact of infrastructure services. In the water sector, this means broadening the agenda to include water quality and water resource management generally. It means including infrastructure services that were omitted from the MDG framework, including energy and transport, discussed in this paper. Goals and targets for energy and transport for the post-2015 development agenda would need to address both universal access and environmental sustainability. It also means recognising the role infrastructure will play in enabling achievement of all the goals in the eventual post-2015 framework.

It is highly likely that the post-2015 goals will apply to all countries, whatever their national context and circumstances. This calls for flexibility in the setting of national targets and indicators to allow for the diversity of contexts, conditions and capacities that exists between countries. The discussion above highlights the widely varying challenges facing different countries in providing access to water and sanitation, energy and transport services, suggesting each country will need to set targets appropriate to its own condition, but consistent with a global goal and targets, and of course consistent with the common principles. As suggested by the High-Level Panel, this flexibility has implications for global monitoring and reporting on progress.

Our analysis of what will be required to achieve universal and sustainable goals and targets for water, energy and transport suggests that “business as usual” will be far from enough. The HLP suggests the same for the post-2015 development agenda as a whole. Amongst the changes that will be necessary to get beyond business as usual are changes in the policy arena. This includes political commitment to achieving universal access to water and sanitation, modern energy and transport. For infrastructure services, this political commitment must be sustained over time, given the lengthy lead times for large investments and their lifetimes. Sustained policy

commitment will also reduce the political risks that are a barrier to private sector investment in infrastructure.

A second governance-related conclusion is the need in many countries for change in the institutional environment for infrastructure development and delivery. Institutions need to provide long-term planning, enable the development of relevant skills and knowledge, and be better co-ordinated across sectors. Transparency and accountability is particularly important in organisations involved in infrastructure development.

Though the investment that will be required to achieve universal access to water and sanitation, modern energy and transport is significantly higher than current levels – five times in the case of modern energy – in comparison to the overall expected investment in each sector it is relatively small. Variety in the technological and organisational options available to deliver infrastructure services suggests the need to use diverse financing sources and mechanisms. In many cases, and with appropriate financial mechanisms, a proportion of this investment can be financed by consumers. The introduction of measures, such as risk guarantees, to improve the attractiveness of investments would encourage more private sector investment.

The operation and maintenance costs of infrastructure services have often been under-funded in the past, leading to poor quality, unreliable services and eventually the need to finance replacement investment. Organisational capacity to manage infrastructure services, including revenue collection, will be a critical factor in achieving access goals.

The additional consumption by poor households that would result from achieving universal access to infrastructure services will not have a significant environmental effect. It is possible to achieve both universal access and the 2°C global climate change goal. Consumption by middle and higher income consumers, a growing number in most developing countries, does have a significant environmental impact. As the same infrastructure generally serves all income groups, environmental sustainability will be an important aspect of post-2015 goals for infrastructure services.

The post-2015 agenda will need to recognise the interdependency of different goals. This is especially evident for water, energy and transport infrastructure. All three have a direct bearing on health, through reduction in water-borne diseases, air pollution, and road traffic accidents. All three have a direct bearing on production, incomes and job creation. They are themselves interdependent, with, for example, transport affecting energy targets, and energy affecting water extraction. This inter-dependency is related to the question of whether infrastructure should be viewed as an enabler of other objectives or as a goal (or goals) itself. Ultimately, how infrastructure in general or specific sectors (e.g. water, energy, and/or transport) will feature in the post-2015 goal framework will depend on what are seen as priorities for achieving the kinds of transformation described in the report of the High-Level Panel.

Chapter 5: Summary of Key Messages

There are strong grounds to include infrastructure-related goals and targets in the post-2015 development agenda.

Business-as-usual will not be enough to achieve universal and sustainable goals and targets for water, energy and transport. Sustained political commitment and higher investment are required.

The additional consumption by poor households arising from universal access would not have a significant environmental effect. It would improve people's health.

