Urban Water Supply and Sanitation in Southeast Asia

A Guide to Good Practice

Arthur C. McIntosh

ASIAN DEVELOPMENT BANK

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Foreword

Most people living in cities and towns would like to have 24-hour piped-water connections. Unfortunately, in many cities, including those in Southeast Asia, only about 50% of the urban population has access to that standard of water supply. Timely availability of water of adequate quality and quantity is one issue. Low service coverage, intermittent supply, and high water losses are other water supply challenges to be addressed. Inadequate attention is being given to the collection, treatment and disposal/reuse of wastewater, and this is reflected both in the institutional setup (responsibility for water and for sanitation is often divided) and in the lack of data available for analysis.

The Asian Development Bank (ADB) would like to make a difference. This book, *Urban Water Supply and Sanitation in Southeast Asia: A Guide to Good Practice*, will increase the understanding and awareness of all stakeholders in the water sector by focusing on the issues that matter. In the process, it will contribute toward ADB's overarching goal of poverty reduction.

There are five voices in this book—those of ADB (based on its policies, operational plans, regional conferences, and publications); the author (based on his 30 years of experience in Asian water supply); other noted authors in the sector (based on their statements, papers, and publications); water and sanitation utilities; and customers in Southeast Asia (based on anecdotal interviews). This structure has provided balance to the book and has also given Arthur McIntosh and the various contributors a certain amount of freedom to address frankly such sensitive issues as tariffs, governance, and privatization. While ADB does not necessarily endorse all views put forward in this book, it does respect these opinions and supports the overall objectives of this work.

In the section on water sources and water resources, there is much to learn from Singapore. Its government has given top priority to water among its policies and has shown the way by recycling water and putting water and sanitation under one roof from source to disposal/reuse. In many other countries, there are often "too many cooks" looking for a piece of the water sector pie. Strong and consistent leadership over the long term is shown to be an important factor in the success of utilities.

The chapter on service coverage highlights the importance of a recent decision made by Viet Nam to abolish connection fees for urban water supply, allow these costs to be funded by loans amortized over several years, and increase tariffs marginally for all, to pay for these loans. This book encourages all utilities (both public and private) to follow this good example. At the same time, we see the need for social engineering in each utility to make sure the urban poor are properly provided for.

In the discussion on tariffs, we learn the importance of maintaining the financial viability of the utility and the autonomy of management through appropriate tariffs. We also learn that it is best for the utility to seek first the customers' endorsement of tariff increases before approaching the government for formal approvals. A transparent tariff policy will be easier to implement.

Nonrevenue water (NRW) can be tackled through managing distribution at the lowest practicable level. But always the "cause" must be identified and treated. We see how

successful NRW reduction is a win-win activity because it not only reduces losses but frees up more water for new connections (paying customers), thus circumventing water source issues at least for the time being. In the home, we see how advisable it is for the utility to go beyond the meter and help customers reduce their own water losses. With the support of ADB, water operator partnerships (between strong and weak utilities) are now flourishing and improving the performance of weak utilities, through peer-to-peer knowledge transfer.

This book mentions many times the need to measure well in order to manage well. Guidance is given in the selection of a few key performance indicators and in the benchmarking of these against other utilities. The role of utility websites in reporting this performance and in promoting customer education is emphasized. We learn that anecdotal interviews and single-street water bill surveys are powerful tools for finding out on the spot what is happening from the viewpoint of customers and noncustomers.

In development we are often advised that all parties in the development process, be they multilateral funding agencies or developing-country utilities, have much to learn from one another.

Business-as-usual is not an option. The inequities affecting the poor beg for immediate attention. ADB believes that governments should seriously consider the recommendations in this book. I commend the efforts of Arthur McIntosh (a former ADB staff) in not only authoring this book but assembling for the reader good advice from many others working in this sector.

This book will be useful to governments, utilities, consultants, development agencies, and nongovernment organizations. It is aimed at professionals in the water sector, especially new professionals who may not be aware of all the problems. It will be valued for its grounding in real data from 14 utilities in Southeast Asia. During his peer review of this book, Graham Jackson, a former senior staff in ADB, declared: “ADB staff in the water sector should never go on mission without it.”

James Nugent
Director General
Southeast Asia Department

Preface

Objective

This book provides stakeholders (governments, development partners, utilities, consultants, donors, academe, media, civil society, and nongovernment organizations) with a point of reference and some tools for moving forward effectively and efficiently in the urban water supply and sanitation sector in Southeast Asia. New generations of water professionals should not have to repeat the mistakes of the past. Instead they should be able to take what has been learned so far and move forward. To facilitate this process, this book was designed to improve understanding and awareness of the issues and possible solutions among all stakeholders in the sector.

Scope

This book focuses on six countries in Southeast Asia—Cambodia, Indonesia, Lao People's Democratic Republic, Philippines, Thailand, and Viet Nam. Field data were obtained from 14 utilities in these six countries. Future studies should bolster the analysis of sanitation, now still regrettably weak for lack of data.

Approach

The information in this book came from the following sources: data from the utilities and anecdotal information from stakeholders in 14 utilities in six countries, which were analyzed by the author; the author's own views based on his 30 years of experience in the Asian water supply and sanitation sector; stories and articles written by noteworthy developing-country practitioners; and information gleaned from recent Asian Development Bank conferences and publications. Most of the information was compiled in 2012 and most data relate to the end of 2011.

How to Use This Book

This book, like the original ADB publication *Asian Water Supplies* (2003), can be read cover to cover (even in a couple of hours, following the red script only) or it can be used as a reference on a specific topic. Important points are purposely repeated. Chapters are topical and do not necessarily flow from one to the next. But the Introduction and the Conclusion bind them all together. Significant statements appear in red. "We" should be taken to mean all stakeholders. There is something to learn from this book for everyone involved in water supplies in developing countries, especially new professionals in the sector and non-technical persons.

Acknowledgments

There are many people to thank for their work in this book. Tan Gee Paw, Ek Sonn Chan, Arjun Thapan, Perry Rivera, Roland Liemberger, Chuanpit Dhamasiri, Kamal Kar, Elsa Mejia, Cesar Yñiguez, Michael White, and Ian Makin contributed major articles.

Data and information from the 14 contributing utilities were supplied by Dang Ngoc Linh from the Hai Phong Water Supply Company; Chea Visoth from the Phnom Penh Water Supply Authority; Nguyen Thanh Sang from BIWASE in Binh Duong; Ariel Noble from the Davao City Water District; Charmaine Rodriguez from the Metro Cebu Water District; Ruri Lubis from PDAM Tirtanadi, Medan; Mohammed Azharuddin from PDAM Tirtamusi, Palembang; Noel Abesamis from Manila Water; Songklod Khanchanasut from the Metropolitan Waterworks Authority, Bangkok; Jerry Palma from Maynilad, Manila; Philippe Pedrini from PALYJA, Jakarta; Lintong Hutasoit from AETRA, Jakarta; Sisamone Kongmany from Lao PDR; and Vo Quang Hien from SAWACO in Ho Chi Minh City.

All photographs in this publication were generously provided by the author and 12 water utilities, namely: Hai Phong Water Supply Company; Phnom Penh Water Supply Authority; BIWASE in Binh Duong; Davao City Water District; Metro Cebu Water District; PDAM Tirtanadi, Medan; PDAM Tirtamusi, Palembang; Manila Water; Metropolitan Waterworks Authority, Bangkok; Maynilad, Manila; PALYJA, Jakarta; and AETRA, Jakarta.

Customers in 10 of the 14 utilities responded to the anecdotal interviews conducted by the utility staff. These, more than facts and figures, kept the book anchored in reality. They told it as it was, and thus contributed to improving future service.

Graham Jackson provided a very useful peer review, and so did Rudolf Frauendorfer and Manoj Sharma. Lourdes Caballero, our researcher, toiled hard and long to get information from various government agencies.

Staff of ADB resident missions in Hanoi, Bangkok, Vientiane, Phnom Penh, Jakarta, and Manila coordinated with the relevant governments and utilities to facilitate visits by this author to all 14 water utilities.

Finally, Michael White and Amy Leung of the Urban Development and Water Division of ADB's Southeast Asia Department got this "project" off the ground and supported it throughout.

Thank you to all.

Abbreviations

ADB	Asian Development Bank
AETRA	Aetra Air Jakarta (private water supply operator in Eastern Jakarta, Indonesia)
ASEAN	Association of Southeast Asian Nations
BIWASE	Binh Duong Water Supply Sewerage and Environment (Viet Nam)
BMW	bio-media wastewater
BOO	build-operate-own
BOT	build-operate-transfer
CBO	community-based organization
CLTS	community-led total sanitation
DCWD	Davao City Water District (Philippines)
DMA	district metering area
DMC	developing member country (of ADB)
FAO	Food and Agriculture Organization of the United Nations
GDP	gross domestic product
GPS	global positioning system
GWP	Global Water Partnership
HCMC	Ho Chi Minh City (Viet Nam)
HDPE	high-density polyethylene (pipe)
HH	household
HPWSC	Hai Phong Water Supply Company (Viet Nam)
IBRD	International Bank for Reconstruction and Development
IBT	increasing block tariff
IMF	International Monetary Fund
IWA	International Water Association
IWADCO	Inpart Waterworks and Development Company (Philippines)
IWK	Indah Water Konsortium (Malaysia)
IWRM	integrated water resources management
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt für Wiederaufbau (German government-owned national development bank)
Lao PDR	Lao People's Democratic Republic
LGU	local government unit
LWUA	Local Water Utilities Administration (Philippines)
MCWD	Metro Cebu Water District (Philippines)
MDG	Millennium Development Goal
mld	million liters per day
MWA	Metropolitan Waterworks Authority (Bangkok, Thailand)
MWCI	Manila Water Company Incorporated (Philippines)
MWSI	Maynilad Water Services Incorporated (Manila, Philippines)
MWSS	Metropolitan Waterworks and Sewerage System (Manila, Philippines)
NEWater	reclaimed water (wastewater treated through reverse osmosis, Singapore)
NGO	nongovernment organization
NRW	nonrevenue water

O&M	operation and maintenance
PALYJA	PAM Lyonnaise Jaya (private water supply operator in Western Jakarta, Indonesia)
PPP	public–private partnership
PPWSA	Phnom Penh Water Supply Authority (Cambodia)
PRC	the People's Republic of China
PSP	private sector participation
PUB Singapore	PUB, Singapore's national water agency
PVC	polyvinyl chloride
PWA	Provincial Waterworks Authority (Thailand)
RWSA	Rural Water Supply Association (the Philippines)
RWSS	rural water supply and sanitation
SAWACO	Saigon Water Corporation (Viet Nam)
SBMA	Subic Bay Metropolitan Authority (the Philippines)
SSWP	small-scale water provider
STBM	Sanitasi Total Berbasis Masyarakat (community-based total sanitation, Indonesia)
STP	sewage treatment plant
UFW	unaccounted-for-water
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VCWSE	Vientiane City Water Supply Enterprise (Lao PDR)
WaterLinks	Asian water supply operators' network
WASRO	Water and Sanitation Regulatory Office (Lao PDR)
WFP	Water Financing Program
WHO	World Health Organization
WOP	water operators partnership
WSP	Water and Sanitation Program of the World Bank
WSS	water supply and sanitation
YDD	Yayasan Dian Desa (Indonesia)

Measurement Units and Symbols

Measurement Units	
km	kilometer
kWh	kilowatt-hour
l/c/d	liters per capita per day
m^3	cubic meter
mld	million liters per day
24/7	24 hours a day, 7 days a week

Currency Symbols	
B	Thai baht
D	Vietnamese dong
KN	Lao PDR kip
KR	Cambodian riel
₱	Philippine peso
Rp	Indonesian rupiah

Currency Conversion Rates

(as of 30 June 2012)*

Currency	**Equivalent of US$1**
Cambodian riel	KR4,100
Indonesian rupiah	Rp9,407.30
Lao PDR kip	KN7,978
Philippine peso	₱42.24
Thai baht	B31.61
Vietnamese dong	D20,850

*Figures have been rounded off.
Source: OANDA website.

Chapter 1

Introduction

Background

This book updates *Asian Water Supplies: Reaching the Urban Poor*, which was published by the Asian Development Bank (ADB) in 2003, but it focuses on Southeast Asia (Cambodia, Indonesia, Lao People's Democratic Republic (Lao PDR), the Philippines, Thailand, and Viet Nam). The first book was well received and used extensively by consultants working in developing countries of Asia, and was reprinted twice over 8 years. Now it is somewhat dated and it is time to review progress in the sector. A Southeast Asian focus was chosen this time because (i) the region leads Asia in water supply and sanitation development, (ii) the six countries have considerably diverse problems and solutions, and (iii) this narrower focus allows more in-depth examples to be showcased.

The original book gave considerable attention to problems that largely characterized South Asia, among them, intermittent water supply, standpipe supplies, and very low tariffs. In Southeast Asia these problems are not so prevalent; where they do exist there is progress toward reduction and elimination. Generally, progress is more noticeable in Southeast Asia.

The issues and solutions discussed in this book are therefore more specific to Southeast Asia. In general, Cambodia, the Philippines, Thailand, and Viet Nam have progressed in urban water supply, but Lao PDR and Indonesia still lag behind. Viet Nam, in particular, has made strides in the governance of urban water supply, including corporatization, full cost recovery, and connection fee waivers. It has also introduced new and innovative utility structures that seek to reduce bureaucracy by including consulting and contracting services within the company, and to integrate water supply and sanitation like those adopted by Binh Duong Water Supply, Sewerage and Environment (BIWASE).

To anchor this book in reality, data on 14 water utilities in Southeast Asia were extensively gathered through utilities, through anecdotal interviews with stakeholders and through street surveys in low-income areas. Key information from the field is found throughout the book in the appropriate chapters.

Issues and Solutions

The table in the Annex identifies a number of issues in the urban water supply sector in Southeast Asia and offers some potential solutions.

What follows here is a short summary of the more important solutions that have emerged mostly over the last decade, to set the tone for this book.

Water Supply

Water Sources and Resources

- Make water a policy priority by leading from the top.
- Recycle wastewater.
- Combine water supply and sanitation under one institutional responsibility.
- Coordinate monitoring among agencies. *Too many cooks spoil the broth.*
- Reduce nonrevenue water; it is the most important and available water source.

Service Levels and Service Coverage

- Know both customers and noncustomers.
- Abolish connection fees and increase tariffs to get everyone connected.
- Establish a social development unit in the utility to handle the water needs of the urban poor.

Nonrevenue Water

- Reduce nonrevenue water (NRW) by managing at the lowest practicable level.
- Consider the caretaker approach to managing at the lowest level.

- Consider all elements of the development cycle, including planning, design, construction, and operation and maintenance, as possible causes of NRW.
- Address the cause, not just the symptom.
- Use rational leak detection and pipe replacement.
- Offer staff incentives (penalties and rewards) for performance in the field.
- Set acceptable NRW standards.
- Customers should not pay for poor efficiency.

Tariffs for Autonomy

- Educate politicians and decision makers with the help of customers, utilities, consultants, donors, and media.
- Have tariff revisions accepted first by customers.
- Analyze water bills in low-income areas.
- Improve efficiency in conjunction with a tariff increase.
- Maintain a lifeline tariff for the urban poor.

Operation and Maintenance

- Consider peer-to-peer knowledge transfer, such as water operator partnerships, to promote improvements in operation and maintenance (O&M).
- Adopt more social engineering.
- Concentrate on customer interface through a good and easily accessible website.
- Go beyond the meter to help customers.
- Adopt a good O&M policy to enhance service and extend equipment lifespan.
- Publish NRW rates and what they mean in terms of foregone revenue, and impact on tariffs and service coverage.

Governance

- Remember that corporatization is a good first step toward autonomy, but it takes time.
- Think results, not process.
- Establish independent regulation.
- Focus on good construction supervision.
- Think customers, not connections.
- Enforce water quality and NRW standards.

Data Collection, Analysis, and Reporting

- Conduct anecdotal interviews.
- Do single-street surveys in low-income areas and analyze the water bills.
- Start with simple benchmarking.
- Set up utility websites that are responsive to the needs of customers and other stakeholders.

Sanitation

(See Table 14.1 Sanitation Challenges and Responses.)

- Make sanitation a government priority.
- Establish sanitation policies and plans.
- Provide budgetary support.
- Set up a mechanism for providing good data.
- Promote public awareness and reporting.
- Put water supply and sanitation under one institutional responsibility.
- Waive connection charges for sewers.
- Make sure tariffs are in place and are collected.
- Recognize the need to subsidize sanitation, where needed.

What Is New?

This is only a small preview of what is to come.

Water Sources and Resources

We have seen the importance of true leadership with people like Ek Sonn Chan in the Phnom Penh Water Supply Authority (PPWSA), Tony Aquino in Manila Water, and Tan Gee Paw in PUB, Singapore's water agency (PUB Singapore). They not only did well but stayed the distance for 10 or more years with patience and persistence, and it paid off. Often too many organizations are involved in decisions on water—too many cooks spoil the broth. We have seen great advances made in water recycling with Singapore PUB's NEWater.[1] It is an example of what can be achieved if sufficient funding is available and water scarcity is an issue. We have recently been given a lesson by Singapore PUB in how to integrate

[1] Reclaimed water in Singapore using reverse osmosis technology.

water and sanitation in the region.[2] The two Manila concessions and BIWASE in Viet Nam are starting to come to grips with this approach. Wherever we look, we see water source issues. But now there is more demand management and NRW reduction.

Service Levels

We are now more aware that we must know not only our customers but also the noncustomer market. It is hoped that the abolition of the connection fee (where connection costs are recovered in higher tariffs for all) will be taken up by other countries now that Viet Nam has shown the way. So we truly can increase the tariffs to get the poor connected. Perhaps we need to educate the unserved urban poor to demand a tariff increase so there will be money to provide them with a connection. Big things are possible for the poor if the utility has a dedicated social development unit. If we manage at the lowest practicable level (as Manila Water, Maynilad, and PPWSA did), we know high NRW can be beaten and coverage increased.

Intermittent Supply[3]

Demand management through much higher tariffs can help to convert intermittent supply to round-the-clock (24/7) water. NRW reduction will also help.

Nonrevenue Water

Since it was first introduced in *Asian Water Supplies*[4] the "caretaker approach" has been used successfully in Viet Nam and the Philippines. Heavy leakage can be corrected through leak detection and pipe replacement. Manila Water was able to take its skills in NRW reduction to Viet Nam. Staff incentives must be built into the equation to reduce NRW quickly. Raw-water pricing could be a good way of speeding up NRW reduction.

Tariffs for Autonomy

In this last decade we have been learning how to analyze water bills in low-income areas. It is not necessary to cut off piped water connections if the matter is handled sensibly. Ek Sonn Chan proved that reducing NRW and improving collection efficiency made higher tariffs unnecessary.[5] With the wastewater bill added to the water bill, we learned that both must be tied to customer consumption to avoid major fixed charges. In this case there is a need for different tariffs for sewered and unsewered areas. We also learned from Indonesia that politicians can be persuaded to increase tariffs if the utility first gets the endorsement of the customers by trading an improved service for higher tariffs.

Operation and Maintenance

Water operator partnerships have flourished in the last decade[6] and have proved effective in improving communication and performance. More attention is now being given to social engineering. Managing at the lowest practicable level is effective. A better customer interface is created and utility websites are becoming more customer-oriented. The Metropolitan Waterworks Authority (MWA) in Bangkok showed that good things happen when the utility goes beyond the meter to help the customer.

Development Projects

The turnkey project approach (design–build–operate) has been used successfully in Viet Nam to minimize bureaucracy and save time in development. While not likely to be adopted as a mainstream approach, it is an alternative to be considered. More and more we get the sense of governments prioritizing their own investments, instead of donors directing resources to meet their own goals. And if we have not considered the endgame of development funding, then we have not been doing our job. We are now well aware that development practitioners should encourage a culture of two-way capacity building.

Governance

Corporatization is the first step toward utility autonomy, but as we have seen in Lao PDR, it cannot just suddenly be switched on. It needs patience, persistence, and weekly workshops to discuss all the implications. After all, corporatization as an organizational staff culture is a paradigm shift away from how a government department usually operates.

Massive bureaucracy has caused us to acknowledge that in development, time is of the essence. In operations, we need to monitor and judge on the

[2] Integration of water and sanitation is not new. It has been practiced for many years in Europe, North America, and Australasia.

[3] Piped water supply that does not provide the customer with water under positive pressure every minute of every day.

[4] Arthur McIntosh. 2003. *Asian Water Supplies: Reaching the Urban Poor*. Manila.

[5] PPWSA has not increased tariffs since 2001.

[6] Besides ADB, the US Agency for International Development (USAID), Japan International Cooperation Agency (JICA), Agence Française de Développement (AFD), and the Netherlands government have been involved.

basis of results, not process, with all its rules and regulations. For every utility, we need to find someone to champion the cause—not necessarily a water expert, but someone held in high regard by the people, who can introduce and sustain the changes needed to improve service delivery and efficiency. Then the donors and the governments must support that person.

Data Collection, Analysis, and Reporting

The preparation of this book has taught us the value of anecdotal interviews, street surveys, and analysis of water bills. These are the tools to be used by all utilities. Some simple benchmarking will be necessary. Eight to ten easily measured and understood performance parameters are enough: more than that, you lose credibility. Utility websites are now required to respond to stakeholders' concerns.

Sanitation

It is clear that water must be combined with sanitation in policy, in utilities, and in tariffs. Community-led total sanitation (CLTS) has gained widespread acceptance as a tool for expanding access to sanitation and introducing behavior change. We have learned that pride, dignity, shame, disgust, and self-respect are the key motivations in selling sanitation to the people, and that sanitation is a public, not a private, good. To accelerate coverage targeted subsidies/incentives can be used to assist the poor.

Myths, Misconceptions, and Realities

Asian Water Supplies (2003) exposed some myths, misconceptions, and realities. Some of them are still around; others have softened with time. Below we revisit them.

Coverage with piped water requires external funds. PPWSA has shown us that after initial assistance from development partners it can fund most of its development from tariff income and efficiency gains, and this with essentially low tariffs. Furthermore, as Ek Sonn Chan points out, of what use is billions of dollars of funding, even with no strings attached, if governance is not right.

Shortage of water is the reason for intermittent water supply. If that were true, then Male in the Maldives would have intermittent supply. The fact that it does not is due to high tariffs, strict metering, high collection efficiency, and low NRW.

Intermittent water supply is acceptable. This is one myth that pertains mostly to South Asia and not to Southeast Asia. There is good awareness of the need to make all piped water potable, and the utilities and the people know that they must eliminate intermittent supply. Still it is clearly an issue in Jakarta.

The poor are unwilling and cannot afford to pay the full cost of piped water. Although almost all other stakeholders know this is not true, unfortunately (as indicated by the anecdotal interviews for this book) some politicians are still saying this. Perhaps they just do not want to lose control. We know that the unconnected poor when they buy from vendors pay many times the amount the rich pay for water, and often the water quality can be suspect.

It is possible to run a $20–$100 million per year commercial operation selling water with civil servant rules and civil servant salaries. Management and staff must be the best on the open market and incentives must match performance. Singapore PUB, MWA, PPWSA, and Manila Water have all proven that. Corporatization is the way to go to achieve autonomy and to run water utilities as sustainable and efficient businesses.

Reducing NRW below 20% of production is not economically justified. Manila Water (11%), PPWSA (5%), and Singapore PUB (3%) have all proven this to be a misconception. As the true cost of water supply is realized, the importance of low NRW becomes apparent. There is a difference between developed and developing countries.

The private sector will bring much-needed funds to the development table and improve water utility efficiency. Manila Water took several years to bring funds to the table. It took close to 10 years for Maynilad to do this, although the Asian financial crisis was partly to blame. When they got the funding, it was accompanied in both cases by significant tariff increases. The concessions in Jakarta have never made efficiency a priority. Only Manila Water among the four concessions has clearly demonstrated efficiencies.

Because of rapid urbanization, it is necessary to go further and further afield to find more water sources. Most of the 14 utilities from Southeast Asia examined for this book expressed water

source problems, but few have pushed the limits of efficient use of the water they have. NRW is still quite high. There is little attempt to use higher tariffs to restrict demand and realize the true value of water. There is still not enough being done to rehabilitate watersheds.

Appropriate legislation allows a water utility to operate with autonomy. Legislation is a necessary but insufficient condition to ensure that a utility operates with autonomy and good service. A strong leader and tariffs that put the money trail through the utility, not the government, are also needed. Low tariffs are synonymous with low autonomy. When customers, through tariffs, pay the full cost of the piped water supply, then they are in the driver's seat, not the government. Examples are MWA, PPWSA, and Singapore PUB. Manila Water and Maynilad enjoy the autonomy that comes from being private operators.

Households in Asia need at least 200 liters per capita day. Except for MWA, with consumption well over 200 liters per capita per day (l/c/d), and Manila Water (around 190 l/c/d), the average per capita consumption for the utilities studied was in the range of 100–150 l/c/d, which can be considered reasonable and in line with usage in Europe. This may be more a reflection of tariff level than anything else.

Private operators are the cause of higher tariffs. The four private operators in Southeast Asia have the four-highest tariffs, averaging about $0.75 per cubic meter ($m^3$), among the 14 utilities studied for this book. This figure can be compared with $0.24/$m^3$ for PPWSA and $0.39/$m^3$ for MWA, both of whom offer a good service. However, Metro Cebu Water District (MCWD) has high tariffs ($0.60/$m^3$) and low service coverage.

Regulatory bodies are needed only because of private sector contracts. The regulatory bodies that act for the four private operators in Manila and Jakarta are not much more than contract administrators. Whether regulators are independent or not, their most important role is being a sounding board for complaints from the public about service.

Private operators are eager to serve the urban poor. The best of the four private operators (Manila Water) averages seven persons per connection, versus MWA, which averages four persons per connection. Even PPWSA averages 9.1 persons per connection. This means that many people still share connections and are being penalized by the block tariff rate, which, of course, benefits the operator. But the private operators are generally no worse than the public operators in this regard.

Chapter 2

Water: The Big Picture

Water source at Angat Dam, Bulacan, Philippines

"We need ecological intelligence and we need to use pricing as an instrument of change. The most valuable liquid in the world is priced so cheap it is lost, wasted, and polluted. If it were oil it would be different. The paradox is that the rich get water cheaply and the poor expensively." (**Sahana Singh**)[7]

Introduction

In Southeast Asia, Singapore has shown the way in water resource management. External forces like dependency on Malaysia for some water supply and internal forces like very limited land for water catchment purposes certainly forced such decisions in recent years as major desalination, water supply catchments off city streets, recycling of wastewater to make NEWater (recycled potable water), and the combining of institutional responsibilities for water and sanitation. But what made it all possible was having a water policy that required having water supply and sanitation under one roof, showing the way forward in the ongoing debate over sanitation in Asia. Of the 14 utilities studied in six Southeast Asian countries, only three include sanitation under the same agency as water. The way forward must be to do what Singapore did 10 years ago and most industrialized countries did around 100 years ago: integrate water supply and sanitation under one responsible agency. Fundamental here was Singapore's insistence on separate sewers for the con-

[7] Sahana Singh is editor of *Asian Water,* a journal published in Singapore.

veyance of sewage and storm water, right from the start. This setup is especially important in tropical climates, where storm watr flows in the rainy season can be many times the dry season flow. Singapore's water policy transcended all other policies in this small island country. It did not come easy. The clean-up of the Singapore River took 10 years of concerted effort. While not every country is a Singapore, and some may say that Singapore was able to do these things because it had wealth and could afford to subsidize the water sector, the experience nonetheless shows what is possible if water policy is given priority. It is time for our Southeast Asian cities to start working toward that goal and for the countries to consider prioritizing their national water policies.

This section tries to present the big picture for water—how water does not exist in isolation. Water security is viewed in a global perspective. (See Box 2.1.) Climate change will affect the future, for our water supply, as well as for our food and energy production. The section looks at the main water user (irrigation) and new developments in that sector. It reveals through anecdotal interviews that people are gaining a different perspective on water resources and are becoming much more concerned about water catchment conservation. It shows the concern of water utilities in Southeast Asia over the quality and quantity of water resources to meet the future needs of an ever-increasing population, particularly since water resource development is in the hands of local and national governments that often appear slow to make decisions. The section discusses water scarcity and how it can be mitigated through effective demand management, perhaps by managing water where it falls rather than conveying fresh or polluted water over great distances. Water catchment rehabilitation and the use of check dams and wetlands are also discussed, as is the role of rainwater harvesting. Finally, the section shows the need for comprehensive monitoring of the quantity and quality of water resources, to enable timely and informed decisions about water management.

Table 2.1 shows the current status of national water policies in four Southeast Asian countries.

Box 2.1: Notes from the Keynote Speech by Dr Mohamed Ait Kadi[a] at the ADB Water Conference, March 2013

According to Darwin, it is not the strongest of the species that survive, nor the most intelligent, but the ones most responsive to change.

The tools we have at our disposal are:

- Policy instruments (economic, social, and environmental) to leverage change;
- Fiscal instruments (pricing of environmental goods);
- Strengthened institutional arrangements;
- A new generation of financial instruments that share risk between government and investors;
- Skill development;
- Information and monitoring; and
- Innovative planning for increased water productivity.

Water security is a global concern. The top-five global risks at present, in terms of impact, are:

- Major systemic financial failures;
- Water supply crises;
- Chronic fiscal imbalances;
- Food shortage crises; and
- Diffusion of weapons of mass destruction.

Water security depends on the following interconnected risks:

- Geopolitical risks;
- Economic risks;
- Societal risks; and
- Environmental risks.

[a] President of the General Council of Agriculture Development.

ADB Water Operational Plan (2011–2020)

The ADB plan provides guidelines and establishes basic principles. The Water Policy (Box 2.2) will remain the bedrock of ADB water operations. Synergies with the programs of other multilateral and bilateral organizations will be pursued.

The first phase of the Water Financing Program (WFP), which was implemented in 2006–2010, achieved the target of doubling ADB's water investment in urban rural and basin water to over $10 billion in 5 years.

The continuation of the WFP during the period 2011–2020 will sustain ADB's water investments at

Table 2.1: National Water and Sanitation Policies

Water Resources	Water Supply	Sanitation
Indonesia		
Indonesia has a National Policy on the Development of Community-Based Water Supply and Environmental Sanitation (WSES). The policy assists local governments in carrying out their water and sanitation development plans more effectively in a decentralized government system. It was designed for all levels of government, nongovernment organizations, beneficiaries, and donors.	There is still no consolidated water policy for urban areas. Government Act 16 / 2005 covers the development of the water supply system. Ministerial Decree 23/2006 covers guidelines for water tariff setting.	The Indonesia Sanitation Sector Development Program is an innovative response to the growing sanitation crisis. Instead of funding investments directly, it fosters an enabling environment for progress, with special attention to city-level planning, the strengthening of sector strategy and institutional arrangements, and advocacy and awareness raising at all levels.
Philippines		
The Clean Water Act 2004 provides for comprehensive water quality management and other purposes. Presidential Decree 1067 instituted a Water Code, thereby revising and consolidating the laws governing the ownership, appropriation, use, exploitation, development, conservation, and protection of water resources.	Administrative Order 94 provides measures for the optimum use of water resources in Metro Manila. In August 2007 the Philippine Water Supply Sector Roadmap was completed and approved by the National Economic and Development Authority infrastructure committee.	There is a National policy on Urban Sewerage and Sanitation 1994. The Philippine Sustainable Sanitation Roadmap, led by the Department of Health, was recently approved by the National Economic and Development Authority interagency subcommittee on water resources. The National Sewerage and Septage Management Plan under the Department of Public Works and Highways is consistent with the sanitation roadmap.
Thailand		
In the water sector, policies are formulated by three agencies, which are responsible for different areas of the water system. The Department of Water Resources is responsible for national water policy. Groundwater policy comes under the Department of Groundwater Resources. The Royal Irrigation Department is responsible for agricultural water policy. A Water Regulatory Commission is planned as an independent agency to regulate the water sector.	The Metropolitan Waterworks Authority and the Provincial Waterworks Authority supply piped water in urban and suburban areas. The Department of Public Works assists 117 municipalities in producing and distributing piped water.	There is systematic inclusion of the Sanitation Program in National Economic and Social Development Plans. A comprehensive vision for water supply, excreta disposal, and refuse disposal has been adopted. There is wide-ranging participation by all key stakeholders and capacity building of key people involved.
Viet Nam		
Government policies in Viet Nam are represented through a combination of laws, decrees, circulars, and decisions. A new Law on Water Resources was approved by the National Assembly in 2012.	For water supply, Decree 117/2007 (amended by Decree 124 in Dec. 2011) requires water supply tariffs to be set to full cost recovery, with calculation of tariff according to Inter-Ministry Circulars 75/2012 and 88/2012. Ministry of Construction has formulated an Orientation Plan for Urban Water Supply to 2025 with a Vision toward 2050 (Decision 1929 /2009/QD –TTg), which includes targets for coverage and nonrevenue water.	For urban wastewater and drainage, the government's strategies were formulated through Decree 88/2007 (under Ministry of Construction Guidance), accompanied by Decision 1930/QD-TTg, which sets future targets. All government activities related to urban environment, including its investment decisions and its dialogue with various development partners, are guided by Decree 88.

$2–$2.5 billion annually, for a total of $20–$25 billion over the 10-year period.

ADB's response will involve (i) expanding and deepening knowledge and analytical work; (ii) advancing inclusive water policy reforms; and (iii) strengthening support for programs and projects in priority areas.

The analytical work will include (i) a *Future of Water in Asia* study, which will consider issues of water governance and demand-side management, among other things; and (ii) a series of improved country water assessments, which will take into account the water, food, energy security nexus and the effects of climate change on water management.

River source of water

Open-canal source of water

Box 2.2: ADB Water Policy,[a] in a Nutshell

Promote a national focus on water sector reform. Developing member countries (DMCs) will be supported in adopting effective national water policies, water laws, and sector coordination arrangements; improving institutional capacity and information management; and developing a national action agenda for the water sector. Throughout, the needs of the poor will be specifically factored into legal, institutional, and administrative frameworks.

Foster the integrated management of water resources. Integrated management will be based on comprehensive water resources assessments and the concentration of interlinked water investments in river basins.

Improve and expand the delivery of water services. Support will be provided to autonomous and accountable service providers, the private sector, and public–private partnerships in water supply and sanitation (rural and urban), irrigation and drainage, and other subsectors, emphasizing equity of access to water for the poor and underserved.

Foster the conservation of water and increase system efficiencies. Packages that combine water use and resource management charges to recover costs, improved regulation, and increased public awareness, as well as provisions to ensure that the poor are not excluded, will be supported.

Promote regional cooperation and increase the mutually beneficial use of shared water resources within and between countries. The primary focus will be on the exchange of information and experience in water sector reform. Support will be provided to enhance awareness of the benefits of shared water resources, create sound hydrologic and socio-environmental databases relevant to the management of trans-boundary water resources, and implement joint projects between riparian countries.

Facilitate the exchange of water sector information and experience. Socially inclusive development principles will be supported to promote stakeholder consultation and participation at all levels, increase the access of poor customers to basic water services, and enhance water investments in DMCs through public–private and community–nongovernment organization partnerships.

Improve governance. To accomplish this, decentralization will be promoted; monitoring and evaluation, research, and learning will be strengthened at all levels, particularly in public sector institutions; and capacity will be built.

[a] ADB 2001

Water policy reforms that may be addressed include: (i) securing efficiencies in irrigated agriculture; (ii) transforming urban water supply agencies into autonomous and accountable service providers that operate under standard business principles; (iii) substantially increasing the volume of wastewater treated and reused; (iv) establishing appropriate regulatory regimes and effective enforcement; (v) rehabilitating groundwater resources; and (vi) introducing basin-wide integrated water resource management (IWRM) on a phased basis.

ADB will continue to work with client governments in advancing tariff reform measures, seeking to avoid marginalizing the poor and vulnerable. This work will include identifying options for financing connection charges (already bearing fruit in Viet Nam).

The priorities, programs, and projects supported by ADB should be those that (i) mainstream efficiencies in water use in project design; (ii) support increased investments in wastewater management and reuse, including sanitation; and (iii) stimulate private sector participation.

There will be support for expanding irrigation areas, but only after substantial efficiency gains from existing water use are demonstrated.

Similarly there will be support for watershed development or rehabilitation projects when they demonstrate clear gains in restoring water balance in the watershed, catchment, sub-basin, or basin concerned.

Substantial reforms in the energy and water sectors will be required to counter the current unsustainable rates of groundwater abstraction evident in many parts of the region. ADB will work with governments, researchers, civil society, and the private sector to halt and, where possible, reverse the decline in the water table.

The availability, quality, and accuracy of data and information will be essential to successful implementation. A critical assessment of how these constraints might affect projects, particularly in developing member countries (DMCs), is required, to determine how much uncertainty can be accommodated. This may especially apply to meaningful NRW reduction and the achievement of irrigation efficiencies.

Water-Food-Energy Nexus

Three main challenges face water management and sustainable food security:

- Water availability has become a serious constraint on sustainable food security in terms of its quality and timing to meet the needs of farmers. Poor water quality in urban areas has become an issue for food safety, for example, in irrigated vegetables.
- A prolonged period of low public investments in irrigation has resulted in poor service to farmers, which in turn is de-motivating them from investing in agricultural input.
- Trends like the decreasing average size of farms, the increasing average age of farmers, and the growing tendency of labor to seek income opportunities away from farming are not conducive to achieving higher food security.

Box 2.3: Climate Change

The consequences of climate change in Southeast Asia may include:

- Decreasing availability of freshwater, particularly in large river basins, threatening water energy and food security;
- Rising sea levels, threatening low-lying coastal areas and island nations;
- Increasing risk of flooding in coastal areas, especially in densely populated areas;
- Growing pressures for large-scale migration;
- Jeopardized sources of livelihood, particularly for the poor in highly vulnerable areas; and
- Increasing health risks from heat waves, vector-borne diseases, water shortages, and contamination.

ADB's strategic priorities with respect to climate change are:

- Expanding the use of clean energy;
- Encouraging sustainable transport and urban development;
- Managing land use and forests for carbon sequestration;
- Promoting climate resilient development; and
- Strengthening policies, governance, and capacity.

ADB is helping its clients to raise their level of efficiency in water use by:

- Revitalizing irrigation to help unlock productivity gains;
- Shifting the governance of water management in agriculture to a serviceoriented approach, with more autonomy and accountability for the irrigation service provider and farmer organizations; and
- Investing in the upgrading of irrigation infrastructure, including the use of modern "smart" technologies.

Changes in the environment, urbanization, and food demand all have an impact on food security in the region. Many rivers in Southeast Asia are in poor health. The unprecedented scale of urbanization is leading to the rapid conversion of the region's most fertile agricultural lands into highways, urban subdivisions, and industrial estates. Population growth has reduced per capita water endowments by an average of 70% since 1950 and the region's economic growth has spurred dietary changes such as the higher consumption of meat, which requires more water than traditional diets. The *Asian Water Development Outlook 2012* published by ADB shows the status of water security in all ADB DMCs expressed in a quantitative manner, and recommends policies for increasing water security.

"Grossly underpricing water perpetuates the illusion that it is plentiful and nothing is lost when it is wasted. Many of the world's shortages stem from failing to value water at anything close to its real worth." (Postel 1997)

Box 2.4: Water Scarcity

Water scarcity is a relative term. It depends on location, climate, season, and potential use of water by humans. The scarcity value of water is determined by the quality of water, the quantity of water, and the number and type of water users. It is greatly influenced, therefore, by the integrity of watersheds, overexploitation of groundwater, cost of water transport and distribution, density of populations, and water pollution levels. What is being seen (and is clearly demonstrated by the extensive use of bottled water) is that the urban issue is one of scarcity of clean and potable water, which is also a reason behind the increased relevance of rainwater harvesting in cities. But water scarcity in Southeast Asia is not manifested across the board. It is characterized more by unequal access to water. In one city some can have their own 24/7 piped water while others rely solely on high-cost vended water. Farmers at the top end of an irrigation scheme will get good water, but those at the bottom end may often be short.

Chapter 3

Water Stories

Sewer canal

Extract from "Green Infrastructure: An Integrated Approach to Urban Storm Water Management" by Amit Prothi ADB Water Conference, March 2013

Urban flooding is a significant problem in Asian cities and is predicted to become worse with climate change. Conventional approaches such as building drains and embankments have been associated with degrading water quality and increasing flooding in downstream areas. Green infrastructure is an approach that seeks to mimic the natural water cycle. By managing land use at the watershed level, allowing streams to flood temporarily, and applying practices such as roof gardens at the building scale, green infrastructure seeks to reduce impervious surface cover associated with urban flooding and reduce risks related to development in floodplains, while in the process creating green spaces that enhance the quality of life of urban residents. Green infrastructure, however, should not be understood as an alternative to conventional systems. Instead, both can be combined to achieve greater levels of sustainable urban development.

The conventional practice for dealing with rainwater in urban areas is to construct drains or sewers that carry it away as quickly as possible, to nearby water bodies or wastewater treatment facilities. Also, streams are channeled or piped to allow urban land to be developed. Such systems are designed to handle relatively frequent events (one-in-30-year probability). Flooding occurs when these systems exceed their capacity, because of inadequate design, blocked

drains, or raised water levels in rivers. This typical engineered response also changes the hydrological cycle where water that would have infiltrated into the ground or returned to the atmosphere through evapotranspiration is carried away. Further, water quality can also be impaired when floodwaters carry pollutants (oils or household chemicals) or when, in the case of combined sewer systems, untreated sewage is discharged into water bodies.

Green infrastructure is a relatively recent term that has come to synthesize an approach that uses natural landscapes, open spaces, and infrastructure systems that mimic nature to manage storm water. Working on scales that range from the regional to the local, green infrastructure approaches have been applied to reduce impervious surface cover in urban settings, clean polluted waters, serve irrigation needs, and replenish groundwater—goals that are critical to urban water management. Importantly, green infrastructure also provides added benefits such as preservation of wildlife habitat and opportunities for recreation, by protecting or creating spaces that provide multiple functions. The approach is gaining popularity in the United States of America and parts of Europe, although several Asian cities also provide examples of successful implementation of practices associated with green infrastructure.

Extract from
"Revitalizing Asia's Irrigation: An Action Agenda"
by Thierry Facon and Louise Whiting
ADB Water Conference, March 2013

The last 40–50 years of irrigation and drainage system performance appear to be a success story. Irrigation development is credited to have provided overall food security, lifted millions out of poverty and hunger, and supported agricultural intensification and diversification and rural development as a springboard for economic development. This is because of increased and more secure water supply to farmers. By 2005, cereal production had tripled, real grain prices had declined by 40%, and the production of fruit, vegetables, and feed had exploded.

The region is changing fast. Wealthier city dwellers have new dietary demands requiring shifts in agriculture. Growing a range of crops requires a different irrigation regime than that needed to supply water to large areas planted with one or two cereals. Farmers have taken advantage of improved access to markets to diversify their activities and produce higher-value niche crops. The large-scale, centrally managed irrigation schemes, but also the traditional farmer-managed irrigation systems, were not designed to be demand-driven or provide the reliable, flexible, and equitable year-round water service that modern farming methods require. Beset with problems of poor design and maintenance, salinity, and waterlogging, many schemes are in decline. Efforts to rehabilitate them have, at best, mixed results. With poor service provision and lack of effective management, farmers have taken irrigation into their own hands, pumping water from aquifers, rivers, and drains, and investing in on-farm storage ponds to augment and better control their water supplies.

Privately sourced groundwater now represents the bulk of irrigation in large parts of South, East and Southeast Asia. Unregulated development of this "atomistic irrigation" has boosted economic efficiency and productivity gains, but has resulted in excessive pressure on the resources. Efforts to reform irrigation schemes by transferring management to farmers have had poor results in terms of improving irrigated agricultural productivity, services to farmers, and the financial resource base for operation and maintenance. These reforms certainly suffered from implementation issues, but many doubt the capacity of irrigation institutions to reform.

Key objectives for the sector have been essentially redefined as improving agricultural water productivity and service to farms and other water users and five key strategies for future interventions have been outlined:

- Modernize yesteryear's schemes for tomorrow's needs;
- Go with the flow by supporting farmers' initiatives;
- Look beyond conventional recipes;
- Empower all stakeholders through knowledge; and
- Invest outside the irrigation sector.

Irrigation Service
by Ian Makin
Principal Water Resources Specialist, ADB

While efficiency is a useful term, it has particular dangers when used in irrigation management. I would like to get this message out in this short article. Irriga-

tion efficiency is a good design objective—i.e., how to arrive at the least-cost construction—but it has dangers when used as an operational management objective, specifically when linked to a "water-saving" objective, if proper water accounting is not done to understand exactly how the system is working in the context of the river basin and other users. We can invest a lot of money seeking to improve efficiency but in the end wind up with a zero-sum game in terms of total production and water consumption. For example, one may proceed to line a canal and vastly reduce water losses in transport, but if the issue is excessive evaporation of water on the ground then this intervention has done nothing to address that issue and indeed may have made things worse.

I would rather we looked at irrigation service than irrigation efficiency. We are looking for reliability and responsiveness. There is no link between service delivery and reward for the operator.

We need to also be conscious of whose perception we are representing. A government or donor might be interested in water management per se. But the organization operating the irrigation may evaluate staff, transport, contracts, concrete poured, etc., not water management.

In the last 20 years we have seen some changes in irrigation. High-tech drip irrigation for specialty crops has been introduced. Farmers are getting older because the youth are not going into agriculture. Over a period of 10 years the average age of farmers went up by 14 years. Also farm size has changed from small one-owner farms to large 20-30-hectare commercial farms. It is public irrigation but by large private landowners. As an example, it is the policy of Japan to move toward such large farms by 2030. Contracted farming is now common and in Malaysia this is known as telephone farming. The landowner lives in the city and contracts out the farming on his land.

