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Phase II

Benchmarking Urban Water Utilities in India

30 years
wsp
water and sanitation program

Phase II

Benchmarking Urban Water Utilities in India

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Abbreviations

ARV	annual rateable value
BAN	Bangalore
BHU	Bhubaneswar
BWSSB	Bangalore Water Supply and Sewerage Board
CAGR	Compound Annual Growth Rate
CHE	Chennai
CHG	Chandigarh
CPHEEO	Central Public Health and Environmental Engineering Organization
CMWSSB	Chennai Metropolitan Water Supply and Sewerage Board
DEH	Dehradun
HMWSSB	Hyderabad Metropolitan Water Supply and Sewerage Board
HYD	Hyderabad
IB-NET	International Benchmarking Network for Water and Sanitation Utilities
ICAI	Institute of Chartered Accountants of India
IMC	Indore Municipal Corporation
IND	Indore
JAM	Jamshedpur
JBIC	Japan Bank for International Cooperation
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
JUSCO	Jamshedpur Utilities and Services Company Limited
MCC	Municipal Corporation of Chandigarh
MoA	Memorandum of Agreement
MoUD	Ministry of Urban Development
NGOs	nongovernmental organizations
NRW	nonrevenue water
O&M	operation and maintenance
OWSSB	Orissa Water Supply and Sewerage Board
PHED	Public Health Engineering Department
PHEO-BHU	Public Health Engineering Organization-Bhubaneswar
PMC	Pune Municipal Corporation
PROOF	Public Record of Operations and Finance
PUN	Pune
RAJ	Rajkot
RMC	Rajkot Municipal Corporation
STP	sewerage treatment plant
UFW	unaccounted-for water
UJS	Uttarakhand Jal Sansthan
USAID	United States Agency for International Development
WSP-SA	Water and Sanitation Program-South Asia
WSS	water supply and sanitation

Units of Measure

cu m	cubic meter
kl	kiloliter
km	kilometer
lpcd	liters per capita per day
MLD	million liters per day

Currency Conversion

US$1 = Rs. 42 (as on May 2007)

Executive Summary

Introduction

The water supply and sanitation (WSS) sector in India suffers from chronic inefficiencies, including limited coverage and poor service quality. To address these shortcomings, the focus of interventions in the sector has predominantly been directed at the supply-side factors, such as capital investments the creation of infrastructure. This, however, has not resulted in improved service delivery. The weak service orientation is exacerbated by the lack of reliable information on the performance of utilities. This limits a utility's ability to understand and gauge its performance, and also constrains any inter-utility comparison.

Benchmarking of WSS utilities is emerging as an important tool of performance improvement through regular monitoring and analyses. It can play a significant role in the sector as a vehicle for institutional strengthening. Sustained benchmarking can help utilities in identifying performance gaps and effecting improvements through the sharing of information and best practices, ultimately resulting in better water and sanitation services to people.

Recognizing the potential of benchmarking as a tool to improve the performance of the Indian utilities, the Water and Sanitation Program-South Asia (WSP-SA) in partnership with the Ministry of Urban Development (MoUD) piloted a benchmarking exercise, covering 13 utilities in India in 2003-04. This exercise, hereafter called Phase I, involved creating awareness about benchmarking, developing the methodology and collecting and analyzing data on an initial sample of WSS utilities in India.

This was followed up with Phase II of the benchmarking exercise in 2005-06. The objectives of Phase II were to build upon the key learnings from Phase I, work with a selected set of WSS utilities to collect fresh data and scale up the exercise to promote the concept amongst a larger number of WSS utilities across India through targeted dissemination and advocacy. The second phase of benchmarking also focused on data collection systems prevailing in the utilities, and a multiyear analysis of performance. This report presents the findings of the Data Collection and Analysis exercise as part of the Phase II activity.

Approach and Methodology

Phase II of the benchmarking exercise covered 10 utilities (Table 1). The choice was based on the following criteria:

- All four geographical zones of the country are represented;
- The different institutional structures prevalent within the country are represented;
- Varying-sized operations are also represented; and
- Ability and willingness on the part of utilities to share the necessary data.

The performance indicators and their definitions as detailed by the International Benchmarking Network for Water and Sanitation Utilities (IB-NET) were adopted for the Phase II benchmarking exercise. In addition to collecting data from the utilities, efforts were directed at understanding the systems deployed to collect data on various performance indicators. The knowledge of the

systems prevailing at the utility level helped in assessing the reliability of the data collected. Each indicator/data was graded on a four-point scale A-D, with A having the highest and D the lowest reliability. The reliability scale is also intended to assist utilities to address system-related problems in data collection and plan measures to enhance data reliability.
It was ensured that at least two data collection cycles took place – one for initial data-gathering, learning and error-checking, and the other for the final data collection and clarifications.

Table 1: List of utilities covered by the study

Zone	Sr. no.	City	Name of utility
North	1	Chandigarh (CHG)	Municipal Corporation Chandigarh
	2	Dehradun (DEH)	Uttarakhand Jal Sansthan
	3	Indore (IND)	Indore Municipal Corporation
South	4	Hyderabad (HYD)	Hyderabad Metropolitan Water Supply and Sewerage Board
	5	Chennai (CHE)	Chennai Metropolitan Water Supply and Sewerage Board
	6	Bangalore (BAN)	Bangalore Water Supply and Sewerage Board
East	7	Jamshedpur (JAM)	Jamshedpur Utilities and Services Company Limited
	8	Bhubaneswar (BHU)	Public Health Engineering Organization
West	9	Rajkot (RAJ)	Rajkot Municipal Corporation
	10	Pune (PUN)	Pune Municipal Corporation

Findings of the Phase II Benchmarking Exercise

The summary of utility performance on select key indicators is provided in Table 2.

Table 2: Comparison of participating utilities on selected key indicators

		Coverage	Production	Metering	Working ratio	Complaints	Daily supply
		in %	lpcd	% of total connections	Opex as % of oper rev	% of water connections	Hours per day
City Boards	Bangalore	91%	143	90%	1.0	NA	2.50
City Boards	Chennai	98%	107	4%	1.4	44%	3
City Boards	Hyderabad	95%	192	93%	1.1	39%	1
City Company	Jamshedpur	79%	608	1%	0.9	43%	6
City Corp.	Chandigarh	100%	290	71%	1.3	2%	12
City Corp.	Indore	54%	102	0%	5.4	0%	0.75
City Corp.	Pune	88%	274	16%	0.8	NA	7
City Corp.	Rajkot	98%	126	0.4%	6.6	30%	0.33
State Agency	Bhubaneswar	45%	269	1%	3.3	8%	3
State Agency	Dehradun	80%	149	8%	1.4	4%	4

Reliability scale A* B C D*

** A refers to a high degree of reliability and D refers to low or negligible reliability. Darker the shade higher the reliability.*

The summary of the status of data collection systems across various participating utilities is provided in Table 3.

Quality of service

Phase II of the benchmarking exercise has revealed considerable scope for improvement of the performance of utilities. The participating utilities have a shortfall in most key indicators.

All the utilities provide water on an intermittent basis. Only Municipal Corporation of Chandigarh (MCC) has claimed that it supplies water on an average of 12 hours in a day. The remaining utilities supply water for shorter durations. Rajkot Municipal Corporation (RMC) supplies water for 20 minutes on an average daily, while customers of Bangalore Water Supply and Sewerage Board (BWSSB) and Hyderabad Metropolitan Water Supply and Sewerage Board (HMWSSB) receive water on alternate days. This is despite production levels being reported to be close to or above Central Public Health and Environmental Engineering Organization (CPHEEO) norms for per capita water availability (except for Chennai and Indore which are well below the norm).

Utilities have been able to provide data on the number of tests conducted for residual chlorine content. The reliability of the tests and the process adopted for conducting these tests have not been recorded and evaluated.

Sewerage treatment facilities in many utilities are inadequate compared to the amount of water supplied. For instance, Public Health Engineering Organization-Bhubaneswar (PHEO-BHU), which supplies 206 Million Liters per Day (MLD) of water, has a sewerage treatment plant (STP) of just 1 MLD capacity. The utilities must not only expand coverage to 100 percent of the service population, but also create the necessary infrastructure to dispose off the sewage in an environmentally-friendly manner.

Sustainability of operations

Apart from quality of service, the operations of many utilities are not financially sustainable. Only three of the 10 utilities are able to generate revenues in excess of their expenditure. Jamshedpur and Pune have the most favorable working ratios with values below 1.0, while Rajkot and Indore have high ratios of 6.6 and 5.8, respectively.

Table 3: Summary of status of data collection systems

	CHG	DEH	JAM	BHU	IND	PUN	RAJ	HYD	CHE	BAN
Coverage – Water Supply	B	B	B	B	B	D	B	D	D	D
Water production	A	A	A	D	D	A	D	A	A	A
Water consumption	C	D	C	D	D	D	D	A	D	A
NRW	B	B	C	D	D	C	D	B	D	B
Proportion of connections that are metered	B	C	C	D	D	C	C	B	D	B
Proportion of functional meters	B	B	B	B	B	B	B	B	B	B
Proportion of water sold that is metered	B	B	B	D	D	B	D	B	B	B
Pipe breaks	B	D	A	A	D	D	D	A	B	A
Sewerage blockages	B	D	A	A	D	D	D	A	B	A
Unit operational costs	B	A	A	B	B	B	B	A	A	A
Power/op. costs	A	A	A	A	A	A	A	A	A	A
Complaints	A	C	A	A	A	D	C	A	A	A

Poor financial performance can mostly be attributed to high levels of nonrevenue water (NRW) or low level of tariffs or to both. An improvement in financial performance necessitates reduction in NRW to acceptable levels and rationalization of the tariff structure.

Most of the utilities, barring Bangalore and Hyderabad, to a large extent, bill the consumers on a flat rate basis. Thus, there is no link between consumption and the charges payable by the consumer. A shift to a volumetric system of charges will require the utilities to develop a proper metering as well as billing and collection system.

Data reliability issues

The reliability of data for key indicators is low. None of the participating utilities has “A” category systems for measuring coverage, metering and the number of hours of supply. Three of the participating utilities do not have “A” category data systems even for measuring water produced.

The data collection systems vary across utilities and are generally weak. As a result, the data collected are not always reliable. For instance, many cities do not have a policy to install meters for all connections. The proportion of metered connections varied from almost negligible metering in Indore to 95 percent metering in Hyderabad. In the absence of metering, no reliable estimate of consumption data is possible. In the case of utilities which had a high proportion of metered water consumption, the reliability of the data was not high, as meters were not tested regularly for proper functioning.

Even for indicators which are as fundamental as coverage, no utility could provide data which could be labeled highly reliable, and different methods have been adopted for measurement. It is defined in terms of percentage of the city covered by some utilities, whereas other utilities define coverage as percentage of the road network covered with water supply pipelines. While the two methods have differing levels of reliability, neither is perceived to be highly reliable. Moreover, the absence of standard definitions undermines the scope for meaningful comparisons.

In the case of some indicators, the issue of reliability can be addressed by introducing minor infrastructure improvements. For instance, the production data from the three utilities – PHEO-BHU, Indore Municipal Corporation (IMC) and RMC – are not reliable as they use methods such as rated capacity of pumps and their hours of operation to estimate the level of production. The mere introduction of flow meters will allow the utilities to measure their production levels accurately.

In the case of other indicators, greater effort will be required on the part of the utilities. For instance, the estimate of the NRW is as high as 50 percent of the total water produced. But this estimate of NRW itself has low reliability in the absence of large-scale metering. Only two utilities, BWSSB and HMWSSB, pursue a policy of providing meters to all direct service connections. Jamshedpur Utilities and Services Company (JUSCO), which has only 0.5 percent of connections metered, uses intermediate level meters to estimate the total consumption by unmetered connections. In most other cases,

either only bulk consumption is metered or a negligible number of connections are metered. Extensive consumer level metering would be required to obtain a precise NRW estimate and initiate necessary measures for loss reduction.

Metering is necessary but not sufficient

The provision of meters in itself would not result in better practices. The meters need to be periodically checked by the utilities for proper functioning. In India, utilities provide water on an intermittent basis. This makes the meters prone to frequent breakdowns on account of air entrapment. Of the utilities studied, only JUSCO has an elaborate meter-checking program. However, only 1 percent of JUSCO's connections or 220 in absolute number are metered. Thus, the checking effort required on the part of JUSCO is relatively low. BWSSB has reported that about 10 percent of its meters were not functioning in each of the three years. HMWSSB has a high percentage (94 percent) of its connections metered, but it does not have a regular meter-checking program. In 2007, HMWSSB had outsourced the meter-checking program to a third party and it was observed that several of the meters were not functioning.

Introducing meters and ensuring that they function properly will allow the utilities to better manage the system. As a first step for reducing unaccounted-for water (UFW) and NRW, utilities would require to provide meters to all direct service connections, and institute a comprehensive meter-checking program. A utility which has all the connections metered will have greater ability to manage its water supply operations.

Network performance data not easily available

Most utilities have not been able to provide reliable data on their network performance. In several utilities, it was observed that data on the length of the distribution system or the sewerage network are not known. In several other cases, this data are not maintained at a centralized level and utilities have found it difficult to aggregate the data from various ward offices. There is no systematic process for recording information on the number of pipe breaks or sewer blockages in several utilities. Only utilities which have an elaborate complaint recording system are able to provide data on the number of blockages or pipe breaks occurring in a year. BWSSB, CMWSSB, MCC and JUSCO have reported elaborate complaint recording mechanisms. However, no utility has been able to provide data on the number of pending complaints or their redressal status.

Conclusions and Way Forward

Phase II of the benchmarking exercise has deepened the process by including data systems analysis and a multiyear performance analysis. The relevance of the benchmarking concept and benchmarking indicators has been reinforced amongst participating utilities and the respective governments. Largely consequent to this exercise, a clear consensus has emerged on the need to adopt benchmarking and scale up the exercise to cover all cities in India.

Simultaneously, it has also demonstrated that for utilities to benefit from benchmarking,

the process of performance improvement has to be accompanied by data systems improvement. Any comparison of performance, whether inter-utility or time-series within a utility, will remain seriously compromised in the absence of reliable data systems.

The absence of sound data systems also weakens the ability to make objective decisions regarding measures required to improve performance. For example, coverage, metering and production statistics are not fully reliable. With the result, there are no data to support a decision to choose between NRW reduction and capacity addition as a means to improve the quantity of water supplied to the consumers. In other words, while there is an immediate need to improve performance on key indicators, the lack of reliable data systems hampers any objective decision-making on the right approach to improve performance. A performance improvement program, therefore, needs to take cognizance of the weak data systems and incorporate a plan to upgrade these along with improvement in service delivery.

Introduction

Background

The water supply and sanitation sector (WSS) in India suffers from chronic inefficiencies, including limited coverage and poor service quality. It is generally accepted that neither differences in institutional structure for service delivery (such as a state government department or a city-specific utility) nor geographical constraints (such as source of water supply or pumping effort) have any direct bearing on the quality of services. There is a consensus that the underlying problems relate to the performance of utilities,[1] such as poor and inadequate investments, poor operation and maintenance (O&M) practices, high nonrevenue water (NRW), uneconomic tariff structure/levels and poor financial management. However, this consensus has not triggered any significant initiatives to improve the performance of the utilities.

The focus of the interventions in the sector has predominantly been to address the supply side factors, that is, capital investments to ensure greater availability of water and sanitation services. The primary reason for the absence of efforts to improve performance improvement has been the lack of reliable information on the performance of utilities. This limits a utility's ability to understand and gauge its performance, and also constrains any inter-utility comparison. The absence of any systematic comparative mechanism restricts the ability of utilities to identify better performing utilities and adopt the best practices in the industry.

Benchmarking as a Tool for Performance Improvement

Benchmarking of WSS utilities is emerging as an important tool of performance improvement through regular monitoring and analyses. Benchmarking may be defined as a systematic search for industry best practices leading to superior performance. It can play a significant role in the sector as a vehicle for institutional strengthening. Benchmarking is increasingly being used as a continuous tool to enhance the quality of service delivery, attract investments, bring about efficiency improvements in systems and processes and optimize costs, among other things. Sustained benchmarking can help utilities in identifying performance gaps and effecting improvements through the sharing of information and best practices, ultimately resulting in better water and sanitation services to people.

Unlike a rating, grading or a ranking exercise, the objective of benchmarking is not merely to differentiate or categorize utilities. The purpose of benchmarking is to monitor, evaluate and

[1] The word utility in this report refers to a generic term implying urban local bodies, state departments, boards or any other institution responsible for providing water supply and sanitation services.

disseminate parameters that are common across the participating entities. Moreover, benchmarking does not stop at disseminating information, but also provides an opportunity to such entities to network and share their experiences with each other and with other members associated with the sector.

There are various types of benchmarking. Quantitative or Metric benchmarking involves the measurement of performance on certain key parameters, and comparisons with their peer organizations or oneself over time. Process benchmarking goes beyond the numbers to identify specific work procedures that need to be improved and then locates external examples of excellence for the setting of targets and possible emulation.

Water and Sanitation Program–South Asia Piloted a Benchmarking Exercise in India

Recognizing the potential of benchmarking as a tool to improve the performance of the Indian utilities, the Water and Sanitation Program-South Asia (WSP-SA), in partnership with the Ministry of Urban Development (MoUD), piloted a benchmarking exercise covering 13 WSS utilities in India in 2003-04. This exercise, hereafter called Phase I, involved creating awareness about benchmarking, developing the methodology and collecting and analyzing data on an initial sample of utilities in India.

A national workshop was organized in New Delhi by WSP-SA in partnership with the MoUD to disseminate the findings and conclude Phase I of the project. The deliberations in the workshop clearly underscored the need to:

- Carry out benchmarking on a sustainable basis to improve sector performance, carry out reforms, and enhance all-round accountability;
- Further the benchmarking exercise initiated by the MoUD and WSP-SA in subsequent phases with greater awareness and demand, inclusion of more utilities, and collaborative efforts of all stakeholders to institutionalize a sustainable benchmarking program at the national level;
- Have a clearly defined and commonly agreed set of performance indicators and measurement methods to analyze and compare performance; and
- Adequately train utility officials to enable them to undertake benchmarking and encourage utilities to take ownership of the process (institutional and financial) to make it sustainable in the long run.

Phase II of the benchmarking exercise was proposed to build upon the key learning from Phase I, and work with a selected set of water supply and sanitation utilities to collect fresh data and scale up the exercise to promote the concept amongst a larger number of utilities across India through targeted dissemination and advocacy. The second phase of benchmarking also focuses on data collection systems prevailing in the utilities, and a multiyear analysis of performance.

Approach and Methodology

A short list of the 16 utilities was prepared in joint consultation with WSP-SA, ensuring that:

- All four geographical zones of the country are equally represented;
- The different institutional structures

prevalent within the country are represented; and
- Varying-sized operations are also represented.

The shortlisted utilities were also perceived to be willing to participate in the benchmarking exercise.

The MoUD, through written communication, introduced benchmarking to the shortlisted utilities and emphasized the usefulness of benchmarking as a tool for improving the performance of the water and sanitation sector in India. The utilities, in turn, committed themselves to the benchmarking initiative through their written replies to the MoUD.

The performance indicators and their definitions as detailed by the International Benchmarking Network for Water and Sanitation Utilities (IB-NET) were adopted for the Phase II benchmarking exercise.[2] In addition to collecting data from the utilities, efforts were directed toward understanding the systems deployed to collect data on various performance indicators. The knowledge of the systems prevailing at the utility level helped in assessing the reliability of the data collected. Each indicator/datum was graded on a four-point scale A-D with A having the highest and D the lowest reliability. The reliability scale is also intended to assist utilities to address system-related problems in data collection and plan measures to enhance data reliability.

Table 1.1: List of utilities shortlisted for the study

Zone	Sr. No.	City	Name of utility
North	1	Chandigarh (CHG)	Municipal Corporation Chandigarh
	2	Dehradun (DEH)	Uttarakhand Jal Sansthan
	3	Agra*	Uttar Pradesh Jal Sansthan and Uttar Pradesh Jal Nigam
	4	Indore (IND)	Indore Municipal Corporation
South	5	Hyderabad (HYD)	Hyderabad Metropolitan Water Supply and Sewerage Board
	6	Chennai (CHE)	Chennai Metropolitan Water Supply and Sewerage Board
	7	Bangalore (BAN)	Bangalore Water Supply and Sewerage Board
	8	Thiruvananthapuram*	Kerala Water Authority
East	9	Guwahati*	Guwahati Municipal Corporation
	10	Kolkata*	Kolkata Municipal Corporation
	11	Jamshedpur (JAM)	Jamshedpur Utilities and Services Company Limited
	12	Bhubaneswar (BHU)	Public Health Engineering Organization
West	13	Rajkot (RAJ)	Rajkot Municipal Corporation
	14	Mumbai*	Greater Mumbai Municipal Corporation
	15	Jaipur*	Public Health Engineering Department (water supply) Jaipur Nagar Nigam (sewerage services)
	16	Pune (PUN)	Pune Municipal Corporation

**Not included in the final study.*

[2] Refer to Annexes 2 and 3 for data collected and indicators used.

Data collection and analysis

It was ensured that at least two data collection cycles took place – one for initial data-gathering, learning and error checking, and the other for the final data collection and clarifications. From the original list of 16 utilities, only 10 utilities were able to provide adequate data for the purpose of performance measurement and analysis. The six cities which did not make it to the analysis phase were Agra, Guwahati, Jaipur, Kolkata, Mumbai and Thiruvananthapuram.

Dissemination of findings

As a part of the awareness-building initiative under the benchmarking framework, a national workshop on 'Benchmarking Urban Water Utilities – Implementing Jawaharlal Nehru National Urban Renewal Mission (JNNURM): Developing a Framework for Performance Measurement' was organized by WSP-SA in partnership with the MoUD, Government of India, Public Record of Operations and Finance (PROOF) and the Institute of Chartered Accountants of India (ICAI) on December 19, 2007, at New Delhi, India. The workshop brought together over 50 representatives from the 10 participating utilities, the Government of India, United States Agency for International Development **(**USAID), the World Bank, Japan Bank for International Cooperation (JBIC), Water and Sanitation Program (WSP), nongovernmental organizations (NGOs), and domestic and international water sector experts on a common platform. The workshop concluded with the following consensus:

- The gaps in data systems revealed through the benchmarking exercise reflect the ground reality. It is important to study the benchmarking data along with the reliability scale for data. The comparison of utility performance using benchmarking indicators also highlights the areas of improvement and is useful for both utility managers and the respective state governments;
- It is important that the JNNURM process incorporates the output of the benchmarking exercise. As a minimum starting step, the Memorandum of Agreement (MoA) signed with the cities should include standard benchmarking indicators. During the scrutiny of the detailed project reports, the impact of the proposed project should be measured against standard benchmarking indicators; and
- The representatives of the JNNURM and the MoUD concurred that during the next revision of City Development Plans, cities can be asked to assess their water and sanitation systems using the benchmarking indicators. They also concurred that starting with a set of pilot cities, the exercise can be scaled up to cover all JNNURM cities. They further emphasized that the preparation of baseline data would be critical for this and that the sector data book must be prepared and updated by the respective utilities.

Contents of this Report

This report discusses the approach towards Phase II of the benchmarking exercise, the results of data systems analysis, an inter-utility comparison and a profile of participating utilities using the benchmarking framework.

Utility Data Systems Analysis

Performance measurement and benchmarking would not be meaningful if the data collected have gaps or are unreliable. Data inadequacies result from the lack of appropriate infrastructure; systems to measure and record data; and incentives and/or necessary regulatory systems that require such data to be generated. The quality of the data provided by the utilities varies both across utilities for the same indicator and within indicators for the same utility. To make the comparison of performance across utilities fair and meaningful, it is essential to highlight both the adequacy and the inadequacy of the data provided by the utilities.