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Appendix

Table A1: Detailed table of major studies estimating the financing needs for the water sector

Study	Scope	Cost Estimate(s)[31]	Comments
OECD, 2006	Water supply and sanitation (WSS) infrastructure service expenditure projections in the OECD and BRIC countries; WSS capital and O&M expenditure needs for all countries as a percentage of GDP; analysed up to 2030.	Global WSS investment needs, 2010-2030[32]: • HICs: 0.35-1.2% of GDP p.a. • MICs: 0.54-2.60% of GDP p.a. • LICs: 0.70-6.30% of GDP p.a. OECD/BRIC projected expenditures on WSS infrastructure: • $780 billion p.a. by 2015 • $1.037 trillion p.a. by 2025 Global WSS total investment need: • ~ $36 trillion, 2010-2030	The estimates focus on costs for 'adequate'[33] WSS infrastructure services, with the GDP percentages including water resources (development, transmission, treatment & distribution) and wastewater (collection, treatment & disposal). Its estimates are synthesised based on past trends, data & similar studies on infrastructure expenditure/needs, and on future trends in water resource demand & availability. It acknowledges climate change in its water resource analysis. The study adjusts its GDP percentage figures for upward movement of some LICs/MICs into MICs/HICs beyond 2015.
Hutton & Bartram, 2008	Estimates spending needed in developing countries to provide new coverage and sufficient O&M to meet the WSS MDG targets, analysing from 2005 – end of 2014.	Cost requirements for new WSS coverage in developing countries: • $18 billion p.a. Cost requirements for O&M of existing WSS services in developing countries: • $54 billion p.a. Additional administration costs of 10-30% also required for effective implementation.	Over the 10-year period, its cost estimates assume 1/10th of the unserved population receives coverage each year. The study focuses only on providing basic improved WSS services and not on advancing infrastructure any further. It was an advance from previous studies in that it attempted to include O&M costs by assuming an investment life of 40 years for piped water & sewerage, and 20 years for other interventions (the latter likely too long). It uses unit cost estimates from the UN GLAAS for new coverage, and various assumptions for O&M costs. It ran 11 different cost scenarios to attain more accurate estimates. It excluded costs related to IWRM, water storage and conveyance, transport & financing costs, sewerage upgrading costs, and climate change costs.
Yepes, 2008	Estimates the spending needed in 145 developing countries to provide new coverage and sufficient O&M to meet the WSS MDG targets, analysing from 2008 – 2015. Also estimates the cost of WWM by defining a goal of	Cost requirements for new WSS capital in developing countries: • $8.3 billion p.a. for urban WS • $16.3 billion p.a. for urban sanitation • $14.4 billion p.a. for rural WSS Cost requirements for O&M of existing WSS services in developing countries: • $8 billion p.a. for urban WS	Calculates the estimates based on a top-down econometric approach, modelling using data on WSS unit costs (based on World Bank data) and existing coverage rates (based on JMP data). O&M costs are estimated by applying a 3% annual depreciation rate on the value of existing connections.

[31] All figures in USD. Also note, not all of these cost figures were summarised in Figure 1, only the summary WSS values.
[32] HICs = High-income countries, MICs = Middle-income countries, LICs = Low-income countries, BRIC = Brazil, Russia, India, China
[33] Not clearly defined and implied both as basic MDG-level services and higher-order services at different points

