İSTANBUL TECHNICAL UNIVERSITY ★ INSTITUTE OF SCIENCE AND TECHNOLOGY

DEVELOPMENT OF BENCHMARKING CRITERIA FOR TURKISH WATER ORGANIZATIONS

M.Sc. Thesis by

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Programme: Environmental Science and Engineering

Supervisor : Prof. Dr. Cumali Kınacı

JANUARY 2004

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FOREWORD

I hope this thesis will show a way to whom want to research about this subject and it will be helpful for them. I want to thank my supervisor Prof. Dr. Cumali Kınacı for his great efforts to prepering and directing this thesis.

Ocak 2004

Zeynep AKGUN

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TÜRK SU İŞLETMELERİ İÇİN KIYASLAMA ÖLÇÜTLERİ GELİŞTİRİLMESİ

ÖZET

Bu çalışmada amaç, çağımızın en genç ve en etkin performans geliştirme yöntemlerinden biri olan kıyaslama (benchmarking) yöntemini kullanarak Türkiye'deki su işletmeleri için kıyaslama ölçütleri önerisi geliştirmektir.

Belirlenen su işletmeleri incelenerek verimin artırılması ve kıyaslama için ölçütler geliştirilmiştir. Bu amaçla önce mevcut uygulamalar ve Türkiye'de belirlenmiş su işletmeleri incelenmiş, daha sonra Türkiye koşulları da dikkate alınarak ölçüt önerileri ileri sürülmüştür.

Öncelikle dünyadaki uygulamalar ile ilgili bilgiler araştırılmış ve daha sonra proje için belirlenen iki su işletmesi arasında kıyaslama yöntemi uygulanmıştır.

Kıyaslama Türkiye gibi küresel rekabette büyük hedefler koyan ülke sektörleri için ucuz ve kullanışlı bir güçlendirme şeklidir. Bu çalışma ile, bir kurumun gerekli birimleri incelenerek düşük maliyette gerçekleştirilecek servis seviyesi belirlenebilmektedir. Ayrıca kurum karını yükseltmek ve maliyetleri düşürmek için kıyaslama ölçütleri belirlendiğinde, su işletmeleri için yol gösterici araştırmalar elde edilebilir.

DEVELOPMENT OF BENCHMARKING CRITERIA TURKISH WATER ORGANIZATION

SUMMARY

Benchmarking is one of the most dynamic methods of improving performance in our time. The aim of this project is to develop proposals for comparative scales and criteria of water operators and companies in Turkey.

Scales for comparison and production increase are developed by studying certain companies. Firstly the existing practices and the identified Turkish water operators are studied for this purpose. Then proposals for scales/criteria are developed, taking into consideration the Turkish condition.

Firstly information about other implementations in the world are researched and later the benchmarking process is applied to two companies identified for the project.

In a country like ours, where national sectors have high goals in global competition, benchmarking provides a cheap and practical method of improvement. By investigating all the elements of an organization at low cost, increasing the level of service and profits whilst decreasing costs will be possible by identifying the benchmarking scales, lighting the way for further studies.

1. INTRODUCTION

Benchmarking is one of the most dynamic methods of improving performance in our time. The aim of this project is to develop proposals for comparative scales and criteria of water operators and companies in Turkey.

Benchmarking process is a part of total quality management. It is a practical and economic way to ‘learn from others’ for companies.

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In a country like ours, where national sectors have high goals in global competition, benchmarking provides a cheap and practical method of improvement. By investigating all the elements of an organization at low cost, increasing the level of service and profits whilst decreasing costs will be possible by identifying the benchmarking scales, lighting the way for further studies.

2.BENCHMARKING

Benchmarking science is a part process of TQM (TOTAL Quality Managment) which becomes more popular in last decades. Years ago, first benchmarkind applicatins are applied to strenghten the armies of the kings. Now, we are applying it to every fields of bussiness and our lives. This word has various definitions which are given below :

2.1. What is benchmarking ?

Benchmarking is a tool to help you improve your business processes. Any business process can be benchmarked."

"Benchmarking is the process of identifying, understanding, and adapting outstanding practices from organizations anywhere in the world to help your organization improve its performance."

"Benchmarking is a highly respected practice in the business world. It is an activity that looks outward to find best practice and high performance and then measures actual business operations against those goals."

Benchmarking is a “continuous, systematic process for comparing performances of organisations,functions or processes against the “best in the world”, aiming to not only match those performance levels but to exceed them” (DGIII , of the European Commission, 1996)

Put simply, it is a management tool that helps managers objectively identify areas for improvement within their own operations and to work with others to improve them. One of the key issues facing managers today is the difficulty in making decisions. Very seldom is all the information available to them. Benchmarking allows decisions to be made based on FACTS, objective information relating to key performance areas.

There are numerous definitions of benchmarking, but essentially it involves learning, sharing information and adopting best practices to bring about step changes in performance. So, at its simplest, benchmarking means:

"Improving ourselves by learning from others".

Most organisations tailor definitions of benchmarking to suit their own strategies and objectives. Two examples are given below.

"Benchmarking is simply about making comparisons with other organisations and then learning the lessons that those comparisons throw up". (The European Benchmarking Code of Conduct)

"Benchmarking is the continuous process of measuring products, services and practices against the toughest competitors or those companies recognised as industry leaders (best in class)". (The Xerox Corporation)

Benchmarking is the process of continuously comparing and measuring against other organizations anywhere in the world to gain information on philosophies, policies, practices, and measures which will help your organization take action to improve its performance.

A benchmark is a standard of excellence or achievement used to compare and measure similar things. It is a new technique for identifying measurable successes of others and applying then to your own organization. The benchmarking process compares an organizations practices, processes and outcomes to standards of excellence in a systematic way. It is a process that can also be used to design a new system or model. The best practice indicators are standards of excellence to help you identify and plan your own program possibilities and enable you to identify what exemplary sites in our study you would like to match or exceed. Benchmarking challenges you to see what made it work for others “their secrets to success” and how you can develop a unique approach that will meet the needs of all your stakeholders. It is not a means for duplicating but a way of defining the best and moving beyond that standard to create your own exemplary system.

Best Practice Benchmarking is the process of seeking out and studying the best internal practices that produce superior performance. "Best practices" are documented strategies and tactics employed by highly admired organizations. Benchmarking can yield great benefits in the education of executive management and realize performance improvements in operations. In addition, benchmarking can be used to determine strategic areas for development.

By identifying how others perform the same functional task or objective, executives gain insight and ideas. Such information affirms and supports quality decision making by executives. This insight is one key benefit and value-added feature of benchmarking,

Benchmarking can take several forms. Internal benchmarking studies the practices and performance within the client organization. External benchmarking determines the performance of other, preferably world-class, organizations. Another form of benchmarking is "process benchmarking." These studies demonstrate how top performing companies accomplish the specific process in question. Such studies can take the form of research, surveys/interviews, and site visits.

The benefits of benchmarking are realized when organizations embark on a change process – making marked improvements in their internal process resulting in higher productivity.

Benchmarking is an ongoing, systematic process for measuring and comparing work processes of one organization that represents best practice for the purpose of organizational improvement. It is used for improving administrative processes as well as instructional models. In essence, it is a process of looking for an external standard for measuring the quality of internal activities and to help identify where opportunities for improvement may be applied. In a way, it is a process whereby an institution is taught how to improve.

Survival for institutions require the need to compare (benchmarking). They need to seek a new paradigm for doing business. The educational environment is constantly changing and no less impacted by the need to engage in benchmarking to stay competitive. Benchmarking is a quality improvement tool.

Benchmarking is the process of identifying, sharing, and using knowledge and best practices. It focuses on how to improve any given business process by exploiting top-notch approaches rather than merely measuring the best performance. Finding, studying and implementing best practices provides the greatest opportunity for gaining a strategic, operational, and financial advantage.

Informally, benchmarking could be defined as the practice of being humble enough to admit that someone else is better at something and wise enough

to try to learn how to match, and even surpass, them at it. Benchmarking is commonly misperceived as simply number crunching, site briefings and industrial tourism, copying, spying, or espionage. In no way quick and easy, benchmarking is actually an ongoing process.

There are numerous steps in each phase of the benchmarking process used by APQC's International Benchmarking Clearinghouse, whose methodology has been recognized as tops among numerous methodologies used throughout the world. Distilled from hundreds of organizations' benchmarking experiences, these steps optimize the process and ensure successful outcomes.

Benchmarking mirrors the continuous improvement efforts that may already exist in an organization. It helps to blend continuous improvement and breakthrough improvement into a single change management system. While benchmarking readily integrates with strategic initiatives such as continuous improvement, re-engineering, and total quality management, it is also a discrete process that delivers value to the organization on its own.

While benchmarking is unfamiliar to most educators, it has been successfully used in business to foster continuous improvement and achieve excellence. Benchmarking can help organizations—including schools, districts, and state agencies—become high performance learning communities.

Benchmarking is an activity where organizations continuously engage in self--study and compare themselves with the leaders in their field so they can identify, adapt, and apply significantly better practices.

It is a systematic, evidence-based, and participatory change process. Benchmarking may be done at the strategic level where the goal is to create a shared vision and identify key levers for organizational change. If the strategic thinking has already been done, then benchmarking can take place at the level of specific practices or processes (e.g., improve curriculum or professional development).

2.2. Benchmarking – A Learning Opportunity

We see that benchmarking provides a basis for learning. If a company or organisation sees that it has an area for improvement then it starts the learning process. It is not enough to just know that your performance levels

are lower than your competitor; you need to learn how you can address the issue. The analogy has been made to medicine, that benchmarking is like the Diagnosis, the second stage in improving the patient is in the Medicine, what steps are taken to improve performance. Benchmarking provides the opportunity to learn with others how to improve your operations.

The best companies and organisations in the world today, truly World Class organisations, exhibit high levels of practice use and performance achieved.These same organisations are often front runners in adopting and developing current best practice. Learning from their own internal experiences as well as from the shared experience of others. These leading organisations are using benchmarking to check their positions relative to others in their own sector, region, country or on a world-wide basis. Even more importantly for them they are taking the opportunity to learn from and with other leading organisations, organisations who themselves are pushing the boundaries of efficiency and effectiveness. Today's market conditions are changing continuously. To survive an organisation needs to adapt and innovate, to acquire new strengths, abilities and new ideas.

2.3. Levels Of Benchmarking

The evolution of benchmarking can be presented as a series of five steps.

1. Analysis of competing goods: Reverse engineering - the benchmarking concept during this phase was concentrated in the comparison of characteristics, functionalities and performance of competing products.

2. Competitive Benchmarking: First developed by Rank Xerox when starting to analyse its own manufacturing costs and verifying they were as high as its competitors' sales prices. Now the emphasis is on processes' efficiency and not only comparing products.

3. Process Benchmarking: During the 80s, managers started to realise that they also could learn with organisations from other sectors (benchmarking out of the box). The amount of information and knowledge available amongst non-competing companies, a priori, higher than between competitors.

4. Strategic Benchmarking**:** A systematic process to evaluate alternative scenarios, to implement strategies and improve performance through the

understanding and adaptation of successful strategies by the partners (competitors or not). It differs from process benchmarking because its scope is larger and deeper.

5. Global Benchmarking: The next generation concept. It is an even more global concept because it includes and analyses cultural differences between companies at world-wide level. It also takes into account the conditions (legal, administrative, education, social, environment) which affect the localisation of companies

In addition to that, by benchmarking it can be found out;

Who performs the business process very well and has process practices that are adaptable to your own organization

Who is the most compatible for you to benchmark with

Most business processes are common throughout industry. For example; NASA has the same fundamental Human Resources requirements for hiring and developing employees as does American Express. British Telecom has the same Customer Satisfaction Survey process as Brooklyn Union Gas. These processes, albeit from different industries, are all common and can be benchmarked very effectively.

For those approaching benchmarking for the first time the plethora of definitions can be confusing, so it can help to focus on the learning and sharing that goes on during the process.

In practice, benchmarking usually encompasses:

- regularly comparing aspects of performance (functions or processes) with best practitioners;
- identifying gaps in performance;
- seeking fresh approaches to bring about improvements in performance;
- following through with implementing improvements; and
- following up by monitoring progress and reviewing the benefits.

2.4. What is Not Benchmarking ?

Although benchmarking involves making comparisons of performance, it is not:

• Merely competitor analysis	Benchmarking is best undertaken in a collaborative way.
• Comparison of league tables	The aim is to learn about the circumstances and processes that underpin superior performance.
• A quick fix, done once for all time	Benchmarking projects may extend over a number of months and it is vital to repeat them periodically so as not to fall behind as the background environment changes.
• Copying or catching up	In rapidly changing circumstances, good practices become dated very quickly. Also, the fact that others are doing things differently does not necessarily mean they are better.
• Spying or espionage	Openness and honesty are vital for successful benchmarking.
• Industrial tourism	If site visits are undertaken, they should be part of a structured programme leading to thorough analysis

2.5. Why use Benchmarking?

- In the Private Sector
- In the Public Sector
- In Europe

The case for benchmarking is a compelling one. When used appropriately, it has proved to be one of the most effective tools for bringing about quantum-leaps in performance. Benchmarking provides:

- an effective ‘wake-up call’ and helps to make a strong case for change;
- practical ways in which step changes in performance can be achieved by learning from others who have already undertaken comparable changes;
- the impetus for seeking new ways of doing things and promotes a culture that is receptive to fresh approaches and ideas; and
- opportunities for staff to learn new skills and be involved in the transformation process from the outset.

2.5.1. In the Private Sector

In the private sector, the purpose of benchmarking is to gain a competitive edge. A benchmarking approach has become embedded in successful commercial organisations as a means of seeking innovation outside the industry paradigm - a way of keeping at the forefront of the competition. Recent surveys show that benchmarking is the third most used management tool. Interest in benchmarking is continuing to grow across the world. Benchmarking is also being recognised as a valuable tool for external learning strategies.

"In my experience, identifying the toughest competitors and world class performers, and then aspiring to beat them is the best way to achieve competitive advantage." (Source: Bill Cockburn, BT Group Managing Director)

2.5.2. In the Public Sector

Over recent years, public sector organisations across the world have gradually been turning to benchmarking their public services. In the UK public sector, benchmarking has been acknowledged as a powerful tool for improving and bringing about the sort of step changes needed to deliver modern public services. This is against a background in which the drivers for change are becoming as intense as the competitive pressures felt by industry.

It has also been recognised that efficient and effective public services play a vital part in improving private sector competitiveness by reducing the burden on business and compliance costs.

Benchmarking is one way of providing the stimulus needed for change in the delivery of both core and non-core activities and for raising the standard of public services by spreading good practices.

Encouraging the widespread and systematic use of benchmarking across the public sector can help with improving performance and can assist individual and organisational learning.

2.5.3. In Europe

In Europe, benchmarking is being used as a tool for bringing about improvements in performance in both public sector and commercial

organisations as a means of increasing the competitiveness of the European economy as a whole.

The European Commission has spearheaded a programme of benchmarking initiatives in which member states lead projects that will enable them to learn from shared experiences and good practice. In particular, within the Enterprise Directorate General (DG), benchmarking initiatives have been geared to improving the competitiveness of organisations working at three levels. These and the terms used for them are listed below:

- Framework Conditions Benchmarking focuses on improving the external environment in which firms operate;
- Enterprise Benchmarking focuses on improving the internal environment within firms and aims to encourage the take-up of benchmarking particularly among small and medium sized enterprises (SMEs); and
- Sectoral Benchmarking focuses on the competitive challenges that firms encounter within specific sectors and involves working with partners from the industries concerned

2.6. Why Do Companies Benchmark?

Benchmarking is the practice of being humble enough to admit that someone else is better at something, and being wise enough to learn how to match and even surpass them at it.

For some companies, benchmarking is synonymous with survival. It provides you with an opportunity to assess your business performance. By looking outward for improvement, you'll gain a better understanding of your relative position in the industry. Benchmarking works because it helps you to understand your own processes and enables you to learn from others.

Benchmarking equals innovation. Real innovation comes from looking for best practices outside your industry. This enables you to learn from others and achieve quantum leaps in performance that otherwise might take years to achieve.

Why do Companies Benchmark?

1. To develop and implement strategic goals

2. To establish realistic actionable objectives
3. To provide a sense of urgency
4. To Encourage striving for perfection and innovative thinking
5. Create a better understanding of the industry, and
6. To emphasize sensitivity to changing customer needs.

While competitive analysis looks at performance measures. Benchmarking looks at performance measures as well as practices and enablers. The American Productivity and Quality Center defines enablers as those processes, practices, or methods that facilitate the I implementation of a best practice and help to meet a critical success factor. Enablers help to explain the reasons behind the performance indicated by a benchmark.

People often mistake benchmarking for competitive analysis. Competitive analysis typically looks at intelligence data: facts and figures, product breakdown (reverse engineering) strategic goals. It's a guessing game as to how to achieve the competitive advantage.

Benchmarking eliminates the guess work by looking at processes and enablers that lead to best practices. Benchmarking doesn't limit itself to competitive information; it seeks innovation by looking outside the industry paradigm.

Benchmarking is even enabling competitors to talk to each other. Through structured studies and shared findings, competing companies can raise the standard of excellence industry-wide. Third party sources can serve as a neutral base for common interest group studies; for example, customer satisfaction measurement, new product development and accounting and finance

2.7. Benefits from Benchmarking

Successful benchmarking, in which gaps in performance are bridged by improvements, results in significant tangible benefits that are needed in the public sector, such as:

- step changes in performance and innovation;
- improving quality and productivity; and
- improving performance measurement.

Benchmarking can also have a beneficial effect on aspects needed to support continuous improvement, such as:

- raised awareness about performance and greater openness about relative strengths and weaknesses;
- learning from others and greater confidence in developing and applying new approaches;
- greater involvement and motivation of staff in change programmes;
- increase in willingness to share solutions to common problems and build consensus about what is needed to accommodate changes;
- better understanding of the 'big picture' and gaining a broader perspective of the interplay of the factors (or enablers) that facilitate the implementation of good practice; and
- Increasing collaboration and understanding of the interactions within and between organisations

2.8. Types of Benchmarking

Benchmarking is a very versatile tool that can be applied in a variety of ways to meet a range of requirements for improvement. Choosing the right benchmarking style makes our job easier. To take the best fit style, the types of benchmarking and some recommendations are given below :

- Types
- When to use these types of benchmarking?
- Types of Benchmarking Table

2.8.1.Types

Different terms are used to distinguish the various ways of applying benchmarking. The first word in each term relates to either the type of partner or the purpose for benchmarking. At the outset of benchmarking projects, it is vital to be clear on exactly what is to be achieved through benchmarking and apply an appropriate methodology.

Standard benchmarking terms include:

1. Strategic Benchmarking
2. Performance Benchmarking or Competitive Benchmarking
3. Process Benchmarking
4. Functional Benchmarking or Generic Benchmarking
5. Internal Benchmarking
6. External Benchmarking
7. International Benchmarking

2.8.1.1 Strategic Benchmarking

Strategic Benchmarking is used where organisations seek to improve their overall performance by examining the long-term strategies and general approaches that have enabled high-performers to succeed. It involves considering high level aspects such as core competencies, developing new products and services; changing the balance of activities; and improving capabilities for dealing with changes in the background environment. The changes resulting from this type of benchmarking may be difficult to implement and the benefits are likely to take a long time to materialise. The analysis of world-class companies in non-competitive

industries to determine opportunities for strategic change initiatives in core business processes. These studies are performed by professionally trained benchmark analysts. Corporate resources required are in the mid-range. (21)

2.8.1.2. Performance Benchmarking or Competitive Benchmarking

Performance Benchmarking or Competitive Benchmarking is used where organisations consider their positions in relation to performance characteristics of key products and services. Benchmarking partners are drawn from the same sector. However, in the commercial world, it is common for companies to undertake this type of benchmarking through trade associations or third parties to protect confidentiality. (sadeleştir) The analysis of relative business performance among direct or indirect competitors. Performance benchmarking uses surveys and database analysis to determine performance trends and define Best Management

Practices. This type uses a third-party consulting firm, and requires the fewest corporate resources.

2.8.1.3. Process Benchmarking

Process Benchmarking is used when the focus is on improving specific critical processes and operations. Benchmarking partners are sought from best practice organisations that perform similar work or deliver similar services. Process benchmarking invariably involves producing process maps to facilitate comparison and analysis. This type of benchmarking can result in benefits in the short term. (sadeleştir) The analysis of performance in key business processes among

identified best-practice companies selected without regard to industry affiliations. Studies are conducted by teams from the process area, and require the greatest corporate resources.

2.8.1.4. Functional Benchmarking or Generic Benchmarking

Functional Benchmarking or Generic Benchmarking is used when organisations look to benchmark with partners drawn from different business sectors or areas of activity to find ways of improving similar functions or work processes. This sort of benchmarking can lead to innovation and dramatic improvements.

2.8.1.5. Internal Benchmarking

Internal Benchmarking involves seeking partners from within the same organisation, for example, from business units located in different areas. The main advantages of internal benchmarking are that access to sensitive data and information are easier; standardised data is often readily available; and, usually less time and resources are needed. There may be fewer barriers to implementation as practises may be relatively easy to transfer across the same organisation. However, real innovation may be lacking and best in class performance is more likely to be found through external benchmarking.

2.8.1.6. External Benchmarking

External Benchmarking involves seeking outside organisations that are known to be best in class. External benchmarking provides opportunities of learning from those who are at the leading edge, although it must be remembered that not every best practice solution can be transferred to

others. In addition, this type of benchmarking may take up more time and resource to ensure the comparability of data and information, the credibility of the findings and the development of sound recommendations. External learning is also often slower because of the ‘not invented here’ syndrome.

2.8.1.7. International Benchmarking

International Benchmarking is used where partners are sought from other countries because best practitioners are located elsewhere in the world and/or there are too few benchmarking partners within the same country to produce valid results. Globalisation and advances in information technology are increasing opportunities for international projects. However, these can take more time and resources to set up and implement and the results may need careful analysis due to national differences.

2.8.2. When to use these types of benchmarking?

When selecting which type of benchmarking to use, the following aspects are considered:

- objectives to be achieved and aspects to be reviewed;
- time and resources available;
- level of experience in benchmarking; and
- the likely sources of good practice.

There are circumstances in which the different types of benchmarking are likely to be more suitable than other types (see table below).

Organisations starting out with benchmarking often opt for internal benchmarking first to build up experience of the benchmarking process before attempting external or functional benchmarking.

Organisations also progress through the various types of benchmarking, for example, using Performance or Competitive Benchmarking to highlight gaps in overall performance before deploying Process Benchmarking to bring about improvements in key process that will, in turn, impact on overall performance.

2.8.3. Types of Benchmarking Table

This table aims to show examples of situations where one type of benchmarking may be more appropriate than others.

Table 2.1. Types of Benchmarking

When the focus is on...	**it could be appropriate to use...**
Re-aligning strategies that have become inappropriate. For example, in the light of changes in the background such as technology or customer requirements.	**Strategic Benchmarking**
The relative level of performance in key areas or activities in comparison with others in the same sector and finding ways of closing gaps in performance.	**Performance or Competitive Benchmarking**
Improving key processes in order to make a difference to performance in a short time.	**Process Benchmarking**
Improving activities or services for which counterparts do not exist. When pressures prevent benchmarking within the same sector. When radical change is needed.	**Functional or Generic Benchmarking**
Several business units within the same organisation exemplify good practice. Exchanging information and data with external organisations would be undesirable. Inexperienced in applying benchmarking. Time and resources are limited.	**Internal Benchmarking**
Examples of good practices are to be found in other organisations and there is a lack of good practices within individual companies. Innovation is sought.	**External Benchmarking**
Good practice organisations are located in other countries. There are few partners within the same country. The aim is to achieve world class status	**International Benchmarking**

2.9. Starting the Benchmarking Process

When we start benchmarking process, first we have to select and use some questions to start and finish it in correct conditions.

2.9.1 Selecting questions

Selecting questions to ask before starting the benchmarking process:

1. What should be benchmarked?

{What specific area or areas need to be benchmarked? To determine this I used Pareto Principle: 20% of all activity affects 80% of the results. Therefore, I will focus on the processes that will have the highest potential for return.}

2. What should you measure?
3. What organization (s) should be benchmarked?
4. How should data be collected?
5. How will the results be implemented?

2.9.2. Benchmarking planning models

There are many models for benchmarking however they all can be identified as having four basic steps.

1. Planning
2. Data collecting
3. Analyzing data collected
4. Adaptation of improvements

or

The benchmarking process can include these following steps:

- **Self-assessment**. Document and study your own organization's vision, practices, and success measures. Decide what to benchmark.
- **Comparison.** Decide who to benchmark. Identify exemplars and establish a benchmarking partnership. Study and assess your partner(s). For example, in the areas of mathematics and science education, you can use local exemplars as well as TIMSS data for comparison purposes.
- **Analysis and Adaptation**. Ask why you are getting your results and why others are getting better results. While benchmarking is often called

"borrowing shamelessly," practices generally require creative adaptation in a new context.

- **Implementation.** Think carefully about what enablers (e.g., resources, schedule changes) are needed. Communicate findings and build support for the changes you want to make.
- **Feedback**. Carefully monitor and measure the results of your innovation and recalibrate if necessary.

Or we can implement detailed project stages for the benchmarking process:

1. Identify what to benchmark
2. Obtain management support
3. Develop measurement instrument
4. Develop the data collection plan of action
5. Review plan with experts
6. Collect my institutions internal published information
7. Conduct interviews with possible peer & management members
8. Form a benchmarking committee to follow the benchmarking data collection, analysis and create suggested improvements
9. Identify and conduct site visits
    1. Collect external published information concerning sites
    2. Collect external original research available on sites
10. Analyze data collected with peer & management members
11. Develop an implementation plan with committee members
12. Present improvement plan to administration
13. Work with administration to implement changes and measure impact
14. Maintain a database of actions, results and assessment of outcomes implemented

2.9.3. Collecting data & information

After starting the process there are some steps to collect data :

- Compile information and data on performance. This may include mapping processes.
- Select and contact partners.
- Develop with partners, a mutual understanding about the procedures to be followed and, if necessary, prepare a Benchmarking Protocol.

- Prepare questions and agree terminology and performance measures to be used.
- Distribute schedule of questions to each partner.
- Undertake information and data collection by chosen method for example, interviews, site visits, telephone, fax and e-mail.
- If benchmarking visits are to be undertaken, develop a programme of visits and agree their purpose.
- Collate the findings to enable analaysis.

2.9.4 Analysing the findings

- Review the findings and produce tables, charts and graphs to support the analysis.
- Identify gaps in performance between your organisation and better performers.
- Seek explanations for the gaps in performance.
- Ensure that comparisons are meaningful and credible. Where necessary, normalise the measures used - that is apply correction factors to take account of reasons for differences in performance other than inefficiencies.
- Communicate the findings as o utlined in the communications strategy at the beginning of the project.
- Identify realistic opportunities for improvements.

2.9.5. Recommendations - making & doing

2.9.5.1. Making Recommendations

- Examine the feasibility of making the improvements in the light of the conditions that apply within your own organisation.
- Agree on the improvements that are likely to be feasible.
- Produce a report on the Benchmarking Project in which the recommendations are included.
- Obtain the support of key stakeholder groups for making the changes needed.
- Develop action plan(s) for implementation

2.9.5.2. Implementing Recommendations:

- Implement the action plan(s).
- Monitor performance.
- Reward and communicate successes.
- Keep key stakeholders informed of progress.

2.9.5.3. Monitoring and Reviewing

- Evaluate the benchmarking process undertaken and the results of the improvements against objectives and success criteria plus overall efficiency and effectiveness.
- Document the lessons learnt and make them available to others.
- Periodically re-consider the benchmarks in the light of changes in those conditions that impact on performance relative to good practice.

2.10. Things to Avoid

When approaching the process for the first time, it is worthwhile learning from others who have built up experience of applying benchmarking in a comparable way. When applying the process, some mistakes and wrong opinions can be done and thougt. In general it is important to avoid:

- benchmarking for the sake of it;
- focusing entirely on comparisons of performance measures rather than the processes and activities that enable the achievement of good practice;
- expecting that benchmarking will be quick or easy;
- spending too long on one part of the process at the expense of other key parts particularly, obtaining support for your recommendations;
- expecting to find benchmarking partners comparable in all respects to your organisation; and
- asking for information and data without being prepared to share it with others. Conversely, expecting organisations to share information that is commercially sensitive. Agreeing to abide by an approved benchmarking code of conduct can help to avoid problems over confidentiality of information.

3 – ENVIRONMENTAL BENCHMARKING IN DIFFERENT SECTORS

3.1. Introduction

There are some case studies of environmental benchmarking in different sectors. These case studies are given for showing examples about environmental benchmarking in other sectors. The aim of these studies is to destroy two myths: 1) that environmental measures are bad investments, and 2) that environmental management is only relevant for large and rich companies.

Historically, environmental measures were designed to reduce end-of-pipe emissions, and were a large financial burden. But recently, a more integrated approach which involves implementing environmental management systems and other environmental management tools has gained wider acceptance. In production, this integrated approach is sometimes known as Cleaner Production, Waste Minimisation, or Pollution Prevention. This new development, which INEM associations, affiliated Cleaner Production Centres and the INEM Secretariat are helping to promote and implement, and it is hoped that case studies about environmental benchmarking will serve as an inspiration to companies around the world to adopt an integrated and preventive approach.

The second myth, that environmental management is only relevant for large and rich companies, also can be laid to rest. Experience has shown that small- and medium-sized companies benefit from implementing environmental measures, and that environmental benefits translate into financial benefits. In the end, the examples provided prove the point that good environmental management is often common sense and leads to greater eco-(logical) and eco-(nomic) efficiency. [2]

3.2. Case Studies in Environmental Benchmarking

In this chapter, there are three case studies developed for the Germaine project. Germaine Project is a benchmarking development project that

made for european countries. The description of the project is in the next paragraph. And the three case studies are:

- Environmental Perfomance Indicators in Public Administrations
- Environmental Management and Benchmarking a Theatre
- Environmental Control Panels in the Catering Services Sector

The Germaine Project

Project Description

The project GERMAINE stands for Gestion Responsable et Maîtrise des Indicateurs Environnementaux: Responsible management through Environmental Performance Indicators. The project is implemented by the Belgian Federation of Companies, the Belgium Association for Eco-Counsellors (ABECE) and the Eco-Counsellor Institute in Namur, from April 2000 till end of 2001. It is financially supported by the Belgian Federal Office for Scientific, Technical and Cultural Affairs.

The goal of GERMAINE is to distribute environmental best-practice cases and to raise the awareness for norms, standards and tools for environmental management in public entities and the services sector.

Sectors involved in the project are:

- Services sector with banks, retailing and catering
- Public organisations: Local authorities, governmental agencies, theatres and other cultural institutions
- Small and Medium-Sized Enterprises from the textile industry and thermoplastics
- Micro-Enterprises: Motor rectification and garages

Indicators that will be defined together with the companies will be:

- Operational indicators, e.g. consumption of resources in relation to unit of production, waste, water and air emissions
- Indicators on the management culture or practice, e.g. supply chain management (especially for local authorities, catering, etc.), e.g. How many environmental criteria the company is putting in their requirements for suppliers?

- Knowledge indicators, e.g. number of trained staff on specific environmental issues in relation to the total number of personnel

  The Project Partners are the Belgium Association for Eco-Counsellors, the Eco-Counsellor Institute and the Belgian Federation of Companies. It is financially supported by the Belgian Federal Office for Scientific, Technical and Cultural Affairs.

  Objectives and background

  The task of the project with the federal administrations is to discover, better understand, know, manage, minimise and compare over time the different environmental aspects and impacts of the institution activities. The Belgian federal administrations have to implement and respect the requirements of the Federal Belgian Plan for Sustainable Development. Environmental performance indicators help them to communicate, manage and follow these requirements

  The process is a part of the project GERMAINE (Gestion Responsable et MAîtrise des Indicateurs Environnementaux): Responsible management through Environmental Performance Indicators.

  Methodology and description

  The different project steps are:

1. The administrations explores the significant environmental aspects of its activities, involving management and staff. They will be supported by an eco-counsellor that is available one day per month for each company.
2. Generic and specific Environmental Performance Indicators will be defined and introduced. The environmental information has to be precise and meaningful to be understood by all administration staff and the interested outside world.
3. To cope the use of indicators with the federal governmental objectives contained in the Federal Belgian Plan for Sustainable Development
4. To compare the relevant data and indicators with data from other countries (Scandinavian countries, Germany, Austria, The Netherlands, etc..).

   The defined indicators will be used for benchmarking:

5. With the indicators that will be defined, best-practice figures for the specific sector can be worked out to give an orientation for other administration in the same branch as well as other interested stakeholders, e.g. NGOs, environmental consultants etc. They will help to analyse environmental performances in other companies in a more efficient way.
6. The best-in-class figures of the indicators are putting a pressure on companies on what other companies already achieved, also on an international level.
7. The indicators will be used for internal benchmarking over time and comparisons among different sections of the administrations, in Belgium and abroad.
8. To make the best-in-class indicators available for a large number of companies and other interested parties, they will be published on the internet.

3.2.1. Environmental performance indicators in public administrations

Organisations: Belgian Federation of Companies, the Belgium Association for Eco-Counsellors and the Eco-Counsellor Institute in Namur
Sector: Public Administration
Country: Belgium

Participating administrations

Two federal Belgian administrations are taking part in the project :

- Transportation and Infrastructure Administration (3 buildings, 350 officials),
- Economic Affairs Administration (2 buildings, 700 officials)

It will be included other public administrations such as:

- the Federal Administration of the Environment
- a regional training centre (Brussels Formation)
- the Post office administration.

3.2.1.1. Indicators for public administrations

Operational indicators

- Cubic meter of water per person/year
- Quantity of waste per person/year

- kWh electricity consumption/square meter/year
- Gj warming energy/square meter/year
- Recycled paper/total paper used
- Cleaning product/square/meter
- Staff mobility (distance/year)
- Function car (distance/year)
- Mission car (distance/year)
- Public transportation (%age of staff)

Indicators on the management culture or practice

- Number of product bought with environmental criteria
- Number of sorted waste

Knowledge Indicators:

- Staff training (hour of environmental information or training)
- Seminars on eco-consumption and mobility

Some examples:

- Water consumption from 10 to 50 cubic meters/person/year (some administrations gets also some laboratories)
- Electricity consumption from 30 to 55 kWh/square me

Difficulties and barriers that have been overcome

The main difficulty so far has been to find the relevant person inside each federal authority. To collect the data will also take some time, caused by the structural complexity of some administrations. It is also needed to gain trust from the other administrative counterpart. (3)

3.2.2. Environmental management and benchmarking a theatre

Company: Theatre Royal de la Monnaie - The Royal Opera House of Brussels, Belgium
Sector: Entertainment
Country: Belgium

Company description

A cultural institution as the famous Royal Opera House of Brussels is a complex enterprise with a large number of products and services.