The People's Republic of China is quite forward looking now in irrigation and goals have been set for the future. India is catching up in terms of irrigation policy and having a National Water Mission. Courtesy of the internet, water policies are more transparent now, especially in India.

Regarding willingness of farmers to pay for water, the issue is more one of governments being reluctant to charge than farmers being reluctant to pay. It is always political football.

There is still a lot of work being done on research and performance benchmarking by International Water Management Institute, the Food and Agriculture Organization, and others. One of the findings is the lack of long-term leadership and management at the senior levels in irrigation administration. Promotion is mostly based on seniority, which means the director general often has a very short shelf life of maybe only 6–12 months—too short to make a difference.

We don't measure water cost per cubic meter in irrigation very often. Water volume allocated per acre is more likely to be measured.

ADB has irrigation infrastructure as one of its five core activities in the water sector, but agriculture is still treated as a noncore subject. That may change in the future as food security becomes more of an issue. ADB and other donors are focusing on irrigation modernization rather than rehabilitation.

Extract from "The Singapore Story: Why Sanitation Is Part of Water Supply" by Tan Gee Paw Chairman, PUB, Singapore's national water agency

Development of Water Resources

For an emerging country the development of water resources can be successfully undertaken only if there is parallel economic, social and educational development. These aspects of development take place best under strong and continuing and stable political leadership.

Water policy development must keep in step with economic, social and educational development, neither running ahead nor getting behind. When Singapore realized many countries did not have a clear water policy, it took the initiative to set up through PUB, the national water agency, the Institute of Water Policy in the Lee Kuan Yew School of Public Policy at the National University of Singapore, which promotes awareness of good water policy development in developing countries.

Water Supply

A new mindset is needed today about the ownership and use of water. Both the water agency and the customer must come to realize that water is a limited resource and that the agency only loans the water to

the customer who after use must then return it to the agency for refurbishment and reuse. The customer pays a fee, not to buy the water nor to own it, but for the loan of that water.

As far back as the 1970s, PUB Singapore realized it must collect back every drop of water it sends out to the people. The potable water lines must be supported by a sewerage system so that used water can be collected and treated for safe discharge while awaiting the day when technology would allow it to be reused again safely. That technology is now here with reverse osmosis techniques creating the now potable NEWater.

Sanitation

The success of a nation may be best measured by the way its disposes of its human waste. For Singapore to become a global city it had to attract and retain the best of talent and investments. For this to be possible it had to collect, treat and dispose of its human waste efficiently. We had to give priority to our sanitation program when Singapore became independent. The massive sewerage construction program took about 25 years. Separating sewers carrying human and industrial waste from those carrying storm water was at the heart of the program. But one thing we never forgot was that the budget for sewerage is considered as important as the budget to provide roads, electricity, and water. Without this budget priority, no effort to transform Singapore into a global city would have succeeded.

But Singapore took water management one step further. Recognizing that it could not do everything itself, the government agencies were co-opted to work closely with the community and industry in the management of water resources.

Extract from "Water Management in Korea"
by Dr. Min Kyung-Jin
ADB Water Conference, March 2013

During the industrialization phase in the 1960s–1980s large dams were built to secure water resources, increase hydropower, and prevent flooding.

In 1981–1990 there was unbalanced growth and development of multiregional supply systems.

During the period 1991–2000 a phenol accident caused an increase in the sewerage coverage ratio.

The period 2001–2008 was marked by sustainable development with ecofriendly development and management of water resources.

Since 2008 there has been water and green growth in the context of climate change.

Among the various development plans that have guided the country's development are the following:

- 10-year national water resources development plan, 1970–1980;
- National water resources plans, 1981–2001;
- Comprehensive plan for clean water supply,1989;
- Comprehensive water management plan,1996; and
- Comprehensive water management plans for four rivers, 1998.

The current institutional structure has three levels of control:

- The national territorial plan and the national environmental plan;
- The national water resources plan, the national water supply plan, and the national sewerage plan; and
- The long-term plan for dam construction, the maintenance plan for water supply, and the maintenance plan for sewerage.

Recommendations:

- Role of the state and the market in good governance;
- Organizational and institutional reform;
- Policy dialogue based on scientific analysis; and
- Water industry promotion.

Chapter 4

Water Management

Anecdotal Interviews on Water Sources and Water Resources

The following is a small sample of comments received from water users in 10 Southeast Asian cities.

Well Water

- "Well water is alum [8] contaminated and not good for domestic use. I will connect to piped water as soon as it comes. Also if power is off there is no well water." (Binh Duong)
- "Using well water I feel insecure about my family's health." (Binh Duong)
- "I use well water for washing and bathing and I buy Aqua for drinking and cooking. It's difficult to be a customer with PDAM." (Medan)

Well water is often contaminated.

Water Quality

- "We boil water before drinking it. It's a matter of perception." (Cebu)
- "Another factor that affects the safety of water is the way you store it. If the source is clean but the container is not, then the water becomes unsafe." (Cebu)
- "Maybe potability is a problem. I drink distilled water." (Cebu)
- "Contamination-wise I think the perennial problem of flooding is a factor." (Cebu)
- "People are now more aware of quality. They want clean water." (Cebu)
- "I am scared to drink water from the tap. I see the pipes going through the drains." (Manila)
- "I expect good water quality from piped water to ensure sanitary eating and drinking." (Binh Duong)
- "Even though PPWSA already told us that the water is clean and can be drunk, we still don't dare to drink it until it has been boiled or filtered because it has the smell of chlorine." (Phnom Penh)
- "MWA should work on making the water drinkable from the pipe so that people can save on monthly expenses." (Bangkok)
- "Water quality is bad so we need to buy bottled drinking water to supplement the piped water." (Jakarta)

Water quality is a big issue. Whether connected or not connected to utility pipes, people still boil and filter drinking and cooking water or buy bottled water.

Pollution and Sanitation

- "We used to get water for drinking from our deep well. Now we buy bottled water at ₱15 per US gallon (3.78 liters). My concern was the toilets in our place because they are so near to the deep well." (Cebu)
- "Garbage is one of the reasons there is flooding because garbage blocks the drainage system." (Cebu)
- "We have a runaway population. The poorer the people are, the more they contaminate the rivers. We don't have a sewerage system nor a recycling system. There is no wastewater management." (Cebu)
- "In schools we need to inculcate the importance of sanitation. Most people do not value sanitation. Some defecate anywhere and do not even know how to use a toilet bowl." (Cebu)
- "We treat our wastes before throwing it. Septage treatment plants are really good." (Cebu)
- "Industry pollutes more than the residents, so raise the tariff." (Bangkok)

[8] A chemical used to remove sediment from water.

School children learn good hygiene

Water sources are being contaminated through pollution and lack of sanitation.

Bottled Water[9]

- "Now even the poorest people use mineral water because they are brainwashed by the capitalists, who say MCWD water is not safe. It is not true. These businessmen bad-mouth MCWD as part of their business strategy." (Cebu)
- "A bottle of mineral water costs ₱25 but the sellers get it from MCWD. It's the same water but the bottled water companies just treat it more." (Cebu)
- "We don't drink water from the tap. We buy mineral water. If we had tests to prove the water is safe to drink then we wouldn't need to buy bottled water." (Manila)

Bottled water appears to be here to stay. Maybe utilities can be more directly involved, since bottled water is often 100–200 times the cost of tap water. However, bottled water creates more plastic waste, which creates another problem.

Water Sources

- "Private companies doing their own extraction need to be regulated." (Davao)
- "Climate change definitely affects the water. We do not know the cycle anymore, so it's difficult for the government to plan." (Cebu)
- "I think improper garbage disposal and El Niño are threats to our water source." (Cebu)
- "We lack water sources in Cebu. We have to look for more sources of water that can last for years and years." (Cebu)
- "The problem is simple. Demand for water increases every year but supply does not. So we must increase water production. Our water comes 76 km in open channels subject to contamination. We need a pipeline for that." (Jakarta)
- "The government should find new sources of water. It's not just water; it's clean water we need. Time is running out. The government needs to solve this problem quickly. It's not just the source, but the infrastructure to bring piped water to the people." (Jakarta)

Whether public or private operator, the utility needs water sources to be planned and developed to keep ahead of demand and not play catch-up forever.

Water Conservation

- "There is a need for strict implementation of watershed protection and conservation to protect the quality of our water." (Davao)
- "We have completed the rehabilitation of 530 hectares of watershed." (Davao)
- "Reforestation helped by big corporations is good." (Davao)

[9] Bottled water has created an environmental problem. It is expensive but many piped water customers opt for it because the safety of potable tap water cannot be guaranteed.

- "There should be better reporting to the public and more public participation in water conservation." (Davao)
- "If the government is serious about sustaining the water supply it must have the political will to declare a chunk of forest-protected area." (Cebu)
- "MCWD can sustain water supply if it plants trees, uses rainwater, and conserves water." (Cebu)
- "The major threat not only in Cebu but throughout the Philippines is climate change. I salute the initiative of continuous planting of trees." (Cebu)
- "Education can help at a very early stage, because the need to conserve water will be embedded in the brain." (Cebu)
- "Let's not just plant trees and leave them. People should come back from time to time to check how the trees are doing." (Cebu)
- "People should conserve water so that others can be connected." (Medan)

People are becoming more aware of the need to conserve water at all stages of the water cycle. The issue of private operators and water conservation needs to be addressed.

Watershed Rehabilitation

One difference between developed and developing countries is the strong protection provided to catchments for water supplies in developed countries. They have good vegetation cover, and human, animal, or agricultural uses of that land are prohibited. In developing countries, especially those with large populations, the governance associated with the use of watersheds for other purposes is invariably quite weak. Furthermore, the rehabilitation of watersheds is a long-term undertaking that does not find much support when measured against the need for short-term political gains. When watersheds are denuded of trees, through logging and firewood cutting, rainfall rapidly becomes runoff, which causes the erosion of fertile land and reduces the time during which this water can be used, unless it is stored in dams. This situation is, of course, exacerbated by the wet and dry seasons that dominate the climates of many Asian countries. Watershed rehabilitation will facilitate the retention of rainwater, which will help river flows become perennial.

Check Dams and Wetlands

There is no doubt that one major frustration of water resources management in Asia is the failure to capture the wet-season runoff so that it can be used throughout the dry season. In the past, too much attention was given to building large dams. Now, more attention is being turned to small (check) dams. Check dams create wetlands and wetlands clarify water and prevent soil from washing downstream. They soak up water during storms and release it slowly in drier times. Water detained in wetlands behind check dams is more likely to percolate down to groundwater, rais-

Table 4.1: Water Source and Water Resource Concerns of Utilities

City or Utility	Water Source and Water Resource Issues
Vientiane, Lao PDR	Inadequate treated sources
Hai Phong, Viet Nam	Need to develop new sources
Ho Chi Minh City, Viet Nam	Many people still use own wells Salinity and pollution problem with sources
Binh Duong, Viet Nam	Has four sources, but people use own wells Utility produces own bottled water
AETRA Jakarta, Indonesia	Two separate agencies for water and sanitation It may be a better idea to plan waterways in front of houses instead of at the rear to improve sanitation
PALYJA Jakarta, Indonesia	Water resource capacity is hampered by poor coordination and cooperation between local governments in development
PAM JAYA, Indonesia	Water resource politics
Manila Water, Philippines	"All the eggs are in one basket" (Angat Dam)
Davao, Philippines	Low service coverage is connected with people's use of own wells
Cebu, Philippines	Control of water resources rests with several local authorities

ing the water table and creating springs and small streams throughout a watershed.

Rainwater Harvesting

Why is rainwater harvesting important? It is often said that water should be free, because it is a gift from nature. That is true if the user of that water collects it as it falls from the sky or draws it from a spring, before it has been treated or delivered, because it is the treatment and transport of water that have associated costs. Water tariffs must be raised to meet the costs of water supply, which continue to increase because of more advanced treatment, greater distances to be traveled, lower groundwater tables, and more costly distribution in densely populated areas. As tariffs rise, rainwater harvesting and other options become attractive. To collect water off the roof of a home or office and store it for future use is efficient. While there are some constraints, such as the room for storage in very densely populated areas, there is tremendous potential not yet harnessed. What is required is for local authorities to amend the bylaws so that no new home is built that does not have rainwater collection from the full roof area and storage for that water on-site. In addition, for the owners of existing houses to also comply with these bylaws, time frames of 5–10 years can be given for the modification of the roofs and grounds of all existing homes. Rainwater harvesting demands a new approach to governance, a participatory form of governance instead of a top–down bureaucratic one. In tropical climates it may not provide a sustainable urban water supply year round but can certainly help supplement other sources during the dry season. This is common practice in rural areas where water scarcity is an issue.

Pollution Control

Water availability can drive economic growth (witness Macau, China, and the Republic of Korea in the early 1980s). Along with a ready source of labor and ready markets or transport to markets, water availability has encouraged industries to spring up in cities. Industries, however, damage waterways through pollution, discharge of raw sewage, and disposal of garbage. Incentives must be created for the relocation of industries to industrial estates, preferably downstream of cities, where their effluents can be treated before they are discharged. Town planning rules must be transparent to the public and implemented. Industries that are water intensive should be closely monitored, the way they are in Singapore, not only for pollution but also for their conservation measures. In line with this, relatively high tariffs can encourage conservation. The “polluter pays” principle can be applied in urban areas, and this can be regarded as trading for the right to restrict other uses. This, more than anything else, is a question of governance. As noted at the Third World Water Forum held in Japan in March 2003, national actions should be more focused on pollution control at the source instead of simply building more and more advanced water treatment systems.

Groundwater Sources: Salinity

Cities are usually located near adequate or once adequate water supplies—mostly near groundwater, but sometimes near surface waters. As we look around Southeast Asia, we can see many examples (Bangkok, Jakarta, and Manila) of groundwater exploitation. These examples show that what

Sewage pumping station

could have been a finite but long-term sustainable resource has been destroyed through the depletion of aquifers, causing salinization and land subsidence. The excessive use of groundwater has been a short-term expediency that is becoming a long-term disaster. Now these cities must rely on surface water as their main source of water supply. Watersheds have been allowed to become denuded, and this encourages flash runoff that erodes fertile soils and results in the loss of steady water flows in the dry season.

Industrial wastewater and domestic sewage have been allowed to pass untreated into major waterways, thereby endangering water supplies of downstream users. Asian cities cannot continue to go to other water catchments without first ensuring that they have optimized water availability and use within the vicinity of urban demand. Over the last 100 years there have been two major shifts in water management. First, the people have given over their role to governments. Second, people rely less on rainwater and have instead exploited rivers and groundwater through the use of dams and tubewells. This second fact has led to a growing stress on water from these sources.

Monitoring of Water Resources

It has been said many times but is worth repeating. *If you can't measure you can't manage.* The ADB Water Policy and the ADB Water Operational Plan, 2011–2020 emphasize the need to collect good data from the field so as to make informed decisions about the use and management of water. Specifically what does this mean?

We know water quality is of great concern because we are contaminating our groundwater and our surface waters alike. So we need to monitor groundwater quality wherever people use water from wells, public or private. Then we need to ascertain the source of contamination and do something about it. It may of course be salinity caused by over pumping beyond the sustainable yield.

Most of our cities have rivers that are effectively combined sewers taking sewage and industrial effluent, as well as storm water. Notwithstanding the considerable dilution in the rainy season, pollution is a problem in the dry season. Surface water quality monitoring here must be continuous. However, once again, we must use this information to determine what can be done to improve the situation.

Now let us turn to monitoring water quantity. In groundwater this may mean monitoring the levels of groundwater continuously throughout the year. In surface water this may mean measuring the natural flows in river sources again throughout the year and correlating this with rainfall.

Likewise we need to be able to measure the quantities of water being abstracted for water supply, on the one hand, and irrigation on the other.

Until there is a good record over at least 10 continuous years, preferably longer, the usefulness of the above data collection for analyzing data and making sound conclusions and recommendations will be limited. This calls for long-term diligence and persistence on behalf of the agency and staff designated to undertake the water resource monitoring. Annual reports of this activity, published on public websites, will allow all to see what is happening.

If watershed rehabilitation is affected, then surface water monitoring in the catchment will be important to show the benefits achieved. Once again we need long-term committed agencies and staff to stay the course for the benefit of the country and the cities concerned. Monitoring of water resources is not compatible with short-term political decision making. One strong agency with skilled staff and an adequate budget is needed to do this job properly. Such an agency and its data and monitoring program should be the foundation for national water policy.

Viet Nam Country Water Assessment
by Des Cleary
ADB Water Conference, March 2013

The ADB water operational plan for 2011–2020 recommended the adoption of country water assessments to improve understanding of water issues at the country level. This resulted from growing international concerns about water security, coupled with the water-food-energy nexus. The assessments will enable the formulation of a national water policy as part of a framework for improved water governance. From such an analysis, a national program of action can be designed, with 10- and 20-year horizons, underpinned by a set of proposals aimed at effective

water resources management. To complement this, an ADB program of funding and technical support will be proposed, for a 10-year horizon.

Despite perceptions, Viet Nam is not rich in water and already some river basins are below the adequate water level for the dry season. Conflicts over access to water—surface and groundwater—are a real and growing issue. Water pollution is also a major issue in most river basins, with terrible pollution levels in some water sources, significantly reducing the utility of that water. This adds to the water security risks. In addition, climate change will progressively require adapting to sea level rise, salt water intrusion, and changes in precipitation and temperature. The net result is a growing threat to future water security over much of the country, and rapidly increasing levels of pollution and degradation of water sources.

The country water assessment reports have seven chapters:

- Introduction, background, purpose of the assessment;
- National setting;
- Water availability;
- Water use and demand;
- Water management;
- Future scenarios; and
- Program component.

Irrigation

Irrigation is currently managed by area, not by water volume, and there is little information about water diversion from rivers and water use on farms. However, estimates of irrigation withdrawals show that water use is dominated by irrigation—by as much as 90% of total water use in some river basins, with the national average at 82%. Concern that the "user-pays" model of irrigation operation and maintenance (O&M), and the difficulty in collecting irrigation service fees, led the government to fully subsidize the O&M costs of irrigation infrastructure above the tertiary canal level from 2008.

Urban Water Supply and Sanitation

In 2009, although nearly 83% of the urban population was served with piped water supply, only 59% had a house connection. Coverage by the water supply companies averages from 70% of the urban population in the large urban areas, to 10%–15% in the small urban areas. The average nonrevenue water for all companies is 30%. The 2009 revenues recovered operational cost and debts; however, input costs continually rise while the water tariff is adjusted only every 5 years.

In 2009 more than 67% of households in urban areas had access to a toilet. The rates were much higher rates in the main cities, but only 60% in smaller cities. Over 4 million cubic meters (m^3) per day of urban wastewater was produced in 2009, but only six cities had wastewater treatment plants installed with a total treatment capacity of less than 380,000 m^3/day. The rest is discharged to the environment without treatment or captured in septic tanks, which are not well maintained.

Legislation

A new Law on Water Resources was approved in 2012 and the government is now beginning its implementation. This is a wide-ranging law with a strong integrated water resources management focus and will have implications for all sectors. It has chapters covering data and information, water resources planning, water source protection, water exploitation and use (including water use efficiency), protection against natural hazards, financial measures, and international cooperation. As many of the measures proposed in the law are completely new to Viet Nam, the government is seeking international support to assist with implementation.

Chapter 5

Water Supply Service Coverage

Introduction and Definition

The best measure of a good water supply service in a city is the number of people with 24-hour access to piped water at home. That is why service coverage must be the most important performance parameter of any water utility.

"Service coverage" means a piped connection to each household, ideally with water available 24 hours a day, 7 days a week ("24/7 supply"). Why 24/7 supply? Because pressurized piped water that is not supplied throughout the day is not potable. Contamination can enter when the pipes are empty.

Options for Gaining Access to Water

How do people gain access to water? Through many means, and sometimes a combination of means from different sources. Everyone has access to water to some degree, but many would like to have better access to safe water. (See Box 5.1.)

Box 5.1: Access to Water: Options

- Rainwater harvesting
- Community well, by hand
- Community well, by pump
- Household well, by hand
- Household well, by pump
- Franchise served by utility
- Community standpipe served 24/7 by utility
- Community standpipe served intermittently by utility
- Water vending truck (source: utility)
- Water vending truck (source: private well)
- Water vendor, by 20-liter container (source: utility)
- Water vendor, by 20-liter container (source: private well)
- Illegal piped connection
- Direct piped 24/7 supply from utility
- Direct piped intermittent supply from utility
- Utility piped connection shared with neighbor
- Piped connection from small-scale water provider
- Bottled water in 20-liter container
- Bottled water in 0.5-liter container

Factors Influencing Choice

- What is the quality of the water? Does the water need treatment?
- How far away is the water source? How much time and energy is consumed in fetching water?
- What is the volume of water used?
- What is the cost of the water?

Anecdotal Interviews on Sources of Water

Bought from Neighbor

- "I buy water from my neighbor at Rp7,000 a container." (Medan)
- "I take water from a neighbor using a hose. I pay him Rp50,000 ($5.44) monthly. Water from a cart and in jerry cans is cheaper (Rp3,000 for 20 cans of 20 liters each) but it is easier this way. If the cost goes up but the increase is due to PAM Jaya, that is OK." (Jakarta)

Shared Connection

- "Another family is renting the back of our house. We share the water." (Cebu)

Happy customer taking water at a tap

Household well with handpump

Rainwater harvesting tanks

Water vendor getting his supply from a kiosk

Water vending cart

Palyja tankers supplying water at a public tap

- "We have three water meters for seven to nine persons and many guests." (Cebu)
- "We used to spend ₱900 for water supplied through a hose from my neighbor's connection. Now we have our own connection. We spend much less for water and it's more convenient." (Manila)
- "I buy water from my neighbor. We go 50:50, so if the water bill is Rp100,000 I pay Rp50,000. I use some well water too, but only to water plants and clean the yard. I cannot afford to pay PDAM's connection fee." (Palembang)

Public Tap

- "I have been getting clean water from public taps these last 8 years. I am not connected to PDAM because I cannot afford the connection fee. My household of seven persons uses about 200 liters a day. I pay Rp50,000 a month to the Board of Public Taps and it pays PDAM." (Palembang)

Water Kiosk

- "I buy water at water kiosks, at Rp500 a jerry can. And I use 10 cans a week." (Jakarta)
- "I support the adoption of kiosk water and water master meters by PALYJA [PAM Lyonnaise Jaya, the private operator of water supply in West Jakarta] for water for slums." (Jakarta)

When people share with or buy from a neighbor they pay more but they get convenience. Water from public taps and water kiosks is cheaper but not convenient. The connection fee is nearly always the constraint.

Bulk Supply to Franchise

- "We are a franchise receiving metered water from MCWD and selling it in pails to our customers (20 households), at ₱1 a pail. The water costs us only ₱4 a cubic meter. We use our money to replace pipes. We store water in drums so we can still provide a service even when the water service is interrupted." (Cebu)
- "Our franchise serves 36 households. We are supposed to receive only 120 m^3 each month, but we normally use 140 m^3 because we also sell to nonmembers. Management is by rotation. All members have their turn to manage the water supply and earn a profit. It's not much, as we follow the rates set by MCWD. The ₱1,500 deposit for a connection is too much for these poor people." (Cebu)
- "In the past our water was provided by a delivery truck and we paid ₱2 per container. We bought only two 20-liter containers every day. We drank the water. It was OK. We had no other option. Now we have a Manila Water connection to the cooperative. We pay the same amount as before but we can use water whenever we need to." (Manila)

Water supplied in bulk to a water franchise is cheaper but not convenient. People still have to cart water to their homes and cannot use much. Utility-supplied water is more convenient and would be preferable if there were no connection fee. As it is, people still need more water.

Well Water

- "I use well water, not PDAM water. I have little income so I am not a PDAM customer. For 22 years I have been using an electric pump to bring water from the well into my house. I use a homemade water filter (sandstone foam) to make the water potable because it smells a little. There is a grant program for connecting to PDAM but my house did not qualify. If it did I would join." (Palembang)

Well water is often contaminated but the utility connection fee is a constraint.

Water Vendor

- "We buy from water sellers and also have a communal well. We want DCWD (Davao City Water District) water." (Davao)
- "We buy from water vendors and have an average water bill of ₱700 per month for our family of five. We drink bottled water. MCWD cannot supply water to us because our village is elevated. We would need booster pumps." (Cebu)
- "We used to buy only 4–5 m^3 from the water seller. Rainwater was our main source. Now we buy 10 m^3 from another seller for D400,000 ($19.50). You should tell your company to hurry up and get us connected."(Hai Phong)
- "Most people here buy water from a cart. There are no drilled wells here; the water is salty. We pay Rp3,000–Rp4,000 per cart of water. One jerry can is Rp500. Why don't we use piped water? It is expensive. Water here near the sea is like auctioned gold."(Jakarta)
- "We buy water from a water cart vendor. A jerry can costs Rp1,500. We use nine cans a day. That's

Rp13,500 ($1.50) per day. Sometimes the water costs more if the vendor has to go farther away. We often have to queue up for 1 hour. Water is expensive, but even more than rice, we need water." (Jakarta)

People pay much more for water from vendors. Utilities should extend their piped service coverage to meet latent demand.

Multiple Sources

- "We use less water because we also use rainwater." (Phnom Penh)
- "I pay Rp20,000 a month, including the installment on the connection fee. I drink this water, but I use groundwater for washing." (connected customer, Jakarta)
- "I pay Rp40,000–Rp60,000 a month for water but use it only for drinking and cooking. I am paying an installment (12-month) on the connection fee." (connected customer, Jakarta)
- "People resort to many sources of water for different uses. Poor people spend up to 20% of their income to buy clean water, while rich people connected to piped water spend less than 2% of their income for clean water." (Jakarta)

People adjust to the price of water by getting water from different sources for different uses.

Measurement of Service Coverage

So how can service coverage be accurately measured? The answer is: *not easily*. When we talk service coverage we tend to think of the number of piped connections and the number of people per connection.

When utilities report service coverage of, say, 95%, this means that 95% of the people in the service

Water vendor

Water delivery services

Urgent drinking water supply by MWA to flooded area

Spaghetti connections in Jakarta

area receive water from the utility. What the reports do not usually reveal is the level of service provided. How many of the connections are to individual households? How many households are served by shared connections? How many are served by public taps? How many use water supplied in bulk to the community? If utilities are going to be transparent, they need to spell out all these details. Only then can we begin to compare apples with apples. Until that happens, we need to use a simple proxy for service coverage.

An approximate measure of service coverage can be derived by dividing the total population of a city by the total number of connections of the utility in the city. In many cases, commercial connections also serve as domestic connections, so this simple calculation is accurate enough to give the big picture.

See Table 5.1 for performance parameters of utilities at the end of 2011. Table 5.2 shows the results of a street survey in a low-income area. More importantly, Figure 5.1 shows the number of persons served by each connection in the surveyed utilities. Clearly there is a big difference in service coverage when it comes to piped water. We can see that by this measure MWA in Bangkok leads the way, followed by Manila Water. MCWD has very poor service coverage.

Notes for Tables 5.1 and 5.2

- Names of the cities covered by the utilities were used instead of the utility names: Jakarta East for AETRA, Jakarta West for Palyja, Manila East for MWCI, Manila West for MWSI, Bangkok for MWA, Binh Duong for BIWASE, Hai Phong for HPWSC, Ho Chi Minh for SAWACO, Davao for DCWD, Cebu for MCWD, Medan for PDAM Tirtanadi, Palembang for PDAM Tirtamusi, and Phnom Penh for PPWSA.
- 24/7 means piped water supply is continuous 24 hours a day 7 days a week
- NRW (%) means [production volume (m^3) - billed volume (m^3)] ÷ [production volume (m^3)] x 100
- Average Tariff (US$/$m^3$) is [billed amount (US$)] ÷ [by billed volume (m^3)]
- Operating Ratio is [operating expenses (US$)] ÷ [operating income (US$)]
- Persons per Connection is [city or service area population] ÷ [total number of utility connections]. It is a proxy for service coverage which cannot be accurately measured unless the numbers on different service levels are known and quoted.
- Collect 98% means the utility collects 98% (or more) of its billing within one month of the bill being issued.
- Daily Consumption (m^3) means average consumption per connection and includes industrial commercial and domestic consumption.
- Sewer Connection means number of sewer connections where known or percentage of population covered or type/status of sewerage system.
- STP Capacity (m^3/d) means total sewage treatment plant capacity in cubic meters per day or percentage of population covered by sewage disposal.
- Average persons/HH means number of people served by one connection.
- Average HH water bill per month (US$) means average water bill for one connection per month.
- Average HH consumption (m^3) means average consumption per connection per month.
- Per capita consumption (l/c/d) is [average monthly billed consumption per connection (m^3)/30] ÷ [total number of people served by all connections]
- Cost of 10 m^3 is taken from utility tariff structure on utility website.

Need for 100% Surveys

Another, more scientific, way of measuring service coverage is to conduct a 100% survey of all people and all water access in a given area, every 5 or 10 years. Just as with NRW reduction, managing discrete units of 500 connections is the only way to really know everything about water in a given area. Likewise, if we really want to get close to the truth about service coverage, we must look at how all people gain access to water.

People's Opinions

Once we have this information, we need to look at a good policy for improving people's access to piped water. To do this, it would be wise to conduct anecdotal interviews among those who are not directly connected to piped water (potential customers) to get their views and comments as to why they have not

Table 5.1: Performance Parameters of Water Utilities, End of 2011

City	City Population in Service Area	Production m3/d	Total Connections	Population with 24/7 supply %	NRW %	Average Tariff (US$/m³)	Operating Ratio	Persons Per Connection	Collect 98%	Daily Consumption (m³/ connection)	Sewer Connection	STP Capacity (m³/d)
Phnom Penh	2,000,000	305,000	219,498	100	6	0.24	0.37	9.1	Yes	1.32	combined	to lake
Jakarta East	4,595,099	744,195	388,166	63	47	0.75		11.8	No	1.02	3% pop.	3% pop.
Jakarta West	4,500,000	712,523	414,470		40	0.88	0.67	10.9	No	1.03	3% pop.	3% pop.
Medan	4,223,000	469,522	418,975	69	30	0.25	0.97	10.1	No	0.78	16,207	60,000
Palembang	1,384,918	251,784	178,006	48	31	0.40	0.78	7.8	No	0.98	negligible	negligible
Vientiane	798,000	184,150	80,663	no	36	0.23	1.16	9.9	No	1.46	combined	wetlands
Manila East	6,000,000	1,276,000	857,981	99	11	0.62	0.45	7.0	No	1.32	99,260	125,695
Manila West	9,379,449	2,089,000	1,005,350	84	42	0.77	0.42	9.3	No	1.20	55,803	470,000
Cebu	2,315,000	179,984	139,949	80	28	0.60	0.78	16.5	No	0.93	negligible	negligible
Davao	1,506,892	247,193	179,933	87	27	0.36	0.83	8.4	No	1.00	negligible	negligible
Bangkok	8,000,000	4,700,000	2,017,531	100	25	0.39	0.67	4.0	No	1.75	54% pop.	1,016,800
Binh Duong	1,619,900	151,658	63,134	100	10	0.32	0.92	25.6	Yes	2.16	constructing	constructing
Hai Phong	1,884,685	154,358	242,801	100	15	0.29	0.72	7.7	Yes	0.54	interceptor	negligible
Ho Chi Minh	7,541,000	1,476,500	856,655	100	42	0.35	0.71	8.8	Yes	1.00	combined	171,500

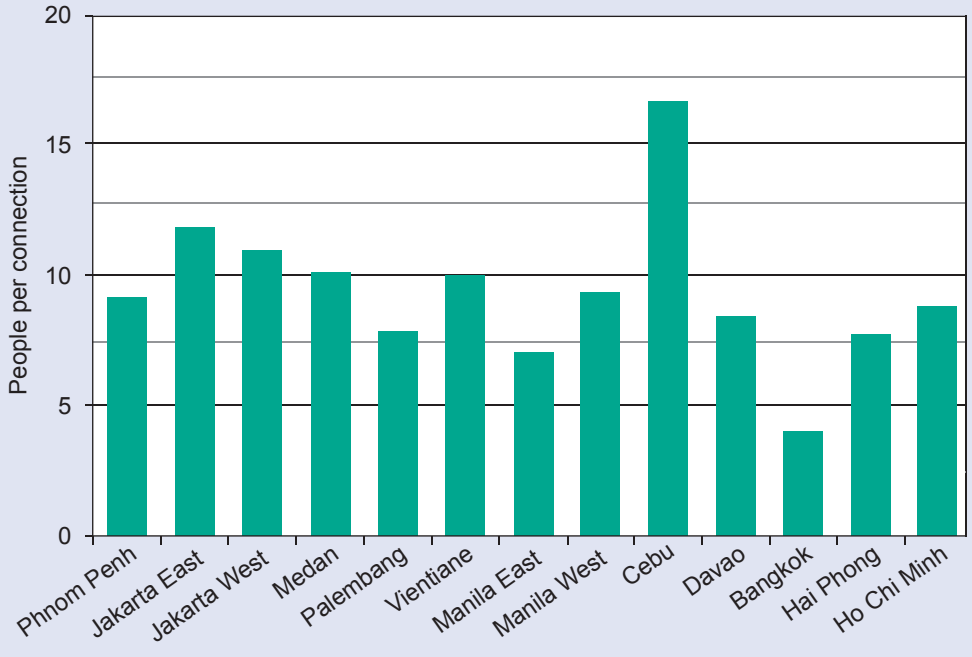
Source: All data from utilities, except city population (from the Internet). *See the notes on definition of terms used in this table.*

Table 5.2: Street Survey of 20 Water Bills in Low-Income Areas[a]

City	Average Persons/HH	Average HH Water Bill/ Month (US$)	Average HH Consump-tion/ month (m^3)	Average Tariff (US$/$m^3$)	Per Capita Consump-tion (l/c/d)	24/7 Supply	Cost of 10 m^3 (US$)
Phnom Penh	4.7	5.71	24.05	0.24	170.6	Yes	1.88
Jakarta East	3.3	7.30	13.60	0.54	137.4	80 / 20	1.85
Jakarta West	4.6	6.04	17.60	0.34	128.9	Yes	1.74
Medan	4.1	3.10	19.95	0.16	162.2	No	1.60
Palembang	5.1	7.79	25.40	0.31	165.0	No	2.70
Manila East	8.2	7.12	22.10	0.32	89.8	Yes	3.18
Cebu	5.8	10.98	20.60	0.53	118.0	50 / 50	4.00
Davao	5.2	4.84	17.45	0.28	111.9	50 / 50	2.69
Bangkok	5.7	12.05	34.20	0.35	201.8	Yes	4.00
Binh Duong	5.1	6.15	21.50	0.27	141.9	Yes	2.56
Hai Phong	3.4	5.19	13.65	0.38	133.8	Yes	3.80

[a] In terms of the general situation of each utility these figures are not statistically significant. However, they do identify issues that can be followed up by the utility.

Figure 5.1: Population Served per Utility Connection



been able to connect. Maybe the high connection fee is the reason; or the requirement to provide proof of land title and certificate of construction completion; or the lack of water resources. Maybe it is the vested interests of those who control the water vendors; or the availability of cheap yet good quality alternatives like wells owned by the households. Maybe it is the lack of investment funds to bring the pipes to a certain area. Or maybe it is the fear of not being able to afford the water bill each month. Maybe it is knowledge that a shared connection (connection serving more than one household) costs both parties more because of the rising block tariff.

Connection Fee

On this matter, Viet Nam's decision to scrap the connection fee for public piped water is commendable. Pressure from ADB and the World Bank over many years helped. The anecdotal interviews conducted for this book clearly show that the people are delighted with this new government policy. It means that when a family gets a new connection, the cost will be recovered over a number of years through a slightly higher tariff for every existing customer. Requirements such as proof of land title and certificate of construction completion should similarly be scrapped. Already the United Nations General Assembly has affirmed the right of all people to water.

Targeting the Urban Poor

The Bangalore Water Supply and Sewerage Board in India set up a special unit to take charge of connecting the urban poor to piped water. A special task force under the unit made the physical connections, simplified the paper work (involving proof of residence, not ownership), and minimized the connection cost. This change in attitude meant that, instead of focusing on service coverage (which can improve after newly developed estates are connected), the utility specifically targeted the urban poor. This focus on the poor has also been done in Phnom Penh and to some extent by the two concessionaires in Manila. In any large city, two groups of urban poor are not connected to piped water. Those residing on the outskirts of a city where the piped services have not yet reached make up the more obvious group. The other is composed of the many pockets of unserved urban poor integrated into those areas of the city where there are already piped services. These may be informal low-income areas that receive water by standpipe or water vendor, or neighbors sharing a connection inside an already well-developed area.

Reducing Nonrevenue Water to Improve Service Coverage

Service coverage is not a stand-alone parameter. Low service coverage often goes hand in hand with high NRW. In fact, high NRW may explain the low service coverage. There may be many illegal connections and also illegal sale of water by utility staff or others to water vendors. There may also be high leakage. Where water resources are limited, addressing the issue of NRW can improve service coverage.

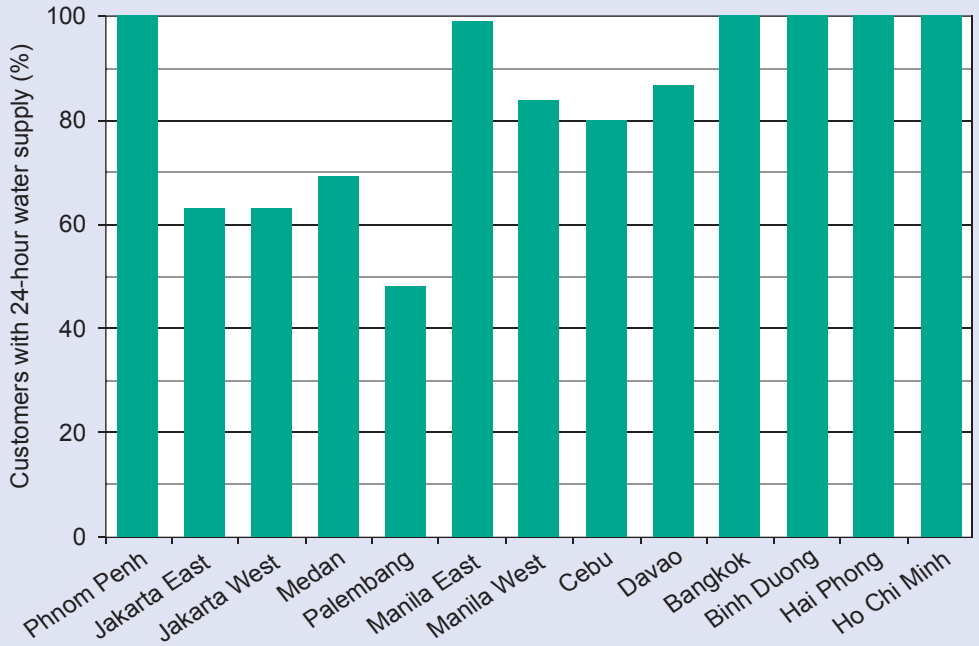
Eliminating Intermittent Supply

Service coverage is likewise related to intermittent supply. Often politicians have insisted on extending the distribution system to new developments on the outskirts of a city without understanding that hydraulics makes it infeasible to do so without "robbing Peter to pay Paul." The percentage of customers receiving 24-hour water supply among the surveyed utilities (see Figure 5.2) shows that intermittent water supply is an issue in more than half of these utilities.(See also Chapter 6: Intermittent Water Supply.) Once again, high NRW may be the primary cause of intermittent supply.

Increasing the Tariff

Service coverage is also affected by the tariff. A very low tariff encourages people to waste water, so in the end there is not enough water for those not yet connected. But this is not just about water; it is also about investment funds. "Raise the tariffs to connect the poor" has been a catch cry with real meaning. If the tariffs were higher, there would be funds to connect the poor people and water would be put to more frugal use. The poor can afford and are willing to pay water tariffs but not connection fees. Raw water pricing is also important, to reduce NRW and water wastage.

Figure 5.2: 24-Hour Water Availability in Utilities



Educating the Newly Connected

No discussion of service coverage would be complete without looking at what happens when a low-income household first connects to piped water. It is very important to run a campaign that teaches these households to use water wisely and take care of internal plumbing leaks. MWA does this well. In this regard, any water tariff should be directly related to consumption (and without fixed charges) so that it is up to the customer to control water use and, therefore, the water bill. Newly connected households may have previously been using only 6 m^3 per month on vended supplies, so if they now use 20 m^3 per month after connecting, then there is plenty of scope for them to economize. Box 5.2 The Case Study of Winnie shows what happens when one goes from buying water from a vendor to using a shared piped connection. The per capita consumption of 20 households in one low-income street is shown in Figure 5.3. The average is around 120 l/c/d, close to the design figure. Per capita consumption covers an enormous range reflective of socioeconomic status or the fact that people have alternative sources of water and use those sources.

Service Coverage

A review of the performance parameters of utilities (see Table 5.1) shows that MWA, with four persons per connection, is well ahead of the rest in service coverage. The next best is Manila Water, with seven persons per connection.

In Jakarta, service coverage under both concessionaires is clearly low. The presence of so many water vendors[10] confirms this, as does the number of people per connection (10.9 and 11.8 persons per connection for the two concessionaires).The connection fee should be abolished. The water resources need augmenting. NRW must be reduced. The tariffs must be raised for highvolume users to manage demand. MCWD is even worse, with 16.5 persons per connection. This is probably because of water source issues, a very active informal market, and the private use of groundwater despite its being saline and otherwise polluted. In Metro Cebu we have an unusual situation where service coverage could actually go down for MCWD because private provid-

[10] Verified through photos and anecdotal interviews, and by the author on the ground.

Box 5.2: Case Study of Winnie: From Purchasing Water off a Vendor to Having a Shared Pipe Connection

2003 Location: Manggahan Floodway, Cainta, Manila
Household Size: 6 persons (Winnie's family)
Source of Supply: Water vendor
Monthly Consumption: 6 m^3
Monthly Cost: ₱900

2013 Location: Manggahan Floodway, Cainta, Manila
Household Size: 6 persons
Source of Supply: Shared piped connection to Manila Water Company
Monthly Consumption: 16 m^3
Monthly Cost: ₱338

Conclusion

The family uses 2.67 times more water while paying only 38% of the previous cost.

Now Winnie has pressure to third floor

Comment

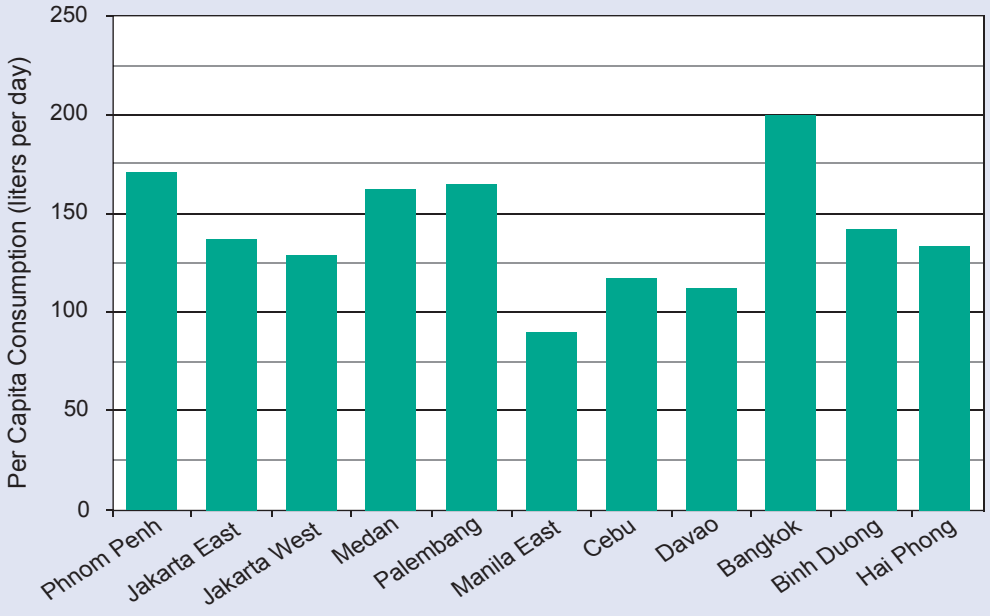
While this is a significant social and economic improvement, it is not as much as is sometimes suggested and does not take into account the connection fee of about ₱7,000, which was paid by Winnie's employer.

ers of piped water are coming in to supply bulk water to large water customers at a tariff below MCWD's. The private providers can do this because, unlike the MCWD, they are not forced to cross-subsidize the tariffs for the poor with those for large commercial or industrial customers. Such activities must be regulated. Note also, in Figure 5.3 below, the high consumption per connection for MWA. This may be partly due to a relatively low tariff.