	doubling 2005 coverage rates by 2030, to enable cost projections along this potential trend.	• $12.7 billion p.a. for urban sanitation • $11.7 billion p.a. for rural WSS Cost requirements for WWM, given the theoretical 2030 goal of doubling 2005 coverage levels in developing countries: • $14.9 billion p.a. for WWM capital • $23.3 billion p.a. for WWM O&M Total (without WWM), 2008-2015: • $71.4 billion p.a. Total (with WWM), 2008-2015: • $109.7 billion p.a.	
Foster and Briceño-Garmendia, 2009	Estimates the spending needed in Africa to meet the WSS MDG targets, analysing from 2006-2015. Also estimates the spending needed on water resource infrastructure and irrigation needs.	Cost requirements for WS to meet the MDG target in Africa: • $16.5 billion p.a. ($11 billion in new capital, $5.5 billion for O&M) Cost requirements for sanitation to meet the MDG target in Africa: • $6 billion p.a. ($4.5 billion in new capital, $1.5 billion for O&M) Total: $22 billion p.a. (3.3% of Africa's GDP). Costs for water resource infrastructure & irrigation in Africa: • $11 billion p.a. for WR (US $8 billion for large hydro, $1 billion each for large storage, small-scale infrastructure, and learning / knowledge management / research) Lump-sum costs for irrigation of $2.6 billion for large-scale and $17.8 billion for small-scale	For WS, it notes that 75% of current spending is 'wasted' due to inefficiencies and a much higher proportion of the costs are needed in low-income fragile states vs. others. Capital cost estimates included both new infrastructure and rehabilitation of existing assets, and are based on 'minimum acceptable asset standards'. Rehabilitation costs were estimated based on a model that accounted for existing O&M backlog in each country. Access patterns (relative proportion of water/sanitation interventions) are assumed to remain consistent. Service upgrading (beyond basic MDG levels) is assumed to be minimal. It only considers climate change in the context of the water resources / irrigation estimates.
Lloyd Owen, 2009	Estimates capital & operational spending trends and needs for 67 (mainly developed) countries, from 2010-2029. The 67 countries chosen were based on their prospects for private sector funding, the availability of good data, and with a population >1 million.	Total capital spending costs for the 67 countries, 2010-2029, using three scenarios: • Low: $2.213 trillion ($111 billion p.a.) • Medium: $2.880 trillion ($144 billion p.a.) • High: $3.792 trillion ($190 billion p.a.) Total operating costs: • $6.760 trillion ($338 billion p.a.) From these costs, a projected finance gap, from 2010-2029 of: • $1.049 to $2.297 trillion ($52- $115 billion p.a.)	It mainly omitted developing countries, focusing on advanced infrastructure needs, rather than basic coverage. Its finance gap was calculated as the total revenue-spending gap within each study country. Does a rigorous accounting for climate change, with different cost estimates for different groups of countries and different potential levels of response.
Fankhauser & Schmidt-Traub, 2010	Estimates the cost of meeting the MDGs for Africa, both with and without climate change, including for the WSS target, from 2010-2020.	MDG cost for African WSS, 2010-2020: • $7.9 billion p.a. Potential range of additional climate change adaptation funding needs: • $2.9 billion p.a. – $7.2 billion p.a.	It does not give much detail for its MDG cost estimate for WSS. It implies that this is only the cost of achieving the basic coverage target and mainly focuses on infrastructure. No disaggregation to capital versus O&M costs. Its main purpose was to account for the extra costs of climate change at the continental level.

Hutton, 2012	An update from the 2008 study, expanded to 136 developing countries and with better data. Timeframe of analysis now 2010-2015 for cost estimates of meeting the WSS MDG. Then estimated the additional capital costs of universal access to WSS, beyond the MDG.	Cost requirements for new WSS capital to meet the MDG, 2010-2015: • $6 billion p.a. for WS • $23 billion p.a. for sanitation Cost requirements for O&M of WSS services to meet the MDG, 2010-2015: • $0.6 billion p.a. for WS • $2.6 billion p.a. for sanitation Capital cost requirements for universal access to WSS (in addition to the MDG costs) (no O&M), ignoring timeframe: • $174 billion (total) for WS • $217 billion (total) for sanitation Total capital costs to both meet the MDGs and achieve universal access: • $535 billion ($203 billion for WS, $332 billion for sanitation; $339 billion for urban areas, $197 billion for rural areas)	It ignores a timeframe for its universal access cost estimates by simply using current WSS unit costs, though these could obviously change in the future, and does not thus account for population growth or climate change. It excludes O&M costs in these future estimations as well, due to difficulty in their accurate estimation. It uses higher unit costs for WSS capital versus the 2008 paper, and includes more factors in its O&M costs. Note that its estimated costs for WS are low, since the global MDG target for WS was already met in 2010, so the estimates only focus on those countries that have individually not met the target. It considers rural and urban targets separately within countries, to ensure that excess urban coverage would not balance out a rural deficit in the calculations.
Dobbs et al., 2013	Estimates of global infrastructure investment needs, 2013-2030, in order to just keep up with GDP growth (but not yet address O&M deficiencies or backlogs), including for WSS infrastructure (not including irrigation).	Projected cost needs for WSS infrastructure and related equipment: • $11.7 trillion, 2013-2030 (~ $650 billion p.a.)	It uses three different methods for estimation: historical spending on infrastructure, stock of infrastructure, and projections of future need. Their WSS estimates were mainly drawn from previous work by Global Water Intelligence (GWI), who projected spending on WSS infrastructure from 2007-2016 *(reference unavailable)*. They then proceeded to simply extrapolate these numbers further out, to 2030, in a straight-line manner. This estimate applies only to infrastructure, is not disaggregated further, and does not clearly specify the countries to which it applies. The report mainly seemed to focus on OECD/BRICS states, though it was not explicitly laid out.

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