World Water Council

Costing MDG Target 10
on Water Supply and Sanitation:

COMPARATIVE ANALYSIS, OBSTACLES AND RECOMMENDATIONS

World Water Council
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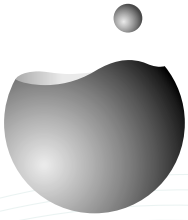

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Comparative Analysis, Obstacles and Recommendations

Jérémie Toubkiss - March 2006

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Abbreviations and acronyms

ADB	Asian Development Bank
EECCA	Eastern Europe, Caucasus and Central Asia
FAO	Food and Agriculture Organisation
GDP	Gross domestic product
GWSSAR	Global Water Supply and Sanitation Assessment Report 2000 of the Joint Monitoring Programme
GWP	Global Water Partnership
HH(s)	Household(s)
IWRM	Integrated Water Resources Management
JMP	Joint Monitoring Programme
MDG(s)	Millennium Development Goal(s)
MFI(s)	Multilateral financial institution(s)
NGO	Non-governmental organisation
O&M	Operation and maintenance
ODA	Official Development Aid
OECD	Organisation for Economic Co-operation and Development
SEI	Stockholm Environment Institute
UN	United Nations
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNICEF	United Nations Children's Fund
WHO	World Health Organisation
WSS	Water supply and sanitation
WSP	Water and Sanitation Programme
WSSCC	Water Supply and Sanitation Collaborative Council

Executive Summary

- In the past few years, many reports have been written assessing the investment requirements for attaining Target 10 of the Millennium Development Goals (MDGs) for water supply and sanitation ("halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation"), all with different results. It is therefore necessary to clarify what lies behind the figures presented in the reports and to explain the reasons for the differing estimates. To this end, this comparative study compares eleven global, regional and national cost assessments.

- The global assessments reviewed range from 9 billion to 30 billion USD per year. The variation between the estimates is largely due to (i) imperfections and inadequacies in the terms used to define Target 10, (ii) the lack of consistent data reflecting the real situation with respect to WSS; this leads to considerable vagueness and shortcomings in the assessments; (iii) the different methods and assumptions used, throughout the calculations, to assess the target population for service provision by 2015, the level of service to be implemented and the unit cost of each water supply and sanitation technology. Consequently, it is difficult to compare the estimated costs.

- In some regions, the cost of maintaining and rehabilitating existing infrastructure will be very high. However, most global estimates neglect this in their calculations. Likewise, the cost of developing water storage and conveyance infrastructure to increase the resources available to people and the costs of financing the investments have not been included either. As a result, the global cost of reaching Target 10 has been underestimated.

- Target 10 only covers water for people and not water for agriculture and industry. Moreover, other MDG targets are either directly or indirectly related to water and sanitation issues. For example, the fulfilment of Target 9 on environmental sustainability and the conservation of natural resources implies wastewater treatment, which is extremely costly. Hence, limiting investment requirements in the WSS sector only to Target 10 is too restrictive.

- Additional funding must be allocated to the WSS sector because the investment requirements are larger than evaluated in the reports and current investment in water supply and sanitation in the developing world are estimated at a mere 14 to 16 billion USD per year. The effort must focus primarily on sanitation, urban areas, and on Sub-Saharan Africa, India and China.

- It seems unnecessary to further refine the global assessments of Target 10. On the contrary, future efforts should be concentrated on the local level, with more planning and, therefore, assessments at national and sub-national levels. These assessments are more accurate and probably more useful to policy makers and donors.

INTRODUCTION

The Millennium Development Goals and Target 10 on water supply and sanitation

At the United Nation Summit in September 2000, 189 UN Member States adopted the Millennium Declaration, from which emerged the Millennium Development Goals (MDGs). The MDGs form a set of political commitments aimed at tackling the major development issues faced by the developing world, within a fixed deadline.

While almost all the MDGs can be indirectly linked to water supply and sanitation (WSS) issues [1], Goal 7 on environmental sustainability addresses them directly: one of its targets, Target 10, is to "halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation" [2]. It must be noted that Target 10 only focuses on "water for people", not water for industry or agriculture (irrigation).

The baseline year for most of the MDG targets, including Target 10, has been set at 1990. Therefore, "2002, the last year for which comprehensive data is available, can be considered the halfway mark towards achieving the 2015 MDG deadline" [3].

The attempt to cost MDG Target 10

Over the past few years, many reports have been written costing the Millennium Development Goals (MDGs) target for water supply and sanitation. Their purpose is to prove that Target 10 is attainable, but its attainment implies a substantial increase of investment in the WSS sector. Nevertheless, the reports all produce different cost estimates, even though they are often based on the same statistical data (especially for current coverage rates, target populations, etc.) and on common basic definitions (of MDG Target 10, related to water supply and sanitation, of the technologies considered to be "improved", etc.). As stated in the Analysis of the 3rd World Water Forum, published in 2003 by the World Water Council and the Secretariat of the 3rd World Water Forum, "it seems obvious that behind these estimates, there are a lot of assumptions that need to be clarified. It is important not to neglect this debate on the figures for the future" [4].

C. Fonseca and R. Cardone (2004) presented an overview of nine global cost assessments, providing a description of each calculation [5]. More global, regional and national estimates have been published since, with even more diverse results. It is therefore necessary to compare more systematically the calculation methods and underlying assumptions in order to explain the variation in estimates.

Aim of the present comparative study

Firstly, it must be emphasised that the aim of this comparative study is not to find the "right methodology" or the "best report". Secondly, this paper does not wish to present a new cost estimate. On the contrary, it highlights the difficulty

1- On this point, see, among others, the World Bank working paper "The Environment and the Millennium Development Goals", 2002, available at: http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000094946_0209060414432.

2- See UN Millennium Project, Task Force 7 on Water and Sanitation: "Health, Dignity and Development: What Will It Take?", 2005, p.XIX. The target for sanitation was added in 2002 following the World Summit on Sustainable Development in Johannesburg.

3- See Joint Monitoring Programme, "Meeting the MDG Drinking Water and Sanitation Target, A Mid-Term Assessment of Progress", p.5.

4- See "Analysis of the 3rd World Water Forum", p.21.

5- See Catarina Fonseca and Rachel Cardone: "Analysis of costs estimates and funding available for achieving the Millennium Development Goals targets for water and sanitation", WELL Briefing Note September 2004, p.1-7, available at http://www.irc.nl/page/16540.

of comparing the various estimated costs and, more generally, of costing Target 10. It also identifies:

- conclusions that are common to all the assessment reports;
- factors that create the greatest variations in the estimates;
- potential weaknesses in each calculation method;
- elements overlooked by all the reports and that must imperatively be included
- the need for further assessments at the national and sub-national levels.

Approach of the comparative study

The comparative study reviews eleven cost assessments. These have been analysed and summarised using a common, detailed format which enables comparison of the investment sectors covered by the assessments, the assumptions used and the methods of calculation (see box 1 below).

Box 1: Format used for the comparative summary of the reports on the cost of meeting MDG Target 10

Name of the institution
Title of the report and year of publication

Main Estimates :

- Number of people/households to be provided with WSS services until 2015
- Investment requirement for water supply
- Investment requirement for sanitation
- Annual global cost
- Annual cost per capita

Methodology:

1 - Scope of the assessment:

- General content of the report
- Are water supply / sanitation / wastewater treatment / hygiene education / replacement of existing but ageing infrastructure / major water storage and conveyance infrastructure / policy formulation & monitoring / IWRM & Ecosan taken into account in the needs assessment?
- Is it a global / regional / local assessment?
- Reference years for calculation

2 - Evaluating the target population:

- Definitions of 'access' to 'safe' water and of 'improved' WSS
- Source of the coverage data/how is it calculated?
- Is urbanisation taken into account?

3 - Assessing the level of service:

- List of technologies to be used in rural and urban areas
- Share of each technology in urban, peri-urban, rural areas (level of services)

4 - Estimating the unit cost:

- Are operation / maintenance / transportation / replacement costs and organisational overheads taken into account in the unit cost?
- Are they calculated for each technology or averaged?
- …given per person reached or per household?
- …differentiated by geographical region?
- …differentiated by rural / peri-urban / urban area?

5 - Global (annual) cost estimates:

- Are they also given per region (or country)?
- …given per capita? (per person reached and as a fraction of the total population)
- …given as percentage of regional or local GDP?

Internet address where the report is to be found.

Given the number of documents and the limited timeframe available for this comparative study, a selection of assessment reports to be reviewed was inevitable (see Box 2 below). The eleven reports have been chosen to reflect the diversity of the institutions publishing cost assessments (international organisations, multilateral financial institutions, NGOs, research institutes) and the varied scope of the assessments (at global, regional or national levels). Among the regional assessments, the comparative study focuses on the geographical zones which will require the highest investment level (Asia, Sub-Saharan Africa, and possibly Eastern Europe, the Caucasus and Central Asia). The selection process has also favoured the most recent reports (within the past three years) or those issued by major international institutions operating in the WSS sector and still considered works of reference [6]. Lastly, only assessments providing details of their calculation methods could be analysed.

Box 2: List of the 11 reports reviewed:

- Asian Development Bank: **Asia Water Watch 2015: Are Countries in Asia on Track to Meet Target 10 of the Millennium Development Goals?** 2005.
- Danish Ministry of Environment / COWI, **Financial needs of achieving the Millennium Development Goals for water and sanitation in the EECCA region**, draft main report, 2004.
- French Water Academy: Henri Smets: **The Cost of Meeting the Johannesburg Targets for Drinking Water: A Review of Various Estimates and a Discussion of the Feasibility of Burden Sharing**, revised edition, 2004.
- Global Water Partnership (GWP): **Towards Water Security: A Framework for Action**, 2000.
- Stockholm Environment Institute (SEI): **Sustainable Pathways to Attain the Millennium Development Goals: Assessing the Role of Water, Energy and Sanitation**, 2005.
- UN Millennium Project, Task Force 7 on Water and Sanitation: **Health, Dignity and Development: What Will It Take?**, 2005.
- Water and Sanitation Programme (WSP): Meera Mehta, Thomas Fugelsnes and Kameel Virjee: **Financing the MDGs for Water and Sanitation: What Will It Take?** 2005.
- Water Supply and Sanitation Collaborative Council (WSSCC): **Vision 21: A Shared Vision for Hygiene, Sanitation and Water Supply, and a Framework for Action**, 2000.
- WaterAid: **The Water and Sanitation Millennium Development Targets in Nepal: What Do They Mean? What Will They Cost? Can Nepal Meet Them?** 2004.
- World Bank: **Progress Report and Critical Next Steps in Scaling Up: Education for All, Health, HIV/AIDS, Water and Sanitation**, Addendum 3: "Water Supply and Sanitation and the Millennium Development Goals", 2003.
- World Health Organisation (WHO): Guy Hutton, Laurence Haller: **Evaluation of the Costs and Benefits of Water and Sanitation Improvements at the Global Level**, 2004.

6- The WSSCC and GWP reports dating from the year 2000, were written before the MDGs were set, which explains why the framework of their assessments is broader than that of MDG Target 10.

RESULTS

This chapter is dedicated to the main findings of the comparative study. After presenting the results of the cost assessments, the chapter highlights general conclusions regarding Target 10 that are common to all the reports, as well as the major future challenges in the WSS sector. It then goes on to explain the causes for variations in estimates, demonstrating the difficulty of costing Target 10.

Firstly, it should be noted that the analysis of the eleven reports met a certain number of difficulties. In fact, it is not always very clear which method has been used or upon which assumptions a particular estimate was based. Likewise, the source of the statistical data used (e.g. on projected demographic growth or the MDG target population) is rarely given.

The following table gives a comparative summary of the eleven reports. It specifies each report's scope (global, regional or national), and its timeframe; it also indicates for each report:

- the sector investments considered necessary in order to attain Target 10;
- how the target population has been calculated;
- the level of service (i.e. the technology mix) planned by the authors;
- what the unit cost of each technology covers and,
- the final result of the calculation.

More comprehensive, formatted summaries of the reports are to be found at the end of this paper, starting on page 16.

Comparative spreadsheet relative to the scope, main assumptions and calculation methods of the reports reviewed

	GLOBAL ASSESSMENTS			GLOBAL & REGIONAL ASSESSMENTS		
	Global Water Partnership 2000	Water Supply and Sanitation Collaborative Council 2000	Water Academy 2004	World Bank 2003	World Health Organisation 2004	Stockholm Environment Institute 2005
SCOPE OF THE ASSESSMENT						
Global estimates (dev. world as a whole)	yes	yes	yes	yes	yes	yes
Regional estimates	no	no	no	yes	yes	yes
Local estimates (at country level)	no	no	no	no	no	no
Reference years	2000 - 2025 *	2000 - 2025 *	2000 - 2015	2000 - 2015	2000 - 2015	2003 - 2015
Water supply	included	included	included	included	included	not included
Sanitation	included	included	included	included	included	included
Wastewater treatment	included (municipal wastewater)	not included	not included	not included	not included	not included
Hygiene education	not included	included	not included	not included	included	not included
Major water storage and conveyance infrastructure	not included	not included	not included	not included	not included	not included
Rehabilitation of old infrastructure	not included	not included	included	not included	not included	not included
IWRM / Ecosan	not included	not included	not included	not included	not included	included (to be implemented everywhere)
Financing costs	not included	not included	not included	not included	not included	not included
EVALUATION OF THE TARGET POPULATION						
Definition of the terms used to define Target 10 (as in:)	JMP 2000	JMP 2000	JMP 2000	JMP 2000	JMP 2000	JMP 2000
Source of coverage data	World Resources Institute, JMP, UNICEF	JMP, UNICEF	JMP 2000	JMP 2000 & Human Development Report 1998	WHO	JMP 2004, FAO
Is urbanisation taken into account?	yes	yes	yes	yes	no	yes
TECHNOLOGY TO BE USED						
List of technologies (as defined in:)	own list	?	JMP 2000	JMP 2000	JMP 2000	own list of Ecosan methods
Share of each technology in urban and rural areas	based on the proportion of the population currently supplied by different methods; details given	only low cost technologies, basic level of service; details given in this study but not in Vision 21	different levels of service are defined; details given	?	only low cost technologies, basic level of service; details given in this study but not in the WHO report	Ecosan applied everywhere; details given
UNIT COST						
Transportation cost (particularly to isolated communities)	not included	not included	not included	not included	not included	included
Operating and maintenance costs	included	not included	included	included	included	included
Organisational overheads / policy formulation, planning, sector monitoring and regulation	included	not included	not included	not included	included	not included
Replacement costs	included	not included	not included	?	included	not included
Calculated for each technology or averaged?	for each technology	averaged	averaged	averaged	for each technology	for each set of technology
Per person or per household?	per person reached	per person reached	per person reached	per person reached	per person reached	per household
Differentiation by region	no	no	2 regional categories (case A and B)	no	yes	yes
Differentiation by rural/urban area	yes	yes	yes	no	no	yes
FINAL RESULTS: annual investment requirement (excluding wastewater treatment and in USD unless specified otherwise)						
...Global estimate	30 billion (100 billion incl. wastewater treatment)	9 billion	24 billion	30 billion	11 billion	15 billion (only for ecosan)
...Per region	no	no	no	yes	yes	yes
...Per country	no	no	no	no	no	no
...Per person reached	no (8.2)	no (2.5)	no (6.6)	no (8.2)	3.8 --> 7 (average 5.2)	rural Ecosan: 1; urban Ecosan: 16 (average: 8.7)
...As a percentage of GDP	no	no	no	no	no	0.02 --> 0.28%

JMP 2000: Global Water Supply and Sanitation Assessment Report 2000 (Joint Monitoring Programme)
JMP 2004: Meeting the MDG Drinking Water & Sanitation target: A Mid-Term Assessment of Progress
? : no data available or unclear - in green and in brackets: own calculation
** The target being «Water security» by 2025 (95% of the population having adequate access to safe water, 90% to improved sanitation, 20% to wastewater treatment, plus progress in irrigation and risk management).*

REGIONAL ASSESSMENTS			LOCAL ASSESSMENTS	
COWI / Danish Ministry of Environment 2004	Water and Sanitation Programme 2005	Asian Development Bank 2005	WaterAid 2004	UN Millennium Task Force on WSS 2005
no	no	no	no	no
Eastern Europe, Caucasus & Central Asia (EECCA region)	Sub-Saharan Africa	Asia & Pacific	no	no
yes	no	no	Nepal	Ghana
2002-2015	2002 - 2015	2002 - 2015	2000 - 2015	2002 - 2015
included	included	included	included	included
included	included	included	included	included
included	not included	included (primary)	not included	included (primary & secondary)
not included	not included	included	not included	included
not included	not included	not included	not included	not included
included	included	not included	included	included
not included	not included	not included	included (in some places)	not included
not included	not included	not included	not included	not included
JMP 2000	JMP 2000	JMP 2000	JMP 2000	JMP 2000
official national statistics & international statistical databases	JMP 2000 & JMP 2004 & ?	JMP 2004 & WHO	Central Bureau of Statistics of Nepal and WaterAid adjustments	JMP 2000 & JMP 2004 & Demographic and Health Survey
no	yes	no	yes	yes
own list (current level of service)	JMP 2000	JMP 2000	JMP 2000 + Ecosan	JMP 2000
urban areas: household connection; rural areas: standpipes or handpumps, and simple ventilated pit latrine	general principles are given, but no details	only low cost technologies, basic level of service; details given in this study but not in the WHO report	based on the proportion of the current population supplied by different methods, with some modifi-cations; details given	only general principles given, but no details
not included	not included	not included	included	not included
included	included	included	included	included
not included	included	included	included	not included
not included	included	included	included	?
for each technology	for each technology	per technology	for each technology	for each technology
per person reached	no data	per person reached	per person reached	no data
yes	no	no	yes	yes
yes	no	no	yes	yes
no	no	no	no	no
6.9 billion € (incl. wastewater treatment)	6.7 billion	8.11 billion (incl. primary wastewater treatment)	no	no
yes	no	(per sub-region)	73.3 million	167 million (174 million incl. wastewater treatment)
no	no (10.3)	no (5.3)	no (3.2)	no
no	2.7%	no	no	2% until 2006, 7.4% until 2015

The range of the estimates

At first, the range of the global estimates seems broad - between 9 billion USD (WHO 2004) and 30 billion USD per year (GWP 2000 and World Bank 2003). After closer examination however, a different picture emerges. Indeed, if the results are analysed on comparable bases, they appear quite similar: approximately 10 billion USD per year would be required to supply low-cost water and sanitation services to people who are not currently supplied (WSSCC 2000, WHO 2004), a further 15 to 20 billion USD a year to provide them with a higher level of service and to maintain current levels of service to people who are already supplied (Water Academy 2004). A much larger figure, up to 80 billion USD, is projected solely for collecting and treating household wastewater and for preserving the global environment through integrated water resources management (IWRM) and ecological methods (GWP 2000 and SEI 2004).