Behind the scenery many small- and medium-sized enterprises (SMEs) are involved in the work of the whole entity: studios for design, the production of costumes and decoration; administrative offices; a canteen; a printing service; a vehicle fleet; technical entities; a team for the maintenance of the buildings; etc. All activities of these SMEs have direct of indirect effects on the environment.

Objectives and background

The task of the project with the Royal Opera House is to discover, better understand, know, manage, minimise and compare over time the different environmental aspects and impacts of the institution activities.

Methodology and description

The initial step has consisted in a first screening of the significant environmental aspects of the opera activities. Service responsible and staff has been involved in the whole process. Tools as the creation of Eco-teams and Input-Output Analysis are being used. An eco-counsellor is facilitating the process.

Examples of some significant aspects and impacts of the different activities are:

Table 3.1. Examples of some significant aspects and impacts of the different activities

Activity	Aspects	Impacts
Decoration services and mechanical ateliers	Emission of organic volatiles solvents	Health risks
Building, visitors hall	Particles from heating	Local air pollution
Atelier of costumes and cleaning services	Sewage water with phosphors and nitrogen	Eutrification of rivers, lakes and coastal zones
Canteen	CO2 and HFC	Contribution to climate change and ozone depletion

The Opera House uses 32 t of paper a year, 25 t for external purposes, 7 t for internal. It is consuming 1.938.000 kWh of energy/year (gas and

electricity). The canteen is producing 7 t of waste per year and the noise in the canteen is 75dBa/4hours a day.

Creating an internal dynamic

The management, together with the eco-counsellors, has decided on which sectors to focus on. The selected themes have been :

1. use of paper,
2. mobility,
3. energy consumption
4. management of waste
5. management of hazardous goods.

The creation of indicators represents the mean to better manage the process while ensuring the possibility of comparative measurements over time.

In order to reduce the environmental impacts, innovative actions are being planned, together with the staff. A participatory approach is being used by creating five different Eco-teams focusing on the five chosen topics.

Each Eco-teams is composed of 3 to 5 persons and is followed by an eco-counsellor. They are meeting every 2 weeks over a period of 12 months where ideas, problems, actions and results are exchanged between the eco-counsellor and the staff. A real internal dynamic is thus created. Each employee of the opera has been informed on the project and on the utility of the Eco-teams by a short brochure.

The defined indicators will be used for benchmarking as:

- best-practice figures for theatres can be worked out to give an orientation for others. The idea is to create common indicators that will also be used for the Opera Houses in Stockholm, Sweden, and the Opera House in Vienna, Austria.
- best-in-class figures of indicators are putting pressure on other organisations achievements.
- internal benchmarking over time and comparisons among different sections of the organisation.

- best-in-class indicators available for a large number of companies and other interested parties. Those indicators could be published on the internet and then be publicly available to any stakeholders.

3.2.2.1.Indicators used for the Royal Opera House are, per Eco-team

Table 3.2. Indicators used for the Royal Opera House

Eco-team	Operational indicators	Indicators on the management culture or practice
Hazardous products	Number of toxic products Total number of products	Number of Bio products Number of Potential Bio products
Management of waste	Kilo of waste per employee	Number of different containers
Energy	KWh used Opera representation	"Energy Star" labelled copiers and computers Total copiers and computers
Paper	Kilo of paper used Copier	Kilo of recycled paper Kilo of total paper used
Mobility	Km of personnel transportation a year	Number of km done by truck a year Number of km done a year

Some general knowledge Indicators

- Number of MSDS sheets / Number of hazardous substances
- Number of employee contacted by the eco-teams [4]

3.2.3. Environmental control panels in the catering services sector

Company: Sodexho Catering Services

Sector: Gastronomy

Country: Belgium

Company description

The pilot company was Sodexho Catering Services, the world leader in catering services. They manage more than 12,000 kitchens and employ 110,000 persons around the globe. In Belgium alone, they serve some 40,000,000 dishes per year.

Two pilot Sodexho kitchens based in Brussels launched an ISO 14001 process early this year. They developed and used environmental performance indicators to analyse, manage, communicate and follow their main environmental aspects.

Objectives and background

Environmental control panels in the catering services are Environmental Performance Indicators that were specifically defined for this sector. They will be used to set-up a range of standard indicators that can be used by every company of that branch. Best-practice examples will be explored. The best-in-class figures shall serve as an example for other companies how environmental performance can be improved. The indicators are also used for internal benchmarking over time and comparisons among different sections of the company.

Methodology and description

The catering service industry have a specific structure: the organisational and ownership structure is mostly the one of a big company (one buyer of food and means, one main administrative unit), but the production of food takes place in many kitchens of different sizes. The kitchens are organised very similarly, as they have to fulfil strong hygienic requirements etc. Therefore the multiplayer effect of the project is high. The indicators for the kitchens can be used immediately for an internal benchmarking.

The different project steps are:

- The company explores the significant environmental aspects of its activities, involving management and staff. They will be supported by an eco-counsellor that is available one day per month for each company.
- Generic and specific Environmental Performance Indicators will be defined and introduced. The environmental information has to be precise and meaningful to be understood by all company staff and the interested outside world.
- Approaches to Eco-management "light" for 12 months will be tested

The defined indicators will be used for benchmarking:

- With the indicators that will be defined, best-practice figures for the specific sector can be worked out to give an orientation for other companies in the same branch as well as other interested stakeholders, e.g. NGOs,

environmental consultants etc. They will help to analyse environmental performances in other companies in a more efficient way. E.g. a part of the work was implemented together with a technical institute, a part of the University of Louvain-la-Neuve in Belgium, which has a lot of background on energy efficiency in the catering sector. They were able to give us some best-in-class energy consumptions for different materials used in the kitchens. We exchanged information and made some real-time cost-effective simulations about electricity consumption and reduction of different installations. After these simulations, the company made some investments to lower the electricity consumption of these installations.

- The best-in-class figures of the indicators are putting a pressure on companies on what other companies already achieved, also on an international level.
- The indicators will be used for internal benchmarking over time and comparisons among different sections of the company.
- To make the best-in-class indicators available for a large number of companies and other interested parties, they will be published on the internet.

3.2.3. Indicators for the catering services industry are:

Operational indicators

- Gr of waste/dishes served
- kWh use of electricity / dishes prepared
- Liters of Cleaning product / year / m2 surface of then kitchen
- % of non-sorted waste
- km made by car by workers / total km made by workers
- number of different cleaning products
- Number of refrigerators using CFC or HCFC
- Hours of lightning / day

Indicators on the management culture or practice

- % of ecologically-friendly ingredients/total ingredients
- % of dishes from ecologically-friendly agriculture/ dishes prepared

- Biodegradability of the cleaning products
- Number of different waste containers

Knowledge Indicators

- number of trained staff / total number of staff
- number of environmental communication tools for the workers (video, guide, maps, etc.)
- Hours taken for environmental communication / week

Some examples:

Table 3.3. Some Example Indicators For Catering Sector

Catering (kitchen)	Indicator	Site A	Site B
Mobility	km travelled by car by workers * 100	0 %.	25 %
	total km travelled by workers		
Waste output	gr waste	120 gr	95 gr
	dish served		
Energy input	kWh electricity	3,5 kWh	6,5 kWh
	dish served		
Cleaning index	Litres cleaning product	0,75 lit.	0,5 lit
	m^2 surface		
Communication index	Hours for env. communication	1,5 hrs.	0,5 hrs
	Week		

The way of communicating the indicators is very important, e.g.: for the use of paper towels the analysis showed, that all Belgian kitchens together were using enough paper towels a year to cover 60 football fields.

Difficulties and barriers that have been overcome

The main difficulty was to involve everybody in the company. As the kitchens are physically separated from the management structure, it was difficult to create a bottom-up dynamic between the workers in the kitchen and the management structure. There were not enough human and financial resources to maintain this dynamic. So it is decided to appoint an environmental co-ordinator for each kitchen and one for the management structure. This created a dynamic of exchanging information and allocated the resources to fulfil the project. [5]

4. BENCHMARKING OF WATER UTILITIES

4.1. Introduction

Benchmarking of water utilities is a practical and economical method to develope utilities' performance. Today, in the world the are some databases and benchmarking networks designed for water utilities. It enables the utilies in this global world to benchmark their capabilities with other utilities.

Performance Indicator Systems for Benchmarking Processes

There are some over-arching principles that will guide development of this data system. Some of them are summarized below.

- Performance indicator systems have limitations largely because the organizations that contribute data are different. Governance, budgeting processes, strategic goals, climatic conditions, geologic conditions, age of facilities, regulatory requirements, raw water quality, the make-up of wastewater, population density, and numerous other factors contribute to these differences. It is recognized that utilities will need to be cautious when using the information for comparative analyses. Arbitrary comparisons will usually be meaningless. Therefore, the system (Benchmarking Process) will contain data for a number of demographic characteristics to assist analysts with making meaningful comparisons.
- The performance indicator system will serve as a starting point for benchmarking. The system will contain indicators, not firm standards of performance. The system will serve well to identify apparent high performers and their counterparts that might benefit from added study to determine whether some sort of change is needed. The system is not intended, nor will it be useful, as a scorecard.
- The indicators may have nearly universal application and they may fit the units of measurement already in place at most utilities. Since units will be

designated, some utilities may need to adjust their systems or convert units to make use of the data.

- Basic uses for these indicators include: comparative analysis with other utilities, possible comparative analysis with other industry groups with similar indicators; identification of potential best practitioners for further study and comparison of practices, and internal trend analysis.
- Having considered each indicator individually, all data will be attributed to the source. For most utilities, all of the needed data is of public record. To be useful for identifying potential benchmarking partners, analysts will need to know the source of that data.
- Data will be updated annually. That frequency seems to balance costs of maintaining the system with usefulness of the data. Options exist for defining what will constitute a year. We may settle on a calendar year so data from all respondents is based upon the identical period. Or, we may collect data for the most recently completed fiscal year, recognizing that data from some utilities might be older than that from others.
- Through Benchmarking, the system can serve both water and wastewater utilities. There will be a single system to contain demographic information and performance indicators for any water, wastewater, or joint water/wastewater utility that wishes to participate.

4.1.2. Why Performance Indicators ?

Performance Indicators Emerge from Performance Measurement Systems

A few utilities have used formal systems of performance measurement for years. Others are just now beginning to appreciate the value of a system of measures to accompany planning targets. Many of those experienced in the use of performance measurement systems advise that organizations consider tiers of measures to support the data needs of different levels of management. Those responsible for specific projects establish and track detailed achievements or measures indicative of their success. Those in middle management establish measures reflective of their broader responsibility. Executives want information that allows them to confirm the health of the entire organization. Each part of the system has a small number of measures useful to those using that information.

A system of performance indicators will have meaning in the context of the performance measurement systems used at the organizations supporting the system. Indicators allow for comparison between organizations and they allow for trend analyses within a single organization. Because they have broad application and are of continual interest, it is possible to define indicators compatible with the measures used by middle and upper management.

4.1.2.1.Utility Benchmarking

In some countries regulators routinely publish indicators of utility service performance through the local media. And maybe exposing the “worst in class” has proven to be a powerful way of pressuring utilities to provide better services to consumers. By focusing political attention on service quality, benchmarking can also help to shield regulators from political interference. The requirements for effective benchmarking are: choosing indicators that are verifiable, consistent with long-term incentives for good performance, and easy for the public to understand.

Benchmarking empowers a broad section of civil society to ask why one service provider has achieved demonstrably better performance than another, or why some companies choose to ignore effluent discharge standards. Mobilizing consumers in this way is likely to lead to demands on the regulated utilities—whether private or public—to improve performance.

Performance benchmarking has become standard practice in the regulated utilities of England and Wales—with considerable success. There the water and sewerage companies provide the regulator, Ofwat, with indicators of service performance covering water supply (water pressure, hosepipe bans, and quality of drinking water), sewerage service, customer service (number of complaints), and environmental impact (leakage, pollution incidents). Ofwat publishes the indicators annually in an easy-to-digest format accompanied by commentary. Figure 1 illustrates Ofwat’s total “score” for water supply, sewerage service, and customer-service performance by U.K. water and sewerage companies. These simple performance scorecards have helped to pressure the “worst in the class” to improve their game and allowed the “best in class” to gain reputation.

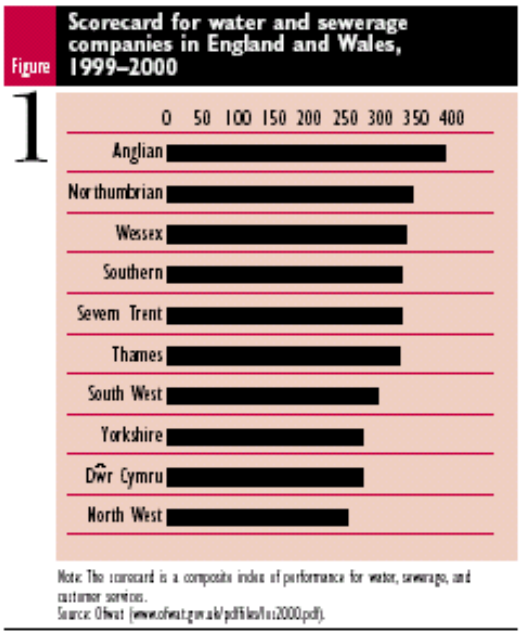


Figure 4.1. Scorecard for Water and Sewerage Companies in England and Wales

Some developing countries have adopted performance benchmarking techniques for similar purposes—and with similar results. For example, in São Paulo, since the introduction of pollution tests and public reporting of results in 1991, 95 percent of the industries that had been pumping untreated effluents into the river have installed waste treatment units to avoid paying fines and seeing their names published. Indonesia's environmental regulatory agency, BAPPEDAL, has developed a simple, color-coded rating system to monitor industry compliance with national environmental standards. Publication of the ratings has brought about spectacular improvements in pollution abatement (World Bank 1999). Procuraduría Federal de Protección al Ambiente, Mexico's environmental enforcement agency, announced last year that it would begin to publish information on the environmental performance of 3,000 industries to provide incentives to reduce contamination. Ratings will include recommendations on how to achieve acceptable environmental performance.

4.1.2.2. Barriers

The power of public reporting seems obvious. So why is it not more widespread? Many of the reasons stem from the legacy of decades of

public sector operation of utilities, or from the presence of vested interests antagonistic to public reporting of performance.

. Insufficient data

The performance of public sector service providers is typically not closely monitored by national policymakers and donor agencies in a format that identifies the best in the class or the underachievers. Data are more likely to reflect either broad policyoriented themes or specific information useful for public investment purposes. Sectoral agencies may be unwilling to report or record information on the extent of underachievement, preferring to focus on actions that enhance specific agency interests—such as new investment programs—rather than those that will benefit consumers.

. Low consumer expectations.

In many countries basic services such as water supply, sanitation, and rural electricity have been provided at subsidized prices, and when consumers are not charged economic costs for services, their tolerance for inefficiency and poor service increases—“You get what you pay for!” Only when services are billed at their true economic value do consumers begin responding to differentials in service quality.

. Powerful vested interests.

In most countries the commercial and industrial elite have strong lobbying powers. Those powers will be used to resist any public reporting system that threatens to expose poor—even illegal— practices and lead to increased costs and adverse public sentiment.

. Conflicts of interest.

Many monopoly service providers are either public agencies or parts of local government. They not only provide but also regulate services—supposedly in the best interests of the consumer. Publicly reporting the agency’s performance therefore directly reflects on the action, or inaction, of the local or national government. So there is a tendency to cover up poor performance.

. Culture of underachievement.

Ideally, pointing the finger at poor performance should be a wake up call for an institution to do better. In many developing countries, however, poor performance is used by institutions to justify demands for more resources.

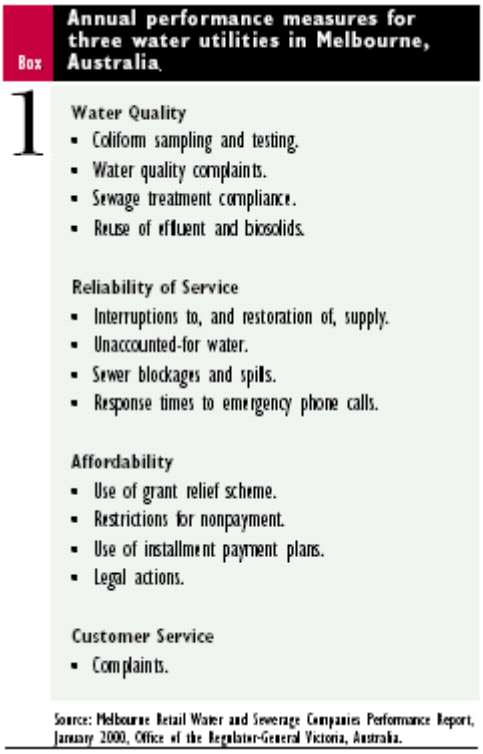
Rather than promoting improved performance, public reporting can open a floodgate of demands from underachievers.

. Inconsistencies in policy framework.

The problems of consumer apathy, conflicts of interest, and other organizational issues sometimes arise because the basic rules of a sector are inconsistent with rational economic principles. In such cases utilities may not be able to do much on their own to lift performance. The policy framework within which the sector operates must be reformed so that pricing, investment, financing, and operational rules will combine to induce producers to provide services that customers want, are willing to pay for, and are sustainable in the long term.

The basis of an effective performance reporting system is good data, the right indicators, clear presentation, and credible public debate.

Measurable and meaningful indicators of performance should reflect obvious features of the product or service so as to allow customers to understand variations in service performance between different entities and over time. Indicators may focus on quality, efficiency, affordability, or comparative performance. Some may be expressed as indexes adjusted for different operating conditions. In Victoria, Australia, the Office of the Regulator-General (box 1) publishes annual performance results for the three regulated water distribution companies in Melbourne. The indicators include water quality (for example, tests per 1,000 customers and the percentage of samples meeting guidelines), the number of interruptions in service, amount of water not accounted for by the utility, response times to emergency calls, number of complaints, and need for payment assistance.



Box 1 Annual performance measures for three water utilities in Melbourne, Australia

Water Quality
- Coliform sampling and testing.
- Water quality complaints.
- Sewage treatment compliance.
- Reuse of effluent and biosolids.

Reliability of Service
- Interruptions to, and restoration of, supply.
- Unaccounted-for water.
- Sewer blockages and spills.
- Response times to emergency phone calls.

Affordability
- Use of grant relief scheme.
- Restrictions for nonpayment.
- Use of installment payment plans.
- Legal actions.

Customer Service
- Complaints.

Source: Melbourne Retail Water and Sewerage Companies Performance Report, January 2000, Office of the Regulator-General Victoria, Australia.

Figure 4.2. Annual Performance Mesures for three Utilities in Melbourne

Indicators should draw on data that are reliable, relatively easy to collect (or of such importance that they ought to be collected anyway), and not susceptible to multiple interpretations. They should reflect conditions over which the service providers have control. Indicators that offer an indisputable basis for judgment are not easy to find. Even the process of measuring some indicators can lead to disputes. For example, of the various methods of estimating water not accounted for, which should be used? Performance results must be communicated a way that will allow the public to make an informed assessment of relative performance and gauge realistically the extent to which improvements should be expected. Long lists of indicators are not necessary; they will be expensive to prepare and may obscure the message. Results may be publicized in many ways. The Web is a convenient place to post performance results, but in most countries newspapers, television, and radio are likely to be more effective in bringing the messages to the attention of the public. The service provider is not the only entity that will be scrutinized when performance reports are issued. The body that prepares the report must also be prepared for media attention. It must be sure that its commentary is fair and objective, and that it can publicly defend its analysis if required. The publication of data also

may tempt some participating organizations to cheat on their performance reports. Routine or random independent audits of the processes of compiling and reporting data may be required to solve the cheating problem.

4.1.2.3. Compiling and Reporting Results

If a formal regulatory agency already exists, it should take the lead. Where the regulator is also the service provider, however, as in the case of locally provided services, responsibility might fall to a specialized municipal performance monitoring unit or to citizen groups. The organization responsible for data collection and reporting may change over time. A private organization might start an initiative that is later adopted by government. Bangalore's nongovernmental Public Affairs Centre, for example, produces a scorecard for performance of the city's public services. The group's presentations are discussed in well-attended town hall meetings and followed up by the local media to pressure providers to improve services. The Public Affairs Centre has now taken the initiative to extend its activities and benchmark the quality of basic services across 22 major states in India.

Consumer advocates and pressure groupscan play a powerful role in mobilizing public opinion in response to published information. Independent analysis lends punch to the data. The international donor community can also help by compiling and presenting comparative performance information. In the water sector the Asian Development Bank has published a comprehensive assessment of utility performance in its Second Water Utilities Data Book (McIntosh and Yniguez 1997). The World Bank, working with many partners, recently launched an international benchmarking network for water and sanitation utilities on the Web.

Samples from the World Bank

All the companies in the sample are utilities responsible mainly for urban centers with service areas covering a city, region or country. The population to be served by these utilities ranges from about 0.2 million to over 17 million. In terms of the service provided these utilities can be divided into three groups: water [11], waste water (4 - all in Korea) and water and waste water [19].

All the public utilities have some degree of autonomy in the sense that they manage, at least, their own budget. However, their autonomy, regulatory system, sector policies and political forces that shape the behavior of these companies are not thoroughly documented in the source reports to allow a meaningful analysis. Therefore, information on these factors, important as they are, is not documented here.

Table 4.1. Sample Utilities from Worldbank's Data

Table 1

Country	*Name of Utility*	*Area Serviced*	*Type of Utility*
Latin America:			
Brazil	Sao Paulo State Water Co.	**State of Sao Paulo**	Regional/Public
Brazil	Sta. Catarina State Water Co.	**State of Sta. Catarina**	Regional/Public
Brazil	Minas Gerais State Water Co.	**State of Minas Gerais**	Regional/Public
Chile	Obras Sanitarias of Valparaiso	**Metropolitan Valparaiso**	Municipal/Public
Chile	Empresa Municipal Obras Sanitarias	**Metropolitan Santiago**	Municipal/Public
Colombia	Water & Sewage Co. of Bogota	**Metropolitan Bogota**	Municipal/Public
Costa Rica	Inst. of Water & Sewage of C. Rica	**70% of the Country**	National/Public
Africa:			
Algeria	Water Supply Co. of Oran	**Oran, Tiemcen, Ain &Mascara**	Regional/Public
Algeria	Water Supply Co. of Annaba	**Annaba & El Tarf Areas**	Regional/Public
Ghana	Ghana's Water & Sewerage Corp.	**40% of the Country**	National/Public
Morocco	National Office of Potable Water	**75% Urban Morocco**	National/Public
Nigeria	Katsina State Water Board	**50% of Katsina State**	Regional/Public
Nigeria	Kaduna State Water Board	**50% of Kaduna State**	Regional/Public
Europe/Central Asia:			
Turkey	Bursa's Water Supply & Sewrg. Auth.	**Metropolitan Bursa**	Municipal/Public
Turkey	Ankara's Water Supply & Sewrg. Auth.	**Metropolitan Ankara**	Municipal/Public
South & East Asia:			
Pakistan	Karachi Water & Sewerage Board	**Metropolitan Karachi**	Municipal/Public
China	Changchun Water Supply Co.	**Metropolitan Changchun**	Municipal/Public
Korea	Kwangju Cosntruct. Bureau (Sewrg. Div.)	**Metropolitan Kwangju**	Municipal/Public
Korea	Pusan City Govmt. (Sewerg. Division)	**Metropolitan Pusan**	Municipal/Public
Korea	Seoul Sewerage Division	**Metropolitan Seoul**	Municipal/Public
Korea	Taejon City Govmt. (Sewerg. Division)	**Metropolitan Taejon**	Municipal/Public
Philippines	Metrop, Waterworks & Sewrg. System	**Metropolitan Manila**	Municipal/Public
High Income Countries:			
Belgium	Compagnie Intercommunale Bruselloise des Eaux	**Brussels area and surroundings**	Municipal
England	Wessex Water	**Central/South**	Regional/Private
France	Banlieue	**Metro Area/Paris**	Private
France	Bordeaux	**City**	Private
France	Societe des Eaux de Marseille	**City**	Private
Germany	Hamburg	**City**	Public
Japan	Osaka	**City**	Public
Japan	Tokyo	**Capital City**	Public
Singapore	Public Utilities Board	**City/State**	Public
Spain	Aguas de Alicante	**City**	Municipal/Private
Spain	Aguas de Murcia	**City**	Municipal/Private
Spain	Aguas de Torrevieja	**City**	Municipal/Private

Table 4.2. Utilities' Values From World Bank's Data

Table 2						
Utility	*Year of Information*	**Annual Water Production Mill. m^3**	*Connections '000*[a/]	*Service Provided*	*Population '000*	*Population* **Served %**
Sao Paulo	1988	**1959**	5080	**W & S.**	17,500	**90** [b/]
S. Catarina	1990	**236**	529	**W & S.**	3,000	**85** [b/]
Minas	1990	**712**	1870	**W & S.**	7,600	**96** [b/]
Valparaiso	1990	**137**	526	**W & S.**	760	**97** [b/]
Santiago	1994	**475**	1811	**W & S.**	5,000	**100** [b/]
Bogota	1990	**537**	1542	**W & S.**	5,000	**94** [b/]
Costa Rica	1991	**194**	437	**W & S.**	1700	**84** [b/]
Oran	1992	**122**	204	**Water**	1,900	**68**
Annaba	1992	**85**	34	**Water**	600	**73**
Ghana	1988	**127**	197	**W & S.**	7,400	**60** [c/]
Morocco	1990	**460**	601	**Water**	11,300	**90**
Katsuna	1990	**13**	21	**Water**	520	**55**
Kaduna	1990	**68**	43	**Water**	1,600	**76**
Bursa	1991	**89**	307	**W & S.**	710	**91** [b/]
Ankara	1988	**176**	832	**W & S.**	2,200	**93** [b/]
Karachi	1989	**470**	1023	**W & S.**	6,300	**N.A.**
Changchun	1990	**170**	388	**Water**	1,600	**90**
Kwangju	1990		96 [d/]	**Sewrge**	1,100	**91** [d/]
Pusan	1990		287 [d/]	**Sewrge**	3,700	**95** [d/]
Seoul	1990		1575 [d/]	**Sewrge**	8,700	**72** [d/]
Taejon	1990		90 [d/]	**Sewrge**	1,000	**87** [d/]
Manila	1988	**172**	641	**W & S.**	5,000	**87** [d/]
Brussels	1991	**N.A.**	N.A.	**W & S.**	1,000	**N.A.**
Wessex	1991	**N.A.**	N.A.	**W & S.**	N.A.	**N.A.**
Banlieue	1987	**N.A.**	N.A.	**Water**	N.A.	**N.A.**
Bordeaux	1982	**N.A.**	N.A.	**Water**	N.A.	**N.A.**
Marseille	1992	**N.A.**	N.A.	**W & S.**	1,000	**N.A.**
Hamburg	1990	**N.A.**	N.A.	**Water**	1,900	**N.A.**
Osaka	1990	**N.A.**	N.A.	**Water**	1,200	**N.A.**
Tokyo	1990	**N.A.**	N.A.	**W & S.**	4,900	**N.A.**
Singapore	1994	**394**	760	**Water**	2,800	**100**
Alicante	1990	**35**	170 [b/]	**W & S.**	600	**100** [b/]
Murcia	1992	**32**	85 [b/]	**W & S.**	335	**100** [b/]
Torrevieja	1992	**6**	46 [b/]	**W & S.**	200	**100** [b/]

N.A: Not Available
a/ Includes W and S connections for W & S utilities
b/ Corresponds only to Water services
c/ Includes 2.1 million inhabitants in rural areas (17% of the total population)
d/ Corresponds to sewerage services only.

4.1.2.4. Creating The Right Incentives

The penalties and incentives of performance reporting are clear enough in the case of private providers: Bad press can affect stock prices and public perceptions, and good press can boost market share and sometimes ease regulatory burdens. But because of the institutional problems discussed earlier the picture is not so clear for the public sector. Certainly, doing well can earn good publicity. Doing badly, on the other hand, can have several outcomes, including requests for more resources.

In the end the public sector must shoulder the burden of addressing how incentives and penalties can best be arranged to enhance performance using the results of public performance reports. How? “Bottom of the class” agencies seeking concessional financing from national government or international financial institutions could be required to prove that their poor performance was due to factors beyond their control. At the other end of the spectrum “top of class” agencies should be rewarded for their superior performance.

By exposing poor performance public reporting makes service providers more accountable to the public and thus increases their motivation for improvement—to the benefit of the end user. Government and donor agencies can do more to encourage public performance reporting and to help guide the effective use of scarce resources.

“Worst in the class” performance must not be seen as a route to additional resources but rather as a clear challenge to do better. [6]

4.2. Benchmarking Programs Developed in Worldbank and AWWA (American Water Works Association)

There are only a few benchmarking programs and networks in the world today. Worldbank and American Water Works Association (AWWA) has useful programs for water utilities.

4.2.1. Benchmarking Programs Developed in Worldbank

There is a Benchmarking Start-Up Kit designed for member utilies in Worldbank. Firsty this kit explains the performance indicators and than decribes the other steps of the it.

4.2.1.1. A Start-Up Kit For Benchmarking Water & Sanitation Utilities

This kit is made available to partners interested in compiling cost and performance data for water and wastewater utilities.Through a variety of different routes, both formal and informal, it is hoped that this information will be shared with peers within and across countries. It is part of an effort to build better and more accessible comparison and evaluation tools for the water sector.

Inter utility performance comparison is needed in the water sector, because the sector offers limited scope for direct competition. Firms operating in competitive marketplaces are under constant pressure to out perform each other.Water utilities are sheltered from this pressure, and it shows: some utilities are on a sustained improvement track, but many others keep falling further behind best practice. Performance differentials are striking, even across countries at similar income levels.

This matters, because a well-run water utility is essential to people's lives. Only the most efficient, financially viable utilities are able to respond to urban growth, connect the poor, and improve wastewater disposal. Access to comparative information will support the development of such well-run companies by providing key stakeholders with the information they need to do their jobs better:

• Utility managers and employees, to identify areas for improvement, adopt realistic targets and—not least—convince authorities of the need for change
• Governments, to monitor and adjust sector policies and programs
• Regulators, to ensure that customers get value, and that providers have incentives
to perform and will stay financed if they do
• Customer groups and NGOs, to exercise "voice" in an informed way
• Aid agencies and advisers, to identify what works, advise their clients accordingly
and back the advice with convincing "before-after" stories
• Private investors, to identify viable markets and opportunities for creating value.

Provision of comparative information in the water sector has improved in the 1990s, as countries have privatized service delivery and started

building regulatory capacities.The United Kingdom is most advanced in the publication of comparative utility data as part of its regulatory regime. Newly established regulatory bodies in Brazil and Peru are now using the core indicators presented in this kit as part of their oversight activity. Internationally, the Asian Development Bank has been a pioneer with its Utilities Handbook, widely referred to by water company managers in Asia. New initiatives are under way in the Baltics, where a group of utilities are benchmarking against each other and their Nordic “twins,” and in Africa a

regional grouping (Water Utilities Partnership) has started an effort to develop and share performance indicators across the continent.

These efforts are promising, but international data sets will be hard to develop:

• It is difficult to agree on a universal set of indicators and their detailed definitions
• The availability of reliable data can be limited
• Comparisons between countries can be influenced by the different operating environment each faces
• The usefulness of an indicator, and its likelihood to be monitored, varies across countries.

Given these difficulties and the sector’s decentralized organization, it is unlikely that a central monitoring system can or should be developed. A more feasible objective, enabled by the Internet, is for a distributed network of stakeholders to build their own monitoring capacities and make their data available publicly on a voluntary basis. If shared definitions are used by a sufficient number of participants, at least for a core set of indicators, this network will add value to all its users and contributors by providing them with useful international comparative information. The Benchmarking Water and Sanitation Utilities: A Start-Up Kit has been developed to support the above concept. In it it will be found:

• A set of core indicators on which stakeholders can build their own customized measurement and monitoring system
• A data listing complete with robust data definitions
• A data capture system that also calculates the complete indicator set
• A route to share information via the World Bank Water Help Desk

4.2.1.2. Core Indicators

Selection of appropriate cost and performance indicators will depend on the situation facing each utility as well as the target audience for the information. Policymakers are looking for highly aggregated information, while utility managers want to see detailed activity costs. The indicators in this kit are presented under a number of headings (see core indicator categories at the table).They are considered a minimum (core) set and were developed in discussion with Bank staff, consultants, and country partners working in the water sector. Likely availability of data was a critical factor in the selection of indicators. The set will not, and is not intended to, fulfill the needs of all the stakeholders in all water and sanitation utilities. Such comprehensive measurement sets would list many pages of indicators, data items, and their associated definitions.

Most utilities will, however, benefit from knowing how they perform in each of these core ratios, how their ratios are trending over time, and how they compare with their peers—nationally and internationally. It is expected that each utility will enhance this core set by adding its own utilityspecific indicators. Such indicators might consider manpower, cost, financial, or quality of service issues, which are of particular relevance to the utility and its stakeholders. In the short term some of the core indicators may require data that is not currently collected by all utilities. It is expected that this will be rectified over time as users begin to appreciate the value of understanding their comparative performance in these key areas.

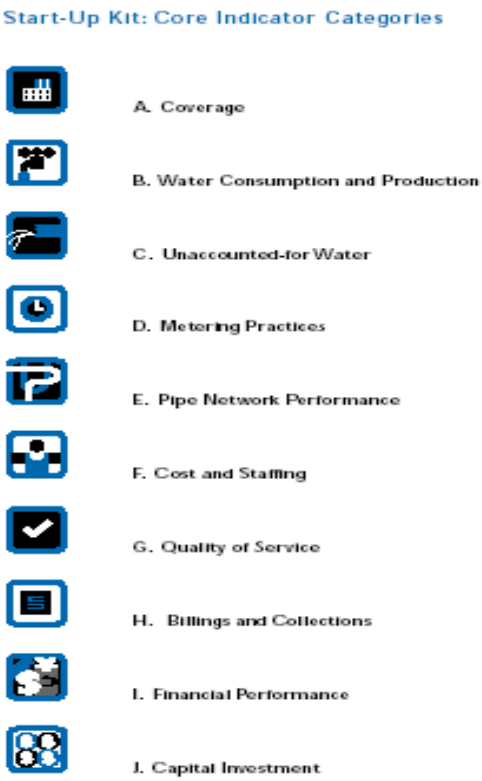


Figure 4.3. Core Indicator Categories in Star-Up Kit

4.2.1.3. Typical Results

The indicators compiled by an individual utility are highly relevant for establishing targets and monitoring trends within that utility.They are at their most powerful, however, when shared with peers so that inter utility comparisons can be made.