This section of the Data Analysis report brings to the fore all issues related to the reliability of the benchmarking data provided by the utilities. The performance of the utilities – discussed later in this report – has to be evaluated in the light of data reliability issues raised in this section.

The data provided by the utilities have been graded on a four-point scale A-D with grade A indicating the highest reliability and Grade D the least reliability. This scale devised by IB-NET is shown in Table 2.1.

For the purpose of the Phase II benchmarking exercise, the scale has been modified to reflect the peculiarities involved for each indicator in measuring the data in the most reliable manner. The modifications in the grading scale help achieve several outcomes. They will reduce the element of subjectivity in classifying the data provided by the utilities. For instance, water production data provided by the utilities are considered Grade A, if output of the water treatment plants is measured using flow meters. All other methods of measurement are low on reliability and hence considered as grade D. Secondly, this modified grade scale provides the utilities an objective

Table 2.1: IB-NET scale for data reliability

Scale	Description
A	Based on reliable records, procedures, investigations or analyses that are properly documented and recognized as the best available
B	Generally as in band A, but with minor shortcomings, for example, some documentation is missing, the assessment is old, or some reliance on unconfirmed reports or extrapolation is made
C	Extrapolation from a limited sample for which band A or B information is available
D	Based on the best estimates of the utility staff, without measurement or documented evidence

assessment of the quality of their data systems and informs them about the acceptable methodology for recording data in a reliable manner.

The discussion begins by stating for each indicator the reliability attached to the different methods adopted/deployed by the utilities for measuring the performance indicators.

Coverage

In most of the utilities covered in this study, data on coverage were not easily available. The problem of data availability exists at two levels. First, most of the utilities do not have an estimate of the population of their service area. The population of the service area is known only for the year in which the Census was conducted, that is, the year 2001. Utilities estimate the growth rate; this estimate varies across departments in the same utility. Secondly, utilities find it difficult to estimate the population covered by their services. To estimate the population covered, three data points would be required:

- Population covered by direct connections;
- Population covered by public water points; and
- Population covered by tankers.

In the long run, it is expected that the utility would attempt to shift all consumers to direct service connections. Therefore, it is critical that the utility adopts a methodology to measure coverage by direct service connection as reliably as possible. The data on population, covered by public water points and tankers, can be established by some normative assumptions. The following discussion will highlight the best possible method of estimating the population covered by direct service connections.

Number of direct service connections

The population covered by direct connections can be estimated by multiplying the total number of connections by the normative assumptions of the number of persons living per household. However, in many Indian cities, the number of connections is not identical with the number of households. This is on account of one connection supplying water to multiple households, as in the case of multi-storied apartments or multiple families living in a single household.

Bhubaneswar, Chandigarh, Dehradun, Indore and Rajkot have used this method. It gives a reasonable estimate of the population served by direct connections. It is not accurate, as some connections would be serving multiple households. Thus, data about the estimates of population covered by direct connections in these cities can be assigned Grade B status.

In other cases, especially in large metropolitan cities such as Bangalore, Chennai, Hyderabad and Pune, application of this method would not be possible. These cities are characterized by large-scale vertical developments. For example, Indore with a population about two-thirds of the population of Pune has 50 percent more connections than Pune.

Geographical coverage

Some cities provide estimates of population served by the geographical coverage of their water and sewerage networks. The term coverage is synonymous with geographical

coverage, that is, the proportion of service area that is served by the network divided by the total service area. This is the simplest form of an estimate and suffers from several approximations. The most common one is that the population densities are not uniform across a service area of the utility. The core area that is densely populated will most likely have a water supply network. Newly developing peripheral areas will have a lower density and may not have a complete network. Therefore, this method can introduce errors. Since this is the simplest form of an estimate, it is being categorized as Grade D type data.

As a refinement of this method, some utilities estimate the population that resides in the geographical area covered by the network. This is then divided by the total population of the service area. Although a refinement, this method still suffers from the same approximations of geographical coverage. This methodology has been given Grade D ranking.

Bangalore, Hyderabad and Pune have adopted this method to estimate service coverage.

Road length coverage

Another method deployed by the utilities is to express the water supply pipeline network as a percentage of the road length network. This is based on the explicit assumption that the road network covers 100 percent of the service area and that water distribution pipelines are embedded along the road network. This measurement is not precise and provides a very rough estimate of the population covered. Another limitation of this methodology is that if there exists a pipeline network on both sides of a road, then it would overestimate the population coverage. This methodology has been qualified as Grade D. Chennai had adopted this method to estimate the coverage ratio.

Property coverage

A correct way to estimate population coverage would be to estimate the number of properties in the service area and the number of properties provided with a direct service connection. Thus, the ratio of the number of properties provided with direct service connection to the total number of properties in the service area would be a reliable estimate of the population covered by direct service connections.

To follow this method, the utility would need to have a database of the total number of properties in the service area. It also needs to have a mechanism to update the database for increase in the number of properties. This method of estimating coverage will have the highest reliability and can be termed as Grade A category data.

In case utilities do not have reliable and up to date data on the number of properties in the service area, then some approximations could be made. The utility can extrapolate the last census data to arrive at the current population. It could then assume a normative number of persons per property. This can provide an estimate of the number of properties in the service area. This data are not as reliable as that provided by the previous methodology, since there is an approximation in the estimation on the number of properties in the service area. Hence, this method is classified as Grade B.

Table 2.2: Reliability scale for the indicator "coverage"

Category	Description of infrastructure and systems for cities that largely have only one household per property	Description of infrastructure and systems for cities that have more than one household per property	Cities that adopt these measures
A	Accurate data on direct service connections and total number of properties are available. A system exists to track increase in water connections and in properties in the service area		–
B	Accurate data on number of properties are not available. The Census population is extrapolated. An assumption of number of people per property is made to estimate number of properties	In cities one connection serves multiple household like in a high-rise apartment complexes, such a method of estimating coverage is not applicable	Bhubaneswar, Chandigarh, Dehradun, Indore, Jamshedpur, Rajkot
C	Not applicable		–
D	The estimates of coverage are not linked to any data on the number of direct service connections. For instance 1. Geographical coverage – either by estimating proportion of area covered by network, or the proportion of population covered by network 2. Road length coverage – total length of the distribution system divided by the total road length of the service area		Bangalore, Chennai, Hyderabad, Pune

Production, Metering and Consumption

Production

Different utilities use different methods for measuring the volume of water produced. The reliability of the different methods of measurement has been graded in Table 2.3.

Table 2.3: City-wise methods of measuring the volume of water produced

Category	Description of infrastructure and systems	Cities that adopt these measures
A	Flow meters are used to measure the volume of water produced at all bulk production points. Approximations may be made to estimate supply from small tube wells	Bangalore, Chandigarh, Chennai, Dehradun, Hyderabad, Jamshedpur, Pune
B	Intermediate reliability is not applicable	Not applicable
C	Intermediate reliability is not applicable	Not applicable
D	Volume of water produced is estimated, based on the number of hours of pump operation or capacity utilization of water treatment plants	Bhubaneswar,* Indore, Rajkot

** Flow meters are used to measure only part of total water produced.*

In Bangalore, Chandigarh, Chennai, Dehradun, Hyderabad, Jamshedpur and Pune, the volume of water produced is accurately measured with the help of flow meters. Hence, the data from these cities have been placed in Grade A. In Indore and Rajkot, the methodology adopted has its own limitations as the efficiency of the pump or the treatment plant is difficult to estimate. The data provided by these utilities are accordingly placed in Grade D. In Bhubaneswar, about half of the water produced is measured using flow meters. However, the low reliability attached to the measurement of the other half of water produced, prompts Bhubaneswar's placing in the Grade D category. Indore and Rajkot estimate the volume of water produced using the number of hours of pump operation and the pump's rated capacity. The production data provided by Indore and Rajkot are thus unreliable and hence placed in the Grade D category.

Metering intensity

The number of connections that are metered as a percentage of the total number of connections differs widely across utilities. At one end, some utilities meter all direct service connections, while in some utilities only a negligible number of connections are metered. The utility, which has all its connections metered, is placed in category Grade A. But none of the 10 utilities has adopted this practice. At the second level, the utility may not have all connections provided with meters, but can install meters at the next level of aggregation. For instance, the utility may provide a meter at an appropriate intermediate level in the distribution network. This system would not be able to provide consumption data at the consumer end, but at least at a bulk level. The data collected under this system would be classified as Grade B. Bangalore, Chandigarh, and Hyderabad have been placed in this category.

Jamshedpur makes up for the small number of metered connections by installing meters at select intermediate distribution points to estimate the consumption level. Jamshedpur is placed in Grade C category. Cities which also meter bulk consumers but make no effort to estimate consumption by other classes of consumers are placed in Grade D category. Such practices are followed by Dehradun, Pune and Rajkot. The cities, which have negligible or no metering, are also placed in Grade D; these are Bhubaneswar, Chennai and Indore.

Table 2.4: Grading of prevailing metering practices

Metering System	Description	Cities
A	Metering for all consumption points	None
B	Metering for all billed consumption points	Bangalore, Chandigarh, Hyderabad
C	Metering only for bulk consumers/select category consumers and intermediate level metering	Jamshedpur
D	Negligible or no metering	Bhubaneswar, Chennai, Dehradun, Indore, Pune, Rajkot

Functionality of meters

It is not sufficient for the utility to just install meters, but also necessary for it to check the functionality of the meters and keep them in a good operating condition. Of the 10 utilities, only Jamshedpur was found to have a regular meter-checking program. But in Jamshedpur, only 0.5 percent (or 220 in absolute terms) of the connections are metered and it is not difficult to regularly check the functionality of meters. Thus, Jamshedpur is placed in Grade B category despite having a meter checking program. The other utilities either do not check the functionality of meters regularly or do not maintain data on the number of properly functioning meters, and are placed in Grade B. Hyderabad recently started outsourcing the activity of checking the functionality of meters. Prior to this, no systematic efforts had been undertaken to identify and rectify the nonfunctional meters.

Water consumption

The reliability of the water consumption data is dependent on the metering intensity and the functionality of meters. The lowest reliability grade assigned within these two independent indicators is taken as the reliability grade for the overall data on water consumption. Table 2.6 illustrates the data grade assigned to this indicator.

Table 2.5: Reliability scale of metering system across cities

Reliability scale	Description	Cities
A	All meters are tested regularly	None
B	Meters are tested infrequently (or) no record of functional meters is available	Bhubaneswar, Bangalore, Chennai, Chandigarh, Dehradun, Hyderabad, Indore, Jamshedpur, Pune, Rajkot
C	Not applicable	Not applicable
D	Negligible or no checking	None

Table 2.6: Reliability of the water consumption data

	Data Reliability		
	Metering intensity (1)	Functionality of meters (2)	Water consumption (lower than the reliability grade assigned to (1) and (2))
Chandigarh	B	B	B
Dehradun	C	B	C
Jamshedpur	C	B	C
Bhubaneswar	D	B	D
Rajkot	C	B	C
Indore	D	B	D
Pune	C	B	C
Bangalore	B	B	B
Hyderabad	B	B	B
Chennai	D	B	D

Metered water consumption as proportion of water produced

The reliability of the data on metered water consumption as proportion of total water produced will in turn depend on the data quality of two indicators: functionality of meters and water production. On the data reliability scale, this indicator will have reliability similar to the lower of the grades assigned to the functionality of meters and the water production data. From Table 2.7, we observe that the highest reliability is assigned to data from Jamshedpur.

Nonrevenue water

NRW is a derived indicator. The indicator for reliability of NRW, as a percentage of total water produced, is dependent on the reliability of data of three other indicators, that is, metering intensity, water production and meter functionality. The lowest of the reliability grade assigned to any of these three indicators is taken as the reliability grade assigned to the data on NRW as a percentage of total water produced. Table 2.8 illustrates the data grade assigned to this indicator.

Table 2.7: Reliability of the data on metered water consumption

	Data Reliability		
	Volume of water produced (1)	Functionality of meters (2)	Metered water consumption as proportion of water produced (reliability is lower than that accorded to (1) and (2))
Bangalore	A	B	B
Bhubaneswar	D	B	D
Chandigarh	A	B	B
Chennai	A	B	B
Dehradun	A	B	B
Hyderabad	A	B	B
Indore	D	B	D
Jamshedpur	A	B	B
Pune	A	B	B
Rajkot	D	B	D

Table 2.8: Reliability of nonrevenue water

	Data Reliability			
	Metering intensity (1)	Volume of water produced (2)	Functionality of meters (3)	NRW as % of water produced (lowest of the reliability grade assigned to (1), (2) and (3))
Chandigarh	B	A	B	B
Dehradun	C	A	B	C
Jamshedpur	C	A	A	C
Bhubaneswar	D	D	B	D
Rajkot	C	D	B	D
Indore	D	D	B	D
Pune	C	A	B	C
Bangalore	B	A	B	B
Hyderabad	B	A	B	B
Chennai	D	A	B	D

Network Performance

Pipe breaks

Data provided by Jamshedpur, Bangalore and Hyderabad would qualify as Grade A. In these three cities, the data collected are based on consumer complaints and inspection by utility staff during supply hours while, in Chennai and Chandigarh, the data provided are based on consumer complaints only. In the case of Rajkot, water is supplied for only 20 minutes daily and pipe breaks are attended to immediately on the same day; only major pipe breaks that are not attended to on the same day get recorded. Hence, data recorded on pipe breaks are not comprehensive and categorized as Grade D. In the case of Dehradun, Indore and Pune, no data are maintained on pipe breaks and hence these cities are placed in Grade D category.

Sewerage blockages

Many of the utilities do not have a system of recording data on sewerage blockages. Only those utilities which have an elaborate system of recording and categorizing complaints data, are able to provide data on sewerage blockages. Likewise, in the case of pipe breaks, Chandigarh, Jamshedpur, Bhubaneswar, Hyderabad and Chennai have provided data for each of the three years. The data collected from the 10 cities have been graded as shown in Table 2.10.

Data provided by Jamshedpur, Bangalore and Hyderabad would qualify as Grade A data. In these three cities, the data collected are based on consumer complaints and inspection by utility staff, while in Chandigarh and Chennai the data provided are based on consumer complaints alone. These data are classified as Grade B data as they report

Table 2.9: Reliability scale for data on pipe breaks

Category	Description of infrastructure and systems	Cities that adopt these measures
A	Clear definition of what constitutes a pipe break. In the absence of a definition, all pipe breaks are recorded Recording of all pipe break complaints from consumers and those reported by utility staff. Compiling this data from ward level to city level	Bhubaneswar, Bangalore, Hyderabad, Jamshedpur
B	Recording of pipe break complaints is not comprehensive. Either some geographies or some categories (like consumer complaints) are not recorded Compiling data from ward level to city level	Chennai, Chandigarh
C	Data maintained at individual ward level Data are not aggregated at city level	–
D	No data maintained on pipe breaks	Dehradun, Pune, Indore, Rajkot

Table 2.10: Reliability scale for data on sewerage blockages

Category	Description of infrastructure and systems	Cities that adopt these measures
A	All blockages are recorded, including complaints from consumers and those reported by utility staff. Compiling this data from the ward level to city level	Bangalore, Bhubaneswar, Hyderabad, Jamshedpur
B	Recording of blockages is not comprehensive. Either some geographies or some categories (like consumer complaints) are not recorded. Compiling data from ward level to city level	Chandigarh, Chennai, Pune, Rajkot
C	Data maintained at individual ward levels Data are not aggregated at the city level	None
D	No data maintained on number of pipes	Dehradun, Indore, Pune

only consumer complaints data and not those detected by utility staff. In the case of Rajkot, the municipal corporation has contracted out the work of attending to sewerage blockages to private sector agencies. The data collected on sewer blockages have been sourced from these agencies. Again here, the data collected are based on consumer complaints and hence categorized as Grade B data. In the case of Pune, these data are maintained at the ward level and not aggregated at the city level. However, not all wards have been able to provide data on sewer blockages. Pune, thus, is also placed in Grade B. In the case of Dehradun and Indore, sewer blockage data are not being maintained. Thus, they are placed in Grade D.

Cost and Staffing

Unit operational cost

Table 2.11: Reliability scale of financial data

Category	Description of infrastructure and systems	Cities that adopt these measures
A	In the case of multifunction agencies like municipal corporations, the budget heads related to water and sanitation are clearly separated. Cost allocation standards for common costs are in place. Accrual-based double entry accounting system. Accounting standards comparable to commercial accounting standards with clear guidelines for recognition of income and expenditure. Accounting and budgeting manuals are in place and are followed. Financial statements have full disclosure and are audited regularly and in a timely manner	Chennai, Bangalore, Hyderabad, Dehradun, Jamshedpur

Category	Description of infrastructure and systems	Cities that adopt these measures
B	Budget heads related to water and sanitation are segregated. Key costs related to water and sanitation are identifiable, although complete segregation is not practiced. Key income and expenditure are recognized, based on accrual principles Disclosures are complete and timely	Pune, Rajkot, Bhubaneswar, Chandigarh, Indore
C	Not applicable	Not applicable
D	Budget heads related to water and sanitation are not segregated from the rest of the functions of the agency Cash-based accounting system. No clear systems for reporting unpaid expenditure. Disclosures and reporting are not timely. Audits have a time lag and are not regular	None

All the utilities can be categorized into either Grade A or B. The reliability of the indicator on total operational cost per unit of water produced is dependent in turn on the reliability of the annual operating expenses and the water production data provided by the utilities. From Table 2.12, it is evident that five of the 10 utilities have the highest reliability while three have the lowest reliability.

Staff/'000 water connections

Data on the total number of employees in the utilities are readily available. However, some utilities cannot segregate all the employees exclusively involved in either water supply or sewerage services, as there are some common functions such as administration, which pertain to both services. In such cases, the unsegregated employees have

Table 2.12: Data reliability – annual operating expenses and water production

	Data Reliability		
	Total annual operating expenses	Water production	Operational cost per unit of water produced
Chandigarh	B	A	B
Dehradun	A	A	A
Jamshedpur	A	A	A
Bhubaneswar	B	D	D
Rajkot	B	D	D
Indore	A	D	D
Pune	B	A	B
Bangalore	A	A	A
Hyderabad	A	A	A
Chennai	A	A	A

been allocated to water supply and sewerage services in the same ratio in which segregated employees in these two services are distributed.

Power/electricity costs as a proportion of operating costs

The details on power costs incurred by utilities are available with all the utilities. The data have been sourced from their annual reports or Budget statements. Issues, if any, will possibly arise in cases where the utility follows a cash-based single entry accounting system. Only expenses for which there is a cash outflow would feature in the income-expenditure statement.

Contracted-out service costs as a proportion of operating costs

Some of the utilities outsource activities such as O&M of water treatment plant and sewerage treatment plants (STPs). Pune has provided these data for all three years. Indore, which contracted out the O&M of the STP for 2006, is able to provide data on the costs incurred. In other cities, where numerous such activities are outsourced, the utilities have not been able to provide data on the costs incurred as no records have been maintained. Hyderabad maintains data on the cost of contracted-out services from 2007.

Quality of Service

Continuity of service

The data on continuity of service provided by all the utilities is based on field-level experience and not supported by any documentation. A better way to provide the data would be to give the average hours of daily supply for each ward/zone of the service. The reliability of these data has not been mapped onto the A-D scale. It would be probably fair to say that this number across the utilities is not reliable.

Complaints about water and sanitation services

The quality of data provided on complaints about water and sewerage services varies across utilities. The data collected from the

Table 2.13: Contracted-out service costs

	Service contracted out	Data provided
Chandigarh	✓	X
Dehradun	✓	X
Jamshedpur	✓	X
Bhubaneswar	X	X
Rajkot	✓	X
Indore	✓	✓
Pune	✓	✓
Bangalore	✓	X
Hyderabad	✓	X
Chennai	✓	X

utilities have been graded on the parameters shown in Table 2.14.

The data on the number of complaints on water and sanitation services have been made available by most of the utilities. Some utilities have not been able to provide data because the complaints have been registered at the ward offices and the utilities have found it difficult to aggregate the data at the main office. Many utilities have responded that not all the complaints reported get registered.

Bangalore, Chandigarh, Chennai, Hyderabad and Jamshedpur have elaborate complaints departments and are placed in Grade A. These five cities segregate the complaints into various categories based on their nature. For instance, Hyderabad's complaints data have been segregated into 24 different categories.

For this indicator, Grade B reliability is not applicable. Bhubaneswar maintains data at the ward level, but the data are not segregated based on their nature. Hence, Bhubaneswar is placed in Grade C. In Indore, data are available for some months in each of the three years and these have been extrapolated to estimate the number of complaints recorded in each of the years. Indore also has been placed in Grade C.

In Rajkot, the complaints on water services are maintained at the ward level, while the sewerage complaints have been contracted out to a third party. But the complaints data are not segregated on the basis of their nature. Hence, Rajkot is also placed in Grade C. Pune does not maintain data on the number of complaints. Hence, Pune has been placed in Grade D. It is only in 2007 that Pune developed a system to record data on the number of complaints received.

Table 2.14: Reliability scale of complaints data provided by utilities

Category	Description of infrastructure and systems	Cities that adopt these measures
A	Multiple mechanisms by which consumers can register their complaints such as by telephone, in person or by writing or by email. Complaints segregated into different categories. Data on redressal status maintained. Complaints data maintained at ward level and city level	Bangalore, Chandigarh, Chennai, Hyderabad, Jamshedpur
B	No intermediate reliability level applicable	Not applicable
C	Multiple mechanisms by which consumers can register their complaints, such as by telephone, in person or by writing letters or emails. Complaints data not aggregated at the city level. Data available for some months have been extrapolated to get data for the year	Bhubaneswar, Dehradun, Indore, Rajkot
D	Complaints data not maintained either at the ward level or city level	Pune

In all cases where the quality of data on the number and type of complaints is good, a central cell is responsible for recording the complaints and aggregating the data on complaints received in each of the zonal/ward/area offices. The prevailing system in all the utilities does not provide data on their complaint redressal status. Some utilities do provide data on the number of complaints pending at the end of each month but, in all cases, the number of pending complaints at the end of each month is reported to be zero. The reliability of these data can be termed as very low. But a good complaint recording system also has been found to be a reliable and ready source of data for measuring network performance.

Wastewater treatment

The data on the volume of wastewater treated have been made available in all the utilities where a STP is in operation. The volume of wastewater collected is estimated by the volume of wastewater treated at the STP with the help of flow meters. The reliability of these data have not been mapped onto the A-D scale.

Billing and Collection

Average tariff

The computation of the average tariff requires the availability of data on total operating revenues and the volume of water sold. The lowest of the reliability grade assigned within these two independent indicators has been taken as the reliability grade assigned to the data on average tariff. Table 2.15 illustrates the data grade assigned to this indicator.

From Table 2.15, it is evident that only Hyderabad and Bangalore have Grade A data for the measurement of this indicator. Jamshedpur and Chandigarh have Grade A data on the total annual operation revenues and Grade C data on water sold.

The other cities have at least one of the data points in Grade D category which is hence unreliable.