Total current investment in WSS (excluding wastewater treatment) in the developing world is estimated at between 14 and 16 billion USD annually [7]. Therefore, if the reviewed reports are considered reliable, the rough estimate of needing to double current investment in order to reach MDG Target 10 would be realistic.

General conclusions common to all the reports

More funding is necessary in the WSS sector

All the reports indicate that much more funding is required in the WSS sector than is presently available. As the MDG 2015 deadline approaches, a simple message needs to be emphasised today more than ever: Governments, donors and consumers able to contribute have to allocate more resources to this sector.

Main regional challenges: the "Big Two" -China and India- and Sub-Saharan Africa

As pointed out in the ADB's "Asian Water Watch 2015", the *global* attainment of the MDGs will largely depend on the progress made by China and India: even if their coverage rates are quite high compared to other developing countries, both will have to produce a huge effort (approximately the half the global investment), due to their demographic weight. Although they have significantly improved their coverage rates since 1990 [8], it is unclear whether or not China and India are on track to reach Target 10, since the ADB and the JMP come to different conclusions [9]. In any case, their coverage rates mask enormous disparities within both countries.

In terms of financial effort, meeting the MDGs in WSS will also be very costly in Sub-Saharan Africa, where the coverage rates are extremely low. According to the JMP, most Sub-Saharan countries are "off track" in reaching Target 10 [10]. Moreover, Sub-Saharan Africa is likely to require the most external financial support.

Promoting the "lower technical options providing appropriate service"

The level of service, that's is to say the technology mix applied in the field, is probably the factor that most influences the bottom line in investment requirement calculations.
This is particularly true for investments in urban areas which, by 2015, will comprise the majority of the populations to be supplied. Investment here would be of course phenomenal if connections to existing water supply and sewer networks

7- Investment in WSS in Africa, Asia, Latin America and the Caribbean between 1990 and 2000 is estimated at around 16 billion USD per year in the JMP "Global WSS Assessment 2000 Report" (p.16-17) and 14 billion USD in the GWP "Towards Water Security: A Framework for Action", 2000 (p.76). The Camdessus report "Financing Water for All" uses the GWP figure of 14 billion USD annually (p.3). It would appear that costs for maintenance and rehabilitation of existing assets are included in this figure.

8- It should be noted nevertheless that, in 1990, the JMP was using different definitions and a less effective data collection methodology than today which might affect the assessment of progress. Furthermore, official statistics are never totally reliable; for instance, they can be used as propaganda or as a means to attract more aid from donors.

9- According to the Asian Development Bank, India is on track to reach both water and sanitation targets, while China is not (see "Asian Water Watch 2015, p.11 and 20). According to the JMP, India is on track only for the water target, whereas China is on track for both targets (see "Meeting the MDG Drinking Water and Sanitation Target: Mid-Term Assessment of Progress", p.10 and 14).

10- See the JMP "Meeting the MDG Drinking Water and Sanitation Target: Mid-Term Assessment of Progress", 2004, p.10-14.

were to be planned for most households (see right-hand column in last table of ADB report). In sectors where an appropriate network exists, a household and sewer connection should be envisaged. In all other sectors, it is imperative that the lower cost options providing a convenient and sustainable service be preferred, in line with the principle "some for all, rather than all for some."

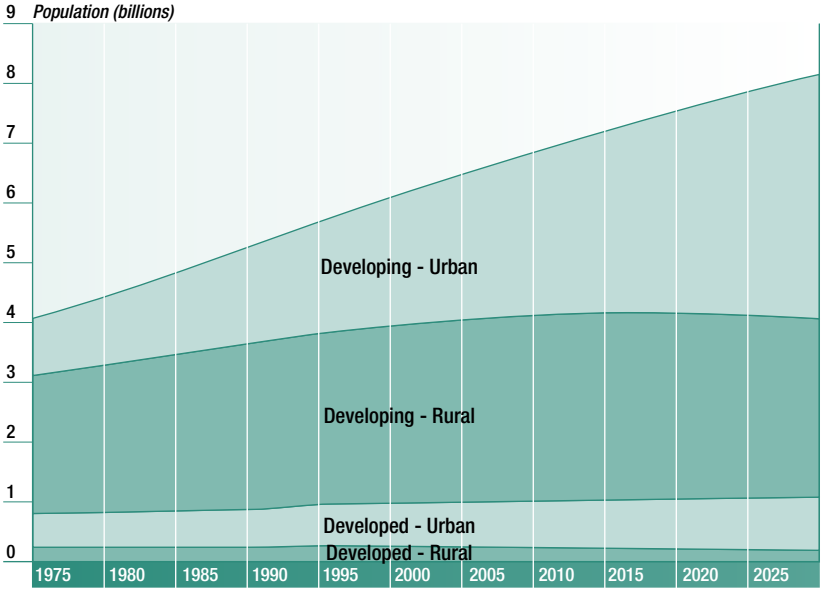
In rural and peri-urban areas, the reports almost systematically advocate lower-cost technologies, but this does not imply that it would be easier (or cheaper) to attain the MDGs in these areas, since geographically isolated or politically marginalised populations are difficult to reach and, therefore, to supply. For this reason, local communities should be involved in the WSS projects as much as possible: the mobilisation of local skills, techniques and labour help to keep costs low and generate local buy-in. This becomes essential in low-income countries (for instance in Sub-Saharan Africa), where the financing supply and economic growth are low but the needs are high.

Where implementation of ecological principles is concerned, for example ecological sanitation, unit costs are definitely higher than for traditional technologies. Moreover, it is unrealistic to integrate Ecosan everywhere. On the other hand, the Stockholm Environment Institute study shows that these methods are more sustainable and longer lasting; they are also affordable, since they enable water savings and the re-use of greywater for agricultural purposes (with the accompanying benefits). A market for this kind of method, above all through encouraging its acceptance and creating a demand, must be promoted.

Focus on urban areas, sanitation, and rehabilitation

The rapid urbanisation process in the developing world (see the chart below) means that water supply and sanitation targets will become primarily an urban challenge. Even if the coverage rates are lower in rural areas, the main effort will have to be produced in the cities. Results suggest that the cost of attaining Target 10 in cities will be two to three times higher than in rural areas (French Water Academy 2004, SEI 2005, WaterAid Nepal 2004, UN Millennium Project 2005).

Figure 1: Rural and urban population dynamics in developed and developing countries, 1975-2030:



Source: Stockholm Environment Institute, "Sustainable Pathways to Attain the Millennium Development Goals: Assessing the Role of Water, Energy and Sanitation", 2005, p.9

In some regions, due to decades of mismanagement, the rehabilitation of neglected infrastructure might be as costly as the installation of new infrastructure. Even in developed countries or those in transition, existing but run-down infrastructure can become a burden. It will be difficult to repair or replace for instance in the Eastern European, Caucasus and Central Asia region (COWI 2004) [11].

All reports agree that the sanitation target will be two to five times more costly to attain than the water target (excepting some country-specific cases), due to much lower coverage rates, more expensive unit costs and a more difficult cost recovery.

The cost of household wastewater collection and treatment will be even higher as the coverage rate in most developing countries is close to zero. In comparison, costs related to hygiene education seem to be moderate. In many cases, funding an awareness campaign in cooperation with local soap companies might be a pertinent strategy.

Main causes of the variations and weaknesses in the estimates

The report analysis revealed that costing MDG Target 10 is not easy, with definition issues on the one hand and, on the other, a lack of adequate and reliable data to reflect the real situation with respect to WSS. This leads the authors of cost assessments to use different assumptions in each step of their calculations and results in considerable approximations and shortcomings in the assessments.

Problems with the definitions in, and scope of, Target 10

Defining the term "basic sanitation"

Some estimates (four out of eleven) include the costs of household wastewater treatment and a few include global measures to ensure environmental protection; certain estimates also cover the cost of hygiene education. However, most of the reports reviewed envisage only septic tanks in some areas or even no wastewater treatment at all.

It is true that the UN Millennium Task Force on Water and Sanitation underscores the importance of meeting household wastewater treatment needs as part of the sanitation target [12]. Nevertheless, it may be argued that wastewater treatment should be part of either the broader Goal 7 on environmental sustainability, or Target 9 on sustainable development and conservation of natural resources, rather than Target 10 in the strict sense: indeed, household wastewater treatment is certainly not a "*basic* sanitation" service. Moreover, "*sustainable* access" does not mean that additional global measures must be taken to treat all household wastewater and ensure environmental protection, but that the WSS service provided "does not *compromise* the goals of sustainable development, namely, economic development, social equity and justice and environmental protection" [13]. Lastly, halving by 2015 the proportion of people without sustainable access to wastwater treatment would be totally unrealistic given the almost total absence of wastewater treatment plants in developing countries [14].

In any case, since wastewater treatment and even recycling urgently needs to be encouraged and enhanced everywhere, the real question is: what would be the total cost of Targets 9 and 10, which should remain inseparable.

Defining "water supply"

Similarly, the UN Millennium Task Force on Water and Sanitation emphasises the

11- As P. Börkey pointed out during a presentation of the decision-support tool FEASIBLE in Paris in February 2006, the OECD foresees a regression in WSS service levels in several areas of the EECCA region in the coming years.

12- See UN Millennium Project, Task Force 7 on Water and Sanitation: "Health, Dignity and Development: What Will It Take?", 2005, p. 107 and Box 3.1, p.30.

13- Ibid, p.32.

14- It is generally estimated that less than 10% of wastewater is treated worldwide. In the developing world, treatment plants rarely exist and when they exist, they often don't function properly.

importance of meeting needs for water storage and conveyance infrastructure as part of the water supply target [15]. Given the demographic shift towards larger urban centres and climate change, investment in this type of large, upstream infrastructure might grow in the future in order to make available more water resources. None of the analysed reports include this investment in their calculations however, most likely due to the acknowledged difficulty in predicting what infrastructure will be required, what the associated costs will be and what proportion of these costs should be attributed to the WSS sector.

Differences in timeframe and geographical scope

The timeframe varies from one report to another, depending on the date of issue and the baseline year for the statistical data used in the calculation. For instance, the GWP and WSSCC reports were issued before the MDGs were set in 2000, so their timeframes are slightly different: ensuring near-global WSS coverage by 2025. Likewise, the SEI's assessment issued in 2005 relies on JMP statistics for the year 2003 and therefore covers the period 2003-2015.

Furthermore, most of the reports assume that Target 10 only concerns the developing world, although progress in WSS coverage is equally necessary in developed countries and those in transition (see WHO and COWI reports).

Evaluating the target population

A lack of consistent data on water supply and sanitation

As previously stated, MDG Target 10 for WSS consists in halving the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015. This means that people who are not currently supplied must be provided with WSS by 2015, *and* that the current level of service must be maintained for those who already have access. However, the evaluation of coverage rates and rehabilitation needs is hindered by the lack of data on the condition of existing infrastructure. And when data does exist, the figures are generally underestimated. This is probably the reason why only one global assessment report includes investment needs for rehabilitation of existing infrastructure (ancient or in disrepair), in addition to investment for additional water supply and sanitation facilities (French Water Academy report) [16]. All the reports dealing with wastewater treatment highlight the even greater dearth of reliable data on that issue.

To assess the population currently supplied and the target population for WSS facility provision by 2015, almost all the reports (WHO 2004, ADB 2005 and WaterAid 2004 excepted) rely on coverage data provided by the Joint Monitoring Programme (JMP). Nevertheless, the method employed by the JMP (see box 3 below) does not provide coverage data matching the definitions in Target 10. Indeed, the JMP's coverage statistics mostly rely on surveys that do not verify the "sustainable" aspect of the household's access to WSS, that is to say "secure, reliable and available for use on demand by users on a long-term basis" [17].

Moreover, MDG Target 10 uses the term "safe" drinking water without defining it, making it impossible to measure the number of people with access to safe water. As a result, population coverage data as provided by the JMP focuses on water delivery, not on water quality. It is based on the people who have access to "*improved* water sources", but that doesn't necessarily mean the water is safe [18]. Even though the notion of "safe" water differs depending on the countries and cultures, minimum standards need to be established in order to estimate the actual number of people having (or lacking) access to safe water. Defining and measuring "basic" sanitation is equally complicated for the same reasons.

15- See UN Millennium Project, Task Force 7 on Water and Sanitation: "Health, Dignity and Development: What Will It Take?", 2005, p.108.

16- In contrast, almost all the regional and national assessments took the repair item into consideration.

17- See UN Millennium Project, Task Force 7 on Water and Sanitation: "Health, Dignity and Development: What Will It Take?", 2005, p.32.

18- "Population-based surveys do not provide specific information on the quality of the drinking water, or precise information on the adequacy of sanitation facilities. The terms "safe" water and "adequate" sanitation were replaced with "improved" to accommodate these limitations. Populations with access to "improved" water supply and sanitation are considered to be covered. See Joint Monitoring Programme, "Global Water Supply and Sanitation Assessment 2000 Report", p.4. On this issue, see also Catarina Fonseca and Rachel Cardone, "Analysis of Cost Estimates and Funding Available for Achieving the Millennium Development Goals Targets for Water and Sanitation", WELL Briefing Note September 2004, p.3.

Box 3: Note on the method used by the Joint Monitoring Programme (JMP) to assess coverage rates in WSS [19]

The assessment questionnaire, used by the Joint Monitoring Programme to assess the coverage rate for WSS in the various developing countries, defined access to water supply and sanitation in terms of the types of technology and levels of service provided.

For water supply and sanitation services:

"Improved water supply sources" included house connections, public standpipes, boreholes with handpumps, protected dug wells, protected springs and rainwater collection; allowance was also made for other locally-defined technologies.

"Access to water" was broadly defined as the availability of at least 20 litres per person per day from a source within one kilometre of the user's dwelling. Types of source that did not give reasonable and ready access to water for domestic hygiene purposes, such as tanker trucks and bottled water, were not included (bottled water was not considered "improved" because of concerns about the quantity of supplied water, not the water's quality).

"Improved sanitation facilities" was defined as including connection to a sewer or septic tank system, pour-flush latrine, simple pit or ventilated, improved pit latrine, again allowing for acceptable local technologies. The excreta disposal system was considered adequate if it was private or shared (but not public) and if it hygienically separated human excreta from human contact.