The figures on the right illustrate the type of comparative assessments that are possible when utilities share data. They show a “snapshot” of staffing levels per thousand connections in a number of different countries. These results allow managers and other stakeholders to understand relative performance, both within a country and between countries. Clearly the greater the number of individual utilities contributing data, the greater the benefit is to the group as a whole. Similar analyses are possible for all the core indicators. The data can also be presented in alternative ways. For example, core indicator values can be compared for similar-size utilities around the world or for all utilities within a particular geographic region. The Start-Up Kit allows annual data to be entered for the period 1994 to 1998. Updates of the kit will be issued in the future.Trend analyses for each indicator are therefore also available to users. Ideally, the data made

available from partners will be attributed to named utilities. This will open up the opportunity to identify and contact better-performing utilities to find out what actions they took to achieve their superior performance.

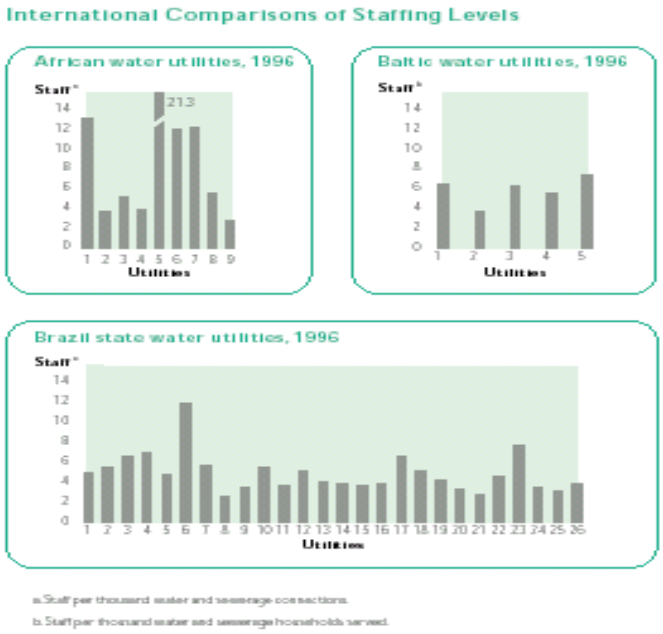


Figure 4.4 International Comparisons of Staffing Levels (The World Bank, May 1999)

4.2.1.4. Core Indicators and Definitions

Introduction

This initiative is aimed at facilitating the sharing of cost and performance information between utilities and between countries. Managers and other stakeholders can draw on this comparative information to help them strengthen the performance of the sector. The initiative addresses the key barriers to sharing that previously existed, namely, a lack of consensus on which indicators to use, a lack of consistent data definitions and a lack of routes by which to share the results.

A minimal set of indicators have been developed based on extensive discussion with partners around the world. These are called the core indicators. Some definitions for the data have been developed and tested to compute the core indicators.

An excel spreadsheet is provided containing the core indicator values for this region/country. The user can undertake customized analyses using this information. [7]

Types of Indicators

The complete set of core indicators are presented below. At any country/region, there will be values for some or all of the indicators, for one or multiple years. The indicators are seen as the minimum needed to provide managers and other stakeholders with an insight into the performance of their utility, compared with others. [8]

Table 4.3. Indicator Definitions

01,1 Water Coverage
02,1 Sewerage Coverage
03,1 Water Production
03,2 Water Production
03,3 Water Production
04,1 Total Water Consumption
04,2 Total Water Consumption
04,3 Total Water Consumption
05,1 Metered Water Consumption
05,2 Metered Water Consumption
05,3 Metered Water Consumption
06,1 Unaccounted For Water
06,2 Unaccounted For Water
06,3 Unaccounted For Water
07,1 Metering Level
08,1 % Sold that is Metered
09,1 Pipe Breaks
09,2 Pipe Breaks
10,1 Sewerage Clogs
10,2 Sewerage Clogs
11,1 Unit Operational Cost W&S
11,2 Unit Operational Cost W&S
12,1 Staff/'000 W conn
12,2 Staff/'000 W&S conn
12,3 Staff/'000 W pop Served
12,4 Staff/'000 W&S pop Served
13,1 Labor costs vs operating costs
14,1 Contract out serv costs vs Oper costs
15,1 Continuity of service
16,1 Complaints of W&S services
17,1 Wastewater treatment
18,1 Average tariff W&S
18,2 Average tariff W&S
18,3 Average tariff W&S
19,1 Total revenues per service pop/GDP
20,1 Residential fixed component of tariff
20,2 Residential fixed component of tariff
21,1 Ratio of industrial to residential
22,1 Connection charge - water
22,2 Connection charge - water
22,3 Connection charge - sewer
22,4 Connection charge - sewer
23,1 Collection period
24,1 Working ratio
25,1 Debt service ratio
26,1 Investments
26,2 Investments
27,1 Net fixed assets/capita

Explanatory Factors Accompanying Indicator Values

When making cost and performance comparisons between utilities using the core set of indicators it is important to try and select "comparator" utilities that allow "like for like" comparisons to be made. To assist users in making these selections the indicator values for each utility have an associated set of Explanatory Factors attached to them. [9] These are:

Utility size band

Utility size is often a driving force in establishing performance. Large utilities can achieve economies of scale which are not open to smaller utilities. Beyond a certain size, however, economies of scale are believed by many to be linear. In this initiative utilities have been allocated to size bands based on population served as follows:

Small (range $\leq$ 125,000)
Medium (range 125,000 - 500,000)
Large (range $\geq$ 500,000)

Range of services provided

Many of the indicator values will be impacted by whether a utility provides only one service or many. Indicators have been developed which attempt to normalize for this effect (e.g. by providing both staff/'000 water connections and staff/'000 water & sewer connections). Selection of comparator utilities which provide similar services will also help when making inter utility comparisons. The following categories have been used:

A Water only
B Sewerage only
C Water and sewerage
D Water, sewerage and other

Extent of private sector involvement

The impact of the private sector on utility performance is an issue of interest to many managers and stakeholders. The following categories have been used to measure the extent of private sector contributions to utility operations:

A None
B multiple service contracts
C management contract(s)
D lease contract(s)
E concession contract(s)
F BOOT/BOT(s)
G full divestiture to private sector

4.2.1.5. CORE INDICATORS FOR WATER AND WASTEWATER UTILITIES [10]

OPERATIONAL INDICATORS

Indicator Definitions

- Coverage
- Water Consumption and Production
- Unaccounted for Water
- Metering Practices
- Pipe Network Performance
- Cost & Staffing
- Quality of Service
- Billings & Collection
- Financial Performance
- Capital Investment

A. Coverage

A.1 Indicators

INDICATOR	UNIT	CONCEPT
1. Water Coverage	%	Population with easy access to water services (either with direct service connection or within 200m of a standpost)/total population under utility's nominal responsibility, expressed in percentage.
2. Sewerage Coverage	%	Population with sewerage services (direct service connection)/total population under utility's notional responsibility, expressed in percentage.

Table 4.4 Coverage Indicators

A.2 Discussion

Coverage is a key development indicator. Both coverage indicators are impacted by currency of census data. The need to estimate populations served by standposts will affect the confidence that can be placed in the water coverage measure.

Coverage provides insights into the extent of the infrastructure provided but not aspects of quality of service. This is discussed in Section G - Quality of Service.

B. Water Consumption and Production

B.1 Indicators

Table 4.5. Water Consumption and Production Indicators

INDICATOR	UNIT	CONCEPT
3. Water Production	lpcd m3/conn/m m3/hh[1]/m	Total annual water supplied to the distribution system (including purchased water, if any) expressed by population served per day; by connection per month and by household per month.
4. Water Consumption	lpcd m3/conn/m m3/hh[1]/m	Total annual water sold expressed by population served per day; by connection per month and by household per month
5. Metered Water Consumption	lpcd m3/conn/m m3/hh[1]/m	Total annual metered water consumed expressed by metered population served per day; by metered connection per month and by metered household per month.

Note 1: household.

B.2 Discussion

Theoretically the "best" water consumption indicator is expressed in terms of lpcd. However there are data problems. Particularly:

- lack of accurate total consumption data (for example from universal metering)
- poor quality, or out of date, census data

While the accuracy of service populations may need improvement, utilities are often more confident in the number of connections in their system, and the number of households they supply. In addition water production figures may be known more reliably than those for water consumption.

To draw on these other sources of (potentially) more reliable data a number of indicators have been included. These will allow trending analyses to be undertaken within a utility. Inter utility comparisons will be more difficult, however, given the different mix of household sizes and dwellings served by one connection. This is especially the case between utilities in different countries. Homogeneity of household size, and dwellings per connection, within a country will allow informed in-country comparisons to be made.

C. Unaccounted for Water

C.1 Indicators

Table 4.6. Unaccounted for water

INDICATOR	UNIT	CONCEPT
6. Unaccounted-for-Water	% m3/km/d m3/conn/d	Difference between water supplied and water sold expressed as a percentage of net water supplied; as volume of water "lost" per km of water distribution network per day; and volume of water "lost" per water connection per day.

C.2 Discussion

Unaccounted for water represents water that has been produced and is "lost" before it reaches the customer (either through leaks, through theft, or through legal but non monitored usage). Part of this unaccounted for water can be saved by appropriate technical and managerial actions. It can then be used to meet currently unsatisfied demand (and hence increase

revenues to the utility), or to defer future capital expenditures to provide additional supply (and hence reduce costs to the utility).

There is a debate as to the most appropriate measure of unaccounted for water. A percentage approach can make utilities with high levels of consumption, or compact networks, look to be better performing than those with low levels of consumption or extensive networks. To capture these different perspectives the reporting of three measures of unaccounted for water has become the norm.

D. Metering Practices

D.1 Indicators

Table 4.7 Metering Indicators

INDICATOR	UNIT	CONCEPT
7. Proportion of connections that are metered	%	Total number of connections with operating meter/ total number of connections, expressed in percentage
8. Proportion of water sold that is metered	%	Volume of water sold that is metered/ Total volume of water sold, expressed in percentage

D.2 Discussion

Metering of customers is considered good practice. It allows customers the opportunity to influence their water bills, and provides utilities with tools and information to allow them to better manage their systems.

The indicators provide two separate perspectives on the issue, both of which are relevant in their own right. Taken together the indicators provide insights into the effectiveness of a metering installation strategy (the ratio of indicator (8)/(7) indicates the extent to which a utility is targeting large water users as the highest priority).

E. Pipe Network Performance

E.1 Indicators

Table 4.8. Pipe Network Performance Indicators

INDICATOR	UNIT	CONCEPT
9. Pipe Breaks	breaks/km/yr. breaks/conn/yr.	Total number of pipe breaks per year expressed per km of the water distribution network; and per number of water connections
10. Sewerage Blockages	blockages/km/yr. blockages/conn/yr.	Total number of blockages per year expressed per km of sewers; and per number of sewerage connections.

E.2 Discussion

The number of pipe breaks, relative to the scale of the system, is a measure of the ability of the pipe network to provide a service to customers. The number of breaks can be normalized by the length of the network and the number of connections.

The rate of water pipe breaks can also be seen as a surrogate for the general state of the network, although it reflects operation and maintenance practices too. It must be recognized, however, that highly aggregated reporting can hide the fact that sections of the network may be perpetually failing, whilst much of the remainder is in reasonable condition.

Sewer blockages are, likewise, a measure of the ability of the sewer network to provide a service to customers. Blockages can reflect a number of issues including the effectiveness of routine operations and maintenance activities, the hydraulic performance of the network, and the general condition of the pipes.

F. Cost and Staffing

F.1 Indicators

Table 4.9 Cost and Staffing Indicators

INDICATOR	UNIT	CONCEPT
11. Unit Operational Cost	US$/m3 sold US$/m3 produced	Total annual operational expenses[1]/Total annual volume sold. Total annual operational expenses[1]/Total annual water produced.
12. Staff/'000 Water conn. Staff/'000 W&S conn. Staff/'000 water pop served Staff/'000 W&S pop served	# # # #	Total number of staff expressed as per thousand water connections; per thousand water and sewerage connections; per '000 water service population and per '000 water and sewerage service populations.
13. Labor Costs as a proportion of Operational Costs	%	Total annual labor costs (including benefits) expressed as a percentage of total annual operational costs.
14. Contracted-out service costs as a proportion of operational costs	%	Total cost of services contracted-out to the private sector expressed as a percentage of total annual operational[1] costs.

Note 1: Annual operating expenses exclude depreciation, interest and debt service

F.2 Discussion

Unit operational costs provide a "bottom line" assessment of the mix of resources used to achieve the outputs required. The preferred denominator related to operational costs is the amount of water sold. This ratio then reflects the cost of providing water at the customer take off point.

Lack of universal metering, doubtful accuracy of many household meters, and a focus in the past on water production, mean that an alternative measure of operational cost per cubic metre of water produced is also relevant in the short term.

Staff costs are traditionally a major component of operating costs. Understanding staffing levels can often give a quick guide to the extent of overmanning in a water utility. While preferable to allocate staff to either water or sewer services, this information is often not available. The staff ratios therefore use both the number of water connections, and the total number of water and sewer connections as denominators. Comparisons are best made between utilities which offer the same scope of service both in terms of total size, and mix of water and sewer service. Note that with increasing use of outside contractors (see ratio (14)) the emphasis on staff numbers will become less relevant. At the current time, and in the developing world, it is still considered a very relevant indicator.

The number of people served per connection varies from country to country depending on the housing stock and different approaches to service connections. To facilitate international comparisons a denominator of populations served has also been included.

The relative weight of labor costs compared to total costs are captured in ratio (13). Utilities are often over staffed and this measure provides insights into the impact of possible changes in future staff numbers.

Ratio (14) quantifies the degree to which outside (private) contractors are used to provide the utility service. Contracting out is seen by many as one route to improve utility performance.

G. Quality of Service

G.1 Indicators

Table 4.10. Quality of Service Indicators

INDICATOR	UNIT	CONCEPT
15. Continuity of Service	Hrs/day	Average hours of service per day for water supply.
16. Complaints about W&S services	% of W&S conn	Total number of W&S complaints per year expressed as a percentage of the total number of W&S connections
17. Wastewater treatment	%	Proportion of collected sewage that is treated by at least primary treatment (including screening).

G.2 Discussion

Historically there has been limited attention paid to measures that capture the quality of service provided to customers. This, in fact, should be a particular focus of performance measurement, especially with the emphasis currently being placed on the use of output measures to monitor service provision.

The measures presented above are a limited first step in the process of capturing information on quality of service. Complaints, while relatively easy to track, give only a glimpse of actual company performance - consumers may have become accustomed to poor service and do not complain. In other instances there are poor, or non existent, mechanisms in place to report complaints. Capturing at least some customer derived data, however, is considered an important starting point.

Collection of wastewater does not mean that the waste is fully treated before discharge back to the environment. This indicator will provide an understanding of the amount of effluent that is discharged without any material treatment by the utility.

A more comprehensive set of quality of service indicators could be developed but the likelihood of the data being collected by utility managers is limited in the short term. Expansion of the set is therefore a medium to long term objective.

H. Billings and Collections

H.1 Indicators

Table 4.11 Billings and Collections Indicators

INDICATOR	UNIT	CONCEPT
18. Average Tariff W&S	US$/m3/yr. US$/conn./yr. US$/hh/yr.	Total annual operating revenues (W&S) expressed by annual amount of water sold; by number of connections and by households served.
19. Total Revenues per population served/GDP	%	Total annual operating revenues per population served/National GDP per capita; expressed in percentage
20. Residential fixed charge	US$/conn./yr. %	Any fixed component of the residential tariff (total amount) and as a proportion of the average tariff per connection per year.
21. Ratio of industrial to residential charges	%	The average charge (per m3) to industrial customers compared against the average charge (per m3) to residential customers.
22. Connection charge	US$ and % GDP - water US$ and % GDP- sewage	The cost to make a residential pipe connection to the water system and the sewer system measured in absolute amount and as a proportion of national GDP per capita.
23. Collection Period	Months	Year-end accounts receivable/Total annual operating revenues expressed in months equivalent of sales.

H.2 Discussion

What people pay for water and sewer services is important. As in other indicators, unreliable consumption information necessitates the use of multiple measures for average tariff (i.e. per cubic meter, per connection, and per household).

High tariffs may reflect the degree to which sewer services are provided. The average tariff used in this indicator does not explicitly account for different services provided and any inter utility comparisons should take this into account.

Average tariffs need to be put in the perspective of affordability. Income data, however, is not easy to obtain. The indicator selected here, therefore, compares average per capita tariffs as a proportion of per capita GDP. GDP will be for a whole country, and not reflect local variations, but is considered adequate for the broad comparisons to be made at the current time. Inter country comparisons will be hindered by the variable relationship that exists between GDP and income, but the trend for this ratio within a country will provide insights into changes in the relative cost of water.

Some utilities use fixed charge components within the residential tariff (i.e. irrespective of the amount of water consumed). Such tariffs can adversely affect low volume water consumers. They also protect the revenue stream to the utility in periods when consumption is highly variable. Comparison of the fixed component with the average tariff will give an indication of the relative weight of the fixed and variable component of a water bill.

There may be a cross subsidy between industrial consumers and residential consumers. The ratio of the average charges (per m3) to industrial and residential customers provides some quantification of this subsidy. Subsidies are complex and this ratio provides only a simplistic assessment of the situation in any utility.

Paying for the service is an on going expense. For many, the cost of connecting to the pipe network can be a significant financial hurdle. Comparing connection charges will provide insights onto the level to which this hurdle has been raised. It is a particular issue when seeking to connect

poorer sections of the community. The indicator provides the absolute level and as a proportion of national GDP per capita.

Billing customers, and getting paid are two different things. The effectiveness of the collections process is measured by the amount of outstanding revenues at year end compared to the total billed revenue for the year. This is expressed in month equivalents.

I. Financial Performance

I.1 Indicators

Table 4.12 Financial Performance Indicators

INDICATOR	UNIT	CONCEPT
24. Working Ratio	#	Total annual operational expenses/Total annual operating revenues
25. Debt Service Ratio	% Operating Revenues	Total annual debt service expressed as a percentage of total annual operating revenues.

I.2 Discussion

These indicators have been selected from a much larger range of financial indicators (which include other leverage, liquidity, profitability and efficiency ratios). They help answer two important questions:Do revenues exceed operating costs ? and What is the fixed hurdle of debt repayment as a proportion of utility revenue ?

J. Capital Investment

J.1 Indicators

Table 4.13 Investment Indicators

INDICATOR	UNIT	CONCEPT
26. Investments	% Operating Revenues US$/c.	Total annual investments expressed as a percentage of total annual operating revenues; and per (water) capita served.
27. Net Fixed Assets/capita	US$/c	Total annual net fixed assets per (water) capita served.

J.2 Discussion

Investment will fluctuate from year to year and the indicators selected will reflect this variation. An inter utility comparison in any one year will likely have a great range of values. Over time, however, rolling average indicators can be calculated that will allow an impression of the steady state level of investment to be observed.

The capital intensity of the utility is captured by the net fixed assets per capita served indicator. Unfortunately there is often limited information available about asset values and until more emphasis is placed on this item the values derived must be treated with caution.

4.2.1.6. The Benchmarking Water and Sanitation Utilities Project

This project facilitates the sharing of cost and performance information between utilities and between countries by creating a network of linked Web sites, through global partnership efforts. Each Web site presents values for a set of core cost and performance indicators for a utility, or utilities, in that particular region or country. The project is in collobration with the World Bank Water Supply & Sanitation Group and sponsored by countries' local utilities or agencies.

AFRICAN UTILITIES

Overview

The Benchmarking Water & Sanitation Utilities Project facilitates the sharing of cost and performance information between utilities and between countries, through global partnership efforts. Each partner presents values for a set of core cost and performance indicators for a utility, or utilities, in that particular region or country. The value of the network increases with each new partner.

Sample of African Utilities

This data presents results for the water service function only of a sample of water and sanitation utilities in Africa. The results are based upon a survey undertaken as the first stage of the Performance Indicators (PI) Project, carried out by the Water Utilities Partnership for capacity building (WUP), which is based in Abidjan, Ivory Coast. The PI project is a far reaching, and ambitious project, which is seeking to compile cost and performance data from across the African continent, and to work with utility managers to use this information as a vehicle for improving utility performance through the use of benchmarking techniques. The WUP PI project ran in parallel with the World Bank's Benchmarking Start Up Kit initiative. [11]

In the first stage of the PI project, it was decided to try and collect data only from active members of the Union of African Water Suppliers (UAWS/UADE) and other utilities that attended any of the various project workshops organised by WUP across the continent. The utilities that filled in and returned the questionnaires provided data for period ranging from 1 to 3 years - most from 1995 to 1997. Most of the utilities provided data for 1996 and hence comparison will mostly be based on that years data.

The performance indicator values presented here consist of the results from 9 utilities from 9 African countries. (It is estimated that there are about 150 water and sanitation utilities in Africa). The institutional arrangements vary from privately operated utilities i.e. SODECI in Cote D'Ivoire to Government owned i.e. Rand Water in South Africa. Some of the utilities only provide water supply and others provide both water supply and sewerage services. Rand water is a bulk water supplier while others like

Windhoek municipality is a retailer of the water i.e. they purchase already treated water from a water company -NAMWATER. The information used to derive the indicator values was taken from responses to the questionnaire sent to each participating utility.

Indicator Values

Partners will want to undertake a range of different analyses. To enable a full range of customized analyses to be undertaken the indicator values for this country/region are contained in excel files . Some utilities prefer to remain anonymous when sharing their indicator values. Utilities are therefore referenced by a unique number, as a minimum. To allow performance comparisons to be made between utilities a set of key explanatory factors are provided for each utility. These explanatory factors are:

- Utility size band (in terms of population served)
- Range of services provided (water, sanitation, both, other)
- Extent of private sector involvement

The indicator values for this country/region are contained in Appendix A.

SAUDI ARABIA UTILITIES

Overview

The Kingdom of Saudi Arabia faces among the world's most severe water supply challenges, with only 400 m3/capita of annual renewable water resources. In the face of these pressures, the Kingdom has done a remarkable job supplying potable water to its population. However, at least 10 percent of municipal residents still lack piped water supplies and over 60 percent are unserved by wastewater collection and treatment. (12)

The Kingdom has met the water and wastewater challenges through a generous program of subsidies to water and wastewater utilities, subsidies that have kept consumer prices low even as supply and treatment costs rise. Although water is one of the Kingdom's most precious natural resources, people do not use it carefully. Reported urban average consumption of up to 400 liters/capita/day (lcd) shows that many people do not conserve water. They do not use the low flow shower heads, water

saving washing machines and toilets, drip irrigation for gardens, and other devices which would reduce consumption of this scarce resource. This compares with the situation in many European cities where consumption is typically less than 200 lcd. The reason is easy to understand. People only conserve things that are expensive or hard to find. In the Kingdom, a family of six can use 500 lcd before the water charge goes above 15 halals (4 Cents) a cubic meter. Clearly there is a need for both demand side and supply side reforms. It is in this context that the water sector ministry MoMRA (Ministry of Municipal and Rural Affairs) decided to undertake a performance benchmarking exercise.

MoMRA undertook their first benchmarking study in 1997. A World Bank Mission at that time collected data, and prepared comparative analyses, for the Water & Sewerage Authorities (WASA) in the Kingdom. For many WASA this was the first time such comprehensive performance analysis had been undertaken. In November 2000 MoMRA decided it was time to update the benchmarking exercise. In order to facilitate both national and international comparisons MoMRA decided to use the World Bank's "Benchmarking Start Up Kit" (The "Kit"). The kit was translated into Arabic and issued to WASA in December 2000. The first set of results were presented at a workshop in May 2001 with results for the four years 1997 to 2000. An excellent achievement. The results are presented in the downloadable spreadsheets below.

The exercise uncovered particular challenges in terms of reporting data consistently and accurately and all WASA are now working hard to make the data set more comprehensive and of a higher quality.

MoMRA and the WASA are also critically aware of the need to use the results of the benchmarking exercise to improve service performance. This initial analysis is therefore seen as a starting point in a longer term program of performance improvement within the sector. This will include the use of a range of performance improvement techniques such as Best Practice Benchmarking, and improved networking amongst sector professionals.

Indicator Values

The indicator values for this country/region are contained in Appendix A.

BALTIC STATES

Overview

The indicator values presented on this node come from five utilities in the Baltic region, which participated in a World Bank funded project to improve water supply services and to reduce environmental pollution entering the Baltic Sea. A major benchmarking initiative was launched as part of the project, which facilitated the routine sharing of information between the utilities across a wide range of performance measures. [13]

The data used to compile the core indicator values presented are a sub set of the dataset shared by the five utilities. Some points to note when reviewing the indicator values provided:

- Much of the population live in apartment blocks for which there is a single connection. Values of indicators using "connection" as the denominator are therefore comparatively high.
- Some utilities provide additional services outside their natural municipal boundary. As a result some coverage indicator values exceed 100%.

The five utilities are described below:

Daugavpils, (population of 120,000) is the city in the eastern Latvia (Latgale) on the border with Lithuania and Belarus. It is located on the Daugava River and is a central point on the rail route between Warsaw to St. Petersburg. Daugavpils is an industrial city with a variety of industries including textile, locomotive repair, machine factories and other plants.

Daugavpils (SIA Daugavpils Udens) Water and Wastewater Company is a closed joint stock company and the municipality controls 100% of stock.

Haapsalu, (population of 17,000) is a resort town on the west coast of Estonia. The city was established in 13th century. The mud bath based tourism is the main development activity and many tourists (mainly from Finland) are coming here.

Haapsalu Municipal Water and Wastewater Company (Haapsalu Veevärk AS) is a closed joint-stock company and it controls 100% of assets.

Klaipeda, (population 201,000) is Lithuania's port city on the Baltic Sea and is the third largest town in the country. It is located on the very southern seashore of the Baltic Sea, at a strait connecting the Kursiu Marios Lagoon

with the sea. Klaipeda is one of the largest commercial and fishing ports on the Baltic Sea.

Klaipeda Water and Wastewater Company (AB Klaipedos vanduo) is an open joint-stock company. It can trade its stocks on the stock exchange, but for the moment does not do that. The control package is in hands of the municipality.

Liepaja, (population of 100,000) is a Latvian city and an ice-free sea port on the eastern coast of the Baltic sea established in 1625. It has developed railroad infrastructure and an airport. Liepaja seaport recommenced commercial activities in 1992 after being a Soviet naval base. It handles Ro-Ro cargo, steel and metals, pulpwood, general cargo, dry bulk cargo and others. The Liepaja Free Economic Zone established in the seaport area provides additional opportunities for investors.

Liepaja Water and Wastewater Company (Privatizejamais pašvaldibas uznemums Liepajas udens) is a closed joint-stock company and the municipality controls 100% of stock.

Siauliai, (population of 147,000) the industrial and cultural center of the northwestern Lithuania, was established in 1236. Essentially an industrial city, Siauliai is also the home of a Pedagogical University and the Siauliai University.

Siauliai Water Supply and Sanitation Company (UAB Siauliu vandenys) is a joint-stock company with a 100% stock belongs to the municipality.

Indicator Values

Indicator values for this country/region are contained in excel files in Appendix A.

MOLDOVA

Overview

Moldova is located in Eastern Europe bordering Romania and Ukraine. Population 4.2 million (2001). Forty-two percent lives in urban area. Municipal water supply system serves with water 75% and with wastewater services 57% of urban population.

Water systems' capacity is 0.7 million cum.m/day (including 0.23 million cub.m/day from the underground sources). Total length of the water network is 3,300 km. Municipal wastewater network has a capacity of 0.65 million cub.m/day. Length of the wastewater network is 1,730 km. Total wastewater discharge form the wastewater networks was 92.5 million cu.m in 2001 of which 95% underwent least primary and secondary treatment. Population consumes 65% of the water and wastewater services (in monetary value), industries and commercial organizations - 27.4%, and budget entities - 7.6%.

Water and wastewater sector employs more than 5,500 workers and engineers in Moldova.

Water utility association Moldova Apa Canal is a non-for-profit professional association of the water utilities of Moldova. It was established on August 16, 2000. Thirty-eight water utilities are members of the association. Three design institutes and several NGOs participate in its activities. Twelve staff members of the association Apa Canal Moldova provide technical assistance to the utility-members of the association, help in investment projects, guide with the water reform, and represent the utility-members in contacts with governmental institutions and local administration.

The study was developed with the financial support of the Ministries of Environment of Norway and Germany under supervision of the EAP Task Force of OECD. [14]

Indicator Values

The indicator values for this country/region are contained in Appendix A.

RUSSIAN FEDERATION

Node Overview

In the Russian Federation 1,082 cities (or 99.1% of cities) and 1,687 small towns (or 90% of small towns) have centralised water systems. Total capacity of the water systems is 90 million cubic meters a day. Average domestic consumption is 225 litres per capita a day, however a substantial part of Russian regions have no more than 150 litres of water per capita a day.

Wastewater capacity in Russia is 56.1 million cubic meters a day. Wastewater utilities process around 87% of wastewater discharged, and only 14% of this volume is treated according to the standard. Water infrastructure and networks are municipal property with rare exception. There are several regions in Russia where water supply systems are regional property. There are also cases where wastewater works are the property of the local industry.

In any town with a population above 70,000 there is usually a special water and wastewater utility. If the population is below this level, then there is one integrated utility that provides all communal services, such as water and wastewater, solid waste removal, and heat and electricity services. Gosstroi of Russia is the national agency that regulates all issues related to the communal services, including water and wastewater services.

The data that is presented covers more than 90 Russian municipal water and sewerage utilities in essentially four regions (Samara oblast, Krasnodar krai, Leningrad oblast, Perm oblast, and few others from northwest Russia) serving over 7.6 million residents (5.2% of total population in Russia). The Institute for Urban Economics collected the information with the organisational support of the EAP Task Force of the OECD and financial support from the governments of Germany and Finland. The Institute for Urban Economics (IUE) is a non-governmental and non-profit organisation, established in 1995. It conducts research and feasibility studies in municipal sector of the Russian Federation.

Indicator Values

To enable a full range of customized analyses to be undertaken the indicator values for this country/region are contained in Appendix A.

UKRAINE

Node Overview

In Ukraine 448 cities (or 100% of cities) and 796 small towns (or 89% of small towns) have centralised water systems. Only 23% of about 29,000 villages have waterworks. The total capacity of the water systems is 8.3 million cubic meters a day, which is provided through 75,000 km of the water network. Wastewater capacity in Ukraine is 7.1 million cubic meters a day. Wastewater utilities process almost 100% of the wastewater

discharged. Water infrastructure and networks are municipal property with rare exception.

The data that is presented covers more than 60 Ukrainian municipal water and sewerage utilities in four oblasts (Kharkiv, Mykolayiv, Lviv, and Transcarpatia) serving over 5.8 million residents (10% of total population in Ukraine).

The Design Institute for Communal Services of Ukraine (UkrNIIProgress) collected the information with the organisational support of the EAP Task Force of the OECD and financial support from the government of Germany. UkrNIIProgress conducts scientific research in water and wastewater infrastructure and economics, solid waste and wastewater sludge collection and utilisation. [16]

Indicator Values

To enable a full range of customized analyses to be undertaken the indicator values for this country/region are contained in Appendix A.

UNITED STATES

US Investor Owned Utilities

The vast majority of American water and sanitation utilities are municipally owned and operated. Only some 15-20% of the population receives its water services from privately owned and operated water companies. These are referred to as "investor owned water utilities". They are regulated by State based regulators (often called Public Utilities Commissions (PUC) or Board of Public Utilities (BPU)). Almost no wastewater services are privately owned and operated. A number of municipally owned utilities have their operations (both water and wastewater) contracted out to the private sector.

The indicator values presented here consists of the results from 89 privately owned and operated utilities with annual revenues greater than $1 million. The information used to derive the indicator values was taken from the 1996 report "Financial and Operating Data for Investor Owned Water Utilities" prepared by National Association of Water Companies (NAWC). NAWC does not audit the information provided by the water utilities and there are no guarantees as to its accuracy nor the consistency of reporting

between companies. Similar information is provided by the water companies to the State Regulators.

The investor owned utilities tend to be relatively small. Those that are large (> 1 million people served) are usually aggregations of smaller systems which have been purchased by a single company. These aggregations allow economies of scale to be achieved. For the three largest investor-owned companies (American Water Works Company, United Water Services and Philadelphia Suburban), such aggregations occur on a state by state basis. Each company comprises a number of state based organizations e.g. New Jersey American is the company within the American Water Works group which serves communities across the state of New Jersey.

Ownership of the investor owned water companies is varied and changing. Historically investors have been institutions and individual stockholders. Recently there have been a number of acquisitions by British and French water companies. In addition consolidation is occurring within the industry on an ongoing basis with companies buying each other to consolidate geographic strongholds, or to expand their portfolio of holdings across the nation.

An investor-owned water utility uses a combination of private capital and borrowed funds to build and expand its system. Access to private capital eliminates the need to issue municipal bonds and reliance on limited public capital to maintain a reliable and safe water supply. All costs are covered by rates or fees for service.

NAWC is the national trade association that exclusively represents the private and investor-owned water utility industry in the United States.

In compiling the core indicator values presented in the downloadable spreadsheet the following simplifying assumptions were made where data was not explicitly available:

a. The sum of Long Term Debt Repayment and All Interest Expense was assumed to be equivalent to Debt Service;

b. All connections were assumed to be fully metered, and as a result all water sold is considered metered;

c. Systems are mature and coverage is assumed at 100%;

d. A household is assumed to be the same as a residential connection - most properties have their own meter. This may lead to some differences in data reporting as some apartment buildings have only a single master meter for the building, while others have meters at each dwelling unit; and

e. Supply was assumed to be uninterrupted - 24 hours/day.

Data on customer service is not available for each utility. A 1995 NAWC report "Customer Service Practices of the Investor Owned Water Utilities" showed, however, the following aggregate indicators:

- Per year, utilities serving between 30,000 and 99,999 connections received, on average, 412 service related complaints, 880 billing complaints, and 316 other complaints (1,608 total); and
- Per year, utilities serving over 100,000 connections received, on average, 405 service related complaints, 722 billing complaints, and 1,834 other complaints (2,961 total).

The information provided in this site has been prepared by consultants working for the World Bank. The NAWC has not endorsed the performance measures used on the site, which have been developed by the World Bank to facilitate performance comparisons between water utilities around the world. [17]

Indicator Values

To enable a full range of customized analyses to be undertaken the indicator values for this country/region are contained in Appendix A.

UNITED KINGDOM (ENGLAND AND WALES)

Node Overview

Background and Support

The provision of UK data in World Bank Start-Up Kit format has been funded by the UK Department for International Development as part of its support to a project by the Water Utilities Partnership (WUP) Africa to develop a pan-African Service Providers Benchmarking Network project (SPBNET.Africa). The World Bank is also a long tern supporter of WUP. WRc plc, as Benchmarking Advisor to SPBNET.Africa, has compiled the the UK data and is hosting this node to provide additional comparative data for use by African Utilities and World Bank Start-Up Kit users generally.