Anecdotal Interviews on Service Coverage

- "Often we have to look the other way and go on laying pipes even if it is not economically viable, just to make water accessible to as many people as possible." (Davao)
- "Deca Homes water is more expensive than DCWD water and is intermittent. We pay ₱127 a month to Deca and ₱360 a month for bottled drinking water." (Davao)
- "Almost every house has a tank for rainwater, but it's not potable water. We get water from the river when there is no rain. The river is 2 kilometers (km) away." (Davao)

Figure 5.3: Per Capita Consumption: A Street Survey



Drinking-water from vending machine

Water tankers for emergency supplies

Drinking-water from the tap

- "We bring water from another subdivision to our place." (Davao)
- "Several families dug a hole beside the river and built a concrete structure (reservoir) around it, then laid pipes connecting to families. The whole thing cost ₱30,000." (Davao)
- "How did we get to the stage where we have to buy water from private providers that is more expensive than the water from the tap?" (Cebu)
- "MCWD has captured only about 50% of demand, so there is a lot of room for improvement." (Cebu)
- "I have two connections. One is from the barangay. I use the minimum and pay ₱150. The other is from the Spider Company. I pay ₱287 for 10 m3. I do not drink the water from these sources; I drink bottled water instead. In all, I pay ₱900 per month for water, which is very expensive, but I don't have a choice." (Cebu)
- "In the past we fetched water from the handpump. We had to queue up with our containers every day. We saved every drop because it was difficult to fetch water. The water sometimes stained our laundry. The Manila Water connection was a big relief and a great convenience." (Manila)
- "We used to have to queue for the delivery truck and sometimes there would be fights. From 1982 to 2005 we had delivery trucks. Then we had a deep well with large tanks and piped supply. In 2008 we got Manila Water. But we still buy drinking water because of the kids." (Manila)
- "I use well water as there is no tap-water line here. Well water is bacteria contaminated. We have to clean the filter in the washing machine once a week and bleach clothes because of the yellow stain. BIWASE has carried out surveys and plans to supply water here." (Binh Duong)
- "Before, when the school was constructed there were no water supply pipes. The school contacted

BIWASE and it invested in and constructed water supply pipes to the school. The water supply service is very good." (Binh Duong)

- "The coverage of clean water in Cambodia is still limited. It is good in Phnom Penh, but it has to be developed much faster in the countryside." (Phnom Penh)
- "We get water from a water seller. Without treatment it is KR2,000/m3. My household spends KR40,000/month ($10). We also use bottled water. We want PPWSA service." (Phnom Penh)
- "People say it's difficult to connect, but PDAM says that's because of low pressure." (Medan)
- "I use a government distiller, not PDAM, because the cost is low (Rp400 for 20 liters). For bathing and washing I use water from the Musi River, but for drinking and cooking I use distilled water (about 40 liters a day). To pay PDAM's connection fee of Rp300,000 to Rp500,000, I would need a subsidy program." (Palembang)
- "Palyja needs to increase piping. The adequacy ratio is only 20%." (Jakarta)
- "The public is not aware of service coverage, but slums don't have piped water." (Jakarta)
- "Water is a basic human need, even in informal or illegal settlements. Maybe it is necessary to have exceptions to the rules for such settlements. It is time to be creative to meet their needs." (Jakarta)
- "Many people in Jakarta still don't have access to clean piped water." (Jakarta)

Service coverage is low in many utilities, perhaps because (i) there is not enough water, (ii) the low tariff affects cost recovery, (iii) not enough investment is being made to extend the pipe works, (iv) NRW is high, (v) there is a tendency to maintain the status quo, (vi) the connection fee is a constraint, or (vii) a combination of these factors. The way forward is to address all these issues. Shared connections, neighborhood resale of water, vended supply of water, standpipes, and intermittent supply are not good enough. The old adage applies: If you can't measure, you can't manage. We need good data. We need to get out there and learn how all people have access to water, then do something to improve that service against measurable targets each year.

Chapter 6

Intermittent Water Supply

Introduction

Intermittent water supply is piped water supply that is delivered less than 24 hours a day. It results in waste of water, requiring larger pipes in the network to deliver the same amount of water in a shorter time. It also allows contaminated water to enter the piped network when the pipes are empty. When associated with public tap supplies, this unreliability promotes stress and fighting among the urban poor who struggle to get their share of water each day. It encourages bribe taking and corruption among the valve turners. It is the main reason why, although public tap water is sometimes free, it is still unacceptable to the people. Water metering is generally inaccurate under intermittent supply. A concerted effort should be made to eliminate intermittent water supply. The perception in the minds of some utility managers that more water is needed to achieve 24/7 supply is a myth that should be strongly debunked.

Prevalence of Intermittent Water Supply

Table 6.1 shows the prevalence of 24/7 water supply among the utilities surveyed in Southeast Asia. We can see that 9 out of 13 of these utilities have

Table 6.1: 24-Hour Water Availability

Utility/City	24-Hour Availability (% of customers)
MWA/Bangkok	100
PPWSA/Phnom Penh	100
BIWASE/Binh Duong	100
HPWSC/Hai Phong	100
SAWACO/Ho Chi Minh City	100
AETRA/Jakarta East	63
PALYJA/Jakarta West	63
PDAM Medan	69
PDAM Palembang	48
MWCI/Manila East	99
MWSI/Manila West	84
DCWD/Davao City	87
MCWD/Metro Cebu	80

Scooping water from in-house ground storage tank during a power outage

Waiting for intermittently supplied water

Reading the water meter

some intermittent supply in their piped network. (Note: Vientiane was unable to measure its availability, but 24/7 water supply is known to be less than 100%.) Intermittent supply affects more than 50% of customers in Palembang, and more than 30% of customers in Jakarta and Medan. Only MWA, PPWSA, and the three Vietnamese utilities, supply 24/7 water to all customers. Even Manila Water has intermittent supply in parts of its network.

Anecdotal Interviews on Intermittent Water Supply

- "Now the water service is pretty good. We don't experience interruptions." (Cebu)
- "We cut our connection and went back to using our deep well because water was available only at night." (Cebu)
- "Water pressure is uninterrupted and water quality is good." (Binh Duong)
- "The water pressure is really good. We have 24/7 water even on the highest floor of the building." (Hai Phong)
- "Sometimes the water is not 24/7 because the electricity goes off, so the water treatment plant and boosters cannot operate." (Medan)
- "The people in Medan are not happy with the intermittent supply." (Medan)
- "We will build a new treatment plant to solve both connection and 24/7 water issues." (Medan)
- "We get water only 2 hours a day but pay Rp180,000 for 20–30m^3. We are not happy." (Medan)
- "For intermittent supply of 30m^3 per month for five persons, I pay Rp110,000 to Rp180,000. I am not happy."(Medan)
- "We use 27m^3 to 32m^3 and it costs Rp60,000 to Rp70,000. Service is intermittent. Sometimes the pressure is low and sometimes the water smells. We need continuous supply of water." (Medan)

Pressure-reducing valve

Valve turning for distribution

Valve turning under intermittent supply

Valve turning for control of distribution

- "I have been using PDAM water for the last 2 years. It is 24/7 water, but I still store some water for the bathroom." (Palembang)

Next to poor water quality, intermittent supply is the most common complaint of people connected to piped water.

Causes

The primary cause of intermittent water supply is the extension of distribution systems beyond their hydraulic capacity to provide service to more customers. This is usually done at the behest of elected officials. Other causes of intermittent supply are a failure to meter completely and accurately and a failure to charge and collect sufficiently high tariffs. It is often said there is not enough water for 24-hour supply. This statement is not valid on two counts. If we look at Male in the Maldives we see a very low consumption of around 10m3 a month and tariffs up over $5 per m3. Yet the Male Water and Sewerage Company provides 24/7 water. A high tariff and strict metering, billing, and collection determine consumption. The other reason the statement is not valid is the fact that high NRW—high leakage and illegal connections—contributes to intermittent supply by lowering water pressure in the distribution system. The answer is to reduce NRW. Sometimes funding agencies and governments worsen the intermittent supply by supporting direct pumping into the distribution system for just 10–12 hours a day in small towns. They say it lowers the power cost. However, it is much more sensible to pump via bulk main to elevated storage for just 10–12 hours a day and keep the entire distribution system under 24-hour pressure through gravity.

Consequences

Households with intermittent water supply must invest extra money in pumping, storing, and treating this resource. Customers without access to 24/7 water supply tend to use more water than others. Because they are never certain when they will next be served, they throw away the surplus "old" water from the previous day to make way for today's "fresh" new water. It is not uncommon to find unattended taps left open to receive the new supply, and this results in overflows to waste when the storage is filled. Intermittent supply causes anxiety, and generally one person from each residence has to devote time to ensuring that water is received when it comes. Valve operators can extract bribes from customers who wish to be assured of adequate service. Sometimes females must venture out in the dark to receive water from public taps. No water from an intermittent supply is safe to drink, because under empty pipe conditions, contaminated water from drains and groundwater can enter the water supply system.

Most water meters do not register accurately under intermittent supply conditions, raising doubts about the validity of metering. Constant valve manipulation increases the need for more frequent valve maintenance and replacement. Reservoir capacities are underused. Systems do not operate as designed because pipe capacities will be smaller under a 24-hour design than under an intermittent supply design. More manpower and more chlorine are needed. Inconvenient supply times mostly affect the poor. Finally, the battle to reduce NRW is sabotaged, because it is not possible to have full accountability of water in subzones. The high costs of intermittent supply are paid by (i) the utility, which incurs higher investment and operating costs; (ii) the customers, who pay to cope with an unsatisfactory service to protect themselves against unsafe water; and (iii) the population as a whole, as the risk of epidemics increases because of the consumption of contaminated water.

- "The piping system in Cebu is dilapidated and it goes through dirty places and leaks, so of course the water gets contaminated." (Cebu)
- "I am scared to drink water from the tap. I see the pipes go through the drains."(Manila)

Note: The utility is not responsible for post-meter piping.

Remedial Actions

Manila Water was able to move from providing only 26% of its customers with 24/7 water in 1997, to providing 24/7 water to 98% of its customers 10 years later. Most of the improvements can be traced to a massive pipe replacement and NRW reduction program. This is not rocket science. It is all about managing at the lowest practicable level (in discrete hydraulic zones of about 500 connections). It may also help to start with those areas that have 24-hour supply (like more wealthy business and residential areas), implement tariff increases commensurate with better service in the areas, and use the funds to gradually expand the coverage of 24/7 water.

Conversion from intermittent to continuous supply may require a number of actions and operations such as:

- Restructuring the distribution network;
- Rehabilitating and replacing those parts of the network that are in extremely poor condition, including replacing customers' connections and meters;
- Managing supply (reducing pressure) to control and reduce leakage;
- Uncovering illegal connections;
- Managing demand to reduce waste and legitimize consumption;
- Strengthening political commitment to reform the water service;
- Exercising patience, persistence, and leadership in addressing the task;
- Making organizational changes;
- Getting management and staff to cooperate (with the help of incentives) in effecting the necessary changes;
- Increasing water charges to achieve financial sustainability; and
- Investing in new source development.

Avoidance Actions

If there is 24/7 water now, how do we avoid intermittent water supply?

- First, it is important to know the hydraulics of the system and not allow the system to be extended beyond the design capacity.
- Second, it is important to keep NRW under tight control.
- Third, it is important to introduce demand management to avoid waste and excessive use.
- Fourth and last, see to it that new source development and the associated infrastructure keeps pace with population growth. Lessons learned from the investigation of 14 utilities in Southeast Asia show that, in general, governments are always playing catch-up when it comes to the development of new water sources for water supply.

"The problem is simple. Demand for water increases every year but supply does not. So we must increase water production. Our water comes 76 km in open channels and is subject to contamination. We need a pipeline for it." (Jakarta)

Chapter 7

Nonrevenue Water

Definition and Components of Nonrevenue Water

The terms "unaccounted-for water" (UFW) and "nonrevenue water" (NRW) have been widely used in the past. The use of these terms, however, has been confusing. The International Water Association (IWA) recommends only the use of "NRW" and defines the NRW terminology and components as in Boxes 7.1 and 7.2 below.

Box 7.1: Water Balance as per International Water Association

Water balance as defined by the International Water Association (IWA) has the following main components:

System input volume: the annual volume put into that part of the water supply system that relates to the water balance calculation.

Authorized consumption: the annual volume of metered or non-metered water taken by registered customers, water suppliers, and others who are implicitly or explicitly authorized to do so for residential, commercial, or industrial purposes. It includes water that is exported.

Water losses: the difference between system input volume and authorized consumption. They consist of apparent losses and real losses.

Commercial (or apparent) losses: water losses resulting from unauthorized consumption and all types of inaccuracies associated with metering.

Physical (or real) losses: water losses resulting from losses at mains, service reservoirs, and service connections (up to the point of customer metering). The annual volume lost through all types of leaks, bursts, and overflows depends on their individual frequencies, flow rates, and duration.

Nonrevenue water: the difference between system input volume and billed authorised consumption.

Reporting of Nonrevenue Water

ADB has produced a very useful report, *The Issues and Challenges of Reducing Nonrevenue Water* (2010) by Rudolf Frauendorfer and Roland Liemberger, which can be downloaded from the ADB website. Among other matters, the report discusses ways in which NRW may be reported.

- For NRW in its entirety: in liters per service connection per day.
- For physical losses (basic): in liters per service connection per day (calculated by dividing the average daily volume of physical losses by the number of service connections), adjusted for the supply time.
- For physical losses (advanced): through the Infrastructure Leakage Index (ILI), which is the ratio between the current annual volume of physical losses and the minimum achievable annual volume of physical losses. As a truly meaningful inter-utility comparison, it indicates how well a distribution network is being managed and maintained at the current operating pressure.
- For commercial losses: in percentage of authorized consumption, incorporating both billed and unbilled consumption.

Generally speaking, NRW can be reported in four main ways, each of which has its use particularly in making comparisons between utilities.

- Production volume minus billed volume, expressed in million liters per day (mld);
- Production volume minus billed volume divided by production volume, expressed as a percentage (this is the most common way of expressing NRW);
- Production volume minus billed volume divided by number of service connections, expressed in liters per connection per day (as in Frauendorfer and Liemberger above); and

Box 7.2: "Best Practice" Water Balance and Terminology, IWA

<table>
<tr><td rowspan="8">System input volume</td><td rowspan="4">Authorized consumption</td><td rowspan="2">Billed authorized consumption</td><td>Billed metered consumption</td><td rowspan="2">Revenue water</td></tr>
<tr><td>Billed non-metered consumption</td></tr>
<tr><td rowspan="2">Unbilled authorized consumption</td><td>Unbilled metered consumption</td><td rowspan="6">Nonrevenue water</td></tr>
<tr><td>Unbilled non-metered consumption</td></tr>
<tr><td rowspan="4">Water losses</td><td rowspan="2">Commercial losses</td><td>Unauthorized consumption</td></tr>
<tr><td>Metering inaccuracies</td></tr>
<tr><td rowspan="3">Physical losses</td><td>Leakage in transmission</td></tr>
<tr><td>Leakage in distribution</td></tr>
<tr><td>Leakage in storage
Leakage in service connections</td></tr>
</table>

- Production volume minus billed volume divided by kilometers of distribution system, expressed in million liters per day per kilometer.

Note: Non-metered consumption can be estimated through district metering and through sample metering of house connections and standpipes.

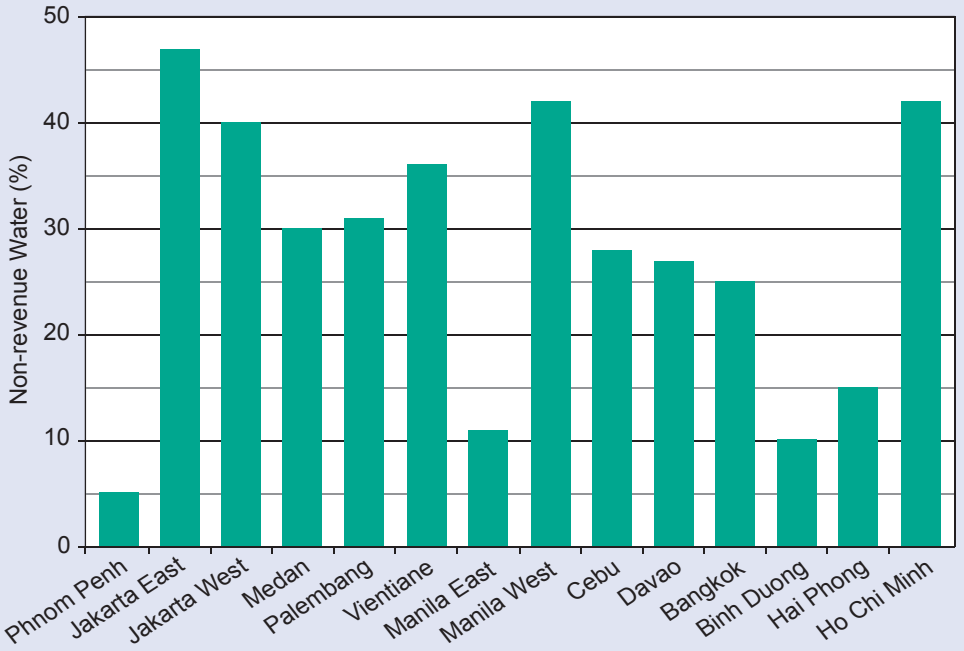
Extent of Nonrevenue Water

Figure 7.1 summarizes the extent of NRW in the 14 utilities studied in Southeast Asia, as of 31 December 2011. The best-performing utilities are PPWSA in Cambodia (6%), BIWASE in Viet Nam (10%), and Manila Water (11%). The worst are SAWACO in Viet Nam and AETRA and PALYJA in Indonesia, and Maynilad in the Philippines (all over 40%). MWA in Thailand, the largest among the 14 utilities studied, has 25% NRW.

Anecdotal Interviews on Nonrevenue Water

- "There are many unscrupulous individuals." (Jakarta)
- "Illegal connections are of two types: house to house, and direct." (Jakarta)
- "Cliques with influential backers must be responsible for the high NRW and illegal connections." (Jakarta)
- "If what is now illegal can just be made legal, there will be no more problem." (Jakarta)
- "The leakage problem is theft of water. It is about the people's character." (Jakarta)
- "There are cliques behind NRW. But it is down to less than 40%."(politician, Jakarta)
- "Old and rusty pipes leak but they cost a lot to replace." (Jakarta)
- "We need to maintain our pipelines and replace distribution lines, especially cast-iron pipes found to be in a porous condition." (Jakarta)
- DCWD must invest more time and money in the caretaker system to reduce NRW. That will bring the DCWD closer to its customers. We need more analysis of results." (Davao)
- "Clean water from source to customer—the entire system—must be ensured. There must be a monitoring system and proper maintenance. Then people will pay for the water they get."(Cebu)
- "The company has no hotline that customers can call to report problems in their pipeline and request quick repairs." (Hai Phong)
- "It is important to maintain pipe networks in good condition." (Bangkok)
- "Customers are happy with MWA's response to leakage reports." (Bangkok)

Figure 7.1: Nonrevenue Water



Why Address the Problem of Nonrevenue Water?

Exploitation of the Poor

NRW and exploitation of the poor often go hand in hand. Vested interests serve the poor illegally with NRW. The poor pay much more for water, especially in terms of the units cost of water they buy from vendors.

Water Conservation

Some water is lost to leaks; some is wasted. Water is becoming increasingly scarce, and our cities must go farther to harness new sources. So we should save every drop we can, in our own interest and for the sake of the nation.

Increased Service Coverage

Less NRW means more money and more water for more people to be connected.

Reduced Cost of Production

If more people are not connected when NRW is saved, the cost of production, which includes the cost of treatment and of pumping, can be reduced. Customers do not have to pay for the inefficiencies of the utility.

Improved Financial Viability of Utility

NRW reduction makes the utility more financially viable either because production cost goes down or because more connections increase revenue.

Better Services to Customers

A reduction in NRW will translate into better service. Water pressure in the distribution system will be higher and there will be less intermittent supply.

Who Benefits? Who Loses?

It is useful to look at NRW from this perspective. As Table 7.1 shows, the utility is always responsible for NRW, the customer pays for NRW inefficiency, and, at

Table 7.1 Nonrevenue Water: Who Is Responsible? Who Pays? Who Benefits?

Type of Loss	Who Is Responsible?	Who Pays?	Who Benefits?
Physical losses			
Leakage	Utility	Regular customer	No-one
Commercial Losses			
Illegal sales (poor)	Utility	Poor customer Regular customer	Poor customer, at higher price Utility staff, others
Illegal connections	Utility	Regular customer	Utility staff Illegal customer
Mis-metering	Utility	Utility Regular customer	Utility staff Specific customer
Mis-billing	Utility	Utility Regular customer	Utility staff Specific customer
Mis-reporting	Utility	Regular customer	Utility staff and others

least in commercial losses, the utility staff potentially benefit the most.

Identifying the Causes of Nonrevenue Water

Introduction

NRW indeed has many possible causes. If the cause is not precisely known, NRW may be temporarily removed, only to reappear. For example, if it is decided that full pipe replacement is what the system needs although illegal connections are the main cause, NRW could drop from 60% to 5% right after complete pipe replacement but could increase again after a few weeks. The cause must first be identified. Then a proper way of eliminating it can be worked out.

Development and Operation and Maintenance

NRW can be caused by poor planning, poor design, poor construction, poor operation, and poor maintenance. Too often water utilities are concerned only with the O&M side and do not trace NRW problems to their root cause, which may lie in the development phase. PUB Singapore, for example, had to replace its thermoplastic and galvanized-iron pipes with stainless-steel pipes to remove a major source of leaks.

Anecdotal Interviews

In the search for the causes of NRW, anecdotal interviews with staff of the utility, customers, those formerly connected to the system, and those never connected to the system provide a good start. The interviews do not use any questionnaire. The responses are recorded verbatim but are completely anonymous.

100% Survey of All People and All Water Use

If a utility genuinely wishes to reduce NRW then it should not hesitate to conduct a 100% survey of all water users and all water use within the service area. This survey can first be done within a hydraulically isolated pilot zone. It must ascertain the source of water, the quantity and quality of water, and the availability and cost of water used by all people living in the area. The survey should also determine how many persons are in each household and whether the area has 24/7 supply.

Survey of Water Billing

This survey involves analysing all water bills within a given zone, over a given month. It looks into estimates of consumption (particularly very large or very low consumption), instances of payment in arrears or non-payment, installment payments of connec-

tion fees, and correlations between billed amounts and water charges. The survey also makes sure that the water bills show the number of persons per connection.

Record of Inactive Connections

Many utilities have a record of inactive connections, or disconnections made possibly because of non-payment. If the utility staff are diligent, they will find out where these former users now get their water, and try to have them formally reconnected. Social engineering—finding out what went wrong and working with the community to correct it—is needed here. Good records are the building blocks of good asset management and will become more essential as the water supply system and the utility develop.

Illegal Connections

Nearly every utility has its share of illegal connections. The likely owners can be easily ascertained through 100% surveys and given a 1-month amnesty period within which to convert. If they fail to respond within that period and continue to have illegal access to water, then their frontage can be fully excavated. When the illegal connection is found, the media (TV and newspapers) can be brought in to show that illegal users cannot hide, and they will be shamed and punished. PPWSA has been particularly good at using this approach.

Illegal Sale of Water

Everyone gets water somehow, somewhere. The source of water can nearly always be traced to the utility, and its illegal sale through utility staff. This is big business and a politician at the end of the line may be benefiting from the arrangement. It is likely to have been the case in cities like Jakarta and Manila, with their very high NRW figures.

Mis-metering

This includes collusion between the meter reader and the customer to record low or estimated consumption; accidental misreading by the meter reader, who cannot maintain accuracy when trying to read too many meters; and inability of the meter reader to gain access to the meter. It also includes inaccurate recording of flow by the water meter. Significant estimated readings should be investigated.

Mis-billing

Brief informal surveys done in the cities of Asia by this consultant and others have shown some discrepancy between the consumption billed to customers and that recorded officially by the utility, with the former often being higher than the latter. There may be room for mis-billing due to downloading errors, but these should not in the end be significant. Where there is high NRW, the discrepancies tend to be larger. The analysis of water bills from the field and comparison with average water consumption and the water bills issued by the utility will always be a valid check. When managing at the lowest practicable level (500 connections) these issues are readily resolved.

Leakage at Connections

This most often occurs at Illegal connections, but can also be found in service connections in general, more than at any other place in the water distribution system. Surprisingly, more and more evidence indicates weaknesses in the service connection pipe itself. This can either mean the pipe (galvanized iron, polyvinyl chloride [PVC], or high-density polyethylene [HDPE]) was substandard, or was treated in a damaging manner during construction.[11]

Leakage in the Network

Leaks can occur in the reticulation pipework, in transmission mains, and in storage. Most importantly, records of repairs done on every leaking or burst pipe should clearly document the type of leak and, if possible, its likely cause. Many leaks can be traced back to poor material specifications, poor construction methods, and poor repair work. The replacement of Vientiane's transmission main is typical. The entire project cycle costs, and not just the initial capital costs and savings on supervision, need to be considered.

Nonrevenue Water and the Urban Poor

Social Engineering

A strong correlation no doubt exists between high NRW and high levels of unserved urban poor. The poor

[11] At the author's place on the Gold Coast in Australia, roots from trees are breaking HDPE water pipes, and not just at joints. This problem is common worldwide.

do use water, and often it is water illegally obtained from the formal piped systems of water utilities. One of the first steps to be taken in reducing NRW should therefore be to ensure access to piped water for all the urban poor. The better utilities, including PPWSA and Manila Water, have pro-poor activities, but still fall short of total accountability for providing access to piped water to the urban poor, including not only existing customers but also those still unserved.

Serving the Poor with Piped Water

This should be an accountability function of the utility, with targets set yearly. Constraints on, and obstacles to, connection should be identified and overcome through the concerted efforts of all water utility departments. Water vending and small-scale water provider (SSWP) supplies should be monitored and licensed but not regulated, except where needed for service quality and efficiency, as determined by the recipients themselves. The cost and ease of connection and the extent to which this is a constraint must be examined. Affordability and willingness to pay should be analyzed in tandem. If necessary, water charges can be collected daily, with the cooperation of the community, as is quite often done by SSWPs.

Temporary Reduction of Nonrevenue Water

Bulk Supply

If a utility supplies water in bulk through a single meter to a high-rise apartment block, subdivision, or informal settlement, any losses in the distribution and individual connections become the responsibility of the community and not the utility. NRW can appear lower than it actually is, as a result. In a more developed country, this type of service is not allowed and the utility must supply water directly to each household.

"Temfacil"

This term used in the Philippines stands for "temporary facility." Galvanized iron pipes are laid above ground in an environment where normal piped service is not feasible or is very costly. Such a facility can be used to provide water in a low-income neighborhood (perhaps an informal settlement) that is expected to be demolished in the next 5 years to make way for new development, or in a low-lying area of town that is flooded daily by the rising tide. In Manila "temfacil" is also known as a low-cost method of bringing down the NRW figure in a given area and preventing illegal connections. In Cebu it is a cheap way of supplying water, but it hinders the services of the water district.

Small-Scale Water Providers

These contractors will lay pipes or even hoses above ground to serve people in low-income areas. They are generally supplied in bulk, legally or illegally, by the utility. This setup combines the "temfacil" and bulk supply options. Clearly, both the utility and the SSWPs benefit from low NRW. But SSWPs should generally be regarded as providing only a temporary solution to the NRW problem. Some might even add that SSWPs perpetuate the unfair treatment of informal settlers as undeserving of a formal house connection.

Lower Pressure

NRW levels are a function of the pressure in the system. Leakage is directly proportional to pressure. Especially when new supplies are connected, it is advisable to use the pressure-reducing valves to lower the water pressure so that it does not produce more leaks. In most developing country cities, a realistic target is for water pressure to be sufficient to serve all uses on the second floor of a house.

Caretaker Approach to Operation and Maintenance and Reduction of Nonrevenue Water

This approach was first described in *Asian Water Supplies (2003)* and has now been taken up by consultants in Davao City and Ho Chi Minh City in particular.

Rationale

Legal and technical approaches to combating NRW have met with limited success. Instead of maintaining a daily presence in a given locality, utility staff will generally appear only when called out in an emergency or crisis. The caretaker approach adds a social dimension to efforts to deal with the problem. The approach is **based on managing water supplies at the lowest practicable level** and on maintaining a good utility–customer interface. It is particularly suitable for developing countries with no shortage of relatively inexpensive manpower.

Definition

The caretaker approach divides the whole water supply system into hydraulic zones, each one with about 500 connections. A caretaker[12] is made responsible for all water supply activities within a given zone. The concept is not new. It has been employed in Tokyo and by a concessionaire in Manila. A small-scale water provider in Manila uses this approach to manage its system by assigning one *aguador* to every 100 connections.

Institutional Framework

The caretaker reports to an O&M supervisor, at a nearby maintenance depot. The caretaker's area of responsibility is small enough to be walked in its entirety once a week. This individual may lease an office from a resident in his or her zone of responsibility and be given a mobile phone. The O&M supervisor (typically an engineer) will be responsible for 10 caretakers and not more than 5,000 connections.

Duties of the Caretaker

The caretaker is expected to develop a friendly relationship with the people living in the zone of responsibility. He or she will:

- keep a daily diary of all activities in the zone;
- be responsible for mapping the distribution system, including all connections;
- be responsible for accurately metering all customer connections and arranging for meter replacement when necessary;
- analyze billing records and collections monthly, investigate instances of high and low consumption and late payments, and report total consumption each month;
- report leaks to be repaired and record the dates the repairs were made;
- record and follow up on customer complaints;
- inspect plumbing in all households and assist with repairs where feasible;
- disseminate to customers (i) notices of supply interruption, (ii) information about water tariffs, (iii) information about water consumption and conservation, (iv) information about demand management and hygiene education, and (v) information about utility performance;
- report alternative sources of water used by both customers and noncustomers.
- report hours of service and pressure at the zone (day and night);
- report the number of persons in each household in the zone each year;
- read district flow meters and pressure gauges daily; and
- inspect the entire zone on foot weekly.

Duties of the Operation and Maintenance Supervisor

In support of the caretaker, the O&M supervisor is expected to

- provide timely assistance and quality control in maintenance and repairs;
- visit and talk with each caretaker daily;
- review caretaker diaries weekly and provide comments and guidance;
- inspect with each caretaker his or her zone once monthly;
- encourage competition and incentives among caretakers for good performance; and
- comment on all caretaker reports before submitting them to the head office.

Flushing Out of Illegal Connections

In this age of information technology, there are few excuses for not having up-to-date data on every household and business, connected or unconnected, in a given water service area. If this information is appropriately analyzed, tracing illegal connections, defective meters, and incorrect meter readings will be relatively easy. At the same time, once the caretakers get to know the people in their zones, and with the timely use of amnesty periods, it should be possible to flush out most illegal connections. Examining individual zones and comparing these with others should make it possible to identify problem areas quickly.

[12] Normally an employee of the utility living within the zone of responsibility.

The Advisability of Total Pipe Replacement

Cost-Effective, Maybe...But Is It Advisable?

Sometimes full pipe replacement may be cost-effective but not necessarily advisable. For example, the water saved over, say, five years may well be worth much more than the cost of pipe replacement. But does this point alone justify the approach? Definitely not. Perhaps NRW can be reduced significantly through the selective replacement of pipes in areas where most pipe bursts occur. Perhaps the NRW is caused mostly by illegal use, which could resume soon after pipe replacement.

Why Is There Nonrevenue Water?

This is the first question that must be answered, before any total pipe replacement program is contemplated. Good records of the location and cause of pipe bursts and leaks are essential. All water use (among both the connected and the unconnected) in the given zone must be completely surveyed. Pipes may have to be sampled to determine their condition, both inside and out. Social engineering with anecdotal interviews will help. Asbestos cement pipes should be replaced, not for health reasons but because they are known to deteriorate with age. When looking for the cause, we should remember it can be found in any of five functions: planning, design, construction, operation, and maintenance. We should also remember the twofold benefit that comes from reducing physical losses (money and water) compared with reducing commercial losses (money only).

Silting Up of Distribution System

In cases where silt has been allowed to accumulate in the distribution system and eventually clog it up completely, total pipe replacement may be justified.

Decommissioning of Old Pipes

Old lines must be decommissioned and capped off. This is very important, and it is the reason why network replacements should be carried out in each district metering area.

Full-Service Coverage Trade-Off

If total pipe replacement has been effected in a given zone, then 100% piped water coverage of individual homes within that zone should be guaranteed as a policy trade-off. This makes common sense, if only to eliminate illegal connections. A well-designed and constructed project will result in fewer operational issues and a longer service life.

Reduction of Nonrevenue Water in Operations

General

When is NRW an operations issue, and when is it a project issue? Generally the answer depends on how bad the situation is and what funds are available in the operational budget, as opposed to the development budget. But at the end of the day, project development is just a one-off activity, while system operation is an ongoing activity, and the two are equally important.

Nonrevenue Water Reduction Needs an Integrated Approach

An enabling environment must be created for NRW reduction. Utilities need management autonomy, and competent and motivated staff. Tariffs must be high enough to induce people to manage their water use better and reduce NRW. Good governance must be practiced.

Record of Leak Repairs and Pipe Bursts

Good records of such repairs, wherever they are undertaken, must be kept. If there are more than four pipe bursts per kilometer per year, then pipe replacement can be considered.

Speedy Leak Identification and Repair

This is essential to minimizing NRW lost. The caretaker approach described above shows how proactive behavior, combined with community cooperation, will help in quickly identifying leaks.

Supervision of Service Connections and Repairs

Often leaks reappear at old repair locations, because the repairs were not supervised well enough to ensure that the proper materials and workmanship were employed. Leaks are now commonly repaired under contract, but this should be even more reason to closely supervise the work.

Repairing a leak

Repairing a broken water distribution pipe

Broken pipe at a stop valve

Broken 200 mm polyvinyl chloride pipe

Broken collar on pipe

Old corroded pipes

Correcting the Faults

Are the leaks due to faulty workmanship? Or are substandard materials to blame? Whatever the cause, the utility must take responsibility for correcting the fault. This is where transparency is important. But training of utility staff and contractors is just as important.

Need for 100% Metering

There is no point in chasing high NRW if only a portion of the distribution is metered or if not all the meters are functioning accurately. If metering is worth doing, it must be done 100%.

Need for Proactive Leak Detection

In addition to the identification and repair of visible leaks, there is a need to identify buried "invisible" leaks. Such leaks can run undetected for years, increasing losses and potentially causing damage to other infrastructure. Often these can cause more damage than large, visible leaks or pipe bursts, since large leaks are repaired very quickly.

Reduction of Nonrevenue Water in Projects

Conversion of Nonrevenue Water Saved into Billed Volume

Saving NRW losses in a given zone is one thing. Converting the saved NRW into billed volume, within or outside the zone, is quite another. This is why 100% service coverage in each zone where the NRW problem is addressed should be the first objective. This is also why hydraulic modeling of the network is important, and must be properly calibrated in the field.

Pilot Project Area

NRW reduction is expensive. So the least-cost, but still effective, approach must be taken. One way to gauge success is to make the improvements in a pilot area first. Good records of the process, the constraints, the time taken, and the cost must be kept. All this will allow good estimates to be prepared for the full project. The utility can also practice the approach and get it right before scaling up or replicating it elsewhere.

Anecdotal Interviews, Followed by 100% Surveys

These will provide a good database for the project and assist in determining the right approach. There is no substitute for hard facts and figures.

Mapping of Distribution

Time and effort must be taken to carefully map the distribution system and all valves, meters, and hydrants. Future repairs can thus be accurately located and more accurate information will be available for hydraulic modeling.

Amnesty plus Media Exposure

The media should be used to bring attention to what you are doing, why, where, and when. The amnesty period for conversion by those on illegal connections can be advertised. If an illegal connection is later unearthed, the media can shame these people on TV and show the penalties they will pay, concentrating at the start on large users to discourage others.

Construction Supervision

Good design, good materials, and well-supervised construction are all necessary and cannot be neglected. What goes into the ground must last for 40 years, not five.

Performance-Based Standard Bidding Documents

If contractors are hired to reduce NRW, as they have been in Southeast Asia, agencies like ADB and the World Bank must consider producing standard bidding documents.

NRW Reduction and Intermittent Water Supplies

If You Can't Measure, You Can't Manage

If water supply is intermittent, consumption cannot be accurately measured with conventional metering. Air entering the system will cause the water meter to spin faster. It goes without saying: if you can't measure, you can't manage.

Installing a 600 mm butterfly valve

Turning a valve to regulate production

Repairing a distribution leak (a)

Repairing a distribution leak (b)

Repairing a distribution leak (c): not easy at great depth

Repairing a distribution leak (d)

Repairing a distribution leak (e)

More obvious leaks

Controls at the Customer Interface

In many areas served intermittently with water, there are no controls at the supply or customer interface. When water is available, it flows into a tank or well, which is allowed to overflow. Therefore, chasing NRW is not practicable if supply is intermittent.

Pilot 24/7 Supply Areas

Intermittent supply can be converted into 24/7 supply one hydraulically isolated area at a time. The area can be fully metered, and supplied through a constant head reservoir. NRW reduction should go hand in hand with the conversion and then become a continuous operation thereafter.

Metering

Production, District, Bulk, and Customer Metering

Meters are needed on pump heads, on the inlet and outlet of water treatment plants, on the inlet to a hydraulically isolated district area, on bulk supply to customers, and on individual supply to customers. Remember: if you can't measure, you can't manage.

Large Customers

Most experts agree that there are reasons to concentrate attention on, say, the top 100 customers by volume. A large portion (maybe 25%) of all revenue will come from these customers, so it is important to measure their consumption accurately. All water meters for these customers must be of good quality and must be working properly, and they must be read and monitored each month to identify discrepancies, such as very low or very high consumption. A monthly report should be prepared and forwarded to the management. Likewise, the timely payment of bills by these large customers should be monitored.

Accuracy of Meters and Their Replacement

Residential water meters for single households should be replaced every 7 years at most. Larger meters may need to be replaced every 3 years. For this reason, it may benefit a utility to have an ongoing contract with a meter supplier for the replacement of meters.

Specification and Procurement of Water Meters

We know it is possible to get domestic water meters for less than $10 each. But have the meters been rigorously tested to meet the minimum specification of the utility, and do they stay functional and accurate beyond their guarantee period? Do they meet the national standards? Water meters must undergo an independent external audit at least yearly. Since the cost of a water meter is only a fraction of the total connection cost, false economy can be avoided and the best water meters that fit the budget should be bought.

New Technologies

Automated meter reading technology has been in use in Southeast Asia for at least 15 years. Penang Water Supply Authority in Malaysia was one of the first to use the technology. Now it is possible by using microchips to remotely and automatically read water meters in large numbers on a given date and time. The price of these new technologies has come down so big utilities should be seriously considering them now. There have also been significant developments in data loggers, pressure valves, noise control, and network modeling. Data loggers can record flow and pressure and noise in the network, and transmit data to a remote computer. They are increasingly being used these days.

Meter Reading and Outsourcing

Meter reading is a core activity of a water utility and should therefore not be outsourced. But if there is major corruption to be overcome, or if the utility does not have enough qualified staff to handle the job, then meter reading may be temporarily outsourced. In Manila, one concessionaire outsourced its meter-reading function. The results, however, were not good. Thousands of customers complained about their water bills.

Analysis of Water Bills

Once a month, the supervisor of a district should review all water bills from his or her area and examine payment arrears and high, low, or estimated consumption; report the findings to management; and state what action the supervisor is taking to correct deficiencies. Social engineering may be the best intervention.

Reading a water meter to control nonrevenue water

Reading the water pressure

Compatibility of Utility Records and Customer Billing

Each area supervisor should calculate for his or her customers the average water consumption and average water bill in the area. Then from time to time audit teams can check on a random sample of, say, 100 water bills from the area, as supplied by the customer and see if they come up with similar results. Actual consumption could be higher than the figure on the official bill. The difference represents NRW.

Box 7.3 The Maynilad NRW Reduction Story

Utilities need more and more water to serve ever growing populations and increase service coverage. But what utilities don't always realize is that reduction of NRW is the cheapest source of new water they can harness. With a sizeable NRW they are sitting on a gold mine. Much of the water currently leaking away could be sold to new customers. An example of a utility that realized this and did something about it is Maynilad Water Services Inc. the privately operated utility serving the western half of Metro Manila, one of the densest populated cities in the world.

In 2007 the NRW stood at about 66% of production and within Maynilad's service area about one third of the nine million people were still unserved with piped water, relying on water vendors, wells and boreholes for their water. About this time Maynilad changed its ownership and management and entered into a performance based advisory contract with *Miya* a global NRW management group.

Between 2008 and 2013 the NRW was lowered from 66% to 35% and this represented a saved volume of water of around 800,000 cubic meters per day or enough to serve a big city. This was probably the biggest NRW reduction project anywhere in the world.

The foundation for this successful achievement was laid by:

- Sufficient funding. During this time Maynilad spent on NRW reduction and management alone about $278 million on capital investments and $76 million on NRW related O&M.
- The involvement of a strong international advisory team.
- Organizational changes which saw the senior staff directly involved in NRW management increase from 5 to 430 engineers.
- The full support of Maynilad's President and his management team as well as the Board of Directors. Overnight it became attractive to have a career in NRW management.

The physical loss reduction allowed Maynilad to reduce water production while increasing the number of customers from 700,000 to more than 1.1 million. This meant an additional two million people were connected to reliable and safe water supply.

Investing in NRW reduction was proved to be an excellent business decision because Maynilad's income tripled from $42 million to $136 million over four years and kept on growing.

Source: Roland Liemberger, NRW Specialist for Miya.

Nonrevenue Water, Tariffs, and Economic Leakage

Low Tariffs Do Not Encourage Reduction of Nonrevenue Water

We often hear that it is uneconomical to chase leakage at levels below 20% of production. That is an interesting notion—and one to which very good water utilities such as Singapore PUB (4% NRW) and Tokyo Metropolitan Waterworks (6% NRW) obviously do not subscribe. Both utilities have relatively high water tariffs. The higher the tariff, the more important NRW reduction becomes. Neither NRW reduction nor water conservation in the home would be very effective if tariffs stayed at around $0.05 per cubic meter.

Leak Detection Equipment and Software Modeling

Visible Leaks First

Often consultants asked to address NRW immediately think of buying leak detection equipment. Someone should remind them that water supplies in developing countries are very different from those in developed countries. Leakage may represent 90% of NRW in a developed country, but only 50% in a developing country. Illegal connections, illegal sale of water, and mis-metering account for most of the difference. Therefore, when addressing leakage in developing countries one of the first tasks should be to make sure there are no unattended visible leaks. Every location is different but in Manila now (not in the past) the majority of water is lost from invisible leaks that never reach the surface.

Network Modeling Is Useful Only If Calibrated with Field Data

There is much talk from academics about using network modeling to identify NRW. But a model is only as good as the field data used to set it up. If those are incomplete, then the model is still not very useful. The reality is that getting complete field data is difficult.

Conclusions

Reducing NRW would not be technically difficult if funds were not an issue. But reducing NRW in a cost-effective and efficient way involves a significant degree of technical difficulty. It is also challenging in a governance sense. Illegal connections can be eliminated only when utilities are autonomous and self-disciplined, and accountable to regulators and the public. In addition, utility employees need genuine, rather than illegal, incentives, to do their jobs. The status quo must be overturned. Water and service levels must be comprehensively audited, and links between NRW, low service coverage, water vendors, and SSWPs must be explored. Much higher tariffs will push customers to exert pressure on operators to eliminate leaks and chase illegal connections and illegal water sales. Good organization development is needed for managerial autonomy and accountability. Finally, managing the water network at the lowest practicable level through hydraulic zoning, for as few as 500 connections, is clearly the way forward.

CHAPTER 8

Tariffs for Autonomy

"There was a need to generate enough income to be independent, but this was done not by increasing the tariff, as much as by increasing collection efficiency and reducing nonrevenue water." (**Ek Sonn Chan**)

Introduction

If there is one specific matter that has most constrained the development and management of water supply in developing countries, it is the issue of tariffs. Some governments have found all sorts of reasons not to approve tariff increases, even if they conform strictly to stated government policies and legislation. The consequences have been slow development, poor O&M, staff demoralization, and opportunities for corruption. This chapter examines the many different factors that affect water tariffs and points the way toward a much-better scenario for water supply in developing countries.

Why do we say "tariffs for autonomy"? Because if utilities were to fund development directly from tariffs, then they (and not their governments) would be calling the shots and would be autonomous to a high degree. That prospect does not sit well with some governments. Decision makers must know the consequences of keeping tariffs low. Official government policy must be declared, and its implementation closely monitored.

Policy Considerations

Governments of developing countries prepare policy statements, including those on cost recovery and tariffs, often at the request of development agencies. But once loans are approved, these policy statements tend to command less attention. The public, as a result, does not get a chance to scrutinize them, and elected officials are left free to interpret and adjust policies ad hoc.

Generally, there is no accountability for the implementation of policies, especially tariff policies. The policy statements should be simple and accessible to everyone. They should be posted on utility websites. The media can help by commenting regularly on the implementation of government policy. Consultants and nongovernment organizations (NGOs) working in the sector should also keep a close watch on the implementation of government policy.

The primary objective of a water utility must surely be to provide 24/7 piped water to all. A secondary objective may be to manage demand so water is used efficiently and not wasted. If governments fail to provide good piped water, especially to industry and commerce, the private sector will drill wells and take groundwater, and may even by default serve some of the public, as is indeed the case in Metro Cebu (Philippines).

Generally, it is acknowledged that water tariffs must balance economic efficiency (water conservation), social equity (service to the urban poor), and financial viability (of the utility). As an interim measure, those receiving 24/7 supply should be made to pay a higher tariff than those with intermittent supply.

Willingness to pay is most influenced by the availability of alternative water sources. In Male in the Maldives, people pay $5.70 per cubic meter of piped water because they have no other sources of water. In contrast, people in a rural village in Indonesia refused to connect to a new piped system because they were already getting good-quality water that cost them nothing from household wells and were unwilling to pay for piped water. Every loca-

tion is different, and politicians who set cost recovery policies should first be well informed about the available options that may cause people to reject the use of piped water. ADB and World Bank post-evaluations of water supply projects have concluded that initial demand is often overestimated because dug wells, hand-pumped tube wells, or other options close to home already satisfy demand. Awareness of matters like water quality also influences willingness to pay. Furthermore, people often get water from several different sources, depending on the intended use.

For many years, 5% of household income was the rule of thumb applied in determining the affordability of water supply in developing countries.[13] In other words, tariffs were considered reasonable if they did not exceed 5% of household income. Poverty mapping of the service area is likewise important, to enable more direct targeting of the poor for subsidies. Of course, metered customers may also use less water to save money. In Male, for example, where the average tariff is $5.70/m^3, a family of five consumes around 10 m^3 per month on average. People adjust their consumption to stay within the bounds of what they can afford.