"Access to water and sanitation" does not imply that the *level of service* or *quality of water* is "adequate" or "safe", as the assessment questionnaire did not include any methodology for discounting coverage figures to allow for intermittence or poor quality of the water supplies. However, the instructions stated that piped systems should not be considered "functioning" unless they were operating at over 50% capacity on a daily basis and that handpumps should not be considered "functioning" unless they were operating for at least 70% of the time with a maximum of two weeks' delay between breakdown and repair. These aspects were taken into consideration for the few countries for which national surveys had not been previously conducted. However, the JMP statistics are primarily based on existing survey data which ignores these aspects.

For rural and urban areas:

The Assessment 2000 did not provide a standard definition of urban or rural areas. Instead, the questionnaire asked for the countries' own working definitions of 'urban' and 'rural'. Similarly, with the household survey data, definitions set by those responsible for the survey were accepted.

19- See JMP, "Global Water Supply and Sanitation Assessment 2000 Report", Annex A, p.77-78.

Consequently, there is too wide a discrepancy between reality and the available information. The JMP Mid-Term Assessment 2004 revised the coverage rates presented in the JMP Global Water Supply and Sanitation Assessment Report 2000 using a new data collection procedure, as the rates proved to be overestimated. As a result of this revision, the discrepancy between the JMP and WHO figures has further deepened, the origin for this discrepancy being unclear. The next JMP Global Sector Assessment Report (to be issued in 2006) will try to further refine the available data [20].

Accounting for demographic growth and urbanisation

The Millennium Project Task Force on Water and Sanitation specified in a recent report that Target 10 actually encompasses four targets. It is indeed divided into one water supply target and one sanitation target, themselves sub-divided into rural and urban subcomponents [21]. Accordingly, there is a need to distinguish between the target population in rural and urban areas. Some assessments take demographic growth and urbanisation into account when calculating both target populations – which shows that there will be a shift in their respective share –, others do not. Yet demographic growth will greatly impact on investment needs; rural exodus and urbanisation will influence investment costs (since technologies used in urban areas are more costly). Hence, both phenomena must *always* be taken into consideration.

Assessing the level of service

Target 10 does not give precise information on the level of services that should be targeted. Yet the technical options chosen can and will vary according to the timing, location, and type of project:

- Standard levels of accepted service could change over the coming years and therefore substantially impact on the scale of investment required [22].
- Service levels cannot be equivalent in rural and urban areas or between regions (e.g. Sub-Saharan Africa and Russia), where the socio-economic situations, existing assets, cultural norms and technical possibilities are different. Nine of out the eleven assessments overlook at least one of these aspects.
- Since the majority of the population to be supplied by 2015 will be located in cities, the number of large-scale urban projects will certainly increase. In terms of people reached, they will constitute the bulk of future projects. As is usually the case, most of them will be funded by aid agencies and multilateral financial institutions (MFIs). In general, they are subject to international tendering procedure as well as compliance with quality standards (WHO guidelines, ISO standards, US Environmental Protection Agency or EU norms, etc.). Yet these technical standards are mentioned neither in the MDG definitions, nor in reference to improved WSS services. It is therefore very difficult to assess the increase in the level of service they imply, the corresponding increase in unit costs and any consequent increase in the cost of attaining Target 10. None of the reviewed reports even mention this problem [23].

In the absence of precise guidelines on this issue, some assessments assume the use of low-cost technologies in every case, while others envisage more expensive methods (like household connections or ecological sanitation).

20- See JMP, "Report of the Third Meeting of the Advisory Group", Geneva, 5-7 October 2004, available at: http://www.wssinfo.org/pdf/JMP_TAG_3_report.pdf. The difference between WHO and JMP data does not mean

21- See UN Millennium Project, Task Force 7 on Water and Sanitation: "Health, Dignity and Development: What Will It Take?", 2005, p.33, figure 3.1.

22- As Mr. Ravi Narayanan, former Director of WaterAid, put it: "We could come to a conclusion that the current standard of having access to a water source within one kilometre of habitations is not adequate, which would immediately require a higher level of service, and therefore cost." (Personal communication, January 22, 2006)

23- This remark has been passed by P.-F. Tenière-Buchot and G. Schmidt-Traub.

Problems in assessing unit costs

For practical reasons, all the assessments assume that the unit costs will remain constant up to 2015 and beyond, even if they may vary with water rarefaction, inflation or technological progress.

Despite this common assumption, the estimation of unit costs for each technology differs from one report to another [24]. There are two main reasons for this:

Firstly, the unit cost of each water supply and sanitation system (including operation, maintenance and replacement costs) depends on the country, the number of people to be supplied (the larger the target community, the greater the economy of scale), on the source and quality of the technology, on the terrain where the infrastructure is to be installed, on the local traditions and culture (e.g. the need for two separate toilets in each household, one for women and one for men), as well as the potential involvement of local manpower and skills. Yet most of the global assessments use dissimilar sources and then calculate regional or global aggregates from them. Aggregate figures mask enormous disparities between local situations and, by doing so, lose their relevance. That is why national assessments are more accurate than regional or global assessments. Therefore, a more exact calculation methodology is required to better represent the diversity of local situations by avoiding the use of averages (and average aggregates). This implies more rigour in the calculation and significant improvements in data collection, admittedly a huge and difficult task.

Secondly, the various unit costs do not include the same components. It is crucial to note here that if, according to MDG Target 10, access to WSS services is to be "sustainable", costs related to operation and maintenance (O&M) and transportation, as well as organisational overheads (e.g. policy planning, monitoring and regulation) and replacement costs, should be incorporated into the unit costs for each technology. However, this is the case only in the WaterAid report.

24- In particular, unit costs given by NGOs tend to be lower than those for projects funded by international organisations or aid agencies. This does not suppose that NGOs understate their unit costs. There are probably many different reasons which cannot be examined within the framework of this comparative study. See Henri Smets, "The Cost of Meeting the Johannesburg Targets for Drinking Water: A Review of Various Estimates and a Discussion of the Feasibility of Burden Sharing", revised edition, 2004, p.28, especially footnote 18, which makes explicit reference to the WaterAid report "Financing the Millennium Development Goals for Domestic Water Supply and Sanitation", 2003; see also the lengthy debate raised in the nineties by John Briscoe of the World Bank and Gourisankar Ghosh of UNICEF on the subject of costs, reported in various publications.

CONCLUSIONS & RECOMMENDATIONS

Comparing the various estimates meaningfully: a difficult task

The wide range of cost estimates stems from the various interpretations in defining Target 10, which lead to:

- different assessment scopes: Does the fulfilment of Target 10 imply the rehabilitation of existing, ageing assets? Is household wastewater treatment included in the term "basic sanitation"? The assessments provide different answers to these questions;
- different appreciations as to the kind of infrastructure and the level of service to be supplied;
- different methods being used to calculate unit costs and global aggregates.

Thus, no two estimates cover the same items, making comparison a delicate issue.

General shortcomings and weaknesses in the global assessments

Target 10 does not cover all water and sanitation issues

It must be stressed that water and sanitation issues are wider than Target 10 alone. For instance, Target 10 covers neither water needs for irrigation and industry, nor treatment of all wastewater. Hence, the required investment in the *broader* WSS sector is much larger than the costing of Target 10 suggests.

Furthermore, most global assessments of Target 10 fulfilment needs are probably underestimated. There are three main reasons for this:

Imprecise estimation of the target population

Firstly, the Target 10 definitions need to be clearly specified, particularly the terms "safe" water and "basic" sanitation. Secondly, data collection procedures need to be improved in order to measure real access to *safe* water (and possibly to wastewater treatment), and to better ascertain rehabilitation requirements. These are prerequisite if the target populations are to be accurately evaluated.

The needs assessments for meeting Target 10 are not sufficient to ensure "sustainable access" to WSS

In general, the estimates failed to include in their calculations:

- costs for rehabilitation or replacement of existing, ageing or neglected infrastructure;
- costs for development of water storage and conveyance infrastructure aimed at providing people with more water resources;
- costs for capacity building and policy planning, monitoring and regulation.

Yet this kind of investment is vital if sustainable access to WSS is to be ensured for all.

Economic cost is not "real" cost

The cost assessments reviewed reflect only the economic cost of investment, with no allowance for the way in which the required investments will be financed. Yet the bulk of future investment in cities will probably be financed through loans, with financing charges (interest payments, commissions, commitment fees, etc.) accounting for a significant percentage of total outlays. However, none of the reports reviewed appear to have added these financing charges to the cost of the projected infrastructure [25]. This omission can be explained by the difficulty of estimating financing charges, which depend on the type and scope of a project, the financing mechanism used and by factors such as timing and location.

Similarly, if local communities, for example in rural areas, contribute their labour to a project, the monetary cost of the investment required will be reduced.

The absence of these factors surely lessens the relevance of the MDG cost assessments, if their objective is a *real* funding requirement figure for Target 10 fulfilment.

The need for assessments at the country level

Target 10 is particularly difficult to cost at the global level. Besides, given the number of global estimates that already exist, it seems pointless to spend even more time and resources refining them [26]. On the contrary, the UN Millennium Task Force recently called for more efforts in planning at the country level, which implies additional cost assessing at the national and even sub-national levels [27]. Furthermore, national assessments might be more helpful to governments of developing countries and donors as an indicator to determine the amount of public funds or official development aid (ODA) to be allocated to the WSS sector.

Therefore, agreement would appear necessary on a comprehensive, standard calculation methodology that could be used by all to generate results at country level. These results could then be compared with each other. The tool developed by Guido Schmidt-Traub [28], Associate Director at the Millennium Project, is a significant step in this direction, even though it could be improved and specified. However, efforts to find the perfect universal model must be necessarily restrained by the many variables dictated by time and location.

25- This key remark has been passed by Pierre-Frédéric Teniè-re-Buchot.

26- This is why the GWP finally abandoned the idea of a more precise cost assessment following the one presented in the "Framework for Action", 2000.

27- Sub-national assessments are especially needed in large countries like Brazil, India, China and Nigeria. See UN Millennium Project, "Health, Dignity and Development: What Will It Take?", 2005, p.32.

28- Ibid, p.103-112. The assessment for Ghana presented in this paper utilized this tool. See also UN Millennium Project, "Investing in Development: A Practical Plan to Achieve the Millennium Development Goals", 2005, p.239-245.

FORMATTED SUMMARIES OF 11 COST ASSESSMENTS

Global Water Partnership (GWP)

Towards Water Security: A Framework for Action - 2000

Main Estimates:

- Number of people to be supplied with water by 2025: not given
- Number of people to be provided with sanitation services by 2025: not given
- Approximate investment requirement for water supply: 13 billion USD per year
- Approximate investment requirement for sanitation: 17 billion USD per year
- Total investment requirement for WSS: approx. 30 billion USD per year
- Average annual cost per capita: not given
- WSS investment compared to the 1990's: plus 16 billion USD approx. per year
- Approximate investment level for wastewater treatment: 70 billion USD per year

Methodology:

1) Scope of the assessment:

The GWP "Framework for Action" defines the main challenges in the WSS sector and offers guidelines to achieving "water security" worldwide by 2025 (not just in the developing world). It also provides a global assessment of investment requirements to meet this "water security" objective. The definition of the water security concept is broader than in the MDGs on water supply and sanitation, which did not exist at the time the Framework for Action was written: in addition to water supply, sanitation and municipal wastewater treatment, it includes improving the efficiency and productivity of irrigation, risk management, the health of freshwater ecosystems and integrated water resources management. In this summary, we will consider only the cost estimates for attaining the water supply and sanitation target as well as those for municipal wastewater treatment in the developing world. Costs related to hygiene education, rehabilitation of old infrastructure and major water storage and conveyance infrastructure seem to have been omitted in the needs assessment.

The starting year for the calculation is not clearly specified, but is assumed to be 2000.

2) Evaluating the target population:

The GWP report considers that 95% of the world population should be provided access to water by 2025. The target population for each region is derived from World Resources Institute, Joint Monitoring Programme (JMP) and UNICEF statistics, taking demographic growth and urbanization into account. However, the GWP report doesn't give the population numbers covered, either globally or per region or in rural/urban areas.

At the time, the number of people to be provided with sanitation was estimated by the JMP at around 2.4 billion; a 90% coverage by 2025 was the goal. Taking this as a baseline, the number has been distributed by region assuming that access to drinking water and access to sanitation would be distributed along the same pattern. No data is given for this regional distribution in the report, or for the rural/urban distribution. In addition, the GWP scenario retains a target of 20% wastewater treatment by 2025.

3) Water supply and sanitation technology to be used:

The GWP used its own list of "appropriate" technologies, not the list established by the JMP in the GWSSAR, as this was not published at the time the Framework for Action was written. However, the lists are similar.

It is assumed that the proportion of each type of technical option for water supply, sanitation and municipal wastewater treatment is based on the proportion of the population currently served by different methods (for example, pit latrines may be cheap, but they are hardly useful in densely-settled urban areas, nor efficient where there are existing sewers nearby).

4) Estimating the unit costs:

The following table lists the different techniques and costs, and presents an estimate of the percentage of population served by each, and a capital cost per unit used. Fifteen percent has been added to capital costs to cover operating, maintenance and replacement. The water supply and sanitation data source is not specified; moreover, no differentiation is made by region. The figures used for wastewater treatment are not current and are derived from projects in just one region of the world (the Middle East) [29].

	Cost USD per person	% applicable
URBAN		
new sewerage	300	25%
basic pit latrine	25	25%
condominial investments	75	25%
extensions to existing sewer	150	25%
water supply sandpipe	50	75%
household connection	200	25%
RURAL		
sanitation and hygiene	10	100%
drinking water	15	100%
WASTEWATER TREATMENT		
low cost, small town	27	20%
low cost, village	140	20%
urban, population 2 million	50	60%
weighted average	63	
O&M and replacement cost at 15%	10	

29- Biwater Ltd as used in 1998 in ERM 1998, Syria NEAP; Howard Humphrey Ltd, Damascus sewerage project 1997 and ERM Pollution Abatement Cost estimation, 1991, and Ashact Ltd.

5) Global cost estimate for developing countries:

	Estimated investment in 2000 (billion USD)	Annual cost per year until 2025 (billion USD)
Access to drinking water	13	13
Sanitation and hygiene	1	17
Municipal wastewater treatment	14	70
Total cost	28	100

The authors of the GWP report acknowledge that these findings are preliminary and should not be considered accurate estimates of the financing required.

http://www.gwpforum.org/gwp/library/sec3b.pdf
http://www.gwpforum.org/gwp/library/sec4.pdf

Water Supply & Sanitation Collaborative Council (WSSCC)

Vision 21: A Shared Vision for Hygiene, Sanitation and Water Supply, and a Framework for Action. 2000

Main Estimates:

- Number of people to be supplied with water by 2025: 3.1 billion
- Number of people to be provided with sanitation services by 2025: 4.9 billion
- Approximate investment requirement for water supply, sanitation and hygiene promotion: 9 billion USD per year
- Average annual cost per capita: not given

Methodology:

1) Scope of the assessment:

The WSSCC report defines the main challenges in the WSS sector and offers guidelines to achieving the "Vision 21" worldwide by 2025 (not just in the developing world). The definition of the Vision 21 concept is broader than the content of the MDGs on water supply and sanitation, which did not exist at the time this report was written.

The WSSCC report also provides (p.28) a rough estimate of the investment needed in developing countries to provide, by 2025, safe and adequate water and sanitation, plus hygiene education, to every person, according to the "Vision 21" concept; the reference year for the calculation is 2000. As mentioned, the assessment covers the expenditure related to water supply, sanitation and hygiene education, but excludes wastewater treatment, rehabilitation of old infrastructure, and major water storage and conveyance infrastructure.

2) Assessing the target population:

In 2000, an estimated 1.1 billion people were without water in the developing world and 2.9 billion without sanitation. By 2025, the world's population will have grown by some 2 billion. By that date, the approximate number of persons to be supplied will be 3.1 billion for water (0.7 billion rural and 2.4 billion urban dwellers) and 4.9 billion for sanitation (2 billion rural and 2.9 billion urban dwellers). The source of this data is the JMP 2000's pre-publication draft figures [30] (Vision 21 was written before JMP 2000 was published).

3) Water supply and sanitation technology to be used:

The WSSCC used the JMP's definition of "access" to "safe" and "adequate" water supply and sanitation, although this was not stated in the published report. The report assumes the use of appropriate low-cost technologies and basic levels of service to achieve Vision 21: community waterpoints from protected but untreated points or piped sources, on-site sanitation using improved pit or pour-flush domestic latrines [31].

30-31- This information has been kindly provided by Jon Lane, author of the Vision 21 cost assessment.

4) Estimating the unit costs:

For a basic level of service per the principles of Vision 21, the average external costs per person (i.e. in addition to those borne by households or communities) may be estimated as 15 USD for rural water, 50 USD for urban water, 10 USD for rural sanitation and hygiene promotion and 25 USD for peri-urban sanitation and hygiene promotion (in some countries these costs may even be lower). Operating and maintenance costs seem to be included, estimated at 15% of capital cost per year. No differentiation by technology and by region is made. The sources of these estimates are "UNICEF and various World Bank publications": Vision 21 used global average figures for basic-level services drawn from the published debate between the World Bank's John Briscoe and Gourisankar Ghosh of UNICEF on the subject of costs [32].