UK Water Sector

The history of the United Kingdom water industry is complex. Today, its organisation varies in different parts of the UK for a variety of geographical, social and political reasons. Water and Wastewater Services in England and Wales are entirely provided by the private sector under the economic regulation of the Office of Water (Ofwat). Those in Scotland and Northern Ireland are provided by the public sector under different regulatory regiemes.

This Node deals only with the private companies serving England and Wales and utilises publicly available performance data produced annually by Ofwat. Similar publicly available data is currently unavailable for Scotland and Northern Ireland

England and Wales

In England and Wales 10 privatised companies provide both water and wastewater services while 16 water supply companies provide drinking water only to their customers.

The water service companies were created in 1989 by the privatisation of ten publicly-owned water authorities, whose areas of responsibility were based on major river catchments. The 16 water supply companies have always been in the private sector and many date back to the 1800s.

In almost all of the 10 water and wastewater company service areas there is a part of the service area which is provided with water by one or more of the 16 water supply companies. Thus the 10 water and wastewater companies will generally serve more customers with wastewater than with water. The indicator values presented below show coverage related to water customers in a service area. Thus many of the 10 water and wastewater companies show sewerage coverage exceeding 100%. [18]

Indicator Values

The indicator values for this country/region are contained in Appendix A.

INDIVIDUAL UTILITY PARTNERS

Node Overview

Individual utilities which are not part of country or regional groupings have provided Core Indicator Values. These have been compiled into the single downloadable spreadsheet below.

Indicator values are presented in non attributable form in the spreadsheet. Many utilities are, however, willing to reveal their name, and to provide links to their web sites. Information about these utilities are provided below :

Individual Partner Websites

The indicator values for Individual Partners are presented in non attributable form. Many of the Individual Partners are in fact willing to have their data presented attributably, and to provide links to their home pages. These are listed below:

Utility ID#	Utility Name	Utility Web Address
3	Western Water, Australia	http://www.westernwater.com.au
4	Scotland	http://www.esw.co.uk/
6	SONEDE, Tunisia	

Table 4.14 Individual Partners' Links

Country names are normally provided in the spreadsheet except where there are a limited number of utilities per country. In this case the country name may be replaced with a region.

Indicator Values

A full range of customized analyses to be undertaken the indicator values for this country/region are contained in Appendix A. Some utilities prefer to remain anonymous when sharing their indicator values. Utilities are therefore referenced by a unique number, as a minimum.

4.2.2. Benchmarking Programs Developed in American Water Works Association – AWWA

In United States, there are many thousands of water , wastewater and water&wastewater enterprises. They all make efforts to evaluate performance of their activities. In addition to their efforts a big number of them join to Qualserve – Benchmarking Clearinghouse Applications of AWWA. Qualserve is an utility improvement program. It is a new program and has always new additions with workshops and developing researches.

4.2.2.1. Benchmarking Clearinghouse Applications

Improving its performance is the best way water or wastewater utilities can deal wit ever-tightening water-quality regulations, consumer demands for better quality and service, and escalating operating costs.

But before improving utility's performance, it is needed to find out how it measures up against industry performance standards. It is needed to know the benchmarks.

That is why Benchmarking Clearinghouse was developed. Benchmarking Clearinghouse is a database of water and wastewater utility performance benchmarks. It will provide the most complete, accurate, and current water and wastewater utility benchmarking data available.

Long used in the private marketplace to help companies gain competitive advantage, performance benchmarks are now being discovered by water and wastewater utilities. Benchmarking Clearinghouse allows utilities to aggregate their resources to build metric and process tools specific to their operations. Utilitis can make significant improvements quickly by applying the benchmarks.

The American Water Works Association (AWWA) and the Water Environment Federation (WEF) co-sponsor the three QualServe programs. All are designed to assist water and wastewater utilities with developing agendas for improvement that reflect their individual needs. Over 100 utilities have completed the self-assessment and peer review programs.

The American Water Works Association Research Foundation (AwwaRF) has provided financial assistance toward development of the Clearinghouse. In early 2000, representatives of several water and wastewater utilities from throughout the United States and Canada

gathered to identify the benchmarking services valued most. They suggested AWWA provide networking opportunities, a code of conduct, communications, training, benchmarking study protocols, a data base of performance indicators suitable for comparative analysis, analytical capability, and affiliation with a premier benchmarking organization, to support benchmarking in a variety of utility settings.

A project to develop performance indicators was approved for funding by AwwaRF in 2001. Twenty-one representatives of water and wastewater utilities, and four consultants noted for their benchmarking work, were invited to participate with QualServe staff and the AwwaRF project advisory committee in the project. In the first phase, it is examined a variety of similar systems in use world-wide, plus related research completed through AwwaRF and the Water Environment Research Foundation (WERF). After the research was completed it has been shared with project participants.

Benchmarking Clearinghouse provides 27 key benchmarks in five areas of water and wastewater utility operation: Organizational Development, Business Management, Customer Relations, Water Operations, and Wastewater Operations. More benchmarks will be developed as the program progresses.

Descriptions of the 27 proposed performance indicators are presented in Appendix B. It is unlikely that all of these will be selected for implementation. The aim is to settle on a selection of between 5 and 20 that provide good coverage of water and wastewater utility operations. At least one will be selected from each of the five QualServe business systems. Crosswalks will be made to other systems such as the American Productivity & Quality Center's Process Classification Framework, to assist those who have developed the performance measurement systems using those formats.

In keeping the size of this review package manageable, it is have provided concise descriptions of each indicator. Actual surveys to collect data will provide additional background on those selected along with expanded definitions of the data elements needed to support the indicator and additional guidance where terminology alone will not overcome ambiguity.

Benchmarking Clearinghouse is a joint program of the American Water Works Association (AWWA) and the Water Environment Federation (WEF), two of the largest technical and educational organizations for water quality professionals.

These two organizations created Benchmarking *Clearinghouse* to provide a suite of products and services unmatched by any other program. As a member of Benchmarking Clearinghouse –

- A member will have access to the operating practices of the best-run municipal water and wastewater utilities in North America.
- A member will receive the annual Performance Indicators Report, the most highly valued report of its kind in the water and wastewater supply field.
- A member will be able to compare his utility's practices with others of the same size, geographic location, water source, management model, or treatment process.
- A member will discover which of his practices meet, exceed, or fall short of industry standards.
- A member will be assured that his utility data is kept confidential. His data will be anonymously compiled with other summary data to produce a national benchmarking database.
- A member will be able to network with other *Benchmarking Clearinghouse* members through the Benchmarking Website to share information, ask questions, and gain new perspectives and fresh ideas.
- A member will receive free registration to two benchmarking workshops.
- A member will have access to staff for assistance in program management, business planning, contract management, and identifying benchmarking topics.

Benchmarking is third arm of QualServe^{tm}, the joint AWWA / WEF utility quality program. When used together with Self-Assessment and Peer Review*,* the other two parts of the program, Benchmarking Clearinghouse provides a comprehensive program of continuous quality improvement for water or wastewater utilities.

4.2.2.2. QUALSERVE

What is Qualserve

QualServe is a voluntary, continuous quality improvement program offered by the American Water works Association (AWWA) and Water Environment Federation (WEF). QualServe provides powerful tools - Self-Assessment, Peer Review, a Benchmarking Clearinghouse, Accreditation(under development), and Customer Satisfaction Surveys (under development) - to help your utility improve service across the entire scope of its operation and to help design your own agenda for continuous quality improvement. The quality improvement programs are based on a series of consensus "best practices" in each of the business process areas that span the entire scope of utility operations and services. Using QualServe will not only help your utility survive the forces that are changing the drinking water and wastewater industries, but thrive in them.

The development of QualServe

QualServe was started by the AWWA in 1997 as a voluntary program that used self-assessment and peer review methods (and benchmarking as a future addition) to identify opportunities for improvement in drinking water utility services. In 1998, the WEF joined with AWWA to expand the program to include wastewater operations. The self-assessment consists of a survey instrument that is administered to utility employees to determine the degree of conformance with a sampling of "best practices" for all of the business process areas of utility operations. The peer review uses teams of trained utility professionals to conduct on-site evaluations to uncover strengths and opportunities for improvement across the entire breath of utility services. All of the QualServe programs are designed to be “user paid” and financially self-sustaining. The development of additional program elements such as benchmarking, customer satisfaction surveys, & accreditation were envisioned from the beginning.

The quality improvement continuum

Participating in QualServe is part of the continuous quality improvement continuum designed exclusively for water and wastewater utilities. QualServe helps your utility assess where it is now and where it is going. The QualServe process helps your management identify both what your utility is doing well and what it might improve. QualServe does not supply

all the answers and all the solutions. Rather, the program gives your utility the basis for designing its own agenda for improvement.

Many quality improvement systems incorporate the same major elements. These steps to achieve continuous improvement have been proven in industry, business, education, medical care, and not-for-profit organizations. Although the steps may have different names, they generally follow a sequence of four major elements: self-assessment, peer review, benchmarking, and accreditation.

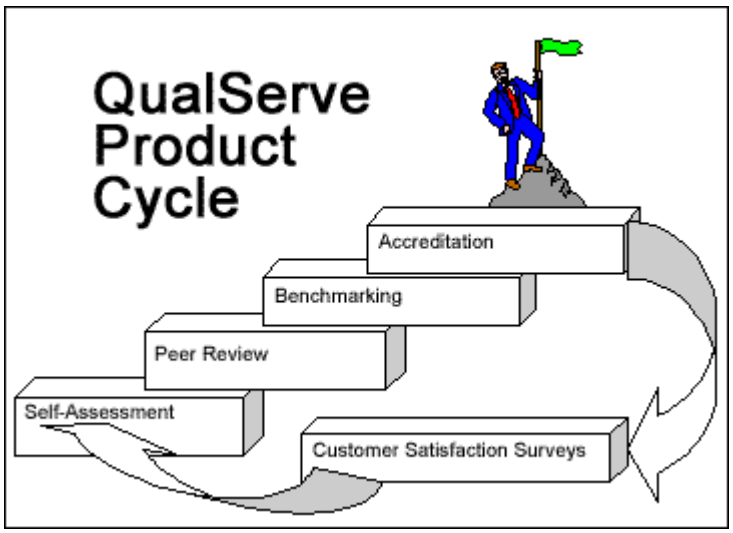


Figure 4.5. Qualserve Product Cycle

The illustration above shows that each step requires time, effort, and resources. In addition, the completion of each step results in increased quality improvement. It is not necessary or sometimes even desirable, to seek quality improvement by proceeding through each step in the order shown. Some utilities may have sufficient quality systems in place to proceed with benchmarking. A utility may be able to seek QualServe Accreditation in one area of operation without first conducting a QualServe Self-Assessment or Peer Review. These are examples illustrating the flexibility of the QualServe suite of quality improvement programs and their applicability to all levels of quality improvement needs.

How does the utility form an agenda for improvement?

The results of the Self-Assessment and Peer Review tell the utility a great deal about its current condition. This information, when compared to the utility's mission, goals, and current plans, helps the utility identify the performance gaps needing attention first. The agenda for improvement is established by developing a plan to fill these gaps. QualServe is intended

to become the core of the quality management cycle of continuous assessment, planning, implementation, review, and comparison.

QualServe's goals

QualServe's primary goals for drinking water and wastewater utilities are:

- Increase customer satisfaction
- Improve efficiency
- Reduce the need for additional regulations
- Receive recognition from customers, owners, and regulators
- Harness the knowledge and energy of all stakeholders

QualServe Programs

QualServe's utility quality improvement programs strive to satisfy all of the goals listed above. To achieve this objective the program incorporates a suite of services that are integrated to complement and assist utilities in their quest for excellence.

➢ **Self-Assessment**

The Self-Assessment helps the utility to see itself through the eyes of its employees. A utility may participate in the QualServe Self-Assessment alone or in combination with the QualServe Peer Review. Customized surveys are administered to utility employees to determine their opinions regarding conformance with best practices. The results of the survey are summarized in a report format with consultation from QualServe staff. The Self-Assessment will identify the specific areas in which improvement is needed, as well as areas in which your utility is performing at a high standard. This is the first step to start a utility in developing an agenda for improvement.

➢ **Peer Review: A view from the outside**

The QualServe Peer Review is preceded by the QualServe Self-Assessment. The Peer Review is about utilities helping utilities. This is the outsider's perspective, provided by experienced water or wastewater utility professionals that make up a Peer Review Team. With diverse areas of expertise from different utilities across North America, these volunteers identify areas of strength and opportunities for improvement. Combined

with the Self-Assessment, the Peer Review Report further assists the utility with the development of an agenda for improvement.

- **Benchmarking Clearinghouse**

  The QualServe Benchmarking Clearinghouse, now underway, provides a service to utilities that want to go beyond accreditation to identify "best-in-class" practices. The service facilitates benchmarking studies and shares results with subscribers. The process is examined and implemented by the participating utility in its effort to improve.

- **Accreditation**

  This new element is being developed. The program incorporates self-examination processes and independent audit processes to verify conformance with recognized "best practices." The audit process is narrowly focused on the major areas of water and wastewater utility operations. QualServe Accreditation program includes the Accreditation vision and mission, and the Accreditation Policy Committee.

- **Customer Satisfaction Surveys**

  The development of a consistent survey process to gather valid information from customers is an important input to the continuous improvement process. Customer satisfaction is one of the primary objectives of a utility's quality improvement motivation; it is critical to seek this information to gauge successes.

  Qualserve participating utilities are given in Appendix D and a Benchmarking Clearinghouse Survey and instructions are given in Appendix C.

5. APPLICATION

There are some information for two sample utilies given below. There are some lack of data about utility information and performance indicators.

5.1. Sample Utilities

5.1.1. ASAT (Antalya Su ve Atıksu İdaresi)

General Information :

Utility Name	ASAT Genel Müdürlüğü
Utility Location	Kızılsaray Mah. 81 Sok. Ayakkabıcılar İşhanı Kat : 4 Antalya
Contact Phone	0-242-248 94 50 - 5 Lines (PBX) 185 Alo ASAT
Fax	0-242-248-94-50 - 193
Web	www.asat.gov.tr
Coverage Area	Antalya Büyükşehir Belediyesi
Population of Coverage Area	620.000
Services Provided	Water & Wastewater Services
Number of Staff	279

Water Services :

Population Service Provided	620.000
Number of Connections	265.000
Length of Water Distribution System	2.000 km
Water Production	73.577.388 m³ / year (2002)
Water Consumption	27.291.048 m³/year (2002)

Wastewater Services :

Population Service Provided	200.000
Number of Connections	9.500
Length of sewerage network	250 km

5.1.2. İSKİ (İstanbul Su ve Kanalizasyon İdaresi)

Figure 5.1. Picture of ISKI

General Information :

Utility Name	İSKİ GENEL MÜDÜRLÜĞÜ
Utility Location	AKSARAY İnebay Mah. Inkılap Cad. No:34 Aksaray İstanbul
Contact	0212 588 38 00 / 16 57 www.iski.gov.tr
Coverage Area	İstanbul Büyükşehir Belediyesi
Population of Coverage Area	12000000
Services Provided	Water and Wastewater Services
Number of Staff	6910

Water Services :

Population Service Provided	12000000
Number of Connections	≅3,000,000
Length of Water Distribution System	12000 km
Water Production	640000000 m3 /year
Water Consumption	450000000 m3/year

Wastewater Services :

Population Service Provided	12000000
Number of Connections	2,500,000
Length of Sewerage Network	9800 km

5.2. Core Indicators and Utilities' Values

Key water management principles are:

· Water should be treated as both a social and economic good.

· Water should be managed within a comprehensive framework, taking into account crosssectoral considerations.
· Water should be managed at the lowest appropriate level, employing a demand-based approach and facilitating participation of all stakeholders.
· Institutional and policy reforms should be linked to incentives influencing decision making. [19]

The chosen companies are utilities responsible mainly for urban centers with service areas covering a city. The population to be served by these utilities ranges from about 0.6 million to over 10 million. In terms of the service provided these utilities are water and wastewater services.

These public utilities have some degree of autonomy in the sense that they manage, at least, their own budget. However, their autonomy, regulatory system, sector policies and political forces that shape the behavior of these companies are not thoroughly documented in the source reports to allow a meaningful analysis. Therefore, information on these factors, important as they are, is not documented here. Complete information needed to complete all indicator values was not available for the two utilities. Therefore, some of the tables and graphs present information on other utilities.

When choosing the indicators the quality of the management information systems should be assessed before discussing with sector officials about which indicators are important and relevant and to whom and how often they should be reported to. If the management information systems are deficient or information is not produced on time, it is important to develop a reliable system and the incentives to keep it relevant and up to date.

5.2.1. Operational Indicators

Operational indicators can be very useful in assessing the performance of water and waste-water utilities in the course of project formulation and supervision of Bank financed projects and in sector work.

Invariable, any indicator portrays an incomplete picture of an utility as it often excludes other contributing factors of performance such as accountability of institutions and incentives, that are not readily captured or quantifiable. In addition, utilities face different social, political and financial constraints. These factors and constraints need to be taken into account when evaluating the performance of an utility. It follows that indicators

should not be used in a rigid prescriptive fashion, and judgment is required to interpret them or to set acceptable or desirable targets.

The idea of a comprehensive and up to date list of indicators from a large number of utilities world wide is attractive but probably not realistic due to the costs involved in collecting this information. We also recognize the interest in correlating indicators to other variables like city or utility size or to GNP. No attempt, however, has been made in this direction at this time as the data base is still small and, therefore, the conclusions reached form such correlations could be spurious.

Indicators should be used selectively. The use of too many is likely to dilute the power of all of them. Managers may become confused about priorities and burdened by paperwork and overwhelmed by detail. On the other hand, the use of too few may not adequately describe the utility's performance and progress in reaching its goals.

Indicators are as good as the data base from which they are derived. For instance, lack of metering of production or consumption casts doubts about the reliability of estimates on water consumption or water losses. There is also the danger of reducing performance evaluation to numbers and for utility managers and staff to play games with them. Therefore:

· watch out for "creaming", e.g., managers tend to produce the numbers they are asked to deliver.
· anticipate resistance. Hard information about efficiency and effectiveness can be threatening to insecure managers who doubt their ability to compete,
· involve the utility managers in developing corrective measures. This is probably the best way to deal with resistance. Managers need to "own" the specific measures to be implemented and the indicators to be generated and to be convinced that they will help them improve the service they are in charge of, and
· analyze the evolution of the indicators to assess progress or deterioration of utilities' performance.

5.2.1.1. Coverage

Table 5.1. Coverage

INDICATOR	UNIT	ASAT	İSKİ
1. Water Coverage	%	100	100
2. Sewerage Coverage	%	20	100

5.2.1.2. Water Consumption and Production

1. UNIT CONSUMPTION

Total water consumption, based on metered consumption, is reported as:

• average daily consumption per person served (liters per capita per day, lpcd),

• average consumption per connection per month (m3/month/connection, m3/m/c).

Table 5.2. Water Consumption and Production

INDICATOR	UNIT	ASAT	İSKİ
3. Water Production	lpcd m3/conn/m m3/hh[1]/m	337,90 21,71	146,12 17,78
4. Water Consumption	lpcd m3/conn/m m3/hh[1]/m	123,29 7,92	102,74 12,50
5. Metered Water Consumption	lpcd m3/conn/m m3/hh[1]/m		

Note 1: household.

5.2.1.3. WATER DISTRIBUTION SYSTEM

1. LENGTH OF WATER PIPED SYSTEMS

parameters : Proportion of connections that are metered

Proportion of water sold that is metered

Length of the water distribution pipe system as a function of:

• the number of people served [meters/person],

• number of connections [meters/connection].

Table 5.3. Length of Water Systems

INDICATOR	**UNIT**	ASAT	ISKİ
Length of the water distribution pipe system	km	2000	12000
The number of pp served Proportion of conn	M/p m/conn	3,23 7,55	1 4

2. PIPE BREAKS

Table 5.4. Pipe Breaks

INDICATOR	**UNIT**	ASAT	İSKİ
Pipe Breaks	Breaks/km/year Breaks/conn/year	0,36 0,08	- -
Sewerage Blockages	Blockages/km/year	-	-

5.2.1.4. UNACCOUNTED FOR WATER (UFW)

parameters : A percentage of net water production (delivered to the distribution system, % UFW).

Physical [pipe leaks and storage tank overflows]

Commercial [meter under-registration, illegal connections, etc.

1. WATER LOSSES

Unaccounted for water (UFW) is expressed as:

• a percentage of net water production (delivered to the distribution system, % UFW).

• as m3/day/km of water distribution pipe system network (m3/day/km d.s.).

Table 5.5. Water Losses

INDICATOR	UNIT	ASAT	İSKİ
6. Unaccounted-for-Water	%	62,91	26,70
	m3/km/d	75,75	43,38
	m3/conn/d	0,453	0,174

5.2.1.5. WASTE WATER COLLECTION SYSTEMS

1. Length of Sewer Systems

Length of the sewerage distribution systemas a fuction of:

- the number of people served [meters of pipes/person],
- number of connections [meters/connection].

Table 5.6 Wastewater Collection Systems

INDICATOR	UNIT	ASAT	İSKİ
Length of the water distribution pipe system	km	250	9800
The number of pp served	m/p	1,25	0,81
Proportion of conn	m/conn	2,63	3,92

5.2.1.6. WASTE WATER TREATMENT

Table 5.8. ASAT Water Quality Values,2002

Parameters	Standard value	ASAT lab's analysis results	Unit
pH	5,5-8,5	7,0-7,5	-
Total Hardness	Max. 50	28,32	oF
Organic material	Max. 3,5	0,1-1,0	mg/l
Nitrite	Max. 0,05	0,02-0,04	mg/l
Nitrate	Max. 45	10-30	mg/l
Manganese	Max. 0,05	0,01-0,03	mg/l
Amonnia	Max. 0,05	0,00-0,03	mg/l
Lead	Max. 0,05	0,00-0,01	mg/l
Turbidity	Max. 5	0,2-0,6	NTU
Conductivity	Max. 2000	400-700	mS/cm
Alkalinity	Max. 50	28-30	oF
Chlorine	Max. 250	15-30	mg/l
Iron	Max. 0,3	0,02-0,04	mg/l
Crom	Max. 0,05	0,00-0,01	mg/l
Reaidual chlorine	0,1-0,5	average 0,25	mg/l

ISTANBUL WATER QUALITY REPORT (NOVEMBER 2003)

Parametre	Turkish Standards TSE 266 1997	World HEALTH Organization (WHO) 1999	Environment Protection Agency (EPA) 2002	Europe Community (EC) 1998	TREATMENT PLANT AVERAGES B.Çekmece	İkitelli	Kağıthane	Emirli	Ömerli(Mur-Orhaniye)	Ömerli (Osmaniye)	Elmalı
PRIMARY STANDARDS (MANDATORY HEALTH RELATED STANDARDS) CLARITY											
Turbidity (NTU)	25	5	1	1	0,24	0,30	0,25	0,43	0,58	0,61	0,42
PRIMARY STANDARDS (MANDATORY HEALTH RELATED STANDARDS) MICROBIOLOGICAL											
Coliform Bacteria	<1	0	<1	0	0	0	0	0	0	-	0
PRIMARY STANDARDS (MANDATORY HEALTH RELATED STANDARDS) ORGANIC CHEMICALS											
Total Trihalomethane	--	460	80	100	60	33	49	37	19	17	38
Bromat	--	25	10	10	-	-	-	-	-	-	-
PRIMARY STANDARDS (MANDATORY HEALTH RELATED STANDARDS) INORGANIC CHEMICALS (mg/l)											
Aluminium	0,20	0,20	0,20	0,20	0,068	0,081	0,051	0,000	0,102	0,080	0,054
Arsenic	0,05	0,05	0,05	0,01	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Barium	0,3	0,7	1	--	0,054	0,025	0,025	0,046	0,020	0,020	0,029
Cadmium	0,005	0,005	0,01	0,005	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Chromium	0,05	0,05	0,05	0,05	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Fuoride	1,5	1,5	0,7-2,4	1,5	0,20	0,09	0,10	0,06	0,06	0,07	0,06
Lead	0,05	0,05	0,05	0,01	0,002	0,000	0,001	0,001	0,002	0,001	0,000
Mercury	0,001	0,001	0,002	0,001	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Nitrate (as NO_3^-)	50	50	45	50	1,0	1,2	1,3	1,0	1,9	1,9	1,7
Selenium	0,01	0,01	0,01	0,01	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Silver	0,01	--	0,05	--	0,000	0,000	0,000	0,000	0,000	0,001	0,000
Antimony	0,01	0,005	0,006	0,005	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Berillium	--	--	0,004	--	-	-	-	-	-	-	-
PRIMARY STANDARDS (MANDATORY HEALTH RELATED STANDARDS) RADIONUCLIDES (pCi/l)											
Gross Alpha	1	2,7	15	--	-	-	-	-	-	-	-
Gross Beta	10	27	50	--	-	-	-	-	-	-	-
SECONDARY STANDARDS-AESTHETIC STANDARDS (mg/l)											
Chloride	600	250	250	250	66	30	40	34	38	38	40
Color (units)	20	15	15	--	2,5	2,5	2,5	2,5	3,3	3,3	2,5
Copper	3	--	1	2	0,002	0,002	0,002	0,002	0,003	0,002	0,003
Foaming Agents (MBAS)	0,2	--	0,5	--	-	-	-	-	-	-	-
Iron	0,2	--	0,3	0,2	0,002	0,004	0,004	0,018	0,017	0,012	0,013
Manganese	0,05	0,5	0,05	0,05	0,002	0,004	0,011	0,001	0,016	0,013	0,047
Odor CausingGeosmin Compounds MID	--	--	--	--	-	-	-	-	-	-	-
PH	6,5-9,2	6,5-8,5	6,5-8,5	6,5-9,5	7,5	7,2	7,2	6,8	6,6	6,6	6,6
Sulphate	250	250	250	250	74	44	65	17	46	45	46
Total Dissolved Solids	1500	1000	500	--	264	162	184	122	144	144	152
Zinc	5	--	5	--	0,005	0,030	0,005	0,026	0,005	0,007	0,028
ADDITIONAL PARAMETERS (mg/l)											
Calcium	200	--	--	--	52	46	49	35	29	28	35
Hardness as ($CaCO_3$)	--	500	--	--	174	135	157	105	85	85	112
Magnesium	50	--	--	--	10,5	4,0	6,1	4,2	4,5	4,5	7,5
Potassium	12	--	--	--	4,85	2,59	2,72	1,26	3,84	3,80	2,81
Sodium	175	200	--	200	41,2	15,7	18,6	8,3	22,7	22,7	19,7
Residual Chlorine	0,5	5	--	--	1,5	0,7	1,3	1	1	0,9	0,6
Ammonia	0,5	1,5	--	0,5	< 0,05	< 0,05	0,06	< 0,05	< 0,05	< 0,05	< 0,05

Table 5.8. ISKI Water Quality Report

5.2.1.7. PERSONNEL

1. NUMBER OF STAFF

Number of staff as a function of:

staff per thousand water connections (W/000) or per thousand water plus sewerage connections ([W+ S]/000).

thousands ofm3 of water sold per year per staff (m3[000]/staff).

kms. of pipes in the water supply systemper staff (km/staff).

persons served [thousands] per staff (PS [000]/st).

Table 5.9. Personnel

INDICATOR	UNIT	ASAT	İSKİ
11. Unit Operational Cost	US$/m3 sold US$/m3 produced		
12. Staff/'000 Water conn. Staff/'000 W&S conn. Staff/'000 water pop served Staff/'000 W&S pop served	# # # #	0,98 0,47 0,39	2,3 0,58 0,29
13. Labor Costs as a proportion of Operational Costs	%		
14. Contracted-out service costs as a proportion of operational costs	%		

Note 1: Annual operating expenses exclude depreciation, interest and debt service

2. STAFF COMPOSITION

ASAT :

Table 5.10 Staff Composition in ASAT

Personnel Description % :	
Managment	**9,50%**
Technical	**10,90%**
Office	**29%**
Blue collars	**50,60%**
Total	**100%**

5.2.1.8. MISCELLANEOUS INDICATORS

VEHICLES/1000 WATER CONNECTIONS

This indicator includes all types of vehicles used in the operation and maintenance of the utility's system. When the utility also provides sewerage services the subscript (w + s) is added next to the figure.

Total Vehicles Number for İSKİ : 131 (2000)

5.2.1.9. Quality of Service

I.1 Indicators

Table 5.11 Quality of Service

INDICATOR	UNIT	ASAT	İSKİ
15. Continuity of Service	Hrs/day	24	24
16. Complaints about W&S services	% of W&S conn	0,09 (per month)	
17. Wastewater treatment	%	-	85

5.2.2. Financial Indicators

Only a selected group of financial indicators is presented in this report.

The technique of ratio analysis is a useful tool to analyze a utility's financial position.

5.2.2.1. OPERATIONAL RATIOS

Table 5.12 Operational Costs (ASAT 2002)

Operational Costs % :	
Personnel	**4,97%**
Energy	**5,66%**
Other	**89,37%**
Total	**100%**

5.2.3. Overwiev of Tariff Rates And Structures

An overview of water and sewerage tariff rates and structures, from a sample of 9 cities believed to be representative of practices in developing countries, is presented in this section. This overview provides some

insights into how rates are structured and offers some recommendations (based on hypotheses that need further testing), into the problems such structures may be causing and pitfalls to avoid. This overview is thus a complement to the set on financial ratios but is not intended to be a thorough discussion of pricing issues.

An understanding of the implications of tariff structures and of the possible distortions that they may be causing is an important step in the design of an strategy and action plan to improve the financial position of a utility based on sound economic principles. (Tariffs of ASAT and İSKİ are given in Appendix E)

6. DISCUSSION

Here, the data collected from ASAT and ISKI are also benchmarked with some other utilities in the world. It can be used more or less performance indicators in benchmarking due to our needs.

6.1. Coverage

Antalya is not an industrial city. It is a touristic city and not all the coverage area needs sewerage network. They use other ways to aside sewerage.

Table 6.1. Coverage

INDICATOR	UNIT	ASAT	İSKİ
1. Water Coverage	%	100	100
2. Sewerage Coverage	%	20	100

6.2. Water Consumption and Production

1. UNIT CONSUMPTION

Total water consumption, based on metered consumption, is reported as:

• average daily consumption per person served (liters per capita per day, lpcd),

• average consumption per connection per month (m3/month/connection, m3/m/c).

Table 6.2. Water Consumption and Production

INDICATOR	UNIT	ASAT	İSKİ
3. Water Production	lpcd m3/conn/m m3/hh[1]/m	337,90 21,71	146,12 17,78

4. Water Consumption	lpcd m3/conn/m m3/hh[1]/m	123,29 7,92	102,74 12,50
5. Metered Water Consumption	lpcd m3/conn/m m3/hh[1]/m		

Note 1: household.

Water production results are well for ISKI and ASAT. They are like the other cities' values in the world. But water consumption values are less than the production values. It shows us there are big values of unaccounted water which will be discussed later.

Table 6.3 Water Consumption in Various Countries

Countries		*Water Consumption*	
Country/City	*Year*	*lpcd*	*m^3/m/c*
Algeria (average)	1990	46	N/A
Brazil (average)	1989	151	25 a/
• Brasilia	1989	211	60 b/
• Sao Paulo	1988	237	38 c/
• Sta. Catarina	1990	143	22
• Minas	1990	154	25
Chile			
• Santiago	1994	204	34 d/
• Valparaiso	1992	N/A	23
China, Changchun	1990	260	33
Colombia, Bogotá	1992	167	30
Costa Rica	1991	208	29
	1994	197	26
Cote d' Ivoire, Abidjan	1993	N/A	34
Senegal, Dakar	1993	N/A	36
Belgium, Brussels	1991	N/A	29
Canada (average)	1984	431	82
France, Paris, C. Banlieue	1987	256	75 e/
Japan, Tokyo	1990	355	57
Spain			
• Alicante	1987	267	16
• Murcia	1992	268	33
UK (average)	1990	136	18
USA (average)	1984	666	89

N/A = data not available

Note: One connection serves more than one housing unit.

a/ 1.3 units/water connection
b/ 2.3 units/water connection
c/ 1.4 units/water connection
d/ 1.1 units/water connection
e/ 3.5 units/water connection

6.3.WATER DISTRIBUTION SYSTEM

1. LENGTH OF WATER PIPED SYSTEMS

Length of the water distribution pipe system as a function of:

• the number of people served [meters/person],

• number of connections [meters/connection].

Table 6.4 Water Distribution System

INDICATOR	**UNIT**	ASAT	İSKİ
Length of the water distribution pipe system	km	2000	12000
The number of pp served Proportion of conn	m/p m/conn	3,23 7,55	1 4

Antalya's water network system is a new system and this city has less population because of that the length of the water distribution system is shorter. The number of people served and proportion of meter per connection values are medium values for İSKİ. For ASAT the values are bigger because it has a new water distribution network and will be developed and proportion of connection will be decrease.

Table 6.5 Water Distribution in Various Countries

County/City	*Year*	*Unit Length (mts/person)*	*Unit Length (mt/connection)*
Brazil (average)	1989	2.3	12.5 a/
• Brasilia	1989	1.8	17.1 b/
• Saó Paulo	1993	2.6	10.7
Chile			
• Santiago	1994	1.6	8.7
• Valparaiso	1992	N/A	11.3
Colombia, Bogotá	1992	1.4	8.0
Costa Rica (average)	1990	N/A	11.6
Togo (country total)	1990	9.1 c/	74.6 c/
Philippines			
• Cabanatuan	1994	N/A	6.8
Romania, Bucarest	1994	1.3 d/	N/A
Belgium, Brussels	1991	N/A	9.8
France, Marseille	1992	2.6	N/A
Germany, Hamburg	1990	2.9	N/A
Japan (average)	1990	4.1	11.8
• Osaka	1990	3.9	N/A
• Tokyo	1990	N/A	9.4
Singapore	1991	1.6	5.5
Spain			
• Alicante	1992	N/A	7.6
• Murcia	1992	3.1	12.6
USA (average)	1984	4.9	24.0
	1990	6.4	N/A

Notes: a/ 1.3 units/connection
b/ 2.3 units/connection
c/ Significant number of standposts (56% of population served).
d/ 7% of population is served by standposts.

2. PIPE BREAKS

Number of pipe breaks per year per 100 kms of pipes in the water system.

A higher number is indicative of problems due to materials, installation, age, soil conditions, traffic and of inadequate maintenance.