In discussing tariffs, we often forget about those who are not connected and about the affordability of connection fees. The fees range from $50 to $200 and must normally be paid upfront by potential customers. For poor households earning $1,000 a year, paying this amount is a near impossibility, so many continue to pay water vendors or neighbors daily. Some will point out that connection fees can be paid in 24 monthly installments. But a monthly fee instalment of about $5, on top of a monthly water bill of $5, may still be out of the reach of many, so that disconnections for nonpayment result (as we have seen in Manila). To overcome the reluctance to connect to piped water, the ideal solution would be to amortize the connection fee in the loan for the construction of the distribution system. Tariffs for all customers are raised a fraction to accommodate loan repayments. This means that those connected effectively cross-subsidize those not connected. And why not? Those connected already benefit from both subsidies and cross-subsidies. This expedient is now legal in Viet Nam, and it is hoped that it soon will be as well in other countries.

[13] See Arthur McIntosh, 2003. Asian Water Supplies: Reaching the Urban Poor. Manila: Asian Development Bank. p.78.

Tariff levels are determined to a large extent by the policy of cost recovery. Is the objective to meet just O&M costs, or to meet O&M costs plus debt service? In general (given the potential for cross-subsidy from nondomestic customers), every city of a million people or more should be able to implement cost recovery for O&M costs plus debt servicing of loans.

The tariff structure determines cross-subsidies. For example, those who use more may pay a higher unit cost for water, or those families who use less than 10 m^3 may be cross-subsidized by the other customers.

Certainly the governing body for urban water utilities must make a policy decision about the extent to which the private sector can be involved in water supply. The private sector operators in Manila and Jakarta have been criticized for their high tariffs. But very good public water utilities, such as those in Phnom Penh, Davao City and Bangkok, also have relatively high tariffs. The point to remember is that all water utilities—all private sector contracts for that matter—must be monitored for their implementation of government policy. While the private sector has the advantage of being able to raise tariffs in accordance with its contract, it must be held accountable for its service level and coverage, on the one hand, and for operating efficiency and investment prudence, on the other. A well-performing private operator can raise funds on the stock exchange, as MWCI did, but a poor-performing private operator cannot. Nowadays the concept of public–private partnerships, with the national (rather than the international) private sector involved, is more accepted.

Tariff Objectives

Governments must have transparent tariff policies stating the objectives of tariffs and the rationale of the policies.

Tariff setting follows five principles:

- **Cost recovery:** the tariff should generate enough revenue to pay O&M costs, repay loans, and pay the capital costs of replacement and expansion.
- **Operating efficiency:** the service provider should operate efficiently so the customer does not have to pay for utility inefficiencies.

- **Fairness:** the water tariff should be equitable to all parties.
- **Affordability:** the water tariff should result in water bills that are affordable to low-income groups.
- **Economic efficiency:** water should be priced high enough to signal the real value of water and encourage customers to conserve resources and use water sustainably.

Following all of the above steps should help to ensure the autonomy of the utility to manage its own affairs.

In terms of tariff structure the objectives may be as follows:

- Demand management and conservation of water;
- Cross-subsidy of the poor (lower-consuming customers) by the rich (higher-consuming customers);
- Cross-subsidy of the unconnected by those with piped water connections;
- Cross-subsidy of domestic use by industry; or
- Cross subsidy of sewerage by water supply.

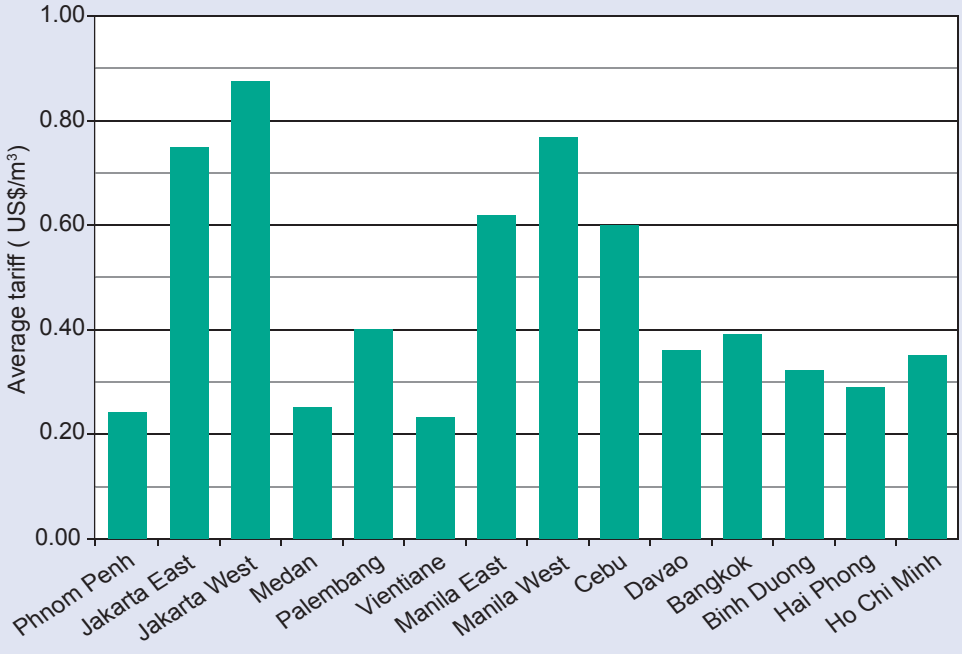
Tariffs in Selected Southeast Asian Cities

Table 5.1 Performance Parameters of Water Utilities (December 2011) include three parameters that pertain to tariffs: (i) average tariff, (ii) operating ratio, and (iii) collection efficiency. Each of these parameters is discussed below.

Average Tariff

This varies from a low of $0.23/m^3 for Vientiane to a high of $0.88/m^3 for PALYJA in Jakarta, and the overall average is about $0.50/m^3 (see Figure 8.1). PPWSA's average tariff of $0.24/m^3 has remained unchanged for more than 10 years.[14] Among the public utilities, MCWD has the highest average tariff ($0.60/m^3). The average tariff for the four private operators varies from

Figure 8.1: Average Tariff, End of 2011



[14] Although it has not increased tariffs since 2001, despite increases in electricity and other costs over the last few years, efficiency gains resulting from the reduction of NRW from 72% to 6%, together with improving collection efficiency, have allowed PPWSA to record a healthy profit each year and continue to expand and improve.

$0.62/m^3 to $0.88/m^3. MWCI's average tariff ($0.62/m^3) allows for sewerage cost recovery, but PALYJA's ($0.88/m^3) and AETRA's ($0.75/m^3) do not cover sewerage costs.

Operating Ratio

This is equal to operating expenses divided by operating income (see Figure 8.2). The 14 utilities have a reasonable average operating ratio of 0.69. The ratios are lowest (best) for PPWSA (0.37) and MWCI (0.45). A low operating ratio indicates ability to fund development directly from tariffs. Medan's operating ratio of 0.97 clearly indicates the need for a tariff increase. The 0.92 figure for BIWASE reflects its broad mandate to include sewerage, as well as contracting and consulting services, so comparing it with the operating ratios of other utilities would be unfair.

Collection Efficiency

This is equal to the amount collected in 1 year divided by the amount billed that year, expressed as a percentage, OR the amount billed in 1 year minus the amount collected that year (accounts receivable), expressed as equivalent number of months of billing. It is difficult to compare collection efficiency or accounts receivable for all 14 utilities. The variable age distribution of bad debts makes comparisons meaningless. Therefore, the following yes–no question was asked of all 14 utilities: *When you bill your customers, do you receive 98% of the billed amount back within 1 month?* The answers showed that 10 of the 14 utilities have a collection efficiency problem. The only exceptions are PPWSA and the three Viet Nam utilities. Perhaps collecting door to door as Viet Nam is doing is the way to improve tariff collection. PAM Jaya in Jakarta is very aware of the collection problems of both AETRA and PALYJA. On the other hand, one can sympathize with customers who are required to pay a very high tariff for intermittent supply.

Results of a Street Survey of Water Bills in Southeast Asia

A street survey of water bills from 20 houses in a low-income area covered by each of 11 utilities was conducted. The results are shown in Figures 8.3 and 8.4. Figure 8.5 shows the cost of 10 m^3 of water.

Figure 8.2: Operating Ratio of Utilities

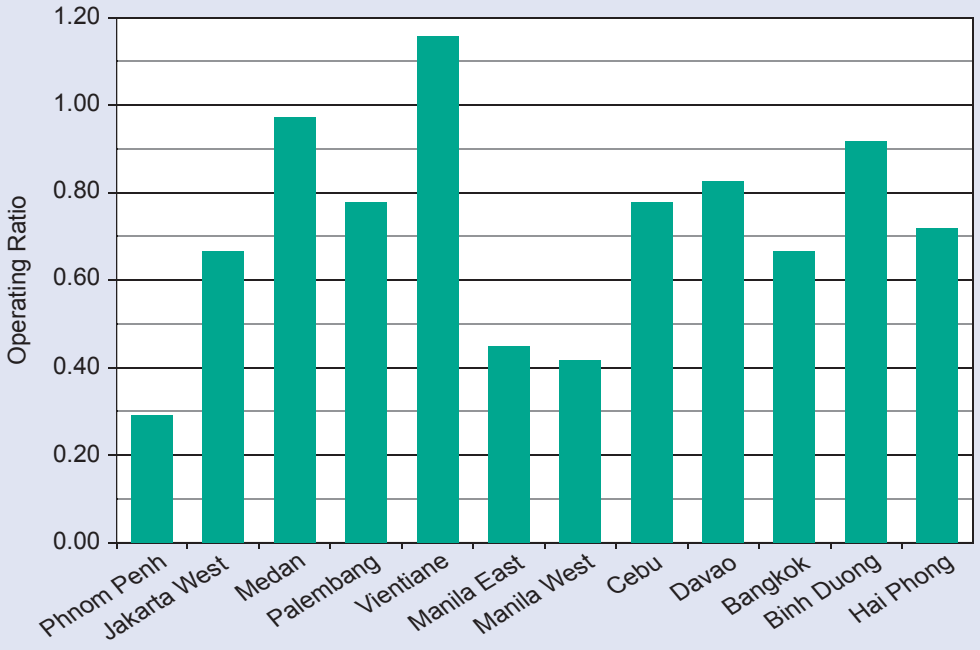


Figure 8.3: Average Monthly Water Bill (Street Survey)

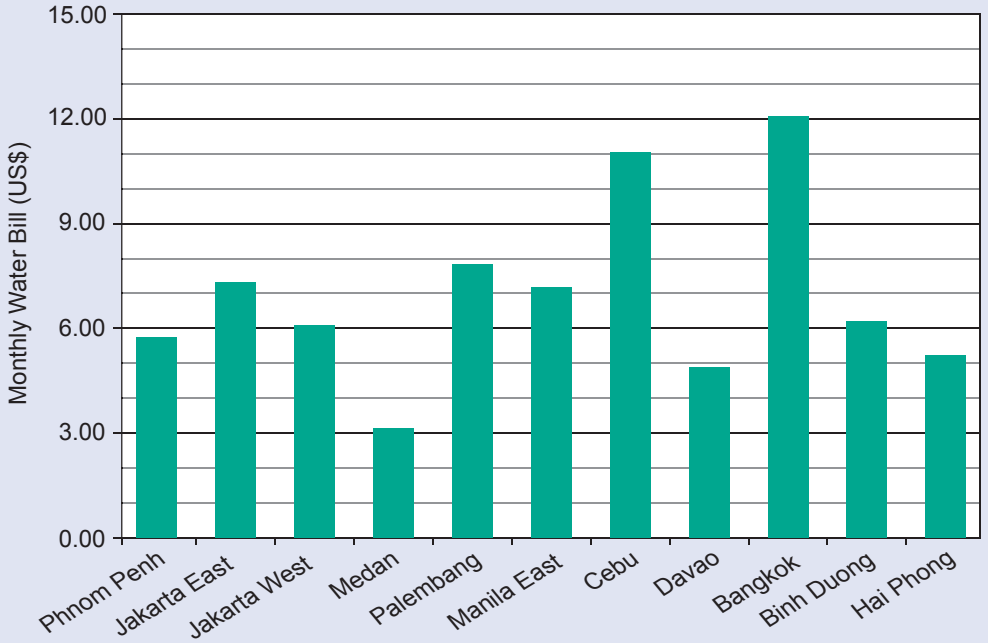


Figure 8.4: Average Tariff (Street Survey in Low-Income Areas)

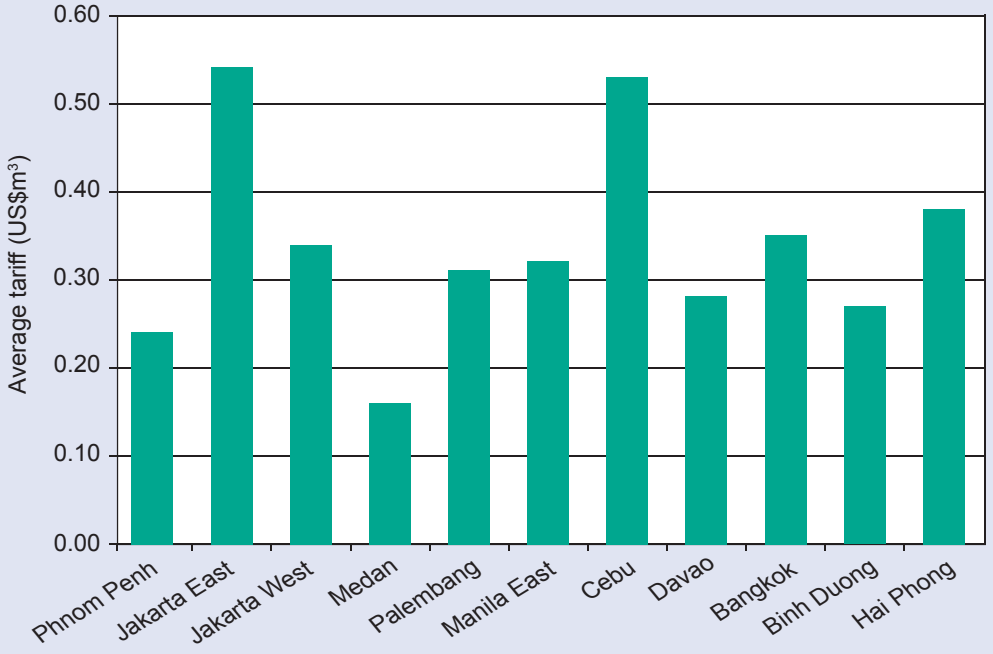
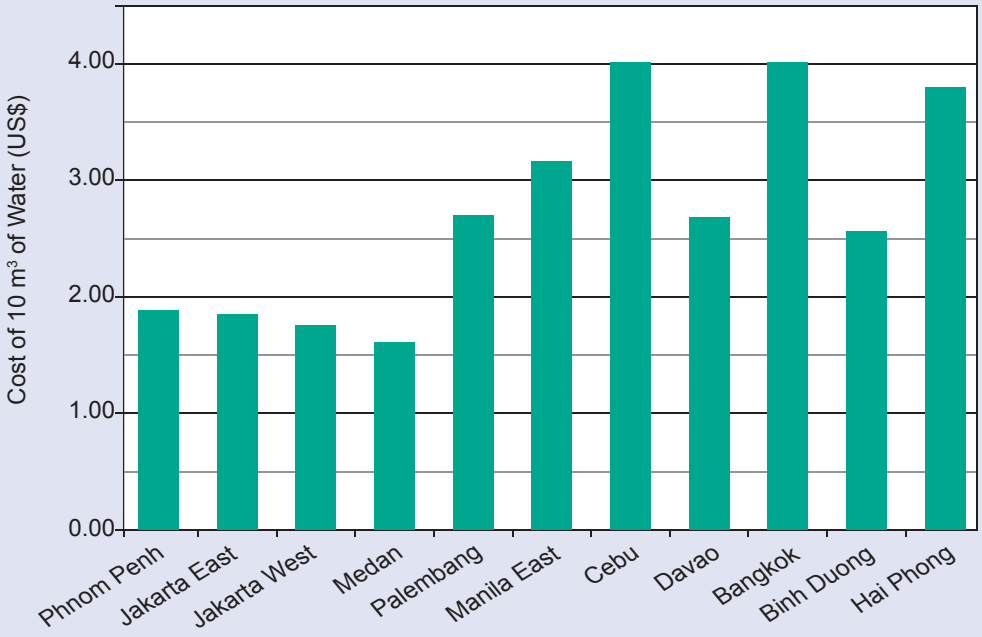


Figure 8.5: Cost of 10 m³ of Water in Utilities



Average Monthly Water Bill in Low-Income Area

This varies widely among the utilities, from a low of $3.10 in Medan to a high of $12.05 in MWA. MWCI's average monthly bill is $7.12.

Average Tariff in Low-Income Area

This varies from Medan's $0.16/m³ to AETRA's $0.54/m³ and MCWD's $0.53/m³. PPWSA's average tariff is $0.24/m³ and MWA's is $0.35/m³. This figure may vary from one street to another within the low-income area covered by the same utility, but it is also interesting to see the variation between utilities.

Cost of 10 m³ of Water

In terms of affordability of the first 10 m³ of water consumed, for all 11 utilities surveyed,[15] the charge varies from $1.60 to $4.00. This would seem to indicate that any affordability issues are associated with (i) the need for education about water demand, (ii) the higher block tariff consumption rate for shared connections, and (iii) additional charges for connection installments and sewerage services.

Anecdotal Interviews on Connection Fees, Tariffs, and Customer Payment Options

Connection Fees

- "MCWD should think long term. The customer will use water forever. So MCWD should be like the phone companies that give us a free meter and just charge for installation. That will bring more customers." (Cebu)
- "The connection fee is ₱4,900, but it can be paid in monthly installments after ₱1,500 is paid up front." (Cebu)
- "We are not connected to MCWD. Our neighbor is. People in the neighborhood who cannot afford to get an MCWD connection buy water from her at ₱3 per pail." (Cebu)
- "I used to pay my uncle ₱500 for water that I fetched from his place. Now we are connected to

[15] SAWACO in Ho Chi Minh City and VCWSE in Vientiane did not provide this information.

Manila Water (MWCI). I pay only ₱300 for water. We connected during a promo. I think the connection cost ₱1,000 in all, with no further installments." (Manila)

- "Many people, those who have their own meter, were offering to sell water to us. We didn't have our own meter because we didn't have enough money for the connection fee. Then a neighbor asked me to pay his disconnection fee. So now his water meter is connected to us. I pay ₱900, but that's for three families." (Manila)
- "We are in Tan An. The water is polluted, so all households in this area use piped water supplied by BIWASE. There is no charge for meter installation." (Binh Duong)
- "We used to pay D1 million (about $49) for a connection, but I have heard that connection is free now." (Hai Phong)
- "We have free connection. It's totally free. And we are very glad." (Hai Phong)
- "I think that free connection is a good development. Poor households don't have to pay for a connection. It is a relief for them." (Hai Phong)
- "The connection fee is about $100, but it can be paid in installments. We provide subsidies of 30%, 50%, 70%, or even 100% to poor families depending on how poor they are." (Phnom Penh)
- "PAM Jaya, through the governor, determines the tariff, but the new connection fee goes straight to PALYJA. Still there is not enough water and the quality is poor." (Jakarta)
- "Piped water is affordable. The connection fee can be paid in installments." (Jakarta)
- "Connection fee by installments is OK." (Jakarta)
- "The connection fee is Rp900,000 ($100), but it can be paid in 12 installments." (Jakarta)

The connection fee is a major constraint on service coverage. Viet Nam has shown the way by providing free connections. Now it's up to other utilities to follow its good example.

Tariffs

- "Is water affordable? Yes, it is. My water bill is ₱300 per month, the same as my cell-phone bill."(Cebu)
- "The pressure at my place is too high. There are many leaks that I cannot trace. I pay ₱2,000 a month so I'm sure there is a leak somewhere. The average should be around ₱400–₱500 per month." (Cebu)
- "I now pay only ₱200 for water from Manila Water. I used to pay ₱1,500 for a truck to bring water every day. We didn't know where the water came from. Sometimes it had sand in it, and even worms. Now the water is good enough to drink." (Manila)
- "In the past we paid ₱5 per container - ₱750 per month. Then we had to carry the water home. We could not drink it, so we had to buy drinking water. We now spend an average of ₱600 monthly, but we use a lot more water than before. And we can drink the water." (Manila)
- "We now pay ₱600 for two houses. We drink water straight from the tap. We were connected to the Metropolitan Waterworks and Sewerage System (MWSS) and the water was cheap, but when it rained the water became turbid and had a certain taste." (Manila)
- "People complain about their water bills because they cannot afford them, given their salaries." (Manila)
- "In the past only a few had legitimate water meters. So those without water were fetching it from those who had water. It cost us ₱1,500 a month for eight persons. Now there are four of us in the house and our bills range from ₱100 to ₱120 a month. Very cheap." (Manila)
- "We pay our landlord a flat rate of ₱600 for water. But for electricity we have a separate meter." (Manila)
- "We pay D200,000 ($10) per month for 30 m^3." (Binh Duong)
- "BIWASE has a policy of supporting poor households. Other households have the same water tariff. The tariff is reasonable." (Binh Duong)
- "The tariff is decided by the Binh Duong Provincial People's Committee. The school balances monthly expenses to make the payment." (Binh Duong)
- "There are four of us in our family and we pay about $7–$8 per month."
- "The tariff is affordable. We have no complaint. The quality of water and of the service is more important than the tariff." (Phnom Penh)
- "The tariff in the provinces is too high when compared with Phnom Penh's." (Phnom Penh)

- "PPWSA charges only KR770/m^3 but I have to pay KR4,000/m^3 as that is the price set by the house owner. So we consume only 3 m^3/month." (Phnom Penh)
- "Politicians say condominium owners charge higher water tariffs than MWA." (Bangkok)
- "Politicians say MWA could increase water tariffs to reflect the higher production cost and the inflation rate. Industrial users should pay more because they consume more." (Bangkok)
- "Tariffs are very low compared with the cost of bottled water. But now we also have to pay the filter cost."
- "MWA could raise the tariff." (Bangkok)
- "I heard PDAM Medan's tariff is the cheapest in Indonesia." (Medan)
- "I don't use PDAM as the tariff is too expensive. I use the well. But for cooking and drinking I use Aqua bottled water." (Medan)
- "The PDAM tariff is determined by the shape and size of the house. We use about 66 m^3 per month and pay Rp100,000 because there are seven people at home. We are lucky we are billed directly at home. It is very convenient." (Palembang)
- "The water is not 24/7, but I use water for only 1–2 hours each day. Our 24 m^3 for six people costs Rp62,450 per month." (Palembang)
- "PALYJA and the government need to educate the public. The public should know that decisions about raw water and the tariff are not made by the operator." (Jakarta)
- "We should compare our tariffs with those of other cities." (Jakarta)
- "The public thinks the tariff is decided by the operator, but really it's the governor's decision." (Jakarta)
- "The operator receives less than the amount contracted with government. That is why services cannot improve." (Jakarta)
- "The issue at the moment is the imbalance between the tariff and the service. They say our tariff is the highest in Southeast Asia and our service the poorest." (Jakarta)
- "People must be told that the government, not PALYJA, decides the tariff. Many people complain about the water tariff, mostly because they don't get enough water." (Jakarta)
- "We pay Rp35,000 ($3.80) for 10 m^3 per month." (Jakarta)
- "If good service is provided, people will pay the water tariff even if it is increased." (Jakarta)
- "People with very low income would refuse to pay Rp3,000 per m^3. But, on average, prices have not increased since 2007, and that is still reasonable in my opinion." (politician, Jakarta)

Customers do not mind paying high tariffs if they get good service and good-quality water. Politicians need to be better educated about what customers think.

Payment

- "There are not enough payment centers." (Davao)
- "I would like to pay the bill online, through the internet." (Cebu)
- "The service is very good. The staff who come to read the meter and collect the bill are always nice and friendly. I have no complaints." (Hai Phong)
- "We are usually not home, so the collectors have to come back many times, even in the evening, to collect the water bill." (Hai Phong)
- "The staff are nice and understanding. One time they came to collect the water bill, but I told them we didn't have enough cash and asked if they could come back later. They readily agreed." (Hai Phong)
- "PPWSA should bill us monthly, not every 2 months." (Phnom Penh)
- "Bill payment is easy now, not like in the past." (Phnom Penh)
- "We issue the bill every 2 months. Billing every month would almost double the cost. If customers don't pay after the second warning, they have to pay not only that debt but also a reconnection fee." (utility representative, Phnom Penh)
- "I always send my payment with the PPWSA staff who gives me the bill." (Phnom Penh)
- "I can also pay cash to the collector who brings the water bill to my home. I give the collector a small tip." (Phnom Penh)
- "In billing procedures, consider extending the period for late payment and arrears." (Bangkok)

- "It's good to have so many options for payment, including drive-through service and automatic deduction through internet banking." (Bangkok)
- "I have been using PDAM water these last 2 years. We like the door-to-door payment." (Palembang)
- "It is 24/7 water but I still store some water for the bathroom. I use 31 m^3 a month, which costs Rp84,230. There are five of us in the house. We always pay the collector at home at the time specified." (Palembang)

Now there are many more options for customer payment, including door-to-door and online payment. No utility needs to fail on this account.

Tariffs and the Urban Poor

The poor are better served through access to piped water than through global subsidies. The first consideration is to get them connected to piped water. And now Viet Nam has shown the way by eliminating connection fees and recovering costs through slightly higher tariffs for all. *Hike tariffs to help the poor:* this is in essence what is being practiced in Viet Nam. In other countries it is better for the unconnected urban poor to go to government and ask for a tariff increase (as has happened once in Manila) so that there are funds to connect them.

Affordability and Willingness to Pay

Water charges, installment charges for connection fees, and sewerage surcharges, in combination, may strain the limits of **affordability** for many customers. Here we can see the difference between a fixed charge, which the customer cannot control, and a variable charge, which the customer can control by using less water. Where the urban poor are concerned, all charges must be tied to metered consumption so that they retain control. Affordability and **willingness-to-pay** go hand in hand. The point to remember about willingness to pay is, *are other sources available to the people?* When the price of water gets too high, most people in Southeast Asian cities have other options. They can use the utility water only for cooking and drinking, and well or spring or river water or rainwater for washing, bathing, and cleaning. The anecdotal interviews show that people are already doing this.

Impact of Low Tariffs

The impact of low tariffs must be clearly spelled out for all stakeholders (but especially politicians). The urban poor are most affected, because low tariffs mean inadequate funds to extend services to them. But there are many other consequences, which when taken together, make a strong case for a sizable increase in water tariffs. Keeping tariffs low and subsidies high risks the sustainability of investments, jeopardizes operations, subverts official policy, hurts the poor, and leads to inefficient use of resources.

Risks to Investment Sustainability

- There are not enough funds to expand water supply, and especially to convert public taps into direct connections to help the poor.
- Assets are poorly maintained, so they depreciate rapidly.

Computerized customer service

Paying the water bill

- Investments from external donors, such as the World Bank or ADB, which increasingly insist on sustainable tariff policies, are less likely.
- Long-term dependence is perpetuated, and this interferes with the sustainability of investments.
- The customer is kept out of the driver's seat.

Risks to Operations

- Corners are cut in pumping hours and not enough chlorine is used for disinfection.
- Professional staff are underpaid, so O&M suffers.
- Water utility staff are demoralized.
- Finances are inadequate to address water losses in the system.
- Collection efficiency is lowered because the customer sometimes has to pay the same amount or even more for transport to pay the bill, and therefore decides not to pay it.
- The private sector is discouraged from participating in operations.

Risks to Official Policy

- The principle of full cost recovery, and thus all policy, is undermined.
- The water utility is continually denied autonomy. Government must always come to its rescue.
- Untransparent government subsidies are maintained.

Harm Done to the Poor

- The poor, relying on a surcharge on the water bill of existing piped water customers, are prevented from connecting to piped water.
- Inequitable subsidies benefiting the rich but not the poor continue.
- The objectives of connecting the urban poor to piped water and providing 24-hour piped supply to the home are ignored.

Inefficient Use of Resources

- Economic growth through stimulation of demand (as in Macau in the 1980s) is discouraged.
- Demand is not managed and the people are not encouraged to conserve water. There is no price elasticity of demand.

Decision makers must be informed of the consequences of keeping tariffs low. Official government tariff policy should be declared and its implementation closely monitored.

Political Perceptions and Willingness to Charge

More than any other single factor, it is often the reluctance of elected officials to increase tariffs that limits the quality and coverage of water supply services. Their reluctance to fund development directly from tariffs further constrains development. Some elected officials do not want to increase tariffs because the money trail runs through government; eliminating subsidies by raising tariffs means that it would not. The issue here is one of governance. This constraint on development is compounded by the reluctance of developing country governments to spend more than 5% of their development budget on water supplies.

When tariffs need to be revised, the utilities will prepare justifications and submit these to government for approval. Often, prompted by the highest elected authorities, they will put off the revisions, citing (i) coming presidential, national, provincial, or local authority elections; (ii) high NRW and other inefficiencies; or (iii) affordability issues involving the poor. In some cases, only a fraction of the tariff revisions sought are approved, undermining the morale of utility staff, perpetuating unnecessary government subsidies, and encouraging corruption. Above all, the urban poor are prevented from connecting to piped water, and intermittent water supply from becoming a 24/7 service. Tariff increases should be directly aligned to improved service, and this aspect should be pointed out to the public and monitored during implementation.

People, in many instances, are willing to pay, but the government is not willing to charge. Accountability for the implementation of government policies must be introduced. If this regulatory function is not formally pursued, it can be taken up by NGOs and the unconnected urban poor. Also, having the tariff revisions approved first by the customer can overcome the reluctance of the government to charge.

The anecdotal interview can help the unserved get connected and the served get better service. Essentially, it records the views of these stakeholders about their water supply without resorting to a formal interview with a questionnaire. A small sample of, say, 20

anecdotal interviews would enable the utility or the consultant to gauge the feelings of the people, as well as their constraints. Why 20? Statisticians say 20 is a statistically significant sample, provided they are not all from one location. The anecdotal interview comments included in this book are only a portion of what was obtained from these interviews, but their analysis offers much food for thought. Besides, if the consultant or the utility staff is unsure about some comments, more interviews can very easily be done. These interviews, ideally supplemented by full questionnaire-based and statistically relevant surveys on matters raised in the interviews, can convince politicians to approve a tariff increase.

Education of stakeholders is critical. Facts and figures are important. We need to know, for every household or business in the city, its sources of water, the quantity received, the quality of water, the reliability of supply, and the cost. The media can help disseminate the information. Supporting documents for tariff increases are often poorly prepared. These documents must (i) explain what the tariff increase will achieve, (ii) describe the consequences of not increasing the tariff, (iii) indicate the people's willingness to pay, (iv) trace the tariff increase to approved policies and plans, (v) compare the increase sought with that obtained by other utilities, (vi) go into the improvements in utility efficiency that will accompany the tariff increase, and (vii) compare the new water bill with other costs, like those of mineral water or cell phones or cigarettes. Recent findings indicate that the utility seeking a tariff increase is well advised to go first to the public (both served and unserved) to get its support, before approaching the politicians for approval.

"Water literacy (especially billing and other procedures) is the need of the hour. Water-literate groups can demand their right in a mature manner. Customers need to know their rights but also how to address complaints to the utility." (**Salma Sadikha**[16])

Estimation of Demand

Overestimated Demand

Initial demand is often overestimated. This was a common finding of two separate studies by the World Bank and the Asian Development Bank,[17] which evaluated 20 years' worth of water supply projects in developing countries. Why is this so? Before the project everyone already has some access to water. Of course, the access may not be the most desirable in terms of quantity, quality, or cost. But we are offering these people an improvement in their water supply, at a cost. (Price as a factor of demand is invariably overlooked.) We are not just offering an engineering design solution that says every person needs 150 l/c/d. Nor are we proposing a socioeconomic solution that allows everyone who wants to have piped water to connect. Despite the initial overestimates, demand will nearly always catch up with supply in the medium to long term. Moreover, given the promise of connection fee waivers in the future, initial overestimates of demand should not be embarrassing.

Demand in Europe

Water design engineers used to assume that development would mean more use of water. But why then is water demand in Europe below 130 l/c/d in cities? (See Table 8.1.) Environmental concerns are one reason, and the cost of production, treatment, and distribution, including power costs, is another. Still another important reason is the fact that the sewerage bill (often 60% of the total) is added to the water bill, but based on water consumption.

Price Elasticity of Demand

When implementing a tariff increase, the opportunity must be taken to carefully monitor the price elasticity of demand. Was demand reduced at all, or in any given category or price range, after the tariff revision? In the case of a block tariff adopted to penalize excessive consumption, monitoring is especially important to find out if the tariff is effective.

Income Elasticity of Demand

This may be even more important than price elasticity of demand. Different parts of the service area should be studied to determine the correlation between household income and water bill. If there is no elasticity or if it is low, then the possibility that the current tariff is sufficient to recover all costs as stated in the government policy should be considered. If it is not, the tariff may have to be raised to comply with policy.

[16] Salma Sadikha is a water champion of ADB. She is a social development specialist and a project manager in the Bangalore Water Supply and Sewerage Board in India.

[17] Asian Development Bank. 1994. *Sector Synthesis of Post Evaluation Findings in the Water Supply and Sanitation Sector.* Manila.

Table 8.1: Per Capita Consumption in Europe, circa 2005–2007

Country	Per Capita Consumption (l/c/d)
United Kingdom	150
Denmark	131
Netherlands	128
Austria	125
Finland	115
Germany	115
Belgium	107

Source: Environment Agency, United Kingdom. 2008. International Comparisons of Domestic Per Capita Consumption. Prepared by Aquaterra.

Factors to Consider in Estimating Demand

Domestic per capita demand, based on current consumption and not on the engineering textbooks, should be estimated. The estimates should take into account the effects of future price hikes, alternative sources of water, and the quality of service now provided by the utility.

The factors to consider in estimating demand are:

- Scarcity and quality of water resources,
- Quality and reliability of existing piped services,
- Availability, quality, and cost of alternative sources,
- Production cost of water,
- Water price and tariff structure,
- Current per capita consumption,
- Demand management, including the quality of plumbing in the home,
- Population growth,
- Service-level policy,
- Connection fee,
- Adequacy of customer metering,
- NRW, and
- Growth of industry.

Tariff Structures and Block Tariffs

The domestic tariff structure of four medium-size utilities (DCWD, PDAM Medan, PPWSA, and HPWSC) in 2012 is shown in Figure 8.6.

- PDAM Medan's tariff is very low and unstructured, so it cannot affect demand management.
- The PPWSA tariff has three increments, but the rate for 15–42 m^3 consumption is not high enough to affect demand management.
- HPWSC has one uniform rate set at a reasonable level ($0.24/$m^3$), but like the PPWSA and PDAM Medan tariffs, it is not effective in demand management.
- DCWD has an aggressive tariff structure but possibly one more increment than is necessary. For example, beyond 30 m^3 consumption, the rate could go directly to $0.70/$m^3$.

The domestic tariff structure of four large utilities (MWA, MWCI, PALYJA, and SAWACO) in 2012 is shown in Figure 8.7.

- PALYJA's tariff structure may be the most appropriate because it (i) caters to the poor who use up to 10 m^3, (ii) provides an affordable tariff up to 20 m^3, and (iii) has a much higher rate for use over 20 m^3.
- SAWACO's tariff structure is similar to PALYJA's with just three tariff rate increments, but it caters more to the poor with a low tariff up to 16 m^3.
- For MWA, it is hard to see how the two very small increments in rate for increased consumption at the lower end of MWA's (12 increment) residential tariff structure can make a difference in affordability or demand.
- MWCI with four increments perhaps has one too many steps. There is little difference between the rate for 0–10 m^3 ($0.20/$m^3$) and that for 10–20 m^3 ($0.26/$m^3$).

Most utilities do not analyze water bills to determine price elasticity of demand and thus provide some rational justification for the current tariff structure. Water availability, cost of production, climate, seasonal use, and varying customer needs, as well as property types, must all be considered.

Figure 8.6: Tariff Structures of Four Medium-Sized Utilities

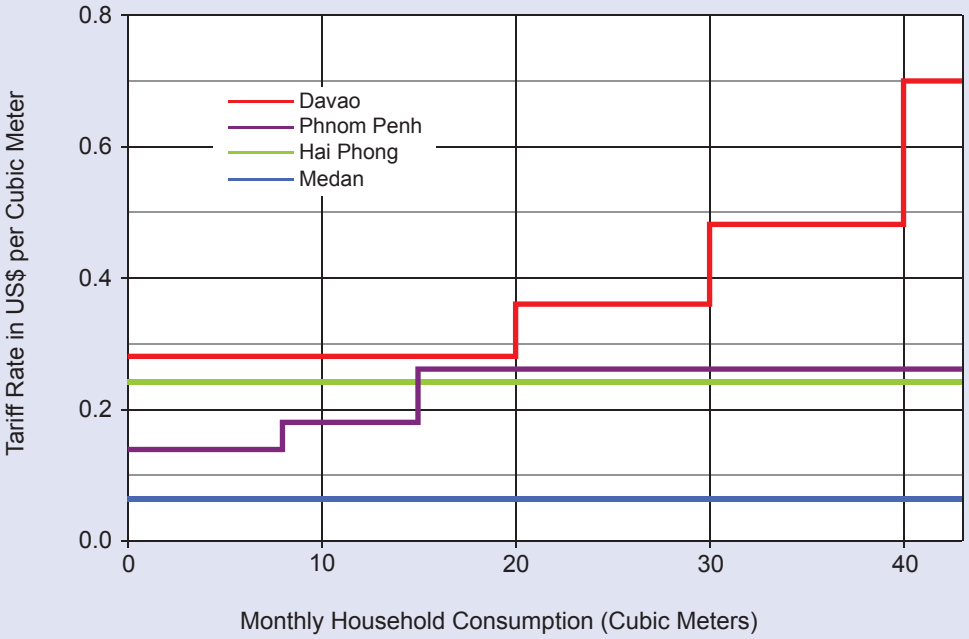
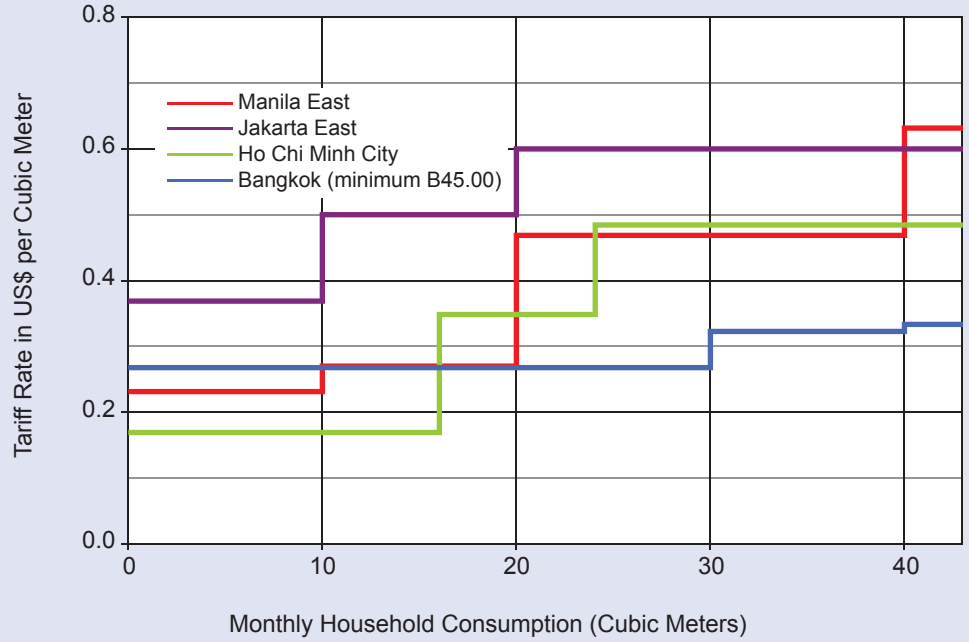


Figure 8.7: Tariff Structures of Four Large Utilities



Note: (i) $1.00 = ₱42.53, $1 = B31.00, $1 = Rp9,180.00, $1 = D20,500.00; (ii) for Ho Chi Minh City, it is assumed that there are four persons in each household.

Pros and Cons of a Rising Block Tariff

Although most developing countries readily accept rising block tariffs, there has been some opposition to these from economists, who assert the following:

- Lifeline rates are too low and include subsidies for the rich.
- Demand management through higher rates for high use is ineffective because the rates are too low.
- Block tariffs do not help the poor who are not connected to piped water.
- When the poor share connections they are charged at the higher combined volume rate.

Others counter these objections with the following statements:

- The range of household income in a city like Manila or Jakarta can vary from $500 to $50,000 or more. A flat-rate tariff would be too high for some and too low for others.
- The water bill for those who consume more than, say, 20 m^3 per month should be based on one rate for the total amount so as not to subsidize the rich.
- Use of over 30 m^3 per month can be billed at a flat rate of $5.00/$m^3$ to discourage high use. This rate should be widely advertised in the media and then strictly enforced in practice.
- The elimination of connection fees will go a long way to getting the poor connected to piped water. When connection fee installments are added to consumption charges, questions of affordability are raised. One could look at the connection fee waiver as a rental situation where the tariff covers a rental of all connections rather than a one-off fee for those seeking a new connection.
- It is recommended that the number of persons served by that connection be noted on each water bill, and that the water bill for a shared connection be adjusted to reflect it.
- Rising block tariffs are effective and fair. They are not perfect but they work well, are easy to implement and easy to communicate to customers, and are a pragmatic solution to a complex issue.

Subsidies and Cross-Subsidies

Very high subsidies mean the money trail runs through government, and governments can be inefficient or even unprincipled. This often explains the long delays associated with procurement for development projects.

Subsidies can be justified if they have a specific purpose, such as targeting the poor. But they must be transparent and time bound, and eventually phased out. Subsidies must be analyzed to determine who benefits. For example, the lifeline rate in a tariff structure often benefits all those connected, but not the very poor who are unconnected and pay much higher prices for vended water. This might be termed "subsidy leakage." Utilities must ensure that the lifeline rate is low (for example, not exceeding 10 m^3) and that consumption beyond 10 m^3 per month attracts the full cost recovery tariff for the entire amount consumed. The typical use of a low-income household is in the 15–20 m^3 range, (16 m^3 in the Case Study of Winnie in Box 5.2). Bills could be simplified by using a flat block rate reflecting the real cost of water with higher blocks to encourage conservation, and targeted subsidies for the identified poor.

Targeted subsidies for the poor are certainly possible in the Lao People's Democratic Republic (Lao PDR) and Thailand. The village headman knows and records all the poor. Water bills can be issued to all at a rate calculated to cover all cost recovery items, including subsidies, and poor customers can take their water bills to the local utility office and pay the subsidized rate after presenting a legitimate identity card. The subsidy is recorded in the billing system and then transferred to the accounting system, where it is aggregated each year for all to see. Subsidies should be simple and transparent. Targeted subsidies are common in India, where there is a computerized below-poverty-line (BPL) card system that is updated every 5 years and subsidies are paid directly into the beneficiary's account.

Sewerage is normally charged as a percentage of the water bill sufficient to cover actual sewerage O&M costs, but not capital costs. This is an efficient way of charging and it puts control of both bills in the hands of the customer, who can control consumption to some degree. Perhaps the only area that may legitimately

attract a subsidy from the government is the capital cost of sewerage. In most high-income countries the capital cost of sewerage and sanitation is subsidized or cross-subsidized. Even New York receives grant funds for that purpose. However, when a government gives a grant to a major urban water utility, all the taxpayers in the country contribute, but only a few in the city benefit. The same can often be said about sewerage development.

The two most common cross-subsidies are:

- From high consumption users to low consumption users; and
- From industrial users to domestic users.

In the future we hope to have one more cross-subsidy: from those connected to piped water to the unconnected urban poor—so that they may be connected.

Operating Ratio: A Guide to Subsidy

The operating ratio of a water utility shows how much subsidy it is receiving from government for development funding**.** PPWSA with its low operating ratio (0.37) gets little subsidy from government. On the other hand, PDAM Medan obviously needs a total subsidy from the government for development funding, given its operating ratio of 0.97.

If subsidies are to be transparent, such terms as O&M costs should be clearly defined. When we get into NRW, the line between O&M and development costs is rather blurred. It must be made clearer.

Connection Fee

As discussed in the chapter on service coverage, people wanting to connect to piped water endure many constraints, the biggest so far being the high cost of the connection fee. (See Table 8.2 for the connection fee in all 14 utilities studied in Southeast Asia.) New-connection fees in the $100–$200 range are out of the range of the poor, even when they are allowed to pay in installments. Next to the connection fee itself are other administrative requirements of connection (proof of land title, etc.), which prevent many from being connected. Of course, in some instances, utilities have benefited from shared household connections, which are charged a higher tariff rate. Viet Nam must be commended for its leg-

Table 8.2: Connection Fees of 14 Utilities

Utility Name/City	Connection Fee		Comment
	Local Currency	US$	
MWA/Bangkok	B5,750	181.90	
PPWSA/Phnom Penh	KR372,250	90.79	Subsidies for the poor of 30%, 50%, 70%, and 100%
VCWSE/Vientiane	KN1,587,000	198.92	
BIWASE/Binh Duong		0.00	Connection fee abolished
HPWSC/Hai Phong		0.00	Connection fee abolished
SAWACO/Ho Chi Minh City		0.00	Connection fee abolished
AETRA/Jakarta East	Rp1,194,502	126.98	
PALYJA/Jakarta West	Rp1,000,000	106.30	
PDAM Medan	Rp575	0.06	
PDAM Palembang	Rp1,100,000	116.93	
MWCI/Manila East	₱7,455	176.49	
MWSI/Manila West	₱4,100	97.06	
DCWD/Davao	₱3,000	71.02	
MCWD/Cebu	₱4,500	106.53	

islation abolishing connection fees and recovering costs through tariffs for all, over many years. It is time for other Southeast Asian countries (at the very least) to follow suit. (See again the anecdotal interviews about connection fees.)