5) Global cost estimate for developing countries:

Multiplying these figures gives a total of approximately 225 billion USD, to be spent over 25 years, to reach all the people currently not supplied in developing countries, or approximately 9 billion USD per year. Current estimates of annual expenditure on water and sanitation in developing countries range from 10 to 25 billion USD, most of which is spent on higher level services in urban centres and whose cost is not recovered from the users. Hence, the author of this outline calculation points out that achieving Vision 21 will mainly depend on political will: If capital costs were recovered from those users who can afford to pay, there would be enough money to cross-subsidise the capital costs of services for those who cannot.

www.wsscc.org/pdf/V21core.pdf

32- This information has also been provided by J. Lane.

Académie de l'Eau

Henri Smets - A Review of Various Estimates and a Discussion of the Feasibility of Burden Sharing (Revised edition March 2004)

Main Estimates:

- Number of people to be supplied with water between 2000 and 2015: 1.53 billion
- Number of people to be provided with sanitation services between 2000 and 2015: 2.105 billion
- Approximate investment requirement for water supply: 9.3 billion USD per year.
- Approximate investment requirement for sanitation: 14.62 billion USD per year
- Total investment requirement for WSS: approx. 24 billion USD per year
- Average annual cost per capita: not given
- WSS investment compared to the 1990's: plus 10 billion USD approx. per year

Methodology:

1) Scope of the assessment:

This global assessment covers the investment requirements in water supply and sanitation for the period 2000-2015 (including investment requirements for rehabilitating old infrastructure). It does not deal with investment linked to wastewater treatment, major water storage and conveyance infrastructure or hygiene education. Secondly, the Water Academy report aims to analyse how this investment can be financed.

2) Evaluating the target population:

The water and sanitation target population for the period 2000 to 2015 has been estimated using the data collected by the Joint Monitoring Programme (JMP) in the Global Water Supply and Sanitation Assessment Report 2000 (GWSSAR) for population supplied in 2000 and demographic growth until 2015 (the term 'supplied' does not necessarily mean 'having *piped* water'). The target population figure is the projected total population for 2015, minus the population already covered by water and sanitation services in 2002 and minus the population not programmed for supply by 2015. The population not programmed for supply by 2015 represents half the percentage not covered in 1990 (or 2002 where 1990 data is unavailable) multiplied by the projected population for 2015. Urbanization has already been taken into account in the GWSSAR target population projection.

MDG target population 2000-2015: number of persons to be supplied in millions:

	Water Supply			Sanitation		
Region	Urban	Rural	Total	Urban	Rural	Total
Africa	210	194	404	212	198	410
Asia	619	361	980	675	857	1532
Latin America	123	23	146	131	32	163
Total	**952**	**578**	**1530**	**1018**	**1087**	**2105**

Source: GWSSAR 2000

3) Water supply and sanitation technology to be used:

Access to safe water and basic sanitation is defined per the concept of "improved technologies" in JMP's GWSSAR. For details on the level of service planned in rural and urban areas, see below.

4) Estimating the unit costs

The average unit cost of new connections has been calculated for two coverage quality case scenarios: The GWSSAR unit cost estimates for household water supply and sanitation connection in each region (Africa, Asia without EECCA countries, Latin America) has been averaged approximately. The unit cost for less elaborate methods (for water supply: public standpipe, bore hole, protected dug well and rainwater collection; for sanitation: small bore hole, pour-flush latrine, ventilated improved pit latrine, simple pit latrine, septic tank) in each region has also been averaged.

These less elaborate methods are used in rural areas. Case A is for providing household connections to water supply and sanitation networks with every new connection in urban areas. In Case B, the service is less elaborate (67% of new connections in urban areas are household connections and 33% of new clients receive a lower level of service such as standposts in deprived areas). Case B corresponds to interim supply conditions in fast expanding new suburbs, the ultimate target obviously being to provide water inside each dwelling. Therefore, cost figures in case B correspond more to Africa and Asia than to Latin America, where fewer connections are needed. Operating and maintenance costs are included.

Unit investment costs (in USD/cap.):

	Unit cost in urban areas (USD/cap.)		Unit cost in rural areas (USD/cap.)
	Case A	Case B	Case A and B
Water supply	100$	67% at 100$ + 33% at 50$ = 83.50$	25$
Sanitation	140$	67% at 140$ + 33% at 90$ = 123.50$	50$
Supply+Sanitation	**240$**	**207$**	**75$**

5) Global cost estimate for the developing countries:

The unit cost data was then applied to the whole MDG targeted population for the period 2000-2015 (15 years) and calculated on an annual basis for both urban and rural areas. The calculation does not differentiate by region:

Annual investment costs (2000-2015) in billion USD [33]:

	Cost in urban areas		Cost in rural areas	Total urban A + rural	Total urban B + rural
	Case A	Case B			
Water supply	6.35	5.30	0.96	7.31	6.26
Sanitation	9.50	8.38	3.62	13.12	12.00
Total investment	**15.85**	**13.68**	**4.78**	**20.43**	**18.26**

The above estimates are then adjusted upwards, since the author assumes that these calculations underestimate costs. Indeed, statistics on population with access to safe water and basic sanitation are less than reliable; moreover, unit costs for water supply and sanitation may increase as a result of increasing urbanization, increasing water scarcity, decreasing renewable water resources and decades of mismanagement and neglect of existing networks. As a result, the overall investment required for water and sanitation is revalued at 24 billion (case A) and 21 billion USD (case B) per year, that is to say approximately 10 billion USD more than investment figures for the 1990's.

http://www.academie-eau.org/IMG/pdf/Jo_burg_6-2.pdf

33- Following a discussion with the author H. Smets, some figures in the table have been slightly adjusted.

World Bank

Water Supply and Sanitation and the Millennium Development Goals Addendum 3. 2003

Main Estimates:

- Number of people to be supplied with water between 2000 and 2015: 1.5 billion
- Number of people to be provided with sanitation services between 2000 and 2015: 2 billion
- Approximate investment requirement for water supply: 10 billion USD per year
- Approximate investment requirement for sanitation: 20 billion USD per year
- Total investment requirement for WSS: approx. 30 billion USD per year
- WSS investment compared to the 1990's: plus 15 billion USD approx. per year
- Average annual cost per capita: not given

Methodology:

1) Scope of the assessment:

This report from the World Bank presents the main challenges concerning the achievement of the MDGs in the WSS sector and formulates guidelines to respond to the challenges. It also provides a global assessment costing the investment needed for water supply and sanitation from 2000 until 2015, excluding maintenance and replacement of existing assets (for example rehabilitation and reconstruction of deteriorated water and sewerage systems), wastewater treatment, awareness campaign and major infrastructure of water storage and conveyance.

2) Evaluating the target population:

It assumes that in order to meet the MDGs, approximately 1.5 billion people (1 billion in urban areas and 0.5 billion in rural areas) will have to be provided access to safe water and 2 billion people (1.1 billion in urban areas and 0.9 billion in rural areas) provided basic sanitation, over the period 2000-2015. These estimates take population growth and urbanization into account. The much larger potential demand for treating collected wastewater and its disposal by environmentally sustainable means is excluded from the assessment.

The population estimates are based on GWSSAR 2000 (p.32-33), itself based on the population growth projection of the UNDP Human Development Report 1998.

Population coverage required by the 2015 international development target

TOTAL	2000 total population (in millions)	2000 total population with access (millions)	2000 total coverage	2015 target total coverage	2015 total population (millions)	2015 target total population to have access (millions)	2015 target additional population to serve (millions)	2015 target increase in total population to be served
WATER SUPPLY								
Africa	784	484	62	82	1078	889	404	83
Asia	3683	2990	81	9&	4347	3970	980	33
Latin America & Caribbean	519	441	85	93	631	588	147	33
Oceania	30.4	26.7	88	94	36.1	33.9	7.3	27
Europe	729	703	96	100	719	718	22	2
Northern America	310	310	100	100	343	343	39	11
Global	6055	4956	82	91	7154	6542	1599	32
SANITATION								
Africa	784	471	60	82	1078	881	410	87
Asia	3683	1767	48	76	4347	3299	1532	87
Latin America & Caribbean	519	402	78	90	631	566	163	41
Oceania	30.4	28.4	93	97	36.1	34.9	7	23
Europe	729	674	92	97	719	698	25	4
Northern America	310	310	100	100	343	343	39	11
Global	**6055**	**3652**	**60**	**81**	**7154**	**5822**	**2175**	**59**

Source: GWSSAR 2000

3) Water supply and sanitation technology to be used:

Access to safe water and basic sanitation is defined within the concept of "improved technologies", as in the JMP's GWSSAR 2000. No detail is given about the proportion of each technology in urban, peri-urban and rural areas, but the unit costs and the results suggest that a combination of low-cost options and more expensive technologies has been envisaged everywhere.

4) Estimating the unit cost:

The unit costs of the different WSS facilities used in the calculation are not given by the report's author. Nevertheless, dividing the annual investment costs by the target population gives an idea of the approximate annual unit cost per person reached used in the calculation:

- In Africa: 70.4 USD for water supply; 121 USD for sanitation.
- In Latin America and the Caribbean: 81.6 USD for water supply; 138 USD for sanitation.
- In Asia: 72 USD for water supply; 133 USD for sanitation.

No differentiation by area (urban vs. rural) is made.

5) Global cost estimate for developing countries:

The following table presents the global estimate for developing countries. The regional categories differ from those used to evaluate the target population (see previous table).

Annual investment cost estimates by region (in billion USD, 2001 prices):

	Water supply	Sanitation	Total	
Region			**USD**	**Share, %**
Africa	1.9	3.3	5.2	17
East Asia & Pacific	2.6	6.9	9.5	32
Europe & Central Asia	0.2	0.4	0.6	2
Latin America & Caribbean	0.8	1.5	2.3	8
Middle East & North Africa	0.6	1.2	1.8	6
South Asia	2.1	6.7	8.8	29
Additional Production	1.8	-	1.8	6
Total Developing World	**10.0**	**20.0**	**30.0**	**100**

Note: The term "additional production" in the left column is not explained.

In order to achieve Target 10, it is estimated that annual investment will need to double from a historical 15 billion USD to 30 billion USD.

This estimate assumes higher investment and operating efficiency than in the past and must be considered the lower end of required MDG investment for a number of reasons. Indeed, analysis of the methodology used in the assessment suggests a somewhat "back of an envelope" approach. Foremost, the cost of rehabilitating run-down water and wastewater systems has not been included in the estimates. The World Bank estimates that such rehabilitation plus maintenance will require no less than 2% of the replacement value of assets indefinitely.

World Health Organisation (WHO)

Hutton & Haller - Evaluation of the Costs and Benefits of Water and Sanitation Improvements at the Global Level. 2004

Main Estimates:

- Number of people to be supplied with water between 2000 and 2015: 0.66 billion
- Number of people to be provided with sanitation services between 2000 and 2015: 1.42 billion
- Approximate investment requirement for water supply: 1.7 billion USD per year
- Approximate investment requirement for sanitation: 9.2 billion USD per year
- Total investment requirement for WSS: approx. 11 billion USD per year
- Average annual cost per person supplied: approx.5.2 USD
- Average annual cost per capita (entire population): approx.1.7 USD

Methodology:

1) Scope of the assessment:

The WHO report estimates the costs and likely benefits to the whole (developing and developed) world of achieving the MDGs in WSS. The cost assessment covers investment requirements for water supply and sanitation for the period from 2000 (the baseline year) to 2015, including awareness campaigns and hygiene education. It does not deal with investment linked to wastewater treatment, rehabilitation of existing assets and new major water storage and conveyance infrastructure.

This global evaluation was conducted at country level, and the results were aggregated (weighted by country population size) to give the regional averages (17 WHO sub-regions categorised according to epidemiological indicators).

2) Evaluating the target population:

The proportion of the population in each country without access to 'improved' water and sanitation in 2000, as estimated in GWSSAR 2000, is taken into account. However, the calculation of the target population is the WHO's own projection, which may explain why the WHO target population figures are much lower than the JMP projection. The WHO's calculation allows for demographic growth, but not urbanisation. The aggregated results for each WHO sub-region are:

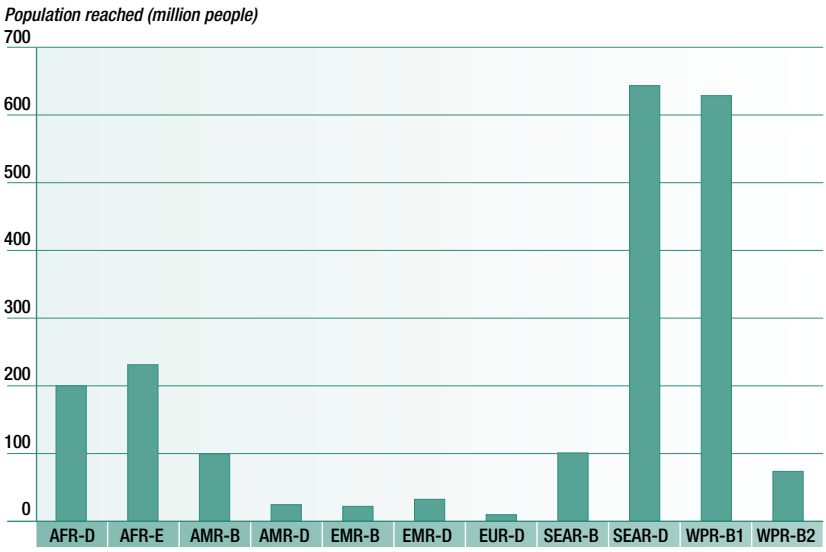
Populations receiving improvements (WHO estimates using predicted population growth 2000 - 2015) [34]:

WHO Region	Overall population (in million)	Water supply target population (in million)	Sanitation target population (in million)	Total target population (in million)
AFR-D	487	96	104	200
AFR-E	481	116	116	232
AMR-A	356	0	0	0
AMR-B	531	40	60	100
AMR-D	93	11	15	26
EMR-B	184	10	12	22
EMR-D	189	13	20	33
EUR-A	413	5	12	17
EUR-B1	176	13	13	26
EUR-B2	62	5	6	11
EUR-D	223	2	8	10
SEAR-B	473	47	55	102
SEAR-D	1689	109	536	645
WPR-A	154	7	21	28
WPR-B1	1488	180	451	631
WPR-B2	176	37	37	74
WPR-B3	9	2	2	4
Dvlpg. World	6022	663	1416	2079
World	**7183**	**693**	**1468**	**2161**

Remark: Countries outside the developing world are listed in green. Source: WHO

Overall, if the MDG target for water were reached, 693 million people would receive improvements in water supply, or 9.6 % of the world's population by the year 2015. An additional 20.6 % of the world's population - about 1.5 billion people - would receive improvements in sanitation if that target were also reached. No differentiation is made between rural and urban populations.

Population reached by achieving the combined water and sanitation Millennium Development Goals, by world sub-region:



34- For results presentation, the WHO chose a sample of five sub-regions to reflect a range of both results and geographical areas: sub-Saharan Africa epidemiological pattern E (AFRO-E), Americas epidemiological pattern D (AMROD), European epidemiological pattern C (EURO-C), South-east Asia epidemiological pattern D (SEARO-D) and Western Pacific Region epidemiological pattern B (WPRO-B1). Together, these five sub-regions accounted for 55.4% of the world's population in the year 2000 and contain the world's two most populous countries: India (SEARO-D) and China (WPRO-B1). The figures for the entire developing world are given here. The list of countries in each WHO sub-region can be found in the WHO report, appendix A1.

3) Water supply and sanitation technology to be used:

Access to safe water and basic sanitation is defined per the GWSSAR 2000 within the concept of "improved technologies".

The authors originally defined two levels of service; finally, only the low-level technology was applied to both urban and rural areas (i.e. without household or sewer connection):

For water supply: 25% of households for each of standpipe, borehole, dug well, rainwater harvesting. For sanitation: 33% of households for each of septic tank, VIP and small pit latrine [35].

4) Estimating the unit cost:

Incremental costs include all resources required to put in place a supply and maintain it, as well as other costs resulting from the intervention. These are divided into investment and recurrent costs and differentiated by region.

Investment costs include: planning and supervision, hardware, construction and house alteration, protection of water sources and training that accompanies an investment in hardware.

Recurrent costs include: operating equipment to provide a service, maintenance of hardware and replacement of parts, emptying of septic tanks and latrines, regulation and control of water supply, ongoing protection and monitoring of water sources, water treatment and distribution and permanent educational activities.