Table 6.6. Pipe Breaks

INDICATOR	**UNIT**	ASAT	İSKİ
Pipe Breaks	Breaks/km/year	0,36	-
	Breaks/conn/year	0,08	-
Sewerage Blockages	Blockages/km/year	-	-

Table 6.7. Pipe Breaks in Various Countries

Country/City	*Year*	*Pipe Breaks Breaks/100km/yr.*
Chile, Santiago	1994	31[a/]
Colombia, Bogota	1994	187
Belarus		
• Minsk	1993	70
• Gomel	1993	25
Belgium, Brussels	1991	21
Singapore	1990	17
USA (average)	1990	17
• Denver, Colorado	76-83	7
• Oakland, California, EBMUD	73-82	16

Note: a/ Down from 39in 1991.

ISKI pipe breaks value breaks/km/year is 0,36 it means its 36 breaks/100 km/year. When we look other countries data 36 is a big value. It must be learned about the technical and maintenance problems to work out them and to reduce this value.

4. PIPE BREAKS AS A FUNCTION OF PIPE MATERIAL

Information on different types of pipes materials. It is useful when designing strategies to reduce physical water losses. We can have opinions about which material will be chosen, which will be changed, etc.

Table 6.8. Pipe Materials in Various Countries

Pipe Material	*Pipe Breaks/100km/yr. City*			
	Denver [a/]	*EBMUD* [a/]	*Bogota*	*Santiago*
A.C.	3.7	10.3	294	38
Cast Iron	7.5	2.6	---	23
Concrete	0.9	---	---	---
Ductile Iron	1.8	---	---	---
Galv. Iron	35.5	5.6	---	---
PVC	---	---	78	8
Steel	0.4	---	---	6
Other Materials	---	---	58	---
Average	6.8	16.8	187	31

Source: a/ Guiding Manual. Rehabilitation Criteria for Water mains. AWWA, 1986.

6.4. UNACCOUNTED FOR WATER (UFW)

parameters : A percentage of net water production (delivered to the distribution system, % UFW).

Physical [pipe leaks and storage tank overflows]

Commercial [meter under-registration, illegal connections, etc.]

1. WATER LOSSES

A major concern about operations of a water utility is the level of UFW. UFW reflects the difference between the volume of water delivered to the distribution system and the water sold. The level of UFWis considered a good proxy for the overall efficiency of operations of a water utility.

UFW includes physical losses [pipe breaks and overflows] and commercial losses [meter under-registration, illegal use including fraudulent or unregistered connections and legal, but usually not metered uses like fire fighting].

ILLEGAL WATER CONSUMPTION AND PRECOUTIONS IN ASAT

There only existing controls against unregistered consuption all day and night in the field. Using the water without metering equipments is taken as illegal use. Making any damages to metering equipments is also illegal. The tariff of illegal use changes for proposes or using times. Presently the price of illegal water is % 100 more than normal water tariffs. If anyone

makes illegal connection, it is determined with two staff of the utility on the place.

ILLEGAL WATER CONSUMPTION AND PRECOUTIONS IN ISKI

There are some subscribers (or unsubscribers) using water unless contracts with İSKİ too. İllegal users are determined by field controls, meterings firms, ALO 185 and by denunciations.

If any subscriber uses illegal water : İllegal water amount prices will be charged to the subscriber's bill.

If any unsubscriber uses illegal water : There are use from İSKİ's general pipe systems. There can be two situations :

a) İllegal use with metering equipments : It will be charged the contract amount and illegal use of water amounts charged.
b) İllegal use without metering equipments : It will be put metering equipments to the place, made contract and the illegal use will be charged in the bill.

Unaccounted for water (UFW) is expressed as:
• a percentage of net water production (delivered to the distribution system, % UFW).
• as m3/day/kmof water distribution pipe system network (m3/day/km d.s.).

Table 6.9 Unaccounted for Water

INDICATOR	**UNIT**	**ASAT**	**İSKİ**
6. Unaccounted-for-Water	%	62,91	26,70
	m3/km/d	75,75	43,38
	m3/conn/d	0,453	0,174

The average rate of UFW in the developing countries of this sample is 37%, more than twice what is considered acceptable in industrialized countries (less than 20%). The highest rate in all examples is found in Bursa and Antalya, with 62% and the lowest in Abidjan, Ivory Coast with 17%. It must be planned effective UFW reduction programs for Bursa and Antalya utilies. ISKI's value is even under the average with 26%, it can be reduced with some programs.

Caution should be used in interpreting UFW data, however, as some reported UFW ratios are not more than gross estimates since full metering is not in place and utilities often do not adhere to the definition given above.

Tabel 6.10 Unaccounted for Water in Various Countries

UNACCOUNTED FOR WATER (UFW)

Country/City	*Year*	*Water Losses % UFW*	*Water Losses m^3/day/km d.s.*
Brazil (average)	1989	39	42
• Brasilia	1989	19	27
• Sao Paulo Metrop. Area	1992	40 a/	70
• S. Catarina	1990	45	n.d.
• Minas	1990	25	n.d.
Chile			
• Valparaiso	1990	41	n.d.
• Santiago	1990	28	52
	1994	22	44
Colombia, Bogota	1991	40	135
Costa Rica	1991	45	n.d.
Ivory Coast, Abidjan	1993	17	n.d.
Algeria, Annaba	1992	35	n.d.
Gambia, Banjol	1993	27	n.d.
Guinea, Conakry	1993	53	n.d.
Senegal, Dakar	1993	29	n.d.
Ghana	1988	49	n.d.
Morocco	1990	32	n.d.
Nigeria			
• Katsina	1990	44	n.d.
• Kaduna	1990	41	n.d.
Togo	1990	22	7
Turkey			
• Bursa	1991	62	n.d.
• Ankara	1988	45	n.d.
Pakistan, Karachi	1989	40	n.d.
China, Changchun	1990	40	n.d.
Philippines, Manila	1988	59	n.d.
Thailand, Bangkok	1990	33	73
France, Bordeau	1982	15	n.d.
Canada (average)	1984	15	16
Japan (average)	1990	11	13
• Tokyo	1990	15	35
Macao	1991	11	n.d.
Singapore	1994	6	9
Spain, Murcia	1993	25 b/	22
USA (average)	1984	12	17

Notes: a/ Up from 25% in 1988.
b/ Down from 45% in 1989.

2. COMPOSITION OF UFW

UFW is broken down by its two main components: physical [pipe leaks and storage tank overflows] and commercial [meter under-registration, illegal connections, etc.]. A good understanding of the relative weights of these components is a *sine-qua-non* condition for the development of a sound program to reduce UFW.

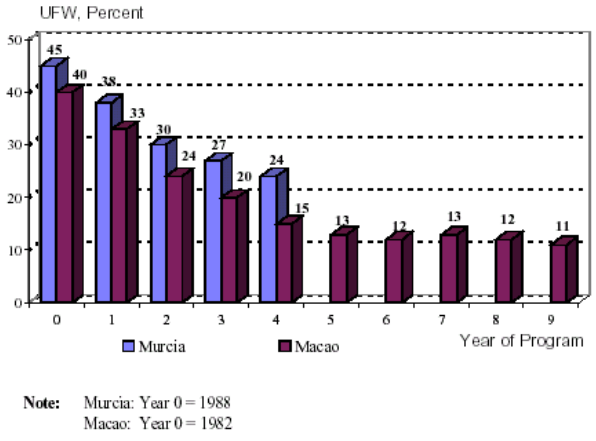
Table 6.11 Composition of Unaccounted for Water in Various Countries

Country/City	*Year*	*Composition of UFW (%)*		
		Physical	*Commercial*	*Total*
Singapore	1989	4	7	11
Spain, Barcelona	1988	11	12	23
Colombia, Bogota	1991	14	26	40
Costa Rica, San Jose	1990	21	25	46

3. UFW EFFECTIVE REDUCTION PROGRAMS

Information about four highly successful UFW reduction programs is presented here. These programs share one common approach: the initial effort was directed towards reducing commercial losses: users were identified, the commercial system (meter reading and billing) was revamped, defective meters were replaced and the number of metered connections was substantially increased. Reduction of leaks was also part of the UFW reduction program but secondary to the reduction of commercial losses. There are a few effective ufw programs below to image these programs in other countries in the world.

a) Macao & Murcia



Note: Murcia: Year 0 = 1988
Macao: Year 0 = 1982

Figure 6.4 UFW % of Murcia and Macao

b) Singapore & Santiago

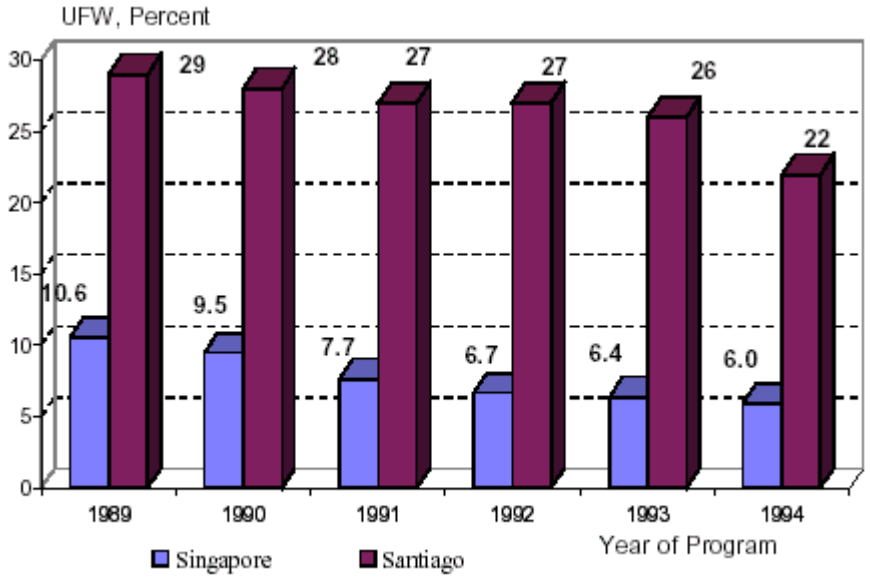


Figure 6.5. UFW % of Singapore and Santiago

4. SUSTAINABILITY OF UFW REDUCTION PROGRAMS

UFW levels can easily deteriorate when a tight control on operations and maintenance and of the commercial system hard and software sub-systems that affect productivity levels, is not maintained. In this particular case, the deterioration is due to a relaxation of policies and accountability.

Evolution of UFW

a) Sao Paulo, Brazil, 1977-92

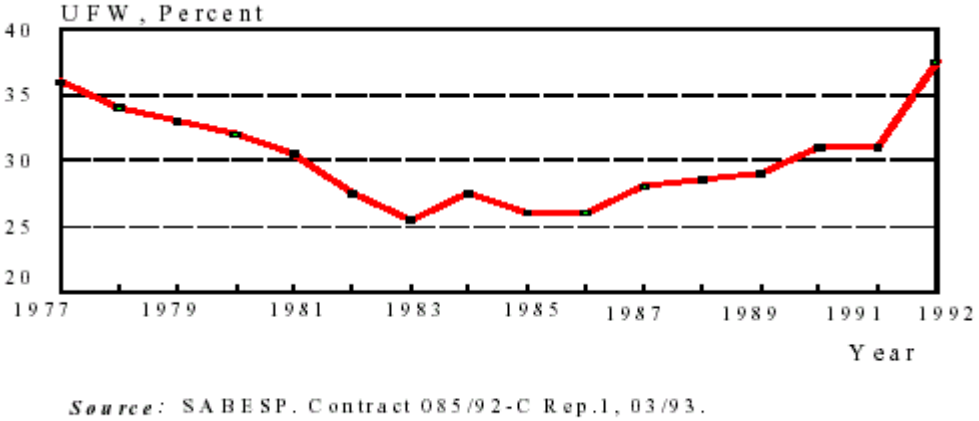
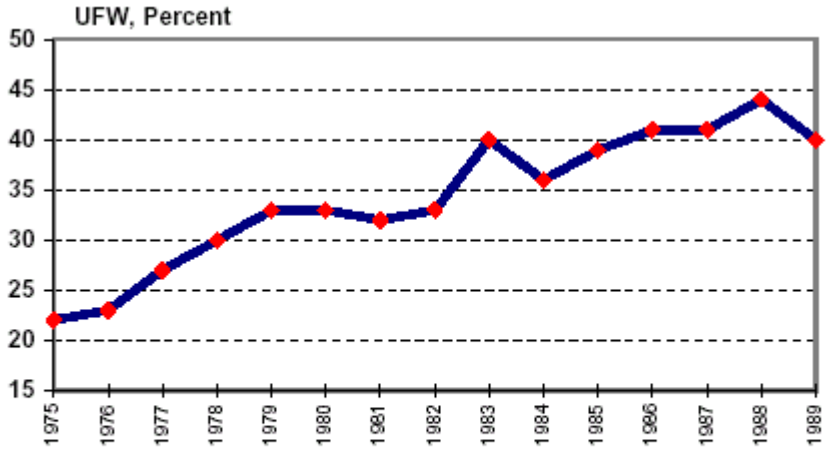


Figure 6.6. Evolution of UFW in Sao Paulo

b) Bogota, Colombia, 1975-89



Source: Yepes Guillermo, Infrastructure Maintenance in LAC. The Costs of Maintenance Neglect and Options for Improvement. Vol. 3, June 1992.

Figure 6.7. Evolution of UFW in Bogota

6.5. Wastewater Collection Systems

1. Length of Sewer Systems

Length of the sewerage distribution systemas a fuction of:

the number of people served [meters of pipes/person],

number of connections [meters/connection].

Table 6.12 Waste Water Collection Systems

INDICATOR	UNIT	ASAT	İSKİ
Length of the water distribution pipe system	km	250	9800
The number of pp served Proportion of conn	m/p m/conn	1,25 2,63	0,81

Table 6.13 Waste Water Collection Systems in Various Countries

Country/City	*Year*	*Unit length:*	
		mts/person	*mts/connec*
Brazil (average)	1989	1.6	11.1 a/
• Brasilia	1989	1.2	11.9 b/
Chile			
• Valparaiso	1992	n.d.	9.8
• Santiago	1990	1.4	7.5
Colombia, Bogota	1992	0.9	6.0
France, Bordeaux	1982	n.d.	10.1
U.K ,Wessex.	1991	n.d.	5.2

Notes: a/ 1.7 units/sewerage connection.
b/ 2.4 units/sewerage connection.

Antalya's sewerage network system is a new system and this city has less population because of that the length of the water distribution system is shorter. Antalya is not an industrial city. It is a touristic city and not all the coverage area needs sewerage network. They use other ways to aside sewerage.

The number of people served and proportion of meter per connection values are normal values for İSKİ becaouse it has a long network. For ASAT the values are bigger because it has a new water distribution network and will be developed and proportion of connection will be decrease.

6.6. WASTE WATER TREATMENT

Drinking water standards in ASAT (TS-266)

As its been in all things, thare are standards of drinking and other kinds of water.These standards are implemented from TSE (Türk Standartları Enstitüsü) in Türkiye. Standards are implemented on countries' water resources and health.

Typical composition of untreated municipal water in Antalya are given below. The standard values are TSE's standard values.

Table 6.14. Asat's Typical Composition of Untreated Municipal Wastewater (2002)

Parameters	**Standard**	**ASAT Laboratuary Results**	**Unit**
pH	5,5-8,5	7,0-7,5	-
Hardness	Max. 50	28,32	OF
Organic material	Max. 3,5	0,1-1,0	mg/l
Nitrite	Max. 0,05	0,02-0,04	mg/l
Nitrate	Max. 45	10-30	mg/l
Manganese	Max. 0,05	0,01-0,03	mg/l
Ammonia	Max.0,05	0,00-0,03	mg/l
Lead	Max. 0,05	0,00-0,01	mg/l
Turbidity	Max. 5	0,2-0,6	NTU
Conductivity	Max. 2000	400-700	mS/cm
Alkalinity	Max. 50	28-30	OF
Chloride	Max. 250	15-30	mg/l
Iron	Max. 0,3	0,02-0,04	mg/l
Crom	Max. 0,05	0,00-0,01	mg/l
Reaidual chlorine	0,1-0,5	average 0,25	mg/l

Table 6.15 Iski's Typical Composition of Untreated Municipal Wastewater

ISTANBUL WATER QUALITY REPORT (NOVEMBER 2003)

Parametre	Turkish Standards TSE 266 1997	World HEALTH Organization (WHO) 1999	Environment Protection Agency (EPA) 2002	Europe Community (EC) 1998	TREATMENT PLANT AVERAGES						
					B.Çekmece	İkitelli	Kağıthane	Emirli	Ömerli(Mur-Orhaniye)	Ömerli (Osmaniye)	Elmalı
PRIMARY STANDARDS (MANDATORY HEALTH RELATED STANDARDS) CLARITY											
Turbidity (NTU)	25	5	1	1	0,24	0,30	0,25	0,43	0,58	0,61	0,42
PRIMARY STANDARDS (MANDATORY HEALTH RELATED STANDARDS) MICROBIOLOGICAL											
Coliform Bacteria	<1	0	<1	0	0	0	0	0	0	-	0
PRIMARY STANDARDS (MANDATORY HEALTH RELATED STANDARDS) ORGANIC CHEMICALS											
Total Trihalomethane	--	460	80	100	60	33	49	37	19	17	38
Bromat	--	25	10	10	-	-	-	-	-	-	-
PRIMARY STANDARDS (MANDATORY HEALTH RELATED STANDARDS) INORGANIC CHEMICALS (mg/l)											
Aluminium	0,20	0,20	0,20	0,20	0,068	0,081	0,051	0,000	0,102	0,080	0,054
Arsenic	0,05	0,05	0,05	0,01	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Barium	0,3	0,7	1	--	0,054	0,025	0,025	0,046	0,020	0,020	0,029
Cadmium	0,005	0,005	0,01	0,005	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Chromium	0,05	0,05	0,05	0,05	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Fuoride	1,5	1,5	0,7-2,4	1,5	0,20	0,09	0,10	0,06	0,06	0,07	0,06
Lead	0,05	0,05	0,05	0,01	0,002	0,000	0,001	0,001	0,002	0,001	0,000
Mercury	0,001	0,001	0,002	0,001	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Nitrate (as NO_3^-)	50	50	45	50	1,0	1,2	1,3	1,0	1,9	1,9	1,7
Selenium	0,01	0,01	0,01	0,01	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Silver	0,01	--	0,05	--	0,000	0,000	0,000	0,000	0,000	0,001	0,000
Antimony	0,01	0,005	0,006	0,005	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Berillium	--	--	0,004	--	-	-	-	-	-	-	-
PRIMARY STANDARDS (MANDATORY HEALTH RELATED STANDARDS) RADIONUCLIDES (pCi/l)											
Gross Alpha	1	2,7	15	--	-	-	-	-	-	-	-
Gross Beta	10	27	50	--	-	-	-	-	-	-	-
SECONDARY STANDARDS-AESTHETIC STANDARDS (mg/l)											
Chloride	600	250	250	250	66	30	40	34	38	38	40
Color (units)	20	15	15	--	2,5	2,5	2,5	2,5	3,3	3,3	2,5
Copper	3	--	1	2	0,002	0,002	0,002	0,002	0,003	0,002	0,003
Foaming Agents (MBAS)	0,2	--	0,5	--	-	-	-	-	-	-	-
Iron	0,2	--	0,3	0,2	0,002	0,004	0,004	0,018	0,017	0,012	0,013
Manganese	0,05	0,5	0,05	0,05	0,002	0,004	0,011	0,001	0,016	0,013	0,047
Odor CausingGeosmin Compounds MID	--	--	--	--	-	-	-	-	-	-	-
PH	6,5-9,2	6,5-8,5	6,5-8,5	6,5-9,5	7,5	7,2	7,2	6,8	6,6	6,6	6,6
Sulphate	250	250	250	250	74	44	65	17	46	45	46
Total Dissolved Solids	1500	1000	500	--	264	162	184	122	144	144	152
Zinc	5	--	5	--	0,005	0,030	0,005	0,026	0,005	0,007	0,028
ADDITIONAL PARAMETERS (mg/l)											
Calcium	200	--	--	--	52	46	49	35	29	28	35
Hardness as ($CaCO_3$)	--	500	--	--	174	135	157	105	85	85	112
Magnesium	50	--	--	--	10,5	4,0	6,1	4,2	4,5	4,5	7,5
Potassium	12	--	--	--	4,85	2,59	2,72	1,26	3,84	3,80	2,81
Sodium	175	200	--	200	41,2	15,7	18,6	8,3	22,7	22,7	19,7
Residual Chlorine	0,5	5	--	--	1,5	0,7	1,3	1	1	0,9	0,6
Ammonia	0,5	1,5	--	0,5	< 0,05	< 0,05	0,06	< 0,05	< 0,05	< 0,05	< 0,05

Table 6.16 Average Typical Composition of UntreatedMunicipal Wastewater in US

Constituent [a/]	*Concentration Range* [b/]:			*U.S.*
	Strong	*Medium*	*Weak*	*Average* [c/]
Solids (total)	1,200	720	350	---
Dissolved, total [d/]	850	500	250	---
• Fixed	525	300	145	---
• Volatile	325	200	105	---
Suspended	350	220	100	192
• Fixed	75	55	20	---
• Volatile	275	165	80	---
Settleable solids, ml/L	20	10	5	---
Biochemical oxygen demand, 5-day 20 °C	400	220	110	181
Total organic carbon	290	160	80	102
Chemical oxygen demand	1,100	500	250	417
Nitrogen (total)	85	40	20	34
• Organic	35	15	8	13
• Ammonia	50	25	12	20
• Nitrite	0	0	0	---
• Nitrate	0	0	0	0.6
Phosphorus	15	8	4	9.4
• Organic	5	3	1	2.6
• Inorganic	10	5	3	6.8
Chlorides [d/]	100	50	30	---
Alkalinity (as $CaCO_3$) [d/]	200	100	50	211
Grease	150	100	50	---
Total coliform bacteria (no./100 mL)	10^7-10^9	10^7-10^8	10^6-10^7	22x106 [e/]
Fecal coliform bacteria (no./100 mL)	---	---	---	8x106
Viruses, pfu/100 mL [b/]	---	---	---	500

Notes: a/ Values are expressed in mg/L, except as noted.
b/ After Metcalf & Eddy, Inc., 1991.
c/ Culp et al., 1979.
d/ Values should be increased by amount in domestic water supply.
e/ Geldreich, 1978.
pfu= Plaque-forming units/100mL.

Source: Water Reuse. Assessment Report Project 92 WRE-1. Environment Research Foundation 1994.

6.7. PERSONNEL

1. NUMBER OF STAFF

Number of staff is as a function of:

staff per thousand water connections (W/000) or per thousand water plus sewerage connections ([W+ S]/000).

thousands of m3 of water sold per year per staff (m3[000]/staff).

kms. of pipes in the water supply systemper staff (km/staff).

persons served [thousands] per staff (PS [000]/st).

Table 6.17 Personnel

INDICATOR	UNIT	ASAT	İSKİ
11. Unit Operational Cost	US$/m3 sold US$/m3 produced		
12. Staff/'000 Water conn. Staff/'000 W&S conn. Staff/'000 water pop served Staff/'000 W&S pop served	# # # #	0,98 0,47 0,39	2,3 0,58 0,29
13. Labor Costs as a proportion of Operational Costs	%		
14. Contracted-out service costs as a proportion of operational costs	%		

Note 1: Annual operating expenses exclude depreciation, interest and debt service

Table 6.18 Personnel in Various Countries

Country/ City	Year	Staff Ratios				
		W/000	W+S/000	000M³/staff	km/staff	000 PS/st
Belarus						
• Minsk	1993	n.a.	n.d.	56	n.d.	0.7
• Gomel	1993	n.a.	n.d.	20	n.d.	0.3
Belgium, Brussels	1992	3.2	n.d.	105	3.3	3.0
Brazil (average)	1989	6.5	5.0	47	1.9 **a/**	0.8
• Brasilia	1989	13.5	7.1	54	1.3 **b/**	0.7
• Sao Paulo	1993	5.1	3.1	n.d.	2.1	0.8
Canada (average)	1984	2.0	n.d.	424	n.d.	1.7
Chile, Santiago	1990	2.1	1.1	191	4.1	2.5
Colombia, Bogota	1994	3.6	1.8	106	1.1	1.7
France, C. Banlieue	1987	4.5	n.a.	200	n.d.	2.2
Guinea (average)	1993	15.0	n.d.	8	n.d.	n.d.
Ivory Coast (average)	1995	4.8	n.d.	22	n.d.	n.d.
Japan (average)	1990	1.7	n.a.	n.d.	7.0	1.7
Macao	1991	2.2	n.a.	148	n.d.	n.d.
Mexico, Monterrey	1987	4.1	2.2	86	2.2	1.5
Romania, Bucharest	1994	n.a.	n.d.	75	n.d.	0.5
Senegal (average)	1993	8.6	n.d.	13	n.d.	n.d.
Spain						
• Alicante	1987	1.1	0.6	170	n.d.	1.9
• Murcia	1992	2.5	n.d.	165	4.9	1.6
Togo	1990	22.4	n.d.	26	3.3	0.5
Turkey, Bursa	1992	4.6	n.d.	40	0.4	0.9
USA (average)	1990	2.7	n.d.	370	8.6	1.5

n.d. = data not available;
n.a. = not applicable.
Notes: a/ 1.3 water units and 1.7 sewerage units per connection.
b/ 2.3 water units and 2.4 sewerage units per connection.

2. STAFF COMPOSITION

ASAT

Table 6.19 Staff Composition in ASAT

Staff Composition % :	
Managment	**9,50%**
Technical	**10,90%**
Office	**29%**
Blue Collars	**50,60%**
Total	**100%**

Table 6.20 Staff Composition in Various Countries

Country/City	*Category/Level Percentage of Labor Force*			
	Management	*Professional*	*Clerical*	*Blue Collar*
Brazil (range)	0.1 - 0.4	7 - 9	17 - 44	46 - 76
• Brasilia	0.2	12	24	64
Chile, Santiago	3	18	37	42
Macao	25		75	

3. TRAINING EFFORT

Training effort is a very important performance indicator. Staff training may be planned and reported in periods.

Table 6.21 Training Effort in Various Countries

Country/City	*Year*	*Training*
Chile, Esval-Valparaiso	1992	41% staff trained/yr 1.2 days/staff/yr
France, C. Banlieue	1987	4% of salaries

6.8. MISCELLANEOUS INDICATORS

VEHICLES/1000 WATER CONNECTIONS

This indicator includes all types of vehicles used in the operation and maintenance of the utility's system. When the utility also provides sewerage services the subscript (w + s) is added next to the figure.

Table 6.22 Vehicles per Connections in Various Countries

Country/City	*Year*	*Vehicles/1000 connec*
Spain,		
• Murcia	1992	0.9 (w)
• Alicante	1992	0.6 (w)
Chile, Valparaiso	1992	0.4 (w+s)
Washington, WSSC	1992	0.6 (w+s)

6.9. Quality of Service

I.1 Indicators

Table 6.23 Quality of Service

INDICATOR	UNIT	ASAT	İSKİ
15. Continuity of Service	Hrs/day	24	24
16. Complaints about W&S services	% of W&S conn	0,09 (per month)	
17. Wastewater treatment	%	-	85

Table 6.24 Additional Information for ASAT

Number of complaints about water quality	172 (2002)
Number of breaks (Water or sewerage)	60 per month
Repair time	1 - 4 hours
Callback time for emergency calls	1 hour
Number of complaints about all services	15.130 per month

Financial Indicators

6.10 OPERATIONAL RATIOS

1. PERSONNEL

PERSONNELCOSTS

Personnel costs are expressed as a ratio to total operating costs (depreciation and debt service excluded). Depreciation and debt service are excluded due to lack of uniformity in treating revaluation of fixed assets and to facilitate comparison of utilities with and without debt service obligations.

As indicated in Infrastructure note W5 - 12 (Annex 2), staff productivity index (See 1.2 below) and personnel costs related to operational costs should be examined simultaneously.

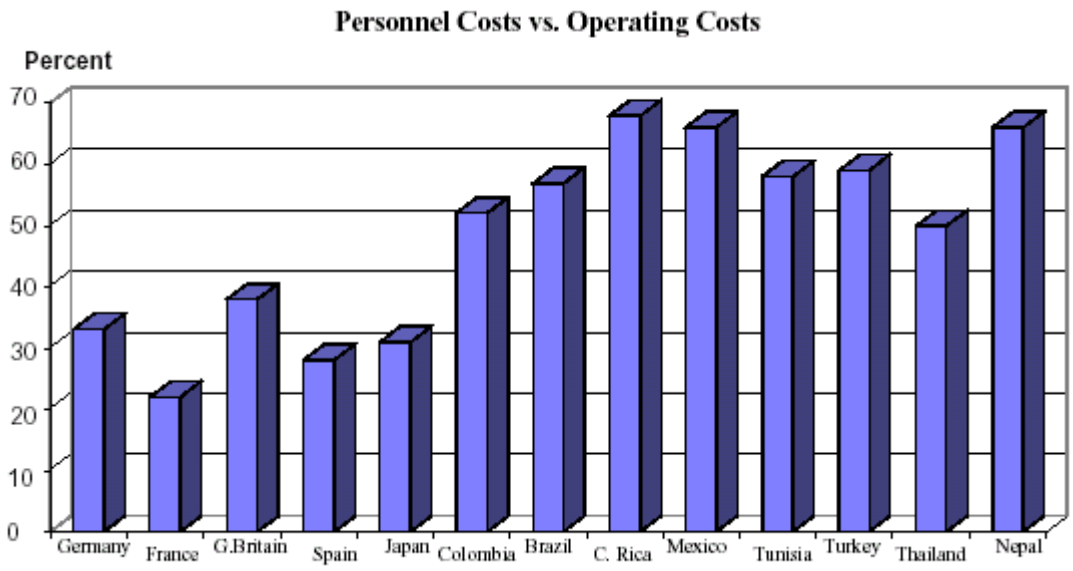


Figure 6.10 Personnel Costs vs. Operating Costs

2 COMPOSITION OF OPERATIONAL COSTS

The two main categories of operating costs are often personnel and fuel/energy consumption.

Other operating cost components include chemicals, maintenance and miscellaneous. Depreciation charges are not included.

ASAT

Table 6.25 Operational Raitos in ASAT (2002)

Operational Costs%	
Personnel	4,97%
Energy	5,66%
Other	89,37%
Total	100%

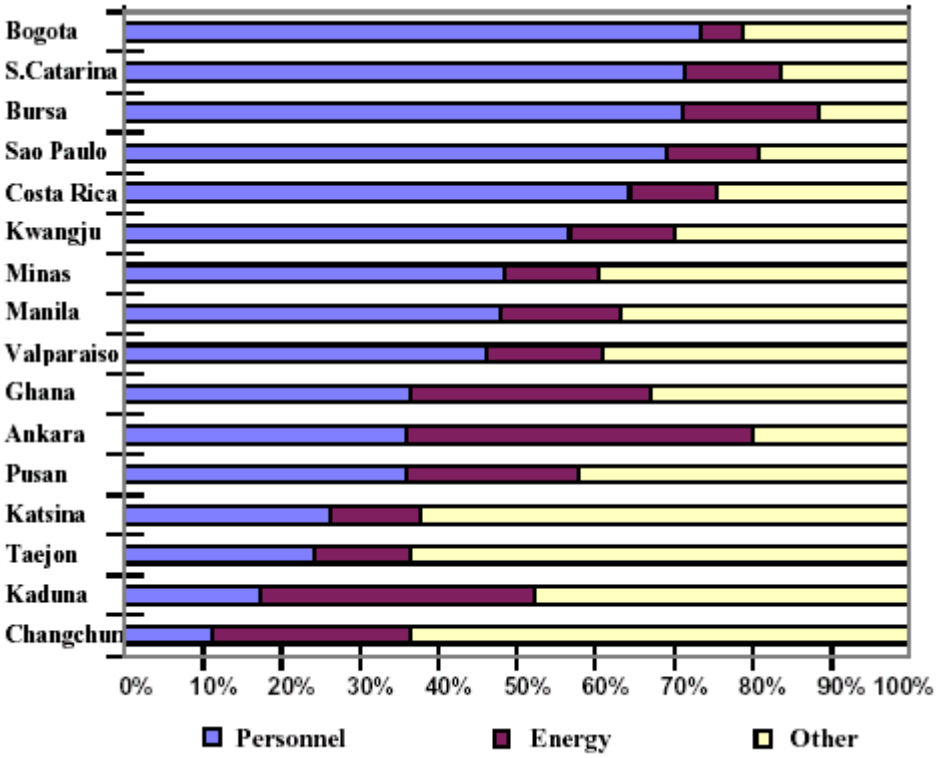


Figure 6.9. Composition of Operational Costs

Table 6.26 Range of Operational Costs (for countries in fig. 6.9)

Range of Operational Costs

	Low Value	*Average Value*	*High Value*
Personnel	11.1 %	46.0 %	73.4 %
Energy	5.3 %	18.4 %	44.0 %
Other	11.5 %	35.6 %	63.6 %

No information is available for industrialized countries for comparison purposes. Because operating costs are utility specific and given the paucity of data at this time, any further elaboration at this point is not warranted.

3. UNIT OPERATIONAL COST (UOC)

Unit operational cost (operational costs1/ / m3 produced) varies from US$0.05 per cubic meter in Karachi and Changchun to US$0.31 per cubic meter in Minas Gerais. About 28% of the utilities have an UOC below 10 cents per cubic meter, 44% an UOC between 10 and 20 cents per cubic meter, and 28% an UOC of 20 cents or higher.

Contrary to what could be expected, we do not see evidence, in this sample, that large utilities have lower UOCs. This could be explained, in part, by specific site conditions and by wide variations of domestic costs and price levels in the different countries. We believe, however, that major differences in UOC can be explained by the quality of service provided by the utilities.