Table 2.15: Reliability grade assigned to the data on average tariff

	Data Reliability		
	Total annual operating expenses	Water production	Average tariff
Bangalore	A	B	B
Bhubaneswar	B	D	D
Chandigarh	B	B	B
Chennai	A	D	D
Dehradun	A	C	C
Hyderabad	A	B	B
Indore	A	D	D
Jamshedpur	A	B	B
Pune	B	C	C
Rajkot	B	C	C

Summary of Reliability Scale Across Utilities and Indicators

Table 2.16: Summary of reliability scale across utilities and indicators

	CHG	DEH	JAM	BHU	IND	PUN	RAJ	HYD	CHE	BAN
Coverage – water supply	B	B	B	B	B	D	B	D	D	D
Water production	A	A	A	D	D	A	D	A	A	A
Water consumption	C	D	C	D	D	D	D	A	D	A
NRW	B	B	C	D	D	C	D	B	D	B
Proportion of connections that are metered	B	C	C	D	D	C	C	B	D	B
Proportion of functional meters	B	B	B	B	B	B	B	B	B	B
Proportion of water sold that is metered	B	B	B	D	D	B	D	B	B	B
Pipe breaks	B	D	A	A	D	D	D	A	B	A
Sewerage blockages	B	D	A	A	D	D	D	A	B	A
Unit operational costs	B	A	A	B	B	B	B	A	A	A
Power/op costs	A	A	A	A	A	A	A	A	A	A
Complaints	A	C	A	A	A	D	C	A	A	A

Inter-utility Performance Analysis

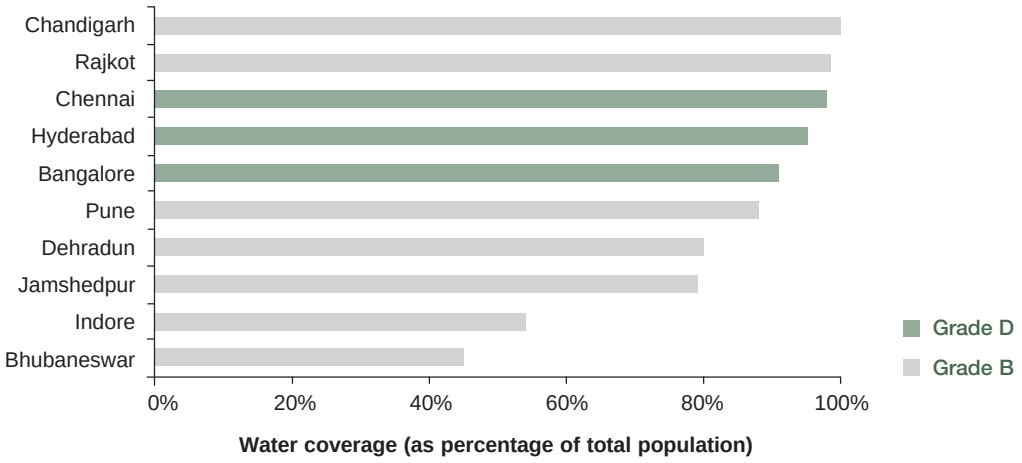
This section compares the performance of the utilities, relative to each other for the year 2006.[3] The discussion will bring out variations in their performance, with regard to some key indicators such as coverage, production, consumption, unaccounted-for water (UFW)/NRW and finances.

Service Coverage

Water supply

As mentioned in the earlier section, the cities have adopted different methods to compute their service coverage ratios. The reliability of the data on service coverage varies for the different methods deployed by the utilities. In the case of Bangalore, Chennai and Hyderabad, the water supply coverage is reported to be in excess of 90 percent. In the case of Pune, it is lower at 88 percent. These four cities rank high on the water supply coverage indicator, but the reliability of the data provided is low. The data provided by these cities have been categorized a Grade D. These four cities use the geographical coverage method for the computation of service coverage and hence are accorded a low grade on the reliability scale. In Indore, the service coverage at 54 percent is low, but the reliability of the data provided is one grade below the best than that can be made available. Only Chandigarh and Rajkot report a good mix of high coverage and reliable data (Grade B). Chandigarh has reported the highest coverage at 100 percent followed by Rajkot at 98 percent. Bhubaneswar scores low on coverage (45 percent) and high in reliability of the data provided (Grade B).

Figure 3.1: Inter-utility comparison – water services coverage



[3] Data for year 2006 have been utilized for comparing performance unless stated otherwise.

Sewerage

Chandigarh at 100 percent has reported the highest coverage for sewerage amongst the 10 cities studied. The other city which has reported a high coverage is Chennai with 98 percent. Bhubaneswar has reported the lowest coverage at 25 percent amongst the 10 cities. The reliability of the data on sewerage coverage is very low across the cities. The estimates are either based on geographical coverage or are the estimates of the utility staff, lacking the support of any kind of measurement or documentary evidence.

Production, Metering and Consumption

Production

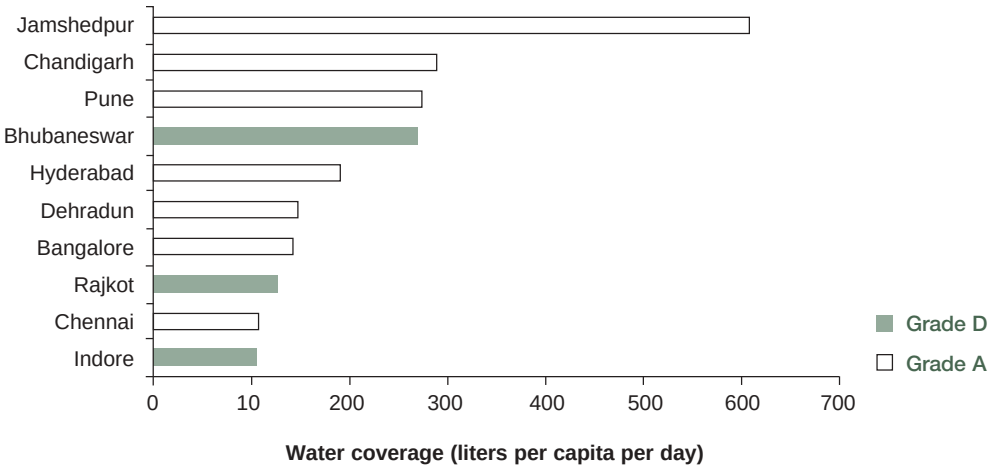
The water production in liters per capita per day (lpcd) is a high 607 in Jamshedpur. This is mainly on account of high levels of industrial and bulk consumption. In Indore, Chennai, Rajkot, Bangalore and Dehradun, the production is in the range of 100-150 lpcd, whereas the cities of Hyderabad, Bhubaneswar, Pune and Chandigarh have production levels in excess of 190 lpcd, but less than 300 lpcd.

However, not all data provided by the utilities are reliable. The seven cities of Bangalore, Chennai, Chandigarh, Dehradun, Hyderabad, Jamshedpur and Pune have installed flow meters to measure production levels. Hence, the data provided by these cities are categorized as Grade A. In Bhubaneswar, of the 206 million liters per day (MLD) water produced, about 100 MLD is measured with the help of flow meters. In Bhubaneswar (for part of the water produced), Indore and Rajkot, the water production level is estimated on the basis of the treatment plant capacity or pump capacity and its operating hours. The production data from these three cities have been categorized as Grade D.

Metering practices

The extent of metering prevalent amongst the 10 cities varies widely. No city, however, meters all connections provided (including public water points). Bangalore reports that all the direct supply connections are metered, while in the case of Hyderabad, 94 percent of the connections are metered. In Dehradun, Pune and Rajkot, bulk consumers are metered. In Bhubaneswar, Chennai and Indore, the

Figure 3.2: Inter-utility comparison – water production levels



numbered of metered consumers is negligible. In Jamshedpur, the number of metered connections as a percentage of the total number of connections is also very small, but the utility provides meters at some intermediate distribution points and attempts to estimate the level of consumption.

Functionality of meters

Only Jamshedpur tests the meters for proper functioning regularly. In the other cities, either the meters are tested infrequently or no data are maintained to ascertain the number of properly functioning meters. Hyderabad has reported that an activity to check the functionality of meters has recently been outsourced to a private agency.

Metered water consumption

The proportion of metered water consumption, as a percentage of water produced, varies widely across cities. Among the 10 cities, Jamshedpur has reported a metered water consumption of 63 percent of total water produced. This is the highest amongst the 10 utilities. However, in Jamshedpur, only 5 percent of the total connections are metered. In Bangalore, all direct connections are metered. But the metered water consumption amounts to 48 percent of the total water produced. Unmetered water consumption (through public water points) in 2006 amounted to about 12 percent of water produced, while the balance was unaccounted for. In Hyderabad, metered water consumption constitutes about 45 percent of the water produced; 5 percent is by way of unmetered consumption and 50 percent is unaccounted-for.

Nonrevenue water

The reliability of the NRW data is influenced by the data reliability of metering intensity, water production data and the functionality of meters. The NRW data provided by Bhubaneswar, Indore, Rajkot and Chennai have the lowest reliability. The Pune and Dehradun data have been categorized as Grade C; the four utilities of Bangalore, Chandigarh, Hyderabad and Jamshedpur have the highest reliability with Grade B category data. With the available quality of data, Bhubaneswar has the highest NRW at 60 percent, while Jamshedpur had the lowest NRW at 9 percent in 2006. Rajkot has low NRW (12 percent), but the data are of Grade D category.

Figure 3.3: Inter-utility comparison – metered water consumption levels

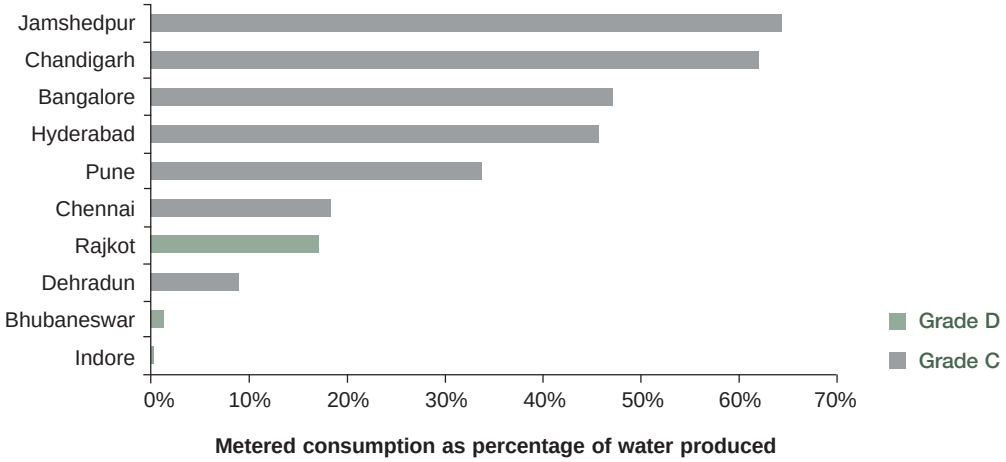
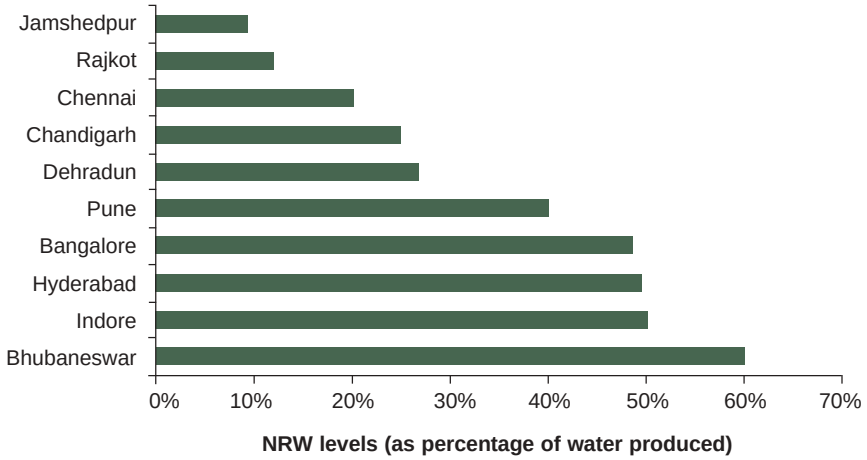


Figure 3.4: Inter-utility comparison – nonrevenue water levels



Cost and Staffing

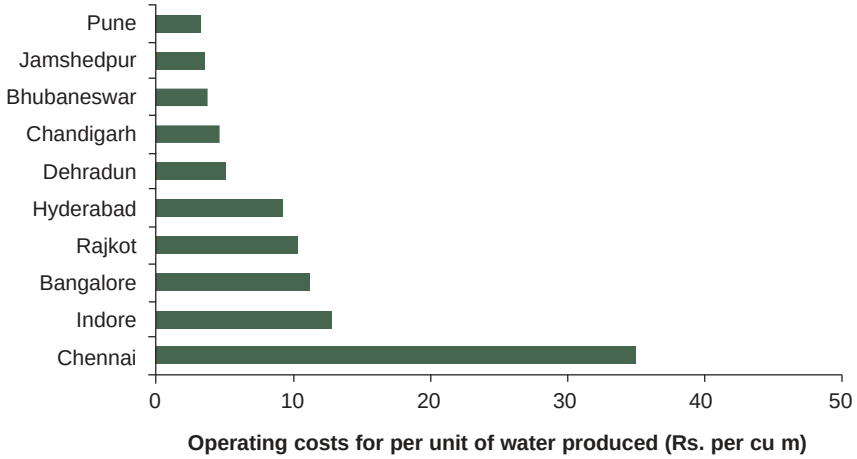
Unit operational cost

The unit operational cost, per liter of water produced was the highest for Chennai[4] at Rs. 34.65 per liter of water produced while the lowest was Rs. 3.44 per liter for Jamshedpur. The water cost in Chennai appears to be very high, as drought-like conditions in 2005 had forced the utility to supply water through tankers on a large scale. Bangalore, Hyderabad, Indore, and Rajkot face a common problem of sourcing water from long distances. This explains the high cost of water production in these four cities, compared to cities like Pune and Bhubaneswar, which have sources of water in close proximity to the city.

Staffing

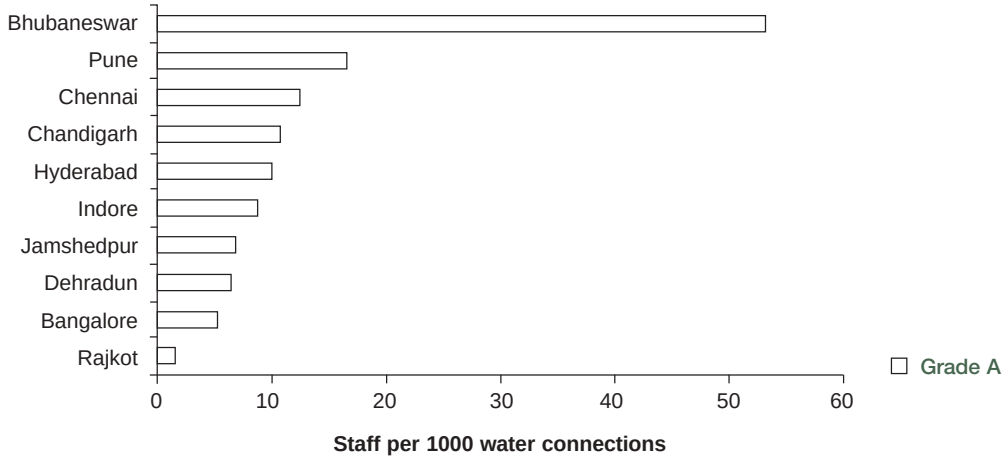
Rajkot has reported the lowest number of staff per 1,000 water connections at 1.1, while Pune has reported the highest at 11.5 per 1,000 water connections. Bangalore has a staffing ratio of 3.3 while Chennai and Hyderabad are almost comparable at around 7.8 per 1,000 connections.

Figure 3.5: Inter-utility comparison – unit operational costs



[4] The Chennai data is for 2005.

Figure 3.6: Inter-utility comparison – staffing pattern



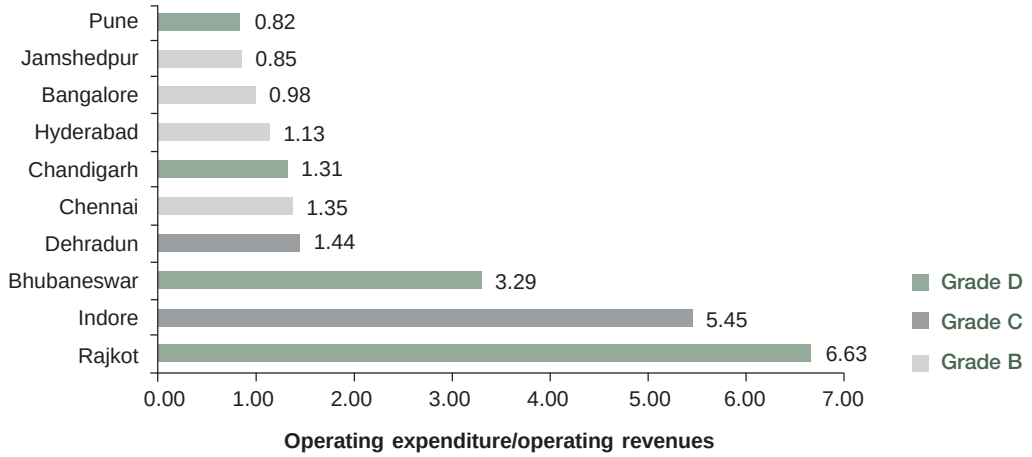
Quality of Service

The utilities which have good systems to record complaints have been found to have a higher ratio for total number of complaints as a percentage of the total number of water supply connections. The utilities which have poor systems are unable to record all the complaints received from the customers. Chennai, Hyderabad and Bangalore which have good systems have reported this ratio in the range of 39 percent to 44 percent, while cities like Indore and Chennai report this same ratio to be in the range of 0.3 percent to 2.26 percent.

Financial Performance

The working ratio (operating expenses/ operating revenues) for the three utilities – Pune, Jamshedpur and Bangalore – is lower than one. Pune has the lowest ratio at 0.82. Bhubaneswar, Indore and Rajkot have operating expenses in substantial excess of operating revenues. Bhubaneswar has a very low cost of production (Rs. 3.67 per liter) but low coverage (45 percent) and lower average revenues per liter of water sold (Rs. 2.78). Bhubaneswar's water production at 206 lpcd is in excess of the requirements of the population of its service area. Indore, like Bhubaneswar, has low coverage and lower realizations, but high cost of production (Rs. 10.77). Indore's production level is only 101 lpcd. Indore sources water from a distance of 70 kilometers (km) of the city, which increases its production costs. Bangalore like Indore also has high production costs on account of sourcing water from great distances. But Bangalore's per unit average realizations are almost five times that of Indore. Indore's working ratio is more than 5.5 times the level of Bangalore. Rajkot has high water supply coverage (98 percent), but the lowest average revenue realized from water sold amongst the 10 cities (Rs. 1.75) along with a high cost of production (Rs. 10.21 per liter). This has contributed to it having the highest ratio at 6.63.

Figure 3.7: Inter-utility comparison – working ratio



Conclusions

For benchmarking to result in utility performance improvement, it presupposes that data used for performance measurement are available and reliable. However, it is observed from the data collection exercise, performed with 10 utilities, that either the data are not readily available or may not be always reliable. Benchmarking utility performance with unreliable data will be misleading.

First of all, it is essential that the data collection systems prevailing in the utilities be improved. Data for some indicators can be improved if the related infrastructure is improved. For instance, the volume of water produced can be accurately measured with the installation of flow meters at the output of the water treatment plants. For some indicators, mere infrastructure improvements will not solve the problems as in the case of metering. A complete overhaul of the system may be required. For instance, one of the critical data gaps observed through the data collection exercise relates to the volume of water consumed. The installation of meters for all connections can provide data on the volume of water consumed. The meters installed need to be checked for their proper functioning. In India, water is supplied on an intermittent basis and, therefore, because of air entrapment, meters are prone to frequent failures. Hence, it is essential that every utility conducts checks for the proper functioning of meters on a regular basis. For all the systemic changes to happen, utilities need to get themselves oriented towards data collection and take decisions based on accurate data.

Performance Analysis of Utilities

Bangalore

About Bangalore Water Supply and Sewerage Board

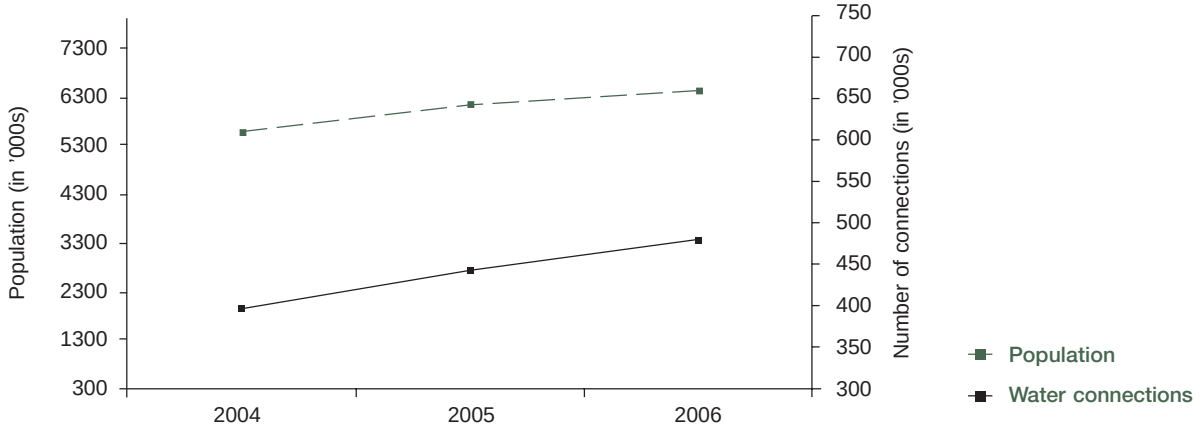
The Bangalore Water Supply and Sewerage Board (BWSSB) was constituted under an Act of the Karnataka State Legislature in 1964. The Board was made responsible for the provision of water supply, sewerage collection and disposal in the Bangalore Metropolitan Area, and other associated services; it presently covers a population of 6.4 million.

Coverage

BWSSB has adopted the geographical coverage method to estimate the population served. BWSSB estimates that its water supply network covers about 90 percent of the service area either through direct service connections or public water points.[5] The coverage, as reported by BWSSB, has remained constant during the period 2004-06 (as the number of connections has increased at a similar rate as population, as Figure 4.1 shows).

The provision of sewerage services is currently concentrated in Bangalore city and its surrounding areas. The population increase in the eight urban local bodies surrounding Bangalore city and forming a part of the Greater Bangalore area has not been accompanied by a commensurate widening of the sewerage network. This has resulted in the reduction of coverage to 79 percent in 2006 from 85 percent in 2004. The estimation of the sewerage coverage ratio is also based on geographical coverage and hence has low reliability.

Figure 4.1: Growth in population and water connections in Bangalore



[5] The estimate of coverage is based on an assessment of geographical areas covered by the water supply network and hence is low on the reliability scale.

Metering, production and consumption

BWSSB draws water from two water sources, primarily Cauvery (850 MLD) and Arkavathy (100 MLD). The water production volumes increased by 21 percent, while the population in the service area increased by 14 percent during 2004-06.[6] Despite the production increasing at a higher pace than population increase, per capita consumption has declined from 112 lpcd in 2004 to 85 lpcd in 2006, on account of the increase in UFW from 129 MLD in 2004 to 373 MLD in 2006. In percentage terms, UFW has increased from 17 percent to 41 percent of water produced.

BWSSB provides meters to all direct service connections. According to BWSSB estimates, 10 percent of the meters were nonfunctional in each of the three years. BWSSB does not have a regular meter-checking program and hence data reliability on the functionality of meters is not high. Metered water consumption, as a percentage of water produced, has increased from 44 percent in 2004 to 46 percent in 2006.

Network performance

Until recently, the data on network performance have been maintained manually by the BWSSB staff at the ward level. From 2006 onwards, BWSSB has started maintaining a computerized database which compiles information on network performance from various ward offices. As a result, data on BWSSB's network performance is available for 2006 alone.