Initial investment cost per capita:

	Initial investment cost per capita (USD year 2000)		
Improvement	Africa	Asia	LA&C
WATER IMPROVEMENT			
House connection	102	92	144
Standpost	31	64	41
Borehole	23	17	55
Dug well	21	22	48
Rainwater	49	34	36
Disinfection at point of use	0.13	0.094	0.273
SANITATION IMPROVEMENT			
Sewer connection	120	154	160
Small bore sewer	52	60	112
Septic tank	115	104	160
Pour-flush	91	50	60
VIP	57	50	52
Simple pit latrine	39	26	60

Evaluating recurrent costs was more problematic due to the lack of easily-available data sources. Values taken from documentation were combined with assumptions for the various items of recurrent cost shown below. Cost estimates were based on the likely recurrent cost as a percentage of annual investment, using values from the documentation (World Bank and other international projects).

35- Details kindly provided by Guy Hutton, co-author of the report.

Assumptions used in estimating annualised, recurrent costs:

Improvement	Length of life in years (+ range)	Operation, maintenance, surveillance as % annual cost (+ range)	Education as % annual cost (+ range)	Water source protection as % annual cost (+ range)
Water improvement *				
Household connection	40 (30-50)	30	-	10 (5-15)
Standpost	20 (10-30)	5 (0-10)	-	10 (5-15)
Borehole	20 (10-30)	5 (0-10)	-	5 (0-10)
Dug well	20 (10-30)	5 (0-10)	-	5 (0-10)
Rainwater	20 (10-30)	10 (5-15)	-	0
Sanitation				
Sewer connection **	40 (30-50)	30 (15-45)	5 (0-10)	-
Septic tank	30 (20-40)	10 (0-10)***	5 (0-10)	-
VIP	20 (10-30)	5 (0-10)	5 (0-10)	-
Simple pit latrine	20 (10-30)	5 (0-10)	5 (0-10)	-

table key:
** For regulated water supply add to this: water treatment costs (60 litres/person/day, at 0.30 USD /m3 in Africa and Latin America, and 0.20 USD /m3 in Asia, treated and distributed).*
*** To calculate sewerage costs, partial sewage is taken to cost 0.15 USD /m3 (based on water usage per person) (range 0.10 to 0.20 USD), using WHO data treatment costs.*
**** To calculate sewerage costs, sewage disposal is assumed to cost 2 USD /person/year for VIP and simple pit latrine, and 3 USD /person/year for septic tanks.*

The table below shows the annual cost of each improvement per person reached, based on the intervention costs and assumptions in the above tables.

Annual costs for improvements per-person reached:

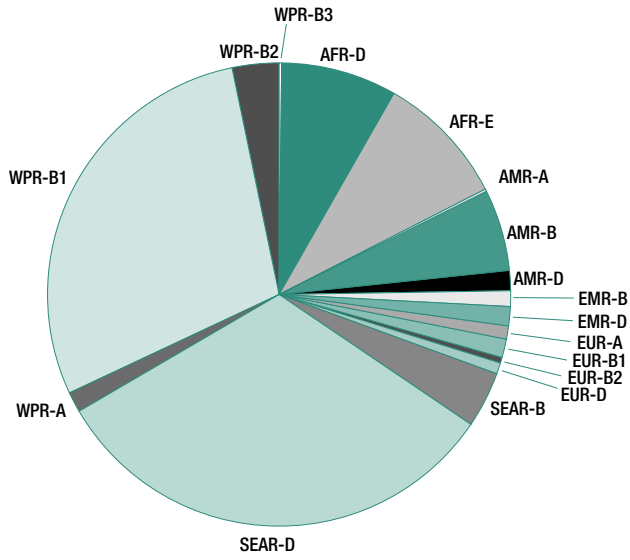
	Annual cost per person reached (in USD year 2000)		
Intervention	Africa	Asia	LA&C
Improved water supply			
Standpost	2.40	4.95	3.17
Borehole	1.70	1.26	4.07
Dug well	1.55	1.63	3.55
Rainwater	3.62	2.51	2.66
Disinfected	0.33	0.26	0.58
Regulated piped water in-house (hardware and software)	12.75	9.95	15.29
Regulated piped water in-house (software only)	8.34	5.97	9.06
Improved sanitation			
Septic tank	9.75	9.10	12.39
VIP	6.21	5.70	5.84
Small pit latrine	4.88	3.92	6.44
Household sewer connection plus partial treatment of sewage (hardware and software)	10.03	11.95	13.38
Household sewer connection plus partial treatment of sewage (software only)	4.84	5.28	6.46

5) Global cost estimate (world and developing world):

Total annual cost of interventions (predicted population growth to 2015):

WHO Region	Overall population (millions)	Total annual cost for water supply (USD, millions)	Total annual cost for sanitation (USD, millions)	Total annual cost for MDG target 10 (USD, millions)
AFR-D	487	222	725	947
AFR-E	481	268	806	1.074
AMR-A	356	0	0	0
AMR-B	531	133	498	631
AMR-D	93	38	119	157
EMR-B	184	24	76	100
EMR-D	189	33	130	163
EUR-A	413	17	94	111
EUR-B1	176	39	97	136
EUR-B2	62	13	38	51
EUR-D	223	8	63	71
SEAR-B	473	121	345	466
SEAR-D	1.689	282	3346	3.628
WPR-A	154	19	128	147
WPR-B1	1.488	465	2817	3.282
WPR-B2	176	94	232	326
WPR-B3	9	6	7	13
Dvlpg. World	6.022	1.696	9.164	10.860
World	7.183	1.784	9.521	11.305

Global cost of reaching combined water and sanitation Millennium Development Goals: Share by world sub-region:



Annual cost per person reached:

WHO Region	Overall population (in millions)	Annual cost per capita reached for water supply (USD year 2000)	Annual cost per capita reached for water supply & sanitation (USD year 2000)
AFR-D	487	2,3	4,7
AFR-E	481	2,3	4,6
AMR-A	356	3,4	5,8
AMR-B	531	3,4	6,3
AMR-D	93	3,4	6,1
EMR-B	184	2,6	4,6
EMR-D	189	2,5	4,9
EUR-A	413	3,3	6,6
EUR-B1	176	2,9	5,2
EUR-B2	62	2,6	4,5
EUR-D	223	3,1	7
SEAR-B	473	2,6	4,6
SEAR-D	1.689	2,6	5,6
WPR-A	154	2,6	5,3
WPR-B1	1.488	2,6	5,2
WPR-B2	176	2,6	4,4
WPR-B3	9	2,6	3,8

Spread over the population as a whole, the costs are less:

Annual cost of interventions per capita (entire population):

WHO Region	Overall population (in millions)	Annual cost per capita (entire population) for water supply (USD year 2000)	Annual cost per capita (entire population) for water supply & sanitation (USD year 2000)
AFR-D	487	0,5	1,9
AFR-E	481	0,6	2,2
AMR-A	356	0	0
AMR-B	531	0,3	1,2
AMR-D	93	0,4	1,7
EMR-B	184	0,1	0,5
EMR-D	189	0,2	0,9
EUR-A	413	0	0,3
EUR-B1	176	0,2	0,8
EUR-B2	62	0,2	0,8
EUR-D	223	0	0,3
SEAR-B	473	0,3	1
SEAR-D	1.689	0,2	2,1
WPR-A	154	0,1	1
WPR-B1	1.488	0,3	2,2
WPR-B2	176	0,5	1,9
WPR-B3	9	0,7	1,4

http://www.who.int/water_sanitation_health/en/wsh0404.pdf

Stockholm Environment Institute (SEI)

Sustainable Pathways to Attain the Millennium Development Goals Assessing the Role of Water, Energy and Sanitation. 2005

Main Estimates:

- Number of people to be provided with sanitation services between 2003 and 2015: 1.75 billion.
- Corresponding number of households: 193 million rural households and 256 million urban households by 2015, in other words 95,000 households per day, or about 65 per minute.
- Approximate investment requirement for sustainable sanitation: 15 billion USD per year, i.e. approx.0.2% of the regional GDP.
- Global cost per year: 13 billion USD for urban areas
- Global cost per year: 0.7 billion USD for rural areas
- Average annual cost per capita for urban areas: 16 USD
- Average annual cost per capita for rural areas: 1 USD

Methodology:

1) Scope of the assessment:

The SEI report aims to prove that poverty and environmental issues need to be addressed together and advances innovative and sustainable solutions for energy, water supply and sanitation within the MDG framework. It also provides a global needs assessment (for the developing world) covering the MDG target 10 on sanitation, among others targets. It does not directly cover the MDG target 10 on water supply, nor the costs related to wastewater treatment, rehabilitation of old infrastructure, hygiene education and major water storage and conveyance infrastructure. It considers the period between 2003 (included) and 2015 (reference years).

2) Evaluating the target population:

The MDG target population for water and sanitation supply between 2003 and 2015, for the nine global regions involved, was assessed using the JMP (WHO & UNICEF, 2004) country data on water and sanitation coverage from 1990 and 2002 and the FAO country population projections for 2015. The replacement of existing, ancient infrastructure is not taken into account.

In 2002, 2.6 billion people lacked basic sanitation. Of these, 0.6 billion were in urban areas and 2.0 billion in rural areas. As we near 2015, the target population will increase, as will the proportion of urban to rural dwellers due to urbanization and urban population growth.

This calculation method gives a target population size in developing countries of 1.75 billion for the MDG on sanitation and 1.23 billion for the MDG on domestic water supply. These estimates are somewhat lower than those provided by the MDG Task Force (UN Millennium Project, 2005) (2.1 and 1.6 billion respectively).

MDG target population 2003-2015: number of persons in millions that will require coverage (FAO, JMP 2004):

UN regions	Urban water target population	Rural water target population	Urban sanitation target population	Rural sanitation target population
North Africa	27,8	13,8	27,6	17,8
Sub-Saharan Africa	146,9	147,9	158,4	199,4
West Asia	43,6	16,8	44,5	22,8
South-East Asia	105,2	31,9	89,7	60,6
Southern Asia	171,2	132,3	189,5	380,9
East Asia	254,2	14,2	247,9	147,8
Latin America & Caribbean	97,4	7,9	114,8	25,2
Eurasia	4,7	9,7	7,5	16,2
Oceania	0,8	2,9	0,8	2,7
Total	**851,9**	**377,4**	**880,6**	**873,5**
Combined Totals	**1.229**		**1.754**	

This data was then used to calculate the number of MDG target households, taking into account current urban-rural proportional needs as well as current average household sizes, both urban and rural (assumed to remain constant between 2003 and 2015), for the nine regions.

Households (in millions) to receive improved sanitation and water services during the period 2003-2015 (UN-HABITAT, JMP 2004, FAO):

UN regions	Urban water supply target households	Rural water supply target households	Urban sanitation target households	Rural sanitation target households
North Africa	6,3	2,5	6,3	3,2
Sub-Saharan Africa	38,9	27,9	42	38,2
West Asia	8,1	2,9	8,4	4,6
South-East Asia	21,7	9,3	18,2	19,4
Southern Asia	34,5	24,2	38,8	72,7
East Asia	111,5	4,2	108,3	43,3
Latin America & Caribbean	26,6	2,1	31,5	7,5
Eurasia	1,1	1,8	1,9	4,1
Oceania	0,3	0,4	0,3	0,4
Total	**249,1**	**75,2**	**255,6**	**193,3**
Combined Totals	**324,3**		**448,9**	

3) Water supply and sanitation technology to be used:

The hypothesis is the use of ecological sanitation everywhere (even in areas where conventional infrastructure already exists), the level of service being differentiated in urban and rural areas (see box 4 'Ecosan' below).

4) Estimating the unit cost:

The unit cost per household was estimated for each ecological sanitation method – including operating, maintenance and local transportation costs (see box 'Ecosan' below) and this figure applied to each type of target household:

the simplest and most affordable methods to be used in rural households, the more sophisticated methods to be used in mainly peri-urban and urban areas. Although, ideally, health quality and environmental protection standards should be the same everywhere, the assumption has been made that sewage systems would be proposed in densely populated urban areas only, since advanced sanitation would not normally be envisaged in peri-urban and deprived areas. Thus, a unit cost was generated per region for urban and rural households.

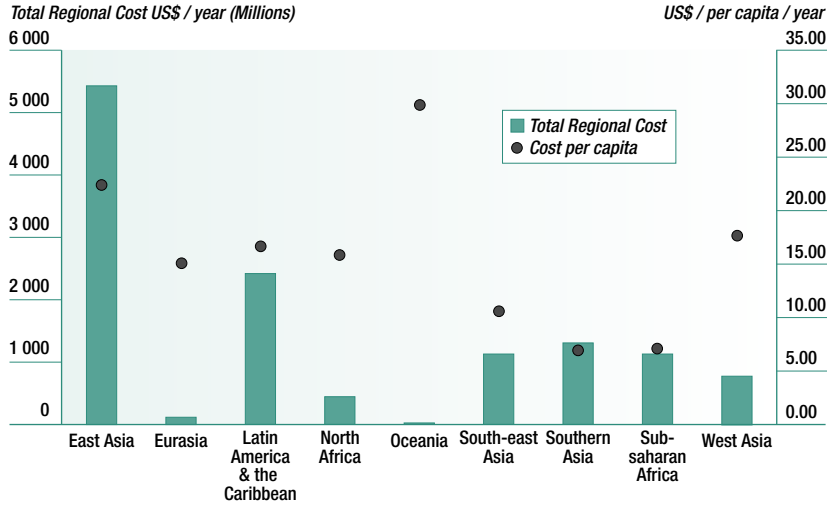
Ecosan household unit costs by UN region (includes initial capital expenditure and O&M for year one of operation):

UN regions	Ecosan unit costs for an urban household (USD)	Ecosan unit costs for a rural household (USD)
North Africa	$ 900	$ 65
Sub-Saharan Africa	$ 350	$ 35
West Asia	$ 1.200	$ 80
South-East Asia	$ 800	$ 60
Southern Asia	$ 440	$ 40
East Asia	$ 650	$ 50
Latin America & Caribbean	$ 1.000	$ 70
Eurasia	$ 725	$ 55
Oceania	$ 875	$ 65

5) Global cost estimate for the developing world:

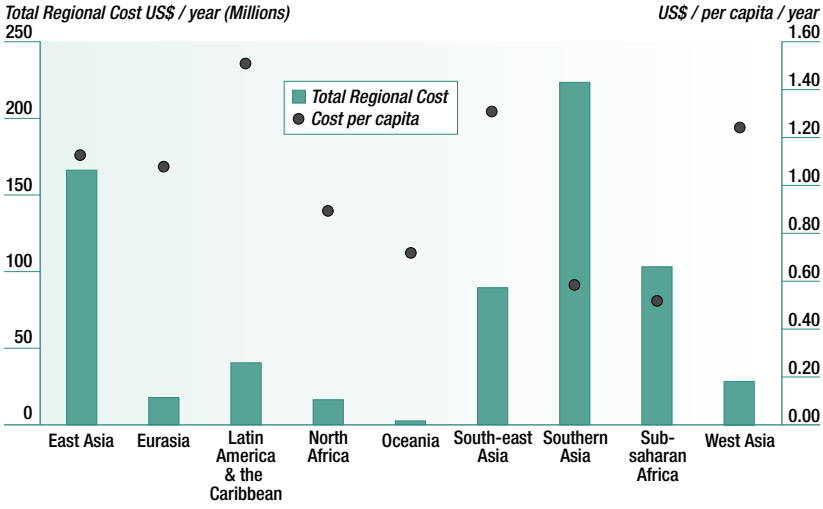
The unit cost data was then applied to the number of MDG targeted households for the period 2003-2015 (13 years) and the annual cost calculated for urban and rural areas in each global region:

Annual cost for urban ecosan (2003-2015):



SEI Graphic: Ian Caldwell (2005)
Data source: FAOstat, JMP and UN-HABITAT, Ecosanres

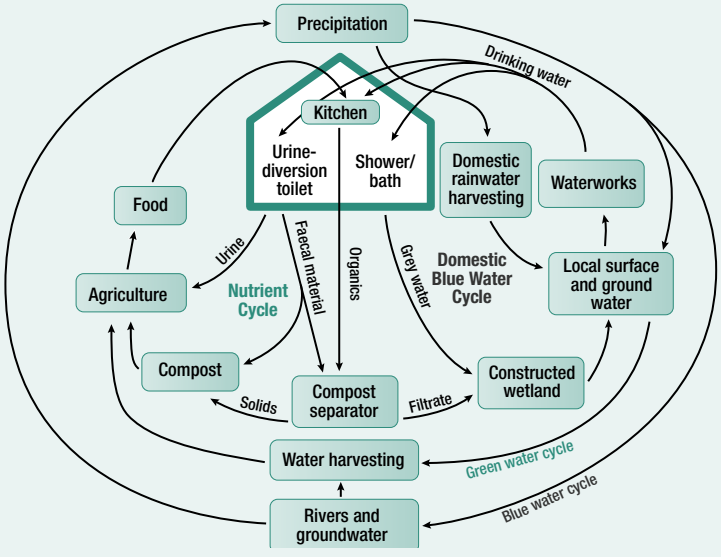
Annual cost for rural ecosan (2003-2015):