"Packaging, appearance, service, status, and other things make people happy to pay. These things are not the 'basic need' itself. To survive, people need to fulfill their basic needs. But to justify paying, people use 'extra stuff." (**Anton Soedjarwo**[18])

Box 8.1: Water and Wastewater Tariff Structures in Singapore, Jakarta, and Manila

Water and wastewater tariff structures may not always be designed to meet local priorities.

Goals may be different for developed and developing cities, depending on local context:

- For **developing** cities: lower NRW, increase service coverage and reliability, ensure affordability to the poor and revenue sufficiency to meet O&M costs.
- For **developed** cities: address water conservation, shift toward cost recovery, ensure environmental sustainability, maintain financial health.

Recommendation for Singapore

- To increase revenue, opt for a different higher tariff rate for nondomestic customers.

Recommendations for Jakarta

- Rethink tariff structure based on floor area of house. It may not effectively represent poor households.
- Adopt a uniform tariff structure for all customers, with greater targeted subsidies for the poor.

Recommendations for Manila

- Simplify the tariff structure by reducing the number of tiers. Currently, there are 9 tiers for domestic and 33 for nondomestic customers.
- Give more focus to water conservation by providing greater information to customers in simplified form, promoting the use of water saving devices, and raising awareness.

Source: Sonia Ferdous Hoque and Dennis Wichelns. 2013. Are Urban Water Tariff Structures Designed to Meet Local Challenges and Policy Goals? Institute of Water Policy, National University of Singapore, ADB Water Conference, 13–15 March 2013.

[18] Anton Soedjarwo has headed the NGO Dian Desa, based in Yogyakarta, for more than 30 years. He has received numerous awards, including the Ramon Magsaysay Award in 1983 for community leadership and the Schwab Foundation Social Entrepreneur of the Year for Indonesia in 2007.

Chapter 9

Utility Management Basics

"Managing a water utility requires a lot of decision making. It may not be a good decision or the right one, but at least make a decision. Be proactive, not reactive. Considering that water demand is ever increasing, passivity has no place in a water utility." (**Rodora Gamboa**[19])

Introduction

This chapter examines the problems associated with managing urban water utilities in Southeast Asia. It identifies tariffs and autonomy as a key issue lead-

Sludge drying bed at WTP

Reading the water meter

Closure valve on water network

Clear-water tank

Clear-water pumps

[19] Rodora Gamboa is a former general manager of DCWD (Davao City) and now the director of the Maynilad Water Academy in Manila.

ing to secondary problems of staff management, governance, metering, NRW and intermittent supply. It looks at the management of development projects and of operations, and it identifies the difference between management and leadership.

Anecdotal Interviews on Utility Management

Utility Comments

- "We like the DCWD gender development program." (Davao)
- "Update as-built drawings and geographic information system (GIS) maps, and have close coordination among departments." (Davao)
- "Some enterprises in Song Than Industrial Park use a very large amount of water. Pungkook Saigon (a manufacturer of textiles, apparel, and luxury goods), for example, uses more than 1,000m^3/day. But the water supply is adequate and uninterrupted." (Binh Duong)
- "Besides laying water pipelines, Construction Joint Stock Company No. 5 also lays sewer lines, and is constructing two water treatment plants and one sewage treatment plant. With the support of BIWASE, all projects are making good progress. The works are completed on time and efficiently." (Binh Duong)
- "Water supply is uninterrupted. Water quality is according to government health standards. NRW in Di An Water Supply Enterprise is 8%." (Binh Duong)
- "The billing system here is computerized. The consumption of each customer can be monitored to see if it is normal, or too low or too high, compared with consumption over the last 6 months." (Phnom Penh)
- "I have to report to the customer relations office any customer who does not pay after the second warning." (Phnom Penh)

DCWD warehouse: a good public image

Cleaning and disinfecting the reservoir

DCWD utility vehicles

Rewinding well-pump motors

- "I am proud to be part of the PPWSA staff. Other utilities should take PPWSA as a model for their management and operation." (Phnom Penh)
- "PPWSA is appreciated worldwide for its rapid development and its high performance." (Phnom Penh)
- "Staff in MWA branches are very helpful in solving problems." (Bangkok)
- "Pressure should be higher so water reaches the third floor." (Bangkok)
- "MWA is better than other state enterprises, but we are still concerned about the possibility of privatization and higher tariffs." (Bangkok)
- "Both international and national consultants say that too many rules and regulations in MWA constrain their own staff." (Bangkok)
- "Politicians say MWA should seek new business challenges with foreign countries by helping developing countries." (Bangkok)
- "Utility staff want MWA to prepare to become an international organization and to lead the Association of Southeast Asian Nations (ASEAN) countries. MWA officers should learn English. MWA should adapt to the ASEAN Economic Community." (Bangkok)
- "Utility managers say MWA must adapt aggressively to a changing world. Constant improvement is necessary. In organization, the Petroleum Authority of Thailand is a good role model. MWA is not yet a first-class organization. There is still much room to improve." (Bangkok)
- "PDAM should tell customers if there are problems with the water. Sometimes the water smells and sometimes pressure is very low." (Medan)
- "I think the regulator should mediate between the operator and government, to make sure that the agreement is carried out. At the moment government is withholding money from the operator." (Jakarta)

DCWD customer meters

A typical MWA customer meter

Testing water quality in MWA laboratory

A water treatment plant

Customer comments

- "I am not aware that DCWD has a website." (Davao)
- "Service in Davao is very satisfactory, so there is no reason to privatize." (Davao)
- "Customers are disconnected only if they have unpaid bills for 2 consecutive months. But there is no written disconnection notice. There should be one." (Davao)
- "Our problem is how to change the name of the registered customer." (Cebu)
- "Staff of BIWASE are enthusiastic. When something needs to be resolved we call Di An Water Supply Enterprise and the staff come and settle the matter immediately, so we are very happy." (Binh Duong)
- "Di An Water Supply Enterprise has made a big effort to improve its services through regular meetings with the People's Council. The Di An radio broadcasts answer all queries of the local people." (Binh Duong)
- "Questions raised by local residents about access to piped water, water pressure, and construction progress are either answered over the radio or directly by the enterprise." (Binh Duong)
- "Local residents do not question the tariff or the connection fee. Those things are decided by the Binh Duong Provincial People's Committee."(Binh Duong)
- "Customer complaints are difficult to handle, especially if they are about consumption being much higher than normal. That is generally caused by leaks in the house." (Phnom Penh)
- "In the morning the water pressure is low." (Phnom Penh)
- "Customers are very happy with the MWA tariff and service in all respects." (Bangkok)
- "PDAM should be more responsive to the complaints of customers." (Medan)
- "We need a proper regulator between the government and the operator." (Jakarta)
- "We should use the bargaining power of customers to change things." (Jakarta)
- "We receive two main complaints from those who are connected: poor water quality and interrupted supply." (Jakarta)
- "Yes, we lack piped water. But first we must address the problems of low availability of raw water, deficient supply network, and inadequate system installation." (Jakarta)
- "We must teach the people not to throw garbage into the river." (Jakarta,)

Utilities must communicate better with their customers. They can use the bargaining power of customers to change things. A user-friendly website is a start. But they can also use the water bill to communicate better.

National Water and Sanitation Policies

Table 2.1 indicates that Viet Nam embodies its water supply and sanitation policies in laws, decrees, circulars, and decisions; Indonesia has no consolidated policy for urban water supply or sanitation; the Philippines has water acts, presidential decrees, and roadmaps, but no specific policy for urban water supply (although it did have a National Policy on Urban Sewerage and Sanitation in 1994); and Thailand's Department of Water Resources is responsible for the country's water policy.

Transparency

Everything begins with a transparent policy. There must be a government policy statement, to guide water supply services, and the statement must be displayed on the utility website, in all utility offices, and in a brochure given free to the public. At the very least, the tariff policy should be published. The policy statement, which should not be more than five pages long, should be reviewed once a year and revised if necessary.

Service Coverage and Service Level

The policy statement should mention direct connections; standpipe supply; water supplied by neighbors, water vendors, and SSWPs; bulk supply to communities; bottled water supply; and private wells and community wells. It should mention supply to informal settlements and to low-income communities and subdivisions. It should mention in-filling, or increasing service coverage in areas already supplied with piped water, as well as how service coverage on the perimeter of the city will be increased. It should set service coverage targets for the supply of piped water directly to the home. The total population of a city divided by

the number of water connections gives a good indication of the effectiveness of service coverage. Each connection is used by only three or four persons in Singapore and Bangkok, cities with good service coverage, compared with over 16 persons in Metro Cebu. Generally, high NRW correlates with low service coverage. The policy statement should mention how NRW saved will increase billed volume through more connections.

Phase out of Standpipe Supplies

This policy is very important and should not be left to chance. The victims of standpipe supplies are often the urban poor, who must wait in line under stressful conditions for their daily share of water. ADB and other funding agencies should strongly advocate the phase out of standpipe supplies.

Connection Fees

It is time for other Southeast Asian countries to adopt forward-looking legislation and policy like Viet Nam's, abolish the connection fee, and recover costs through tariffs for all. Meanwhile, the utilities should do a 100% survey of connected and unconnected persons, and their means of access to water. Every water bill should show how many are using each connection so that charges can be adjusted and those on shared connections are not penalized with block tariffs for high consumption.

Sanitation and Sewerage

Will all areas be sewered and will sewage be treated before discharge into an approved water body? Or will only certain areas be sewered, so that the rest must rely on on-site sanitation using septic tanks? What is the policy for sludge collection from septic tanks? Is that a public or a private activity? In which areas are pit latrines allowed? What is the policy for community sanitation facilities? Does sanitation development offer scope for a strong partnership between the mayor, NGOs, and the community? What about sanitation in schools—is there a policy for that?

Cost Recovery and Tariffs

Is it government policy to recover only O&M costs from tariffs or is the government intent on full cost recovery, including all debt servicing, and on direct investment from tariff revenue? A water utility, for which tariffs are the life blood, must consider this policy the most important of all. Perhaps the policy can be couched in terms of the operating ratio. The lower the ratio, the more autonomous the utility, and the more development it can fund directly from tariffs. An operating ratio of 0.50 implies that half of the tariff revenue goes to O&M costs, and half to development costs. PPWSA, for one, already has an operating ratio of 0.37. The tariff policy should also specify how tariffs can be adjusted regularly to comply with the policy.

Subsidies

Subsidies must follow certain rules. They must have a clear rationale. They must be transparent. And they must be implemented only for a limited time and eventually phased out. Direct subsidies commonly paid by government to the utility include part or all of development costs. More often than not, cross-subsidies—from nondomestic to domestic tariffs, from high to low consumption, from water to wastewater tariffs, from those connected to those unconnected, from urban to rural areas—are really direct subsidies. Transparency demands analysis to determine who is benefiting from the subsidies. Often the rich benefit, when the first 10 m^3/month of consumption is at a concessionary rate, for example, or when nationwide taxes pay for sewerage services for the rich people in the cities.

Service to the Urban Poor and Social Engineering

All water utilities in developing countries must take a proactive approach to social engineering and the provision of piped water to the homes of the poor. They should spell out their policy for serving the urban poor and set up a special unit with qualified sociologists to implement that policy.

Small-Scale Water Providers, Water Vending, and Resale of Water

We know about the SSWPs and water vendors who are in the business of transporting and selling water. We know that someone with a connection can sell water to a neighbor or barter water for goods or services. What we need here is a clear policy statement. For example, the price of water from utilities to SSWPs and vendors could be regulated, but not the SSWPs and vendors themselves. These should simply be registered and their service, especially their source of water and area covered, should be monitored and made public. A connected customer who sells water to an unconnected neighbor should not be penalized with a rising block tariff.

Private Use of Groundwater

Uncontrolled use of groundwater by both domestic and nondomestic users has caused water resource problems in many cities in Asia. All users who extract groundwater with motorized pumps should be licensed and their extraction metered. What can't be measured can't be managed. The government can have a policy for making these people pay for water that belongs to everyone and not just a few. The policy could state that if public supply is available, then people must connect to that supply and not extract groundwater except through hand-pumped tube wells.

Demand Management and Water Conservation

Good-quality water is no longer readily available to all. Therefore, we must see to it that water is used wisely. People should not use more water than they need and can afford to pay for. A system must be in place to limit the amount of water wasted in the home. Intermittent water supplies must be eliminated. Those who use more than the normal requirements must pay progressively higher tariffs.

Staffing, Training, and Institutional Development

Water utility management must be independent of outside interference in staffing appointments and staff must be qualified and trained for the functions they are expected to perform. There must be a policy regarding staff salaries. PPWSA staff receive salaries comparable with those in the private sector, as well as bonuses for good performance. Dedicated staff who perform as they do deserve such salaries and bonuses. These are not just any government employees. These are professionals who should not be judged by the number of hours spent at the workplace but on the basis of utility performance against targets. The corporatization of utilities like PPWSA has allowed them to provide competitive compensation. With respect to institutional development, twinning arrangements and the participation of consultants should be addressed. There must be a policy for the use of contractual staff, stating, among other things, why, when, and how they are to be hired. The training of consultants and contractors should be part of this policy.

Outsourcing

Depending on the size of the utility and its locality, some activities may be outsourced to allow the utility to focus on its core business activities, provided that outsourcing yields appropriate efficiency gains that benefit both the utility and the customers. The outsourced activities may include vehicle maintenance, meter repair, pump maintenance, service installation, repair of leaks in the distribution system, security services, and cleaning services. Recently there has been debate about whether meter reading should also be outsourced. Generally no core activity (such as meter reading) should be outsourced, but acute staff shortage or improprieties within a utility may warrant temporary outsourcing. Furthermore, strict quality control is required when outsourcing. PPWSA tried outsourcing but could not find the necessary level of expertise and service, so now all activities are done in-house.

Private Sector Participation

Private sector participation (PSP) is a hot topic and very political. If PSP is involved, a regulator must first be appointed. The issue with PSP is the often unrealistic expectations of what it can deliver and the unrealistic allocation of risks. The softest forms of genuine PSP may be a service contract and a management contract, in that order. Build–operate–transfer (BOT) and build–operate–own (BOO) arrangements for the production of treated water in bulk for a utility have been popular. The issue here is the take-or-pay provision, which must be agreed on so that the utility and the private contractor both get what they want. In Asia, only one of the four concessions in Manila and Jakarta might claim success in PSP (with a second now headed in the right direction). Still, governments should send clear signals to prospective private operators through policies that unequivocally state the government's position on the use of PSP in the water supply sector.

Corporatization and Autonomy of the Utility

Governments that support a policy of corporatizing utilities should say so and give the reasons for that support. Corporatization confers more autonomy, keeps finances ring-fenced, and promotes a culture of accountability and efficiency. ADB's Operational Plan 2011–2020 supports it.

Nonrevenue Water

Governments must publish their policy for reducing NRW and follow that up with regular pronouncements on the levels of NRW, the number of households that could be connected if NRW were reduced to a reasonable level, and the possible effect on tariffs.

Intermittent Supply

Government policy should make it very clear that intermittent water supply is in no way an accepted means of providing potable water to the people. The objective of 24/7 water should be targeted for individual zones to start with and the target area gradually expanded to include the entire water distribution network. The achievement of 24/7 objectives should be both time bound and area bound. Perhaps those with 24/7 supply should pay a higher tariff than those with intermittent supply. The utility should include in its annual report progress in eliminating intermittent supply.

Utility Performance and Reporting

Every utility should set performance targets for itself and give an account of its progress in meeting these targets in its annual report. Performance can be benchmarked against that of other Asian utilities or against the utility's own performance over time. The targets should not be too many at the start. The following eight parameters will be sufficient to indicate the overall health of the water utility:

- Population of the city,
- Volume of production,
- Number of connections,
- 24/7 water supply (percentage of connections),
- Level of nonrevenue water,
- Average tariff,
- Operating ratio, and
- Collection efficiency.

Procurement, Consulting, and Contracting

The government should have clear policies and rules for procuring goods and services, but it may follow the policies of the external funding agency. Why do procurement, contracting, and consultant contracts take so long to be awarded? Bureaucratic inefficiencies are the main reason. And so we go back to tracing the money trail. If the operating ratio is close to unity, the utility management has little influence over procurement decisions. But if revenue from tariffs funds most of the development, then the utility can have its say and expedite development. Policies that include the parallel implementation of contracts with transparent competition will speed up development.

Utility Regulation and Policy Implementation

Too often governments produce policy statements to satisfy funding agencies, only to forget about them once the loan is approved. This is where the regulator comes in. The regulator should monitor the implementation of government policy and report on it to the public at least once a year.

Demand Management

This section relates demand management to domestic, commercial, and industrial uses of water. The focus, however, is on water for domestic use. In this context, demand management means control of water use.

Benefits of Demand Management

Water conservation. If demand management can defer new source development, governments will have funds to spend on other urgent developments.

Efficient use of water**.** Emphasis on demand management will focus attention on reducing nonrevenue water and programs to reduce intermittent supply.

Equitable use of water. Customers should have the right to consume a reasonable amount of piped water at a reasonable cost. Those still unconnected should be very few. Those who are already connected, on the other hand, should use water wisely.

Minimal cost to the customer. Poor customers who have to pay more than $150 to be connected are forced to stay unconnected and to buy water from a vendor or to share a connection with a neighbor. The unit rate of shared water is typically about 50% higher than the cost of water from an individual piped connection.

Management at the lowest practicable level. Good demand management is not possible without water distribution management at the lowest practicable level. Details about every customer, including plumbing, average water use, and number of people using the connection, must be known.

Stakeholders with Vested Interests

Several stakeholders in water supply with vested interests may or may not be interested in demand management.

- The government and politicians should be interested in demand management because if existing users were to practice it, more people could be connected. The government must state its demand management policy and integrate it with its other policies, including those on private sector operators, tariffs, and connection fees.
- The regulator should be interested in demand management because it must monitor government policy, protect customers, report to the public, and involve civil society (media, academe, and NGOs). In the case of private operators, who are regulated by contract, the regulator must see to it that demand management principles are written into the individual contracts.
- The public operator has a vested interest in how demand management translates into more efficient operations through a reduction in NRW and intermittent supply and through plumbing assistance to customers.
- The private operator may have little interest in demand management because profits depend on the volume of water sold. For this reason the operator will not generally be interested in helping the customer fix leaks in home plumbing or supportive of efforts to conserve water by installing rainwater tanks. Neither will the operator be inclined to give every customer a separate connection, because water from connections shared between neighbors sells at a higher unit rate.
- The customer has a vested interest in keeping water charges low and therefore fixes the plumbing and is careful not to waste water.

Low-income customer washing pots under a running tap

Who Takes Action?

The existing state of affairs in the field must be ascertained and analyzed to provide the regulator and the government with facts and figures that they can use as a basis for action. When the utility is privately operated, demand management must be initiated by the government, the regulator, civil society, and the customer.

The Customer and Demand Management

General. Customers are mainly interested in the service level and the water bill. A good service level means an individual piped connection to each household, 24/7 supply, and good-quality water. The water bill should be equitable, that is, the charges should not be fixed but should be based on customer consumption. If wastewater charges are included in the bill, they should be tied to the water consumption instead of being fixed charges. The water bill should reflect efforts to conserve water in the home.

Connection fee. Connection fees, as discussed, are often too high and prevent the poor from having individual connections. When the poor must buy water from a vendor or share a connection with a neighbor, the unit rate of water is significantly higher. There are two possible solutions, one temporary and one permanent. Where one connection serves two households, for example, two bills should be issued for the two sets of consumption. But this is only a temporary solution. A more permanent solution is free connection and cost recovery through tariffs paid by all customers.

Consumption. On the Gold Coast in Australia per capita consumption is normally around 120 l/c/d. In European cities it is only about 110–130 l/c/d. In

Manila, Philippines, per capita consumption averages around 116 l/c/d without demand management, and closer to 75 l/c/d with some demand management. Phnom Penh's average consumption of 170 l/c/d (according to the street survey) is clearly too high and may reflect the low tariff.

Education of customers. The wide range of consumption values revealed in both customer surveys in Manila shows considerable scope for demand management. First, good plumbing in the home should be assured. Second, wasteful habits of using water (washing clothes or dishes under a running tap, for example) should be avoided. This is why shared connections should be officially recognized and treated as more than one connection for tariff purposes. Customers must also read their own water meters regularly. Sudden high consumption may mean a leak in the internal pipework.

Transparency. The water bill must be kept simple, and the service level and tariffs must be easily understandable to customers. Wastewater charges should be based on consumption and on the recovery of the operating costs of wastewater collection and treatment. The operator should report annually to the public on operations.

Good data and analysis. There is an old saying, "If you can't measure you can't manage." One area that needs much more attention is the monthly analysis of water bills. Feeding the data from water bills into a computer and trying to uncover anomalies is not good enough. What is needed is for the caretaker to manage at the lowest practicable level (maybe 500 connections per caretaker) and to analyze the bills and follow up on any anomalies in the field.

Financial Sustainability of the Utility

Water utility managers always say that the financial sustainability of the utility is the first requirement. This means that all O&M costs, including debt service, must first be met from tariffs. Later, as the utility matures, some development can be financed directly from tariffs. This must be mandated in a policy statement available to everyone. It should be on the utility website. Financial sustainability is tied to autonomy and the ability to manage without government or political interference. Ring-fencing the utility as a corporation is one way to get started on the road to autonomy.

Managing Development

Development Objectives

These objectives should reflect the policy of the government, especially in regard to service to the urban poor, service coverage, and service levels, and should be reflected in time-bound action plans. The starting point can be the population served per connection and this figure should be reported each year as a measure of progress. But eliminating intermittent supply should also be a top priority. There should be a master plan, as well as a 5-year development plan, to guide development. As the anecdotal interviews show, Southeast Asia needs timely source development.

Designs and Specifications

Most countries have national standards and specifications. Although tenders are based on these standards, however, the awarded contract may not implement those standards. This is very important, because it is where corruption hits development hardest. Skimming off the top of contracts has an effect far greater than the money taken. Materials and construction will be substandard, and infrastructure that is meant to last 40 years may fail or deteriorate after just 5 years. The answer lies in starting with relatively robust estimates and supervising construction very strictly.

Sources of Funding

Sourcing funds for development is an issue. The government and the utility must consider various sources of funding: local bonds, a share issue on the stock exchange (for the private sector), a grant from government or an external funding agency, or a loan from an external funding agency. A source that is not often used, because it requires an independent utility management, is tariff revenue in excess of that needed for operation and maintenance. Only a few well-run large utilities have revenues in the tens of millions of dollars to fund expansion internally. Many small and medium-sized utilities cannot fund investment directly from accumulated revenues. Infrastructure is usually financed over many years (typically 20–25 years) to minimize the impact on tariffs.

The Local Water Utilities Administration (LWUA) in the Philippines supported the bigger utilities for financing, but not the smaller ones. Donors like ADB could work more with the banking sector to help smaller utilities get long-term credit. But government and utilities

cannot keep borrowing for development. There has to be an endgame and a decreasing operating ratio is part of that endgame.

Time Is of the Essence

Why does it take more than 8 years to complete some water supply projects funded by multilateral institutions? We know that bureaucracy has a great deal to do with this. Time is of the essence, especially for the people waiting for piped water. What is the sense in talking to a community about its willingness to pay for piped water when the water will not be delivered for at least 8 years? It can also take years to recruit consultants and award large supply or construction contracts. In the 1980s many ADB-financed water supply and sanitation projects were implemented in the Republic of Korea and the average implementation time was 3–4 years. Perhaps there are lessons to be learned from those days.

Quality Control and Construction Supervision

The development that is executed must be sound and robust and must last its entire design life, despite corruption. This is the most important thing. Only very strong quality control and construction supervision can assure this. Experienced international experts should be considered for this work and paid well so as not to be tempted or coerced by the contractor into approving substandard work. In all foreign-assisted projects local staff should be trained in the professional approach to construction supervision. Contractors must also be trained and development agencies should assist in the training. Perhaps this issue should be addressed by the industry itself with appropriate support from development partners. The industry may also benefit from an increased emphasis on construction supervision in the civil engineering curriculum of universities.

Managing Operations[20]

Managing People

Strategic analysis and planning. Strategic analysis answers three questions: Where are we now? Where do we want to go? How will we get there? Answering these questions will involve (i) considering external influences, including growing customer demand, public or customer needs, availability of resources, economic situation, politics, laws and regulations, and compliance with standards; (ii) considering internal influences, including people, money, training, and equipment; (iii) comparing the organization with others, especially those in the same industry (benchmarking); and (iv) analyzing strengths, weaknesses, opportunities, and threats (SWOT).

Functions of water supply utilities. Functions are groups of actions that belong together for one reason or another. They are the building blocks of the organization. The mission statement, overall objectives, and strategic analysis lead to functions. Some common functions relating to water supply are:

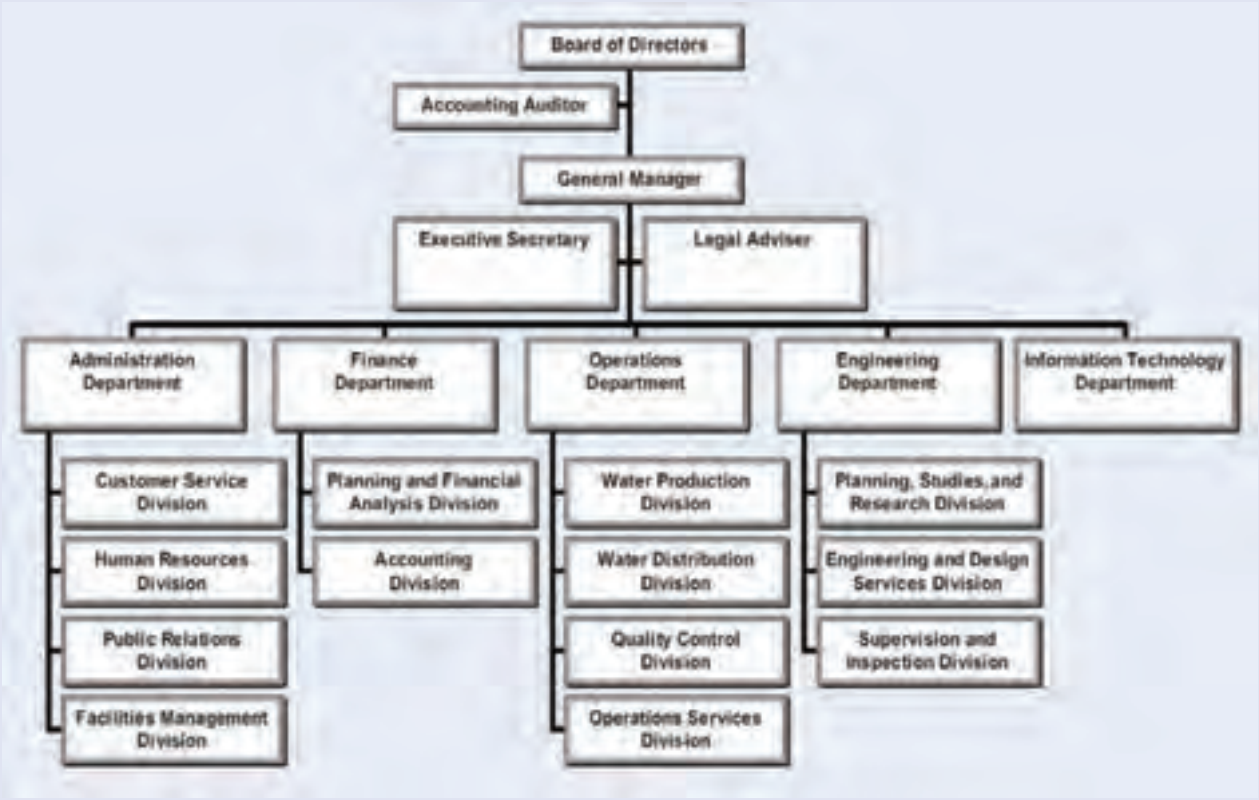
- Operations (production and distribution);
- Administration (human resources, public relations, customer service, and materials management);
- Business management (accounting, billing and collection, and financial planning and management); and
- Technical (research and development, quality control, and information systems).

Organization chart. Without an organization chart it would be hard to trace reporting relationships and responsibilities, and how functions work together. The chart (see Figure 9.1 for a sample organization chart for a water utility) is about functions and not about people. The general manager strategizes, plans, organizes, leads, reports, represents, and controls. The department director plans, organizes, leads, reports, and controls. The division manager plans, organizes, implements, reports, and controls. The section supervisor implements and controls. The foreman implements and controls. The workers implement. A manager should never manage too many people. This management principle is not always observed. Some say the optimum number of people under a manager is four; others say, six. On the other hand, managing just one or two people is also not desirable.

Capacity building. Assessing the capabilities of staff against organizational functions will show whether they can do the job or require training. New staff may have to be hired. If the need is only temporary (as for project implementation), contractual, instead of permanent, staff can be hired.

[20] See also Nancy E. Barnes and Abdelkarim Asa'd. 2003. *A Challenging Experience in Organization Development: A Guidebook.* Jerusalem Water Undertaking and GTZ.

Figure 9.1: Sample Organization Chart of a Water Utility



Note: Wastewater operations, if included, would be part of the operations department.
Source:Nancy E. Barnes and Abdelkarim Asa'd. 2003. A Challenging Experience in Organization Development: A Guidebook. Jerusalem Water Undertaking and GTZ.

Managing Water

Accounting for water. Accounting for the water going into the distribution system and for its use, wastage, or loss is one of the most important operations of any water utility. It requires a fully metered production system, as well as fully metered customer use.

NRW reduction and management at lowest practicable level. Once NRW can be measured or accurately estimated, the next step is to reduce it to manageable levels. Managing the system at the lowest practicable level is the only proven method of NRW reduction. This means managing in hydraulically isolated zones with as few as 500 connections. NRW reduction can be implemented as an operation activity or for a short time as a project activity. But whatever low figure of NRW is achieved it has to be sustained at that level. And that is a task for operations.

Water pressure and 24/7 supply. These go hand in hand. Indeed 24/7 water might be defined as continuous positive pressure in the distribution system. But 24/7 water alone is not good enough. The minimum water pressure must at least raise the water without pumping to the second floor of a building. In a developing country this is good enough. In a developed country, however, there would need to be at least 6 meters of residual pressure at the customer meter. Pressure gauges can be attached to fire hydrants so that the pressure can be monitored throughout the day. Fire hydrants cannot fight fires if the distribution system does not have 24/7 water. Intermittent water supply is not acceptable. Valve turning to rotate the water supply under intermittent supply conditions encourages bribery and corruption.

Water quality. The utility operations unit must keep its eye on water quality. The quality of water as it leaves a treatment plant is generally up to stan-

dard, but the quality of water at the customer tap can often be compromised by external contamination, especially if supply is intermittent. Sometimes the distribution pipes have been contaminated with silt or unsanitary water so that they are permanently damaged and need total replacement. Water quality tests at the customer tap, under intermittent supply, will only show how bad the water quality is. Every attempt must therefore be made to eliminate intermittent water supply. After 24/7 supply is attained and sustained, water from the tap of the customer should be carefully and regularly monitored. Anecdotal interviews with customers can also keep the utility vigilant about water quality. There must also be a proper laboratory at the treatment works, with qualified and trained staff for water quality control.

Managing Money

Metering, billing, and collection. Why meter some consumption and not other consumption? Why meter 95% of the system and yet have only 60% of those meters recording flow accurately? If a job is worth doing it is worth doing well. The aim should always be 100% customer metering with meters that are all working properly and accurately. Meter reading must be efficient and accurate, and accountability must be built into the system. Area supervisors should report on the billing each month and take steps to correct problems. Water bills should be easy to pay and several methods of payment should be made available to customers.

Accounting for money. Some water authorities in developing countries have annual turnover of more than $100 million a year but no professionally qualified accountant on their staff. Development funding agencies must take a harder stand on such basics. Cashbook accounting must be replaced with accrual accounting, which provides more checks and balances. Internal auditors must compare the average water bill on the customer's side with the average water bill reported by the utility.

Records and mapping. Many utilities do not have good records and maps of their pipework. These records and maps are important, especially for asset management and NRW reduction. With today's GIS and global positioning system (GPS) capability, there is no excuse for not having good records. Every leak repair presents an opportunity to update the size, depth, material, and location of pipes and connections.

Energy efficiency. Today we are concerned about global warming and energy use. Water utilities often use a great deal of power and many pumps do not operate at optimum efficiency. The water utility operations should undergo an energy audit every year and the results should be made available to the public. Most inefficiencies relate to groundwater pumping, where poorly developed wells and falling water tables pose continual problems. Energy efficiency is particularly important for utilities in areas with expensive electricity supplies and old equipment, as the savings in electricity will allow relatively quick recovery of equipment replacement costs.

Managing the Community

General. Water customers are the public served by the utility. They must be carefully managed. The water utility is there to serve the people. They must know what sort of service they are entitled to receive and have access to a complaints department in the utility that responds in a timely manner. School groups

Testing water quality at MCWD

Sharing knowledge in Kuala Lumpur

Customer water meters

MWCI customer water meters

Annual report cover

can be taken on a tour of the treatment works. There should be good cooperation between the education department and the water supply enterprise. Customers must be told in advance about shutdowns for maintenance.

Anecdotal interviews. This is a quick way of ascertaining in a generic manner community satisfaction with public services. Twenty persons representing those with piped water connections at home and twenty representing those with no connection are interviewed. They are asked first if they wish to talk about their water service or the lack of it. Their anonymity is assured, but their words are recorded and analyzed. If necessary, the interviewees can be prompted to talk about things like connection fees, tariffs, water quality, or reliability of supply.

Social engineering and unit for the urban poor. Water is a basic human need. Water supply is not just about engineering or financial matters; it is also about social values like discrimination against the poor in receiving piped water and about willingness to pay and affordability. Every water utility should have a unit dedicated to serving the urban poor and facilitating their connection to piped water, to cut through bureaucracy and minimize costs. The unit should also assist customers in resolving billing irregularities and potential disconnection issues. A qualified social scientist or sociologist should head the unit.

Facts and figures from the field. A water utility in a major city must obtain complete and up-to-date facts and figures from the field, about all people and businesses connected to piped water, as well as all those not connected—number of persons in each

household or business, location (now by GPS), source of water, quantity of water used, quality of water, cost of water, and reliability of supply. These figures should be made available in summary form to the public annually. They will highlight the real service coverage and real service levels in the city.

Annual report. Every water utility must produce an annual report containing not only its audited financial statements but also an account of its operating efficiency and its development works. Such a report should show comparative figures for the last 10 years, so any improvements are evident. Of course, the annual report must be timely. It must be released not later than 6 months after the end of the reporting year. It should also be posted on the utility website.

Utility website. Every self-respecting water utility now has (or should have) its own website. But the websites are vastly different from one another. An organization like the Southeast Asian Water Utilities Network (SEAWUN), if given the right support, could work for the standardization of reporting on a few key parameters such as population, production volume, number of connections, status of 24/7 supply, NRW, average tariff, operating ratio, and collection efficiency. This way every website can be unique, but it can share common reporting features with other websites to allow comparisons of performance. An example of a very good utility website is PPWSA's.

Handling of complaints. Complaints received by a water utility are usually of three main types: (i) no water, (ii) bad water quality, and (iii) billing problems. The utility must see to it that the customer is able to communicate these complaints to the right person, who can resolve these issues as quickly as possible. All complaints lodged, and the action taken and when, should be recorded. This record should be reviewed by management at least monthly and management actions should be made part of the record.

Plumbing assistance in the home. Demand management and water conservation should concern every water utility. Newly connected customers in particular should be educated about the proper use of water, so they do not waste it. In areas where water is scarce, the water utility may regularly inspect internal plumbing in the home for leaks, or at least promote greater awareness through education and public promotion campaigns. Often the float valves on toilets and overhead tanks do not work normally, and a great deal of water is lost. Utility staff inspecting water bills should be alert to higher consumption in any home. Utilities can provide customers with plumbing assistance and washers for taps at cost. MWA was one of the first utilities to embrace the concept of water management after the meter.

Education of customers. Every year the utility should run water education programs in the schools, in the community, and in the media (such as TV and radio). These programs can cover hygiene education, sanitation, solid waste management, and water conservation. Amnesties can also be offered to those who reveal illegal connections.

Chapter 10

Improving Management

Water Operator Partnerships and Capacity Building

Capacity building can take many forms. It is not just about training. It is also not just about the developing-country "recipient." When two parties get together to share knowledge, each one is building capacity. They can learn from each other. International people know about many countries. Local people know a lot about their own country. If each has respect for the other they can both learn. Regular workshops dealing with topics suggested by the developing-country utility, national consultants, or local government are helpful.

Water operator partnerships (see special article that follows) are now a good way to go. What is important is that the capacity-building program is not ad hoc or left to chance. It should be planned for implementation over a number of years (even 10 years is not too long). Long-term funding support, especially from a bilateral agency, is very good in building the long-term relationships and trust needed for capacity building.

Water Operator Partnerships by Michael White

Definition. A water operator partnership (WOP) is the twinning of a weak water utility with a strong water utility to improve performance through peer-to-peer knowledge transfer. The partnership can be between two utilities in the same country, or between a utility in a developing country and one in a developed country, or between two developing-country utilities.

History. Ad hoc partnerships have been around for 20 years or more, but Asian Development Bank (ADB) support for these partnerships began in earnest in 2006. Since then, about 65 partnerships have been created. The US Agency for International Development (USAID) also implemented a WOP program for 5 years, in close collaboration with ADB, but that program closed when program funding ended. Since 2006, ADB has allocated around $5.3 million in aggregate to this form of capacity building, and the funding has come mostly from Japan but also from the Australian Agency for International Development, ADB's Water Fund, and the Pacific Region Infrastructure Fund.

Objective. The benefit to developing-country utilities has been capacity building through direct access to successful utility experience and international best practice. For the developed-country utility, it is training for its staff in community social responsibility, and exposure to different practices and new business opportunities. For governments, the partnership means better performance of the water sector. For ADB, it means good relationships built in the sector for ongoing business opportunities. It creates demand from other developing country utilities for more water operator partnerships.

Partners. The developing countries involved have been from all over Asia and the Pacific, but the predominant demand has come from Southeast Asian countries including, Cambodia, Indonesia, the Lao People's Democratic Republic, Myanmar, Philippines, Thailand, and Viet Nam. The rationale here is that it is better to improve those who are already starting to do well so that they get stronger and are able to become expert (or mentor) partners themselves in the future. Even from within Southeast Asia, there have been a number of expert twinning partners, including the Indah Water Konsortium in Malaysia, the Provincial Waterworks Authority in Thailand, Binh Duong in Viet Nam, the Phnom Penh Water Supply Authority in Cambodia, and Manila Water in the Philippines. In Indonesia and Cambodia, partnerships between domestic utilities have been supported. The developed country participants have come mostly from Australia, Japan, Netherlands, New Zealand, South Korea, and Spain.

Scope. The nature of the activities undertaken has focused mainly on reducing nonrevenue water, to satisfy a significant demand from industry, but has grown

to include many other aspects of water utility management including water quality, asset management, and sanitation.

Time frame. On average, the timeframe for each partnership has been 18–24 months. Typically the expert partner makes about four visits to the recipient partner, for a total of 80–120 person-days of input, and the recipient makes one reciprocal visit of about 40 person-days to the expert partner. The timeframe is limited by the financial assistance available under the WOP program.

Costs. Each partnership can cost up to $50,000, and this amount covers only expenses such as travel, transport, and per diems. No remuneration is paid to the expert utility, which provides its staff input for free. Sometimes the recipient partner will contribute local transport. The program provides only for capacity building, and not for equipment.

Results. Almost invariably, the response from both recipient and expert utilities has been, "Can we do more?" Typically senior and middle management staff from the expert utility participate. Language has not been a great barrier as a common operator business language is used, meaning, it is two hands-on practitioners getting together. Consultants are not involved. Of the 65 partnerships created so far, only one early partnership failed.

Conclusion. The main lesson learned is that a water operator partnership is a very cost-effective means of capacity building. There is "buy-in" by management on both sides because of the very high value for money. The partnership is certainly demand driven on the developing-country side. But ADB must look after the expert partner in particular, because they are the ones providing the free expertise and extensive utility-based knowledge and practices.

Future considerations. The ongoing WOP program goes up to 2015, and most likely beyond. More recently, attention has been given to helping the recipients prepare outline strategic development plans that would ensure the sustainability of the partnership benefits and provide the operators, ADB, and other donors with a potential pipeline of loan and technical assistance projects. This may lead to paid input of utility experts in both the project preparation technical assistance and loan stages of ADB projects, not to replace consultants, but to provide specific utility-based management and operating expertise.

Public–Private Partnerships: What Has Worked, What Hasn't, and Why

Concessions in Manila

The Manila Water concession covering East Manila was launched as one of two concessions in Manila in 1997 in response to a declared water crisis. It may have been the easier of the two concessions,[21] partly because it was smaller and partly because it was not so greatly burdened with past foreign debt. The Asian financial crisis meant that little money was invested in the early years, but Manila Water concentrated first on improving efficiencies and later on reducing NRW. To a large extent, this meant that the effects of El Niño were not greatly felt, as water recovered from NRW was used to supply new connections. Then with time and a proven track record, Manila Water was able to launch an initial public offering on the stock exchange and acquire an extra $100 million for investment in infrastructure. Shareholders and staff who acquired shares in the company benefited greatly from a major increase in the share price over those years. One can conclude that Manila Water seems to have been the only truly successful "privatization" in the water sector in Asia in recent times. Only now, however is this concession beginning to address its mandate for sewerage.

Maynilad, the other concession, was mired in very heavy NRW (over 60%) for the first 10 years, and this was exacerbated by indifferent company management. Only in the last 5 years, with the restructuring of the company, has NRW been addressed (now down to 35%) through partnership with a private international firm to establish the world's largest NRW reduction program. Significant progress continues to be made and this concession is beginning to show signs of success, but it has not been easy.

Concessions in Jakarta

Unlike the Manila concessions, which were awarded after public bidding, the two concessions in Jakarta were awarded under negotiated contracts in 1998. The awards were made to Suez Lyonnaise des Eaux and Thames Water. Local partners originally joined these concessionaires but later relinquished

[21] Both concessions were joint ventures of local companies with international companies, with the latter having the so-called expertise in water utility management under private operator guidelines.

their shareholdings after a change in government in Indonesia. Neither of these two concessions has had responsibility for sewerage (unlike those in Manila), yet they have appeared to perform poorly. At the core of this poor performance is a battle over source development, high NRW, low collection efficiency, and a failure of the regulator to increase tariffs. One might refer to this as a classic but complex chicken-and-egg situation. Of course, the urban poor continue to suffer greatly by having to rely on water from vendors with high unit prices. The service coverage of 11–12 persons per connection is poor. Very strong local management is the biggest difference between the Manila and Jakarta concessions: those in Manila have it, while those in Jakarta do not.

Concession in Bangkok

During the Asian financial crisis (1997–1999), the International Monetary Fund and the Thailand government put much pressure on MWA in Bangkok to privatize, but the utility resisted this by taking a long, hard look at itself and becoming very much more efficient. It cut its NRW down from 40% to 30% and, among other things, devoted a lot of its efforts to good customer relations by taking an interest in water service beyond the water meter. Its service coverage of four persons per connection is surpassed only by Singapore PUB among the large Southeast Asian water utilities.

Build–Operate–Transfer Contracts

BOT contracts have been promoted in Southeast Asia, primarily for the construction of new production and treatment facilities. However, the take-or-pay contracts had early teething problems. Ho Chi Minh City in 1997–2000 was at the center of early controversies in this field because it failed to construct a new distribution network to use the capacity created at the source. Later contract negotiations, forced by public pressure, resolved these issues.

The Case of BIWASE

BIWASE in Binh Duong, Viet Nam, is an interesting experiment in public–private partnership (PPP) that in 2012 was just getting under way. In addition to water supply, it is also responsible for sewerage, and it has its own contracting firm and consulting firm. This arrangement addresses the issues of timeliness and government bureaucracy and red tape. So far, however, its progress has been slow because many people in its service area already have their own wells. Therefore, BIWASE is undertaking an aggressive marketing campaign to increase piped water connections.

Why Public–Private Partnerships?

Less Bureaucracy and Red Tape

One thing that holds back development is the time it takes to implement a development project (8 years on average in water supply) because of rules and regulations, both on the government and on the donor side. The private sector is not constrained to the same extent by red tape. The sector can be monitored and judged on results. But it can take several years to set up a PSP operation and keep it working until it lives up to its promise.

More Efficiency

Governments are not renowned for running businesses because most of their staff are not trained that way and there is no corporate culture to support it. When public utilities are corporatized or the private sector is involved, operating efficiency becomes more likely. Indeed, if the private sector were inefficient, it would not make much profit.

More Funds for Development

This was a major reason for considering the private sector at the start. But ironically, the large international companies did not bring that money in the end; strong domestic companies did. If one utility has to be responsible for both water supply and sanitation, then it will undoubtedly help if the private sector is involved.

Autonomy of Operations

This is still one of the main reasons for involving the private sector in developing-country water supply. Its contract keeps operations at arm's length from day-to-day involvement by government.

Principles to Follow in Public–Private Partnerships

A precondition to introducing any private sector concession is having a competent regulator set up before the contract is awarded. Otherwise, the performance of the concessionaire cannot be monitored effectively.

Good Management Skills

What Ayala Corporation and Tony Aquino brought to the Manila Water concession was good management of people, money, and water as a business. The human resource culture was perhaps the most important of all. The result is staff who are proud of where they work, because they know they are diligent and do a good job.