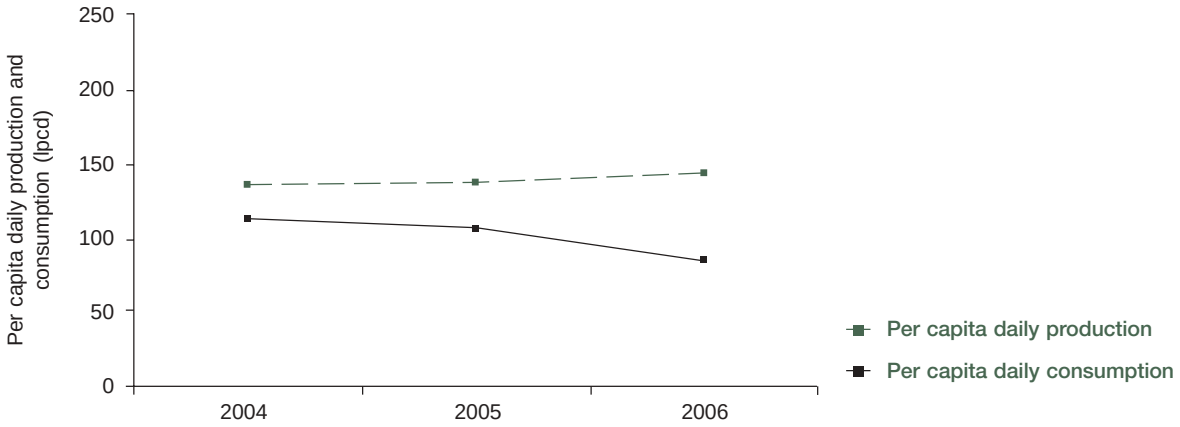
The city recorded 5.23 pipe breaks per km of pipeline in the year. The corresponding figure for sewer blockages was 8.22.

Staffing and financial performance

BWSSB had 2,600 employees in 2006 of whom 50 percent were involved in water supply, while 30 percent were involved in providing sewerage services. The remaining employees were involved in activities which involved both services.

With the increase in the number of water connections, BWSSB's staffing ratio (utility staff per 1,000 water connections) has improved from 7.22 to 5.42 in the three year period (2004-06).

Figure 4.2: Water production and consumption levels in Bangalore



[6] The production volume data are measured with the help of flow meters and hence are high on the reliability scale.

BWSSB charges residential users Rs. 6 for every cubic meter (cu m) of consumption on a monthly basis, up to a maximum of 8 cu m. This rate is progressively increased to Rs. 36 per cu m for consumption greater than 100 cu m. Nonresidential consumers have to pay Rs. 36 per cu m for consumption up to a maximum of 10 cu m. The nonresidential monthly charges are progressively raised to Rs. 60 per cu m for consumption in excess of 100 cu m. Sewerage charges form 35 percent of the water charges payable by the consumer, with a minimum charge of Rs. 15 per month. For industrial consumers, the monthly charges are Rs. 60 for every cu m of consumption.

BWSSB's revenues have increased by 17 percent in 2004-06. However, the production volume has grown by 21 percent in the same period. The tariff increase in February 2005 has raised the average revenues realized per unit of water sold from around Rs. 18 in 2004 and 2005 to Rs. 21 in 2006. But the rise in expenses by 31 percent over 2004-06 has resulted in the working ratio increasing from 0.88 in 2004 to 0.98 in 2006.

Power-related expenses form a large proportion of BWSSB's total operating expenditure, since water is pumped from the Cauvery source, which is located 100 km away from Bangalore city. Electricity costs have however declined from 71 percent of BWSSB's total operating cost in 2004 to 59 percent in 2006. This is because energy costs have risen at a slower pace (about 10 percent) than production volumes (about 21 percent).

BWSSB's average collection period (the average period of outstanding receivables) has been reported as 363 days (12 months).

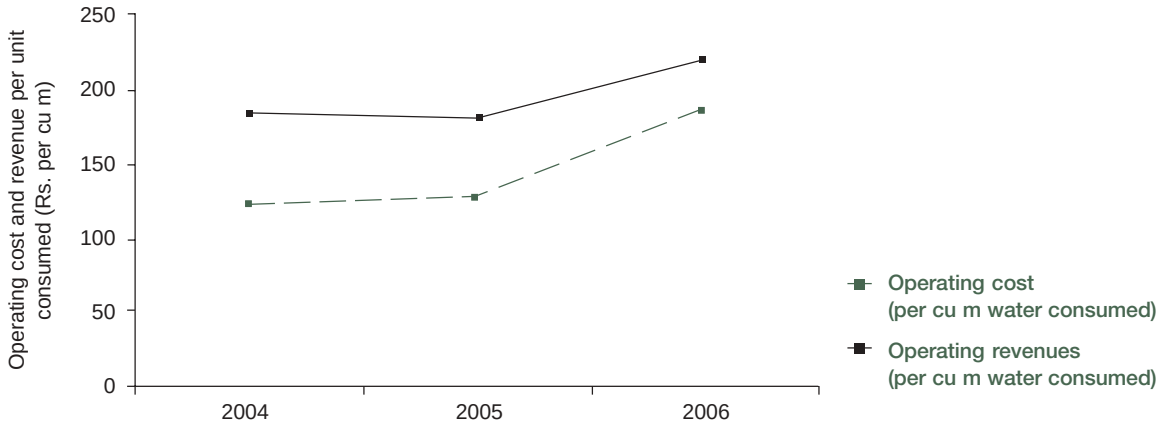
Quality of service

BWSSB consumers receive water on an intermittent basis. BWSSB supplies water on an average for four to six hours on alternate days.

According to BWSSB, 90-95 percent of the samples pass the test for residual chlorine.

Though BWSSB has an elaborate system for recording complaints, it has not been able to provide any data on the total number of

Figure 4.3: Operating cost and revenue levels in Bangalore



complaints received in each of the three years. Data regarding the number of complaints received by BWSSB are not available.

Of the 288 MLD sewage collected, 105 MLD (37 percent) undergoes secondary treatment.

Summary

BWSSB's water supply services cover 90 percent of its service area, while its sewerage services cover 65 percent of its service area. Its per capita water production level was 143 lpcd, while the corresponding consumption was only 85 lpcd. About 49 percent of water produced constituted NRW. BWSSB has to source a large proportion of its water requirement from a distance of 100 km. This increases the pumping costs and consequently increases water production costs. The pumping costs constitute about 59 percent of the total operating costs and it costs BWSSB Rs. 11.1 to produce cu m of water. Its tariffs are correspondingly higher at Rs. 21.96 per cu m of water consumed. The high proportion of UFW has resulted in the working ratio being marginally greater than unity in 2006, despite the unit realizations (from water consumed) being significantly higher than the unit production costs.

BWSSB supplies water to its consumers for four to six hours on alternate days. The quality of water supplied has been of acceptable standards as 90-95 percent of the samples tested passed the test for residual chlorine.

Bhubaneswar

About Public Health Engineering Organization, Bhubaneswar

The Public Health Engineering Organization (PHEO) is responsible for operating and maintaining urban water supply and sewerage services in Orissa, while the Orissa Water Supply and Sewerage Board (OWSSB) is responsible for executing major water supply and sewerage projects. Both agencies are under the administrative control of the Housing and Urban Development Department of the government of Orissa.

The Bhubaneswar division of PHEO, henceforth referred to as PHEO-BHU is responsible for providing water supply and sewerage services in the city of Bhubaneswar. The area of the city is about 135 sq km and its population was estimated to be 0.76 million in 2006.

Coverage

The water supply services of PHEO-BHU cover 45 percent of the population of Bhubaneswar. This coverage estimate is derived from the population covered by direct service connections and public water points. The Census 2001 estimation of six people per household indicates that the population covered by direct service connections is estimated to be 0.314 million. According to PHEO-BHU, the population covered by public water points is estimated to be 0.03 million. The coverage in 2004 was 45.8 percent.

The sewerage system in the city was designed about 50 years ago; no large-scale improvements have been effected since then. The sewerage network coverage has declined to about 25 percent in 2006 from 28 percent in 2004.[7] The situation has deteriorated in the last few years; the expansion in the network has not been able to keep pace with population growth.

Metering, production and consumption

PHEO-BHU sources about 166 MLD of water from the three surface water sources of the Kuakhai, Daya and Mahanadi rivers and 40 MLD of water from 137 tubewells located across the city. The total annual water production measures about 206 MLD. About 100 MLD of water sourced from surface water sources is measured with the help of flow meters, while the balance 66 MLD is measured based on the capacity utilization of the treatment plant. The production levels have remained the same for all three years. The population increases in these years have led to a decline in per capita production volumes by about 10 percent from 298 lpcd in 2004 to 268 lpcd in 2006.

In Bhubaneswar, less than 1 percent of the connections are metered. The metered water consumption levels are less than 1 percent of the total water produced. PHEO reports that of 206 MLD of water produced, about 82 MLD (40 percent) is being consumed and billed.[8] The low level of metered water consumption (less than 1 percent) implies that the reliability of the consumption data

[7] The estimate of coverage is based on the assessment of geographical areas covered by the sewerage network and hence is low on the reliability scale.
[8] Only about half of the production volumes are measured with the help of flow meters and hence the total production data have low reliability. In the absence of large-scale metering, the consumption data have very low reliability.

provided is very low. Using the consumption data provided by the utility, the per capita daily consumption levels have been assessed as 108 lpcd in 2006.

As per the data provided by PHEO-BHU, both the NRW and UFW levels are estimated to be about 60 percent of the total water produced in each of the three years. However, the reliability of this estimate is low. The utility can increase coverage significantly without further augmenting its production capacity by reducing UFW to acceptable levels.

Network performance

About 2,000-2,200 pipe breaks have been recorded annually; this corresponds to about 2.49 pipe breaks per km per year (2006). OWSSB reports that about 80 percent of the existing sewers are inadequate or damaged and need repair/replacement. About 2,500 sewerage blockages have been recorded annually; this corresponds to about 7.51 blockages per km per year (2006). The records for sewer blockages are prepared on a regular basis at the section level (headed by a junior engineer). These are then collated for the entire city periodically.

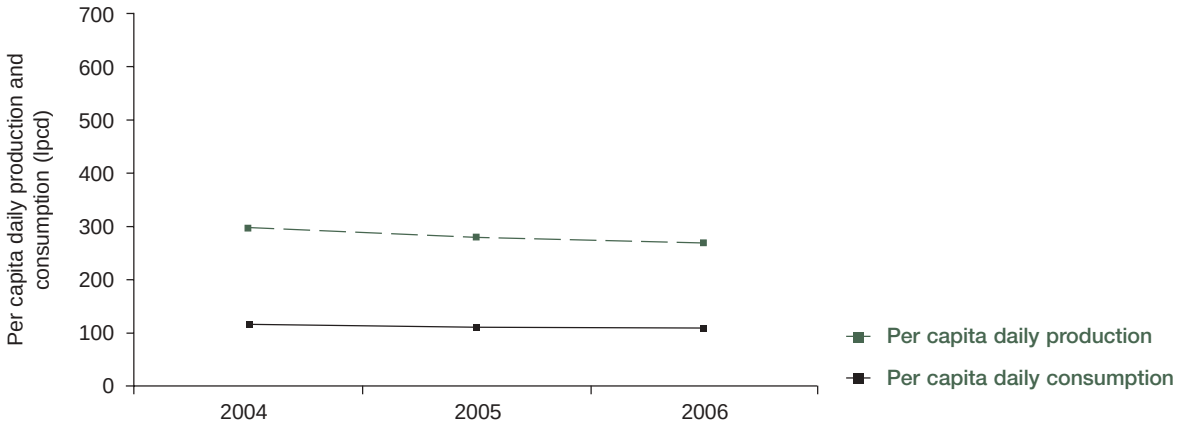
Staffing and financial performance

In 2006, PHEO-BHU had 610 employees of whom 426 employees were involved in water supply, while 184 were involved in providing sewerage services. With an increasing number of connections, the staffing ratio (utility staff per 1,000 water connections) has improved significantly over the three-year period 2004-06, from 31.13 in 2004 to 11.68 in 2006.

Bhubaneswar has very limited metering; for such connections, the tariff is consumption-based. The rate per cu m ranges from Rs. 2.42 for domestic users to Rs. 5.64 for institutional and Rs. 8.00 for commercial and industrial users. For unmetered connections, a minimum tariff of Rs. 30 per month per household is levied. For sewerage services, tariff varies with the size of connection; it ranges from Rs. 200 to Rs. 800 per month.

In terms of water connection charges, industrial users are charged twice as much as domestic users; a one-time connection charge of Rs. 3,000 is levied for a domestic connection, Rs. 5,000 for institutional connections and Rs. 6,000 for commercial/ industrial connections.

Figure 4.4: Water production and consumption levels in Bhubaneswar



PHEO-BHU's total expenses for every cu m of water produced, Rs. 3.27, are among the lowest incurred by the 10 utilities; but its working ratio at 3.29 ranks as one of the highest amongst the 10 utilities. This is probably on account of the high proportion of NRW (about 60 percent) involved and the low level of tariffs charged.

The utility spends almost 50 percent of its operating costs on power-related expenses. The salary expenses, as a percentage of operating costs, contribute about 15 percent. PHEO-BHU contracts out limited services like minor repair and maintenance work, chemical procurement for water treatment plants, and vehicle repairs. But the expenditure is recorded under corresponding heads like repair and maintenance and vehicle expenses. Thus, no separate records of expenses are maintained under the category of contracted services.

The collection period (outstanding debtors/ revenues) was reported as 590 days (19.67 months) in 2006. The level of debtor days is high because of the organization's policy of not writing off debtors.

Quality of service

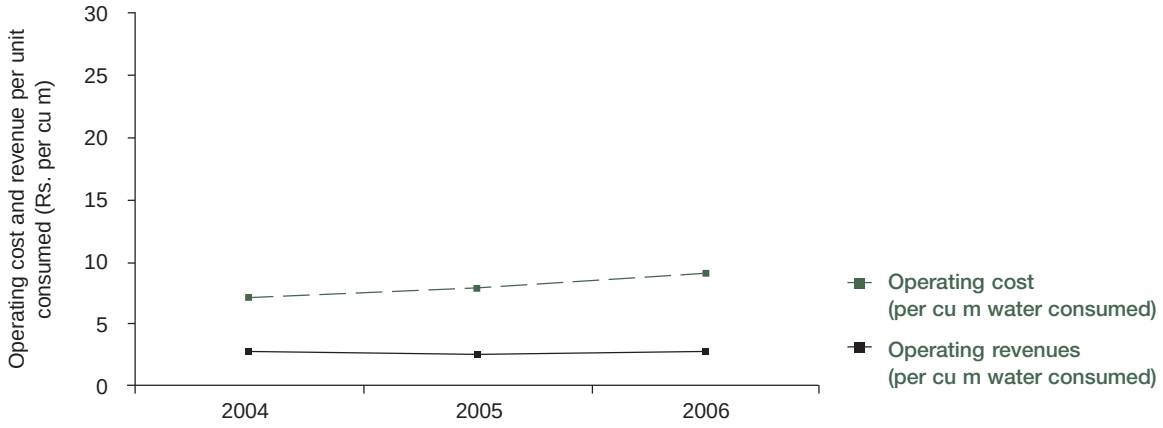
On an average, the city receives three to four hours of water supply per day. However, seasonal fluctuations remain high. The utility receives, on an average, 1,050 complaints per month via letters, emails and personal visits to relevant officials. Complaints are received for about 25 percent of the water connections annually. The data are based on complaint records prepared at the division level. The number of complaints, as a percentage of water and sewerage connections, has decreased from 10 percent in 2004 to 8 percent in 2006.

The city has one functional STP with a capacity of 1 MLD only, which treats less than 2 percent of the wastewater collected. The untreated wastewater flows into 10 drains, which meet river Kuakhai and Gangua Nalla, leading to high levels of contamination in these two water bodies.

Summary

PHEO-BHU produces about 206 MLD of water. In per capita terms, this translates into 269 lpcd. The production data are not entirely reliable as only about 100 MLD of

Figure 4.5: Operating cost and revenue levels in Bhubaneswar



water produced is measured using flow meters. There is a considerable loss of water during transmission and distribution. PHEO-BHU estimates the consumption level at 108 lpcd and the balance water is unaccounted for. But only 1 percent of the water produced is metered. Thus, the reliability of the consumption data is also low. PHEO-BHU's water supply services covered about 45 percent of the population in 2006. Thus, the existing production, if efficiently distributed, can be used to increase coverage significantly without any supply augmentation.

The utility benefits significantly on account of an abundant source in close proximity. The per cu m production cost at Rs. 3.67 is one of the lowest amongst the 10 utilities. The high level of NRW (60 percent) has resulted in a working ratio of 3.29. In the absence of large-scale metering the reliability of the NRW estimate is also low.

The sewerage services provided by PHEO-BHU cover only 26 percent of the city population. The sewage treatment facilities are highly inadequate. The utility has sewage treatment of just 1 MLD capacity. The untreated wastewater flows into 10 drains which meet river Kuakhai and Gangua Nalla, thus contaminating the two water bodies.

PHEO-BHU receives about 1,000-1,100 complaints per month via channels like letters, mails and personal visits to relevant officials. This amounts to about 15 percent of the total water connections. The entire city receives intermittent supply of three to four hours per day only. Water quality from both surface and ground sources has been found to meet the required standards.

Chandigarh

About Municipal Corporation of Chandigarh

The Union Territory of Chandigarh measures about 114 sq km in area and has a population of 0.9 million, as per the 2001 Census. It is one of the fastest growing cities of India with a population decadal growth rate of 40.30 percent. Prior to 1976, all functions such as water supply, sewerage, storm water drainage, city roads, solid waste management and fire wings were looked after by the respective departments of the Chandigarh administration. The Municipal Corporation of Chandigarh (MMC) was formed under the Punjab Municipal Act, 1976. Thereafter, the functions of works and maintenance for specific roads, water supply, sewerage, storm water drainage, solid waste management and fire tendering were transferred to MCC.

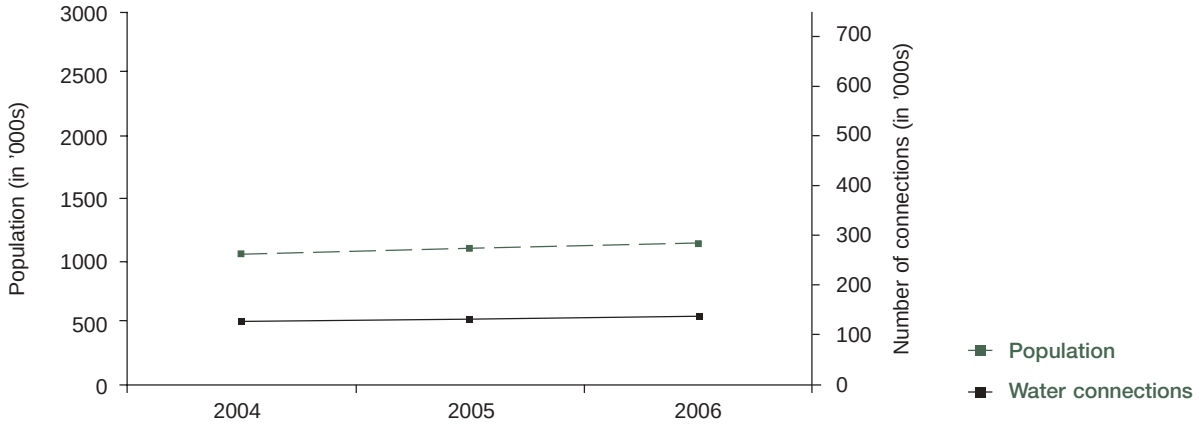
Coverage

The water supply coverage has been maintained at 100 percent for each of the three years. Coverage includes supply through direct service connections or public water points. Of the estimated 1.15 million population, about one million are served by direct service connections.[9]

Though MCC has fairly accurate data available for the number of connections in the city, it does not have any records of the population being served by these connections, resulting in low reliability of the coverage data.

MCC claims 100 percent sewerage coverage in its service area. It provides sewerage services to its customers through direct sewerage connections and mobile toilets for slum areas; approximately one million customers are serviced through direct service connections and the remaining 0.15 million customers are serviced through mobile/community toilets. The data on coverage are based on estimates of the MCC staff and not substantiated by documentation or basis for measurement. The reliability of the data sewerage coverage is thus low.

Figure 4.6: Growth in population and water connections in Chandigarh



[9] This figure is calculated by multiplying the number of direct service connections (137,409 in 2006) with the assumption that each connection serves 7.28 people. The Census data estimate 4.5 persons living per household and not 7.28 as assumed by MCC. Thus, MCC coverage data maybe overstated and be low on reliability. Further, about 0.15 million customers have been covered by public water points. This number is calculated by multiplying the number of public water points (1,200) by an estimated number of people being served per public water point (125).

Metering, production and consumption

MCC sources surface water at Kajauli, about 27 km from the city. Water is also sourced from 200 tube wells to service its customers located in the peripheral areas of the city. The per capita daily production levels have been in the range of 290-295 lpcd. This is measured with the help of flow meters. The per capita daily consumption levels have been in the range of 239-256 lpcd. UFW, which measured about 13 percent in 2004 and 2005, has increased to 17 percent in 2006. The reliability of the data on UFW is low as not all connections provided by MCC are metered.

For 2006, approximately 10 percent of the meters were observed to be faulty. The corresponding figures were 6.6 percent and 7.4 percent in 2004 and 2005, respectively.

Network performance

MCC's network performance shows a constant record of one pipe break per km of pipeline, in each of the three years studied. These data are maintained by MCC at the ward levels. However, they are not supported by any documentation. The number of sewage blockages per km of pipeline increased from 1.49 in 2004 to 1.77 in 2006. The reliability of the data on network performance is low, as systems to record pipe breaks and sewer blocks are not adequate.

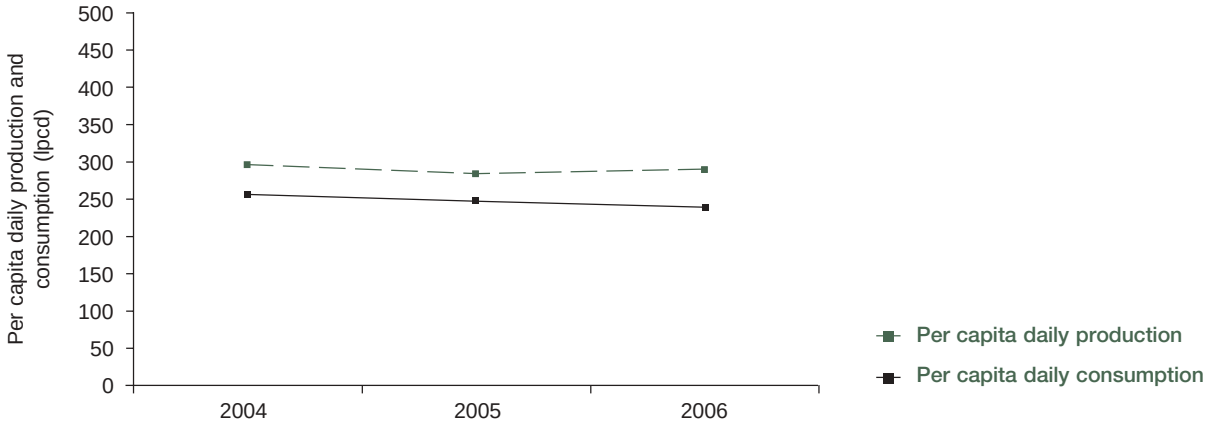
Staffing and financial performance

MCC had 1,808 employees on its rolls in 2006 to run its water and sewerage services. Of them, 1,610 have been deployed for water services while 198 are involved in providing sewerage services. As a result, the total staff employed has decreased from 1,806 in 2004 to 1,466 in 2006. The staffing ratio (utility staff per 1,000 water connections) has improved significantly over the three-year period 2004-06; it declined from 13.88 in 2004 to 10.76 in 2006.

For a sewerage connection, a minimum one-time connection fee of Rs. 500 is levied. The charges vary as per the size of the plot with a maximum charge of Rs. 3,000 per connection. For a new water connection, Rs. 500 is collected as security and Rs. 30 as an installation charge.

The billing for water and sewerage charges is computerized and done centrally. In addition, spot bills are raised manually. This leads to data gaps, which are related to category-wise consumption as well as demand, collection and arrears of individual customers.