SEI Graphic: Ian Caldwell (2005)
Data source: FAOstat, JMP and UN-HABITAT, Ecosanres

Box 4: Definition of Ecological Sanitation (Ecosan) used by the SEI

Ecosan attempts to reduce the use of water in toilets in order to simplify the task of waste treatment and to conserve and protect this essential resource for drinking, hygiene, food production and recreation. Ecosan emphasises the separation of sources to allow for containment, sanitization and reuse of excreta after treatment. This separation is applied to urine, faeces, greywater and household organic wastes. The aim is to protect human health and the environment while minimizing water use in sanitation systems and recycling nutrients to help reduce reliance on artificial fertilizers in agriculture. The schema of a complete household ecosan and eco-water use system is presented here (modified from M. Oldenberg, [Otterwaser]):



Ecosan methods available are:

- in mainly urban areas: 1) Urine-diverting porcelain dry toilet (indoor and multistorey); piped urine system, dry faeces collection and composting, decentralized piped grey water treatment using a septic tank and aeration treatment: 1190 USD per household; 2) Conventional indoor toilet with sealed conservancy tank, black water collection by truck; local biogas digester; decentralized piped greywater treated using a septic tank and vertical biofilm filter technique: 1500 USD per household; 3) Indoor dry single-vault urine-diverting pedestal toilet; decentralized piped greywater treatment using constructed wetland; local transportation included: 675 USD per household.
- in mainly peri-urban areas: 1) Dry single- or double-vault urine diverting squat- or pedestal toilet with permanent upper housing structure; greywater treatment using on-site filtration pit; transportation assumed as local labour: 400 USD per household; 2) Dry single or double-vault urine diverting squat- or pedestal toilet (LASF or Skyloo) with permanent upper housing structure; greywater treatment and disposal on-site; local recycling: 110 USD per household.
- in mainly rural areas: 1) Soil composting pit with concrete slab and simple upper housing structure

(Arborloo or Fossa Alterna); grey water treatment and disposal on-site; local recycling: 55 USD per household; 2) soil composting shallow open pit; soil added after each use: 35 USD per household.

The advantages of Ecosan solutions over conventional approaches include:

- Permanent installations (conventional pit latrines last 5-10 years and then are often abandoned),
- Prevention of downstream ground and surface water contamination by both nutrients (e.g. nitrates) and pathogens (Ecosan systems provide a high level of pathogen eradication),
- Improvements over leaky septic tanks and sewage systems,
- Low-cost latrines in urban areas do not require large-bore sewage collectors and large treatment plants,
- Savings of domestic water (especially important in drought-prone regions),
- Alternatives to pit latrines in areas of high water tables and flooding,
- Recycling of nutrients derived from human excreta for local agriculture (especially important in regions with poor soil fertility and poverty)

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http://www.sei.se/SustMDG31Auglowres.pdf

COWI / Danish Ministry of Environment

Financial needs of achieving the Millennium Development Goals for water and sanitation in the EECCA region. Draft report 2004

Main Estimates (for the EECCA region):

- Number of people to be provided with sanitation services between 2002 and 2015 in the EECCA region: not given.
- Approximate investment requirement for water supply: 4.7 billion EUR.
- Approximate investment requirement for sanitation and wastewater treatment: 2.2 billion EUR.
- Overall cost per year: 6.9 billion EUR.
- Average annual cost per capita (entire population): 23.6 EUR.

Methodology:

1) Scope of the assessment:

The COWI / Danish Ministry of Environment draft report provides a costing of the MDGs in water supply and sanitation in Eastern Europe, the Caucasus and Central Asia (EECCA region) for the period 2002-2015. The calculations take into account not only water supply and sanitation systems, but also investment for wastewater collection and treatment. It includes the costs of service extension and of rehabilitating the existing system to a level where it can provide safe and adequate WSS services; it excludes hygiene education, IWRM and overheads.

In its draft report, COWI further studies the feasibility of financing the "total cost" estimate. The three sources of financing available to the WSS sector (user charges, public subsidies and international aid) are assessed and various scenarios constructed in order to carry out a sensitivity analysis using the FEASIBLE financial modelling tool. FEASIBLE is a computerised decision support tool developed by COWI with the assistance of the OECD and funded by the Danish Ministry of Environment, which assists in addressing financial issues related to the achievement of environmental goals.

2) Evaluating the target population:

The total population data, based on official national statistics and international statistical databases, is broken down into urban and rural categories and into five different sizes of population centre, ranging from more than one million inhabitants to fewer than five thousand inhabitants, unit costs varying with the average size of the population centre.

COWI defines access to safe water and basic sanitation within the JMP's GWSSAR 2000 concept of "improved facilities". Water supply and sanitation coverage estimates, distinguishing between "improved" and "unimproved» sources, between "centralised infrastructure" and "other", as well as between "urban" and "rural areas" are taken mostly from the household surveys' estimates published by the JMP and verified/modified by other data sources. It should be noted that, when it comes to sanitation, COWI's coverage estimates are almost always si-

gnificantly higher than the JMP's household surveys' estimates.

Moreover, demographic growth and urbanisation over the period 2002-2015 seem not to have been accounted for in the calculation. The *number* of people to be supplied by 2015 is not given.

3) Water supply and sanitation technology to be used:

For those in urban areas without access to a safe water supply and/or sanitation, the adequate technology will be considered to establish a connection to the existing centralised system. It is envisaged that rural populations without access to improved water will generally be supplied water through two main technologies - standpipes with a small-scale water supply for relatively large settlements and hand pumps for smaller villages. For rural populations without access to improved sanitation, connection to simple ventilated pit latrines is envisaged.

On the subject of rehabilitation needs, the information and percentages in the table below are based on data collected from numerous surveys and public sources, as well as from COWI's own projects carried out in the region over the last ten years. It should be noted that different values appear throughout COWI's draft report for the same data (20-50 per cent instead of 10-50 per cent, 20-50 per cent instead of 30-50 per cent, 10-50 per cent instead of 20-50 per cent). The main assumptions and rehabilitation needs of the WSS systems are:

	Water supply	Sanitation
URBAN AREAS	20% to 50% of network infrastructure and equipment of centralised water systems should be substantially rehabilitated. 30% has been estimated for the majority of countries, though 20% for the Russian Federation and Belarus. For the share of population not having access to safe water supply, a connection to the existing system is considered as the «improved» technology in the MDG sense.	10% to 50% of centralised sewerage collection and treatment systems should be rehabilitated. 10% is assumed for calculation purposes. A connection to the existing centralised system is considered as the adequate technology for the share of population not having access to sanitation.
RURAL AREAS	20% to 50% of existing water supply systems and 20% to 40% of other sources such as wells and springs need rehabilitation. Stand posts with a minor system of supplied waer for relatively large urban settlements and hand pumps for smaller villages are assumed to provide safe water to the population without access.	10% to 40% of existing rural water technologies need rehabilitation. 40% is assumed for the purpose of calcultation. Simple ventilated pit latrines are assumed to provide adequate sanitation.

4) Estimating the unit cost:

Unlike the other reports costing the MDGs in WSS, the COWI draft report gives its estimates in euros. Unit costs are determined using several cost functions, such as the length of the distribution network as a function of the total population and its density, or the pipe density as a function of the total population. Due to their complexity and the fact that they are not fully developed in COWI's draft report, only the results of these calculations are shown below. These costs are then "calibrated" to reflect price and cost levels in the various EECCA countries. At this stage of the calculation, operating maintenance and replacement costs, as well as transportation costs, are not taken into account.

Unit costs in Euro per capita

Category	Rural village	Small town	Town	Large city
Population	1 000	10 000	100 000	1 000 000
WATER SUPPLY				
Hand pump / protected well	45	45	45	45
New connection treatment	80	45	20	10
New connection distribution	100	100	100	120
Renovation treatment	25	15	7	4
Renovation distribution	30	30	30	40
SANITATION				
Improved pit latrine	40	40	40	40
New connection - wastewater treatment (mechanical)	60	40	20	20
New connection sewer	180	160	150	100

5) Global cost estimate for the EECCA region:

«MDG costs": Estimation of the investment costs of achieving the MDG for water supply and sanitation, divided into new connections and renovation of existing systems, in million EUR:

	Water Supply		Sanitation		Water supply and Sanitation	
Country	**Renovation**	**Service Extension**	**Renovation**	**Service Extension**	**Renovation**	**Service Extension**
Russia	3.850	0	2.370	0	6.220	0
Belarus	430	0	190	0	620	0
Kazakhstan	520	20	140	20	660	40
Ukraine	2.050	120	660	110	2.710	230
Armenia	140	0	50	10	190	10
Azerbaijan	260	30	140	200	400	230
Georgia	170	10	40	10	210	20
Moldova	100	10	40	10	140	20
Kyrgyzstan	170	40	30	140	200	180
Tajikistan	200	70	20	170	220	240
Turkmenistan	260	10	40	40	300	50
Uzbekistan	910	240	190	370	1.100	610
TOTAL	**9.060**	**550**	**3.910**	**1.080**	**12.970**	**1.630**

«MDG costs": Estimation of the investment costs of achieving the MDG for water supply and sanitation, totals in million EUR, and per capita in EUR:

	Water Supply		Sanitation		Water supply and Sanitation	
Country	Total Expenditure	Per Capita	Total Expenditure	Per Capita	Total Expenditure	Per Capita
Russia	3.850	27	2.370	16	6.220	43
Belarus	430	43	190	19	620	62
Kazakhstan	540	37	170	12	710	49
Ukraine	2.180	45	780	16	2.960	61
Armenia	140	44	50	16	190	59
Azerbaijan	280	35	340	43	620	78
Georgia	190	42	50	11	240	53
Moldova	110	26	50	12	160	37
Kyrgyzstan	210	42	170	34	380	76
Tajikistan	270	41	190	29	460	71
Turkmenistan	270	51	90	17	360	68
Uzbekistan	1.150	46	560	22	1.710	69
TOTAL	**9.620**	**34**	**5.010**	**18**	**14.630**	**52**

The COWI report produces a result of € 14.6 billion for the period 2002-2015 (the so called «MDG cost" estimate), i.e. € 52 per capita on average (out of the entire country population, not just the population reached). Approximately two thirds of this amount covers water supply, and almost 90 per cent of it rehabilitation costs (as opposed to service extension costs). The high cost of service extension in the sanitation sector in Central Asia should be noted.

The COWI then takes these «MDG costs" a step further and attempts to calculate "total costs". These «total costs» represent:

- the sum of_ "MDG costs" over the period 2002-2015 (14 years);
- plus O&M costs of the existing system over the period 2000-2020 (21 years);
- plus O&M costs of new extensions and additional facilities to be built over the period 2000-2020;
- plus re-investment over the period 2000-2020, that is to say investment required to maintain the same level of quality/service of the existing infrastructure (COWI does not include such costs under "MDG costs", where the level of quality/service is assumed to be improved above the current level).

Transportation and replacement costs are still not included.

This second cost estimate corresponds to an aggregate of costs over two different periods, i.e. 14 years

and 21 years. Furthermore, it is not clear how the O&M and re-investment costs have been calculated. The annual "Total costs" estimates per country are obtained by dividing the "Total costs" estimate by 20:

"Total cost": Total average annual expenditure including O&M and reinvestment, plus investment for MDG, in million EUR per year:

Country	Water Supply		Sanitation		Water supply and Sanitation	
	Total Expenditure	Per Capita	Total Expenditure	Per Capita	Total Expenditure	Per Capita
Russia	2,408	16.6	1,254	8.6	3,662	25
Belarus	211	20.9	91	9.0	302	30
Kazakhstan	233	16.1	100	6.9	333	23
Ukraine	868	18.0	384	8.0	1,252	26
Armenia	58	18.1	26	7.9	84	26
Azerbaijan	102	12.8	87	10.9	189	24
Georgia	69	15.3	29	6.3	98	22
Moldova	44	10.2	26	6.1	70	16
Kyrgyzstan	80	16.0	30	6.0	110	22
Tajikistan	85	13.1	32	4.9	117	18
Turkmenistan	120	22.7	32	6.1	152	29
Uzbekistan	411	16.5	142	5.7	553	22
TOTAL	**4,687**	**16.3**	**2,232**	**7.2**	**6,919**	**23.6**

The annual "Total costs" estimate of € 6.9 billion appears out of proportion with the "MDG costs": over a 14-year period, it represents nearly € 97 billion, more than six times the "MDG costs".

When analysing the COWI report, a certain number of problems appear that make comparison with other MDG cost estimates for WSS very difficult:

1) The COWI report, which dates from May 2004, is still in draft form, although at a very advanced stage. Indeed it has never been finalized.
2) The COWI estimates on the cost of MDGs in the EECCA region are expressed in euros, whereas all other estimates for MDGs in WSS are in US dollars. Comparison would require converting the COWI estimates into USD, which raises the problematic question of the applicable exchange rate.
3) The COWI annual "total cost" estimate for the period 2002-2015, which includes O&M expenditure for both existing systems and additional facilities to be built over the period 2000-2020, as well as investment required to maintain the same level of quality/service for existing infrastructure, is about 7 billion euros per year in the EECCA region alone. The very high cost of rehabilitating existing, neglected infrastructure in the EECCA region (almost 90% of the "MDG cost") explains the very high costing of the MDGs in the COWI report. In other words, the real challenge for the EECCA region in the coming years seems to lie more with the O&M of WSS systems and maintaining existing infrastructure at its current level of quality/service, than with extension costs or costs to improve the current level of quality/service and bring it up to "MDG Target 10 compliant" levels. Nevertheless, this result does appear disproportionate to the global estimates provided in other reports, costing the MDGs in WSS worldwide between 9 and 30 billion USD per year. The difference in the projected level of service (for instance regarding wastewater treatment), in coverage rates and the currencies used could explain this difference.

Water & Sanitation Programme (WSP)

Mehta, Fugelsnes, Virjee Financing the MDGs for Water and Sanitation: What Will It Take? 2005

Main Estimates (for Sub-Saharan Africa):

- Number of people to be supplied with water between 2002 and 2015: not given
- Number of people to be provided with sanitation services between 2002 and 2015: not given
- Approximate investment requirement for water supply: 3.3 billion USD per year
- Approximate investment requirement for sanitation: 3.4 billion USD per year
- Total investment requirement for WSS: approx. 6.7 billion USD per year
- Average annual cost per capita: not given
- Average investment requirement in WSS as a percentage of GDP: 2.7 %

Methodology:

1) Scope of the assessment:

Firstly, the WSP report analyses the financing requirements, affordability and feasibility of reaching the water and sanitation MDGs. The assessment covers the Sub-Saharan African region for the period 2002-2015. Secondly, it presents the actions required to improve the prioritisation and use of public resources and leverage additional non-public resources.

Expenditure estimates for meeting the MDGs take into account new infrastructure and rehabilitation of non-functioning infrastructure, policy formulation and standard setting and sector monitoring and regulation. However, wastewater treatment, large-scale water storage and conveyance infrastructure and hygiene education are not included. The assessment provides preliminary requirement estimates: More work is called for to especially understand the costs of sanitation i.e. hygiene promotion, etc.

2) Evaluating the target population:

The target population has been assessed per the Joint Monitoring Program "Global Water Supply and Sanitation Assessment Report 2000" (GWSSAR) data and the revised statistics contained in the JMP Mid-Term Assessment 2004, which take demographic growth and urbanization into account. However, the JMP Mid-Term Assessment gives no direct estimates of the target population to be supplied by 2015. The WSP assessment takes into account the rehabilitation of old infrastructure. No figure is given in the assessment.

3) Water supply and sanitation technology to be used:

Access to improved water supply and sanitation technologies is defined as in the JMP's GWSSAR (2000). The assessment assumes that a large proportion of the population will depend on simple and improved pit latrines, rather than water-borne sewerage. In the baseline estimate, the technology mix includes some house connections in rural and urban areas and waterborne sewerage in urban areas. No further detail on the proportion of each technology in the different regions and in rural/peri-urban/urban areas is given.

4) Estimating the unit cost:

The results are based on several hypotheses that vary depending on the country situation, and do not take into account variations in the cost of service due to demographic factors, geographic and climatic condition, coverage level and level of service in urban, peri-urban and rural areas.