Domestic Leadership and Exit Strategies for Internationals

Strong domestic leadership is important because the company must know the local culture and what motivates people. It would be naive to assume that the company can work outside the bounds of local politics, so the ability to get the job done in the context of local politics is also important. International firms may bring the necessary technical skills, but they should ideally have an exit strategy for getting out of the business after they build capacity.

Tariffs

Whether water supply is managed publicly or privately or by the two sectors together, without the freedom to have tariffs that enable financial viability, the company will not work. However, a note of warning: despite very high tariffs, service in Jakarta is low and the companies do not even take care of sewerage.

Contracts Based on Policy

The Manila and Jakarta concessions are regulated by contract, but the regulator in both cities is not strong. It is better to make the contracts reflect government policy. If that policy needs to change, then the contracting parties can agree on a revised contract.

Transparency and Accountability

All utilities, whether public or private, must report fully and transparently to their public every year. The information should have a timely release (not more than 6 months after the end of the financial year) and should also be found on the utility website.

Regulation

Regulation by contract makes the regulator a mere contract administrator, instead of a true regulator. Whatever its role, however, it is good to have a regulator, if only as a focal point for the public to vent their complaints. In the Manila concessions, pressure from the public has led to some good results. For example, the idea that a concession provides only bulk supply, and not distribution pipes and connections, to a national housing subdivision was challenged and overturned. We should continue to pursue the ideal of an independent regulator for both public and private operators.

Service to the Poor

Despite its public relations campaigns, the private sector has a mixed record of service to the poor. The large number of shared connections has allowed the sector to obtain more revenue from the block tariff system. Improvements in real service coverage could start with a dedicated unit in the utility to serve the urban poor, and a free-connection policy.

Water Conservation

If the private sector makes more profit as it sells more water, then one has to wonder what incentive it might have to conserve water use and to help people save water in their homes. It may not be in the private operator's contract to guide the customer in using water "beyond the meter," but in a developing country with a high proportion of urban poor it is a corporate social responsibility of the operator to do so.

Management Contracts

Manila Water recently completed a management contract to reduce NRW in Ho Chi Minh City. The company learned a great deal about the local culture and how to do business in Viet Nam. Now it is back in that city to put the lessons learned to good use under another NRW reduction management contract. This time many more local people will be hired.

To reduce NRW, there is much to be said for different management contracts with the private sector for different hydraulic zones, operating simultaneously. If there are incentives as well as competition and the work is monitored and reported well, only good can come out of it. Management contracts, rather than concessions, may be the way to go for the private sector in the future. But at the core of the decision will be appropriate and sustainable tariffs.

ADB Approach

ADB's Water Operational Plan 2011–2020 calls for greater private sector participation. ADB needs to promote water, wastewater management, and sanitation as a business. Programs and projects that mobilize the private sector may have priority over others.

ADB assessed PPP in Cambodia in July 2012. PPP can help the government meet the financing gap by stimulating private sector investment and financing for infrastructure. It provides a means of improving efficiency and service delivery to users and gaining access to new expertise and technology, thus reducing the annual costs of infrastructure to the government. A PPP is a genuine partnership between the public and private sectors in which risks are shared. It is a contractual agreement between the government and the private sector. Under a PPP arrangement the private sector agrees to provide infrastructure and related services in exchange for project revenues and government support. A recommendation of the ADB assessment was the need to view the PPP process as a long-term strategy rather than a short-term quick fix.

More specifically, ADB can provide (i) technical assistance and grants for developing projects; (ii) loans and grants for project design and implementation; (iii) assistance in reforming the sector; (iv) assistance in training and capacity development; and (v) assistance in building institutions.

Leadership and Management

Ek Sonn Chan

There is a difference between leadership and management, and in developing-country water supply it is epitomized by one man who has stamped his mark on the industry. Ek Sonn Chan of Phnom Penh in Cambodia has developed the Phnom Penn Water Supply Authority far beyond what others thought possible. In the 1990s he accepted funding assistance from ADB and the World Bank, as well as from the Japan International Cooperation Agency (JICA) and the Agence Française de Développement (AFD), but now most of the development is funded out of tariff revenue.

Ek Sonn Chan clearly had an end game that included the autonomy and independence of his water authority. He fought and beat high-ranking politicians (who thought they did not need to pay their water bills), because he had the support of government at the highest level. He paid good salaries to his staff. He never stopped learning. He reduced NRW from more than 60% to just 6% in 15 years. His success was built on (i) management restructuring—promoting young dynamic staff to the front line, moving older, inefficient staff into dormant roles, and promoting staff on the basis of quality and results; (ii) culture change—setting a good example from the top, working hard and getting well rewarded, applying incentives and penalties, being fair, being firm and having faith, and encouraging a team spirit; and (iii) a self-reliance program—upgrading skills through training and sharing of experience, lowering NRW, maximizing bill collection, and ensuring that tariffs could meet costs.

An e-mail sent by this author to Ek Sonn Chan, requesting eight pieces of information on the performance of the Phnom Penh Water Supply Authority, was returned the same day with the information sought. Small wonder then that Ek Sonn Chan was awarded the prestigious Ramon Magsaysay Award in 2006 for his contribution to government service and for excellence achieved in his chosen field.

Tony Aquino

Tony was the president of Manila Water for most of the first 12 years of its existence. He led and managed from the front, and ran what is perhaps the only truly successful privately run water supply concession in the developing world. A modest man, Tony even credits Ek Sonn Chan for some of the ideas about NRW reduction that he implemented for the concession serving 6 million people, in the process bringing down NRW from 60% in 1997 to just 20% by 2008 (and 11% in 2011). He introduced the concept of zonal management. Each of his managers at one time was responsible for a zone with as few as 500 connections. On a scale never before seen, he adopted the concept of total pipe replacement for beating NRW.

Tony implemented full accountability among his staff. Every week he would oversee their performance meetings in person. He inspired his staff by going out into the field and working alongside them. One Sunday morning, at a time when water bills in an area were difficult to collect, he said, "Come, let's do it together." And they did. In the wake of the Asian cur-

rency crisis, he did not spend much money on development but concentrated on becoming efficient. Then when the financial outlook improved, he was able to obtain $100 million from the share market to move ahead with development.

Leadership and Management

Leaders inspire people. They are dynamic individuals, strong and courageous and prepared to take risks. Leaders push the envelope and try new ways of doing things. Managers, on the other hand, do what has been set out for them to do, maybe reaching for higher and higher targets but not necessarily breaking new ground.

Innovations in Management

General

Managing an urban water utility in a developing country is not easy. Many forces—political, financial, technical, environmental, social, economic—come to bear and balancing these is a challenge. Innovations in water supply management are not common. Most things have been tried before, but what is new is trying them in a new environment. The following are some important activities that have surfaced in the last 10 years.

Zonal Management

An international water conference in Dublin in the 1980s concluded that water should be managed at the lowest practicable level. This means dividing the distribution into zones that can be hydraulically isolated so that NRW, in particular, can be measured and controlled. During the late 1990s this concept was introduced by Manila Water, the Phnom Penh Water Authority, and MWA in Bangkok. The size of the manageable zone was reduced step by step, and now a zone has as few as 500 connections. When a zone is this small, the *caretaker* or manager has little difficulty knowing about everything in that zone, including water leaks, high and low users of water, the name of every family, the number of people per connection, illegal connections, and water available from other sources like neighbours and vendors. The caretaker or manager can thus advise management on development, rehabilitation, and operating matters within the zone. The caretaker is not a policeman but a member of the community helping the other members whenever he can.

Anecdotal Interviews

The water and sanitation sector in developing countries is only just beginning to discover that powerful tool that is the anecdotal interview. It costs very little and takes very little time to complete. But its results can be the starting point for new developments or for radical improvements in operations. Every year, the utility, through its social engineering department, should carry out at least 20 anecdotal interviews in different areas where people receive piped water from the utility, and another 20 interviews among people who are not directly connected to piped water from the utility.

The anecdotal interviews will be mostly with the heads of households. Each will last about 10 minutes, and what is said about the water supply now and in the future will be recorded. Problems and solutions should be explored, but as there will be no structured questionnaire and anonymity will be guaranteed, people will be encouraged to express their honest views. The transcripts should then be carefully summarized and analyzed to highlight the issues and potential solutions.

Social Engineering

For so long, water supply development and operations were ascribed solely to engineering. Now environmental, financial, economic, and social matters are being addressed in integrated management. Of all these, social engineering is the most important but still receives the least attention. A social engineering unit should be established in every water utility and more women should be encouraged to be engaged in and possibly lead these units. Such units can address customer complaints, affordability and willingness-to-pay issues, disconnections, illegal connections, water vending, and sale of water by neighbors. These units can help the urban poor get connected to piped water. They can also work with the NRW reduction teams to control water pilferage.

Weekly Accountability

There is no use setting a person a task to do if no one checks how well the job was done. Was it done on time? Was it done within budget? Manila Water has taught us the value of a weekly management meeting that reviews the performance of staff in the field, especially in terms of collection efficiency, NRW reduction, new connections, and increased billed volume. Unfortunately, for many Asian utilities accountability is not a

strong point even if it needs to be. Accountability must be accompanied with good remuneration, benefit and incentives packages for staff, and career development opportunities at all levels.

Integrated Staff Development

This means hiring young college graduates every year and putting them through on-the-job training in all the main departments of a water utility over a period of, say, 3 years, then working with them on their chosen career path until they gain more experience. It means giving every professional a chance to participate in national, regional, and international seminars, workshops, and conferences. It means encouraging promising young professionals to do research and write papers on new findings from the field. It means recognizing the experience of "old hands" and getting them to pass this on to the new generation. It means recognizing the functions of a good water utility and ensuring through recruitment, training, or reorganization that there are enough people to perform these functions. Once again, Manila Water is a champion of this style of management.

Design–Build Contracts

The biggest single issue in development is the time it takes to implement a project. When people are desperate for piped water, will they be happy waiting 8 or more years to get it? The award of large consulting, supply, or construction contracts can delay projects. So one way to potentially speed things up is to consider awarding design–build contracts—not necessarily one large contract, but a number of smaller contracts that optimize the use of construction and consulting resources in the country, and at the same time provide competition and transparency in performance. This solution could be appropriate when many small towns are to be developed and works can be ring-fenced. However, as more contracts will result in more administration and bureaucracy, appropriate contract packaging strategies must be developed by experienced project and contract personnel to ensure the most efficient balance.

Connection Fee Amortization

Another big issue that has been swept under the carpet and stayed unacknowledged for so long is the connection fee for piped water. This is part and parcel of the service coverage issue. The proportion of the population receiving piped water directly from the utility must be monitored and progress on this front must be a top priority. Connection fees in Southeast Asian utilities, which often range from $50 to $200, are an impediment to the poor getting connected to piped water. The good example of Viet Nam can be followed and connection fees abolished.

Full Pipe Replacement

Total pipe replacement has been shown to be an effective tool against high NRW, in both Manila concessions. We know that the move is cost effective if we start with NRW of 60% in a given zone and end up with just 5% after total pipe replacement. But is it prudent? In other words, could the results have been achieved without total pipe replacement? And will the high NRW not recur?

If we do not know for sure what is causing the NRW in the first place (illegal connections or the illegal sale of water could be the cause), we cannot be confident we have beaten the problem of high NRW in a sustainable manner through total pipe replacement. So yes, this is an effective tool, but it is also the most expensive and disruptive option. Care must therefore be exercised. This approach may not be effective when NRW is 30% and you want it reduced to 10%.

Chapter 11

Success Stories in Management

"Success in a utility comes from good staff, good internal standards, a passion for accomplishment, and hard work." (**Tony de Vera**)

The Manila Water Story
by Perry Rivera

Caught in a Vicious Cycle

In the mid-1990s, Metro Manila's water sector was trapped in a vicious cycle. Decades of underinvestment had led to poor water and wastewater services and low coverage. As a result, the government was unable to increase its water tariffs because customers were unwilling to pay and collections were poor. This situation translated into very low cash flows for the government, thus further worsening infrastructure underinvestment in the sector.

The following facts and figures show the dismal situation during those times:

- Only 26% of the 3.1 million customers of the Metropolitan Waterworks and Sewerage System (MWSS) at the time had access to 24/7 water.
- System losses clocked in at almost two-thirds of water produced, or close to 1,000 million liters per day. This is the same as saying that for every 1 cubic meter sold to the public, 2 cubic meters were lost to either physical leaks or pilferage.
- A measly 3% of customers were covered by sanitation services.
- Efficiency-wise, MWSS employed 9.8 employees per 1,000 connections, or two to seven times more people than other major Asian capitals.

Fortune in Misfortune

Philippine President Fidel V. Ramos (1992–1996) embarked on a reform agenda for Metro Manila's water sector as part of his larger vision of reaching "newly industrialized country" status for the Philippines by 2000. The focus on the National Capital Region had an obvious reason: its activities contributed an average of 30% to the national economy from 1990 to 1995.

Mustering the needed political support, Ramos was able to urge Congress to pass the National Water Crisis Act of 1995, which sought to involve the private sector in providing the financial resources and operational know-how that would help reverse the years of underinvestment and poor efficiencies in Metro Manila's water and wastewater systems. After public bidding by MWSS, Manila Water won a 25-year concession for the Metro Manila East Zone. The East Zone was a defined geographic area with 23 cities and municipalities, including 6 in Metro Manila and several towns in Rizal Province, and an estimated population of 6 million.

A Model on Which Fortune Can Build

The public-private partnership between MWSS and Manila Water had three objectives:

- To improve the delivery of water and wastewater services to existing customers in the East Zone;
- To increase efficiency in water and wastewater operations; and
- To expand water and wastewater coverage to areas still unserved.

The concession agreement adopted a "regulation-by-contract" regime, where most activities normally regulated by an independent regulatory agency were instead laid down in a clear and detailed manner

under a contract. This approach ensured that the balance never tipped in favor of either the operator or the general public. The contract had built-in features of proper utility regulation at the outset, providing a stable and predictable regulatory environment—a basic requirement for sustained private investment in major public infrastructure projects.

The concession agreement was performance based. It was outcome oriented, with the concessionaire obliged to achieve mutually agreed service and efficiency targets.

- Formula-based tariff setting limited the discretion of regulators and politicians.
- On being awarded the concession, the concessionaire was obliged to absorb former MWSS employees, ensuring a smooth transition to private sector operations and job security for the former government employees.
- MWSS retained ownership of the water and wastewater asset base. Any additional assets invested in by the concessionaire during the life of the concession were to be turned over to MWSS at the end of the concession period.
- Disputes between the concessionaire and MWSS were to be resolved via arbitration. A panel was to be created for the purpose under concession agreement rules, and its decision, once issued, would become binding on both parties.

Paving the Road to Success

A corporate transformation—a change in how the operator managed its resources to achieve the most optimal outcomes—was required. Willful and directed organizational change was the key, and every facet of the organization had to change. From being "reactive and complacent," the workforce had to be "proactive and responsible" for this to happen. The company therefore pursued a strategy for developing its key assets—its employees—through a three-pronged program. It had to decentralize, incentivize, and train and develop these employees.

Decentralization entailed empowering every employee, regardless of rank or position. Each one was expected to take charge in his or her assigned area of work. In return for taking on these responsibilities, the employee was either rewarded for accomplishments or penalized under a system of performance-based

High-density polyethylene pipes for transmission mains

Constructing new transmission pipeline

Constructing a water intake

incentives, in which performance was measured in terms of actual output or outcome against targets set at the start of each calendar year. To complement this system, a comprehensive training and development program was rolled out to further develop the leadership and technical skills the company needed to continue improving over the long term.

Most notable of these achievements were:

- Over $1 billion in investments since takeover;
- About ₱5.7 billion in MWSS debt serviced by the end of 2011;
- Nonrevenue water reduced from 63% in 1997 to 11.2% by December 2011;
- 1,133 million liters per day (mld) of potable water delivered to the East Zone as of December 2011, compared with only 440 mld in 1997;
- 99% coverage of 24/7 potable water supply for 6 million customers in 2011, versus 26% for 3.1 million customers in 1997;
- About 3 million more customers served in the East Zone, more than half (about 1.7 million) of whom came from poor households that used to rely on poor-quality vended water at rates up to 20 times higher than those charged by Manila Water;
- Improved operating efficiency, as evidenced by the reduction in the number of employees per household connection from 9.8 in 1997 to only 1.3 in 2011;


Laying 220 mm high-density polyethylene pipes


Daytime construction of transmission mains

- Consistent "very good" rating from Manila Water's customers in the public assessment of water services since 2008;
- The lowest water rates among the country's top metropolises, at a mere ₱8 per cubic meter (m^3) for low-income families;
- Highly competitive tariff rates for average East Zone residential customers, at only ₱20/m^3;
- Ever-improving corporate financials, from a net income of negative ₱38 million in 1997 to ₱4 billion by the end of 2010; and
- Global recognition of performance, as evidenced by the numerous awards and citations from various local and international institutions.

The Roadblocks Ahead

The next big challenge for Manila Water lies in environmental sustainability, particularly wastewater. Now that water supply coverage is reaching completion, there has been a shift toward expanding wastewater coverage in Metro Manila to deal with the ever-worsening water pollution. But wastewater operations cost much more than water supply operations. Manila Water is forced to find innovative solutions to this pressing problem, while keeping tariffs affordable to the residents of the East Zone.

Box 11.1: A Successful Small-Scale Water Provider in Manila

Elsa Mejia began as a housewife whose husband was in the business of constructing large steel water reservoirs and drilling wells for water in small towns and municipalities in and around Metro Manila. She had a strong desire to help the poor get piped water.

Starting in the 1990s the family company Inpart Waterworks and Development Company (IWADCO) invested some $350,000 over a 5 year period to serve 125,000 people in low income communities with piped or hose connections. IWADCO could not get loans, so the investment money was obtained from relatives and friends at an interest rate of 5% per month. With such a punishing interest rate it was important that the company completed all works within six weeks, so tariffs could start defraying interest expenses and repay principal as quickly as possible. If this had not been possible, IWADCO would have gone broke very quickly. IWADCO was able to deliver piped water to the people on a 24/7 basis soon after appraisal of the community needs.

The operations hinged on partnerships forged with communities and local governments. Management contracts were signed with local governments building on whatever water supply system was in place. The company offered to operate, improve, and expand water supply facilities at no cost to the local governments, who also got a share in the gross income of the project.

In 2007 Elsa became the President of the National Water and Sanitation Association of Small-Scale Water Providers. It now has hundreds of members and is growing stronger each year. Already her success can be measured by the fact that her interest rate for obtaining investment monies has come down to 3% per month. The trust and good deeds built up over 20 years are now bearing fruit and investors are coming to her.

Source: *Elsa Mejia, President of IWADCO and President of The Philippine National Association of Small-Scale Water Providers.*

Night-time construction of transmission mains

Box 11.2: Water Sector Reform in Bangkok

The Metropolitan Waterworks Authority, or MWA, is a large state enterprise that provides water supply to the Bangkok metropolitan area, as well as to the provinces of Nonthaburi and Samutprakarn, covering a total of more than 3,000 square kilometers. At present, MWA has approximately 2 million connections and a net annual profit of around B4,000 million, even though the price of water has remained unchanged for the past 10 years. The impact of the Thai financial crisis of 1997 was severe and lengthy, not only at the national level, but also for every organization and household.

The privatization of state enterprises as a means of combating the financial crisis, was proposed by the International Monetary Fund and supported by the Government. MWA was one of those state enterprises that were earmarked for "privatization". As Governor of MWA I decided in the first instance to use this as an opportunity to strengthen the organization and improve the performance of MWA staff through building values, more pride in their work and team spirit. Staff contributed their ideas for reforms through monthly meetings and in turn we educated them about many aspects of privatization. The building stone was showing the linkage between MWA customers and the government. We needed to get our customers on board by providing better services and developing a good healthy relationship with them.

A multi-faceted reform program was implemented that included:

- Setting up work standards and assessing daily and monthly performance, and replacing overtime pay with a system of incentives.
- Putting in place accountability measures and a time frame at every working level. This was gradually shortened with time.
- Modernizing operations and improving efficiencies as part of restructuring the MWA branch offices.
- Streamlining and simplifying MWA procedures.
- Offering services to customers beyond the meter point in dealing with internal leaks and water quality issues.
- Computerization of many procedures including online services to our customers.
- Introducing easy payment of water bills at convenience stores.

Looking back, I now see the financial crisis in 1997 as a blessing in disguise. The restructuring of MWA might not have occurred had we not been forced by the crisis to overcome the challenges of privatization. At the end of the day we averted being privatized, partly because we reformed ourselves, but also because we and others in government recognized that water is not a goods to be bought and sold, but a national resource not only for the health and welfare of the people, but also a vital part of national security.

Source: *Chuanpit Dhamasiri, former Governor of MWA, Bangkok.*

Chapter 12

Governance

"Unless urban water governance practices are improved significantly, universal access to clean drinking water will remain an unachievable dream, even if billions of dollars of investment are provided with no strings attached." (**Ek Sonn Chan**)

Introduction

The statement above is not an exaggeration. Governance is that important to our future water supply. But what do we mean by "governance"? Governance has to do, first of all, with enforcement of the law and accountability, transparency, and implementation of government policy. It also means having the knowledge, ability, and autonomy to practice sound management. In developing countries, low tariffs that allow governments, and not customers, to be in control are at the core of such problems as low service coverage, lack of demand management, and conflict among water users. Decoupling tariffs from the political process should be at the core of all governance objectives. However, high NRW, a symptom of poor governance, can also be reduced without increasing tariffs, as was done in PPWSA.

ADB's water policy suggests that governments have to modify their role. They have to move away from being service providers and become regulators. Most DMCs make their service providers more autonomous and accountable through a phased program of reorganizing existing agencies or creating new enterprises. In Lao PDR corporatization is slow to take root because it is so different from what the water agency has been used to. The law must hold water service providers and resource managers accountable for their performance relative to the standards set.

The allocation of water to high-value uses is a matter of economic accountability, and ADB will support the DMCs in developing appropriate methods to improve allocative efficiency. Externalities, especially social and environmental, will be considered in the allocation. Promoting the participation of public, private, community, and NGO stakeholders is a key element of this policy. Transparency will be most effective when governments make timely information about water policies and projects available to the general public and clarify their rules, regulations, and decisions for the sector.

This chapter explores governance in the context of operations and projects. It invites readers to take another look at the problem and solution charts at the end of the chapter to see why governance is both a core problem and part of a core solution.

Operations

One of the most important considerations in utility operations is autonomy to run the utility efficiently and competently. In many cases, however, elected officials interfere in attempts by utilities to exercise autonomy when setting tariffs to recover costs, and become overly involved in daily utility operations to the extent that they control management, replace heads of utilities on political grounds, and control utility staffing. Because many utilities are not allowed to pay their professional staff at market rates, the quality of their personnel suffers. They try to run $100-million-a-year businesses without competent and qualified accountants, and they predictably fail to perform.

Some elected officials also interfere in the granting of new connections, and prevent disconnection for unpaid bills. They keep new connection fees high, thus encouraging illegal connections and the large bulk-water users these connections serve. They have also been known to allow syndicates to control water supplies to the poor, who end up paying many times the unit rate paid by the rich for water. Officials can profit from the purchase of utility water

by vendors, and some condone free groundwater use by major industries. They often use their influence to get access to 24-hour supply for themselves, while most other people must put up with intermittent supply. Some officeholders insist on distribution network extensions in violation of hydraulic design standards, causing interruptions in water supply.

Transparent government policies on tariffs, service levels, operator performance, and incentives are lacking. Policies are unknown to customers, and tend to change to suit the current political climate. Without such policies, governments and utilities are not held accountable for their performance.

In some water utilities, the management of human and financial resources is weak. The lack of skilled staff in these areas may be due to civil service rules and salaries. Job descriptions are nonexistent in many cases, and promotions are often based on age, length of service, and personal connections and not on merit. So, there are few incentives for staff to perform well.

Interestingly enough, these institutions have many highly educated technical and engineering professionals, but in the climate of low autonomy, accountability, and transparency, and indifferent management, their skills largely go untapped. O&M is a poor relation to development in the absence of incentives, and low tariffs do not help. So valve operators, meter readers, and new-connection teams can often collude with customers to create their own incentives. Utility staff sell water from the system informally to SSWPs, thus increasing the apparent water losses. Meters are not replaced even when they no longer work properly. Annual reports on operations, which could easily be produced 6 months after the financial year, often become official only about 2 or 3 years later, when they are no longer of much use to the public in responding to performance. Customers become so used to poor service, in fact, that they tend to regard it as normal.

High NRW, intermittent water supply, and low service coverage are direct results of the lack of autonomy and accountability, and indications of poor governance. Part of the governance problem lies in having a single entity as owner, regulator, and operator. Self-regulation can work only in a highly disciplined society. It is generally acknowledged that in developing countries these responsibilities are best kept separate. If poor governance is the root of the problem and government is in control, government can hardly be expected to reform itself. There are too many vested interests, and the people who stand to make a considerable profit from those interests (some elected officials, utility staff, utility owners, and local authorities) are too many and too comfortable with the status quo.

Legislation—cleaned up and made more relevant to today's world—is necessary but insufficient to correct these problems, as ADB's experience has amply shown. We must go outside government to the people who are most affected, such as the unserved urban poor, who pay $5/m^3 to water vendors. Civil society must exert pressure on governments for reforms, and see to it that governments do not ignore the law or their own policies, by extending distribution systems beyond their capacity to provide 24-hour supply, for example. It can do this if it understands the issues and is interested in doing something for the poor and the ill-served.

Policy transparency is fundamental, and civil society must hold governments accountable for implementing the policies. Water utility operators, on the other hand, need autonomy, accountability, incentives, and the ability to perform. Ring-fencing the utility by making it a corporation or state-owned enterprise is a first step toward autonomy. Once gained, autonomy must be balanced by accountability for performance. This is happening now and to good effect in Viet Nam. Corporatization is also making good, steady progress in Lao PDR. (See Box 12.1).

Autonomy and accountability for operators will come with transparent policies and independent regulation as operators know what is expected of them and understand that the public will hold them responsible. But incentives and the ability to perform can come only when staff are opened up to market forces. The most successful public water utilities pay their staff salaries comparable with those paid in the private sector, such as Bangkok's well-managed Metropolitan Waterworks Authority and the Phnom Penh Water Supply Authority. These utilities are able to offer attractive salaries because they have been corporatized, but remain in the public sector. Besides, to curb corruption, its inducements must be removed or at least significantly reduced.

With transparent policies, an independent regulator, and operators given incentives to perform, the situation in the sector may change.

Projects

Many water supply projects in developing countries must contend with outside interference in project man-

Box 12.1: Corporatization

Why Corporatize?

Corporatization was a process often promoted in the 1990s and early 2000s as a precursor to privatization. Nowadays, it is seen more as the transformation of a poorly performing state-owned entity into a legal, efficiently operated corporate entity that is still fully owned by the government. Corporatization eliminates the need for subsidies, generally results in better services to customers, confers greater accountability, and possibly yields a dividend from the improved performance. Full or partial privatization remains an option for the government following corporatization.

What Does Corporatization Involve?

A fundamental first step in corporatization is the legal establishment of the entity as a company. In the Lao People's Democratic Republic, the industry and commerce sector issues a registration certificate under the Enterprise Law. The law requires the state-owned company to operate on the basis of business principles, which involve setting up accounting and internal control mechanisms and undergoing an annual audit to provide the degree of accountability required. In return, the state-owned company is provided some degree of autonomy.

What Are the Issues?

The process can be described relatively easily on paper, but there are several very real challenges to be addressed:

- Creating awareness of the process and its benefits and constraints among decision makers;
- Developing the capacity of nonfinancial managers to read, understand, and interpret financial statements; and
- Transforming the mindset of the general staff and the operating principles of the entity from that of a budget-based line agency to that of a business operation.

agement, with effects that far exceed what is readily visible. Elected officials, in their desire to please the electorate, extend water distribution systems beyond their capacity to provide 24-hour supply, although this amounts to "robbing Peter to pay Paul." Then in the location of investments, the hometowns of government leaders are fairly common choices, sometimes despite feasibility studies showing that the investments cannot be sustained and that providing O&M subsidies to such water supplies indefinitely would be imprudent. Some leaders, however, prefer to spread investments thinly, and thus sacrifice efficiency for the sake of popularity and political expediency. Many other needs are not addressed thoroughly, as a result. New investments often overlook the concerns of the poor, partly because they have no voice, and partly because the leaders have interests in maintaining the status quo, including condoning the existence of syndicates that prey on the poor. *Pork barrel* spending moreover allows officials to promote their personal agendas and, in the process, subvert investment policy.

Projects financed by development agencies in particular are hindered by the involvement of elected officials. Consultants and contractors are said to hand over percentages of their contracts to elected and appointed government officials in exchange for favorable consideration of their bids. Payments are made first for short listing or prequalification, then again for the winning bid. Consultants and contractors must therefore share the blame with officials for perpetuating this system, whose impact is far reaching and cumulative. When consulting fees are squeezed, consultants can scarcely make a profit, so they skimp on construction supervision. When their profits are squeezed, contractors compensate by lowering the specifications for materials and civil works. Add to this the inadequate supervision by consultants and one result is pipelines with a significantly shortened service life. For example, instead of lasting for 40 years as they were meant to do, the pipelines may serve for less than 10 years because pipes with lower pressure ratings were installed and inadequate bedding and backfilling were used, such that traffic damages the pipes. If steel is left out of water-retaining structures, and lower-quality concrete and fittings that are not properly protected against corrosion are supplied, the structures may leak and the reinforcing steel may corrode very early in its life reducing the lifespan of the structures and potentially putting safety at risk.

When development-agency financing is involved, governments almost always call for less input from international consultants, to save budget and perhaps to prevent close scrutiny of procurement and con-

struction. Partly because local contractors are easier to control, governments may even try at times to downgrade international competitive bidding to local competitive bidding. Under-the-table payments by consultants to civil servants working alongside them, to gain their full cooperation, are not uncommon. A pervasive lack of professionalism has been noted among local consultants and government staff. But international consultants and contractors who take the view that they should do the same are no less to blame. When it takes too long to procure goods or recruit consultants, corruption could be a cause. A visit free of charge to the countries of suppliers or consultants, as a favor for appointment, might move government leaders to approve furtive agreements. Estimated costs are often inflated to take the so-called corruption factor into account.

The cost of facilitation in developing countries is considerable. Two government agencies, in irrigation and water supply, for example, will not necessarily cooperate with each other unless the wheels are illicitly oiled. This is all part of the "governance scene". A transparent investment policy would certainly help lay the foundation for good governance. It should spell out the criteria to be met, and the overall objectives and goals. Civil society can then monitor performance in implementing the policy. Service to the urban poor should be a top policy priority. Consulting and procurement can be taken right out of the government's hands and subcontracted to a project management team. How well this team complies with the guidelines or rules and regulations can be audited from time to time. Of course, the outsourcing can be voluntary (as of now) or it can be mandatory (when the tariff increases to a level that puts customers in control). Development agencies can get tough on the implementation of loan covenants and audit quality control far more closely. They can also look at the long-term goal of implementing projects over a shorter period, say, 3 years instead of 8, to gradually reduce the bureaucracy. Lastly, development agencies can promote professional societies and professionalism more actively in developing countries. But before any of this can happen, governments must set clear policy directions for water resources management, including pollution control, watershed protection and rehabilitation, and groundwater use by industry.

Tariffs and Governance

Since the money trail and power run through governments when subsidies are high and tariffs low, the answer is to raise tariffs. The more customers pay, the more power they will have to demand better service. Policies must include much-higher tariffs that are compatible with full cost recovery. There must be a move toward tariffs that cover investments directly, and a shift in control from governments to customers. Some government officials who benefit from improprieties in the control of funds for the high subsidies to water supply may, however, be reluctant to let this happen.

Public Awareness and Transparency

To deal with corruption, transparency in operations must increase, civil organizations must be empowered through information and involvement, and laws must be rationalized and enforced. The internet and civil society (represented by NGOs, journalists, and academe, who are becoming much better informed about the world around them) are powerful agents of change in these times. Moreover, computerization has left few excuses for not having excellent information on which to base management decisions.

Water Priority Champions: Leadership, Management, and Continuity

Successful water supply utilities around Asia, and particularly in Southeast Asia, have some common strengths and attributes.

First let us take water supply in Singapore. From the earliest days Lee Kuan Yew declared that, as a matter of policy, water was the country's top priority. PUB Singapore manages all aspects of the water cycle in an integrated manner, from sourcing, collection, purification and supply of drinking water, to the treatment of used water and its reclamation into NEWater, as well as the drainage of stormwater. In essence, Singapore has a closed water loop. This integrated approach to managing its water resources has enabled Singapore to put in place a robust and diversified water supply strategy with the Four National Taps. These are: local catchment water, imported water, NEWater (Singapore's brand of ultrapure, high-grade reclaimed water) and desalinated water. If Singapore can make water its top policy priority, why can other countries not consider the same policy?

Then the Philippines had President Fidel Ramos, who pushed through legislation that paved the way

for the private sector to be involved in water supply in Metro Manila.

Singapore had a water champion in Tan Gee Paw. Phnom Penh had Ek Sonn Chan. Manila had Tony Aquino. All three were strong leaders and good managers, but more importantly they stayed the course for 10 years or more to see that their vision and goals were indeed achieved.

Continuity is very important. It took 10 years for Singapore to clean up its rivers, for PPWSA in Cambodia to become independent, and for Manila to beat its problem of high NRW. Patience and persistence are the key ingredients of success.

Anticorruption Efforts and the Urban Poor

Because of vested interests, the urban poor can be unfairly treated, both in trying to gain access to piped water and in trying to cope once connected. This section summarizes the problems involved and what might be done to help.

Gaining Access to Piped Water: Issues Most Prone to Corruption

- High connection fees
- Land tenure issues
- Complicated connection procedures
- Lack of water resources (the poor are the last to be served)
- Inadequate delivery infrastructure
- Vested interests of water vendors
- Valve turning in non-24/7 supply, affecting the poor at public taps

Gaining Access to Piped Water: Some Solutions

- Creation of water utility unit dedicated to serving the urban poor and simplifying procedures
- Abolition of connection fees (discriminatory toward the poor)
- Use of proof-of-residency certificates
- Annual monitoring and reporting by regulator or NGO on connections for the poor
- Use of anecdotal interviews as sources of good field information
- Official resale of water to neighbors
- Push for 24/7 water supply
- Higher tariffs (provide funding to connect the poor)

Coping after Getting Connected: Issues

- Possibility that private sector operator may condone high water use
- Sharing of one connection by two or three households under increasing block tariff (IBT) system
- Overcharging by utility (low tariffs raise few objections)
- Unissued water bills, which utility staff allow to accumulate for around 6 months and then “negotiate”
- Water contamination (still an issue in many cities), as a result of intermittent supply
- Bulk charging to communities based on mother meter, but exploitative charging by communities
- Low-standard (and maybe spaghetti) water lines resulting from community responsibility for distribution

Coping after Getting Connected: Some Solutions

- Regulator or NGO enforcement of transparency at all levels
- Good data collection (knowledge is power for civil society)
- Checking of utility figures for average consumption and average water bill versus customer figures
- More anecdotal interviews
- Awareness building in society about water conservation
- Modification of IBT policy to protect the poor

Human Right to Water and Sanitation

In 2010 the UN General Assembly and the UN Human Rights Council recognized and defined access to safe drinking water and sanitation as a human right. According to these organizations, the right to safe

Figure 12.1: Governance Problem Chart

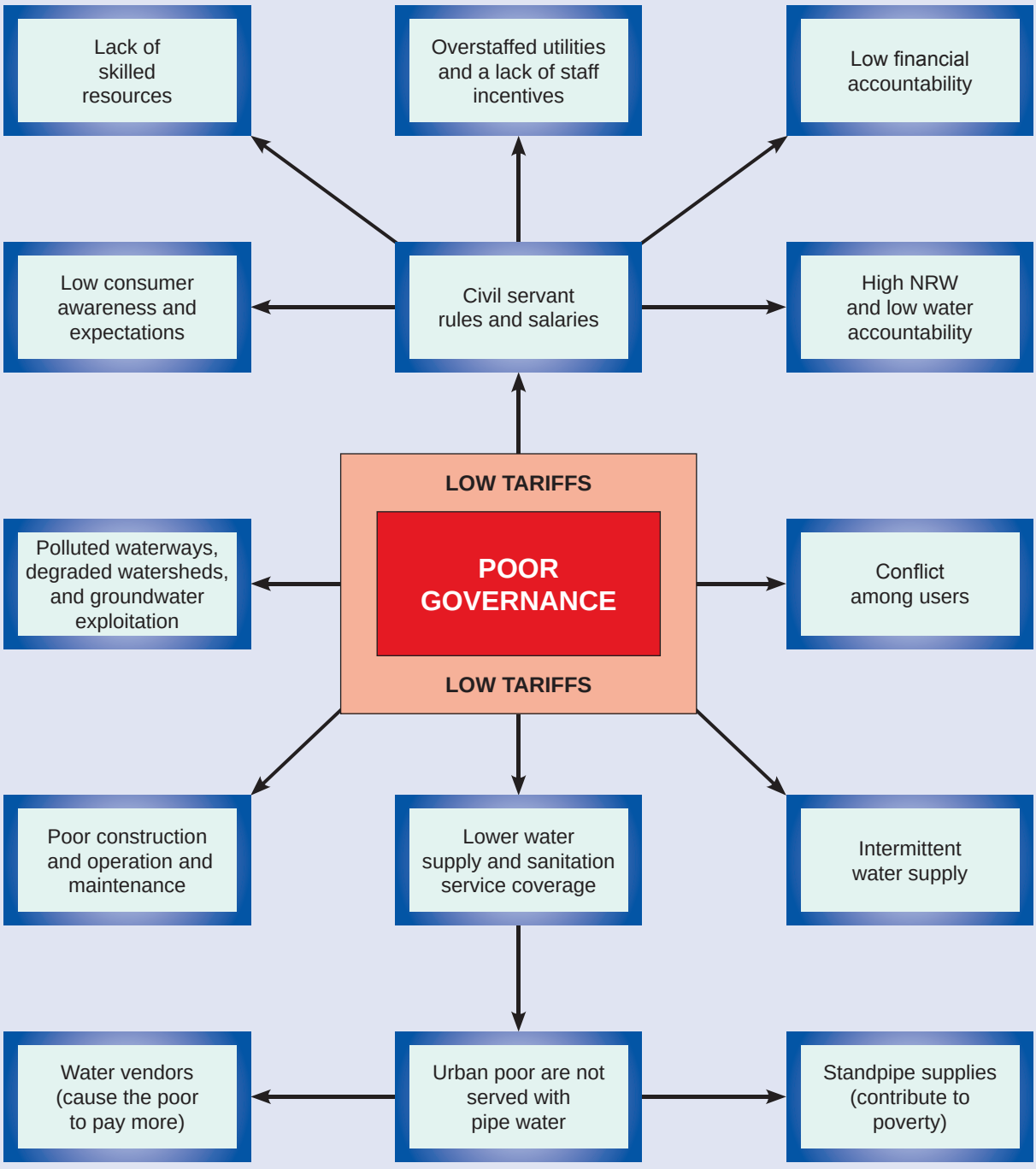
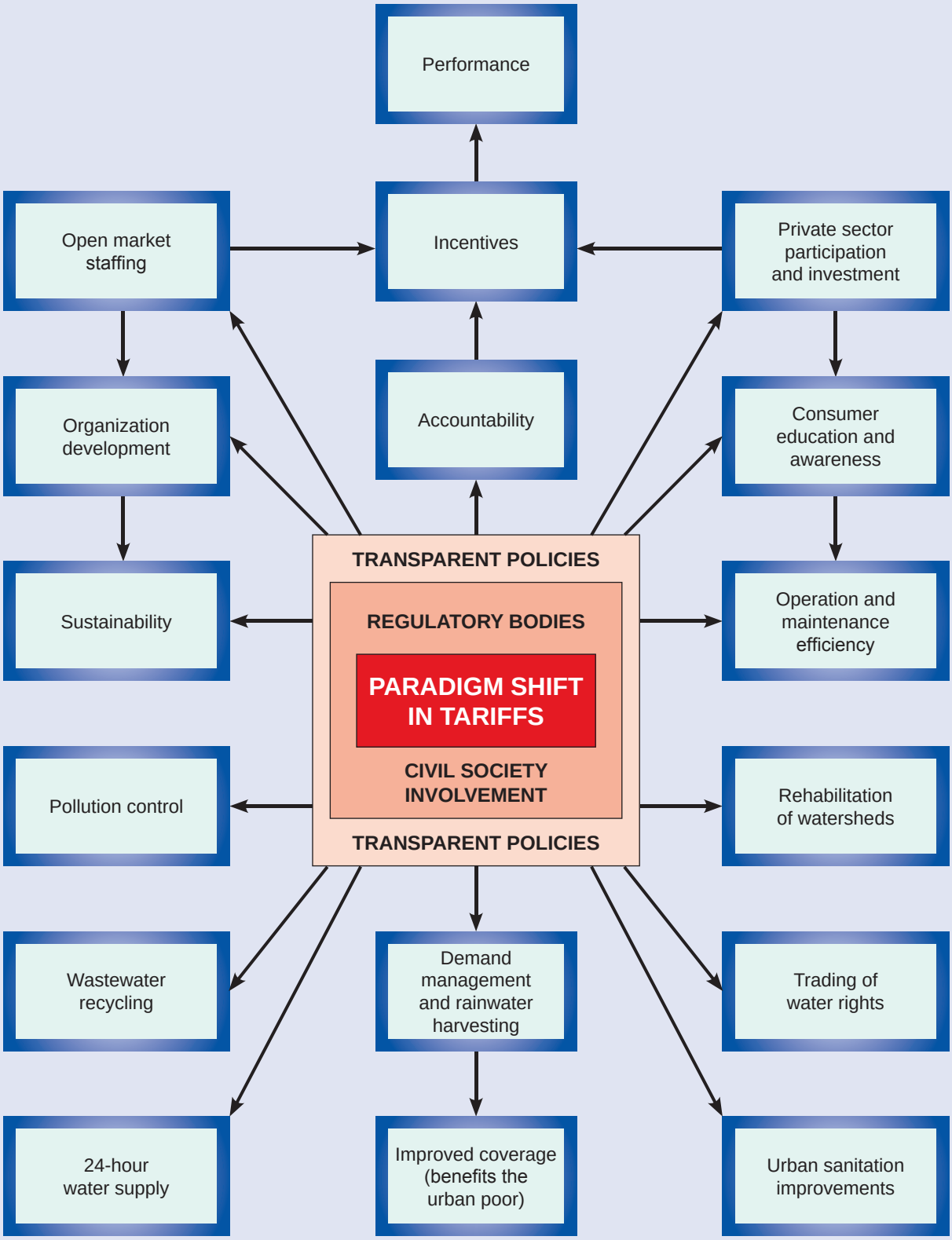


Figure 12.2: Governance Solution Chart



drinking water must be progressively realized in compliance with six key technical criteria: safety, sufficient quantity, acceptability, accessibility, affordability, and nondiscrimination. "Progressively realized" implementation means that not every target has to be met everywhere at one time.

Governance Problem and Solution Charts

In the 10 years since the first *Asian Water Supplies* (2003) book was published, the nature of governance problems and solutions has not changed much (see Problem and Solution charts). But improvements have been taking place in Southeast Asian utilities, especially in Manila Water, MWA, PPWSA, and the Vietnamese utilities.

The Problem Chart shows that poor governance is still the root cause of the issues that beset the water supply sector in Southeast Asia, particularly as governments take action to develop new water sources for large urban cities. In some places service coverage, especially among the poor, and prevalence of water vending are still issues. Intermittent supply continues to be an issue in Indonesia. Collection efficiency is not what it should be. To some extent, water accountability and NRW reduction have improved, but much remains to be done. Pollution control has had little visible improvement, although some utilities like BIWASE, Manila Water, and Maynilad are starting to address this issue.

The Solution Chart gives more attention to utility performance, transparency, and accountability. Only PUB Singapore has gone into water recycling. Tariffs in general are better now, and the average operating ratio of 0.69 reflects this improvement. Civil society is getting more involved. But no examples of good regulatory bodies, whether private or public sector, have yet been found, maybe because governments still want to retain control and regulation is very political in nature.

Rebuilding the Water Supply System for a Former Ghost Town: A Case Study of the Phnom Penh Water Supply Authority by Ek Sonn Chan

Introduction

Phnom Penh, the capital of the Kingdom of Cambodia, lies at the confluence of three rivers—the mighty Mekong, and the Tonle Sap and Bassac rivers. The level and the quality of water in these rivers change as the seasons change. Phnom Penh, with a total surface area of 678 square kilometers, is divided into 9

Box 12.2: A Modern Khmer Legend

In 1993 Ek Sonn Chan took over responsibility for Phnom Penh's broken water supply system. Ravaged by war, and long years of neglect, PPWSA was a utility only in name. But by the turn of the century it had been transformed into a world class water utility that has since won almost every award for excellence worth winning.

In 1995, ADB provided a small loan and some technical assistance. A year later, PPWSA became an autonomous public enterprise. Ek Sonn Chan built a new cadre of technical staff and invested in training. He encouraged risk taking; he even outsourced meter reading, billing and collection, and pipe repairs until his team demonstrated that PPWSA could perform each of these functions more efficiently and economically in-house. Professional competence was assiduously developed; wage rates were brought in line with the private sector; and performance was rewarded. His strength of character and moral courage ensured that PPWSA's autonomy was respected.

ADB stayed the distance with Ek Sonn Chan throughout the early years. It held fast when he needed support to fight battles with his political masters. He did not get bureaucratic responses from us on a plethora of issues; he got practical solutions. As a result, the project was completed ahead of schedule, within cost, and with virtually every loan covenant met and exceeded. It was an exemplary development performance.