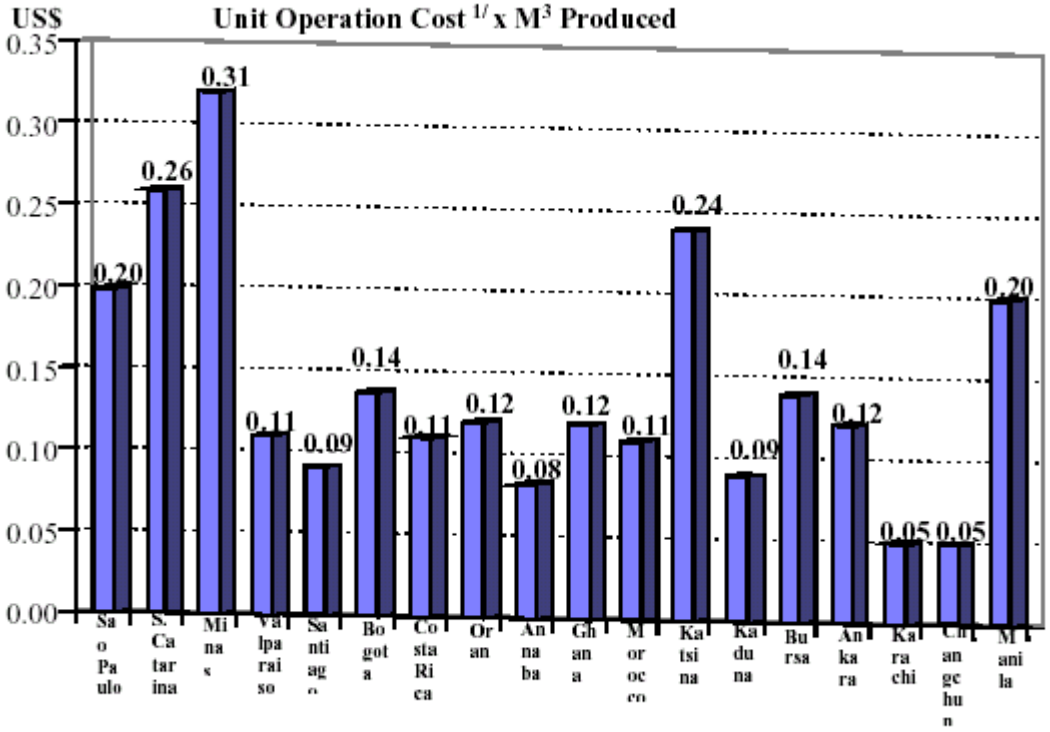


Figure 6.10. Unit Operation Costs

6.11. OVERVIEW OF TARIFF RATES AND STRUCTURES

An overview of water and sewerage tariff rates and structures, from a sample of 9 cities1 believed to be representative of practices in developing countries, is presented in this section. This overview provides some insights into how rates are structured and offers some recommendations (based on hypotheses that need further testing), into the problems such structures may be causing and pitfalls to avoid. This overview is thus a complement to the set on financial ratios but is not intended to be a thorough discussion of pricing issues.

An understanding of the implications of tariff structures and of the possible distortions that they may be causing is an important step in the design of an strategy and action plan to improve the financial position of a utility based on sound economic principles.

TARIFF STRUCTURE

Satisfactory tariff levels must provide adequate funds to meet operations, debt service and capital expansion requirements. Tariffs should also encourage efficiency in the use of resources; and many would argue, on fairness grounds, that the tariff structure should make these services affordable by the poor. Reconciliation of all these objectives remains an elusive task.

All tariff rates, except Singapore and Ankara, reviewed here have two components: a fixed charge and a volumetric charge (related to consumption). The first is often intended to cover the fixed costs of the utility and the second the variable ones. In addition, most tariff rates are progressive, e.g., the volumetric charge increases as consumption increases.

Rate progressivity is often the result of the decision to provide a cross-subsidy from some, presumably wealthy, groups to other groups with a more limited capacity to pay (the poor, schools, hospitals, etc.). More recently, rate progressivity has found its defenders among those interested in promoting water conservation. Whatever the argument, progressivity introduces economic distortions in the use of water, which need to be but are often poorly understood. In addition, low rates often discourage utilities from reaching the poor or reducing UFW. ASAT and İSKİ 2003 Tariffs are given in Appendix E.

Table 6.27 Customer Categories in ASAT

Customer Categories :	**Customers**
Corporate	32822
Industrial	1131
Domestic	229670
Public	434
Other	453

Most utilities in the sample have also flat charges, independent of consumption, either by design or fiat (when meters are not installed or operative) to deal with non-metered consumption. None of the utilities in this sample fully meters consumption.

In all documented cases here, sewerage charges are a fixed percentage of the water charges. These charges range from a low 18% in San Jose to 100% in Santa Catarina. The average lies around 40% to 50%2 . In some cases, like Ankara, the tariff charged for water also covers sewerage services.

Table 6.27 Comparison of annual water charges in industrialized countries for a family of four in a house and consuming 200 m3/year [137 liters/capita/day] (prices in 1991 US dollars)

Country/City	Charge US$/m^3	Country/City	Charge US$/m^3	Country/City	Charge US$/m^3
Austria		Germany		Luxembourg	
• Linz	0.64	• Berlin	1.00	• Luxembourg	1.34
• Salzburg	0.99	• Dusseldorf	1.56		
• Vienna	1.07	• Frankfurt	1.66	Netherlands	
		• Gelsenwasser	1.95	• Amsterdam	0.94 a/
Belgium		• Hamburg	1.59	• The Hague	1.17
• Antwerp	0.68	• Munich	1.05	• Utrecht	0.57
• Brussels	1.48	• Stuttgart	1.79		
• Liege	0.93			Spain	
		Hungary		• Madrid	0.84
Denmark		• Budapest	0.21	• Barcelona	0.90
• Aarhus	0.72	• Miskolc	0.72	• Seville	0.51
• Copenhagen	0.60	• Pecs	0.86	• Alicante	0.46
• Odense	0.65			• Murcia	0.98
		Italy			
Finland		• Bologna	0.49	Switzerland	
• Helsinki	0.94	• Milan	0.13	• Berne	0.63
• Tampere	1.01	• Naples	0.62	• Geneva	2.12
		• Rome	0.27	• Zurich	1.63
France		• Turin	0.25		
• Banlieue/Paris	1.46			United Kingdom b/	
• Lyon	1.52	Japan		• Bristol	1.23
• Marseille	1.20	• Nagoya	0.41	• Cardiff	1.72
• Nice	1.51	• Osaka	0.25	• London	0.88
• Paris	0.72	• Sapporo	0.57	• Manchester	1.29
		• Tokyo	0.45	• Newcastle Upon Tyne	1.37
		• Yokohama	0.41		
		Low Value (Milan)	US$ 0.13 /m^3		
		Average	US$ 0.96 /m^3		
		High Value (Geneva)	US$ 2.12 /m^3		

Notes: a/ Average b/ Metered Consumption

7. CONCLUSION

In water utilities or enterprises, public or private, benchmarking processes are developing everyday. Because benchmarking is an effective, easy and cheap way to make comparisons, start innovations (if necessary) and to understand the enterprise's position in the sector.

Benchmarking process can be applied to Water & Wastewater utilities, environmental parts of the companies and also to all parts of companies in all fields. We always use it in our lives, too.

If it is not forgotten that benchmarking is not :

-only competitor analysis

-done once for all time

-copying

-industrial tourism

-spying or espionage

-quick and easy,

than the benchmarking process could be sucsessful.

As seen in World Bank and AWWA web based database ' BenchWater@ ' can be developed for water & wastewater utilities in Turkiye.

This study shows a way as a handbook to public and private utilities and other sectors how to start an environmental benchmarking process and how to use it with recommendations. Service quality and customer satisfaction become more important everyday and especially in water utilities water losses and pipe breaks can be decreased only after some studies.

And it musn't be forgotten that when applying the benchmarking process, there will be lack of information and data. The data and information might

be collected as much as possible. The important thing is to use and discuss the data correctly.

In a country like ours, where national sectors have high goals in global competition, benchmarking provides a cheap and practical method of improvement. By investigating all the elements of an organization at low cost, increasing the level of service and profits whilst decreasing costs will be possible by identifying the benchmarking scales, lighting the way for further studies.

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APPENDIX

Table A.1. African Utilities' Values

Country	Utility	Size Band	Services Provided	Extent of PSP	Year	1,1 Water Coverage %	2,1 Sewerage Coverage %	3,1 Water Production lpcd
Benin	SBEE	Large	A	A	1995	36,94%		23,15
Benin	SBEE	Large	A	A	1996	37,99%		25,33
Burkina Faso	ONEA	Large	C	A	1995	18,83%		32,24
Burkina Faso	ONEA	Large	C	A	1996	18,90%		27,70
Burkina Faso	ONEA	Large	C	A	1997	18,97%		33,64
Cote d'Ivoire	SODECI	Large	A	E	1995	36,54%		58,89
Cote d'Ivoire	SODECI	Large	A	E	1996	37,82%		58,70
Cote d'Ivoire	SODECI	Large	A	E	1997	39,34%		56,67
Morocco	ONEP	Large	A	A	1995	48,89%		120,03
Morocco	ONEP	Large	A	A	1996	49,48%		125,09
Morocco	ONEP	Large	A	A	1997	52,00%		120,39
Namibia	WINDHOEK	Medium	C	A	1995	100,00%		290,76
Namibia	WINDHOEK	Medium	C	A	1996	100,00%		231,64
Namibia	WINDHOEK	Medium	C	A	1997	100,00%		194,00
Nigeria	KdSWB	Large	A	A	1995	35,00%		122,52
Nigeria	KdSWB	Large	A	A	1996	35,00%		119,81
Nigeria	KtSWB	Large	A	A	1995	17,59%		60,76
Nigeria	KtSWB	Large	A	A	1996	17,73%		59,94
Senegal	SDE	Large	A	E	1996	46,28%		69,85
Senegal	SDE	Large	A	E	1997	46,29%		65,65
South Africa	RAND WATER	Large	A	A	1995	94,74%		313,85
South Africa	RAND WATER	Large	A	A	1996	94,87%		266,86
South Africa	RAND WATER	Large	A	A	1997	95,00%		278,88
Togo	RNET	Large	C	A	1995	30,70%		66,81
Togo	RNET	Large	C	A	1996	29,47%		67,47
Togo	RNET	Large	C	A	1997	28,59%		58,14

3,2 Water Production m3/c/m	3,3 Water Production m3/hh/m	4,1 Total Water Consumption lpcd	4,2 Total Water Consumption m3/c/m	4,3 Total Water Consumption m3/hh/m	5,1 Metered Water Consumption lpcd	5,2 Metered Water Consumption m3/c/m	5,3 Metered Water Consumption m3/hh/m
24,56	27,00						
24,08	27,26						
45,01	49,29	24,96	34,86	38,17			
37,65	40,98	26,87	36,52	39,75			
44,72	48,49	27,02	35,93	38,95			
28,79	29,91	55,25	27,01	28,07			
28,50	29,53	51,44	24,98	25,88			
27,74	28,74	47,07	23,04	23,87			
107,62	120,37	109,15	97,87	109,47			
101,27	111,94	112,53	91,11	100,70			
99,62	109,70	108,62	89,88	98,98			
45,18	48,08	263,91	41,01	43,64			
36,67	39,13	205,67	32,56	34,74			
31,55	33,76	168,04	27,33	29,24			
85,44	90,13	57,58	40,16	42,36			
81,36	86,53	68,39	46,45	49,40			
70,93	81,57	45,15	52,70	60,61			
65,67	83,28	48,27	52,89	67,07			
34,94	37,24	48,87	24,45	26,06			
31,57	38,68	47,23	22,71	27,83			
80.446,32		313,85	80446,32				
70.302,75		266,86	70302,75				
75.452,56		278,88	75452,56				
55,16	60,53	48,31	39,88	43,77	58,64	48,41	53,13
54,65	60,32	51,14	41,42	45,72	60,47	48,98	54,06
46,25	50,57	43,51	34,61	37,85	51,96	41,34	45,19

6,1 Unaccounted For Water %	6,2 Unaccounted For Water n3/km/d	6,3 Unaccounted For Water m3/conn/d	7,1 Metering Level %	8,1 % Sold that is Metered %	9,1 Pipe Breaks breaks/km/yr	9,2 Pipe Breaks breaks/conn	10,1 Sewerage Clogs clogs/km/yr	10,2 Sewerage Clogs clogs/conn
			100,00%		0,27	0,01		
			100,00%		0,27	0,01		
22,57%	8,73	0,33	100,00%		0,44	0,02		
3,00%	1,02	0,04	99,99%		0,57	0,02		
19,66%	7,93	0,29	100,00%					
6,17%	1,73	0,06	100,00%					
12,37%	3,65	0,12	100,00%					
16,94%	5,19	0,15	100,00%					
9,06%	16,03	0,32	100,00%		0,03	0,00		
10,04%	16,87	0,33	100,00%		0,03	0,00		
9,78%	15,66	0,32	100,00%		0,05	0,00		
9,23%	3,05	0,14	100,00%		0,06	0,00		
11,21%	3,06	0,14	100,00%		0,05	0,00		
13,38%	3,17	0,14	100,00%		0,06	0,00		
53,00%	68,25	1,49	3,13%					
42,91%	55,66	1,15	3,79%					
25,69%	32,56	0,60	1,05%					
19,46%	25,18	0,42	0,95%					
30,03%	16,83	0,35	100,00%		7,08	0,15		
28,06%	16,70	0,29	100,00%		8,24	0,14		
0,00%	0,00	0,00	100,00%		0,04	0,09		
0,00%	0,00	0,00	100,00%		0,04	0,09		
0,00%	0,00	0,00	100,00%		0,02	0,04		
27,70%	11,10	0,50	100,00%	121,38%				
24,21%	9,71	0,43	100,00%	118,25%	2,53	0,11		
25,16%	8,60	0,38	100,00%	119,42%	3,15	0,14		

11,1 Unit Operational Cost W&S US$/m3 sold	11,2 Unit Operational Cost W&S US$/m3 prod	12,1 Staff W conn #/'000	12,2 Staff W&S conn #/'000	12,3 Staff W Pop Served #/'000	12,4 Staff W&S Pop Served #/'000	13,1 Labor costs vs Operating costs %	14,1 Contract out serv costs vs Oper costs %
	0,29	5,83		0,17		43,06%	
	0,34	5,36		0,17		43,47%	
0,30	0,23	9,58		0,21		42,31%	
0,69	0,66	9,06		0,20		22,06%	
0,47	0,38	11,90		0,27		27,27%	
0,35	0,33	4,13		0,26		30,95%	
0,39	0,34	3,75		0,23		28,49%	
0,39	0,32	3,57		0,22		26,33%	
0,31	0,28	14,13		0,48		20,54%	
0,32	0,28	12,72		0,48		25,49%	
0,29	0,26	12,30		0,45		24,31%	
0,61	0,55	2,90		0,57		4,17%	
0,65	0,58	2,79		0,54		6,36%	
0,90	0,78	2,73		0,51		8,19%	
0,11	0,05	24,56		1,07		11,57%	
0,08	0,05	21,33		0,96		10,78%	
0,12	0,09	43,43		1,13		14,29%	
0,16	0,13	39,95		1,11		9,23%	
0,54	0,37					17,64%	
0,71	0,51	5,12		0,32		20,09%	
0,18	0,18	3.111,42		0,37		19,97%	
0,17	0,17	3.068,35		0,35		22,83%	
0,18	0,18	3.045,88		0,34		21,99%	
0,36	0,26	13,24		0,49		34,65%	
0,38	0,29	12,11		0,45		32,44%	
0,43	0,32	12,63		0,48		31,71%	

15,1 Continuity of service Hrs/day	16,1 Complaints of W&S services %	17,1 Wastewater Treatment %	18,1 Average Tariff W&S US$/m3	18,2 Average Tariff W&S US$/conn/yr	18,3 Average Tariff W&S US$/hh/yr	19,1 Total Revenues / Service Pop / GDP %	20,1 Residential Fixed Component of Tariff US$/conn/yr
18,00				118,25	129,99	0,92%	
17,00				101,40	114,76	0,83%	
24,00			0,97	407,02	445,66	3,76%	
24,00			0,98	428,39	466,23	3,86%	
24,00			0,90	389,55	422,35	3,93%	
22,00			0,55	178,65	185,64	1,50%	
22,00			0,68	203,04	210,35	1,65%	
23,00			0,45	125,28	129,79	1,08%	
24,00			0,29	345,12	386,03	0,94%	
24,00			0,31	343,87	380,10	0,95%	
24,00			0,29	312,87	344,56	0,94%	
24,00			0,63	307,85	327,57	2,79%	
24,00			0,64	250,17	266,93	2,39%	
24,00			0,67	220,74	236,19	2,04%	
			0,10	47,29	49,89	0,82%	
			0,09	51,11	54,35	0,74%	
			0,08	47,97	55,17	0,49%	
			0,09	58,53	74,22	0,53%	
16,00			0,53	154,91	165,11	1,73%	
16,00			0,75	204,14	250,13	2,59%	
24,00			0,28	274173,29		0,84%	
24,00			0,28	235551,12		0,76%	
24,00			0,28	249209,70		0,77%	
20,00			0,49	234,53	257,38	2,71%	
20,00			0,52	256,63	283,23	2,77%	
20,00			0,68	280,94	307,16	3,11%	

20,2 Residential Fixed Component of Tariff %	21,1 Industrial to Residential Ratio	22,1 Connection Charge - water US$/conn	22,2 Connection Charge - water % of GDP	22,3 Connection Charge - sewer US$/conn	22,4 Connection Charge - sewer % of GDP	23,1 Collection Period Months	24,1 Working Ratio #
							0,72
							0,97
	2,53						0,31
	2,49						0,70
	2,19						0,52
							0,64
							0,57
							0,85
							1,05
							1,01
							1,00
							0,97
							1,02
							1,34
	31,93						1,07
	8,59						0,91
	31,08						1,60
	8,12						1,70
							1,01
	1,70						0,94
	1,00						0,63
	1,00						0,62
	1,00						0,66
							0,74
							0,74
							0,63

25,1 Debt Service Ratio %	26,1 Investments %	26,2 Investments US$/capita	27,1 Net Fixed Assets/Capita US$/capita
436,89			$14,16
430,03			$22,06
59,61			$31,73
67,61			$35,94
62,26			$30,52
23,73			$4,60
18,58			$4,31
26,13			$3,64
155,71			$72,09
140,63			$75,14
181,95			$69,29
179,24			$157,29
228,57			$154,67
293,99			$161,59
232,71			$38,35
13,85			$1,90
22,83			$2,58
60,16			$54,78
83,22			$57,87
91,35			$63,07
128,16			$75,25
108,80			$68,60
73,92			$45,39

Table A.2. Africa – Weighted Average Values

Country	Utility	Size Band	Services Provided	Extent of PSP	Year	1,1 Water Coverage %	2,1 Sewerage Coverage %	3,1 Water Production lpcd	3,2 Water Production m3/c/m	3,3 Water Production m3/hh/m
Africa	**Weighted Average Values**				**1995**	37,50%	-	91,58	69,91	75,82
Africa	**Weighted Average Values**				**1996**	38,80%	-	89,83	61,02	65,89
Africa	**Weighted Average Values**				**1997**	41,79%	-	90,24	59,25	65,26

4,1 Total Water Consumption lpcd	4,2 Total Water Consumption m3/c/m	4,3 Total Water Consumption m3/hh/m	5,1 Metered Water Consumption lpcd	5,2 Metered Water Consumption m3/c/m	5,3 Metered Water Consumption m3/hh/m	6,1 Unaccounted For Water %	6,2 Unaccounted For Water n3/km/d	6,3 Unaccounted For Water m3/conn/d	7,1 Metering Level %
84,12	62,75	68,00	58,64	48,41	53,13	13,52%	11,84	0,32	91,77%
80,34	53,45	57,57	60,47	48,98	54,06	15,07%	12,43	0,31	93,41%
78,15	51,31	56,51	51,96	41,34	45,19	13,40%	10,62	0,26	100,00%

8,1 % Sold that is Metered %	9,1 Pipe Breaks breaks/km/yr	9,2 Pipe Breaks breaks/conn	10,1 Sewerage Clogs clogs/km/yr	10,2 Sewerage Clogs clogs/conn	11,1 Unit Operational Cost W&S US$/m3 sold	11,2 Unit Operational Cost W&S US$/m3 produced	12,1 Staff W conn #/'000	12,2 Staff W&S conn #/'000	12,3 Staff W Pop Served #/'000
121,38%	0,12	0,00	-	-	0,31	0,27	11,20	-	0,45
118,25%	1,78	0,04	-	-	0,35	0,29	10,11	-	0,43
119,42%	2,31	0,05	-	-	0,36	0,31	8,02	-	0,37

12,4 Staff W&S Pop Served #/'000	13,1 Labor costs vs Operating costs %	14,1 Contract out serv costs vs Oper costs %	15,1 Continuity of service Hrs/day	16,1 Complaints of W&S services %	17,1 Wastewater Treatment %	18,1 Average Tariff W&S US$/m3	18,2 Average Tariff W&S US$/conn/yr	18,3 Average Tariff W&S US$/hh/yr	19,1 Total Revenues / Service Pop / GDP %	20,1 Residential I Componen Tariff US$/conn
-	22,58%	-	22,89	-		0,35	253,18	274,56	1,14%	
-	24,44%	-	21,85	-		0,39	241,93	261,21	1,20%	
-	23,50%	-	22,46	-		0,38	235,16	258,99	1,20%	

23,1 Collection Period Months	24,1 Working Ratio #	25,1 Debt Service Ratio %	26,1 Investments %	26,2 Investments US$/capita	27,1 Net Fixed Assets/Capita US$/capita
-	0,89	128,77%	-	-	$49,30
-	0,89	103,56%	-	-	$44,83
-	0,93	121,88%	-	-	$42,07

Weighted Average Values for Suudi Arabia

Country	Utility	Size Band	Services Provided	Extent of PSP	Year	1,1 Water Coverage %	2,1 Sewerage Coverage %	3,1 Water Production lpcd	3,2 Water Production m3/c/m	3,3 Water Production m3/hh/m
Saudi Arabia	Weighted Average				1997	88	52	369		
Saudi Arabia	Weighted Average				1998	91	38	318		
Saudi Arabia	Weighted Average				1999	91	37	305		
Saudi Arabia	Weighted Average				2000	92	41	283		

4,1 Total Water Consumption lpcd	4,2 Total Water Consumption m3/c/m	4,3 Total Water Consumption m3/hh/m	5,1 Metered Water Consumption lpcd	5,2 Metered Water Consumption m3/c/m	5,3 Metered Water Consumption m3/hh/m	6,1 Unaccounted For Water %	6,2 Unaccounted For Water n3/km/d	6,3 Unaccounted For Water m3/conn/d	7,1 Metering Level %
279						24	24,3		71
224						28	36,3		74
213						28	37,1		79
192						28	38,2		88

8,1 % Sold that is Metered %	9,1 Pipe Breaks breaks/km/yr	9,2 Pipe Breaks breaks/conn	10,1 Sewerage Clogs clogs/km/yr	10,2 Sewerage Clogs clogs/conn	11,1 Unit Operational Cost W&S US$/m3 sold	11,2 Unit Operational Cost W&S US$/m3 prod	12,1 Staff W conn #/'000	12,2 Staff W&S conn #/'000	12,3 Staff W Pop Served #/'000	12,4 Staff W&S Pop Served #/'000
	1,24		1,24		0,29		24,5	13,8	1,94	1,22
	1,72		5,71		0,40		20,5	12,8	1,50	1,07
	1,73		5,88		0,41		21,3	12,2	1,40	1,00
	1,69		5,26		0,46		21,8	12,7	1,34	0,93

13,1 Labor costs vs Operating costs %	14,1 Contract out serv costs vs Oper costs %	15,1 Continuity of service Hrs/day	16,1 Complaints of W&S services %	17,1 Wastewater Treatment %	18,1 Average Tariff W&S US$/m3	18,2 Average Tariff W&S US$/conn/yr	18,3 Average Tariff W&S US$/hh/yr	19,1 Total Revenues / Service Pop / GDP %
60	55	18,4	7,1		0,05			0,09
50	51	17,7	9,3		0,11			0,14
48	51	15,6	10,9		0,11			0,14
0	0	16,1	8,1		0,14			0,17

20,1 Residential Fixed Component of Tariff US$/conn/yr	20,2 Residential Fixed Component of Tariff %	21,1 Industrial to Residential Ratio	22,1 Connection Charge - water US$/conn	22,2 Connection Charge - water % of GDP	22,3 Connection Charge - sewer US$/conn	22,4 Connection Charge - sewer % of GDP	23,1 Collection Period Months

24,1 Working Ratio #	25,1 Debt Service Ratio %	26,1 Investments %	26,2 Investments US$/capita	27,1 Net Fixed Assets/Capita US$/capita
6,44				
2,98				
3,06				
2,59				

Table A.3. Indicator Values of Baltic States

Country	Utility	Size Band	Services Provided	Extent of PSP	Year	1,1 Water Coverage %	2,1 Sewerage Coverage %	3,1 Water Production lpcd
Estonia	Haapsalu	Small	C		1994	74,47%	70,92%	318,33
Estonia	Haapsalu	Small	C		1995	79,39%	60,31%	281,88
Estonia	Haapsalu	Small	C		1996	79,23%	64,62%	252,69
Latvia	Daugavpils	Small	C		1994	79,94%	76,57%	427,12
Latvia	Daugavpils	Small	C		1995	80,23%	76,99%	409,25
Latvia	Daugavpils	Small	C		1996	79,81%	75,93%	396,77
Latvia	Liepaja	Small	C		1994	82,96%	87,93%	331,42
Latvia	Liepaja	Small	C		1995	86,63%	91,32%	299,85
Latvia	Liepaja	Small	C		1996	87,64%	92,72%	292,07
Lithuania	Klaipeda	Medium	C		1994	107,18%	98,82%	402,16
Lithuania	Klaipeda	Medium	C		1995	107,00%	98,62%	377,50
Lithuania	Klaipeda	Medium	C		1996	107,20%	98,26%	351,34
Lithuania	Siauliai	Small	C		1994	84,86%	84,86%	289,32
Lithuania	Siauliai	Small	C		1995	84,58%	84,61%	251,31
Lithuania	Siauliai	Small	C		1996	83,96%	83,96%	207,15

3,2 Water Production m3/c/m	3,3 Water Production m3/hh/m	4,1 Total Water Consumption lpcd	4,2 Total Water Consumption m3/c/m	4,3 Total Water Consumption m3/hh/m	5,1 Metered Water Consumption lpcd	5,2 Metered Water Consumption m3/c/m	5,3 Metered Water Consumption m3/hh/m
	29,05	240,05		21,90			
86,74	25,77	226,55	69,71	20,71	158,07	48,64	
74,54	23,08	199,49	58,85	18,22	148,19	43,72	
367,90	41,57	292,24	251,72	28,44			
348,53	39,83	272,84	232,36	26,56			
331,59	38,62	272,23	227,51	26,50			
255,25	32,26	260,43	200,58	25,35	271,85	209,37	
230,94	29,26	217,79	167,74	21,25	240,65	185,34	
223,65	28,44	193,65	148,29	18,86	235,40	180,26	
808,82	36,70	369,49	743,10	33,71	367,16	738,43	
755,74	34,45	340,89	682,44	31,11	353,83	708,35	
700,13	32,06	304,41	606,61	27,78	314,29	626,30	
220,57	26,44	254,25	193,84	23,24	251,72	191,91	
190,83	22,93	206,85	157,08	18,88	204,80	155,52	
155,40	18,90	167,06	125,33	15,24	165,40	124,08	

6,1 Unaccounted For Water %	6,2 Unaccounted For Water n3/km/d	6,3 Unaccounted For Water m3/conn/d	7,1 Metering Level %	8,1 % Sold that is Metered %	9,1 Pipe Breaks breaks/km/yr	9,2 Pipe Breaks breaks/conn	10,1 Sewerage Clogs clogs/km/yr	10,2 Sewerage Clogs clogs/conn
24,59%	35,28			58,70%	1,89		0,26	
19,63%	23,58	0,56	88,33%	61,63%	1,60	0,04	0,18	0,01
21,05%	22,46	0,52	86,16%	64,00%	2,25	0,05	0,22	0,01
31,58%	61,71	3,82	122,02%		0,56	0,03	0,56	0,03
33,33%	61,71	3,82	122,02%		0,56	0,03	0,50	0,03
31,39%	55,28	3,42	122,02%		0,61	0,04	0,50	0,03
21,42%	39,86	1,80	52,60%	54,90%	1,11	0,05	0,17	0,01
27,37%	46,08	2,08	52,60%	58,12%	0,99	0,04	0,15	0,01
33,70%	54,94	2,48	52,60%	63,93%	1,03	0,05	0,11	0,01
8,13%	22,83	2,16	92,42%	91,84%	2,88	0,27	1,18	0,16
9,70%	25,47	2,41	92,42%	95,93%	2,90	0,27	1,13	0,15
13,36%	32,49	3,07	92,42%	95,42%	2,72	0,26	1,10	0,15
12,12%	17,97	0,88	101,00%	100,00%			11,32	0,41
17,69%	22,68	1,11	101,00%	100,00%	13,66	0,67	11,87	0,43
19,35%	20,21	0,99	101,00%	100,00%	13,32	0,65	7,41	0,27

11,1 Unit Operational Cost W&S US$/m3 sold	11,2 Unit Operational Cost W&S US$/m3 prod	12,1 Staff W conn #/'000	12,2 Staff W&S conn #/'000	12,3 Staff W Pop Served #/'000	12,4 Staff W&S Pop Served #/'000	13,1 Labor costs vs Operating costs %	14,1 Contract out serv costs vs Oper costs %
0,58	0,44			3,81	1,95	50,38%	
0,64	0,51	36,96	25,00	3,65	2,08	49,32%	
0,65	0,51	37,66	25,48	3,88	2,14	46,38%	
0,29	0,20	121,99	65,05	4,31	2,20	33,75%	
0,25	0,16	121,99	65,05	4,36	2,22	40,40%	
0,31	0,21	121,99	65,05	4,44	2,28	34,55%	
0,33	0,26	100,64	48,05	3,97	1,93	24,30%	
0,29	0,21	91,31	43,59	3,61	1,76	40,41%	
0,51	0,34	90,43	43,18	3,59	1,75	31,12%	
0,16	0,15	160,75	89,91	2,43	1,26	24,40%	
0,26	0,24	157,72	88,21	2,40	1,25	19,06%	
0,33	0,28	151,05	84,48	2,31	1,20	17,44%	
0,26	0,23	112,49	58,77	4,49	2,24	41,36%	
0,34	0,28	105,47	55,10	4,22	2,11	40,33%	
0,39	0,31	102,47	53,53	4,15	2,08	46,05%	

15,1 Continuity of service Hrs/day	16,1 Complaints of W&S services %	17,1 Wastewater Treatment %	18,1 Average Tariff W&S US$/m3	18,2 Average Tariff W&S US$/conn/yr	18,3 Average Tariff W&S US$/hh/yr	19,1 Total Revenues / Service Pop / GDP %	20,1 Residential Fixed Component of Tariff US$/conn/yr
24,00			0,58		152,56	1,93%	
24,00			0,77	643,17	191,09	1,97%	
24,00			0,83	589,39	182,49	2,05%	
24,00			0,27	815,60	92,16	1,34%	
24,00			0,26	714,61	81,67	1,31%	
24,00			0,30	815,88	95,03	1,44%	
24,00			0,36	872,78	110,30	1,61%	
24,00			0,40	804,04	101,86	1,63%	
24,00			0,48	848,63	107,90	1,64%	
24,00			0,21	1891,90	85,83	1,83%	
24,00			0,29	2373,85	108,21	1,95%	
24,00			0,34	2466,64	112,95	1,77%	
24,00			0,37	863,14	103,47	2,20%	
24,00			0,44	822,56	98,85	1,78%	
24,00			0,53	799,98	97,30	1,52%	

20,2 Residential Fixed Component of Tariff %	21,1 Industrial to Residential Ratio	22,1 Connection Charge - water US$/conn	22,2 Connection Charge - water % of GDP	22,3 Connection Charge - sewer US$/conn	22,4 Connection Charge - sewer % of GDP	23,1 Collection Period Months	24,1 Working Ratio #
						1,66	1,00
						1,84	0,83
						1,18	0,77
						4,31	1,07
						4,13	0,96
						3,63	1,02
						3,29	0,90
						6,61	0,74
						8,39	1,06
						2,30	0,77
						2,70	0,90
						1,56	0,96
						1,47	0,71
						1,61	0,77
						2,11	0,73

25,1 Debt Service Ratio %	26,1 Investments %	26,2 Investments US$/capita	27,1 Net Fixed Assets/Capita US$/capita
12,87			$82,10
44,27	123,67%	$78,62	$184,72
306,74	198,34%	$120,53	$254,53
0,00	1,06%	$0,30	$39,56
0,00	0,00%	$0,00	$30,84
0,52	6,47%	$1,92	$34,54
	17,20%	$5,93	$38,97
1,51	374,26%	$118,84	$136,93
3,81	167,48%	$56,46	$166,94
0,00			$119,34
1,73	70,09%	$25,28	$125,96
0,39	113,99%	$42,92	$157,66
1,89			
0,01			$254,31
5,24			$230,47

Table A.4 Weighted Average Values for Baltic States

Country	Utility	Size Band	Services Provided	Extent of PSP	Year	1,1 Water Coverage %
Baltics	**Weighted Average Values**				**1994**	90,94%
Baltics	**Weighted Average Values**				**1995**	91,71%
Baltics	**Weighted Average Values**				**1996**	91,73%

2,1 Sewerage Coverage %	3,1 Water Production lpcd	3,2 Water Production m3/c/m	3,3 Water Production m3/hh/m	4,1 Total Water Consumption lpcd	4,2 Total Water Consumption m3/c/m	4,3 Total Water Consumption m3/hh/m	5,1 Metered Water Consumption lpcd
88,16%	367,40	389,86	34,27	308,57	328,01	28,78	325,68
88,52%	339,41	341,36	31,66	275,25	276,83	25,68	293,63
88,36%	314,43	312,69	29,32	246,74	245,37	23,01	258,69

5,2 Metered Water Consumption m3/c/m	5,3 Metered Water Consumption m3/hh/m	6,1 Unaccounted For Water %	6,2 Unaccounted For Water n3/km/d	6,3 Unaccounted For Water m3/conn/d	7,1 Metering Level %	8,1 % Sold that is Metered %	9,1 Pipe Breaks breaks/km/yr
363,52	-	16,01%	33,41	2,03	92,96%	87,04%	1,76
307,55	-	18,90%	36,21	2,12	92,67%	90,22%	4,80
268,31	-	21,53%	37,86	2,21	92,51%	90,69%	4,69

9,2 Pipe Breaks breaks/conn	10,1 Sewerage Clogs clogs/km/yr	10,2 Sewerage Clogs clogs/conn	11,1 Unit Operational Cost W&S US$/m3 sold	11,2 Unit Operational Cost W&S US$/m3 produced	12,1 Staff W conn #/'000	12,2 Staff W&S conn #/'000	12,3 Staff W Pop Served #/'000
0,12	2,70	0,17	0,23	0,20	122,47	63,83	3,53
0,28	2,76	0,17	0,28	0,23	112,28	59,38	3,40
0,27	1,92	0,12	0,36	0,28	109,70	58,05	3,36

12,4 Staff W&S Pop Served #/'000	13,1 Labor costs vs Operating costs %	14,1 Contract out serv costs vs Oper costs %	15,1 Continuity of service Hrs/day	16,1 Complaints of W&S services %	17,1 Wastewater Treatment %	18,1 Average Tariff W&S US$/m3	18,2 Average Tariff W&S US$/conn/yr
1,79	31,03%	-	24,00	-		0,28	1078,33
1,73	30,77%	-	24,00	-		0,33	1100,32
1,71	28,44%	-	24,00	-		0,39	1138,69