Unit costs for operating and maintenance and sector development in particular are difficult to arrive at, given wide variations due to the number of variables. These estimates conservatively assumed that the total costs for operating and maintenance and sector development were similar to the costs estimated in JMP 2000, but applied these costs to both new and existing infrastructure as opposed to new infrastructure alone. They assumed that operating and maintenance costs amount to 10 percent of the replacement value of installed infrastructure and sector development costs two percent. The unit cost for each technology used and per person reached are not given.

5) Global cost estimate for Sub-Saharan Africa:

The total annual expenditure requirement in the sub-Saharan African water sector is in the order of 3.3 billion USD per year. Total expenditure requirement to reach the sanitation targets in Africa is similar – about 3.4 billion USD per year.

The annual requirement will increase due to higher operating and maintenance costs for the additional capital assets resulting from the extension of coverage.

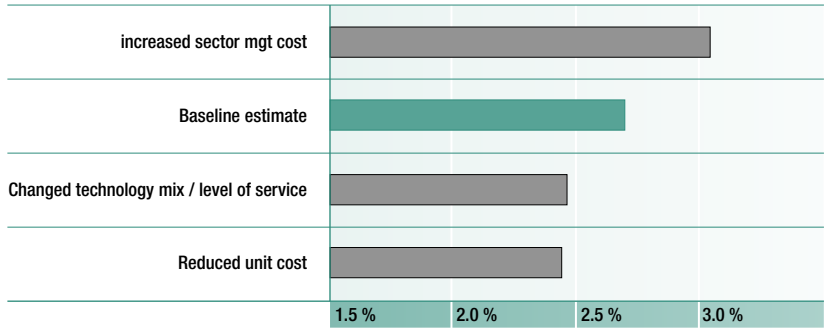
Annual expenditure requirements to meet the MDGs in Sub-Saharan Africa (2002):

	Capital investment	Operation and maintenance	Sector management	Total	% required in rural areas	requirements as a share of GDP
Water supply	1.1	1.8	0.4	3.3	35.8%	1.3%
Sanitation	1.5	1.5	0.4	3.4	55.5%	1.4%
TOTAL	**2.6**	**3.3**	**0.8**	**6.7**	**n.a.**	**2.7%**

Source: Calculations using data from World Bank Development Indicators 2004, Joint Monitoring Program (GWSSAR) 2000 and 2004.

The figure below shows the impact of changes in technology mix and service levels, unit costs and sector management cost. The fall in cost resulting from a change in technology mix and service level is moderate because of the conservative baseline estimate. Reductions in unit (capital) costs yield similar results. A ten percent decrease in unit costs reduces the total requirement by ten percent, or 0.3 percentage points of GDP. The total cost is also sensitive to changes in sector management requirements. If the sector management cost is increased to 4 percent, double the baseline estimate, total costs are increased from 2.7 to 3.0 percent of GDP for both water and sanitation.

Impact of technology choices and changes in unit and sector management costs:



The WSP report highlights the need for detailed costing and financial planning at national level, as in-country requirement estimates vary significantly in relation to the country-level technology mix, unit costs and service standards.

http://www.wsp.org/publications/af_washsynthesis.pdf

Asian Development Bank

Asia Water Watch 2015: Are Countries in Asia on track to meet Target 10 of the Millennium Development Goals? 2005

Main Estimates (for Asia & Pacific):

- Number of people to be supplied with water between 2000 and 2015: not given.
- Number of people to be provided with sanitation services between 2000 and 2015: not given
- Approximate investment requirement for water supply: not given.
- Approximate investment requirement for sanitation: not given
- Total investment requirement for WSS (in Asia & Pacific): approx. 8.11 billion USD per year
- Average annual cost per person: not given

Methodology:

1) Scope of the assessment:

The ADB assessment covers investment requirements in water supply and sanitation in the Asian and Pacific countries for the period 2002 to 2015. It also presents progress on, and prospects for, achieving the MDGs in WSS in Asia. The MDG cost estimate includes water distribution, primary wastewater treatment and hygiene education but not rehabilitation of old equipment and major water storage and conveyance infrastructure.

2) Evaluating the target population:

The figures for populations in countries or subregions with access to improved drinking water and sanitation facilities by 2015 claim to be based on the JMP accepted indicators in their report "Meeting the MDG Drinking Water and Sanitation Target: A Mid-Term assessment of Progress", 2004 (see p.17 and 25 of the ADB Water Watch 2015, source for the table below). Nonetheless, it seems that the WHO figures have been utilised instead.

As the data generally available only covered two reference years, a linear rate of change had to be assumed. The annual rates estimated from this were projected to 2015 to calculate the target population to by supplied. Demographic growth has been taken into account in this calculation, but not urbanisation. The exact target population is not given.

Water supply coverage (JMP 2004)

	1990			2002			Meeting Target 10		2015 projected
Subregion	Total WS (%)	Urban WS (%)	Rural WS (%)	Total WS (%)	Urban WS (%)	Rural WS (%)	Target increase (%)	Target total coverage (%)	WS coverage (%)
East and Northeast Asia	70	100	59	80	94	69	15	85	91
North and Central Asia	92	96	82	91	98	79	3	95	90
Pacific	89	100	65	87	98	56	6	95	85
South and Southwest Asia	71	90	64	85	94	80	15	86	102
Southeast Asia	73	91	65	78	91	70	14	87	83

Sanitation coverage (JMP 2004)

	1990			2002			Meeting Target 10		2015 projected
Subregion	Total WS (%)	Urban WS (%)	Rural WS (%)	Total WS (%)	Urban WS (%)	Rural WS (%)	Target increase (%)	Target total coverage (%)	WS coverage (%)
East and Northeast Asia	23	64	7	49	74	32	38.5	62	104
North and Central Asia	82	91	63	79	90	59	9.0	91	76
Pacific	89	98	69	87	99	58	5.5	95	85
South and Southwest Asia	23	58	9	39	69	25	38.5	62	66
Southeast Asia	47	67	39	60	79	49	26.5	74	77

3) Water supply and sanitation technology to be used:

Access to improved water supply and sanitation is defined per the JMP definition in the GWSSAR 2000. “Wastewater treatment” implies the use of adequate but inexpensive technologies that involve, for example, chemical water supply treatment or primary wastewater treatment.

There is no indication in the report as to how the different technologies are applied over rural and urban populations, but the report does rely on the method and calculation of the WHO (see the summary of the report of Hutton and Haller, 2004).

4) Estimating the unit cost:

In line with the WHO report, the investment requirements cover:

Investment costs: planning and supervision, hardware, construction and house alteration, protection of water sources and training that accompanies an investment in hardware.

Recurrent costs: operating equipment to provide a service, maintenance of hardware and replacement of parts, emptying of septic tanks and latrines, regulation and control of water supply, ongoing protection and monitoring of water sources, water treatment and distribution and permanent educational activities.

The table below shows the annual unit cost for each improved technology (per person reached) used in this analysis. No differentiation by country has been made.

Annual costs for improvements per-person reached:

Type of improved technology implemented	Cost in USD (year 2000) per person reached
Improved water supply	
Standpost	4.95
Borehole	1.26
Dug well	1.63
Rainwater	2.51
Disinfected	0.26
Regulated piped water in-house (hardware and software)	9.95
Regulated piped water in-house (software only)	5.97
Improved sanitation	
Septic tank	9.10
VIP	5.70
Small pit latrine	3.92
Household sewer connection plus partial treatment of sewage (hardware and software)	11.95
Household sewer connection plus partial treatment of sewage (software only)	5.28

Source: WHO data for Asia (Hutton and Haller 2004)

5) Global cost estimate for Asia and Pacific:

The investment costs were annualised and added to the recurrent costs to obtain the final total costs per intervention per year, based on the life of the technology and a discount rate of 3%. The table below shows the cost estimates for each of the four interventions by subregion. The intervention that would satisfy Target 10 requires the least amount of annual recurrent investment, at around USD 8 billion.

Annual costs for water supply and sanitation development in the Asia-Pacific region (total costs per year, million USD, year 2000 prices)

	MDG Target 10	Access for all by 2015	Access for all + disinfection at point of use	Regulated, in-house piped WSS connection
East and Northeast Asia	2.99	5.99	6.38	24.55
North and Central Asia	0.20	0.39	0.49	4.12
Pacific	0.02	0.04	0.05	0.24
South and Southwest Asia	3.95	7.90	8.40	40.83
Southeast Asia	0.96	1.91	2.08	15.55
Total	**8.11**	**16.24**	**17.40**	**85.28**

Source (cited by ADB): UNESCAP

WaterAid

The Water and Sanitation Millennium Development Targets in Nepal: What Do They Mean? What Will They Cost? Can Nepal Meet Them? 2004

Main Estimates (for Nepal):

- Number of people to be supplied with water between 2000 and 2015: 10.3 million (approx.2 million households)
- Number of people to be provided with sanitation services between 2000 and 2015: 13 million (approx.2.5 million households)
- Approximate investment requirement for water supply: 936 million USD (approx.62.5 million USD per year)
- Approximate investment requirement for sanitation: 163 million USD (approx.11 million USD per year)
- Total investment requirement for WSS: approx. 1100 million USD, or 73.3 million USD per year
- Average annual cost per person provided with WSS: approx.3.2 USD
- Average annual cost per household provided with WSS: 16.3 USD

Methodology:

1) Scope of the assessment:

The WaterAid Nepal (WAN) assessment covers investment needs for water supply and sanitation in Nepal for the period 2000 – 2015. It includes transportation costs, organisational overheads and costs for rehabilitation of old assets and their partial replacement in the Terai region. It does not cover investment for wastewater treatment, hygiene education, major water storage and conveyance infrastructure.

This WaterAid report also calculates the resources available in the WSS sector in order to obtain the resource gap (difference between resource requirements and availability for achieving the MDGs in WSS).

2) Evaluating the target population:

Based on the adjusted WaterAid Nepal estimates (taken from several data sources), the MDG for drinking water in Nepal will be to provide a supply point within 15 minutes' walk from home to 63% of the population in rural areas and 85% in urban areas. The corresponding figures for sanitation will be to provide facilities to 56% of the population in rural areas and 80% in urban areas. Urbanisation is taken into account in these figures.

Regression-adjusted estimates of water and sanitation coverage in 1990 and 2000, adjusted for MDG 2015:

Year	1990	2000	2015 (MDG)
Drinking water coverage in %			
Rural	25	42	63
Urban	70	78	85
National	30	48	65
Sanitation coverage in %			
Rural	12	19	56
Urban	60	67	80
National	18	27	59

Estimation of the MDG target population for drinking water:

RURAL					
Year	**Estimated/ Target served in %**	**Total rural population in millions**	**Total Population supplied in millions**	**Average HH Size**	**Total No. of HHs supplied /to be supplied**
1990	25	16.3	4.08	5.6	727,679
2000	42	19.68	8.27	5.6	1,476,000
2015 (target)	63	23.93	15.08	5.5	2,741,073
Total Number of households to be supplied between 2000 and 2015					1,265,073
Average number of households to be supplied per year between 2000 and 2015					84,338
URBAN					
Year	**Estimated/ Target Supplied in %**	**Total urban population in millions**	**Total Population supplied in millions**	**Average HH Size**	**Total No. of HHs supplied /to be supplied**
1990	70	1.8	1.26	5.4	233,333
2000	78	2.99	2.33	5.4	431,889
2015 (target)	85	6.85	5.82	4.8	1,213,021
Total Number of households to be supplied between 2000 and 2015					781,132
Average number of households to be supplied per year between 2000 and 2015					52,076

Estimation of the MDG target population for sanitation:

RURAL					
Year	**Estimated/ Target supplied in %**	**Total Population in millions**	**Total Population supplied in millions**	**Average HH Size**	**Total Estimated No of Toilets**
1990	12	16.3	1.96	5.6	349,286
2000	19	19.68	3.74	5.6	667,714
2015 (target)	56	23.93	13.64	5.5	2,435,732
Total number of toilets required to be constructed between 2000 and 2015					1,768,018
Average number of toilets required to be constructed per year between 2000 and 2015					117,868
URBAN					
Year	**Estimated/ Target supplied in %**	**Total Urban Population in millions**	**Total Population supplied in millions**	**Average HH Size**	**Total Estimated No of Toilets**
1990	60	1.8	1.08	5.4	200,000
2000	67	2.99	2.00	5.4	370,981
2015 (target)	75	6.85	5.14	4.8	1,070,313
Total number of toilets to be constructed between 2000 and 2015					699,331
Average number of toilets to be constructed per year between 2000 and 2015					46,622

3) Water supply and sanitation technology to be used:

The WSS methods planned by WAN to ensure access to drinking water and basic sanitation are defined according to the GWSSAR definition of "improved technologies", with some additions (Ecosan, double pit latrine).

Almost all 20 Tarai districts are recorded as arsenic-affected areas. For this reason, WaterAid Nepal estimates that 6% of the Tarai population will require deep tube wells to replace existing shallow tube wells by the year 2015. The figures on population numbers by technology have been adjusted accordingly.

WaterAid Nepal best estimates of population by water technology zone in 2015:

AREA	Water Technology Zone	% of Population
Rural	Shallow tube Well	35
	Deep Tube Well	11
Rural/sub Urban	Gravity Flow	54
RURAL AND SUB URBAN TOTAL		**100**
Urban	Small Towns	54
	Kathmandu reform	46
URBAN TOTAL		**100**

WaterAid Nepal best estimates of population by sanitation technology zone in 2015:

Region	Sanitation Technology zone	% of population
Rural Hill	Single Direct Pit	10
	Single Pit offset latrine	10
	Double Pit offset latrine	10
	VIP Latrine	70
RURAL HILL TOTAL		**100**
Rural Tarai	PF Single Pit	45
	PF Double Pit	45
	ECOSAN	1
	Septic Tank with soak pit	9
RURAL TARAI TOTAL		**100**
Semi Urban	PF Single Pit	44
	PF Double Pit	45
	ECOSAN	1
	Septic Tank with soak pit	10
SEMI URBAN TOTAL		**100**
Urban	PF Single Pit	25
	PF Double Pit	25
	Septic Tank with soak pit	35
	Latrine with sewer connection	15
URBAN TOTAL		**100**

4) Estimating the unit cost:

Per capita cost requirements depend on the type of technology used. Per capita costs range from 10 USD (rural shallow tube well) to the Kathmandu reforms (including the Melamchi tunnel) at 312 USD. Other unit costs are derived from the experience of WaterAid Nepal and its partner organisations.

Per capita cost by zone water technology:

Region	Water Technology Zone	Per capita technology cost in USD
RURAL	Shallow tube well	10
	Deep Tube Well	45
RURAL/SUB URBAN	Gravity Flow	45
URBAN	Small Towns	40
	Kathmandu	312

Per capita cost by zone sanitation technology:

Region	Sanitation Technology zone	Per capita technology cost in USD
RURAL HILL	Single Direct Pit	8
	Single Pit offset latrine	16
	Double Pit offset latrine	19
	VIP Latrine	10
RURAL TARAI	PF Single Pit	36
	PF Double Pit	42
	ECOSAN	36
	Septic Tank with soak pit	97
SEMI URBAN	PF Single Pit	40
	PF Double Pit	46
	ECOSAN	40
	Septic Tank with soak pit	107
URBAN	PF Single Pit	44
	PF Double Pit	51
	Septic Tank with soak pit	119
	Latrine with sewer connection	95

5) Global cost estimate for Nepal:

The total cost for the population is the product of estimated additional population to be served by each technology multiplied by technology cost per capita. The total population-based cost is estimated at 813 USD million for drinking water and 486 million USD for sanitation.

The majority of existing gravity flow drinking water schemes requires rehabilitation, the rehabilitation cost therefore has been added to these figures. Moreover, per capita technology cost estimates usually exclude organisational overheads (planning, reporting, regulation, etc.) so these must also be added.

Approximately one-third of Nepali districts have sanitation and water coverage below the national average. The majority of these districts are in the Far West and Mid West development regions, which have poor infrastructure or are not even connected to the road network. Programmes have to reach these relatively

inaccessible districts, which means the cost of supply will increase. This factor is referred to as “difficulty level cost” and has been included in the investment calculations.

Communities contribute between 10 % and 20 % to the capital cost of rural water supply schemes, most of which is provided in voluntary labour. The total projected contribution by communities is 383 million USD, which has been subtracted from the total investment cost.

Thus, the overall financial resource requirement to meet the drinking water MDG in Nepal is 936 million USD (360 million USD for rural/sub urban, 576 million USD for urban). The total resource requirement for the sanitation MDG is 163 million USD (130 million USD for rural, 33 million USD for urban). The total resource requirement for both water and sanitation is 1.099 billion USD.