Figure 4.7: Water production and consumption levels in Chandigarh



In 2006, MCC incurred an operating expense of Rs. 5.59 per cu m of water consumed, against which it realized Rs. 4.68 per cu m as operating revenues. In the three years, 2004-06, while per unit operating expenses have increased by 8 percent; per unit operating revenues have increased by 2 percent only, showing a decline in the financial performance of MMC. The working ratio has thus increased from 1.23 in 2004 to 1.31 in 2006. Given MCC's low operating expenditure and reported NRW, the poor working ratio may be attributed to an inappropriate tariff rate or structure.

MCC spends almost two-thirds of its operating costs on power-related expenses. In the three years, 2004-06, while the power costs component rose from 60 percent in 2004 to 63 percent, the salary component remained almost constant at 30 percent. The expenses on contracted services are not being maintained separately, though services for repairs and maintenance of assets are being contracted out. MCC plans to outsource increasingly to private contractors and keep its establishment costs under check.

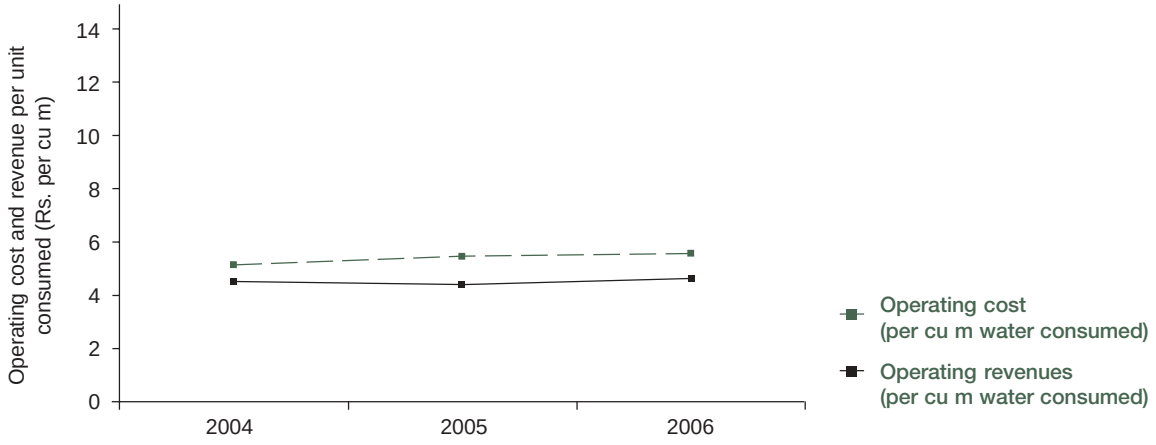
Quality of service

On an average, MCC supplies water for 12 hours daily. With regard to the quality of water supplied, it has reported that 100 percent of the samples passed the test for residual chlorine.

In Chandigarh, consumers can register their complaints in their respective ward offices in person and/or in writing. The complaints can also be made via email and telephone. MCC's website provides detailed information to consumers regarding the procedure for registering complaints and the expected redress time, based on the nature of the complaints. The number of complaints related to water services has shown a gradual increase; it has risen from 1,330 in 2004 to 1,495 in 2005 and 1,600 in 2006. The complaints related to sewerage services have also shown a steady rise, from 1,350 in 2004 to 1,500 in 2006. The total number of complaints as a percentage of the number of water and sewerage connections has increased from 1.07 percent in 2004 to 1.18 percent in 2006.

Approximately, 75 percent of the sewage generated in the service area undergoes some form of treatment before disposal. About 67 percent of the sewage generated is subjected to primary treatment, of which 33 percent undergoes secondary treatment

Figure 4.8: Operating cost and revenue levels in Chandigarh



also. About 5 percent of the sewage is treated up to tertiary levels.

Summary

MCC sources about 325 MLD of water for supplying to its service area corresponding to 282 lpcd. Its reliance on ground water resources is approximately 90 MLD, mainly supplying water to people staying on the outskirts of the city. According to MCC, it covers 100 percent of the population residing in its service area with water supply and sewerage services. The reliability of these data is however very low. The per capita water consumption was about 239 lpcd in 2006. The consumption data have low reliability as not all the connections are metered. As a result MCC's NRW estimate of 17 percent suffers from low reliability.

MCC's working ratio has increased from 1.23 in 2004 to 1.31 in 2006.

On an average, MCC supplies water for 12 hours daily. With regard to the quality of water supplied, it has reported that 100 percent of the samples passed the test for residual chlorine.

Chennai

About Chennai Metropolitan Water Supply and Sewerage Board

The Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) was constituted under the CMWSS Act, 1978, to attend to the needs of the citizens of Chennai city regarding planned development and appropriate regulation of water supply and sewerage services. The Board is presently serving 175 sq km of Chennai city and 8 sq km of its peripheral areas, covering a population of 5.32 million. In the peripheral areas, CMWSSB provides the bulk of water supply; water distribution is managed by the concerned local bodies.

Coverage

CMWSSB's water supply network coverage has been estimated at 98 percent in 2006 and has remained constant during the period 2004-06. This has been calculated based on the proportion of road network covered by the piped water network. The reliability of the water network coverage estimates provided by CMWSSB is low.

CMWSSB provides sewerage services to the entire Chennai city and to parts of adjoining areas. Its sewerage network coverage has been estimated at 98 percent in 2006 and has remained constant during the period 2004-06. This has been calculated on the basis of the proportion of road network covered by the sewerage network.

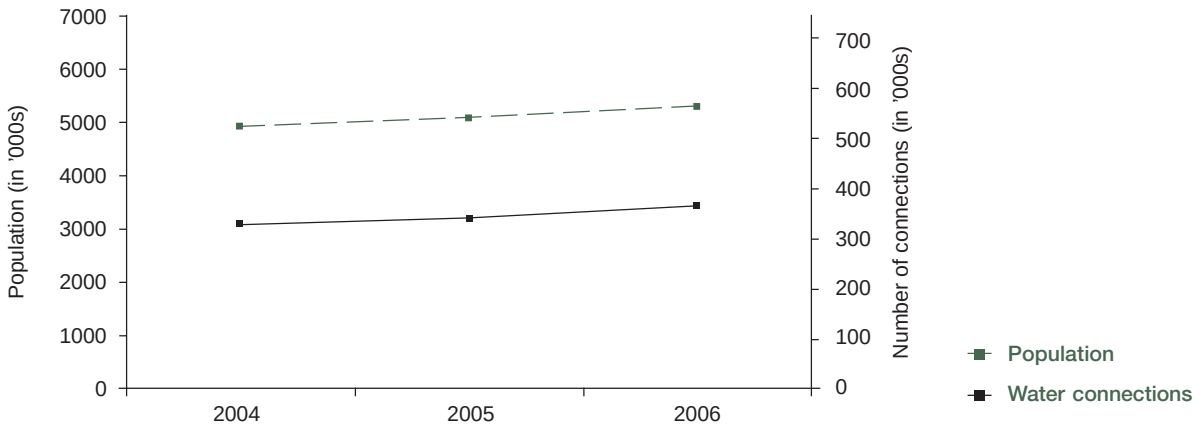
The reliability of using geographical coverage to estimate population coverage is low.

Metering, production and consumption

The per capita daily production levels in the city have increased significantly from 37 lpcd in 2004 to 108 lpcd in 2006, registering an increase of almost 200 percent. The absence of a perennial water source results in sharp variation in the volume of water produced annually.

Chennai has three water sources – ground water, surface water, and water sourced from distant sources via tankers. The ground water supplied has been in the range of 30-36 million cu m in the three years 2004-06. The proportion of water supply from surface water sources has been varying across the years. In 2004, the surface water contribution was very low, even lower than the ground water supply. With the commissioning of the New Veeranam project in 2004,

Figure 4.9: Growth in population and water connections in Chennai



CMWSSB has augmented its surface water supply by 66 million cu m. This is a perennial source, which is expected to reduce the variations in annual supply to some extent.

Tanker water supply from distant sources is resorted to in times of acute drought. For instance, in 2005, about 17 percent (16 million cu m) of the annual production was supplied through tankers.

The metered connections are primarily those having bulk consumption. In 2006, 3.5 percent of the connections were metered and corresponded to 21 percent of the water consumption.

The production data provided by CMWSSB are reliable. The Board has installed flow meters at various points in the production system to assess production levels. However, due to lack of metering at the consumption end, the reliability of the corresponding consumption data is very low. As per the production and consumption data provided by CMWSBB, the UFW and NRW levels in Chennai have been assessed as 12 percent and 16 percent in 2006. This data has low reliability as only 3.5 percent of the connections are metered.

Network performance

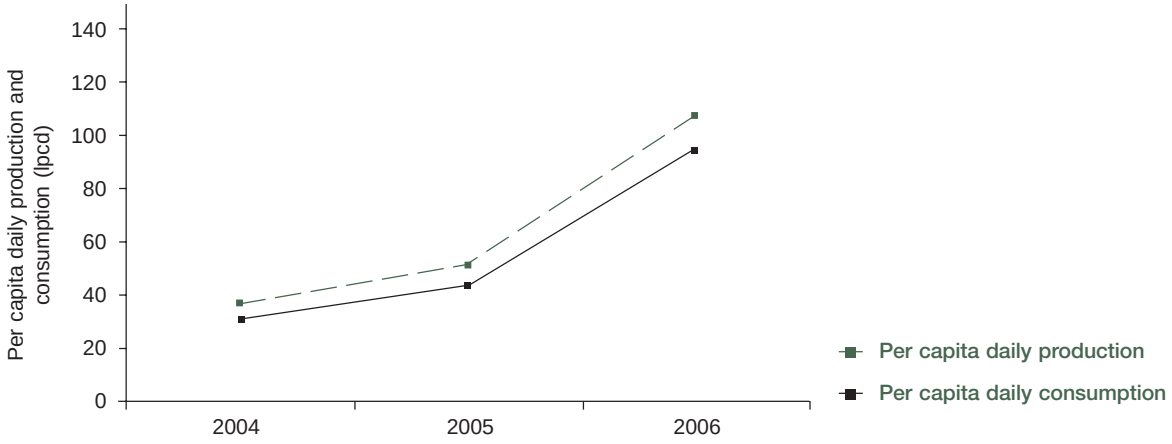
CMWSSB's network performance in terms of pipe breaks per km of pipeline declined during the three-year period 2004-06. The figure has increased from 0.12 in 2004 to 0.19 in 2006. The number of sewage blockages per km of pipeline increased from 16.84 in 2004 to 19.82 in 2006.

Staffing and financial performance

CMWSSB had 4,594 employees in 2006 of whom 1,967 employees were involved in water supply while 1,176 were involved in providing sewerage services. The remaining 1,451 employees were involved in activities, which cannot be categorized into either of these services. With the increase in the number of water connections, CMWSSB's staffing ratio (utility staff per 1,000 water connections) has improved from 15.42 to 12.56 during the three years (2004-06).

Domestic consumers are charged at a fixed rate of Rs. 50 per month. In addition, consumers are liable to pay 1.5 percent and 5.5 percent of the annual assessed value of their property as water and sewerage tax, respectively.

Figure 4.10: Water production and consumption levels in Chennai



CMWSSB incurred expenditure in the range of Rs. 32-Rs. 35 per cu m of water produced in the period 2004-05. This is considerably high, compared to other cities. The production cost ran high as considerable expenditure was incurred in providing drought relief in 2004 and 2005. The extraordinary expenses pertain to large-scale tanker water supplies during these years. The revenue per cu m of water consumed was Rs. 40.11 in 2004 and Rs. 30.28 in 2005. The fixed rate tariff structure does not correlate revenues with the volume of water consumed. Thus, the increase in consumption in 2005 has resulted in lower per unit realization. The increase in production reduces the state government contribution in the form of grants for drought relief. The fixed tariff structure creates a scenario where, beyond a certain production level, every incremental production results in higher revenue deficit. The working ratio has thus increased from 0.96 in 2004 to 1.35 in 2005 with increasing production levels.

The average collection period (debtors/ annual revenues) has been reported as 718 days (29.33 months), which is one of the highest among the cities covered by the study.

For CMWSSB, staff-related expense as a proportion of the total operating expense has been in the range of 20-30 percent; the power expense component has varied between 8-11 percent during 2004-05. During these years, the Board had to incur considerable expenditure in providing tanker water services. This has distorted the contribution of other operating costs to the total operating expenditure.

CMWSSB has outsourced some of the activities such as O&M of water treatment plants. It does not separately maintain a record of the cost incurred in outsourcing these activities.

Quality of service

CMWSSB supplied water for two hours each day in 2004 and 2005. This figure rose to three hours per day in 2006 on account of the increased availability of water. With regard to the quality of water, 98.85 percent of the samples passed the test for residual chlorine in 2006.

CMWSSB has an elaborate reporting mechanism for complaints. Consumers can either report their grievances in person, or by telephone or email, or by writing to CMWSSB. The complaints are recorded on a zonal basis. Data on the number of complaints received during a month and pending at the end of a month are maintained within each zonal office. The complaints received are classified into six different categories – water pollution, no water/ defective water supply, sewer main block, house sewer block and others. These complaint data are displayed on the website. The number of complaints registered as a percentage of water and sewerage connections has been in the range of 40-45 percent of the number of water connections.

In 2006, about 75 percent of the wastewater collected was subjected to secondary treatment. This is lower than the 100 percent treatment level in 2004 and 2005.

Summary

CMWSSB provides water supply and sewerage services for Chennai city and some of the adjoining urban areas. For the

adjoining areas, barring some pockets, CMWSSB provides only bulk supply while the distribution is undertaken by the local bodies concerned. Most of the services provided by the Board are concentrated in Chennai city. The service coverage for water supply and sewerage is estimated to be 98 percent.

The average hours of daily supply in the best case is not more than four to six hours. All consumers receive intermittent supply. The quality of water supplied by the Board is of acceptable standards as almost 99 percent of the samples pass the test for residual chlorine.

The Board received about 160,000 complaints in 2006 which implies about 435 complaints per 1,000 connections. CMWSSB's biggest challenge is to provide adequate piped water in absence of an adequate perennial source. The water supply during 2004-06 ranged from 184 MLD to 576 MLD.

Almost 97 percent of the water supply connections are unmetered. Domestic consumers pay a fixed charge of Rs. 50 per month. In addition, consumers are liable to pay 1.5 percent and 5.5 percent of annual assessed value of their property as water and sewerage tax, respectively. The fixed tariff structure creates a scenario where, beyond a certain production level, every incremental production results in higher revenue deficit. The working ratio has thus increased from 0.96 in 2004 to 1.35 in 2005 with increasing production levels.

Dehradun

About Uttarakhand Jal Sansthan

Uttarakhand's water supply and sewerage system is governed by two statutes enacted in 1975 – the Kumaon and Garhwal Water (Collection, Retention and Distribution) Act of 1975 and the Uttar Pradesh Water Supply and Sewerage Act of 1975. After the formation of Uttaranchal, the Uttaranchal Jal Sansthan was formed in 2001, merging the Kumaon and Garhwal Jal Sansthans. It was renamed Uttarakhand Jal Sansthan (UJS)[10] in October 2006, after the state was renamed Uttarakhand. UJS incorporated both the construction and the O&M wings and was staffed by engineering professionals.

Coverage

Water supply and sewerage services in Dehradun are provided by UJS and cover a population of 0.785 million (estimated municipal population in 2006).

The water supply network coverage in the city has increased from 75 percent to 80 percent during 2004-06.[11] In Dehradun, water is provided mainly through direct water connections or shared taps. About 9-10 percent of the water is provided by public water points. This estimate is based on the hours of supply and volume of water supplied in an hour.

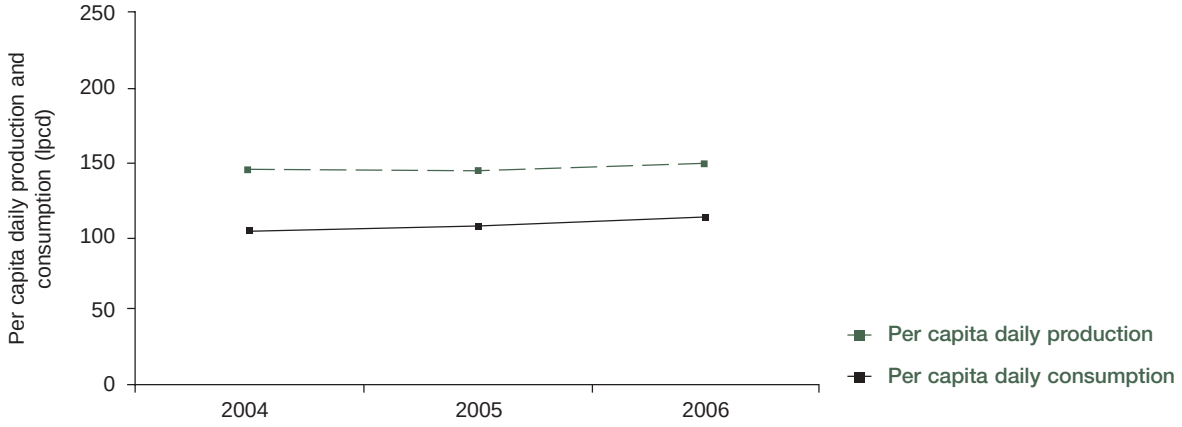
Though UJS has fairly accurate data available for the number of connections in the city, it does not have any records of the population being served by these connections and/or the exact number of properties in the city; this leads to poor reliability of the coverage data.

About one-third of the city's area is covered by the sewerage network. The geographical basis for estimating coverage is low on reliability.

Metering, production and consumption[12]

An amount of 117 MLD of water is being produced in the city. The situation has remained almost unchanged in the 2004-06 period. Of this, about 23 percent is sourced

Figure 4.11: Water production and consumption levels in Dehradun



[10] During the study period, the utility was called Uttaranchal Jal Sansthan.
[11] As per UJS standards, a household is considered 'covered' under the water supply system if there is piped water connection within a radius of 200 m.
[12] The production levels have been calculated based on flow meter readings made at all bulk production points and estimates of water supply from small tube wells, hence the data reliability level is high. But due to limited metering, the reliability of consumption data is very poor. Accordingly, the UFW estimates may be highly inaccurate.

from 15 different surface water sources; the remaining is sourced through 72 tube wells installed across the city.

Dehradun used to have limited metered connections till 2002. When Uttaranchal Jal Sansthan was formed (on August 26, 2002), a resolution was passed to regard all domestic connections as nonmetered and the rest as metered.

In 2006, about 8 percent of the connections were metered, corresponding to 11 percent of consumption, which is mainly attributable to commercial and institutional (nondomestic) users.

UJS reports that these meters have been installed from 2003 to 2006, and are thus mostly in a functional state. Accurate data regarding the functional status of meters have not been maintained systematically.

Per capita daily production levels have gone up from 145 lpcd in 2004 to 149 lpcd in 2006, suggesting an increase of 3 percent in three years, while per capita daily consumption levels have risen from 104 lpcd in 2004 to 113 lpcd in 2006, suggesting an increase of 9 percent in three years.

UFW levels in the city are quite high and have been estimated as 24 percent for 2006. The levels have decreased by 14.4 percent over the three-year period (2004-06).

Network performance

There are no records maintained by the utility on the number of pipe breaks or sewer blockages.

Staffing and financial performance

UJS had 396 employees in 2006 of whom 345 employees were involved in water supply, while 51 were involved in providing sewerage services. With an increasing number of connections, the staffing ratio (utility staff per 1,000 water connections) has improved slightly over the three-year period 2004-06, declining from 6.66 in 2004 to 6.35 in 2006.

Given the very limited levels of metering, a system of property value-based billing is followed in the case of domestic users. Consumption-based tariffs are levied on nondomestic users. The monthly charges vary from Rs. 67 to Rs. 150 for domestic users, depending on the property value. In case the property value has not been assessed, the charges depend on the number of water taps in the property and the type of connection (whether gravity-based or pumping-based). The monthly charges vary from Rs. 41 to Rs. 100. In the case of nondomestic users, the rate varies according to their user category (commercial, industrial or institutional) and type of connection (whether gravity-based or pumping-based). The rate per cu m varies from Rs. 8 to Rs. 10.50 per month.

Besides these, both user categories are charged fees under the heads of service fees and meter rent. The water connection charges (one-time) are Rs. 3,715 for domestic users and Rs. 4,515 for nondomestic users.

For sewerage connections, a sewerage fee is charged at the rate of Rs. 15 per toilet seat per month. The development charges (annual) for this vary, depending upon the plot size with a minimum fee of Rs. 750.

In 2006, UJS incurred an operating expense of Rs. 6.75 per cu m of water consumed, against which it realized Rs. 4.86 per cu m as operating revenues. In 2004-06, while per unit operating expenses have increased by 55.64 percent on account of rising power costs, per unit operating revenues have increased by

33 percent only, showing a decline in the financial performance of the Sansthan. In the same period, UJS has been able to maintain an average working ratio (operating expense/ operating revenues) of 1.49.

UJS spends almost three-fourths of its operating costs on power-related expenses. In the three years, 2004-06, the power costs component rose from 65 percent in 2004 to 75 percent in 2006. Establishment expenses as a percentage of operating costs have declined from 26 percent in 2004 to 19 percent in 2006. The expenses on contracted services are not being maintained separately, though several services are being contracted out.

The collection period (the average period of outstanding receivables) for UJS was very high at 1,171 (39 months) days in 2005, as the utility does not pursue a policy of writing off debtors periodically.

Quality of service

The city receives two to four hours of water supply per day; the seasonal fluctuations remain high. UJS receives about 2,000-2,500 complaints per month via various channels like letters, mails and personal visits/calls to the relevant officials.[13] The number of complaints as a percentage of water and sewerage connections has increased from 2.91 percent in 2004 to 4.01 percent in 2006, suggesting an increase of almost 40 percent over the three-year period 2004-06. Recently, a call center facility has also been established to streamline the process.

There are no wastewater treatment facilities in the city.

Summary

UJS-Dehradun produces 117 MLD of water (186 lpcd). The city has a per capita consumption of 130 lpcd with about 80 percent coverage. About 10-12 percent of the consumption is through metered connections. The entire city receives intermittent supply of two to three hours per day only. Due to very limited metering, the total consumption data are not reliable. UJS estimates that the NRW levels are about 30 percent of water produced currently.

UJS has a staff strength ratio of 6.27 persons per 1,000 water and sewerage connections. The organization is incurring a high operating cost of Rs. 5.12 per kiloliter (kl) of water produced. About 20 percent of the operating costs are incurred due to establishment expenditure and about 70-75 percent go toward power/electricity costs. This may be attributed to the topography of the city and hence higher pumping costs.

With an operating ratio of 0.69 and a collection period of 23.77 months, financial management (especially the collection aspect) of the organization needs significant improvement.

The sewerage services provided by UJS cover only 25-30 percent of the city population. There are no sewage treatment facilities in the city.

UJS receives about 2,000-2,500 complaints per month via various channels like letters, emails and personal visits to relevant officials. Recently a call center facility has also been established the streamline the process.

[13] The reliability level of complaints data is very low and is based on approximations made by the utility personnel. This is mainly because a large number of complaints received directly by the utility personnel on mobile phones do not get recorded in the system.

Hyderabad

About Hyderabad Metropolitan Water Supply and Sewerage Board

The Hyderabad Metropolitan Water Supply and Sewerage Board (HMWSSB) is a statutory authority in charge of providing and maintaining water supply and sewerage facilities in Hyderabad. The Board is at present serving Hyderabad city and the surrounding municipalities of Kukatpally, Qutubullapur, LB Nagar and Gaddiannaram, covering a population of 5.05 million. It also provides bulk supply to six other municipalities. The sewerage services provided by the Board are limited to Hyderabad city and some peripheral areas.