18,3 Average Tariff W&S US$/hh/yr	19,1 Total Revenues / Service Pop / GDP %	20,1 Residential Fixed Component of Tariff US$/conn/yr	20,2 Residential Fixed Component of Tariff %	21,1 Industrial to Residential Ratio	22,1 Connection Charge - water US$/conn	22,2 Connection Charge - water % of GDP	22,3 Connection Charge - sewer US$/conn
96,23	1,76%	-	-	-	-	-	-
102,06	1,74%	-	-	-	-	-	-
106,77	1,64%	-	-	-	-	-	-

22,4 Connection Charge - sewer % of GDP	23,1 Collection Period Months	24,1 Working Ratio #	25,1 Debt Service Ratio %	26,1 Investments %	26,2 Investments US$/capita	27,1 Net Fixed Assets/Capita US$/capita
-	2,58	0,84	1,08%	9,38%	$2,95	$82,65
-	3,22	0,85	2,64%	121,27%	$40,47	$141,61
-	3,06	0,93	12,38%	107,52%	$38,23	$155,97

Table A.5 Weighted Average Values for Moldova

Country	Utility				Year	1,1 Water Coverage %	2,1 Sewerage Coverage %	3,1 Water Production lpcd
Moldova average	Weighted Average Values				1996	68%	55%	652,94
	Weighted Average Values				1997	70%	56%	623,54
	Weighted Average Values				1998	71%	55%	566,89
	Weighted Average Values				1999	72%	54%	465,91
	Weighted Average Values				2000	73%	56%	339,91
	Weighted Average Values				2001	75%	57%	319,56
Small (<15,000)	Weighted Average Values				1996	45%	34%	217,67
	Weighted Average Values				1997	49%	41%	233,22
	Weighted Average Values				1998	56%	37%	220,12
	Weighted Average Values				1999	57%	37%	176,27
	Weighted Average Values				2000	58%	38%	125,58
	Weighted Average Values				2001	58%	36%	91,46
Moldova medium (15,000-100,000)	Weighted Average Values				1996	61%	39%	239,12
	Weighted Average Values				1997	61%	40%	231,35
	Weighted Average Values				1998	63%	39%	217,30
	Weighted Average Values				1999	65%	39%	171,53
	Weighted Average Values				2000	66%	40%	142,01
	Weighted Average Values				2001	66%	40%	115,95

3,2 Water Production m3/c/m	3,3 Water Production m3/hh/m	4,1 Total Water Consumption lpcd	4,2 Total Water Consumption m3/c/m	4,3 Total Water Consumption m3/hh/m	5,1 Metered Water Consumption lpcd	5,2 Metered Water Consumption m3/c/m	5,3 Metered Water Consumption m3/hh/m	6,1 Unaccounted For Water %
225,91	58,16	457,39	154,85	39,87	2.232,92	973,77	920,70	30%
201,25	53,59	437,29	141,14	37,58	2.279,10	861,63	297,54	30%
174,76	49,14	396,55	122,25	34,37	1.975,30	671,08	157,18	30%
137,63	39,43	323,97	95,70	27,42	1.576,64	474,21	86,81	30%
99,01	28,49	221,44	64,50	18,56	844,88	246,41	38,85	35%
89,46	23,96	186,08	52,09	13,95	518,70	145,37	28,12	42%
46,35	19,06	188,36	40,11	16,50	589,86	165,24	209,09	14%
50,10	20,10	205,11	44,07	17,68	1.148,82	293,35	92,78	12%
44,32	18,57	183,68	36,99	15,49	1.227,46	258,69	97,25	17%
31,71	14,66	133,24	23,97	11,08	387,97	69,13	21,00	24%
24,07	10,39	95,05	18,22	7,86	218,02	41,84	10,05	24%
16,82	3,69	63,12	11,61	2,55	162,19	29,83	7,51	31%
48,09	20,77	189,03	38,01	16,42	480,76	113,89	62,43	20%
46,14	19,81	176,15	35,13	15,08	497,83	113,32	76,19	23%
43,30	18,32	160,81	32,05	13,63	560,40	123,05	63,88	25%
33,88	14,37	132,69	26,21	11,12	598,32	119,87	35,70	23%
27,34	11,61	102,13	19,67	8,35	483,39	93,08	19,13	28%
21,80	9,34	76,10	14,31	6,13	266,31	50,08	9,88	34%

6,2 Unaccounted For Water n3/km/d	6,3 Unaccounted For Water m3/conn/d	7,1 Metering Level %	8,1 % Sold that is Metered %	9,1 Pipe Breaks breaks/km/yr	9,2 Pipe Breaks breaks/conn	10,1 Sewerage Clogs clogs/km/yr	10,2 Sewerage Clogs clogs/conn	11,1 Unit Operational Cost W&S US$/m3 sold	11,2 Unit Operational Cost W&S US$/m3 produced	12,1 Staff W conn #/'000	12,2 Staff W&S conn #/'000
67,43	2,34	13%	79%	4,62	0,14	4,61	0,22	0,17	0,12	51,73	38,86
63,44	1,98	13%	81%	4,61	0,14	3,81	0,17	0,20	0,14	49,37	36,30
56,86	1,73	15%	82%	4,55	0,14	4,87	0,17	0,22	0,16	50,10	36,36
46,55	1,38	17%	83%	4,58	0,14	4,75	0,20	0,17	0,12	48,39	35,26
38,68	1,13	22%	85%	4,93	0,14	4,95	0,21	0,26	0,17	47,08	34,12
40,87	1,23	31%	88%	5,56	0,17	4,74	0,20	0,37	0,22	46,78	34,24
7,99	0,21	1%	4%	1,98	0,05	1,45	0,06	0,37	0,31	66,54	53,24
6,35	0,20	1%	10%	2,25	0,07	1,18	0,06	0,42	0,38	66,72	51,46
8,33	0,24	4%	33%	2,82	0,08	2,54	0,10	0,38	0,32	61,55	47,06
8,98	0,25	7%	22%	2,72	0,08	1,80	0,10	0,34	0,26	53,75	42,02
6,47	0,19	13%	31%	2,98	0,09	1,93	0,11	0,44	0,33	56,49	43,35
5,38	0,17	19%	49%	3,25	0,10	2,27	0,13	0,52	0,36	52,10	40,40
12,62	0,33	5%	14%	3,67	0,09	4,12	0,14	0,31	0,25	46,04	35,42
13,31	0,36	5%	16%	3,15	0,08	3,77	0,13	0,38	0,29	47,27	35,35
13,63	0,37	6%	22%	3,00	0,08	5,38	0,12	0,37	0,28	48,61	36,22
9,48	0,25	7%	35%	2,60	0,07	5,62	0,21	0,29	0,23	47,46	35,31
9,51	0,25	10%	48%	2,85	0,08	5,34	0,19	0,35	0,25	45,92	33,89
9,14	0,25	14%	50%	2,63	0,07	3,34	0,12	0,41	0,27	45,90	33,89

12,3 Staff W Pop Served #/'000	12,4 Staff W&S Pop Served #/'000	13,1 Labor costs vs Operating costs %	14,1 Contract out serv costs vs Oper costs %	15,1 Continuity of service Hrs/day	16,1 Complaints of W&S services %	17,1 Wastewater Treatment %	18,1 Average Tariff W&S US$/m3	18,2 Average Tariff W&S US$/conn/yr	18,3 Average Tariff W&S US$/hh/yr	19,1 Total Revenues / Service Pop / GDP %	20,1 Residential Fixed Component of Tariff US$/conn/yr	20,2 Residential Fixed Component of Tariff %
4,38	2,54	17%	8%	21,54	6%		0,21	402,24	100,62	9%	-	-
4,65	2,63	20%	9%	21,52	6%		0,29	488,06	129,92	10%	0	0
4,94	2,82	21%	4%	20,24	6%		0,26	374,77	104,86	9%	0	0
4,98	2,84	20%	4%	19,59	6%		0,20	229,65	65,80	9%	0	0
4,92	2,79	24%	3%	18,72	7%		0,36	275,36	79,22	10%	0	0
5,08	2,91	20%	5%	19,54	4%		0,39	241,68	64,73	7%	309296,6	1265,404
9,51	6,09	20%	1%	17,18	3%		0,45	252,53	91,83	8%	-	-
9,45	5,68	20%	2%	17,94	3%		0,50	267,62	108,87	9%	0	0
9,30	5,86	26%	1%	17,05	4%		0,42	188,43	78,93	7%	0	0
9,09	5,73	26%	2%	14,31	5%		0,37	106,64	49,30	7%	0	0
8,96	5,61	36%	2%	10,01	5%		0,39	86,35	37,26	5%	0	0
8,62	5,45	40%	1%	10,56	7%		0,43	60,35	13,24	3%	0	0
7,15	4,54	28%	4%	20,62	7%		0,37	169,46	73,26	7%	-	-
7,21	4,55	27%	4%	20,52	8%		0,45	184,18	79,08	6%	0	0
7,42	4,66	31%	3%	16,18	8%		0,39	145,86	62,26	6%	0	0
7,31	4,57	28%	2%	15,01	9%		0,32	99,57	42,23	6%	0	0
7,25	4,51	35%	2%	13,19	10%		0,34	80,59	34,22	4%	0	0
7,42	4,60	36%	4%	12,16	9%		0,42	71,60	30,67	3%	0	0

21,1 Industrial to Residential Ratio	22,1 Connection Charge - water US$/conn	22,2 Connection Charge - water % of GDP	22,3 Connection Charge - sewer US$/conn	22,4 Connection Charge - sewer % of GDP	23,1 Collection Period Months	24,1 Working Ratio #	25,1 Debt Service Ratio %	26,1 Investments %	26,2 Investments US$/capita	27,1 Net Fixed Assets/Capita US$/capita
9,68	0	0	0	0	7,49	0,82	0%	7%	2,70	334,70
8,21	0	0	0	0	6,49	0,71	0%	6%	3,00	371,44
7,57	0	0	0	0	7,95	0,86	2%	6%	2,45	311,59
7,78	0	0	0	0	9,08	0,87	0%	7%	1,85	163,19
6,28	0	0	0	0	10,25	0,73	1%	16%	5,57	158,96
4,25	0	0	0	0	10,43	0,96	19%	59%	15,49	143,29
19,94	0	0	0	0	15,84	0,81	0%	59%	12,71	432,98
9,40	0	0	0	0	14,71	0,85	0%	159%	28,11	351,37
8,74	0	0	0	0	17,27	0,90	4%	22%	4,06	295,47
10,63	0	0	0	0	15,70	0,92	1%	4%	0,57	161,19
8,06	0	0	0	0	21,81	1,11	0%	0%	-	156,38
5,29	0	0	0	0	22,56	1,21	0%	0%	-	117,69
8,04	-	-	-	-	10,50	0,85	2%	30%	11,66	379,11
7,11	-	-	-	-	7,98	0,84	3%	18%	7,05	420,25
7,03	-	-	-	-	9,97	0,96	4%	14%	3,03	339,79
6,16	-	-	-	-	11,03	0,93	5%	5%	0,85	180,09
6,45	-	-	-	-	9,88	1,03	7%	5%	0,63	177,59
7,46	0	0	0	0	10,30	0,99	2%	1%	0,13	158,48

Table A.6 Weighted Average Values for Russia

Country	Utility	Size Band	Services Provided	Extent of PSP	Year	1,1 Water Coverage %	2,1 Sewerage Coverage %
Russia	**Weighted Average Values**				**1997**	86,04%	66,72%
Russia	**Weighted Average Values**				**1998**	86,65%	67,29%
Russia	**Weighted Average Values**				**1999**	87,42%	68,53%
Russia	**Weighted Average Values**				**2000**	88,32%	69,89%
Russia	**Weighted Average Values**				**2001**	88,09%	69,63%

3,1 Water Production lpcd	3,2 Water Production m3/c/m	3,3 Water Production m3/hh/m	4,1 Total Water Consumption lpcd	4,2 Total Water Consumption m3/c/m	4,3 Total Water Consumption m3/hh/m	5,1 Metered Water Consumption lpcd	5,2 Metered Water Consumption m3/c/m
473,73	189,71	40,85	361,46	119,35	32,28	159,86	91,24
471,54	184,23	54,48	360,97	115,81	42,76	166,30	90,51
466,14	165,85	54,28	354,68	105,75	41,62	146,17	83,82
458,20	164,65	41,18	340,09	103,89	30,18	167,23	88,65
455,27	158,39	39,79	336,49	98,95	28,79	182,50	95,06

5,3 Metered Water Consumption m3/hh/m	6,1 Unaccounted For Water %	6,2 Unaccounted For Water n3/km/d	6,3 Unaccounted For Water m3/conn/d	7,1 Metering Level %	8,1 % Sold that is Metered %	9,1 Pipe Breaks breaks/km/yr	9,2 Pipe Breaks breaks/conn
14,04	22,05%	57,87	1,40	20,23%	58,10%	1,19	0,03
13,67	21,91%	51,64	1,33	21,16%	59,09%	1,31	0,03
13,40	21,97%	49,54	1,22	24,33%	55,65%	1,32	0,03
13,35	23,06%	49,46	1,27	24,90%	56,19%	1,36	0,03
12,30	23,59%	47,42	1,20	27,92%	56,72%	1,21	0,03

10,1 Sewerage Clogs clogs/km/yr	10,2 Sewerage Clogs clogs/conn	11,1 Unit Operational Cost W&S US$/m3 sold	11,2 Unit Operational Cost W&S US$/m3 produced	12,1 Staff W conn #/'000	12,2 Staff W&S conn #/'000	12,3 Staff W Pop Served #/'000	12,4 Staff W&S Pop Served #/'000
1,93	0,05	0,26	0,20	45,79	81,76	4,19	5,64
2,27	0,05	0,17	0,13	46,87	83,45	4,33	5,79
1,93	0,05	0,08	0,06	44,50	79,67	4,43	5,96
1,87	0,05	0,10	0,08	45,24	80,98	4,52	6,03
1,63	0,04	0,13	0,09	43,01	81,12	4,61	6,21

13,1 Labor costs vs Operating costs %	14,1 Contract out serv costs vs Oper costs %	15,1 Continuity of service Hrs/day	16,1 Complaints of W&S services %	17,1 Wastewater Treatment %	18,1 Average Tariff W&S US$/m3	18,2 Average Tariff W&S US$/conn/yr	18,3 Average Tariff W&S US$/hh/yr
22,48%	16,42%	23,30	1,13%	93,67%	0,18	262,10	82,43
22,89%	18,46%	23,30	1,25%	93,71%	0,12	164,62	64,88
24,79%	17,16%	23,50	1,09%	93,81%	0,05	69,97	27,56
25,85%	17,44%	23,50	1,31%	92,60%	0,06	81,65	25,58
28,53%	17,51%	23,40	1,93%	90,77%	0,08	101,11	31,95

19,1 Total Revenues / Service Pop / GDP %	20,1 Residential Fixed Component of Tariff US$/conn/yr	20,2 Residential Fixed Component of Tariff %	21,1 Industrial to Residential Ratio	22,1 Connection Charge - water US$/conn	22,2 Connection Charge - water % of GDP	22,3 Connection Charge - sewer US$/conn	22,4 Connection Charge - sewer % of GDP
1,14%	-	-	4,51	-	-	-	-
1,19%	-	-	6,61	-	-	-	-
0,82%	-	-	4,59	-	-	-	-
0,90%	-	-	5,64	-	-	-	-
0,96%	-	-	3,61	-	-	-	-

23,1 Collection Period Months	24,1 Working Ratio #	25,1 Debt Service Ratio %	26,1 Investments %	26,2 Investments US$/capita	27,1 Net Fixed Assets/Capita US$/capita
7,43	0,84	-	-	-	$202,46
9,99	0,87	-	-	-	$143,54
10,00	0,92	-	-	-	$56,14
8,29	0,99	-	-	-	$53,70
5,62	0,96	-	-	-	$54,43

Table A.7 Weighted Average Values for Ukraine

Country	Utility	Size Band	Services Provided	Extent of PSP	Year	1,1 Water Coverage %	2,1 Sewerage Coverage %	3,1 Water Production lpcd	3,2 Water Production m3/c/m	3,3 Water Production m3/hh/m
Ukraine	**Weighted Average Values**				**1994**	-	-	-	-	-
Ukraine	**Weighted Average Values**				**1995**	-	-	-	-	-
Ukraine	**Weighted Average Values**				**1996**	-	-	-	-	-
Ukraine	**Weighted Average Values**				**1997**	84,60%	64,21%	528,37	190,95	44,37
Ukraine	**Weighted Average Values**				**1998**	82,51%	61,08%	534,76	184,99	43,95
Ukraine	**Weighted Average Values**				**1999**	83,09%	61,92%	511,87	176,53	42,07
Ukraine	**Weighted Average Values**				**2000**	84,56%	67,81%	470,62	158,08	38,50
Ukraine	**Weighted Average Values**				**2001**	81,77%	66,21%	466,65	147,94	35,31
Ukraine	**Weighted Average Values**				**2002**	-	-	-	-	-

4,1 Total Water Consumption lpcd	4,2 Total Water Consumption m3/c/m	4,3 Total Water Consumption m3/hh/m	5,1 Metered Water Consumption lpcd	5,2 Metered Water Consumption m3/c/m	5,3 Metered Water Consumption m3/hh/m	6,1 Unaccounted For Water %	6,2 Unaccounted For Water n3/km/d	6,3 Unaccounted For Water m3/conn/d	7,1 Metering Level %
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
385,47	140,45	32,38	1.735,09	625,30	-	27,10%	48,02	1,73	5,67%
381,53	131,90	31,33	1.233,38	430,83	-	28,60%	48,57	1,75	7,24%
370,11	127,57	30,39	993,08	328,55	-	27,68%	44,97	1,61	9,96%
337,75	113,41	27,60	574,18	181,50	-	28,23%	42,35	1,47	16,32%
321,28	101,79	24,28	477,51	143,60	-	31,15%	43,51	1,52	22,75%
-	-	-	-	-	-	-	-	-	-

8,1 % Sold that is Metered %	9,1 Pipe Breaks breaks/km/yr	9,2 Pipe Breaks breaks/conn	10,1 Sewerage Clogs clogs/km/yr	10,2 Sewerage Clogs clogs/conn	11,1 Unit Operational Cost W&S US$/m3 sold	11,2 Unit Operational Cost W&S US$/m3 produced	12,1 Staff W conn #/'000	12,2 Staff W&S conn #/'000	12,3 Staff W Pop Served #/'000	12,4 Staff W&S Pop Served #/'000
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
26,29%	2,47	0,09	2,64	0,01	0,21	0,16	47,56	68,29	4,02	5,52
24,52%	2,51	0,09	2,43	0,01	0,19	0,14	48,26	61,58	4,26	5,77
27,06%	2,48	0,09	2,46	0,01	0,15	0,11	49,09	65,58	4,35	5,66
27,78%	2,40	0,08	2,22	0,01	0,13	0,09	48,26	91,24	4,39	5,47
34,14%	2,26	0,08	2,47	0,01	0,15	0,10	47,50	90,07	4,58	5,65
-	-	-	-	-	-	-	-	-	-	-

13,1 Labor costs vs Operating costs %	14,1 Contract out serv costs vs Oper costs %	15,1 Continuity of service Hrs/day	16,1 Complaints of W&S services %	17,1 Wastewater Treatment %	18,1 Average Tariff W&S US$/m3	18,2 Average Tariff W&S US$/conn/yr	18,3 Average Tariff W&S US$/hh/yr	19,1 Total Revenues / Service Pop / GDP %	20,1 Residential Fixed Component of Tariff US$/conn/yr
-	-	-	-		-	-	-	-	-
-	-	-	-		-	-	-	-	-
-	-	-	-		-	-	-	-	-
16,98%	15,19%	19,70	1,42%		0,17	$306.19	$67.39	1,82%	0,00
16,81%	15,62%	19,40	1,35%		0,12	$186.1	$44.05	1,94%	0,00
14,82%	15,34%	19,40	1,38%		0,08	$129.21	$30.82	1,78%	0,00
16,01%	12,66%	19,00	1,09%		0,11	$150.22	$36.6	2,37%	0,00
19,02%	12,34%	19,00	1,11%		0,10	$127.1	$30.34	1,77%	0,00
-	-	-	-		-	-	-	-	-

20,2 Residential Fixed Component of Tariff %	21,1 Industrial to Residential Ratio	22,1 Connection Charge - water US$/conn	22,2 Connection Charge - water % of GDP	22,3 Connection Charge - sewer US$/conn	22,4 Connection Charge - sewer % of GDP	23,1 Collection Period Months	24,1 Working Ratio #
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
0,00%	7,37	0,00	0,00%	0,00	0,00%	10,99	0,84
0,00%	9,08	0,00	0,00%	0,00	0,00%	15,14	0,90
0,00%	15,88	0,00	0,00%	0,00	0,00%	16,92	0,93
0,00%	6,79	0,00	0,00%	0,00	0,00%	11,89	0,83
0,00%	6,94	0,00	0,00%	0,00	0,00%	14,20	0,88
-	-	-	-	-	-	-	-

25,1 Debt Service Ratio %	26,1 Investments %	26,2 Investments US$/capita	27,1 Net Fixed Assets/Capita US$/capita
-	-	-	-
-	-	-	-
-	-	-	-
0,00%	6,01%	$1.82	$231,46
0,00%	5,92%	$1,45	$137,56
0,00%	1,28%	$0,94	$80,06
0,00%	1,44%	$1,28	$60,45
0,00%	0,82%	$0,74	$103,77
-	-	-	-

Table A.8. Core Indicator Values of US

Country	Utility	Size Band	Services Provided	Extent of PSP	Year	1,1 Water Coverage %	2,1 Sewerage Coverage %	3,1 Water Production lpcd
United States	ARTESIAN WATER	Medium	A	G	1996	100,00%		332,82
United States	AVON WATER	Small	A	G	1996	100,00%		362,77
United States	BARN- STABLE	Small	A	G	1996	100,00%		274,50
United States	BATON ROUGE	Medium	A	G	1996	100,00%		700,86
United States	BERMUDA WATER	Small	A	G	1996	100,00%		793,40
United States	BIRMING- HAM	Small	A	G	1996	100,00%		394,34
United States	BRIDGEPORT HYDRAULIC	Medium	A	G	1996	100,00%		501,90
United States	CALIF AMERICAN	Medium	A	G	1996	100,00%		633,30
United States	CALIFORNIA WATER CO	Large	A	G	1996	100,00%		726,39
United States	CITIZENS UTIL / CAL	Medium	A	G	1996	100,00%		1.320,22
United States	CITIZENS UTIL / ILL	Small	A	G	1996	100,00%		363,76
United States	CITIZENS UTIL / OH	Small	A	G	1996	100,00%		347,18
United States	CITIZENS UTIL / PA	Small	A	G	1996	100,00%		324,06
United States	COLLEGE UTIL CORP	Small	A	G	1996	100,00%		181,13
United States	CONNECTICUT AMERICAN	Small	A	G	1996	100,00%		687,29
United States	CONNECTICUT WATER SE	Medium	A	G	1996	100,00%		289,44
United States	CONSUMERS ILLINOIS	Medium	A	G	1996	100,00%		605,75
United States	CONSUMERS MAINE	Small	A	G	1996	100,00%		396,96
United States	CONSUMERS NEW HAMP	Medium	A	G	1996	100,00%		59,77
United States	CONSUMERS NEW JERSEY	Small	A	G	1996	100,00%		322,01
United States	CONSUMERS OHIO	Medium	A	G	1996	100,00%		433,68
United States	CONSUMERS PA-ROAR. C	Small	A	G	1996	100,00%		353,09
United States	CONSUMERS PA-SHENANG	Small	A	G	1996	100,00%		742,14
United States	CONSUMERS PA-SUSQUE.	Small	A	G	1996	100,00%		367,09
United States	DOMINGUEZ WATER	Small	A	G	1996	100,00%		1.054,99

3,2 Water Production *m3/c/m*	*3,3 Water Production* *m3/hh/m*	*4,1 Total Water Consumption* *lpcd*	*4,2 Total Water Consumption* *m3/c/m*	*4,3 Total Water Consumption* *m3/hh/m*	*5,1 Metered Water Consumption* *lpcd*	*5,2 Metered Water Consumption* *m3/c/m*	*5,3 Metered Water Consumption* *m3/hh/m*
34,95	37,57	280,87	29,49	31,70	280,87	29,49	31,70
38,71	43,40	309,52	33,03	37,03	309,52	33,03	37,03
39,14	50,64	233,02	33,23	42,99	233,02	33,23	42,99
53,45	53,45	653,02	49,80	49,80	653,02	49,80	49,80
59,81	65,22	690,01	52,02	56,72	690,01	52,02	56,72
44,50	47,51	309,84	34,96	37,33	309,84	34,96	37,33
53,92	58,84	394,71	42,40	46,27	394,71	42,40	46,27
68,06	77,74	605,05	65,02	74,27	605,05	65,02	74,27
89,18	103,61	525,81	64,55	75,00	525,81	64,55	75,00
105,78	120,83						
34,86	37,30	324,17	31,07	33,24	324,17	31,07	33,24
31,62	32,48	289,11	26,33	27,05	289,11	26,33	27,05
31,87	34,02	302,80	29,78	31,79	302,80	29,78	31,79
47,60	51,68	156,24	41,06	44,58	156,24	41,06	44,58
75,43	84,33	548,68	60,22	67,32	548,68	60,22	67,32
30,87	34,09	260,59	27,79	30,69	260,59	27,79	30,69
42,21	54,41	485,00	33,79	43,56	485,00	33,79	43,56
39,31	45,69	308,61	30,56	35,52	308,61	30,56	35,52
31,75	34,82	51,26	27,22	29,85	51,26	27,22	29,85
36,70	38,85	278,81	31,77	33,64	278,81	31,77	33,64
38,03	40,97	369,94	32,44	34,95	369,94	32,44	34,95
36,48	38,32	207,40	21,43	22,51	207,40	21,43	22,51
72,66	79,72	555,48	54,38	59,67	555,48	54,38	59,67
49,16	53,59	207,40	27,77	30,28	207,40	27,77	30,28
109,05	123,46	950,13	98,21	111,19	950,13	98,21	111,19
80,06	81,24	761,45	69,23	70,25	761,45	69,23	70,25
85,13	100,68	928,78	83,20	98,39	928,78	83,20	98,39

6,1 Unaccounted For Water *%*	*6,2 Unaccounted For Water* *n3/km/d*	*6,3 Unaccounted For Water* *m3/conn/d*	*7,1 Metering Level* *%*	*8,1 % Sold that is Metered* *%*	*9,1 Pipe Breaks* *breaks/km/yr*	*9,2 Pipe Breaks* *breaks/conn*	*10,1 Sewerage Clogs* *clogs/km/yr*	*10,2 Sewerage Clogs* *clogs/conn*
15,61%	8,32	0,18	100,00%	100,00%				
14,68%	0,06	0,19	100,00%	100,00%				
15,11%	8,85	0,19	100,00%	100,00%				
6,83%	4,36	0,12	100,00%	100,00%				
13,03%	4,20	0,26	100,00%	100,00%				
21,43%	14,76	0,31	100,00%	100,00%				
21,36%	15,24	0,38	100,00%	100,00%				
4,46%	4,72	0,10	100,00%	100,00%				
27,61%	41,01	0,81	100,00%	100,00%				
			100,00%					
10,88%	6,84	0,12	100,00%	100,00%				
16,73%	6,05	0,17	100,00%	100,00%				
6,56%	2,44	0,07	100,00%	100,00%				
13,74%	3,65	0,22	100,00%	100,00%				
20,17%	17,64	0,50	100,00%	100,00%				
9,97%	3,97	0,10	100,00%	100,00%				
19,93%	12,61	0,28	100,00%	100,00%				
22,26%	9,20	0,29	100,00%	100,00%				
14,25%	4,16	0,15	100,00%	100,00%				
13,41%	7,76	0,16	100,00%	100,00%				
14,70%	8,33	0,18	100,00%	100,00%				
41,26%	21,85	0,49	100,00%	100,00%				
25,15%	24,82	0,60	100,00%	100,00%				
43,50%	29,36	0,70	100,00%	100,00%				
9,94%	22,63	0,36	100,00%	100,00%				
13,53%	14,95	0,36	100,00%	100,00%				
2,28%	6,91	0,06	100,00%	100,00%				

11,1 Unit Operational Cost W&S *US$/m3 sold*	*11,2 Unit Operational Cost W&S* *US$/m3 prod*	*12,1 Staff W conn* *#/'000*	*12,2 Staff W&S conn* *#/'000*	*12,3 Staff W Pop Served* *#/'000*	*12,4 Staff W&S Pop Served* *#/'000*	*13,1 Labor costs vs Operating costs* *%*	*14,1 Contract out serv costs vs Oper costs* *%*
0,71	0,60	2,33		0,68		30,25%	
0,85	0,72	3,19		0,91		29,64%	
0,54	0,46	1,38		0,29		26,34%	
0,27	0,25	1,75		0,70		38,51%	
0,50	0,43	4,13		1,67		46,89%	
0,92	0,72	2,13		0,58		27,22%	
0,71	0,56	2,10		0,59		28,10%	
0,58	0,56	1,90		0,54		17,55%	
0,49	0,35	1,70		0,42		22,35%	
	0,15	1,23		0,47		27,49%	
0,83	0,77	1,78		0,55		34,75%	
1,59	1,37	5,76		0,67		46,51%	
0,66	0,53	2,50		0,69		26,04%	
1,22	1,10	2,63		0,75		28,75%	
0,53	0,43	1,83		0,80		32,91%	
0,81	0,63	3,13		0,96		32,14%	
1,46	1,25	2,12		0,12		18,59%	
0,64	0,55	1,60		0,43		32,91%	
0,70	0,60	1,74		0,60		28,34%	
1,14	0,67	2,09		0,62		27,29%	
0,41	0,31	2,47		0,77		41,02%	
0,74	0,42	2,42		0,55		41,51%	
0,49	0,44	2,12		0,62		16,34%	
0,48	0,41	2,08		0,70		27,52%	
0,12	0,12	1,02		0,35		39,15%	

15,1 Continuity of service *Hrs/day*	*16,1 Complaints of W&S services* *%*	*17,1 Wastewater Treatment* *%*	*18,1 Average Tariff W&S* *US$/m3*	*18,2 Average Tariff W&S* *US$/conn/yr*	*18,3 Average Tariff W&S* *US$/hh/yr*	*19,1 Total Revenues / Service Pop / GDP* *%*	*20,1 Residential Fixed Component of Tariff* *US$/conn/yr*
24,00			1,02	359,39	386,34	0,37%	
24,00			1,17	464,21	520,51	0,47%	
24,00			0,72	286,25	370,30	0,22%	
24,00			0,44	261,31	261,31	0,37%	
24,00			0,66	409,84	446,91	0,59%	
24,00			1,24	519,24	554,40	0,50%	
24,00			1,18	602,15	657,12	0,61%	
24,00			0,80	622,00	710,48	0,63%	
24,00			0,63	491,80	571,39	0,44%	
24,00				289,71	330,92	0,39%	
24,00			1,13	420,41	449,81	0,48%	
24,00			0,99	312,63	321,21	0,37%	
24,00			1,38	493,31	526,51	0,55%	
24,00			2,25	1107,19	1202,05	0,46%	
24,00			0,92	664,12	742,42	0,66%	
24,00			1,88	626,52	691,80	0,64%	
24,00			0,86	349,21	450,15	0,54%	
24,00			1,34	492,54	572,42	0,54%	
24,00			2,43	794,34	871,15	0,16%	
24,00			0,99	377,11	399,22	0,36%	
24,00			1,03	399,15	429,99	0,49%	
24,00			1,89	485,15	509,65	0,51%	
24,00			0,64	416,71	457,21	0,46%	
24,00			1,05	349,65	381,20	0,28%	
24,00			0,57	669,48	757,95	0,70%	
24,00			0,70	581,93	590,50	0,70%	
24,00			0,15	151,67	179,37	0,18%	

20,2 Residential Fixed Component of Tariff *%*	*21,1 Industrial to Residential* *Ratio*	*22,1 Connection Charge - water* *US$/conn*	*22,2 Connection Charge - water* *% of GDP*	*22,3 Connection Charge - sewer* *US$/conn*	*22,4 Connection Charge - sewer* *% of GDP*	*23,1 Collection Period* *Months*	*24,1 Working Ratio* *#*
	0,67					1,08	0,70
	0,74					1,30	0,72
						1,55	0,75
						1,36	0,61
	0,60					0,90	0,76
	0,75					1,87	0,74
	0,35					1,33	0,60
	0,93					0,71	0,73
	0,46					0,85	0,76
						3,13	0,66
	0,50					0,08	0,60
	0,78					0,99	0,71
	0,55					0,96	0,72
	0,66					1,16	0,65
	0,33					1,56	0,62
	0,24					1,58	0,60
	0,78					1,17	0,60
	0,80					1,05	0,64
	0,42					0,84	0,68
	0,35					1,04	0,61
	0,42					1,47	0,64
	0,40					0,72	0,70
	0,89					0,79	0,86
	0,73					2,81	0,68
						0,55	0,82

25,1 Debt Service Ratio *%*	*26,1 Investments* *%*	*26,2 Investments* *US$/capita*	*27,1 Net Fixed Assets/Capita* *US$/capita*
36,87	38,87%	$40,46	$427,91
6,57	45,82%	$60,63	$702,83
10,47			$171,55
18,22	24,20%	$25,23	$318,83
2,44	25,57%	$42,28	$595,68
15,19	34,66%	$48,51	$389,37
11,95	52,02%	$88,69	$577,69
-1,06	16,39%	$28,85	$378,62
8,62	19,52%	$23,79	$288,90
			$446,36
			$526,16
			$410,73
0,03			$1.534,50
13,18	22,37%	$28,66	$625,10
15,29	14,61%	$26,88	$656,86
16,65	27,94%	$49,92	$666,61
16,55	26,37%	$40,20	$708,36
14,49	19,60%	$29,66	$580,53
21,28	11,19%	$5,09	$217,49
13,80	50,92%	$51,26	$454,86
12,58	40,73%	$56,39	$545,79
15,26	32,62%	$46,59	$600,22
18,06	32,41%	$41,97	$446,63
14,70	92,31%	$73,32	$296,42
3,58	13,33%	$26,26	$308,55
14,51	48,68%	$94,78	$975,06
11,61	6,44%	$3,32	$201,10