Urban water supply development in Asia is a difficult proposition. It has few champions. Ek Sonn Chan was a rare one. He taught us the importance of identifying a genuine leader, sticking to her (or him) through thick and thin, with friendship and professionalism, and without the impediments of bureaucracy. It is only then that life-changing transformations can be wrought.

Source: *Arjun Thapan, former Special Senior Advisor for Infrastructure and Water to the President of ADB.*

districts and 96 subdistricts, and has one-and-a-half-million residents.

The Water and Electricity Company was created by the French colonizers in 1895. Over the years, this water utility expanded as the city grew. In 1975, the production capacity was 150,000 cubic meters per day. The 288-kilometer cast-iron-pipe network covered 70% of the city residents. But during the Khmer Rouge regime, from 1975 to 1979, the water supply system did not operate. Many of the production and distribution facilities and equipment were destroyed. Many of the company's qualified personnel were also killed.

The water supply utility resumed operations in 1979, when the people returned to the city. With many of its facilities and equipment destroyed, the company saw its water production capacity shrink significantly between the 1980s and 1993 as a result of poor maintenance. In 1993, with its century-old pipe network and poor distribution, the Phnom Penh Water Supply Authority (PPWSA) was barely functioning. Only roughly a quarter of the population received piped water. Employees were demoralized and underpaid. Only 13% of connections were metered, and only 28% of the water produced for the system was actually sold. The collection rate did not even reach 50%. Illegal connections were widespread, and unaccounted-for water was at a high 72%. Even worse, the employees themselves were responsible for much of the water theft. They were installing illegal connections at $1,000 per connection and receiving kickbacks from large customers in exchange for lower meter readings.

After the Paris Agreement of 1991, the general election of 27 July 1993 produced a new government. Cambodia was out of the international embargo. The country was eligible for international assistance. The government started rebuilding its infrastructure. The water sector was on the priority list. It was in this environment that I was appointed by the Phnom Penh City Governor to head PPWSA on 11 September 1993. My first job was to look for money from international institutions to pay to the aluminium sulfate supplier. Finally the embassy of Japan kindly provided $50,000. I made it through that first job, but I felt very ashamed. I resolved not to do the same thing again. So I started setting up a young, dynamic working team, restructured the organization by getting rid of corrupt and incompetent people, and worked to change the culture to one that was transparent, fair, and well managed. But even with a lot of effort, the results were not satisfactory, because we depended on many different decision makers from higher institutions, which had no interest in the PPWSA change of culture. In December 1996, with policy support from the government and the assistance of foreign donors and international organizations, PPWSA was made a public enterprise, with full financial and administrative autonomy. A new era had dawned. I began the institutional reforms in earnest.

First, a new organizational structure was established with new roles, rules, and regulations to meet the challenges. Older, inactive managers were replaced by young, dynamic, and well-educated staff. Within this new organization structure, I introduced a new management model—a core culture of change. The higher the position, the harder one had to work and the stricter the standards of behavior that one had to follow.

Second, with these new people, I invested continuously in building and updating capacity in all areas and at all levels. All staff members were provided with good financial packages, so that they could have a good standard of living. These financial packages have allowed us to attract and retain good staff members. At the same time, there are serious and immediate sanctions for staff who engage in unethical behavior, including speedy dismissal after a transparent, fair, and quick review of individual cases. Thanks to this practice, corruption in the authority has become history.

Third, I knew that we needed to generate enough income to be independent. We had to increase the water tariff or the bill collection ratio, and reduce non-revenue water. I first thought of increasing the water tariff, because that's the easy way and our business is a monopoly. But in practice, increasing the water tariff was not an easy task, and not a smart way to be sustainable. In the end, increasing the collection ratio became our first priority. We started a general survey of customers to update the customer base. Between the start of 1994 and the end of 1995, we found 12,980 wrongly recorded customers, and 13,901 real customers who were never recorded. Finally, we had a customer file with 26,881 real customers. With motivation and strict discipline of water bill collectors, collection efficiency gradually improved. Then the customer base was updated as rapidly as possible, along with an accurate database of all households that had connections. Both databases have been kept up-to-date. Metering, accurate billing, and prompt bill collection were made essential requirements.

Fourth, the reduction of NRW was relentlessly pursued and monitored, from accurate metering of all connections to a campaign against illegal connections, accurate reading and billing, and effective leak repair and pipe replacement. In 2003, with the assistance of the Japan International Cooperation Agency (JICA) and experts from the Kitakyushu Water Bureau, we started the District Metering Area program. In 2004 two pilot zones were completed. To reduce water losses we introduced a responsibility system for our technical team. By internal agreement the team would get bonuses or face penalties depending on the outcome of the NRW reduction by the end of the year. Water losses have been reduced significantly since then. More water has been saved for thirsty families and more income has been generated for the authority.

Fifth, in 2005, we introduced the Water for All program. Poor customers are looked after, so that they can afford to pay their water bills. The poor should get the same water service as the rich people. The World Health Organization recommends that the water bill for the poor should not exceed 5% of their income. In Phnom Penh, the average water bill for the poor is well below this 5% ceiling. In fact, the water expenditure of the poor has dropped to just one-fifth of what they were paying to private water vendors, before they were connected to the city's water system.

Finally, we continued down our path to the future by increasing the production of treated water and gradually enlarging the network to cover more customers, both domestic and industrial.

Today, the residents consume 112 liters per capita per day of water on average, with 24/7 assured supply and metered connections. PPWSA has become profitable and is continuously increasing coverage to outer Phnom Penh. In the past 17 years, PPWSA has increased its annual water production by 461% and its customer base by 818%. It has reduced losses from unaccounted-for water, from 72% of treated water produced in 1993 to around 6% at present. Even though all water consumed must now be paid for, it is consumed without delay.

Chapter 13

Data Collection, Analysis, and Reporting

Introduction

If you can't measure you can't manage. This holds true particularly in the water sector. The quantity, quality, and timeliness of water from source to customer, as well as the payment for the use of that water, must be accounted for. So must the income and expenditures of the water utility. The performance of the water utility must be measured. Water bills must be examined every month for insufficient or excessive use. The number of people receiving water from the utility must be counted regularly and the service level must be determined. Is the connection individually piped? Is it shared? Is the water taken from a public tap? Is it obtained through a franchise or cooperative? The people who have access to water through other means, through water vendors or SSWPs, or who use well water, rainwater, river water, or bottled water, must be counted. Therefore, the water utility must build a good computerized database, with data that are known to be reliable and accurate. The importance of having a GIS-based map of the whole water and wastewater distribution network cannot be overemphasized.

This book includes the result of surveys of 14 water utilities in six Southeast Asian countries. The surveys sought information about (i) water utility performance and performance parameters; (ii) water bills (through street surveys in low-income areas); (iii) needs and expectations of customers, noncustomers, and other stakeholders (through anecdotal interviews); (iv) use of pipe materials; and (v) water utility facilities and activities, with supplementing photos. This information is presented in the previous chapters. In this chapter, the data collected and the analysis are summarized.

Water Utility Websites

Websites, now the main link between utilities and customers, were reviewed for this book. All 14 utilities maintain websites and a sample of their content is shown in Table 13.1.

Table 13.1: Content of Selected Water Utility Websites

Utility	Website Content	Annual Report	Language
BIWASE	http://www.biwase.com.vn *Home* Water tariff, customer services, customer assistance, investment projects *Joint Ventures, Training, Notices, News, Business Fields, Business Diary, Science Innovation* *Web Links, Rewards, Contact Us* *About BIWASE* Financial capacity, subsidiary enterprises, human resources, history, board of directors	None	English, Vietnamese

continued on next page

Table 13.1 *continued*

Utility	Website Content	Annual Report	Language
MWCI	http://www.manilawater.com *About Us* Manila Water story, customer service, our people, awards and accolades, FAQs, facilities *News, Investor Relations* *Corporate Sustainability* Vision, policy, commitments, framework, reports, programs *Careers, Contact Us*	2012 report	English
MWSI	http://www.mayniladwater.com.ph *News and Information* *About Us* Corporate profile, vision, mission, values, history, corporate social responsibility *Services, Customer Page, Customer Education* *Vendor Opportunities, Careers, Contact*	2010 report	English
PPWSA	http://www.ppwsa.com.kh *Home* News, e-payment, public health, procurement *Investment* Project management, bidding, contracts *Securities Exchange* *Finance* Annual, semiannual, quarterly reports *Customer Service* House connection, billing, meters *Supply* Production, distribution, water quality, NRW *Social* Water supply for poor program, community development *Careers* Human resources, training, recruitment *About Us* Organization structure, indicators, vision, mission, history, publications, pictures *Contact Us*	2012 report	English, Khmer
MWA	http://www.mwa.co.th *Home* News, services, water quality, future plan and policy, good governance policy, community social responsibility, training, international relations, highlight articles, annual reports *About MWA* Vision, mission, values, logo, history, organization chart, board of directors, executives, governors, awards, location, MWA development *Service* Training, tariffs, meters, connections, payment *Products* Tap water, bottled water, bulk water, free *Water Supply* Sources, treatment, transmission, quality *Performance Statistics* Operation highlights (6 years to 2009), annual reports, corporate efficiency plan, risk management, water loss reduction *Site Map, Site Introduction, Contact Us*	2011 report	English, Thai
PALYJA	http://www.palyja.co.id *Home* *Profile* About us, key figures, corporate governance, ethics, transfer of know-how and technology, risk management, future planning, publications *Main Business* Facilities and infrastructure, service coverage ratio map, water quality, Water for All *Customer Services, Careers, News and Activities, Links*	2011 report	English

Comments

Several Vietnamese and Indonesian utilities have websites only in the local language; other utilities have English-only websites. The most important finding from Table 13.1 is the wide variety of topics covered on the websites, but also the dearth of reporting on performance by the utilities. Of the 14 utilities in Southeast Asia studied for this book, only six include their latest annual report on their websites. The Southeast Asian Water Utilities Network (SEAWUN) could help all utilities in Southeast Asia, first and foremost, by guiding them to show on their websites the latest results for the eight to 10 most common indicators of operating performance, such as those used in this book.

Benchmarking and Performance Improvement in Asia by Cesar E. Yñiguez

Benchmarking is the search for industry best practices that lead to superior performance. There is a big performance gap between water utilities in developed countries and those in developing countries. This gap is the reason why some utilities provide good-quality water supply, 24/7, while others struggle with intermittent supply and doubtful quality. How can some utilities perform well while others cannot?

In 1993, the Asian Development Bank (ADB) tried to find answers by learning how water utilities in the Asia and Pacific region were performing. It started by gathering performance data from 38 water utilities in the region. The number of utilities covered increased to 50 in 1997, when the *Second Water Utilities Data Book for the Asian and Pacific Region* was published. In that data book, 21 parameters were recorded for all 50 utilities. But in *Asian Water Supplies: Reaching the Urban Poor,* published by ADB and the International Water Association (IWA) in 2003, utility performance was evaluated through just 13 indicators covering customer satisfaction, water resources management, financial management, human resources management, and accountability. The present book uses 10 performance parameters.

Subsequent ADB initiatives, through regional networks like the Southeast Asian and South Asian Water Utilities Networks (SEAWUN and SAWUN), introduced performance benchmarking in the various regions to improve performance. Similar benchmarking activities were carried out under the World Bank's Water and Sanitation Program–South Asia in India, Pakistan, and Bangladesh around the mid-2000s.

The Global Water Operators' Partnership Alliance of the United Nations gave real meaning to benchmarking activities by initiating performance improvement in developing-country utilities, with the help of better-performing water utilities within and outside the region. WaterLinks was established with the support of ADB, IWA, and the United States Agency for International Development (USAID) to provide the platform for such partnerships in Asia and the Pacific (see Box 13.1).

While the partnerships started with regional benchmarking, national partnerships like the Philippine Association of Water Districts, the Indonesian Water Supply Association (PERPAMSI), the Malaysian Water Association, and the Vietnam Water Supply and Sewerage Association are now also active in performance monitoring and improvement, especially in Southeast Asia. National associations in South Asia are not as active as their Southeast Asian counterparts, but Bangladesh and Pakistan are organizing themselves, following their initial benchmarking activities and the experience of developing and discussing the benchmarking results and performance improvement plans in the concluding workshops.

Collecting performance data yearly is not difficult if the water utilities cooperate and the national water associations coordinate the task. At the start, the performance data can be limited to those needed to compute the performance indicators in the five areas mentioned at the beginning of this chapter. Additional information can be collected only when the utilities decide to improve their performance by comparing their processes with performance benchmarks set for

Box 13.1 WaterLinks

Established in 2008, WaterLinks is a regional network of water service operators, practitioners, and development partners that encourage water operator partnerships in Asia and the Pacific and brings about efficiency improvements to increase and expand access to urban water supply and sanitation services. The WaterLinks Center, a fully independent nonprofit organization in Manila, Philippines, has been providing secretariat and technical support on behalf of the network since 2011.

the better-performing utilities. Recent documentation shows that benchmarking and performance improvement can be done effectively through water operator partnerships, although some utilities are going beyond these partnerships in pursuing improvements.

Quality of data is one issue. The validity of the data collected should be rigorously checked before publication. Those collecting the data may have to communicate with the same agency over and over for this purpose. Interpretation of data is another issue. Often it is a case of comparing apples with oranges, e.g., comparing a gravity-fed system with a 24/7 pumped system.

Data Collection and Analysis for This Book

How every indicator is measured must be defined in detail. If there are too many indicators, recording is unlikely to stay accurate for more than a year or two. Indicators are mostly management tools for comparing performance over time and against the performance of others.

If water supply and sanitation performance indicators are to be designed from scratch, we can hypothetically start with just 10. This number is enough to cover the important subjects of **water, people, and money.** Yet it is not so large that the work will annoy or bore the people doing it.[22]

For **water,** we can measure production capacity, nonrevenue water, and sewage treatment plant capacity.

For **people,** we can measure city population, number of water connections, 24/7 water supply, and number of sewer connections.

For **money,** we can measure average tariff, operating ratio, and collection efficiency.

A water utility that is strong in these performance parameters will surely be in good standing.

These same performance parameters were used in analyzing and comparing the 14 utilities that compose the database for this book. Because of their simplicity of measurement, these parameters were already being used by nearly every utility. Besides, we could compare performance over 10 years because these simple performance parameters were also used in the *Asian Water Supplies* book published in 2003. The issue here was the unavailability of information from the utilities about sewer connections and sewage treatment plant capacity, as these are normally the responsibility of the city administration. Water supply and sanitation should be considered together, as they are in Singapore, Manila, and Binh Duong.

A simple way to supplement the utility data is to conduct a survey of water bills in 20 consecutive houses of one street in a low-income area. The survey can be done by one person in half a day, yet it provides an excellent field check on utility data by ferreting out information about the average water bill, average water consumption, per capita consumption, average tariff, service coverage, and 24/7 availability.

Summary Findings of Data Collection and Analysis for 14 Utilities *(See Tables 5.1 and 5.2 in Chapter 5)*

Objectives

Data were collected and analyzed to provide a factual foundation for this book on water supply and sanitation in Southeast Asia.

Scope

Data collection comprised five main elements:

- Performance parameters of the utility,
- A street survey of 20 consecutive houses in a low-income area,
- Anecdotal interviews with 10 customers and 10 other stakeholders,
- A review of the use of pipe materials, and
- Photos of water supply and sanitation facilities and services in the subject utilities.

[22] It may be argued that ADB member countries already have many benchmarking examples. But in more than 20 years of experience in this field (starting with the Water Utilities Data Book for the Asian and Pacific Region published by ADB in 1993) the author has found that earlier efforts were not uniformly accepted and implemented because there were too many key performance indicators. Unless and until a very small number of indicators gain universal acceptance there is no point in insisting on complexity.

Methodology

Performance Parameters

- These were nominated by the consultant and obtained from the utilities without issues, except for the way in which collection efficiency was measured. In the end the consultant decided to ask just one question requiring a yes–no answer in this regard: *Is 98% of the amount billed collected within 1 month?*
- Since only three of the 14 utilities are also responsible for sewerage and sanitation in their city, there was a lack of data in this field.

Street Survey

- A street in a low-income area served by the utility was selected and the consultant went from door to door on one side of the street asking 20 consecutive households questions about their current water bill, the number of people taking water from the connection, and the nature of the service (24/7?).
- In some instances, arrears in the water bill and installment payments for connections may have distorted the results obtained.

Anecdotal Interviews

- The people interviewed were selected at random and were anonymous.
- The interviews were done with a voice recorder. The recorded responses were later translated into English.
- Some found it easy to talk. Others had to be constantly prompted with questions.
- But in general a great deal of useful information was obtained as to the quality of services provided (or not provided, in the case of the unconnected) by the utility.

Use of Pipe Materials

- This was intended to be a one-page review, but some utilities produced in-depth reports.
- Other utilities simply summarized past and present use for connections, distribution, and transmission.
- In all cases, the results obtained met the purpose.

Photos

- Some excellent and diverse photos were provided by the utilities.
- However, because of their lack of ownership of sanitation and sewerage the photos were light on sanitation.

Results and Analysis

The results are shown in Table 5.1 (performance parameters of the utilities) and Table 5.2 (street surveys).

Service Coverage

MWA, with the fewest persons (four) per connection, is way out in front.

- The average is 9.3 persons per connection, or if the average household size is 4.5 persons then it is equivalent to less than 50% service coverage.
- MCWD, with 16.5 persons per connection, is the least capable in this regard.
- Among the four private operators, the average is 9.75 persons per connection.
- The connection fee varies from $200 (VCWSE) to zero (the three utilities in Viet Nam). The average connection fee is around $100—clearly still a major hindrance to wider service coverage.

Connections and Consumption

- MWA, with more than 2 million connections, is twice as large as the next-largest utility surveyed. If we divide consumption (production minus NRW) by the number of connections, we can see that the largest users of water are those served by MWA (1.75 m^3/day/connection), and that HPWSC customers use the least water (0.54 m^3/day/connection). This may mean that industries account for a higher proportion of total water consumption in Bangkok.
- Average consumption of water supplied by the utilities is around 1.0 m^3/day/connection.

Average Tariff

- The average tariff in the water utility sector ranges from a high of $0.88/$m^3$ to a low of $0.23/$m^3$. Among the surveyed utilities, the average is about $0.50/$m^3$.

- The average tariff for the four private operators surveyed varies from $0.62/m^3 to $0.88/m^3.
- MCWD, at $0.60/m^3, has the highest average tariff among the public operators surveyed. This high figure may reflect the high pumping (electricity) costs in the Philippines.
- AETRA's and PALYJA's average tariffs, excluding sewerage costs, are high, yet their overall performance is weak. It is well known that their collection efficiency is low.

Operating Ratio

- The average operating ratio is a reasonable 0.69.
- The lowest operating ratios are PPWSA's (0.37) and Manila Water's (0.45).
- Medan, which has an operating ratio of 0.97, may need a tariff increase.

Collection Efficiency

- Only 4 of the 14 utilities are able to collect 98% of their billing within a month.
- PALYJA and AETRA in Jakarta have serious collection efficiency issues.
- Maybe those in trouble should look to the utilities that collect door to door, or have facilities for online payment.

Intermittent Supply

- Only 5 of the 14 utilities can supply water 24/7 to all their customers.
- Palembang, which supplies water 24/7 to only 48% of its customers, is the worst performer in this regard.

Nonrevenue Water

- To derive the NRW figures, the utilities subtracted the billed volume from the production volume and divided the result by the production volume. Average NRW is 28% but varies from 5% to 47%.
- The best performers in this category are PPWSA (6%), BIWASE (10%), and Manila Water (11%). The worst (all with NRW over 40%) are Maynilad, PALYJA, AETRA, and SAWACO; three of these four are private operators.

Sanitation

- Of the 14 utilities, only BIWASE, Manila Water, and Maynilad are also responsible for sanitation.
- We can learn from PUB Singapore that since water is becoming increasingly scarce, the utilities had better include sanitation among their services to be able to supplement their supply with recycled water.

Summary Highlights of Anecdotal Interviews

Sources

- When people share water with a neighbor, or buy water from a neighbor, they pay more but they get convenience. Public tap or kiosk water is cheaper but not so convenient. The connection fee is often the main constraint.
- Water supplied in bulk to a cooperative or franchise is cheaper but not convenient, as the water still has to be carted home so one cannot use too much water. On the other hand, piped water supplied to homes without a connection fee would be very convenient but would encourage more use.
- Well water is often contaminated, but the connection fee keeps people from converting from well water to a piped connection.
- People pay much higher for water from vendors. Clearly, piped water service coverage needs to be extended in this case.
- People adjust to the price of water by obtaining water from different sources for different uses.

Service Coverage

- Low service coverage in many utilities can be caused by any one or a combination of factors.
- These possible causes of low service coverage are (i) high NRW, (ii) water insufficiency (iii) low tariffs (and therefore no funds for network expansion), (iv) high connection fees, and (v) indisposition to change.

Nonrevenue Water and Illegal Connections

- People notice when their pipeline runs through highly polluted drains and are afraid to drink the water.
- First, eliminate intermittent supply. It is time to address the issue of high NRW and low service coverage.

Water Quality

- Whether or not the water comes from a piped connection, water quality is a big issue.
- People still boil and filter drinking and cooking water or buy bottled water.

Bottled Water

- Bottled water is here to stay. This phenomenon is not confined to the developing world.
- Maybe utilities (like BIWASE) can become more involved in producing their own bottled water.

Water Resources

- Whether publicly or privately run, the utility needs to plan and develop water sources to stay ahead of demand and not play catch-up forever.
- The best-available water source is NRW reduction.

Water Conservation

- People are becoming more aware of the need to conserve water at all stages of the water cycle.
- The issue of water conservation by private water operators needs to be addressed.

Connection Fees

- Connection fees are undoubtedly major constraints on service coverage.
- Viet Nam has dealt with this constraint by doing away with connection fees. It is now up to other utilities to follow its good example.

Tariffs

- Obtain consumer approval to a tariff increase before seeking government approval.
- Customers do not mind high tariffs if they are connected and get good service and good-quality water.
- Politicians need to be better attuned to the views of customers.

Intermittent Supply

- Poor water quality is the most common complaint of people who get their water directly (piped connections) or indirectly (public taps) from utilities.
- Intermittent supply is the next most common.

Payment Options

- Now there are many more options for customer payment, including door-to-door and online payment.
- There is no need for any utility to fail on this account.

Utilities and Customers

- Utilities need to communicate better with their customers. They can use the influence of customers to change things.
- A user-friendly website is a start. Communication through the water bill is another way.
- Utilities need to improve constantly and learn from other utilities.

Pipe Materials Use Review

The 14 utilities were surveyed for their past and present use of pipe materials. It was surprising how much this has changed over the years. Box 13.2 summarizes the pipe materials that were once in use but are now being phased out. Box 13.3 summarizes the pipe materials that are now preferred.

Box 13.2: Pipe Materials on Way Out

For Connections	For Distribution	For Transmission
Galvanized iron	Galvanized iron	Glass fiber–reinforced
Polybutylene	Asbestos cement	Reinforced concrete
UPVC	UPVC	Prestressed concrete

UPVC = unplasticized (rigid) polyvinyl chloride.

Note: UPVC is both a material preferred by some utilities for connections as well as a pipe material on the way out for use in connections by other utilities.

Box 13.3: Pipe Materials Currently Preferred

For Connections	For Distribution	For Transmission
HDPE	HDPE	Steel
Galvanized steel	Ductile cast iron	Ductile cast iron
UPVC		

HDPE = high-density polyethylene, UPVC = unplasticized (rigid) polyvinyl chloride.

Note: UPVC is both a material preferred by some utilities for connections as well as a pipe material on the way out for use in connections by other utilities.

Chapter 14

Sanitation: An Overview

"If you want to measure progress in the development of a city, don't measure it by the number of skyscrapers that have been built. Measure it by the way human waste is disposed of." (**Tan Gee Paw**)

Introduction

Everyone knows that sanitation development lags far behind water supply development. But why is this so? There is no single answer. Analysis that considers not only the big picture but also many smaller things that have an impact is needed. Table 14.1 (Sanitation Problems and Responses) breaks the problems down into four areas: foundation problems, technical matters, social matters, and financial matters. It identifies responses and gives, where appropriate, references for further guidance.

Gender Issues

Findings from various World Bank studies indicate that men and women value sanitation very differently. For women, who are more personally concerned with these issues, and more intimately involved in them with respect to their families, sanitation is often the second-highest development priority. For men, on the other hand, it may be only the eighth highest. To ensure that water sector activities are gender responsive at policy and institutional levels, ADB is promoting the integration of gender concerns in policies, plans,

Table 14.1: Sanitation Problems and Responses

Problem	Response	References
Foundation Problems		
Low government priority	Example of Singapore: top priority given to both water supply and sanitation	Tan Gee Paw (PUB Singapore)
Lack of policy and planning	Donor support for preparation of policy and plans and implementation monitoring NGO and media reports on implementation Donor assistance in replicating successful small-scale technologies	PUB Singapore, IWK, MWC, Maynilad, BIWASE ADB Operational Plan WOPs Roshan Shrestha (ENPHO)
Lack of budgetary support	Tied to priority, policy, and planning Donor support: no water supply projects without wastewater disposal	Tan Gee Paw (PUB Singapore) Sahana Singh (*Asian Water*)
Lack of good data	Donors, especially bilaterals, need to provide support. Simple benchmarking.	ADB's *Asian Sanitation Data Book* and Sanitation Dialogue
Public awareness and reporting	Environmental NGOs and media and consumer anecdotal interviews More important than the budget Sanitation promoted as a business	Sahana Singh *(Asian Water)* Anecdotal interviews ADB Sanitation Dialogue

continued on next page

Table 14.1 *continued*

Problem	Response	References
Divided institutional responsibility for water and sanitation	Good examples from Singapore, Manila Water, and Maynilad, and from developed countries Need for donor support	Tan Gee Paw (PUB Singapore) BIWASE, Viet Nam
Technical Matters		
Separate sewer vs combined sewer	Progressive development from septic tanks to combined sewers to interceptors to sewage treatment plants Separate sewers a must for new development	PUB Singapore Manila Water ADB Water Conference Viet Nam
Decentralized vs centralized	Issues of practicality and land availability: too many small decentralized systems lead to too many disposal problems Local management, treatment, disposal	Yogyakarta, Indonesia (NGO Dian Desa in 2003)
Construction difficulties Population density	Large sewers impossible in densely populated big cities; consider decentralized solutions or more pumping stations	Metro Manila's example of decentralized solution
Permanent pumping costs	Energy efficiency policies Consumers pay for O&M only in sewerage	
Need to recycle	Separate systems for sewers and rainwater harvesting	NEWater PUB Singapore (but recycling solution may be unaffordable to others)
Wastewater disposal	Anaerobic digestion and biogas Improved STP operations	ADB Water Conference WOPs Anecdotal interviews
Social Matters		
Sanitation a low priority among males but top priority among females	More proactive donor support for females in sanitation Focus on schools and public toilets	ADB Operational Plan Anecdotal interviews
Marketing Health and hygiene problems	Dignity, prestige	WOPs (IWK)
Open defecation	ODF, CLTS /STBM Dignity, shame, disgust, peer pressure Public, not private	Kamal Kar (CLTS Foundation) ADB Water Conference (STBM)
STP location and objections	Possibility of underground location with landscaping Proactive land planning Media assistance	Bangkok
Need for increased consumer awareness of pollution of downstream waters	NGOs, media, academe Strict enforcement of environmental laws Donor support	Sahana Singh (*Asian Water*) Anecdotal interviews Viet Nam
Financing Matters		
High capital cost	Phased approach to policy and planning Long-term loans Donor support	ADB sewerage projects in the region
High O&M costs (pumping)	Consumer pays O&M cost only	
Water a priority of low-income groups	ODF a good start Targeted subsidies No fixed charges	Kamal Kar (CLTS Foundation) ADB Water Conference
Affordability and willingness to pay	Free connection O&M to be covered by consumer; capital cost to be covered by government Combined bill for water and sanitation	Anecdotal interviews IWK

programs, and projects. Incorporating explicit gender equity provisions into the objectives and scope of water sector activities is encouraged. This should start in schools as a first priority. No girls should be kept out of school because of inadequate sanitation provision. Gender equity can extend to the concept of open defecation-free, low-income settlements in and around cities. It can extend further to well-maintained and clean public toilets throughout a city.

Sanitation and Sewerage

The reality is that most of the sanitation in Southeast Asian homes relies on septic tanks, from which effluent flows directly into often-open storm-water drains in the streets and then discharges untreated into rivers passing through the city. In Manila and other cities, attempts are being made to collect and treat effluent before discharge into the river. Septic tank desludging is often free if availed of during routine utility cleaning. The alternative of having conventional sewerage and sewage treatment plants in the central city is just too costly and too disruptive to be contemplated as a practicable solution. It is heartening to note in this regard that the two private sector concessionaires in Manila have targeted a $3 billion sewerage and wastewater improvement program over the next 15 years—all of it to be privately financed.

In Yogyakarta, Indonesia, around 2002, the NGO Dian Desa facilitated the construction of a decentralized small sewerage and sewage treatment system for 500 households in an urban slum. The treatment facility was landscaped and below ground. It is still working perfectly today. It was paid for and is operated completely by the people who use it. The secret to its success may well be the local community who built and own the facility and will not allow it to fail. However, decentralized sewerage systems have some issues, one being the multitude of disposal systems needed. It is more likely that there will be a natural progression from septic tanks, to septic tanks with combined drains, followed by interceptor sewers and then by wastewater treatment facilities such as waste stabilization ponds, as development makes the economic resources available. A promising new project in New Zealand, adopted by four local councils, provides wastewater treatment without sludge formation, using a modified biological trickling filter process without clarifiers.

City administrations should take strong action in new developments so as not to perpetuate the difficulties in sanitation delivery. They should manage the collection and treatment of wastewater locally and see to it that waste is not conveyed into someone else's backyard. So for new developments, separate sewers for sewage and storm water, like those that Singapore has had for many years, are the way to go. In fact, they should be mandatory for all new developments.

Sanitation Policies in Southeast Asia

There is clearly a need for explicit government policies and plans for sanitation and sewerage development or redevelopment, supported by a budget. Every part of a city, new or old, needs such a plan.

Research shows that all six Southeast Asian countries in this study have no clear national urban sanitation policy, just mostly adhoc sanitation plans for cities. If these countries were to do nothing else but incorporate sanitation responsibility into the water utilities, as Manila (Maynilad and Manila Water) and Binh Duong (BIWASE) have already done, then that would be one mighty step in the right direction. When responsibility for water and sanitation services is under one roof, it is relatively easy to pay for both services through the water bill. But a note of caution needs to be sounded

Septic tank desludging

Septage treatment plant

here. Both services should be charged on the basis of metered water consumption, with no fixed charges. Above all, transparency is necessary. Another point to remember here is that almost everywhere in the world, sewerage capital costs are covered by grants or cross-subsidized in some way.

ADB and other donors must help politicians and decision makers become more aware of the links between water and sanitation. Agreement to put water and sanitation under one roof should be complemented by a government assurance that all associated subsidies will be paid to the utility each year as a public service obligation, until the consumers can afford to pay the full cost recovery tariffs. The utility presents its financial accounts each year, showing the subsidy in a transparent way, and then the government writes a check. This is what the Provincial Waterworks Authority in Thailand does. The government must have sufficient economic resources, and the utility must operate efficiently.

ADB Water Operational Plan (2011–2020)

Wastewater Management

Investments in wastewater management and reuse will have to be expanded significantly and allied with the cleanup of polluted surface water and groundwater. Different standards, treatment levels, and technologies apply to different needs. Countries need to start with available infrastructure and technology and upgrade their assets over time. Installations in new cities and retrofitting of older systems can adopt the cascading modular system. This involves clean water for drinking, cascading down to gray water filtered for agricultural, urban, and industrial use, and subject to further filtering for potential recycling or environmental recharge, etc. Wastewater can also be “harvested” for energy production or nutrient capture, or used, after further filtering, in agriculture or for environmental purposes. Decentralized systems will help facilitate this approach. Appropriate technology, which meets differentiated end needs at costs that attract investments, will be the recommended solution. ADB will help its DMCs determine which option—e.g., wastewater recycling, beneficial reuse of sludge byproducts—best suits the needs. (In this regard, energy-efficient wastewater treatment technologies are now so advanced that treatment systems when coupled with energy-generating systems can become energy surplus systems.)

Sanitation

ADB will pursue investments in sanitation infrastructure and services, wherever required, to secure higher gains for public health and strengthen the economic competitiveness of cities. The scaling up of sanitation will be a key activity in the surge to deliver progress against the MDG targets, and will be central to the success of future urban and rural water operations. Implementing sanitation investments as a small component of larger urban and rural water supply projects is not recommended. Typically, water supply projects should include a meaningful sanitation component to allow a balanced approach to total water service delivery. Projects should also indicate what should be done with the incremental wastewater generated from their development. This means responsibly addressing system input and output, i.e., water and wastewater. There will be support for stand-alone sanitation investments, where there is a need for them, and where a sound and sustainable business case can be made. The sequencing requirements of clients may determine early operations in water supply with wastewater and sanitation investments to follow. This applies where a client country has requested an official development assistance partner to lead in sanitation and ADB to lead in water supply.

Rehabilitation of Rivers

River cleanups are very expensive; however, delaying an expansion of investments in this subsector is no longer acceptable. Future investment demand for river cleanups will be significant because of the need to conserve water and growing concerns in communities about the health of their rivers. Knowledge and skills developed from work on IWRM, rural water, and irrigation, where appropriate, will inform approaches.

Main Findings from ADB Sanitation Dialogue in May 2011

The Big Picture

- Sanitation should be high on the priority list and should get political support.
- Good data and information are needed but unavailable.
- Innovative sanitation approaches and services (including not using fresh water to transfer sewage) are necessary.
- National discharge standards are important.

Marketing

- Awareness raising and behavior change are more important than the budget.
- The marketing of sanitation services should be based not on health and hygiene but more on dignity, prestige, and peer pressure.
- Promoting household sanitation must start with thorough social mobilization to motivate communities and create demand for sanitation.
- Planning, education, and awareness should be integrated.
- Schoolchildren should be used as agents for change.

Business Opportunities

- Sanitation as a business has had success.
- Operation and maintenance, an area of major weakness in the past, offers good business opportunities for the private sector.

Box 14.1: Findings from ADB *Asian Sanitation Data Book 2008*

Main Findings

- Data, especially health statistics, are limited.
- Lack of sanitation leads to polluted groundwater and surface water.
- Open defecation is widespread.
- There are few sanitation plans.
- Good data on capital or operation and maintenance (O&M) expenditure are unavailable.
- Only 10% of cities surveyed cover O&M costs.
- On average, only 20% of operating costs are covered by tariffs.
- Responsibilities are shared by several institutions—four on average.
- Only 4 of 22 cities relying on septic tanks have septage treatment facilities—two government and two private.
- Two cities have accepted eco-san toilets.
- In 18 of 27 cities with some sewerage, the services cover only 35% of the area, on average, and only 29% of the population.
- Water supply services cover 50% of the area, on average, and 58% of the population.
- In 22 cities with individual septic tanks, area covered averaged 48%.
- In 13 cities with communal septic tanks, area covered averaged 4%.
- In 18 cities with pit latrines, area covered averaged 17%.
- In 13 cities with open defecation, area covered averaged 17%.

Missing Information Elements

- Price of new sewer connections (only 5 of 18 cities with sewerage responded),
- Sanitation policy and essential indicators,
- Size of each centralized sewerage system,
- Combined versus separate sewer systems, and
- Industrial versus domestic waste.

Conclusions

- No data = no measurement = no management.
- Sanitation is not a government priority.
- Although water is a government priority, many still buy bottled water.

- Utilities will increasingly become resource recovery businesses.
- Sound asset management is important.
- Sanitation has the potential to become a resource for generating energy, reducing water stress, producing better agricultural products, and enhancing resilience to climate change.
- Wastewater reclamation is a must, with a great business future.
- Financial sustainability is problematic.

Technologies

- Finding the right technology and design is important. There is a wide range of sanitation technology choices, but not enough information for selecting appropriately among them and applying the technology to local conditions.
- The link between technology and knowledge must be considered.
- Social entrepreneurs, the R&D movers of society, play an increasingly important role.
- Knowledge sharing is important. Different organizations should collaborate.
- What has succeeded should be used and replicated. All steps in the process, especially the engagement of stakeholders, are needed.
- Associations with industry should be used.
- Water and sanitation must be considered as a whole.

Financing

- Tariffs must at least cover all O&M costs.
- Capital costs may be funded with government grants.
- Contributions from the municipal budget should cover shortfalls in meeting O&M costs from tariffs.
- A phased approach and decentralized sanitation options should be used.
- Public-funded support should complement, not replace, sanitation markets.
- The supply chain should be strengthened, to improve access to services and hardware.
- To reach scale, new performance-based financing mechanisms for sanitation services are needed.

Extracts from ADB and National University of Singapore's *Good Practices in Urban Water Management* (2012)

Bangkok

Bangkok has adopted a combined sewer network for surface runoff and wastewater. In 2009, there were 22 municipal wastewater treatment plants (WWTPs) under the supervision of the Water Quality Management Office. Of these, seven were central WWTPs with a combined treatment capacity of 992,000 cubic meters per day (m^3/d) and 12 were small community WWTPs with a treatment capacity of 24,800 m^3/d. Wastewater treatment services cover only 12% of the responsibility area and slightly over 3 million people, or about 54% of Bangkok's population. Up to 25% of the wastewater volume generated is treated and about 3% is recycled. The seemingly slow pace of development of wastewater treatment infrastructure can be attributed to the high costs and the difficulty in finding suitable locations for treatment plants, especially since land in Bangkok is very expensive.

Manila

For Manila Water and Maynilad, the initial priority after privatization in 1997 was water distribution. The schedule for sanitation coverage was specified in the concession agreement, although both utilities lagged in actual achievement in sewerage and sanitation. With the extension of the concession agreement from 2022 to 2037, the two utilities have agreed to move forward on an aggressive sanitation and sewerage program. Manila Water has a "three rivers plan" dividing the east concession into 29 catchment areas. The old practice of wastewater management in the metropolis was built on septic tanks, which would eventually spill into the drainage system and into the Pasig River. At the start, both concessionaires concentrated on desludging septic tanks. The long-term goal is dedicated sewerage lines, but it is likely to be realized only toward the end of the concession period. Meanwhile, Manila Water is implementing a combined sewerage–drainage solution. Wastewater that would otherwise flow through drainage pipes into the rivers in the metropolis is channeled into one of 38 sewage treatment plants and treated before discharge into the Pasig, Marikina, or San Juan rivers or into Laguna Lake. Critical infrastructure investment by Manila Water will raise sewerage coverage to 30% by 2012 and, it is hoped, to 63% by 2022, compared with 3% coverage in 1997.

In 2011 Manila Water's sewage treatment capacity totaled 150,000 m^3/d. The utility has a fleet of 77 trucks for de-sludging septic tanks. Both Manila Water and Maynilad produce bio-solids, which they sell as fertilizers to farming communities. Since 2008, Manila Water has been supplying some 4,000 m^3/d of recycled water to the University of the Philippines–Ayala Techno Hub for gardening and toilet flushing.

Singapore

Wastewater management is an integral part of the water cycle in Singapore. When the country gained independence in 1965, only 45% of its population had access to proper sanitation. By 1997 it was fully served by a modern sanitation system. Years of substantial investment in used water infrastructure had paid off.

Used water is collected through a network of underground sewers that lead to sewage treatment plants, which in Singapore are known as water reclamation plants to reflect the fact that water is a resource to be reclaimed. This used water network is separate from the storm-water collection system, which comprises drains that collect and channel storm water and surface-water runoff to rivers and reservoirs. The separation of the two systems prevents used water from polluting reservoirs and waterways.

In 2012, about 575 million m^3 of used water was treated. The largest facility is the Changi Water Reclamation Plant, with a capacity of 800,000 m^3/d. The plant covers 32 hectares of land, but its plant-on-plant design saves land costs. Used water is first treated at the water reclamation plants. Much of the treated used water is then piped to NEWater plants as feedwater for NEWater production. To produce NEWater, treated used water is further purified through a three-stage process of microfiltration, reverse osmosis, and ultraviolet disinfection. The excess treated used water is discharged into the sea.

Singapore imposes stringent limits on the physical and chemical characteristics of trade effluent that industries discharge into public sewers. Source control at the industries ensures that water received at the water reclamation plants is suitable for treatment to NEWater standards. Site surveillance of targeted companies and on-site volatile organic carbon monitoring system at factories, sewer networks, and inlets of water reclamation plants allow early detection of illegal discharge, and therefore adequate response time to safeguard downstream treatment processes.

Sewage treatment plant in Singapore

Chapter 15

Sanitation Stories

Extract from "Wastewater Management beyond Biogas Plants"
by Javier Coloma and Graciano Carpes
ADB Water Conference, March 2013

In Indonesia's sanitation sector, the few sewerage systems are managed by the local office of the regional water utility (PDAM), public enterprises, and public service agencies. Regional governments generally agree on the need for solid waste services but have done little to provide proper wastewater management. The challenges in the sanitation sector include (i) incomplete policies and regulations; (ii) low priority given to sanitation, especially at the local level; (iii) underinvestment and limited funding; (iv) limited availability of master plans for dealing with the challenges of sanitation; and (v) lack of expertise and qualified personnel for proper sanitation management.

Improving the capacity of wastewater operators remains essential for increasing service coverage, quality, and continuity. EMASESA, water and sanitation operator for Seville, Spain's third-largest metropolitan area, has been working since 2012 with two Indonesian wastewater companies in Yogyakarta and Surakarta under the 30-month ADB regional technical assistance project Supporting Water Operators' Partnerships in Asia and the Pacific. The experienced utility is transferring knowledge about asset management to the Indonesian utilities as part of a twinning arrangement. The work is structured as follows: (i) diagnostic visits; (ii) work planning; (iii) work plan implementation and monitoring, including theoretical and practical training; and (iv) twinning program completion and evaluation, including knowledge product development.

A new approach to policy making, institutional reform, strategic planning, and awareness building for the sector—an outgrowth of the government's ongoing Acceleration of Sanitation Development for Human Settlements Project in 2010–2014—is also being scaled up at the national level and implemented in 330 cities and regencies throughout Indonesia.

Under the WOPs program, the assistance comprises a range of knowledge and capacity development services, foremost of which is technical and management support from well-performing "mentor" operators through twinning partnerships with lesser performing "recipient" operators. The activities focus on: (i) establishing and supporting regional water utility networks; (ii) facilitating water operators twinning partnerships; (iii) training and technical support for continuous improvement and benchmarking; (iv) training workshops on operational efficiencies, and; (v) developing knowledge products.

Recommendations

The visits by the "mentor" operators to Surakarta and Yogyakarta resulted in recommendations in the following areas to complement the work that is taking place:

- Electromechanical maintenance workshops;
- Pipe-cleaning workshops;
- Funding for house connections;
- New treatment plants and networks for the city regions;
- New technologies for sewer installations; and
- Health and safety.

Extract from "Making Wastewater an Asset"
by William Powell
ADB Water Conference, March 2013

Current mainstream technologies for wastewater treatment, such as activated sludge and tertiary nutrient removal, are too costly to provide a satisfactory solution to the increasing wastewater problems in developing regions. These technologies do not allow for reuse of valuable energy and nutrients (Gijzen 2001). Mainstream technologies require consistent maintenance, trained operators, chemicals, and electricity to be effective, while invariably releasing

biogases into the atmosphere. Treatment plants are applicable when dealing with huge volumes of wastewater and industrial wastewater, and in communities where landmass is in short supply. As a global society, we are losing the battle to manage our wastewater. The demand for fresh water for agriculture is increasing.

So why go to great expense to remove organic matter from wastewater? Why not make use of it? I know some progressive organizations do. However, if we as a global society were successful at this approach, then we wouldn't have bio-matter wastewater (BMW) polluting our water and causing enormous human health issues worldwide. So, rather than trying to remove the BMW in treatment facilities, why do we not simply assist nature in the process? BMW contains sludge components that in time will break down the organic matter naturally. The problem is, in today's world, the populations of people and animals are producing enormous quantities of BMW at such a rapid rate and nature cannot metabolize fast enough. By speeding up the natural decomposition of sludge, we resolve many issues. In nature, the microbes and enzymes follow the food source, sludge, or manure underground, in lagoons, or in holding tanks. This is by far the most cost-effective and simplest solution. In the process of accelerated decomposition of sludge or manure, the fully treated environmentally acceptable wastewater outflow becomes ideal irrigation water for some agricultural crops or golf courses. The outflow water contains mineral nutrients, in more readily bio-available forms, for plants and crops. Another side effect of the accelerated decomposition is the accelerated release of biogases, thus allowing the cost-effective harvesting of these biogases, methane in particular, for heating or power generation.

In Canada, over 300 municipalities and numerous contained livestock producers, located mostly on the prairies, use a compound developed in the 1950s and 1960s to manage their BMW. BMW management has had a 40-year history of continued success. For maintenance, the compound is added once a week to the BMW lift station or holding facility. The annual cost of using the compound for maintenance is between $0.50 and $6 per person, depending on population, retention time between inflow and outflow, and the climate. In Southern Africa, it cost $20,000 (or $0.20 per person) to clean out 15,000 meters of partially blocked sewage pipes with sludge and sand. Removing the sludge manually from underground pipes would have been very expensive. It was a cost the customer could not afford. Previously the BMW was backing up through manholes and down the streets, for up to 5 years in some places.

Combining the successes of 40 years of BMW remediation with the experience gained from 31 years of using anaerobic digestion for biogas collection yields a profitable solution to BMW. Certain variables—availability of land, already-established infrastructure, local temperature, and the local price paid per kilowatt-hour of electricity—affect the viability of the installation of an anaerobic digestion system.