Coverage

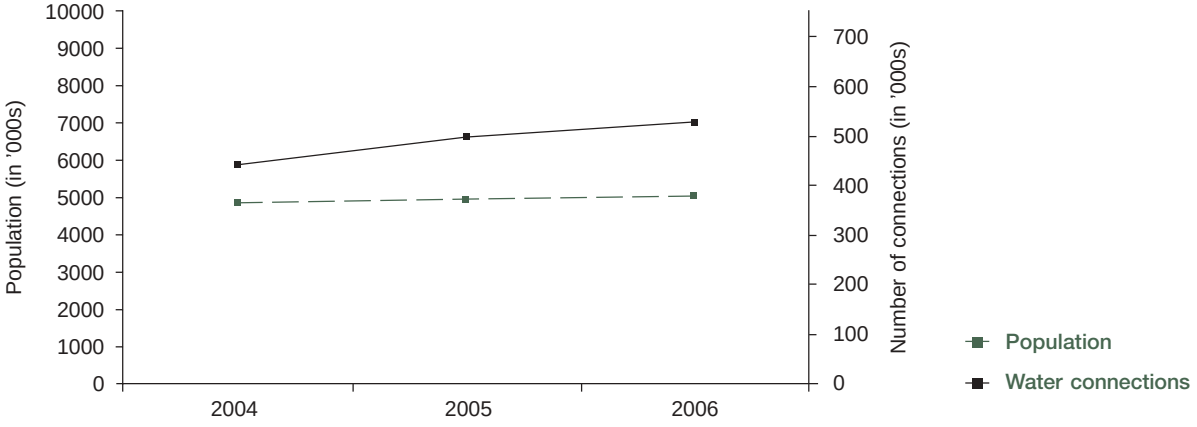
HMWSSB's water supply network coverage has been estimated at 95 percent in 2006 and has remained constant during the period 2004-06.[14] This has been calculated, based on the geographical area covered by the pipeline network. In the three years (2004-06), the population of the area has grown at a Compound Annual Growth Rate (CAGR) of 2.25 percent, while the number of direct serviced connections has grown at a CAGR of 9.63 percent. Despite this, the coverage has remained constant at 95 percent in each of the three years.

HMWSSB provides sewerage services, mainly to the city of Hyderabad and some peripheral areas. Based on the area covered by the network, the sewerage system coverage has been estimated as 51.4 percent for 2006 and has remained constant during the period 2004-06.

Metering, production and consumption

The city draws 88 percent of water from surface water sources and the balance from ground water sources. Besides direct service connections, bore wells, public standposts and tankers are being utilized to supply water. The per capita daily production has increased by 38.4 percent in three years, from 139 lpcd in 2004 to 192 lpcd in 2006. The same period saw a 21.3 percent increase in per capita daily consumption levels, which rose from 80 lpcd in 2004 to 97 lpcd in 2006. The increase in production has been higher than the corresponding increase in consumption. As a result, UFW

Figure 4.12: Growth in population and water connections in Hyderabad



[14] The reliability of the coverage data computed using the geographical coverage methodology is low.

has increased from 42 percent of water produced in 2004 to 50 percent in 2006. The NRW levels in 2006 were also observed to be 50 percent of total water produced. The reliability of the UFW/NRW estimates is not very high as there is no regular meter checking program testing for proper functioning.

In 2006, 93.4 percent of the connections were metered, corresponding to 90 percent of the water consumption. Data regarding the functional status of meters have not been maintained.

The services for meter reading and repair are expected to be outsourced in the future.

Network performance

HMWSSB's network performance has improved; both pipe breaks and sewer blockages have shown a decrease over the three-year period 2004-06. The number of pipe breaks per km of pipeline was 3.97 in 2006, against 4.23 and 4.68 in 2004 and 2005, respectively. The number of sewage blockages per km of pipeline decreased from 17.7 in 2004 to 16.35 in 2005 and 15.27 in 2006.

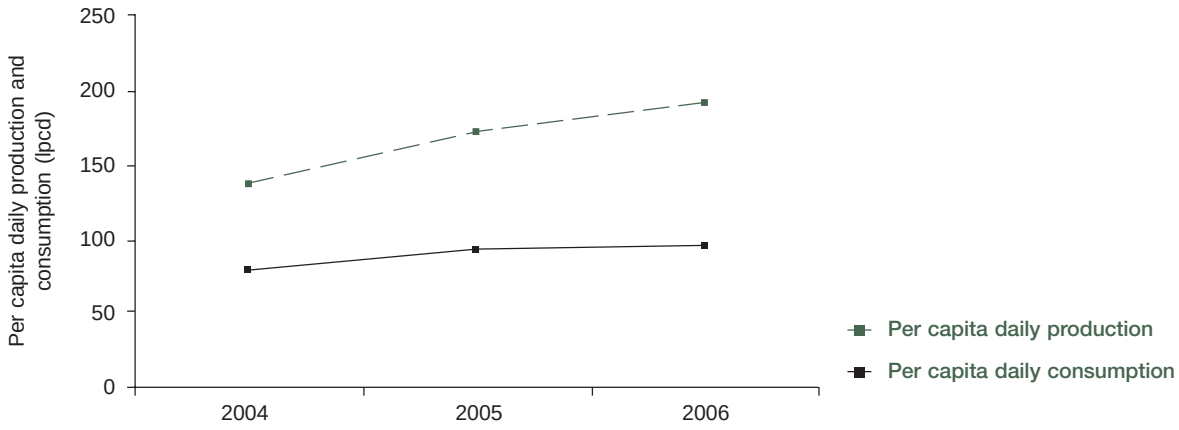
Staffing and financial performance

HMWSSB had 5,241 employees in 2006 of whom 2,883 employees were involved in water supply, while 745 were involved in providing sewerage services. The remaining 1,613 employees were involved in activities which cannot be categorized into either of the services.

The staffing ratio (utility staff per 1,000 water connections) has improved slightly over the three-year period 2004-06; it declined from 6.67 in 2004 to 5.42 in 2006.

HMWSSB follows a volumetric system for levying charges for water consumption for both domestic and nondomestic consumers. At the base level, for monthly consumption of less than 15 cu m, consumers are charged Rs. 6 per cu m of water consumed. For monthly consumption in excess of 200 cu m, the rate is Rs. 35 per cu m. For sewerage services, the charges are calculated as 35 percent of the amount payable for water services. The water connection charges are linked to the size of the plot. For the first slab, which includes plot areas up to 80 sq m, the charges are Rs 1,250 each for a water and sewerage connection.

Figure 4.13: Water production and consumption levels in Hyderabad



In 2006, HMWSSB incurred an operating expense of Rs. 18.16 per cu m of water consumed, against which it realized Rs. 16.11 per cu m as operating revenues. In the three years 2004-06, while per unit operating expenses have increased by 19 percent, per unit operating revenues have increased by 5.24 percent only, showing a decline in the financial performance of the Board. In 2006, the working ratio was calculated to be 1.13. Only in 2005, this ratio was below unity at 0.91. The collection period for HMWSSB has declined from 296 days in 2004 to 228 days in 2006.

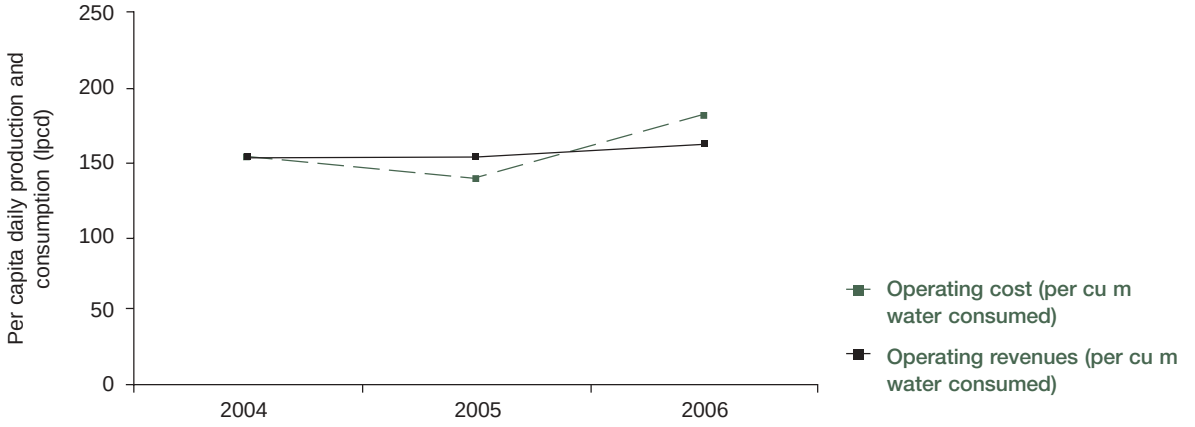
An analysis of various components of the operating expenses reveals that HMWSSB spends almost equally on both salaries and power-related expenses. While the salary component of operating costs has declined from 32.51 percent in 2004 to 26.19 percent in 2006, the power costs component rose from 23.95 percent in 2004 to 33.93 percent in 2006. The expenses on contracted services are not being maintained separately. From 2007 onwards, the utility is recording costs for contracted-out services separately.

Quality of service

HMWSSB supplies water for 30-45 minutes on alternate days, despite a production level of 192 lpcd. In 2006, the quality of water deteriorated as only 87 percent of the samples passed the test for residual chlorine, against 97 percent in 2004 and 2005. Of the 48.55 million cu m of wastewater collected in the city, about 70 percent is subjected to primary treatment and only 15 percent undergoes secondary treatment.

HMWSSB has an elaborate system for documenting complaints received from its customers. Consumers can report their grievances in person, by telephone, by email or by writing to HMWSSB. The complaints are recorded on a zonal basis and categorized under 24 different heads. The number of complaints, as a percentage of water and sewerage connections, has increased from 26 percent in 2004 to 40 percent in 2006.

Figure 4.14: Operating cost and revenue levels in Hyderabad



Summary

The service coverage for water supply is estimated to be 95 percent and that for sewerage is estimated to be 65 percent of the service area. The average hours of daily supply in the best case is about 30-45 minutes on alternate days. In 2006, there was a deterioration in the quality of water as only 87 percent of the samples passed the test for residual chlorine. In other years, almost 97 percent of the samples passed this test. HMWSSB has probably the most elaborate system for documenting complaints received from its customers. The complaints are categorized into 24 different heads. The number of complaints as a percentage of water and sewerage connections has increased from 14 percent in 2004 to 22 percent in 2006.

HMWSSB also ranks high in terms of metering with 95 percent of the connections metered but there is no proper record to ascertain the functionality of meters installed. The proportion of NRW to the total water produced is very high at 50 percent. During the period 2004-06, water production increased by 45 percent while consumption increased by only 27 percent. This can also be observed from the fact that UFW as a percentage of water produced has increased from 42 percent to 50 percent in the same period.

Indore

About Indore Municipal Corporation

Indore Municipal Corporation (IMC) is responsible for providing civic services in the city of Indore; this includes water supply and sewerage services. The employees of the Public Health Engineering Department (PHED) are responsible for bulk of O&M and capital development works related to water supply services. The salaries of the PHED department are paid by the state government but the employees are under the administrative control of IMC. IMC also has a water and sewerage works department and is involved only in some of the O&M activities.

In 2006, Indore was estimated to have a population of 1.8 million.

Coverage

The water supply coverage is estimated by taking into account the population served by direct service connections and that served by public water points. The population in the 2004-06 period has increased by 9 percent, while the number of connections has increased by 6 percent. As a result, the coverage has declined from 57 percent in 2004 to 54 percent in 2006. In 2006, of the 0.97 million population served by water supply, 0.79 million were covered by direct supply connections while 0.18 million were served by public water points. There is no change in the estimate of population served by water points in each of the three years. This also could have contributed to the decline in coverage to some extent.

IMC does not maintain a database of the number of its sewerage connections. The sewerage system is about 600 km in length, while the road network length measures about 1,700 km. Thus, IMC has assessed the coverage as 35 percent, based on its road network length coverage. On the other hand, as per a household survey conducted by IMC, the population covered by sewerage services is 55 percent.

Metering, production and consumption[15]

IMC draws water from two perennial surface water sources – the Gambhir river (26 MLD) and the Narmada river (140 MLD). It also sources water from the rain-dependent Bilawali Tank (4 MLD) and ground water sources (13 MLD). The Narmada river, which supplies the bulk of the water, is situated 70 km away from the city. The water production levels have remained constant for each of the three years studied; but with the rising population, water production in daily per capita terms has declined from 112 lpcd in 2004 to 102 lpcd in 2006.

There are no metered water connections in the city. About 60 bulk supply connections outside the city limits are metered. In the absence of metering, the consumption data are just an estimate without any documentary backing. Based on data provided by IMC, it is observed that per capita daily consumption has declined from 89 lpcd in 2004 to 81 lpcd in 2006.

IMC estimates that one-third of the water produced is provided free of cost and 50 percent of the water produced does not

[15]The production levels have not been calculated based on accurate scientific methods, hence the data reliability level is low. Due to limited metering, the reliability of consumption data is poor. Accordingly, the UFW estimates may be highly inaccurate.

generate any revenues. Based on data provided by IMC, UFW in the city has been estimated to be 20 percent and has remained the same for each of the three years.

Network performance

IMC does not maintain any data on the number of pipe breaks and sewer blocks occurring in a year.

Staffing and financial performance

In 2006, 1,285 employees of IMC were involved in providing water services and 120 employees in the Sewerage Department. With the increasing number of connections, the staffing ratio (utility staff per 1,000 water connections) has improved slightly over the three-year period, 2004-06; it declined from 9.69 in 2004 to 8.84 in 2006.

In Indore, water tariffs are fixed depending on the size of the connection and the user category. The tariffs vary from Rs. 150 per month for a half-inch connection to Rs. 7,680 per month for a 6-inch connection, in the case of domestic connections. In the case of industrial consumers, the corresponding range is Rs. 300-Rs. 38,000. The connection charges for a half-inch water supply connection are Rs. 2,500 and that for a sewerage connection are Rs. 200 per toilet seat. No recurring charges need to be paid by the consumer for sewerage services.

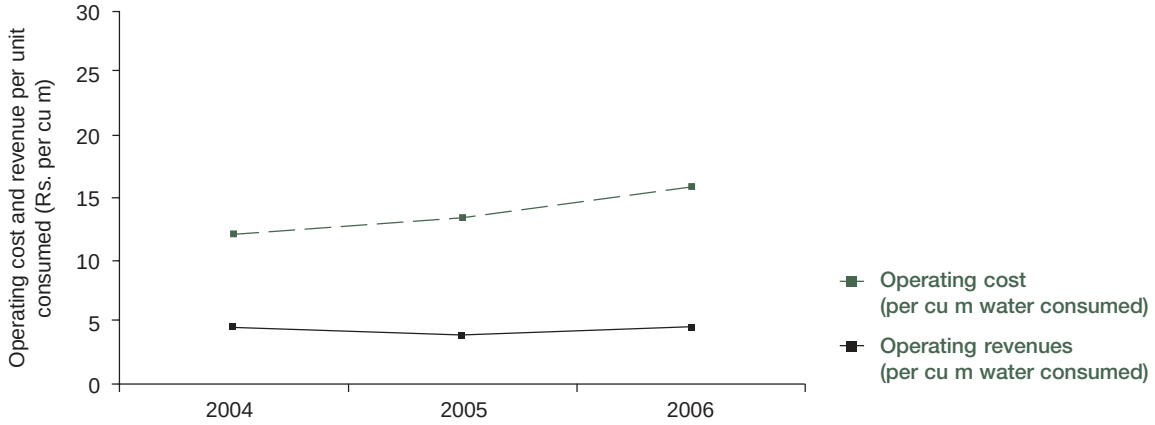
The per unit production cost for IMC has been rising. It has increased from Rs. 12.10 per cu m in 2004 to Rs. 15.96 per cu m in 2006, because of rising power costs. IMC has to source the bulk of its water from a distance of 70 km and hence incurs high pumping costs.

The rise in production costs has not been accompanied by an increase in realizations. The average realizations per unit of water sold have remained almost constant at about Rs. 4.68 per cu m.

IMC's working ratio has increased from 4.15 in 2004 to 5.45 in 2006.

The average collection period (the average period of outstanding receivables) for IMC was very high at 600 days (20 months) during 2004-06, mainly because IMC does not follow a policy of writing off debtors periodically.

Figure 4.15: Operating cost and revenue levels in Indore



Quality of service

The city receives 45 minutes of water supply per day. In Indore, only a limited proportion of the complaints received are recorded by IMC. The status of the recorded complaints, rectified or pending, is available on a monthly basis. The number of complaints, as a percentage of water and sewerage connections, has been reported as 0.35 percent during 2004-06. However, the complaints data are not reliable as IMC has an inadequate complaint recording system. The primary treatment plant's capacity in Indore is 90 MLD, of which 60 MLD is being utilized.

Summary

IMC sources about 183 MLD of water for supply to its service area. This corresponds to per capita production of 101 lpcd. IMC was providing water supply services to 48 percent of the population in 2006 by piped water or through public standposts. The water is supplied daily for an interval of 45 minutes. All the consumers get water on an intermittent basis. The sewerage network covers only a part of the city population. Only 55 percent of the city's population is connected to a sewerage network. It has a tertiary treatment plant which treats 52 MLD of sewage out of 60 MLD of sewage collected.

IMC has to source water from a distance of 70 km from the city. This increases its cost of production. It costs Rs. 12.77 per kl of water produced. IMC realizes only Rs. 4.68 per kl of water sold and has a reported NRW of 50 percent of water produced. All this has put considerable strain on the finances of the utility. The working ratio in 2006 was 5.45. In Indore almost all the connections are unmetered. In this scenario, the reliability of the consumption data and NRW estimates is very low.

Jamshedpur

About Jamshedpur Utilities and Services Company Limited

Jamshedpur Utilities and Services Company Limited (JUSCO) was incorporated in August 2003 as a 100 percent subsidiary company of Tata Steel. It commenced provision of civic and municipal services from April 1, 2004. Prior to this date, it was just a department in Tata Steel. It is the only corporate private sector provider of civic and municipal services in India. JUSCO's area of operations is spread over 64 sq km in the city of Jamshedpur and encompasses water, wastewater, power, public health and horticulture services along with other services like planning, engineering and construction to keep up with the growing civic needs of the people within its service area. JUSCO's civic and municipal services are managed by a team of qualified professionals and monitored by JUSCO's Board of Directors.

Coverage

JUSCO supplies water to its customers mainly through direct service connections and public water points. In the event of emergencies and bulk demand, it also supplies water through tankers. Its water supply network coverage[16] increased from 75 percent in 2004 to 79 percent in 2006. This includes bulk industrial consumers and retail consumers being served by direct service connections and public water points.

Under sewerage services, JUSCO provides direct service connections to its customers. In the three years (2004-06), the coverage has remained almost constant at around 62 percent.

Metering, production and consumption

JUSCO sources approximately 375 MLD of water, which is supplied through approximately 42,000 direct service connections. The Subernarekha river is the primary source of water for the city. In times of lean flow or high pollution load in the river, a portion of the requirement is drawn from the Dimna reservoir.

There has been an increase in per capita daily production levels[17] from 547 lpcd in 2004 to 608 lpcd[18] in 2006. On the other hand, per capita daily consumption levels have increased from 226 lpcd in 2004 to 554 lpcd in 2006. The rise in consumption is on account of increased bulk industrial consumption. Thus, UFW decreased from 58 percent in 2004 to 8 percent in 2006.

Most of the water connections provided by JUSCO are unmetered; a metering policy is currently under formulation. In 2006, about 0.5 percent of the connections were metered, corresponding to 70 percent of the water consumption. This is because the metered connections were primarily industrial connections with bulk consumption. In 2006, approximately 2.25 percent of the meters were recorded as

[16] As per JUSCO's definition of coverage, a person is considered 'covered' by the water supply system if she/he is within easy access to water services (either with direct service connection or within 200 m of a standpost or served by other sources of potable water provided by the utility, for example, overhead storage or tanks).

[17] Both production and consumption data provided by JUSCO are fairly reliable. JUSCO has installed electromagnetic flow meters at all the water treatment facilities to assess production levels. Meters installed at select public water points are used to measure the volume of water consumed and these data are extrapolated to measure consumption levels at all public water points. JUSCO also measures losses in the conveyance system through the electromagnetic flow meters installed at the abstraction, inlet and outlet of the treatment facilities. (With 1 percent consumption metering, it is difficult to defend consumption data as reliable whatever aggregate/bulk metering one may do.)

[18] The production data presented here also include nonpotable industrial water supply.

faulty. This is substantially better than the figure for 2004, when 30 percent of the total connections were recorded as faulty.

Network performance

The network performance in JUSCO in terms of pipe breaks per km of pipeline shows an improvement during the three-year period 2004-06. The figure has declined from 10.93 in 2004 to 6.24 in 2006. The number of sewage blockages per km of pipeline increased from 0.38 in 2004 to 0.42 in 2006.

Staffing and financial performance

JUSCO had 289 employees in 2006 for providing water and sewerage services. Of these, 209 were deployed for water services and the balance was engaged in sewerage services. JUSCO has maintained the staffing ratio (utility staff per 1,000 water and sewerage connections) at 3.50 for the three-year period (2004-06).

In 2006, JUSCO incurred an operating expense of Rs. 3.78 per cu m of water

Figure 4.16: Water production and consumption levels in Jamshedpur

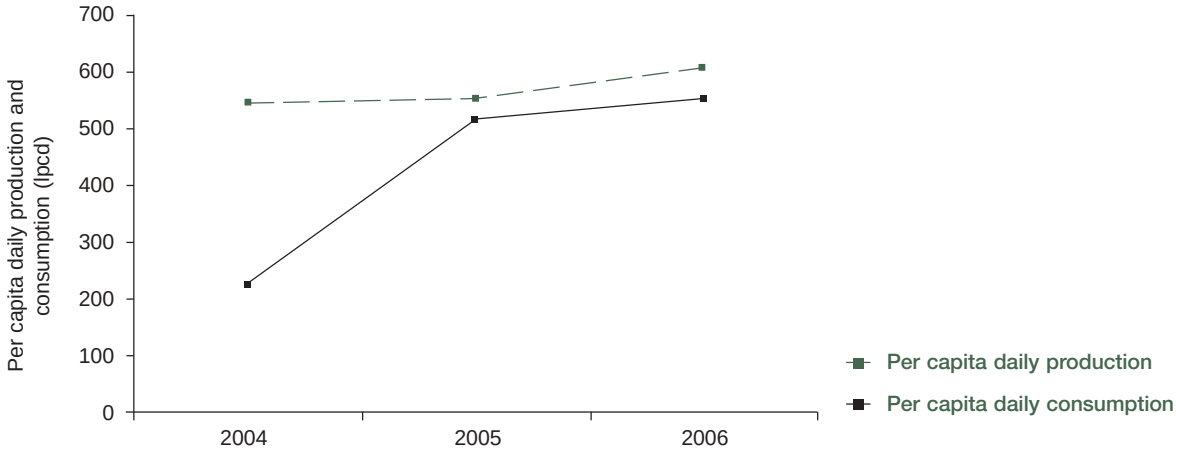
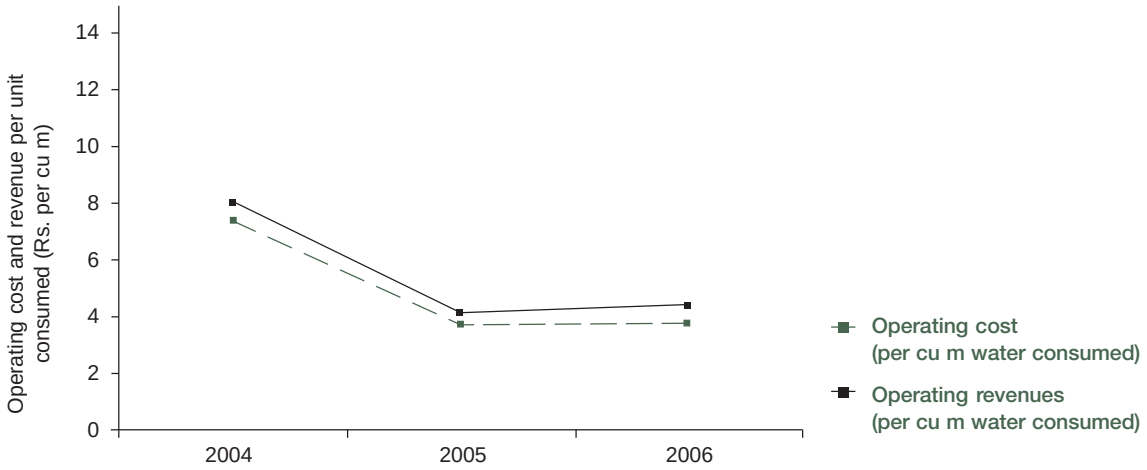


Figure 4.17: Operating cost and revenue levels in Jamshedpur



consumed, against which it realized Rs. 4.44 per cu m as operating revenues. In 2005-06, while per unit operating expenses have remained almost constant, per unit operating revenues have increased by 7.4 percent, showing an improvement in the financial performance of the utility. In each of the three years, JUSCO has been able to maintain the working ratio below unity, the average being 0.9. Its average collection period has been reported as six days, the lowest among the cities covered by the study.