The method used by WaterAid to assess the cost of reaching Target 10 in Nepal is very comprehensive. It seemed therefore interesting to reproduce in this paper the tables summarizing the details of the calculation.

Calculation of Resource Requirement to meet the Drinking Water MDG

Region	Water Technology zone	% of total population in 2015	A	B
			Additional Population to be supplied by 2015	Per capita technology cost in $
Rural	Shallow tube well	35	2,759,401	10
	Deep Tube Well	11	867,240	45
Rural/SU	Gravity Flow	54	4,257,361	45
Rural and Sub Urban Total		**100**	**7,884,002**	
Urban	Small Towns	54	1,978,795	40
	Kathmandu reforms	46	1,685,640	312
Urban Total		**100**	**3,664,435**	
National			**11,548,437**	

C= A*B	D	E =(C+D)*.12	F= 15% for STW +20% for GF + 5% for small towns	G= C+D+E+F
Population based Cost required in million $	Rehab Cost in million $	Overhead cost at 12% in million $	Difficulty level cost in million $	Total cost required in million $
27.6	1.9	3.5	4	37
39.0	2.7	5.0	7.0	54
191.6	13.4	24.6	39	269
258.2	**18.0**	**33.1**	**50.0**	**360**
79.2	5.5	10.2	4.7	100
476				476
555.2	**5.5**	**10.2**	**4.7**	**576**
813.4	**23.5**	**43.3**	**54.7**	**936**

Calculation of Resource requirements to meet sanitation MDG

			A	B	C= A*B
Region	Sanitation Technology zone	% of total population in 2015	Additional Population to be supplied by 2015	Per capita technology cost in $	Population Cost required in million $
RURAL HILL	Single Direct Pit	10	569,540	8	4.6
	Single Pit offset latrine	10	569,540	16	9.1
	Double Pit offset latrine	10	569,540	19	10.8
	VIP Latrine	70	3,986,780	10	39.9
Rural Hill Total		**100**	**5,695,400**		**64.4**
RURAL TARAI	PF Single Pit	45	2,183,237	36	78.6
	PF Double Pit	45	2,183,237	42	91.7
	ECOSAN	1	48,516	36	1.7
	Septic Tank with soak pit	9	436,647	97	42.4
Rural Tarai Total		**100**	**4,851,637**		**214.4**
SEMI URBAN	PF Single Pit	44	779,753	40	31.2
	PF Double Pit	45	797,475	46	36.7
	ECOSAN	1	17,722	40	0.7
	Septic Tank with soak pit	10	177,217	107	19
Semi Urban Total		**100**	**1,772,166**		**87.5**
URBAN	PF Single Pit	25	377,406	44	16.6
	PF Double Pit	25	377,406	51	19.2
	Septic Tank with soak pit	35	528,368	119	62.9
	Latrine with sewer line	15	226,443	95	21.5
	Total	100	1,509,623		120.2
National			**13,828,825**		**486.5**

D=C*.12 for Rural and C*.05 for others	E=(C+D)*.05 for Rural hill	F=C+D+E	G	H = (F*G)/100	J =F-H
Overhead cost in millions $	Difficulty level cost in million $	Total cost required in million $	Community Contribution %	Community contribution in millions $	Total External Resource to be supported in million $
0.5	0.3	5.4	100	5.4	0
1.1	0.5	10.7	26	2.8	7.9
1.3	0.6	12.7	21	2.6	10.1
4.8	2.2	46.9	100	46.9	0
7.7	**3.6**	**75.7**		**57.7**	**18**
9.4	4.4	92.4	73	67.5	25
11	5.1	107.8	67	72.3	35.6
0.2	0.1	2.1	43	0.9	1.2
5.1	2.4	49.8	0	0	49.8
25.7	**12**	**252.1**		**140.6**	**111.5**
1.6	0	32.7	73	23.9	8.8
1.8	0	38.5	67	25.8	12.7
0	0	0.7	43	0.3	0.4
0.9	0	19.9	100	19.9	0
4.4	**0**	**91.9**		**69.9**	**22**
0.8	0	17.4	73	12.7	4.7
1	0	20.2	67	13.5	6.7
3.1	0	66	100	66	0
1.1	0	22.6	100	22.6	0
6	0	126.3		114.9	11.4
43.8	**15.6**	**546**		**383.1**	**162.9**

UN Millennium Project Task Force on Water & Sanitation

Health, Dignity, and Development: What will it take? 2005

Main Estimates:

- Number of people to be supplied with water between 2002 and 2015 in the developing world: 2.1 billion
- Number of people to be provided with sanitation services between 2002 and 2015 in the developing world: 1.6 billion
- Number of people to be provided with WSS by 2015 in Ghana: not given
- Approximate investment requirement for water supply in Ghana: 100 million USD per year
- Approximate investment requirement for sanitation in Ghana: 60 million USD per year
- Approximate investment requirement for wastewater treatment in Ghana: 7 million USD per year
- Total investment requirement in Ghana (2005-2015): approx. 174 million USD per year
- Average annual cost per capita: 7.2 USD

Methodology:

1) Scope of the assessment:

The UN Millennium Project Task Force on Water and Sanitation sought to answer two questions: How can the use of water as a resource be optimised to achieve the Millennium Development Goals? What will it take to expand water supply and sanitation coverage dramatically and sustainably and what actions are needed?

The water and sanitation needs assessment (chapter 8) provides a methodology applicable at both national and global levels which is used for a few African case studies (reference years 2002-2015) but not for a global need assessment.

The methodology covers the needs in water supply, sanitation, wastewater treatment, and hygiene education. It does not cover the following interventions: soak away for treating and disposing of sullage, large-scale infrastructure for water storage and conveyance, infrastructure for flood management and control, upgrading of existing water and sanitation infrastructure, advanced wastewater treatment for industrial effluents and other chemicals, or integrated water resources management (IWRM), including hydrological monitoring systems.

2) Evaluating the target population:

Water supply infrastructure:

Coverage data for access to water supply is based on the Joint Monitoring Programme estimates for 2002 (WHO/UNICEF JMP 2004). These estimates have used national sources and also include estimates of the percentage of existing, non-functioning infrastructure, assuming that these facilities will be gradually re-

habilitated through 2015 at 50 percent of the replacement cost. Data from the most recent Demographic and Health Survey (www.measuredhs.com) for each country is used to approximate the percentage of users having access to a particular technology.

Sanitation and wastewater treatment infrastructure:

Coverage data for access to sanitation is also based on the Joint Monitoring Programme's estimates for 2002. In contrast to water supply, no reliable data is available on the percentage of non-functioning sanitation infrastructure. Based on interviews with experts, it was conservatively assumed that 15 percent of sanitation infrastructure is defunct. Just as for water supply infrastructure, the authors of the assessment project that these facilities will be rehabilitated by 2015 at half the cost of construction. In line with the analysis of water supply, the current coverage of sanitation technologies was derived from the most recent Demographic and Health Survey data.

3) Water supply and sanitation technology to be used:

Access to drinking water and sanitation is defined as in the GWSSAR, within the concept of "improved facilities".

Water supply infrastructure:

"Improved water supply": household connection, public standpipe, bore hole, protected dug well and rainwater collection (source: GWSSAR).

For rural water supply, the study estimates the relative share of each technology, applying the following hypotheses:

- Avoiding an increase in the number of people depending on rainwater in those areas where rainfall is highly variable.
- Limiting growth in standpipe numbers (also known as public water taps) to the rate of population growth over the period, in order to increase revenue collection.
- Assuming that household connections will reach the same proportion of the population as public standposts by 2015.
- Placing the primary focus on water sources that require little or no treatment and that are subject to minimal distribution costs, such as groundwater, spring water, gravity-fed upland water and rainwater.
- Increasing the number of boreholes to half that of improved dug wells, as defined by the Joint Monitoring Programme, subject to technical feasibility.

For urban water supply, the assessment applies two basic hypotheses:

- Improving revenues from user charges, shifting from standpipes to household connections.
- Roughly limiting growth in access to dug wells, boreholes, and public standpipes to population growth rates.

Sanitation and wastewater treatment infrastructure:

"Improved sanitation": sewer connection, small bore hole, pour-flush latrine, ventilated improved pit latrine, simple pit latrine, septic tank (source: GWSSR 2000).

For rural sanitation, the relative share of each technology was estimated applying the following hypotheses:

• Making no additional public investment in the extension of conventional sewerage, simplified sewerage, or septic tanks, except where such sewerage can be linked to either high-density housing areas, where costs can be recovered from residents, or effluent use for agriculture.
• Apportioning the remaining service gap equally among pour-flush toilets, ventilated improved pit (VIP) latrines and pit latrines.

For urban sanitation, the applied set of hypotheses is:

• Limiting the increase in conventional sewerage connections to areas within the current sewerage boundaries, on the assumption that existing conventional sewerage has enough capacity for twice the current population coverage.
• Providing simplified sewerage for at least 50 percent of those with household connections to public water supplies.
• Discouraging growth in septic tank use, and limiting any such growth to no more than 10 percent of the current level; all septic tanks should include two parallel sets of soak pit systems designed so that each one is in service for one year, while the other one is rested.
• Apportioning the rest of the coverage gap equally among pour-flush, VIP latrine, and pit latrines.
• Providing properly attended and maintained public toilet facilities in busy public places, as done by Sulabh International in India.

No further detail is given in this report on the share of each technology applied in the different regions of Ghana or in rural/peri-urban/urban areas.

The Millennium Task Force 7 on Water Supply and Sanitation insists on the fact that the provision of new water supply and sanitation infrastructure must be accompanied by community mobilisation and a raising of awareness. These interventions can require substantial resources that must be included in the needs assessment. Typically though, such programmes for water supply and improved sanitation are combined into a single campaign. To avoid double accounting, the resource requirements of all community mobilisation programs have been counted as part of the sanitation needs assessment.

4) Estimating the unit costs:

Water supply infrastructure:

The costs for operation and maintenance are applied over the full range of infrastructure in both urban and rural areas. Capital costs for each type of water supply technology vary across countries; data has been collected from a number of sources, including the WHO/UNICEF JMP 2000, national water ministries, project documentation from multilateral and bilateral organizations, and nongovernmental organizations. Unfortunately, data on capital costs tends not to be differentiated by urban and rural areas. It is generally assumed that rural capital costs for boreholes, rainwater collection, and dug wells are about 40 percent of the urban costs, while household connections and those for public standpipes twice as expensive as in denser, urban areas. In addition to the resources required for water supply infrastructure, the cost of raw water provision and general operating and maintenance costs were included. The cost of treating and providing safe drinking water has been included in overall operating and maintenance expenses. Based on data provided by various members of the task force, the cost of operation and maintenance, including the cost of providing safe drinking water, ranges between 5 and 10 percent of the capital replacement cost. Accordingly, this range has been applied to the different technologies, depending on the complexity of their maintenance.

Sanitation infrastructure:

Capital costs data has been collected from the same sources used to estimate costs for water supply. Two sets of operating costs for sanitation systems have been differentiated: First, resources required for maintaining physical infrastructure, including local treatment of excreta, such as emptying of pit latrines, VIP latrines, and septic tanks. Based on data provided by the Task Force, the total operating and maintenance costs of this type has been estimated to be between 5 percent and 10 percent of capital cost. Second, operating costs incurred in on-site education accompanying the rollout of infrastructure and required to promote proper use, operation, and maintenance of sanitation facilities; in the calculation, these operating costs are estimated at 20 percent of capital costs [36], covering the full range of activities accompanying the installation of new sanitation facilities.

Wastewater treatment:

As described previously, some wastewater treatment may be required for sewered sanitation systems, particularly in densely populated urban and rural areas or in the vicinity of fragile freshwater ecosystems, such as shallow lakes. The tentative target for wastewater treatment (set by the authors of the report), is to provide primary or secondary treatment to approximately 60 percent of all households with access to sewerage (conventional or simplified). Tertiary and advanced industrial wastewater treatment have been excluded from this analysis, assuming that this investment can and should be financed by the private sector, a sector which generates wastewater requiring such treatment.

5) Global cost estimate for Ghana:

Because community preferences, applicable technologies, unit costs, technology standards and so forth vary from country to country, the Millennium Project has not prepared a global estimate of the financing needs for water and sanitation. Instead, the focus is on developing a methodology for national needs assessments and then applying it in a number of countries.

To cover the necessary gradual increase in interventions and the human and organizational resources that deliver them, the Millennium Task Force 7 tentatively projects a linear scaling up of investment in the years to 2015. Over time, operating costs, including maintenance, are generally higher than the initial capital costs; the level of resources required for operation and maintenance are often grossly underestimated. A preliminary needs assessment for Ghana quotes total investment figures for the years 2005, 2010 and 2015, underlining the gradual scaling-up of investment. The columns on the right provide total investment needs and averages over the period 2005 to 2015. The following table divides investment by total population (not the population served) to obtain per capita estimates of the resources required.

36- Corresponding to the estimate for India in Shekhar 2003.

Resource requirements for reaching MDG target 10 in Ghana (2005-2015): total cost estimates in 2003 in million USD:

Category	2005	2010	2015	Total 2005-2015	Annual average 2005-2015	Share of total over period (%)
WATER SUPPLY						
RURAL						
Capital cost	10 026 715	6 327 163	7 639 544	74 871 750	6 806 523	3
Operating cost	15 944 164	15 012 887	14 650 132	166 297 043	15 117 913	5
Subtotal	25 970 879	21 340 050	22 289 676	241 168 793	21 924 436	8
WATER SUPPLY						
URBAN						
Capital cost	14 141 600	27 763 761	35 064 790	304 373 750	27 670 341	15
Operating cost	33 732 643	48 904 528	67 383 252	545 650 636	49 604 603	20
Subtotal	47 874 243	76 668 289	102 448 042	850 024 386	77 274 944	35
Total	**73 845 122**	**98 008 339**	**124 737 718**	**1 091 193 179**	**99 199 380**	**43**
SANITATION						
RURAL						
Capital cost	3 735 093	7 970 192	24 860 156	114 308 051	10 391 641	4
Operating cost	3 083 993	5 126 261	9 535 140	61 225 914	5 565 992	3
Subtotal	6 819 086	13 096 453	34 395 296	175 533 965	15 957 633	7
SANITATION						
URBAN						
Capital cost	14 183 612	19 706 385	24 615 225	219 489 019	19 953 547	19
Operating cost	14 863 110	21 324 792	58 216 033	269 123 521	24 465 775	15
Subtotal	29 046 722	41 031 177	82 831 258	488 612 540	44 419 322	34
Total	**35 865 808**	**54 127 630**	**117 226 554**	**664 146 505**	**60 376 955**	**41**
WASTEWATER TREATMENT						
Rural	10 304	3 051	1 361	35 587	3 235	-
Urban	1 883 716	6 910 847	11 063 001	76 981 097	6 998 282	4
Total	**1 894 020**	**6 913 898**	**11 064 362**	**77 016 684**	**7 001 517**	**4**
Hygiene education	5 305 757	7 285 891	9 776 081	81 199 248	7 381 750	4
Global cost	**116 910 707**	**166 335 759**	**262 804 715**	**1 913 555 617**	**173 959 602**	**100**

Resource requirements for reaching MDG target 10 in Ghana (2005-2015): total cost estimates per capita in 2003 (in USD):

Category	2005	2010	2015	Annual average 2005-2015	Share of total over period (%)
WATER SUPPLY					
RURAL					
Capital cost	0.5	0.3	0.3	0.3	4
Operating cost	0.7	0.6	0.6	0.6	9
Subtotal	1.2	0.9	0.8	0.9	13
WATER SUPPLY					
URBAN					
Capital cost	0.6	1.2	1.3	1.1	16
Operating cost	1.5	2.0	2.6	2.1	29
Subtotal	2.2	3.2	3.9	3.2	44
Total	**3.4**	**4.1**	**4.7**	**4.1**	**57**
SANITATION					
RURAL					
Capital cost	0.2	0.3	0.9	0.4	6
Operating cost	0.1	0.2	0.4	0.2	3
Subtotal	0.3	0.5	1.3	0.7	9
SANITATION					
URBAN					
Capital cost	0.6	0.8	0.9	0.8	11
Operating cost	0.7	0.9	2.2	1.0	14
Subtotal	1.3	1.7	3.1	1.8	26
Total	**1.6**	**2.2**	**4.4**	**2.5**	**35**
WASTEWATER TREATMENT					
Rural	0.0	0.0	0.0	0.0	0
Urban	0.1	0.3	0.4	0.3	4
Total	**0.1**	**0.3**	**0.4**	**0.3**	**4**
Hygiene education	0.2	0.3	0.4	0.3	4
Global cost	**5.4**	**6.9**	**10.0**	**7.2**	**100**

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