As a general guide, the capital outlay for the installation of an anaerobic digestion system to capture biogas is between $50 and $65 per person, or between $3,000 and $5,000 per kilowatt-hour. This amount does not include the purchase of land or infrastructure to bring the BMW to the location. The income from power generation is $10 or more per person per year. This means a return on investment in 5 years or possibly less. Managing this anaerobic digestion system entails minimal maintenance cost and expertise. Added benefits are the availability of treated, environmentally acceptable water rich in outflow mineral nutrients for use in irrigation, and the possible application of carbon credits. Compare this with the cost of installing wastewater treatment plants—a capital outlay of $500 or more per person—plus the ongoing maintenance cost, the continuous need for sludge removal, and, in most cases, the release of biogases into the atmosphere.

Extract from "A Rapid Assessment of Septage Management in Asia: Policies and Practices in India, Indonesia, Malaysia, the Philippines, Sri Lanka, Thailand, and Viet Nam" US Agency for International Development, January 2010

Main Recommendations

- *Raise awareness of the direct health, environmental, and economic benefits of proper septage management among both policy makers and septic tank users.* Such awareness is critical in creating new policies and programs and ensuring public and financial support for initiatives.
- *Establish and enforce clear national and local policies for scheduled desludging and for septage treatment and disposal.* Clear legal and regulatory requirements provide the foundation for compre-

hensive septage management programs. There is a need to update and enforce septic tank design codes, mandate scheduled desludging, and strengthen the monitoring of illegal dumping and the enforcement of regulations preventing illegal dumping.

- *Strengthen the capacity of implementing agencies and utilities.* National and local governments should provide technical support and training to national and local officials and both public and private operators through capacity-building initiatives that focus on the technical, institutional, planning, social, and financial aspects of septage management. They should build wastewater infrastructure using real estate leverage, and develop mechanisms for interagency coordination and dialogue.
- *Enable private service providers to scale up scheduled desludging.* Local governments should create incentive schemes and regulatory programs for scheduled desludging by private service providers.
- *Increase funding for septage management and reform tariff structures.* Where possible, combined billing and collection systems should be maintained for septage management and water services. Opportunities and incentives for commercial activities should be created.
- *Share experiences through peer-to-peer cooperation.* Cooperation can be achieved through water operator partnerships, nationwide replication, regional research collaboration, and dialogue at regional events.
- *Manage water and wastewater jointly, as a long-term goal,* as is being done in Johor Bahru, Malaysia.
- *Ho Chi Minh City is the first city in Viet Nam to privatize septage management.* HCMC passed legislation in 2007 on septage management in order to control illegal septage disposal by private operators. But because the treatment facility is located 20 kilometers outside the city, most desludging companies choose not to travel that distance.

Box 15.1: Community-Led Total Sanitation

Most past approaches to on-site sanitation were based on the assumption the people were poor and could not afford to build their own toilets so they must be helped with money, materials, technical aid and prescriptive solutions including teaching hygiene behavior. Mostly overlooked, was the potential of communities, their collective strengths and local and indigenous knowledge.

Although over the last few decades many latrines were built for both private and public use, many were not used or maintained for the purpose they were built. The conclusion was that most of the development professionals fixed more on *things* than on people. Construction of a latrine was viewed as the solution not behavior change.

But the situation was even worse, because without proper hygiene behavior change, the enhanced and easy access to water caused contamination to spread faster than before. Without any doubt sanitation must be seen as the precursor for creating water facilities if a sustained outcome on health is to be guaranteed.

Through the community led total sanitation (CLTS) approach, people have realized the basic truth that no human being is willing to live on feces and eat each other's feces. From the moment this realization triggers humane elements of disgust, shame and self-respect, a radical transformation begins. So a drastic shift in the approach brought about by CLTS was the change in assumption from *health as the driver of change* to *shame, disgust and self respect* as the main shaker.

We have gone from a situation where building latrines was subsidized by governments and donors to a situation where every household within a community, even a poor community, builds their own latrine without subsidy. The main driver was collective realization of the fact that so long as any one member of a community defecates in the open all the others are in danger of ingesting feces, which was unacceptable. Social solidarity brings the entire community together toward changing behavior collectively. Once they achieve ODF status peer pressure keeps it up.

The other transformation was the shift from an outside agency-led supply driven partial sanitation drive, to a local community-led demand driven total sanitation approach which was self mobilization. This came about through an understanding of the concept of *public good* instead of the former *individual good* which was based on toilet acquisition for only a few. Today CLTS based on open defecation free communities is being implemented in more than 50 countries and governments in 17 countries have adopted CLTS in their respective national sanitation policies.

Source: Kamal Kar, Founder of the CLTS approach to sanitation.

Extract from "Manila Water's Separate Sewer and Combined Sewer-Drainage Systems" by R. Baffrey, A. Adis, and G. Aranzamendez ADB Water Conference, March 2013

When Manila Water first looked to expand sewerage and sanitation coverage in Manila's east zone, the most logical technical solution seemed to be to put up centralized sewage treatment (CST) systems, as proposed in previous sewerage master plans of MWSS. However, it was determined that implementing those plans would entail massive road excavations and require 47 hectares of land. The capital costs would be very high. Since capital costs are directly recovered from customer tariffs, the realization of the plans had to carefully account for, and was subsequently limited by, the customer's ability to pay.

Using a strategy that was both technically feasible and affordable to customers, Manila Water was able to expand the sewerage and sanitation coverage in the east zone at a faster pace. The major component of this strategy was the construction of sewage treatment plants, employing either separate sewer or combined sewer-drainage systems where they were most appropriate and feasible.

Separate sewer systems have sewer lines that are directly connected to houses and establishments to convey wastewater to treatment facilities. These networks are operated separately and independently from storm drains and are considered the highest level of wastewater treatment.

In pursuing this approach, Manila Water specifically targeted preexisting CST systems and corresponding dedicated sewer networks. At the start of privatization, these systems did not operate efficiently and did not meet the regulatory standards for treated effluent. Many of the facilities had deteriorated, and access manholes had been covered and built over with housing infrastructure. Ownership issues also arose as informal settlers and others claimed the land occupied by the CST systems. In addition to this, the settlers informally residing on these structures faced serious health risks. Maintaining these systems via desludging was therefore difficult. Accumulated sludge and grit eventually rendered the CST systems inefficient and ineffective. Still, the facilities had unique advantages, specifically for the implementation of separate sewer systems: available land and preexisting sewer networks.

Hence, the evident strategy to be employed was to upgrade these CSTs into package sewage treatment plants (STPs) or, alternatively, lift stations, which in turn would convey wastewater to larger, more centralized STPs. As mentioned previously, this strategy eliminated two of the main challenges facing sewerage expansion: the inconvenience of laying sewer pipelines and the acquisition of land for the STPs. Since sewer lines already existed, no excavation had to be done in areas already served by CSTs. Pipelaying costs were therefore minimal and there was no impact on pedestrians and vehicular traffic. Also, the locations of the CSTs were simply used as sites for the package treatment plants and lift stations.

Indah Water Konsortium (Malaysia's National Sewerage Company)

Background and History

Indah Water Konsortium (IWK) is a government-owned company that provides sewerage services to about 20 million users (population equivalent) across the 11 states of Peninsular Malaysia. Currently, IWK manages more than 5,900 public sewage treatment plants; 700 network pumping stations; a 16,300-kilometer network of sewerage pipelines; and septage and desludging services for over 1 million individual septic tanks. Wholly government-owned, IWK was established in April 1994 following the Malaysian government's decision to federalize and privatize sewerage services nationwide in December 1993. The government's decision essentially established the Sewerage Services Act of 1993, the Sewerage Services Department as the regulating agency, and IWK as the concessionaire for sewerage services nationwide. IWK's concession covers 87 local authorities in Peninsular Malaysia and the sewerage services are administered via 19 operational unit offices catering to service areas (zones) demarcated along local district boundaries. In hindsight, the government's decision played a key role in the country's achievements in sanitation provisions to secure public health and protect environmental resources. Basic sanitation coverage in Malaysia is now more than 95%, exceeding the target set in the United Nations Millennium Development Goals. Modern community and regional sewerage systems predominate throughout the country.

Over the past two decades, IWK, with other related governing agencies, has overseen the realization of modern and efficient sewage treatment systems in Malaysia. The key areas of achievement, challenges, and lessons learned are described below.

Improved sewerage facilities, services, and operations

IWK's service area has seen a significant increase in population equivalent served with connected services, from 2.5 million in 1994 to 20 million in 2013. Additionally, IWK has systematically overseen progress in treatment technologies adopted. Old and underperforming systems, such as communal septic tanks, oxidation ponds, aerated lagoons, and Imhoff tanks, are progressively being upgraded into mechanized secondary treatment systems or rationalized into modern sophisticated regional sewage treatment plants. IWK has also developed standard procedures for sewer maintenance, as well as for a quick response in resolving sewer blockages.

Sustainable sewerage planning and development for systematic infrastructure improvements

In the early years, one of the major challenges faced by IWK was a dilapidated sewerage system inherited from local authorities. To realize the much-needed improvements in sewerage infrastructure and systems nationwide, IWK worked hand in hand with policy makers and infrastructure developers to institute sewerage planning and development controls. These included sewerage catchment strategies and national guidelines for sewerage development and certification services.

Asset management systems for sustainable sewerage services

In line with IWK's goal of sustainable delivery of sewerage services, IWK has focused more recently on developing systems for the systematic management of its physical assets as well as the interface with human, financial, information, and intangible assets. IWK's strategic approach has been to focus on asset data integrity, systems for managing data and transforming the data into information, and decision-making tools to enable the information to be processed and used as a basis for decisions and actions relating to assets and service delivery.

Customer services and awareness program for sustainable services

Another major obstacle for IWK was the lack of public awareness and willingness to pay. IWK overcame this challenge by establishing dedicated customer relations and communications services. A customer charter specifying the desired level of services ensures that acceptable time is taken to respond to and address public inquiries. The percentage of complaints resolved in recent years has been as high as 95%–97%. Over the years, IWK has spent millions of dollars implementing public awareness programs to educate consumers about the importance of proper sewage treatment as part of the country's sustainable development.

Information systems to integrate operations and management processes

To manage the diverse and huge number of facilities it had inherited from local authorities across Malaysia, IWK incorporated and developed information technology systems for its asset database, operation and maintenance, customer care, and administrative functions.

Value creation for the sewerage industry

IWK's holistic approach included components that create future value, namely, research and development (R&D), training, and quality systems. R&D projects were carried out to improve sewage treatment, and promote reuse and green technology. For operational excellence, IWK established a structured technical training program to ensure a highly skilled workforce. IWK has so far developed more than 50 in-house training modules for all aspects of sewerage management and for the various levels of the workforce.

Regional Involvement in Water Operator Partnerships

Given its varied experiences and lessons learned, IWK is able to provide capacity-building and technical services to other developing countries to improve their sanitation services. This is evident in Malaysia's involvement in regional capacity-building programs via regional development agencies such as the Asian Development Bank, the US Agency for International Development (through its Environmental Cooperation–Asia [ECO-Asia] program),and others. As Malaysia's leading sewerage operator, IWK has provided a varied range of mentoring programs to recipient operators in India, Indonesia, the Philippines, and Viet Nam to improve their local sanitation services. IWK's range of sewerage facilities are much-sought-after training grounds for other developing countries. Through the years, IWK has received many requests from Middle Eastern and South and Southeast Asian countries for technical visits and training services. Technical and consulting services in sewerage sys-

tems planning, operation, and optimization have also been provided to countries in those regions.

Recent Trends, Challenges, and Strategies for Future Development

More recently, the need to make further progress toward greater transparency and economically sustainable integrated water and wastewater services has led to the passage of the Water Services Industry Act of 2006 and the establishment of the National Water Services Commission in 2008. **Integrated services, with joint billing for potable drinking water supply and sewerage, are expected in the near future.** Given the country's visions for a sustainable future, there is potential for the transformation of the current public utility setup into a resource recovery venture. One key area would be to develop green technologies for sewerage revolution. Waste treatment facilities can be turned into by-product centers that generate additional revenue while greening the environment. It is a concept of sustainability through zero waste management and the conversion of waste to wealth.

Box 15.2 Malaysia Water Operator Partnerships on Sanitation

- *March 2009:* Experts from Indah Water Konsortium (IWK) of Malaysia trained counterparts from **Medan, Indonesia,** to improve access to the city's sewerage network by increasing consumer demand through a sanitation promotion campaign.
- *August 2009:* **Medan** formally launched its sanitation promotion campaign, aimed at increasing resident connections to the city's newly constructed sewerage network. City workers distributed sanitation booklets to residents, quizzed the campaign audience on the benefits of sewer connections, and gave prizes such as educational T-shirts to the winners.
- *March 2010:* As part of their twinning partnership, two staff members of **Maynilad Water Services in the Philippines** visited IWK in Kuala Lumpur to participate in sanitation promotion and planning training based on the 10-step water and sanitation promotion toolkit of the US Agency for International Development's Environmental Cooperation–Asia (ECO-Asia) program. The twinning partners reviewed the problem statement of the promotion program and pilot area survey results, and drafted a strategy for change. The objective was to increase household willingness to connect to sewer lines.
- *January 2011:* **Five water districts in the Philippines** signed a partnership agreement with Malaysia's national wastewater operator, IWK, and Maynilad Water Services to cooperate in developing and improving septage management programs. The water districts were seeking assistance in designing effective septic tank desludging and treatment and disposal procedures.
- *July 2011:* **Thirteen staff members from two wastewater operators in Indonesia and five wastewater system employees from the Philippines** gained vital knowledge and practical skills in operating and maintaining septage treatment plants and desludging fleets from Malaysia's IWK.

Chapter 16

Sanitation in Southeast Asia

Status of Sewerage Management in Southeast Asia

(See Table 5.1 Performance Parameters of Utilities, End of 2011)

In terms of sanitation, the best of the 12 Southeast Asian cities covered by this study is Bangkok, yet that city serves only about 54% of its population with sewerage and treats only about 25% of the wastewater it generates. In Manila, the two concessionaires are only now beginning to come to grips with wastewater collection, treatment, and disposal. Maynilad treats about 25% of its wastewater; Manila Water, only about 10%. In Jakarta, at most 3% of the population has access to sewage collection and treatment services. Ho Chi Minh City treats about 12% of its wastewater and sewage. Vientiane discharges combined storm water and sewage to wetlands; Phnom Penh, to a natural lake. Cebu, Davao, and Palembang have hardly made a start on sewerage management.

But it is encouraging to note that nearly all the cities surveyed have plans to increase sewerage coverage and are getting funding support from the private sector arm of the World Bank Group (Manila), ADB, and the Government of Japan. (See Table 16.1 for the current status of sewerage management in the 12 cities and their planned improvements.)

Anecdotal Interviews on Sanitation

- "We used to get drinking water from our deep well. Now we buy bottled water at ₱15 per gallon (about 4 liters). The nearness of toilets in our place to the deep well was a concern." (Cebu)
- "Garbage blocks the drainage system and causes flooding. In Cebu you can't find a garbage bin when you need one. Segregating garbage at home is a question of values and discipline." (Cebu)
- "We have a runaway population. The poorer people are, the more they contaminate the rivers. We have no sewerage system. We have no recycling system. There is no wastewater management." (Cebu)
- "In schools, we need to teach the importance of sanitation. Most people do not value sanitation. Others defecate anywhere, and do not even know how to use a toilet bowl." (Cebu)
- "We have to treat our wastes before releasing them into the environment. Septage treatment plants are really worth having." (Cebu)
- "The government must start to tackle sanitation. First, it must tackle septage management." (Cebu)
- "Right now there are even free desludging projects." (Manila)
- "Industry pollutes more than residential consumers, so industry must pay higher tariffs."(Bangkok)

Water sources are being contaminated through pollution and poor sanitation. The schools must teach the importance of sanitation and good hygiene.

Focus on Schools for Water Supply and Sanitation

If you can't measure you can't manage. How many times do we say this, see this, hear this?

Let us apply that to water supply and sanitation in the schools. The very first job of a city administrator is to make sure that ALL schools have the necessary water supply and toilet facilities. Any money to be spent on water supply and sanitation in the city must first go into getting 100% coverage in all its schools. Why?

The future will depend on today's young people. They are not yet fixed in their ways. They are ready

Table 16.1: Status of Sewerage Management in 12 Cities in Six Southeast Asian Countries, 2013

City	Current Status of Sewerage Management	Plans for Sewerage Management
Philippines		
Manila: Maynilad	There are about 56,000 sewer connections. The combined drainage and sewerage system feeds STPs with a combined capacity of 470,000 m^3/day. Initially under concession contract focused on septic tanks and desludging. Sewerage coverage is only 8%.	Plans to finance its own sewage and wastewater collection, treatment, and disposal. Increase in sewerage coverage to 32% is planned over the next 5 years. Aim is 100% coverage by 2037.
Manila: Manila Water	Initially (from 1997) concentrated on septic facilities and desludging and treatment of septage. There are 77 de-sludging trucks. Interceptor sewers lead to 38 STPs with a total capacity of 150,000 m^3/day. Combined sewerage drainage coverage now is about 30%.	Plans to increase sewerage coverage from about 30% now to 63% by 2022. The long-term goal is dedicated sewerage lines, but that is likely to be realized only toward the end of the concession period (2037).
Metro Cebu	There are only minor sewerage and sewage treatment facilities. STP capacity is about 1,200 m^3/d.	Japan is helping with new technology for sludge dewatering. A new STP is being constructed. ADB is involved in a new regional project.
Davao City	Water supply coverage has been a priority since the creation of DCWD in 1973. Coverage is now 60%. There are negligible sewerage and sewage treatment services	ADB is supporting the Urban Water Supply and Sanitation Project. AusAID is providing cofinancing.
Indonesia		
Jakarta	Only about 3% of Jakarta has proper sewerage services. STP capacity is only about 39,000 m^3/day.	JICA is assisting with the planning of new STPs, which should be operational by 2020.
Medan	About 16,200 official sewer connections discharge into an STP with a capacity of 60,000 m^3/day, but only 10,000 m^3/day is treated because of poor design and O&M.	ADB loan support will be used to rehabilitate STP and allow it to operate at 60,000 m^3/day, and to provide sewers serving 171,000 people.
Palembang	Palembang does not have a sewerage system. Domestic wastewater goes into septic tanks.	AusAID in 2010 gave a grant for a wastewater masterplan. A pilot project will be constructed in 2014.
Viet Nam		
Ho Chi Minh City	Only 10% of domestic wastewater and 30% of industrial wastewater is treated. The combined STP capacity is about 171,500 m^3/day, excluding STPs in small industrial and residential estates.	The World Bank is assisting with an environmental sanitation project. The central government has approved plans leading to 100% sewerage coverage by 2020.
Hai Phong	A combined sewer system feeds directly into the rivers through canals and tide-blocking sewers. There are only a few small wastewater treatment facilities. There is a regulating pond system of about 71 hectares. The only sludge treatment plant has a capacity of about 7,000 m^3/day.	From 1999 to 2007, a wastewater project funded by the World Bank was implemented. A 9 km by 2.5–3.0 m diameter interceptor sewer was built under the project. There is a master plan for Hai Phong drainage and sewerage up to 2020.
Binh Duong	No sewerage and sewage treatment facilities are operating. However, BIWASE's responsibility for both water and sewerage is a big plus for the future.	Sewage treatment plants and a sewerage system are now being constructed.

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Table 16.1 *continued*

City	Current Status of Sewerage Management	Plans for Sewerage Management
Thailand		
Bangkok	Bangkok has a combined sewer network for surface runoff and wastewater. In 2009, the 22 municipal wastewater treatment plants had a combined capacity of 1,016,000 m^3/day. Wastewater collection services are available to about 54% of the population but only 25% of the wastewater volume generated is treated and only 3% is recycled.	The slow pace of wastewater treatment is attributed to the high cost of land and the difficulty of finding suitable locations.
Cambodia		
Phnom Penh	There are no wastewater treatment plants. Wastewater is pumped from the sewer system, which serves most households, into a natural lake.	JICA is assisting in the construction of sewers, but there are as yet no plans for other wastewater treatment.
Lao People's Democratic Republic		
Vientiane	Combined drains and sewers take effluent from septic tanks and small package treatment plants and discharge into rivers or into a large wetland area.	There are proposals to improve the performance of wetlands to treat wastewater. Constructed wetlands still preferred.

to learn. If they come home from school and tell their parents about the very good water supply and sanitation facilities at the school, that puts pressure on the parents to at least match those facilities at home.

The school should not be teaching hygiene education if it has no water supply and sanitation facilities for everyone. What is the point in talking about washing hands if there is no water supply and soap? What is the point in sending girls to the school if the toilets are only for boys?

This is not just a top–down issue. Part of the problem lies with the schools that have money to spend, but often priority is not given to water supply and sanitation. Since more than one institution is involved, they need to coordinate with one another to achieve a common goal.

In some respects, peer pressure and the dignity and prestige aspects of community-led total sanitation (CLTS) can apply to any given school that claims to have fully adequate water and sanitation facilities. Other schools, in turn, will come under pressure to perform.

Of course, it is one thing to provide good facilities, and another to adequately maintain them. Maybe the school children should take turns keeping the toilets and the drinking and washing areas clean. This is good training and it will prepare them to be responsible adults.

Wastewater Treatment in Viet Nam

Industrial Wastewater

Pollution violations by industrial manufacturers have drawn much attention from media, government, and the general public in recent years. Public interest groups have begun to highlight the impact of polluting manufacturers on the environment and the economy. Companies on the environmental blacklist have been subjected to boycotts by partners and customers, or have had their loan applications rejected by banks.

Vedan Vietnam, a producer of food additives, was shut down and fined about $7.5 million for discharging about 5,000 m^3/d of untreated wastewater into the Thi Vai River. In similar fashion, the Hao Duong leather processing factory in Hiep Phuoc Industrial Park, which was found to be discharging 1,000 m^3/d of untreated wastewater into a nearby canal, had its power supply cut off and was forced to close down until it installed a proper wastewater treatment system.

Municipal Wastewater

According to the Hanoi Drainage Company, the city discharges 450,000–510,000 m^3/d of wastewater into lakes and rivers. Over 90% is discharged untreated, seriously polluting these watercourses. But a Prime Minister's Decision in 2008 made it mandatory for new

USAID training workshop in septage management

urban residential areas and industrial parks to develop and construct *separate* sewer systems for storm water and wastewater. Moreover, municipal and industrial wastewaters must be pretreated to comply with environmental standards before being discharged into the city drainage systems. Many wastewater treatment plants are now being constructed all over Viet Nam.

The Hai Phong One Member Sewerage and Drainage Company collects a wastewater tariff equal to 15% of the water tariff. It uses this income to cover most of the O&M expenditures for the sewerage and drainage system in the four inner districts of Hai Phong and to provide free septic tank desludging services to households in those districts. Under a World Bank loan, there are plans for a gradual increase in the proportion of the wastewater tariff to 25% of the water tariff by 2015.

Water Recycling in Southeast Asia

Singapore

Four NEWater plants in Singapore produce NEWater. NEWater is made by further purifying treated used water through a rigorous three-stage process, namely, microfiltration, reverse osmosis and ultraviolet disinfection. It is ultraclean and safe to drink. NEWater is used primarily for non-potable industrial purposes while a small amount is mixed with raw reservoir water before it undergoes conventional treatment at the waterworks. Today, NEWater can meet up to 30% of Singapore's water needs.

Indonesia

Water recycling is slow to catch on in Indonesia, despite the pressing need in Jakarta. In fact, Jakarta may be the only megacity in the world without a centralized wastewater treatment plant. Reusing water has never been a priority in Jakarta, but in Singapore and Hong Kong, China it is part of public policy.

However, the planned community of Lippo Karawaci, on the outskirts of Jakarta, offers an example of good total water management. All drainage is contained and directed to the golf course and water ponds for storage. The reserve keeps the underground aquifer replenished and can be used during a drought. All buildings and homes in Karawaci have piped water and are hooked up to a central sewerage system. Discharged wastewater is treated in a central sewage treatment plant and the cleaned water is diverted back into six water ponds scattered around the community or used for irrigation. These water management practices have been in use for 15 years.

Some people are urging the Jakarta Administration to issue a regulation mandating the recycling of water in city office buildings and the use of the recycled water in toilets, sinks, and showers. Others are calling for a regulation for all new buildings that requires the treatment and reuse of sewage water and the collection, treatment, and use of rainwater.[23]

[23] Source: Jakarta Globe (2011).

Thailand

Thailand's wastewater treatment plants recently came under fire after it was revealed that just 20% of all wastewater is treated and 40% of the wastewater treatment plants are underperforming.

Philippines

Xavier School, in Manila undertook its own wastewater recycling to maintain the ecological balance. Raw-water consumption, the school administrators were convinced, would be costly unless the water was reused in some way. Wastewater from drainage, drainpipes, and toilets is collected at the recycling plant, undergoes membrane-based filtration, and is treated for reuse in the irrigation of the football fields, general cleaning, and toilet flushing. Recycling has reduced the school's water bill, and the reduction is large enough to allow the school to recover the investment cost within 3 years.

Viet Nam

Water recycling is not yet a common option in Viet Nam, because the supply of freshwater and groundwater remains plentiful, water is therefore priced low, and water resource exploitation is not strictly regulated. The government has been asked to raise water prices to encourage people to save water, and to provide subsidies to investors in water recycling projects. One good recycling example is the Saigon Pearl residential area in Binh Thanh district, which uses recycled water for irrigating small plots of land, in the process saving the residents about $2,000 a month.

Sewerage and Sanitation Financing

This subject does not exist in isolation and is often a complex issue. For example, getting the institutional responsibility right is a top priority. As we have seen from the example of Singapore, Manila Water and Maynilad in the Philippines, and BIWASE in Viet Nam, it is important to work toward getting one institution responsible for both water and sanitation. Responsibility should cover the entire water cycle from source to disposal/reuse.

Charging for sewerage and sanitation through a surcharge on the water bill, based on water consumption and on actual O&M costs for sewerage and sanitation, is the way to go. In most cases, however, this is not the situation and sanitation remains the underfunded "poor relation" of water supply.

The example of Malaysia shows that people will not pay to connect to a sewer but can be persuaded with the right marketing campaign to avail themselves of sewerage services. In any willingness-to-pay situation, one only needs to answer the question "Do they have options?" to gauge the potential to pay for sewerage services. If there is one thing certain, it is that people in developing countries will not pay to connect to a sewer. As is now the case with water in Viet Nam, the connection must be free or subsidized in some way. Under the new Metropolitan Sanitation Management and Health Project for five cities in Indonesia, which is funded by ADB, the sewer connections will be provided free (i.e., amortized under the loan).

Few developed countries funded the capital costs of sewerage directly from the contributions of people who benefited. Most of them used grant funding from central governments. So why should developing countries in Southeast Asia be any different?

Good legislation passed recently in Viet Nam mandates developers to separate domestic sewage from storm water (as indeed Singapore did many years ago) and to make separate provision for both in collection, treatment, and disposal. In this case, the cost of a new house will include the capital cost of sewerage and drainage works.

We have seen what was possible in a self-funded decentralized sewerage system for 500 low-income households in Yogyakarta, Indonesia. There, it was the strong cohesive social force of the community that ensured sustainability. Where there is a will, there is a way.

The massive community-led total sanitation (CLTS) transformation that has been taking place around the world, and also now in Southeast Asia, has shown us that education, behavior change, and sanitation marketing are essential tools for successful rural and urban slum community sanitation projects. Implemented well, CLTS can negate the need for subsidies for latrine building. Open defecation–free policies are based on using peer pressure to force the people in a community to fund their own latrines for sanitation. While this campaign had a worldwide leader in Kamal Kar, it also relies on local community leaders to inspire the people.

But at the end of the day, who will finance the capital investment for sewerage? This is a big issue. Does

the government have the economic resources to meet the total sanitation needs? In a small country like Lao PDR, the government does not.

Urban Sanitation Solutions

There is no standard solution or "one shoe fits all" for urban sanitation. Each city, town, and village requires its own tailored solution. There are numerous types of collection and storage systems and a plethora of treatment technologies, from very basic to highly advanced. Selecting the right solution requires the skills of knowledgeable and experienced professionals, and for most cases in Southeast Asia, high technology is not the answer. The selection of appropriate and sustainable sanitation solutions for any given location will need to consider many things including: existing sanitation collection and treatment, population density, land use, land availability and cost, local topography, local expertise and capabilities, wastewater characteristics, discharge standards for local watercourses and land applications, power supplies and costs, chemical supplies and costs, willingness-to-pay, affordability, health and safety issues, operations and maintenance, and potential for reuse.

The development of sewerage and sanitation systems in large cities can take many decades to complete, so short and medium-term solutions must be implemented to address the immediate sanitation challenges, even if the long-term solution is determined to be centralized sewerage. Given the prevalence of household latrines and septic tanks in most Southeast Asian cities and towns, a first step may to improve and formalize septage collection and treatment rather than construct sewerage systems, as has recently been implemented in Manila. Or maybe small decentralized wastewater management systems could be appropriate in villages and towns, or parts of large cities.

In large Asian cities, with their mix of new and old development, high and low-income areas, informal settlements, and peri-urban areas, sanitation solutions will often be complex and likely to involve different solutions for different areas. This can result in a combination of on-site and off-site treatment, various types of collection systems, and various levels of service. So an appropriate long-term strategy must be developed (say over 30–50 years), including short and medium-term solutions that can be adapted and upgraded over time to meet increasing standards. For smaller towns and villages, it may be easier to implement longer-term solutions more quickly, without the need for medium-term goals.

Typical types of sewage/wastewater collection and conveyance systems include conventional sewerage (separate and combined), interceptor sewers with overflows, simplified sewerage, small-bore (settled) sewerage, and condominial sewerage. Each has its own application and design constraints, together with operation and maintenance needs. The selection of the conveyance system and the types of wastes carried have a significant impact on the selection and design of the downstream wastewater treatment plants.

Most "high-tech" wastewater treatment plants are variants on the original Activated Sludge Process (ASP), which although around since the early 1900's, is still the basis for the majority of treatment plants in developed countries. Such processes allow the treatment of large quantities of wastewater to very high standards on relatively small areas of land, but require expensive electro-mechanical equipment, large quantities of electricity, and highly experienced operations staff. In most developing countries, ASP and other "high-tech" treatment processes are not well-suited because they are typically complex, high-cost, and high maintenance; when low-cost and low maintenance are the primary criteria.

Low-cost/low maintenance wastewater treatment options are many and include aerated lagoons, upward-flow sludge blanket (UASB), tricking filters, waste stabilization ponds, and various proprietary package plants. The choice of process is based, broadly speaking, on a balance of power requirements versus land area/cost, although other practical considerations play a part.

Further reading on sanitation development options can be found in two recent publications (i) ADB, 2014. *From Toilets to Rivers – Experiences, New Opportunities, and Innovative Solutions*; and (ii) Robbins, David and Ligon, Grant. 2014. *How to Design Wastewater Systems for Local Conditions in Developing Countries.*

Governments need to recognize the importance of urban sanitation, give it high priority (together with water supply), develop sustainable solutions, and commence implementation. Given the general dearth of sewerage and treatment experience and expertise in Southeast Asia, professional expertise from outside the region may be needed to ensure good long-term strategies are adopted and cost-effective and appropriate solutions are selected.

Chapter 17

Conclusions

"Unless urban water governance practices are improved significantly, universal access to clean drinking water will remain an unachievable dream, even if billions of dollars of investment are provided with no strings attached." Ek Sonn Chan)

The conclusions will address two concerns: keeping one's goals in sight and doing what must be done to reach those goals.

Keeping One's Eye on the Ball

The goal for a utility is to provide 24-hour piped water to every household and business in the community, and to operate and develop efficiently.

The immediate goal for sanitation is to put water and sanitation under one roof.

Main Tasks

Governance might be defined as a structured, disciplined environment where urban water supply and sanitation operations and development can take place transparently, efficiently, sustainably, and with accountability.

Below are 16 activities that can be implemented to improve governance and help us achieve our goals.

- *Providing good leadership*. Tenuous leadership is common. Success, on the other hand, needs good leaders like Ek Sonn Chan and Tony Aquino, who stayed the course for 10 years or more. The leader we are looking for does not have to be a water expert but must be ready to put earlier successes to work as head of the water utility. That leader, once found, must have the support of governments and donors. Good governance comes when the buck stops with one person.
- *Delegating responsibility*. It's all about timely decision making. A leader in control will make decisions after seeking advice, and should know how to delegate responsibility.
- *Reducing political interference*. Government policy must be transparent, to start with. Its implementation must be monitored by civil society. We can progress further with private sector management that keeps operations at arm's length from the politicians.
- *Trimming the bureaucracy.* We need to monitor results, not the process. Civil-servant rules are not appropriate for running a business (selling water). Again, private sector involvement will help.
- *Paying better salaries.* Water is a business and must be run like one. Civil-servant salaries have no place in that business. We must recruit the best people from the open market and pay them open-market salaries, the way PPWSA in Cambodia and MWA in Thailand are now doing.
- *Raising tariffs.* Why are low tariffs a problem? Low tariffs direct the money trail and decision making through government, not the utility. Higher tariffs put the customer in control. To raise tariffs, the utility must go to the customers *and noncustomers* and get them to agree to higher tariffs, but the utility must also provide better services. What the customers endorse, the politicians must follow.
- *Reducing nonrevenue water.* Manila Water and PPWSA have proven that managing the distribution system at the lowest practicable level can greatly reduce NRW. In Viet Nam and the Philippines, we are seeing the successful use of the caretaker approach to reducing NRW, based on the same principle of managing at the lowest practicable level. It is important to remember the transition from NRW project to NRW as part of operations.
- *Instituting timely reporting*. Every utility must be required to produce an annual report to the public

within 6 months of the end of each financial year. If Manila Water and PPWSA can do this, why can't others?

- *Speeding up development time.* The target must be to reduce the average implementation time for a water supply or sewerage project from 8 to 3 years. It makes commonsense to use all resources available, and not just some. Utilities like BIWASE that combine consulting and contracting are headed in the right direction.
- *Minimizing procurement slippage.* When both the consultant and the contractor get squeezed on their bids, there is a snowball effect that can drastically shorten the life of the water facility under construction. The answer may lie in strict construction supervision (which applies also to leak repairs) and long-term accountability for the product through private sector involvement.
- *Improving metering, billing, and collection.* There is no excuse for not achieving close to 100% in metering, billing, and collection. If a job is worth doing, it's worth doing well. We can manage the utility distribution at its lowest practicable level, provide incentives and targets, and hold weekly accountability meetings, taking the lead from Manila Water.
- *Serving the unconnected urban poor.* Viet Nam has set a good example of providing free connections to all and recovering costs with higher tariffs for all, spread over several years. We can also create unique departments to serve the urban poor.
- *Giving sanitation a higher priority.* Governments need to recognize the importance of urban sanitation and give it a high priority, similar to that of water supply, if any real progress is to be made. Singapore and Malaysia have shown the way, and other countries need to consider similar strategies.
- *Improving support for sanitation development.* Most developed countries have urban water supply and sanitation under one roof, with responsibility for water from source to disposal/reuse. This is the only successful model for supporting long-term urban sanitation development.
- *Subsidizing urban sanitation.* Most successful utilities around the globe have benefitted from the government subsidizing the capital costs of urban sanitation infrastructure. Governments of developing countries should consider to do the same, since full cost-recovery is very difficult to achieve, even when cross-subsidized by water supply revenues. However, full cost-recovery is an essential target for operation and maintenance costs.
- *Starting with septage management.* Many households in Southeast Asian cities and towns already have latrines or septic tanks. Implementation of good septage collection and treatment by local governments and utilities will have a significant impact in reducing pollution and improving the environment. Septage management provides a cost-effective and relatively quick solution to urban sanitation challenges, paving the way for longer-term targets for city-wide sewerage and wastewater treatment solutions.

Annex

Issues and Possible Solutions

Issue	Possible Solutions
Water Sources and Resources	
Too many organizations involved	Provide leadership from the top (policy priority)
Too many local authorities in control or vying for control	Provide leadership from the top (policy priority)
Inadequate facts and figures	Provide aid and stay the distance
Supply versus demand (every one of 14 utilities in Southeast Asian database has water source problems)	Reduce NRW, conserve water, manage demand, raise tariffs, speed up development of new sources
Pollution control and cross-contamination	Combine water and sanitation under one roof
Falling water tables	Invest in infiltration, not drainage
Flooding and drought (climate change)	Provide more storage, big or small Undertake small-scale water impounding projects
Policy and management	Make water the top policy priority, as Singapore has done
Failed regulation	Realize that a one-person regulator is better than nothing
Increasing salinity	Monitor and report, and act to ban pumping
Inefficient use of water	Improve irrigation efficiencies, promote small-scale rainwater harvest systems
All eggs in one basket	Develop more source options
Low access to relatively large-scale and long-term funding for capital investments	Provide innovative financing; leverage scarce ODA resources with local debt capital
Over abstraction of water	Coordinate monitoring by agencies, such as department of environment, and utilities
Fluctuating mass balance between water allocation and consumption	Coordinate between water resources board and utilities and local environmental monitoring
Noncompliance with watershed approach to water resource management	Map urban watersheds appropriately
Unprioritized sustainability of sources	Raise awareness of water harvesting techniques and community involvement
Service Levels and Service Coverage	
Poor monitoring of environmental flows	More proactive environmental monitoring agencies
Inadequate measurement	Know consumers and nonconsumers Institute 100% metering and 100% efficient and careful meter reading and billing Provide performance-based incentives for monitoring and reporting key performance indicators
Shared connections	Know the number of people served and adjust water bills accordingly Provide free connections
Too low tariffs	Hike tariffs to help the poor Engage in willingness-to-charge initiatives and provide incentives for decision makers

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Issues and Possible Solutions *continued*

Issue	Possible Solutions
Resistance to change among vested interests in water vending	Hike tariffs to help the poor get connected
High connection fee hampering improvements in service coverage	Abolish connection fee; include amortized costs in tariffs for all (as in Viet Nam)
Lack of alternatives for gaining access to water	Conduct a marketing campaign to increase connections
Illegal connections	Reduce NRW; manage at lowest level
Unserved urban poor	Create a social development unit in the utility
Intermittent Supply	
Nonpotable water	Reduce NRW; introduce hydraulic zoning
Fights at standpipes	Progressively attain 24/7 water
On-site storage and pumping costs	Manage demand through tariffs
Higher pumping pressure and, hence, more leakage	Stop pumping into distribution system
Wasted water	Improve water balance in reservoirs
Extension of distribution beyond design limits	Use hydraulic design and then resist moves by politicians to extend distribution system beyond hydraulic limits
Poor asset management	Implement proper asset management
Nonrevenue Water	
Who benefits? Who pays?	Analyze
NRW and the unconnected urban poor	Invest in NRW reduction (it is good business)
Illegal connections	Follow a caretaker approach
Can't measure, can't manage	Institute 100% accurate metering coverage
Poor construction	Supervise construction strictly
Poor repairs	Enforce accountability and quality control
Heavy leakage	Establish an efficient leakage detection program and replace leaking pipes
Poor staff attitude	Provide staff incentives
Poor O&M policy and inadequate enforcement	Increase awareness of NRW as a source
Tariffs for Autonomy	
Reluctance to charge, but not to pay	Analyze water bills in low-income areas
Tariffs too low to restrict demand	Improve efficiency
Unjust shared connections	Review the block tariff structure implementation Abolish the connection fee
No consumer control, with fixed costs especially for wastewater charges	Do away with fixed costs; tie all costs to consumption
Political interference	Raise tariffs to provide autonomy
Low collection efficiency	Wage an education campaign on making tariff revisions Go to consumer first, then government
High operating ratio	Base tariffs on policy, not politics
Need for higher tariffs to connect urban poor	Hike tariffs to connect the poor Offer lifeline tariffs and a progressive tariff structure
Incorporation of sewerage tariff	Analyze and justify cross-subsidies

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Issues and Possible Solutions *continued*

Issue	Possible Solutions
Operation and Maintenance	
NRW as a capital cost issue	Take loans from donors
NRW as an operating cost issue	Introduce social engineering
Poor workmanship in repairs	Institute quality control and accountability
Lack of management skills	Build capacity Form water operator partnerships
Poor construction standards	Supervise construction Use foreign consultants
Lack of accountability	Manage at lowest practicable level
Civil-servant rules and salaries	Undertake organization development and allow market forces to prevail
Poor customer relations	Improve consumer interface (website)
Consumer concerns about water quality	Help consumers beyond the meter and eliminate intermittent supply
Inconsistent or no O&M policy	Develop a comprehensive O&M policy
Low sustainability because of high capital expenditure or high operating expenditure	Integrate systems; provide management contracts; institute cost sharing for costs of back-office technicians; provide incentives, such as concessional loans, to encourage collaboration Increase tariffs
Development Projects	
Protracted timeline and excessive bureaucracy	Keep projects and activities small; use turnkey design–build–operate projects Balance process requirements, such as safeguards, with scale of project
Fewer beneficiaries than projected	Encourage countries to prioritize their own investments instead of having donors direct the use of resources to meet their own goals
Higher NRW than projected	Invest in NRW reduction (it is good business)
Less demand than projected at appraisal	Don't overestimate demand; keep in mind that people already have water Balance social values with practical outcomes
Private operators competing with the public but not compelled to cross-subsidize the poor	Regulate to level the playing field
Support for water but not for "post water"	Develop peri-urban areas mostly through private informal initiatives with local, not central, government
Unproven sustainability	Consider the endgame for aid Invest more in women and children as agents for change Replicate small-scale projects on a larger scale Undertake sufficient analysis to identify sustainable water solutions (wells vs piped water if latter is not sustainable)
Not enough listening to locals	Urge development practitioners to encourage a culture of two-way capacity building
Intense development pressure	Sip development slowly with the people
Long-term water planning but short-term politics	Identify champions and leaders in water and stay the course with them; remember that patience and persistence lead to success

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Issues and Possible Solutions *continued*

Issue	Possible Solutions
Conflict between privatization in the water sector and concept of water conservation	Corporatize water utilities gradually, as in Lao PDR
Unhelpful silver-bullet solutions, such as management by objectives, good governance, corporatization, and privatization	Adopt sensible diagnostic approaches to identifying development needs
Too many organizations making water supply decisions	Provide leadership from the very top
No access to piped water in slums	Go through an NGO intermediary
Lack of coordinated development	Identify the links in the water chain (political decision makers, public administrators, service operators, consumers), then define their roles and responsibilities
Governance	
Importance of time	Engage in turnkey contracting (everyone works)
Too much bureaucracy, leading to corruption	Think results, not process
Failed regulation	Try regulation by one person (focal point)
Lack of good data and analysis	Ask aid agencies to assist
Lack of clear policy	Introduce policy that is transparent to everyone
Lack of leadership	Find a champion, then support that champion
Politicians interfering with utility operations	Get consumers on board
Crisis management	Be proactive, not reactive
Tariffs too low, so money trail runs through government and attracts corruption	Raise tariffs to increase autonomy and put consumers in control
Lack of accountability	Undertake organization development
Poor evaluation and reporting	Increase transparency
Misdirected training	Build capacity, focusing on the right people
Lack of communication	Improve communication with stakeholders
Too much corruption	Set a good example at the top
Large projects attracting corruption	Look at smaller projects
No government accountability for policy implementation	Let NGOs monitor the implementation of government policy and report to the public
Bottlenecks in the chain of responsibility	Organization development
Poor decision making because of overlapping jurisdictions	Organization development and leadership
Weak interagency coordination, especially among those responsible for water allocation and distribution	Leadership
Data Collection Analysis and Reporting	
Can't measure, can't manage	Institute 100% accurate metering
Lack of data and, hence, policy weakness	Conduct anecdotal interviews Conduct street surveys and analyze water bills
Lack of analytical skills	Consider money–water–people analysis
Lack of action on data and analysis	Consider revising tariffs, undertake a management change and introduce accountability
Too many parameters	Use simple benchmarking
Data credibility	See to it that utility websites are responsive to stakeholders' needs Check data

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Issues and Possible Solutions *continued*

Issue	Possible Solutions
Irregular monitoring of consumption trends	Annual task
Overlooked health indicators	Annual reporting
Sanitation	
Weak or nonexistent data	Ask aid agencies to help
No clear policy	Combine sanitation policy with water policy
Inadequate operating funds	Combine sanitation funding with water tariff
Inadequate funding for capital works	Obtain grant financing from the central government
No incentives to connect to sewer	Offer free connection to sewer
Huge capital requirement for centralized sewerage, making such sewerage systems almost impossible to achieve	Build small, decentralized systems and septage treatment facilities (cost-effective alternatives) instead
No sanitation provisions for girls in schools	Adopt a strong government policy for schools
Open defecation	Promote community-led total sanitation as a matter of policy
No attention to women's self-respect and dignity	Focus on meeting women's needs
Heavily polluted waterways	Recycle water (it is good business) Clean up and persist at this for at least 10 years
No time-bound goals	Policy and plans
Weak drainage and local flooding	Start by improving the drains
Ineffective sanitation-for-health program	Engage in inspirational marketing of sanitation Create awareness and encourage behavior change; understand people's perceptions; focus on pride and dignity, shame and disgust, and self-respect and the public good

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Urban Water Supply and Sanitation in Southeast Asia

A Guide to Good Practice

The purpose of this book is to provide stakeholders in Southeast Asian urban water supply and sanitation (meaning governments, utilities, consultants, donors and NGOs) with a point of reference and some tools to move effectively and efficiently to improve both development and operational performance. The ultimate aim is good quality 24/7 piped water in all homes. It is a contribution toward the Asian Development Bank overarching goal of poverty reduction.

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ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to approximately two-thirds of the world's poor: 1.6 billion people who live on less than $2 a day, with 733 million struggling on less than $1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

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