Quality of service

JUSCO supplies water daily on an average for six hours. In 2006, 97.40 percent of the samples of water supplied by JUSCO passed the test for residual chlorine. JUSCO has a 24x7 customer-compliant management cell called the JUSCO Sahayog Kendra. The Sahayog Kendra, managed by JUSCO, facilitates the process of understanding the needs and problems of consumers and stipulates a time-bound redress commitment. The cell receives complaints from consumers telephonically or via Internet/ intranet. Complaints are segregated and classified into 24 categories. A well-defined escalation structure for unattended complaints ensures that all customer complaints are prioritized and attended to. The Kendra also conducts customer surveys through its contact centers to obtain valuable customer feedback on its operations and services. In the three years (2004-06), the number of complaints as a percentage of water connections decreased, from 44 percent in 2004 to 43 percent in 2006.

About 66 percent of the wastewater collected (48 MLD) undergoes secondary treatment.

Summary

JUSCO sources approximately 375 MLD of water for supply to its service area; corresponding to 608 lpcd. The high per capita production is attributable substantially to the industrial demand from the steel industry as well as other industrial activity in JUSCO's service area. Although just 0.5 percent of the total water connections are metered, they account for over 70 percent of the total water consumed. This is attributable to the high levels of metered industrial water consumption within JUSCO's service area.

In 2006, JUSCO incurred an operating expense of Rs. 3.78 per cu m of water consumed, against which it realized Rs. 4.44 per cu m as operating revenues. In 2005-06, while per unit operating expenses remained almost constant, per unit operating revenues increased by 7.4 percent, showing an improvement in the financial performance of the utility. In each of the three years, JUSCO has been able to maintain the working ratio below unity, the average being 0.9. Its average collection period has been reported as six days, the lowest among the cities covered by the study.

JUSCO supplies water for six hours daily equivalent to 608 lpcd. In the year 2006, 97.40 percent of the total samples have passed the minimum residual chlorine requirements.

The Sahayog Kendra managed by JUSCO facilitates in understanding the needs and problems of consumers and stipulates a time bound redressal commitment. A well-defined escalation structure for unattended complaints ensures that customer complaints are prioritized and attended to.

Pune

About Pune Municipal Corporation

The Pune Municipal Corporation (PMC) is responsible for providing civic services, including water supply and sewerage services in the city of Pune.

Coverage

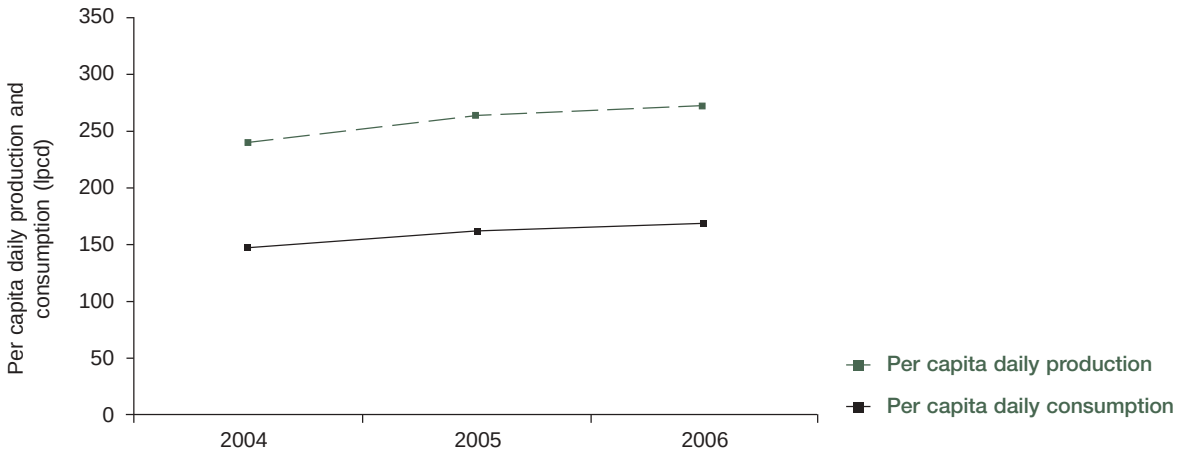
PMC estimates the population covered by its water supply services on the basis of the geographical area covered by its water pipeline network. The coverage has been estimated at 88 percent in 2006 and has remained more or less on the same level in the previous years. Similarly, estimates of the population covered by PMC's sewerage services are based on the geographical area covered by its sewerage network. PMC estimates its sewerage coverage to be 57 percent in 2006. This has remained almost constant in the previous two years.

Metering, production and consumption

PMC sources its water from the Khadakvasla dam, which is located 12 km from the city. This source feeds five water treatment plants, whose aggregate water treatment capacity is about 900 MLD. The per capita daily production has increased from 242 lpcd in 2004 to 274 lpcd in 2006, that is, increased by 13 percent. PMC has deployed flow meters to measure the volume of water produced and hence the production data are fairly reliable.

In 2006, about 16 percent of the connections were provided with meters. A large proportion of the connections are industrial or bulk supply connections. Metered water consumption constituted about 55 percent of the total consumption in 2006. In the absence of large-scale metering, the total consumption volume is just an estimate, and not accurate. The metered water consumption volumes constitute about 39 percent of the total water produced; no significant change has been observed in this ratio for the previous two years. PMC estimates that the consumption volumes have increased from 148 lpcd in 2004 to 168 lpcd in 2006. As per these production and consumption data, the UFW level in Pune is 40 percent, one of the highest among cities covered by the study.

Figure 4.18: Water production and consumption levels in Pune



Network performance

PMC does not maintain data on pipe breaks, while the data on sewer blockages is available for a couple of wards. Based on the limited sewer blockage data that were provided, the number of sewer blocks occurring per km of sewer network was calculated as 5.85 in 2006. PMC does not maintain a centralized database on the length of the water distribution network and sewerage system. There is also no record of the expansion in length of the network carried out in the three years of the study.

Staffing and financial performance

PMC's staffing ratio (utility staff per 1,000 water connections) has improved from 19.93 in 2004 to 16.65 in 2006. The ratio is higher than that observed in most of the other utilities covered by the study; this may be attributed to the relatively fewer number of water connections despite high consumption levels, as a large proportion of the connections relate to bulk consumers.

In Pune, the water and sewerage tariffs are charged as a percentage of property tax, which is linked to the annual rateable value (ARV) of the property. The domestic tariff as a percentage of ARV is as follows: water tax (25 percent), conservancy tax (13 percent), water benefit tax (2 percent) and sewerage benefit tax (4 percent). The nondomestic rates are about 1.5 times the domestic rates.

In 2005, PMC incurred an operating expense of Rs. 3.21 per cu m of water produced. In terms of per cu m of water sold, it incurred a cost of Rs. 5.24 per cu m against which it realized revenues of Rs. 6.53 per cu m. PMC's working ratio in 2004 was 0.92; it improved to 0.82 in 2005.

PMC's average collection period measured 848 days in 2005. The collection period is long, as PMC does not follow a policy of writing off old debts.

Quality of service

PMC supplies water for about eight hours per day. The data on complaints are not maintained centrally and were not available for the study. Recently, a central monitoring cell has been created to keep a record and respond to complaints regarding water and sewerage services. Almost 100 percent of the samples passed the test for residual chlorine.

In 2006, about 67 percent of the wastewater collected was subjected to secondary treatment.

Summary

PMC enjoys a low water production cost because of close proximity to the source. The per capita consumption of water is more than adequate at 168 lpcd. Consumers, on an average, pay Rs. 6.53/kl of water consumed. The high realization is on account of a significant number of bulk connections.

Consumers, along with abundant supply, get seven hours of water supply daily on an average. About 68 percent of the wastewater collected is subjected to secondary treatment.

Not all connections are metered and thus the data reliability with regard to NRW and consumption data is low. The presence of a large number of bulk consumers allows PMC to have realizations twice the production cost. However, a high incidence of NRW (about 40 percent according to PMC) has not allowed the working ratio to further improve from the reported 0.82.

Rajkot

About Rajkot Municipal Corporation

Municipal services were provided by the erstwhile Municipal Borough under the Gujarat Municipal Act, 1963. Thereafter it was converted into the Rajkot Municipal Corporation (RMC) on November 19, 1973. The city administration was placed under the new statute of the Bombay Provincial Municipal Corporation Act 1949. RMC is responsible for the provision and management of basic urban infrastructure including water supply, wastewater collection and disposal, garbage disposal, city roads and street lighting. Presently, it covers a 1.2 million population, spread over 105 sq km.

Coverage

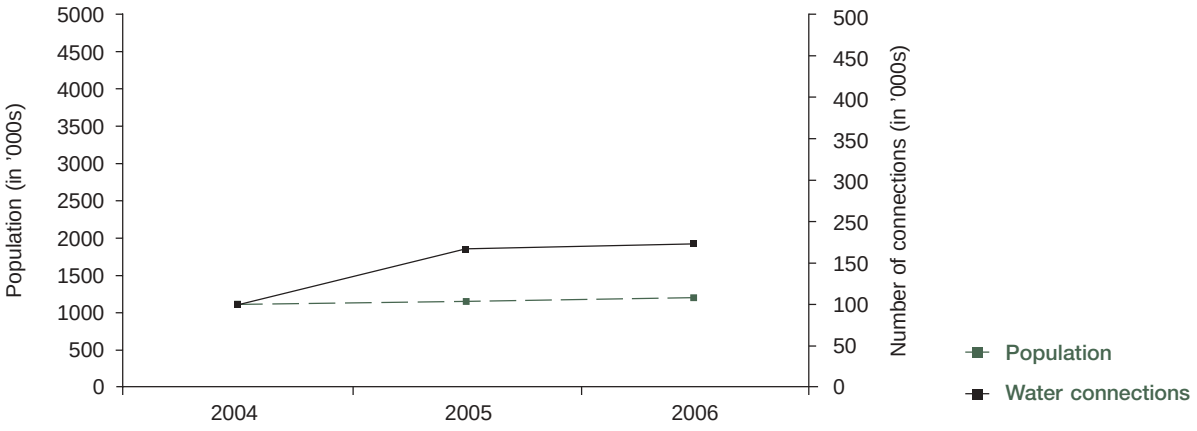
In Rajkot, water supply coverage has been computed by multiplying the number of households served through direct service connections and the estimated average household size. The average household size is based on Census 2001 data. The population covered by public water points is also included in the coverage ratio. The number of connections has increased from .11 million in 2004 to .19 million in 2006; the population covered by public water points has consequently increased from 0.075 million in 2004 to 0.10 million in 2006. The 75 percent increase in the number of connections and increased coverage through public water points has allowed RMC to increase the population covered by water supply services from 63 percent in 2004 to 98 percent in 2006.

RMC has calculated the sewerage coverage based on its estimate of the number of households provided with sewerage connections and the estimated average household size in the city (based on data from Census 2001). The sewerage system coverage has been estimated as 55 percent for 2006. In 2004, the corresponding figure was 40 percent.

Metering, production and consumption[19]

RMC sources approximately 150 MLD of water. Besides this, tankers are utilized by RMC to supply additional water to households in times of breakdown and temporary bulk demands. The per capita daily production

Figure 4.19: Growth in population and water connections in Rajkot



[19] It may be noted that the reservoir levels are measured only at the end of the distribution cycle and not before the commencement of pumping. This results in an error in assessing the supply/production levels, especially if the reservoir is not filled completely before the commencement of the pumping process. Thus, the data reliability level for water production is very low. Due to very limited metering, the reliability of consumption data is also very poor. Accordingly, the UFW/NRW estimates may be highly inaccurate.

levels[20] have increased from 114 lpcd in 2004 to 126 lpcd in 2006, implying an increase of about 10 percent in three years. As per the Municipal bye-laws, metering is compulsory for bulk water connections greater than three-fourth of an inch in size. In 2006, only 0.4 percent of the connections were metered, corresponding to 17 percent of the total water produced. The share of metered water consumption is disproportionate as meters are provided only for bulk consumers. No data on the functionality of meters are maintained.

RMC estimates that the consumption levels have risen from 105 lpcd in 2004 to 112 lpcd in 2006 implying an increase of 6.5 percent in three years. Based on the production and consumption data, the UFW was estimated to be 11 percent in 2006. The UFW was data have low reliability in the absence of large-scale metering and inaccurate production data.

Network performance

RMC's network performance shows a constant figure of 0.01 pipe breaks per km of pipeline in each of the three years. The data recorded for pipe breaks are not comprehensive. According to RMC, most cases of pipe breaks are attended to on the same-day basis and only unresolved cases are recorded at the end of each day.

RMC has contracted out services for the repair of sewerage blockages to private agencies. These agencies are paid on a per complaint basis. The data on the number of sewerage blockages are recorded and maintained by the private sector agencies and reported to RMC. The number of sewage blockages per km of pipeline increased from 137 in 2004 to 156 in 2006. These figures are the highest amongst the cities covered by the study.

Staffing and financial performance

RMC had 311 employees in 2006 for water and sewerage services. Of these, 211 were deployed for water services, while 100 were involved in providing sewerage services. The staffing ratio (utility staff per 1,000 water connections) has declined significantly from 3.09 in 2004 to 1.62 in 2006, registering a decrease of almost 50 percent. This is because the number of connections has increased by 75 percent, while the total number of employees has declined by 10 percent during the 2004-06 period.

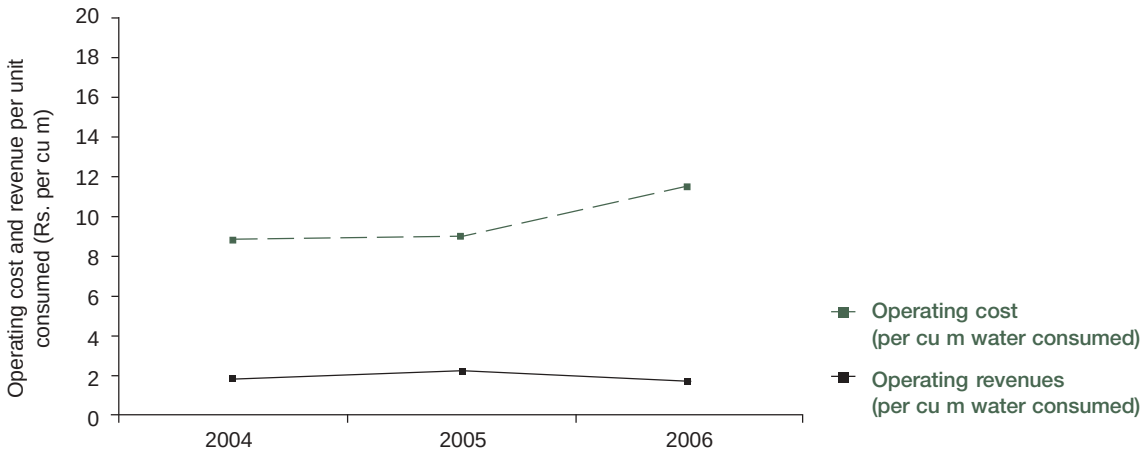
Although metering is mandated for bulk connections, the water charges are fixed, depending on the size of the connection; it varies from Rs. 360 to Rs. 2,400 per month. The residential tariffs are linked to the size of the connection; they vary from Rs. 32 to Rs. 96 per month. The water connection fee (one-time) varies from Rs. 1,650 to Rs. 1,850 per connection, depending on the size of the connection. For sewerage connection, a one-time fee of Rs. 500 is charged.

The per unit production cost was Rs. 10.21 per cu m in 2006; against this, the realization was Rs. 2.16 per cu m. The working ratio has deteriorated from 4.21 in 2004 to 6.63 in 2006.

Both labor and power costs have declined as a percentage of total costs, during the period under review. Power costs, as a percentage of total operating costs, have declined from 42 percent in 2004 to 27 percent in 2006 while establishment expenses have decreased from 12.2 percent to 9.7 percent of the total operating costs. The rise in other expenses has contributed to the rise in per unit production cost.

[20] Production data are not reliable as they are based on the rated capacity of the pumps and the pump operating hours.

Figure 4.20: Operating cost and revenue levels in Rajkot



Quality of service

RMC has an average daily supply of water for 20 minutes, one of the lowest among the cities covered by the study.

It is reported that almost 100 percent of the samples passed the test for residual chlorine.

In Rajkot, customers can register their complaints in the respective ward offices in person or in writing. The details are maintained at the ward office. The complaint cell for sewerage services has been contracted to private sector agencies. The number of complaints related to water services has shown a gradual decline, reducing from 5,235 in 2004 to 4,568 in 2006. Sewerage services-related complaints have shown a steady rise from 41,168 in 2004 to 58,441 in 2006. As a percentage of water connections, the number of complaints has declined from 37 percent in 2004 to 30 percent in 2006. The entire sewage collected is subjected to secondary treatment, while 60 percent of it is subjected to tertiary treatment.

Summary

RMC sources approximately 150 MLD of water for supply to its service area. This corresponds to per capita production of 125 lpcd. RMC provides water at 111 lpcd to its consumers at an average of 20 minutes per day. In spite of its limited source availability, RMC serves water to 98.33 percent of the population in its service area. The number of connections increased by almost 75 percent over the 2004-06 period. Only 16 percent of the water produced is through metered connections. Thus, the data reliability of the NRW and UFW levels is very low.

RMC covers about 55 percent of the service area population through direct service connections. It has a tertiary treatment plant which treats 52 MLD of sewage of 60 MLD of sewage collected.

RMC's staffing ratio of 1.62 per 1,000 water supply connections in 2006, reads well in comparison to its peers. Its low cost recovery hinders in undertaking fresh investments needed to improve service levels in areas such as sewerage coverage; sewerage network presently covers only 55.23 percent of the total population.

RMC recovers only 15 percent of its operating costs from water and sewerage revenues.

Annex 1

Utility Profiles

Bangalore		
Water Utility	Bangalore Water Supply and Sewerage Board (BWSSB) BWSSB was constituted under an Act passed by the Karnataka State Legislature in 1964, by which it was made responsible for making provisions for water supply, sewerage and disposal of sewage in the Bangalore metropolitan area. Currently, the main focus of service of BWSSB is Bangalore. BWSSB is expected to progressively provide water and sewerage services to other parts of the Bangalore metropolitan area. BWSSB sources water mainly from two sources: the Cauvery (850 MLD) and Arkavathy (100 MLD), respectively. The Cauvery source is located about 100 km away from the city.	
General Data About Water Utility	Population (2006) Connections • Water • Sewerage Staff (2006) Annual revenues Annual O&M costs Annual collections	6.462 million 479,720 485,920 2,600 Rs. 3,801 million Rs. 3,741 million Rs. 2,167 million
Production and Distribution	Annual production volume Annual consumption volume Annual production volume (lpcd) Annual consumption volume (lpcd)	337 million m^3 201 million m^3 143 85
Service Indicators	Coverage • Water supply • Sewerage Hours of service Average tariff	 91 percent 79 percent 5 21.96/cu m
Efficiency Indicators	Nonrevenue water Unit production cost Working ratio Staff/'000 connections Revenue collection efficiency	49 percent Rs. 11.10/cu m 0.98 5.42 57 percent

Bangalore			
Tariff Water Supply	Category and Consumption in cu m Domestic 0-8,000 8,001-25,000 25,001-50,000 50,001-75,000 75,001-100,000 100,000 & above Nondomestic 0-10,000 10,001-20,000 20,001-40,000 40,001-60,000 60,001-100,000 100,000 & above Industries	Monthly Charges Rs./cu m 6 9 15 30 36 36 36 39 44 51 57 60 60	Minimum charges 48 201 676 1,326 2,226 5,826 360 390 880 1,002 2,280
Sewerage	Domestic 0-25,000 25,001-50,000 Above 50,000 Connection charges Water supply Sewerage	 Rs. 15.00 at flat rate 15 percent of water supply charges per month 20 percent of water supply charges per month Rs. 1,400 250	

Bhubaneswar		
Water Utility	Public Health Engineering Organization, Bhubaneswar	
	The PHEO is responsible for operating and maintaining urban water supply and sewerage services in Orissa, while OWSSB is responsible for executing major water supply and sewerage projects. Both agencies are under the administrative control of the Housing and Urban Development Department of the government of Orissa. The Bhubaneswar division of PHEO is responsible for providing water supply and sewerage services in the city of Bhubaneswar. The area of the city is about 135 sq km and its population was estimated to be 0.766 million in 2006.	
General Data About Water Utility	Population Connections • Water • Sewerage Staff (2006) Annual revenues Annual O&M costs Annual collections	0.76 million 52,210 32,720 610 Rs. 84.01 million Rs. 276.2 million Rs. 69.17 million
Production and Distribution	Annual production volume Annual consumption volume Annual production volume (lpcd) Annual consumption volume (lpcd)	75 million m^3 30 million m^3 269 108
Service Indicators	Coverage • Water supply • Sewerage Hours of service Average tariff	 45 percent 26 percent 4 Rs. 2.78/cu m
Efficiency Indicators	Nonrevenue water Unit production cost Working ratio Staff/'000 connections Revenue collection efficiency	60 percent Rs. 3.67 3.29 8.16 82 percent
Tariff Water Supply	 Consumer category Water Supply Institutional Commercial and industrial	 Rate per cu m in Rs 5.64 8.00
Sewerage	Consumer Category Private apartment building/commercial/industrial Connection charges Water supply Sewerage	Monthly charge Rs. 200: 4 inch minimum size sewer Rs. 500: 6 inch minimum size sewer Rs. 800: 8 inch minimum size sewer Rs. 3,060 1,560

Chandigarh		
Water Utility	Municipal Corporation of Chandigarh	
	The Union Territory of Chandigarh measures about 114 sq km in area and has a population of 0.9 million as per the 2001 Census. It is one of the fastest growing cities of India with a population decadal growth rate of 40.30 percent. Prior to 1976, the Corporation's functions such as water supply, sewerage, storm water drainage, city roads, solid waste management and fire wing were looked after by the respective departments of the Chandigarh administration. MMC was formed under the Punjab Municipal Act, 1976. Thereafter, the functions of works and maintenance for specific roads, water supply, sewerage, storm water drainage, solid waste management and fire tendering were transferred to MCC.	
General Data About Water Utility	Population Connections • Water • Sewerage Staff (2006) Annual revenues Annual O&M costs Annual collections	1.15 million 137,409 126,000 1,466 Rs. 429 million Rs. 562 million NA
Production and Distribution	Annual production volume Annual consumption volume Annual production volume (lpcd) Annual consumption volume (lpcd)	122 million m^3 100 million m^3 290 239
Service Indicators	Coverage • Water supply • Sewerage Hours of service Average tariff	 100 percent 100 percent 12 Rs. 4.68/cu m
Efficiency Indicators	Nonrevenue water Unit production cost Working ratio Staff /'000 connections Revenue collection efficiency	25 percent Rs. 4.61/cu m 1.31 9.72 NA
Tariff Water Supply	Consumer category Domestic – metered 0-15 cu m 15-30 cu m 30-60 cu m Above 60 cu m Domestic – unmetered Commercial Institutional Residential connection charges Water supply Sewerage	Rate in Rs./cu m 1.75 3.50 5.00 6.00 Rs. 100 per month 11.00 9.00 Rs. 500 500

Chennai		
Water Utility	Chennai Metropolitan Water Supply and Sewerage Board	
	CMWSSB was constituted under the CMWSS Act, 1978 for exclusively attending to the needs of the citizens of Chennai city regarding planned development and appropriate regulation of water supply and sewerage services in the Chennai Metropolitan Area. The Board is at present serving 175 sq km of Chennai city and 8 sq km of peripheral areas, covering a population of 5.32 million. In the peripheral areas, the Board mainly provides bulk water supply; water distribution is managed by the concerned local bodies.	
General Data About Water Utility	Population Connections • Water • Sewerage Staff (2006) Annual revenues Annual O&M costs Annual collections	5.320 million 365,680 374,790 4,594 Rs. 2,485 million Rs. 3,362 million Rs. 929 million
Production and Distribution	Annual production volume Annual consumption volume Annual production volume (lpcd) Annual consumption volume (lpcd)	210 million m^3 186 million m^3 108 95
Service Indicators	Coverage • Water supply • Sewerage Hours of service Average tariff	 98 percent 98 percent 3 Rs. 30.28/cu m
Efficiency Indicators	Nonrevenue water Unit production cost Working ratio Staff /'000 connections Revenue collection efficiency	15.81 percent Rs. 34.65/cu m 1.35 7.86 37 percent
Tariff Water Supply	Consumption category Domestic – metered 0-10 cu m 11-15 cu m 16-25 cu m Above 25 cu m Commercial – private hospitals 0-500 cu m Above 500 cu m Commercial – others 0-500 cu m Above 500 cu m Residential connection charges Water supply Sewerage	Rs./cu m 2.50 10.00 15.00 25.00 50.00 80.00 for entire quantity 35.00 60.00 for entire quantity Rs. 1,930 3,330

Dehradun		
Water Utility	Uttarakhand Jal Sansthan, Dehradun	
	Uttarakhand's water supply and sewerage system is governed by two statutes enacted in 1975 – the Kumaon and Garhwal Water (Collection, Retention and Distribution) Act of 1975 and the Uttar Pradesh Water Supply and Sewerage Act of 1975. After the formation of Uttaranchal, the Uttaranchal Jal Sansthan was formed in 2001, merging the Kumaon and Garhwal Jal Sansthans and incorporating both the construction and the O&M wings. Its name was changed to Uttarakhand Jal Sansthan (UJS) in October 2006.	
General Data About Water Utility	Population Connections • Water • Sewerage Staff (2006) Annual revenues Annual O&M costs Annual collections	0.785 million 62,370 2,470 396 Rs. 152 million Rs. 219 million Rs. 98 million
Production and Distribution	Annual production volume Annual consumption volume Annual production volume (lpcd) Annual consumption volume (lpcd)	43 million m^3 33 million m^3 149 113
Service Indicators	Coverage • Water supply • Sewerage Hours of service Average tariff	 80 percent 30 percent 4 Rs. 1.44 /cu m
Efficiency Indicators	Nonrevenue water Unit production cost Working ratio Staff/'000 connections Revenue collection efficiency	27 percent Rs. 5.11/cu m 1.44 5.53 65 percent
Tariff	Annual property assessment	Water tariff rates (average in Rs. per month)
	Up to Rs. 360 Rs. 361-Rs. 2,000 Rs. 2,001-Rs. 3,500 Rs. 3,501-Rs. 6,000 Rs. 6,001-Rs. 8,000 More than Rs. 8,001	70 75 80 110 125 150
	For residential connection where property assessment data is not available	
	Number of taps 1 2 3 4 Metered supply Residential Commercial Industrial Connection charges Water supply Sewerage	Monthly charges, Rs. 45 50 75 90 Rs./cu m 4.00 10.50 12.00 Rs. 3,715 1,500

Hyderabad		
Water Utility	Hyderabad Metropolitan Water Supply and Sewerage Board (HMWSSB)	
	HMWSSB is a statutory authority in charge of providing and maintaining water supply and sewerage facilities in Hyderabad and its surrounding municipalities. HMWSSB was constituted on November 1, 1989, under the provisions of the Hyderabad Metropolitan Water Supply and Sewerage Act, 1989. The Board is responsible for the supply of potable water including planning, design, construction, implementation, maintenance and O&M of water supply and the sewerage system. The Board is stipulated to run on commercial lines by generating surplus through tariffs in a manner that will meet operational costs, capital expenditure and debt servicing.	
General Data About Water Utility	Population Connections • Water • Sewerage Staff (2006) Annual revenues Annual O&M costs Annual collections	5.050 million 526,870 439,600 5,241 Rs. 2878 million Rs. 3.25 million Rs. 2.80 million
Production and Distribution	Annual production volume Annual consumption volume Annual production volume (lpcd) Annual consumption volume (lpcd)	354 million m^3 179 million m^3 192.12 96.93
Service Indicators	Coverage • Water supply • Sewerage Hours of service Average tariff	 95 percent 51.40 percent 2 Rs. 16.11 /cu m
Efficiency Indicators	Nonrevenue water Unit production cost Working ratio Staff /'000 connections Revenue collection efficiency	49 percent Rs. 9.16/cu m 1.13 7.91 97 percent
Tariff Water Supply	Monthly consumption in cu m 0-15 16-30 31-50 51-100 101-200 Above 200 cu m	Rs./cu m 6-00 8-00 15-00 20-00 25-00 35.00 for entire consumption
Sewerage	35 percent of water charges are payable by consumers as sewerage charges	

Indore				
Water Utility	Indore Municipal Corporation			
	IMC is responsible for providing civic services in the city of Indore. Water supply and sewerage is one the many services it provides to its citizens. The PHED, a state government department, had been responsible for providing water services to the city earlier. Currently, the employees of PHED, stationed in Indore, are under the administrative control of IMC, but their salaries are still paid by the state government. Besides, IMC has employees on its rolls who are responsible for providing O&M services other than operating the water treatment plant. PHED is also responsible for providing O&M services. IMC provides water supply to Indore city from two perennial sources – Yashwant Sagar Dam on the Gambhir river (26 MLD) and Narmada river (180 MLD). Besides, the rain-dependent Bilawali Tank (4 MLD) and ground water (13 MLD) are the other two sources of water. Narmada river is at a distance of 70 km from the city. But of the 180 MLD sourced, 140 MLD is supplied to Indore city while the balance 40 MLD is sold en route to towns and villages.			
General Data About Water Utility	Population Connections • Water • Sewerage Staff (2006) Annual revenues Annual O&M costs Annual collections		1.8 million 158,920 0 1,405 Rs. 157 million Rs. 852 million Rs. 154 million	
Production and Distribution	Annual production volume Annual consumption volume Annual production volume (lpcd) Annual consumption volume (lpcd)		67 million m^3 53 million m^3 101 81	
Service Indicators	Coverage • Water supply • Sewerage Hours of service Average tariff		 54 percent 33 percent 0.75 Rs. 4.68/cu m	
Tariff structure	Type of connection	Size in inches	for 2005	for 2006
	Domestic	½	60	150
		¾	120	250
		1	250	500
		1 ½	480	1,000
		2	960	2,000
		3	1,920	4,000
		4	3,840	8,000
		6	7,680	14,000
	Commercial	½	150	300
		¾	300	600
		1	700	1,400
		1 ½	1,200	2,400
		2	2,400	5,000
		3	4,800	10,000
		4	9,600	20,000
		6	19,200	38,000

Indore				
	Industrial	½	300	600
		¾	600	1,200
		1	1,200	2,400
		1 ½	2,400	5,000
		2	4,800	10,000
		3	9,600	20,000
		4	17,200	35,000
		6	38,400	76,000
	Connection charges	Rs.		
	Water supply	2,500		
	Sewerage	200		

Jamshedpur		
Water Utility	Jamshedpur Utility Services Company Limited	
	JUSCO was incorporated in August 2003 as a 100 percent subsidiary company of Tata Steel. It commenced provision of civic and municipal services from April 1, 2004. It is the only corporate private sector provider of civic and municipal services in India. JUSCO's area of operations is spread over 64 sq km in the city of Jamshedpur and encompasses water, wastewater, power, public health and horticulture services along with other services like planning, engineering and construction to keep up with the growing civic needs of the people within its service area.	
General Data About Water Utility	Population Connections • Water • Sewerage Staff (2006) Annual revenues Annual O&M costs Annual collections	0.615 million 42,000 40,000 289 Rs. 550 million Rs. 470 million Rs. 537 million
Production and Distribution	Annual production volume Annual consumption volume Annual production volume (lpcd) Annual consumption volume (lpcd)	137 million m^3 125 million m^3 608* 554*
Service Indicators	Coverage • Water supply • Sewerage Hours of service Average tariff	 80 percent 62 percent 6.00 Rs. 4.44 /cu m
Efficiency Indicators	Nonrevenue water Unit production cost Working ratio Staff /'000 connections Revenue collection efficiency	9 percent Rs. 3.44/cu m 0.85 4.98 97 percent
Tariff	Industrial water Raw water Clarified water	Rate in Rs./cu m 5.39 5.51
	Potable water (metered) Domestic and commercial consumers Institutional consumers Industrial consumers Potable water	 7.9 4.4 9.9 Flat rate
	Bagan areas/bustee areas Plot area up to 1,600 ft^2 Single storey Additional storey or part thereof	 120 110
	Lease and other holdings Plot area up to 2,500 ft^2 Single storey Additional storey or part thereof	 240 180

** Includes nonpotable industrial production also.*

Jamshedpur		
	Plot area 2,500-5,000 ft^2 Single storey Additional storey or part thereof	 450 300
	Plot area 5,000 ft^2 and above Single storey Additional storey or part thereof	 540 360
	Nondomestic/commercial holdings Plot area up to 1,600 ft^2 Single storey Additional storey or part thereof	 450 350
	Plot area 1,600-2,500 ft^2 Single storey Additional storey or part thereof	 540 360
	Plot area 2,500 ft^2 and above Single storey Additional storey or part thereof	 600 400

Pune		
Water Utility	Pune Municipal Corporation	
	PMC is responsible for providing civic services including water supply and sewerage services in the city of Pune. PMC sources its water requirements from the Khadakvasla dam, located 12 km away from the city. This source feeds five water treatment plants whose aggregate water treatment capacity is about 900 MLD.	
General Data About Water Utility	Population Connections • Water • Sewerage Staff (2006) Annual revenues Annual O&M costs Annual collections	3.1 million 10,6500 NA 1,773 Rs. 1,140 million Rs. 933 million Rs. 780 million
Production and Distribution	Annual production volume Annual consumption volume Annual production volume (lpcd) Annual consumption volume (lpcd)	319 million m^3 196 million m^3 274 168
Service Indicators	Coverage • Water supply • Sewerage Hours of service Average tariff	 88 percent 57 percent 7 Rs. 6.53/cu m
Efficiency Indicators	Nonrevenue water Unit production cost Working ratio Staff /'000 connections Revenue collection efficiency	40 percent Rs. 3.21/cu m 0.82 11.48 68 percent
Tariff Water Supply	Metered supply Domestic – metered Residential Commercial and industrial	Rate/cu m 3 16
	Unmetered supply Residential Nonresidential	Flat rate per annum Rs. 900 to 1,100 per annum Rs. 500 to 1,000 per annum
	Connection charges Water supply Sewerage	 1,200 2,000

Rajkot		
Water Utility	Rajkot Municipal Corporation	
	Municipal services in Rajkot were provided by the erstwhile Municipal Borough under the Gujarat Municipal Act, 1963. The Rajkot Municipality was thereafter converted into RMC on November 19, 1973. The city administration was placed under the new statute of the Bombay Provincial Municipal Corporation Act 1949. RMC is responsible for providing and managing basic urban services such as water and sewerage disposal services, garbage disposal, citywide roads and street lighting. The service area has a population of about 1.2 million, spread over 105 sq km.	
General Data About Water Utility	Population Connections • Water • Sewerage Staff (2006) Annual revenues Annual O&M costs Annual collections	1.195 million 192,000 120,000 311 Rs. 84 million Rs. 558 million NA
Production and Distribution	Annual production volume Annual consumption volume Annual production volume (lpcd) Annual consumption volume (lpcd)	55 million m^3 49 million m^3 126 111
Service Indicators	Coverage • Water supply • Sewerage Hours of service Average tariff	 98 percent 55 percent 0.33 Rs. 1.75 /cu m
Efficiency Indicators	Nonrevenue water Unit production cost Working ratio Staff /'000 connections Revenue collection efficiency	 Rs. 10.21/cu m 0.63 1.10 NA
Tariff	For all consumers Connection charges Water supply Sewerage	Rs. 600 per month Rs. 1,650 500

Annex 2

Data Summary Sheet (2005-06)

		Bangalore	Bhubaneswar	Chandigarh	Chennai	Dehradun	Hyderabad	Indore	Jamshedpur	Pune	Rajkot
Population (to be serviced)	in million	6.46	0.77	1.15	5.32	0.79	5.05	1.80	0.62	3.19	1.20
Metering											
Water connections	in nos.	479720	52210	137409	365680	62370	526870	158920	42000	106500	192000
Number of metered connections	in nos.	479720	740	108862	–	NA	492000	0	222	16530	715
Number of functional metered connections	in nos.	431740	356	97976	12800	5000	492000	0	217	16530	715
Water production											
Total water production	in mn m^3 per year	336.93	75.19	121.91	210.42	42.71	354.12	66.79	136.51	319.01	54.75
Daily supply	in hrs/day	5.00	4	12.00	3.00	4.00	2	0.75	6.00	7.00	0.33
Water Consumption											
Metered consumption (billed metered)	in mn m^3 per year	157.34	0.67	75.19	38.51	3.65	160.83	0	87.60	106.82	9.13
Billed unmetered consumption	in mn m^3 per year	15.75	29.57	16.43	138.65	27.63	17.84	33.4	36.14	84.59	39.06
Total billed consumption	in mn m^3 per year	173.09	30.24	91.615	177.16	31.28	178.67	33.4	123.735	191.41	48.18
Unbilled consumption	in mn m^3 per year	27.53	0	8.76	8.37	1.10	0	20.04	0.73	4.30	0.55
Total consumption	in mn m^3 per year	200.62	30.24	100.38	185.53	32.38	178.67	53.44	124.47	195.71	48.73

		Bangalore	Bhubaneswar	Chandigarh	Chennai	Dehradun	Hyderabad	Indore	Jamshedpur	Pune	Rajkot
Water coverage											
Population covered	in nos.	5875000	345800	1150000	5213600	628000	4797500	974580	488000	2808760	1175000
Sewerage coverage											
No of people covered by direct serviced connections	in nos	5104410	197000	1150000	5213600	235500	2595450	600000	380500	1809420	660000
Sewage collected	in mn m^3 per year	288.0	21.9	79.5	140.0	20.0	48.6	32.9	20.8	164.5	21.9
Water quality and customer service											
Tests conducted for chlorine	In nos.	20000	4500	3650	28080	1600	7846	7846	11000	23659	16100
Tests passed	In nos.	18000	4500	3650	27756	1536	6831	6831	10714	23512	16085
Wastewater undergoing primary treatment only	in mn m^3 per year		0.00	24.85	0.00	0.00	33.95	32.85	0.00	0.00	0.00
Wastewater undergoing secondary treatment	in mn m^3 per year	105.12	13.84	28.17	105.85	0.00	7.30	0.00	13.84	111.30	21.90
Complaints	In nos.	NA	4085	3100	161216	2500	208039	576	18000	NA	58441
Staffing											
Staff deployed for water	In nos.	1625	426	1336	2875	345	4165	1285	209	1223	211
Total Staff	In nos.	2600.00	610.00	1466.00	4594.00	396.00	5241.00	1405.00	289.00	1773.00	311.00

		Bangalore	Bhubaneswar	Chandigarh	Chennai	Dehradun	Hyderabad	Indore	Jamshedpur	Pune	Rajkot
Network performance											
Pipe breaks	In nos.	25500	1825	1500	500	NA	5780	NA	3200	NA	15
Sewer blockages	In nos.	30480	2198	1600	52512	NA	43203	NA	210	4634	58441
Financial performance											
Operating cost	Rs. mn.	3,740.50	276.17	561.53	3,361.46	218.45	3,245.00	852.65	470.00	932.70	558.85
Water	Rs. mn.	–	–	–	–	215.67	2,109.25	772.65	–	772.00	545.65
Sewerage	Rs. mn.	–	–	–	–	2.78	1,135.75	80.00	–	160.70	13.20
Labor cost	Rs. mn.	–	42.36	172.00	723.46	40.94	850.00	141.87	72.50	166.93	54.10
Electricity cost	Rs. mn.	–	139.92	353.50	265.77	162.87	1,101.00	630.77	190.00	317.91	150.00
Contracting cost	Rs. mn.	–	–	–	–	–	–	–	–	–	–
Operating revenues											
Operating revenues (total billings)	Rs. mn.	3,800.41	84.01	428.94	2,484.69	152.15	2,878.00	156.48	550.00	1,139.55	84.25
Operating revenues (water)	Rs. mn.	–	55.55	–	1,877.14	148.15	2,447.00	156.48	550.00	802.73	79.25
Operating revenues (sewerage)	Rs. mn.	–	–	–	607.55	4.00	432.00	NA	–	336.82	5.00
Collections	Rs. mn.	2,166.70	69.17	428.94	928.69	98.16	2,784.00	154.00	536.60	780.00	–
Year end receivables	Rs. mn.	2,154.35	111.73	–	1,556.00	NA	1,736.00	257.70	13.40	1,812.10	192.59

Annex 3

Indicator Summary Sheet (2005-06)

		Bangalore	Bhubaneswar	Chandigarh	Chennai	Dehradun	Hyderabad	Indore	Jamshedpur	Pune	Rajkot
Coverage											
Water coverage	in %	90.92	45.14	100.00	98.00	80.00	95.00	54.14	79.29	88.11	98.33
Sewerage coverage	in %	78.99	25.72	100.00	98.00	30.00	51.40	33.33	61.82	56.76	55.23
Water production, consumption and metering											
Per capita daily production	lpcd	142.85	268.93	290.43	108.36	149.06	192.12	101.66	607.64	274.17	125.52
Supply continuity	% of 24 hours a day	20.83	16.67	50.00	12.50	16.67	8.33	3.13	25.00	29.17	1.39
Per capita consumption	lpcd	85.06	108.16	239.13	95.17	113.01	96.93	81.34	554.02	168.20	111.72
Functional meters	% of total connections	90.00	0.68	71.30	3.50	8.02	93.38	0.00	0.52	15.52	0.37
Metered consumption	% of total consumption	78.43	2.22	74.91	20.84	11.27	90.02	0.00	70.38	54.58	18.73
Unaccounted for water	% of water produced	40.46	59.78	17.66	15.98	24.19	49.55	19.99	8.82	38.65	11.00
Nonrevenue water	% of water produced	48.63	59.78	24.85	15.81	26.76	49.55	49.99	9.36	40.00	12.00
Staffing											
Staff – Water	%age of total staff	62.50	69.84	91.13	62.58	87.12	79.47	91.46	72.32	68.98	67.85
Staff – Sewerage	%age of total staff	37.50	30.16	8.87	37.42	12.88	20.53	8.54	27.68	31.02	32.15
Staff per 1,000 water connections	ratio	5.42	52.90	10.67	12.56	6.35	9.95	8.84	6.88	16.65	1.62

		Bangalore	Bhubaneswar	Chandigarh	Chennai	Dehradun	Hyderabad	Indore	Jamshedpur	Pune	Rajkot
Unit operating cost and revenues											
Unit operational cost	Rs. per cu m water produced	11.10	3.67	4.61	34.65	5.11	9.16	12.77	3.44	3.21	10.21
Average revenue (demand)	Rs. per cu m water sold	21.96	2.78	4.68	30.28	4.86	16.11	4.68	4.44	6.53	1.75
Working ratio	Operating revenue/ operating expenses	0.98	3.29	1.31	1.35	1.44	1.13	5.45	0.85	0.82	6.63
Cost split											
Labor costs vs operating costs	%age of total operating cost	–	15.34	30.63	21.52	18.74	26.19	16.64	15.43	17.90	9.68
Electrical energy costs vs operating costs	%age of total operating cost	–	50.66	62.95	7.91	74.56	33.93	73.98	40.43	34.08	26.84
Contract-out services costs vs operating costs	%age of total operating cost	–	–	–	–	–	–	–	–	–	–
Collection efficiency											
Collection period	Days	362.92	589.56	0.00	611.55	–	227.60	610.78	9.11	847.97	–
Collection ratio	%	57.01	82.34	100.00	37.38	64.52	96.73	NA	NA	68.45	0.00%

		Bangalore	Bhubaneswar	Chandigarh	Chennai	Dehradun	Hyderabad	Indore	Jamshedpur	Pune	Rajkot
Network performance and customer service											
Pipe breaks	No. per km of network	5.23	2.00	1.00	0.19	–	3.97	–	6.24	–	0.01
Sewer blockages	No. per km of network	8.22	7.51	1.77	19.82	–	15.27	–	0.42	5.85	155.84
Samples passing on residual chlorine conducted	% of tests	90.00%	100.00%	100.00%	98.85%	96.00%	87.06%	87.06%	97.40%	99.38%	99.91%
Complaints of W&S services	% of water connections	–	7.82%	2.26%	44.09%	4.01%	39.49%	0.36%	42.86%	–	30.44%
Wastewater undergoing primary treatment	% of wastewater collected	0.00%	0.00%	31.24%	0.00%	0.00%	69.92%	100.00%	0.00%	0.00%	0.00%
Wastewater undergoing secondary treatment	% of wastewater collected	36.50%	63.20%	35.42%	75.61%	0.00%	15.04%	0.00%	66.44%	67.65%	100.00%

Institutionalizing Benchmarking

The Water and Sanitation Program–South Asia in partnership with the Ministry of Urban Development, Government of India, undertook a project on Benchmarking Urban Water Utilities.

WSP-SA completed Phase I of the project in 2005. Building on Phase I, the focus in Phase II was to improve the quality of data, to highlight the information gaps, and explore institutional mechanisms to undertake performance benchmarking on a sustainable basis. As part of Phase II, data on water and sanitation services was collected from ten Jawaharlal Nehru National Urban Renewal Mission (JNNURM) cities and a detailed analysis carried out to arrive at the performance trends and data gaps.

To take forward the key messages from Phase I and Phase II, the Water and Sanitation Program-South Asia, in collaboration with the Ministry of Urban Development, the Institute of Chartered Accountants of India (ICAI), and PROOF organized a roundtable discussion on performance measurement and benchmarking on December 19th, 2006, in New Delhi. The roundtable brought together city officials, experts and practitioners, to disseminate and discuss the results from the aforementioned initiatives and brainstorm on the development of a common performance measurement framework for cities under the urban renewal mission.

In a significant outcome, Ministry of Urban Development committed to institutionalize benchmarking by linking it to the urban renewal mission and other centrally-sponsored programs. The key issue being explored is the use of such a benchmarking program to monitor and evaluate progress under the urban renewal mission in achieving urban water and sanitation services. As a preliminary step, the Ministry constituted a Core Group on Benchmarking with a mandate to develop a framework of Service Level Benchmarks for water supply, wastewater management, and solid waste management. WSP-SA, alongwith CRISIL, PROOF and ICAI, is working with the Ministry to finalizing this framework and is supporting adoption of the same at various levels of decision making.

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