14,87	20,44%	$37,63	$810,17
17,44			$2.353,29
7,41	18,60%	$24,28	$423,42
17,67	27,06%	$11,51	$156,17
5,72	13,46%	$16,20	$150,92
8,77	35,28%	$47,10	$386,04
10,03			$339,69
17,05	35,60%	$48,47	$532,79
33,37	15,65%	$51,18	$936,24
15,81	39,64%	$148,84	$1.734,75
5,35	9,09%	$13,69	$197,07
9,58	57,42%	$298,23	$1.322,48
8,14	25,65%	$40,73	$389,73
8,62	12,75%	$20,89	$485,43
29,61	53,49%	$152,49	$991,65
15,50	91,43%	$86,91	$451,08
17,82	47,54%	$82,94	$719,23
15,34	18,82%	$30,85	$473,79
10,12	11,85%	$22,20	$391,61
9,39	5,65%	$6,37	$201,20
14,98	13,82%	$20,00	$924,81
10,01	22,24%	$28,02	$394,57
7,22	52,20%	$36,56	$233,97
9,10	27,04%	$119,15	$844,94
2,96	133,21%	$395,99	$952,28
22,68	26,81%	$32,62	$540,43
64,52	31,55%	$41,14	$518,30
32,18	63,75%	$85,24	$555,84
19,01	22,45%	$25,20	$426,08
41,74	-5,11%	($10,29)	$820,91
16,47	6,76%	$18,51	$861,28
6,35	28,46%	$49,88	$430,48

Table A.8. Individual Partners' Indicator Values

Country	Utility ID	Size Band	Services Provided	Extent of PSP	Year	1,1 Water Coverage %	2,1 Sewerage Coverage %	3,1 Water Production lpcd	3,2 Water Production m3/c/m
Australia	3	Small	C	B	1996	100,00%	82,35%	354,55	28,65
Australia	3	Small	C	B	1997	100,00%	81,40%	439,63	33,82
Australia	3	Small	C	B	1998	100,00%	82,76%	453,47	31,58
Poland	1	Medium	D	A	1996	73,21%	57,14%	682,93	212,92
Poland	1	Medium	D	A	1997	73,40%	57,80%	664,42	204,07
Poland	1	Medium	D	A	1998	73,94%	58,45%	593,61	180,56
Poland	5	Medium	D	B	1994	100,00%	90,99%	339,53	209,25
Poland	5	Medium	D	B	1995	100,00%	91,01%	327,56	189,14
Poland	5	Medium	D	B	1996	100,00%	91,00%	300,93	169,03
Poland	5	Medium	D	B	1997	100,00%	91,00%	290,97	158,58
Poland	5	Medium	D	B	1998	100,00%	91,01%	269,37	140,93
Tunisia	6	Large	A	B	1994	73,79%		135,32	22,73
Tunisia	6	Large	A	B	1995	74,44%		127,24	20,80
Tunisia	6	Large	A	B	1996	75,11%		123,12	19,73
Tunisia	6	Large	A	B	1997	75,80%		123,52	19,41
Tunisia	6	Large	A	B	1998	76,64%		124,10	19,14
United Kingdom	4	Large	D	B C F	1998	100,00%	92,72%	503,43	33,03
United Kingdom	4	Small			1996				
United Kingdom	4	Small		B C F	1997				
United States	2	Small			1995				
United States	2	Small	B		1996				
United States	2	Small	B		1997				
United States	2	Small	B	A	1998		100,00%		

3,3 Water Production m3/hh/m	4,1 Total Water Consumption lpcd	4,2 Total Water Consumption m3/c/m	4,3 Total Water Consumption m3/hh/m	5,1 Metered Water Consumption lpcd	5,2 Metered Water Consumption m3/c/m	5,3 Metered Water Consumption m3/hh/m	6,1 Unaccounted For Water %
31,61	328,77	26,56	29,31	339,37	27,42	29,31	7,27%
37,10	407,77	31,37	34,41	420,13	32,32	34,41	7,25%
34,29	415,68	28,95	31,43	426,92	29,73	31,43	8,33%
	347,48	108,33		368,43	114,86		49,12%
	326,91	100,41		347,01	106,58		50,80%
	309,20	94,05		319,18	97,08		47,91%
31,00	266,72	164,38	24,35	279,42	172,20	203,03	21,44%
29,93	252,35	145,71	23,06	272,88	157,56	185,67	22,96%
27,46	233,74	131,29	21,33	254,53	142,98	168,77	22,33%
26,56	227,35	123,91	20,76	247,82	135,06	160,12	21,87%
24,58	218,92	114,53	19,98	238,99	125,03	148,77	18,73%
23,45	99,19	16,66	17,19	99,19	16,66	17,19	26,70%
21,50	93,96	15,36	15,87	93,96	15,36	15,87	26,15%
20,40	91,36	14,64	15,14	91,36	14,64	15,14	25,79%
20,10	96,12	15,10	15,64	96,12	15,10	15,64	22,19%
20,32	97,76	15,08	16,00	97,76	15,08	16,00	21,23%
35,62	354,08	23,23	25,05	6.508,63	427,09	361.958,33	29,67%
					427,59		29,67%

6,2 Unaccounted For Water n3/km/d	6,3 Unaccounted For Water m3/conn/d	7,1 Metering Level %	8,1 % Sold that is Metered %	9,1 Pipe Breaks breaks/km/yr	9,2 Pipe Breaks breaks/conn	10,1 Sewerage Clogs clogs/km/yr	10,2 Sewerage Clogs clogs/conn
2,12	0,07	96,88%	100,00%	0,29	0,01		
2,50	0,08	97,06%	100,00%	0,40	0,01	0,44	0,01
2,02	0,09	97,37%	100,00%	0,19	0,01	0,08	0,00
55,59	3,44	92,50%	98,08%	0,60	0,04	0,62	0,03
54,75	3,41	92,68%	98,38%	0,54	0,03	0,68	0,04
45,73	2,84	95,24%	98,31%	0,61	0,04	0,59	0,03
38,72	1,48	95,20%	99,73%	2,39	0,09	1,16	0,07
39,74	1,43	92,24%	99,74%	2,25	0,08	1,16	0,07
35,37	1,24	91,57%	99,72%	2,75	0,10	1,09	0,06
33,37	1,14	91,51%	99,75%	2,45	0,08	0,98	0,05
25,98	0,87	91,36%	99,74%	2,35	0,08	0,96	0,05
11,86	0,20	100,00%	100,00%	0,57	0,01		
10,60	0,18	100,00%	100,00%	0,55	0,01		
9,83	0,17	100,00%	100,00%	0,46	0,01		
8,30	0,14	100,00%	100,00%	0,45	0,01		
7,85	0,13	100,00%	100,00%	0,44	0,01		
21,66	0,32	2,28%	41,83%	0,10	0,00	0,70	0,01
21,66			41,83%	0,10			
						0,05	0,03

11,1 Unit Operational Cost W&S US$/m3 sold	11,2 Unit Operational Cost W&S US$/m3 prod	12,1 Staff W conn #/'000	12,2 Staff W&S conn #/'000	12,3 Staff W Pop Served #/'000	12,4 Staff W&S Pop Served #/'000	13,1 Labor costs vs Operating costs %	14,1 Contract out serv costs vs Oper costs %
0,96	0,89	2,66	1,37	1,00	0,55	31,67%	0,91%
0,66	0,61	2,26	1,20	0,90	0,49	33,37%	5,88%
0,57	0,52	1,97	1,09	0,86	0,47	32,62%	6,11%
0,50	0,25	32,35	23,96	3,16	1,77	24,98%	
0,43	0,21	30,54	22,36	3,02	1,69	30,01%	
0,48	0,25	29,00	21,00	2,90	1,62	29,97%	
0,27	0,21	31,29	19,69	1,54	0,81	31,64%	16,25%
0,38	0,29	29,51	18,88	1,55	0,81	28,74%	18,50%
0,45	0,35	29,01	18,55	1,57	0,82	30,13%	20,38%
0,46	0,36	28,69	18,34	1,60	0,84	31,61%	18,90%
0,50	0,41	27,84	17,79	1,62	0,85	38,36%	20,37%
0,29	0,21	6,52		1,18		62,09%	
0,34	0,25	6,00		1,12		61,34%	
0,36	0,26	5,44		1,03		62,88%	
0,32	0,25	5,43		1,05		63,13%	
0,33	0,26	5,18		1,02		63,50%	
1,05	0,74	2,38	1,22	1,10	0,57	34,79%	
						44,26%	
0,85	0,60					41,99%	
						66,39%	6,76%
						65,67%	8,65%

15,1 Continuity of service Hrs/day	16,1 Complaints of W&S services %	17,1 Wastewater Treatment %	18,1 Average Tariff W&S US$/m3	18,2 Average Tariff W&S US$/conn/yr	18,3 Average Tariff W&S US$/hh/yr	19,1 Total Revenues / Service Pop / GDP %	20,1 Residential Fixed Component of Tariff US$/conn/yr
24,00		100,00%	2,24	715,48	789,49	1,22%	468,75
24,00		100,00%	1,91	719,83	789,49	1,30%	435,56
24,00		100,00%	1,47	511,09	554,90	1,16%	354,72
24,00	27,41%		0,58	754,94		1,99%	9,78
24,00	23,07%		0,58	693,02		1,85%	9,26
24,00	20,00%		0,64	725,77		1,77%	10,34
24,00	5,88%	87,00%	0,34	676,92	100,27	1,31%	0,00
24,00	5,29%	91,00%	0,44	774,93	122,64	1,25%	0,00
24,00	7,16%	90,00%	0,49	777,20	126,26	1,14%	0,00
24,00	5,52%	88,00%	0,50	750,33	125,69	1,13%	0,00
24,00	5,19%	91,00%	0,54	736,91	128,53	1,04%	0,00
24,00			0,46	91,21	94,11	0,93%	10,17
24,00			0,51	94,46	97,64	0,88%	11,57
24,00			0,52	91,73	94,83	0,81%	12,12
24,00			0,48	86,37	89,45	0,82%	10,59
24,00			0,46	82,82	87,89	0,76%	10,32
24,00	4,62%	82,00%	1,56	434,06	467,99	0,88%	378,00
24,00		82,00%					
24,00		82,00%	1,37				
		100,00%					

20,2 Residential Fixed Component of Tariff %	21,1 Industrial to Residential Ratio	22,1 Connection Charge - water US$/conn	22,2 Connection Charge - water % of GDP	22,3 Connection Charge - sewer US$/conn	22,4 Connection Charge - sewer % of GDP	23,1 Collection Period Months	24,1 Working Ratio #
65,52%	0,49	2001,56	9,07%	1610,94	7,30%	4,76	0,43
60,51%	0,45	2370,37	10,87%	1777,78	8,15%	4,36	0,34
69,40%	0,74	2327,04	12,06%	1823,90	9,45%	2,09	0,39
1,30%	0,76					15,27	0,86
1,34%	1,69					13,85	0,75
1,43%	1,58					14,43	0,74
0,00%	1,46					1,64	0,77
0,00%	1,75					1,91	0,85
0,00%	1,31					1,59	0,92
0,00%	1,24					1,97	0,92
0,00%	1,04					1,34	0,94
11,15%	2,55	150,73	8,51%			9,17	0,62
12,25%	2,58	156,61	7,80%			8,45	0,66
13,22%	2,51	151,59	7,03%			8,74	0,68
12,27%	2,51	130,41	6,36%			9,39	0,67
12,46%	2,50	124,94	5,84%			9,66	0,72
87,08%	0,99	550,00	2,39%	193,33	0,84%	2,52	0,67
						2,34	0,62
	1,04					2,08	0,62
				850,00	3,17%		
				900,00	3,22%		
				950,00	3,24%	0,34	0,59
				1000,00	3,28%	0,37	0,57

25,1 Debt Service Ratio %	26,1 Investments %	26,2 Investments US$/capita	27,1 Net Fixed Assets/Capita US$/capita
38,96	22,90%	$61,67	$2.074,86
31,85	24,49%	$69,69	$2.048,74
35,73	23,51%	$52,49	$1.747,10
	37,78%	$27,82	
0,77	58,37%	$40,06	
0,38	90,88%	$65,96	
	16,96%	$5,67	$108,61
	7,06%	$2,88	$100,61
	11,89%	$5,01	$94,99
0,66	11,22%	$4,70	$82,39
0,25	9,54%	$4,09	$89,43
35,94	44,19%	$7,30	$87,49
32,41	44,30%	$7,79	$95,09
28,65	36,26%	$6,31	$91,92
29,72	30,65%	$5,13	$80,03
19,64	37,32%	$6,09	$78,13
39,12	8,25%	$16,59	$509,96
87,17	9,91%		
43,02	9,24%		
46,82	22,40%		
46,19	29,06%		

APPENDIX B : Summary of Indicators Proposed for the Organizational Development Business System

The indicators are listed in priority order as expressed by workshop participants. Review by utility executives and managers is sought to assist with identifying the most promising indicators from the proposed list, or with offering alternatives. All comments will receive consideration by workshop participants when they reconvene to make final recommendations on the selection of 5 and 20 indicators. Detailed guidance on each final indicator will be developed at that time.

Indicator	Data Elements and Definitions
Investment in Employee Training compares the costs of employee training with total labor costs. This indicator is expressed as a percentage. % = 100 (Training costs) / Total labor costs	• Training costs include all such costs paid by the utility and associated with training utility employees, regardless of whether training is held at or away from the utility. Included are salaries and benefits of each employee during periods of training, registration and tuition fees, associated travel and expenses, training material costs, and training contract costs. • Total labor costs include the cost of direct salaries and the cost of employee benefits such as vacation, holidays, health care and retirement. Overtime costs are included.
Organizational Best Practices Index is comprised of five individual components, each evaluated by the utility survey participant, relative to a scoring matrix provided with the survey. Indices will range between 1 and 100 for all five components. Data for each individual component will also be available.	The five components included in the index are: • Use of a recognized self-assessment system to gauge performance • Development and updating of strategic and business plans annually • Adherence to a formal program for organizational quality improvement • Implementation of a formal performance measurement system • Implementation of an asset management program
Employee Safety Rates are based on the US OSHA standards. Three individual indicators are recommended relative to person hours worked by utility staff: recordable incidents; lost work-day cases; and lost days	Definitions are the same as those in OSHA 200. These will be included in the guidance for those utilities not subject to OSHA. In addition to the three data sets listed to the left, we will need the total person-hours worked by all utility staff during each year.
Planned Maintenance compares the time invested in planned maintenance with the total investment of time in all maintenance activities. % = 100 **(**Planned work order hours completed) / Total work order hours completed	Planned maintenance is defined by the utility's strategy for maximizing its assets. One utility's program may differ from another's. The underlying assumption is that planned maintenance is more efficient than reaction to emergencies. To provide meaningful data, a utility will need a work order system that is capable of distinguishing between hours spent on planned versus unplanned maintenance.
Workforce Flexibility compares the number of job classifications with the total number of budgeted positions, expressed as a percentage. % = 100 (Number of job classifications) / Number of budgeted positions	This indicator is based on the premise that workforce flexibility increases with a reduction in the number of job classifications. • The number of job classifications equals the sum of the number of levels within each job series actually in use. Each classification has its own duties and pay range. • Budgeted positions include of those approved in the budget regardless of whether they are occupied or vacant. Shared positions count as one. Part-time positions count.
Monthly Cost of Water and Wastewater Service for a residential customer using a standard quantity of water is calculated in US $ separately for water and sewer service.	This indicator might be particularly sensitive to explanatory factors. The standard quantity of use would be set at approximately 7500 gallons per month. Utilities would calculate the bills for water and sewer service consistent with such usage.

Summary of Indicators Proposed for the Business Operations Business System

The indicators are listed in priority order as expressed by workshop participants. Review by utility executives and managers is sought to assist with identifying the most promising indicators from the proposed list, or with offering alternatives. All comments will receive consideration by workshop participants when they reconvene to make final recommendations on the selection of 5 and 20 indicators. Detailed guidance on each final indicator will be developed at that time.

Indicator	Data Elements and Definitions
Return on Assets is a simple ratio expressed as a percent. % = 100 (Net income) / Total Assets	• This indicator would be based on the most recent fiscal year, using data compiled in accordance with Governmental Accounting Standards Board (GASB) Statement 34. Utilities not subject to GASB, and those with unaudited financial statements would be provided with guidance and a worksheet to extract comparable data.
Operations and Maintenance Costs per Connection is calculated as: % = 100 (Total Cost of O & M) / # of customer connections	• For joint water / wastewater utilities, separate ratios would be reported. • Customer connections means those for water and sewer service. A customer may have more than one of each. • O & M costs include all expenses, including depreciation, for related activities as included in the audited financial report.
Debt Ratio compares liabilities to assets. % = 100 (Total Liabilities) / Total Assets	• Liabilities include all short- and long-term debt as shown on the utility's balance sheet. • Assets are the sum of liabilities and owner equity as shown on financial statements. • For joint water / wastewater utilities, separate ratios would be reported.
Water / Wastewater Affordability Index is the average customer bill as a percent of medium household income as compared to the local median household income. % = 100 (Bill for water or wastewater service) / Local median income	• Local median income is per U.S. Bureau of Labor statistics. We will need counterpart data for Canadian utilities and those in U.S. where USBL data is not available. • For joint water / wastewater utilities, separate ratios would be reported. • Costs include ad valorum taxes. • Both water and wastewater bills are to be based on 7500 gallons water usage per month.
Investment in Capital Replacement is the ratio of annual investment in capital replacement relative to the total non-depreciated asset value of the utility plant in service: % = 100 (Annual investment for capital replacements) / Value of utility assets	• For joint water / wastewater utilities, separate ratios would be reported. • Capital replacements include all those completed and placed into service during the reporting period. • Plant and equipment assets are valued at the non-depreciated costs at the start of the reporting period, excluding the value growth of assets during the reporting period.

Summary of Indicators Proposed for the Customer Relations Business System

The indicators are listed in priority order as expressed by workshop participants. Review by utility executives and managers is sought to assist with identifying the most promising indicators from the proposed list, or with offering alternatives. All comments will receive consideration by workshop participants when they reconvene to make final recommendations on the selection of 5 and 20 indicators. Detailed guidance on each final indicator will be developed at that time.

Indicator	Data Elements and Definitions
The **Service Quality Index** is an aggregate of 5 factors important to water and wastewater service: quality; reliability; pressure; billing accuracy; and complaints. Since each factor would be calculated separately, they could stand alone as indicators.	• The tentative formula for this indicator is complex and subject to change. As proposed, each factor is itself the aggregate of several components. For instance, complaints would include totals for those falling into 9 categories: taste; odor, appearance; hardness or aggressiveness; odors associated with wastewater operations; facility appearance; water pressure; billing accuracy; and other miscellaneous complaints. • The factors would be weighted 30 percent each for quality and reliability, 20 percent for pressure, 15 percent for billing accuracy, and 5 percent for complaints. • The index would include components for both water and wastewater service. Since data would be provided by utilities incrementally, the index would be useful for comparison among water, wastewater, and joint water / wastewater utilities.
Cost of account management per customer is a ratio expressed as a percentage: % = 100 (Total cost of managing customer accounts) / Total number of water and/or sewer accounts	• Accounts means the total number of billed water and/or sewer service accounts. • Total costs include all capital investments, other direct costs, salaries and benefits, and indirect costs associated with service start-up, service connections, meter reading, bill preparation and delivery, payment processing, account reconciliation, delinquent account follow-up, response to associated customer inquiries and complaints, service calls, customer information and education, surveys of customers, and management, supervision and reporting.
Time to resolve complaints quantifies the average elapsed hours to resolve work orders associated with complaints. % = # work orders due to complaints / # hours to resolve these complaints	• Count all work orders generated in response to customer complaints, and completed, during the course of the reporting period. Add the number of similar work orders carried forward from the previous reporting period and completed during the current reporting period. • For each such work order, count all hours from the time the complaint was received through the time the complaint was reconciled.
Investment in external relations compares the total cost of external relations to the number of accounts serviced.	• Accounts means the total number of billed water and/or sewer service accounts. • Costs include all of those related to strategizing the external relations program; such as, developing materials, conducting meetings with stakeholders, lobbying, sponsoring events, serving on committees and boards, participation in civic organizations, donations to charities, cash and in-kind donations to water and environmental organizations, and expenses related to membership in professional organizations.
Organizational Response to Customer Input might be measured in one or both of two indicators**: the change in complaint rate from the previous year**; and/or**, the change in average time needed to resolve complaints**.	• To support this indicator, utilities would need to maintain and provide data on the total number of complaints, the time needed to resolve each one, and the total number of customer accounts.

Summary of Indicators Proposed for the Water Operations Business System

The indicators are listed in priority order as expressed by workshop participants. Review by utility executives and managers is sought to assist with identifying the most promising indicators from the proposed list, or with offering alternatives. All comments will receive consideration by workshop participants when they reconvene to make final recommendations on the selection of 5 and 20 indicators. Detailed guidance on each final indicator will be developed at that time.

Indicator	Data Elements and Definitions
Repairs per mile of distribution system is based on the number of breaks and other leaks actually repaired during the reporting period. % = 100 (# of repairs) / miles of pipe	• A break is any abrupt loss of water. • A leak is a continual and possibly progressive loss of water. • All distribution piping under control of the utility counts. Service lines do not. Valves and hydrants are considered part of distribution piping. • A repair is any intentional action to restore distribution piping to a non-leaking condition. Multiple repairs to correct the same condition are counted separately.
A **Water Quality Index** is a single indicator comprised of several utility-specific components. The index would be dimensionless, and would be constructed with a scale of perhaps 1 to 100.	• The index would be based upon both primary drinking water standards and aesthetic qualities such as taste, odor, and appearance. Utilities would report which standards they are subject to, which they had been in violation of and for how long during the reporting period, plus other data that might be needed to complete the calculation. A worksheet and guidance would be provided to assist with compiling this information. Each utility would be responsible for using that information to calculate its own index.
Unbillable Water is calculated as a percentage: % = 100 [1 - (Volume of water billed) / (Volume of water distributed)]	• Water billed is the total volume of all water billed to customers during the reporting period. • Water distributed is the sum of the metered volumes entering the distribution system from all sources.
Disruptions of service include six separate ratios for planned and unplanned disruptions of three different durations. The calculated ratios would be relative to the total number of customer connections.	• Service disruptions are all conditions within facilities under control of the utility that cause at least one customer to lose full service. • Utilities would maintain data for both planned and unplanned events of 0 to 6 hour, 6 to 12 hour, and more than 12-hour duration.
Cost to treat water compares the total cost of water treatment operations and maintenance to the volume of water treated. It would be reported in US $ per million gallons treated.	• Costs of treatment O & M include all burdened costs (labor, supplies, equipment, and contracts) related to all treatment facilities. • The volume of water treated is the sum of volumes produced at all treatment facilities. It includes unbillable water.

Summary of Indicators Proposed for the Wastewater Operations Business System

The indicators are listed in priority order as expressed by workshop participants. Review by utility executives and managers is sought to assist with identifying the most promising indicators from the proposed list, or with offering alternatives. All comments will receive consideration by workshop participants when they reconvene to make final recommendations on the selection of 5 and 20 indicators. Detailed guidance on each final indicator will be developed at that time.

Indicator	Data Elements and Definitions
Cost to Process 1 MGD of Wastewater is calculated as a ratio of total costs to total flow. The indicator is expressed in US $ per million gallons of wastewater processed.	• The indicator is based on the burdened cost of all expenses for operation and maintenance of the wastewater system. • Flow is the total for the budget year used for calculating total costs.
Overflows are expressed as a ratio of total overflow events divided by the total number of miles in the collection system.	• Overflow events include all sanitary sewer overflows plus all dry weather overflows of combined sewers during the reporting period. An overflow is a discharge through a manhole, clean-out, pump station, floor drain, fixture, (or catch basin for combined sewers in dry weather) provided that the overflow is related to limitations or problems with system components under control of the utility. A single problem could result in multiple overflows. • The collection system includes all piping under control of the utility and conveying wastewater to a treatment facility or discharge point.
Permit compliance rate compares permit violations incurred during the year to the total number of permitted facilities. The rate could be expressed in two ways: based on the number of violations; or, based on the percentage of time in violation.	• To support both measures, utilities would need to maintain and report data on the number of permits held, the number of violations relative to each permit, and the duration of each violation. • For the purposes of this indicator, violations are infractions of a reportable parameter contained in a discharge elimination or air quality permit.
The **collection system rehabilitation and replacement ratio** is an indicator of how closely a wastewater utility is implementing its collection system rehabilitation and replacement plan. The ratio is expressed as a percent. % = 100 (actual miles of rehab and renewal completed) / planned miles of rehab and renewal for the year	• Utilities would compile data from projects completed during the course of the reporting period, and from projects planned for completion during that period. • This is a companion indicator to the treatment plant reinvestment ratio (shown immediately below).
The **treatment plant reinvestment ratio** is an indicator of how closely a wastewater utility is implementing its treatment plant (TP) rehabilitation and replacement plan. The ratio is expressed as a percent. % = 100 (Actual expenditures on TP renewal/replacement) / planned expenditures on TP renewal/replacement	• Utilities would compile data from projects completed during the course of the reporting period, and from projects planned for completion during that period. • This is a companion indicator to the collection system rehabilitation and replacement ratio (shown immediately above).
Collection System Integrity is expressed as the number of collection system failures experienced during the reporting period, as compared to the total miles of pipe in the collection system.	• A failure means the discovery and full restoration of a flow restriction caused by structural failure or deterioration of piping materials. • Piping materials include those gravity and pressurized pipes under control of the utility through the point of discharge to treatment or disposal.

APPENDIX C : Benchmarking Clearinghouse Survey

Instructions for Completing the Survey

All responses will be compiled and presented on the QualServe website. The survey is now available on-line at www.qualserve.org. If you complete the survey on-line, simply fill out the survey and submit your responses. If you received a hard copy, you may submit comments to pcrotty@awwa.org as an e-mail attachment, by fax to 303-794-6303, or by postal service to QualServe, 6666 W. Quincy Ave., Denver, CO, 80235, USA.

We have attempted to provide sufficient background on each proposal without going into unnecessary detail. The first step is to determine whether utilities will support the proposed indicators. Once decisions have been made on which indicators to include in the system, guidance will be expanded to assist utilities with providing the needed data.

Selecting good candidate indicators is hard work. What seems important to the staff of one utility may not be valued by others. Some of those proposed here may not work well for investor-owned utilities, at water wholesalers, or at regional wastewater utilities providing only treatment and disposal services. Help us to understand which these are. If possible, offer alternatives or definitions of data elements that will make the indicators more universally applicable.

A few of the proposals are similar as they were constructed by different workgroups. If you have a preference of one approach over another, please note this in the space provided for comments.

The survey is organized into two sections. The first asks for your opinions of the value of each proposed indicator. The second asks for your consideration of more general questions. Both have importance. Add pages with written comments as you see fit. If you have questions you need answered before you complete the survey, please feel free to contact someone from the list of project participants shown on documents. If you can't reach the person of your choice by phone, send an email with times that you will be available for a return call.

Proposed Indicator	Your Opinion of Value	Narrative Comments
1 = I do not support this indicator for comparative analysis among utilities. 2 = I see some value to this indicator for comparative analysis among utilities. 3 = I see substantial value to this indicator for comparative analysis among utilities.		
Indicators proposed for the QualServe Organizational Development Business System		
Investment in Employee Training	○ 1 ○ 2 ○ 3	
Organizational Best Practices Index	○ 1 ○ 2 ○ 3	
Employee Safety Rates	○ 1 ○ 2 ○ 3	

Planned Maintenance	○ 1 ○ 2 ○ 3	
Workforce Flexibility	○ 1 ○ 2 ○ 3	
Cost of Water and Sewer Service	○ 1 ○ 2 ○ 3	
Indicators proposed for the QualServe Business Operations Business System		
Return on Assets	○ 1 ○ 2 ○ 3	
O & M Costs per connection	○ 1 ○ 2 ○ 3	
Debt Ratio	○ 1 ○ 2 ○ 3	
Water / Wastewater Affordability Index	○ 1 ○ 2 ○ 3	
Investment in Capital Replacement	○ 1 ○ 2 ○ 3	
Indicators proposed for the QualServe Customer Relations Business System		
Service Quality Index	○ 1 ○ 2 ○ 3	
Cost of account management	○ 1 ○ 2 ○ 3	

Time to resolve complaints	○ 1 ○ 2 ○ 3	
Investment in external relations	○ 1 ○ 2 ○ 3	
Response to customer input	○ 1 ○ 2 ○ 3	
Indicators proposed for the QualServe Water Operations Business System		
Repairs per mile of distribution system	○ 1 ○ 2 ○ 3	
Water quality index	○ 1 ○ 2 ○ 3	
Percent Unbillable water	○ 1 ○ 2 ○ 3	
Disruptions of service	○ 1 ○ 2 ○ 3	
Cost to treat water	○ 1 ○ 2 ○ 3	
Indicators proposed for the QualServe Wastewater Operations Business System		
Cost to process 1 MGD of wastewater	○ 1 ○ 2 ○ 3	
Overflow rate	○ 1 ○ 2 ○ 3	

Permit compliance rate	○ 1 ○ 2 ○ 3	
Collection system rehab/replace ratio	○ 1 ○ 2 ○ 3	
Treatment plant reinvestment ratio	○ 1 ○ 2 ○ 3	
Collection system integrity	○ 1 ○ 2 ○ 3	

General Questions:	
I see value to a performance indicator database for water and wastewater utilities:	○ Yes ○ No
My utility would contribute data to a performance indicator database:	○ Yes ○ No
My utility is comfortable with our data being attributed to us by name:	○ Yes ○ No
My utility could submit data:	☐ for the calendar year ☐ for our fiscal year ☐ for each calendar quarter
My utility supports a joint database system for water and wastewater data:	○ Yes ○ No
My non-utility organization sees value to a performance indicator database:	○ Yes ○ No ○ N/A

Please tell us a little about yourself:	
I represent:	☐ a water utility ☐ a wastewater utility ☐ Other:
In my organization, I am:	○ an executive ○ a manager/supervisor ○ a staff person
I am familiar with performance indicator data systems in use by others:	○ Yes ○ No

I would use a performance indicator system for:	☐ comparative analysis ☐ trending at my utility ☐ other
I (my organization) am a member of:	☐ AWWA ☐ WEF ☐ AMSA ☐ AMWA ☐ AwwaRF ☐ WERF ☐ NAWC
Please send me information about QualServe and the Benchmarking Clearinghouse.	○ Yes ○ No
It's your option, but the following information will help us if we need additional information to fully understand your comments:	Name: Address: City: State/Prov: Mail Code: Phone: Fax: E-Mail:

Submit Form Clear Form

APPENDIX D: Qualserve Participating Utilities

More than 100 utilities are participating in the QualServe Self-Assessment and Peer Review programs.

Self-Assessment & Peer Review

Anniston Water Works and Sewer Board, AL
Beaufort Jasper Water & Sewer Auth., SC
Bedford County Public Service Authority, VA
Birmingham Water Works Board, AL
Bridgeport Hydraulic Company, CT
Charlotte Mecklenburg Utilities, NC
Chesapeake Department of Public Utilities, VA
City of Ann Arbor Water Utilities Department, MI
City of Bamberg Board of Public Works, SC
City of Calgary Waterworks Division, AB
City of Carrollton, TX
City of Cleveland Division of Water, OH
City of Durham, Environmental Resources Department, NC
City of Edmonton Drainage Services, AB
City of El Paso, TX
City of Everett Public Works Dept., WA
City of Flagstaff Utilities Department, AZ
City of Fort Collins Utilities, CO
City of Henderson Utilities Services Division, NV
City of Kelowna Water Utility, BC
City of Kissimmee, Department of Water Resources, FL
City of Los Angeles, CA
City of Peoria, AZ
City of Port St. Lucie Utility System Department, FL
City of Salem, OR
City of Stuart, FL
City of Tallahassee Water Utilities Department, FL
City of Titusville, FL
City of Vancouver, Waterworks Operations, BC
City of Winnipeg Water & Waste, MB
Clarksville Gas and Water, TN
Cobb County Water System, GA
Columbus Water Works, GA
Contra Costa Water District, CA
Corporation of the Town of Fort Erie, ON
County of Kauai, HI
Davidson Water, Inc., NC
Destin Water Users, Inc., FL
East Bay Municipal Utilities District, CA
EPCOR Water Services, Inc., AB
Fairfax County Wastewater Management, VA
Fort Bend Municipal Utility Dist. No. 41, TX
Georgetown County Water and Sewer District, SC
Gila Resources, AZ
Green Bay Water Utility, WI
Guadalupe Blanco River Authority, TX
Guam Water Authority
Gwinnett County Dept. of Public Utilities, GA

Hilton Head No. 1 Public Service District, SC
King County Department of Natural Resources, WA
Lehigh County Authority, PA
Littleton/Englewood Wastewater Treatment Plant, CO
Louisville Water Company, KY
Macon Water Authority, GA
Massachusetts Water Resources Authority, MA
Maui Board of Water Supply, HI
Napa Sanitation District, CA
Oak Creek Water & Sewer Authority, WI
Ohio-American Water Company, OH
Oklahoma City Water Utilities Trust, OK
Onondaga County Water Authority, NY
Palm Beach County Water Utilities Department, FL
Palmdale Water District, CA
Park Water Company, CA
Peterborough Utilities Services, Inc., ONTARIO
Rapid City Water & Water Reclamation, SD
Regional Municipality of Ottawa-Carleton, ON
Regional Municipality of Waterloo, ON
Rock River Water Reclamation District, IL
Salt Lake City Dept. of Public Utilities, UT
San Antonio Water System, TX
San Francisco Public Utilities Commission, CA
Santa Clara Valley Water District, CA
Santa Cruz Water Department, CA
Sarasota County Government Utilities Department, FL
Sheffield Utilities, AL
Shoreline Water District, WA
SJWD Water District, SC
South Tahoe Public Utilities District, CA
Spartanburg Water System & Sanitary Sewer District, SC
Spotsylvania County Dept. of Utilities, VA
St. Johns County, FL
St. Louis County Water Company, MO
St. Paul Water Utility, MN
Victor Valley Wastewater Reclamation Authority, CA
Washington County Service Authority, VA

Self-Assessment Only
Alameda County Water District, CA
Broward County Environmental Operations Division, FL
City of Boynton Beach Utilities Department, FL
City of Chandler, AZ
City of Naperville Department of Public Utilities, IL
City of Newark Division of Water & Wastewater, OH
City of San Buenaventura, CA
City of Solon Water Reclamation, OH
City of West Palm Beach Utilities, FL
City of Winter Springs, FL
Cobb County Water, GA
Delta Diablo Sanitation District, CA
Dublin San Ramon Services District, CA
Guafdalupe-Blanco River Authority, TX
Halifax Regional Water Commission, NS

Long Beach Water Dept., CA
Lucas County Sanitary Engineering, OH
Manitowoc Public Utilities, WI
Montgomery County Sanitary Engineering, OH
Northshore Utility District, WA
Orange County Utilities Water Department, FL
Orange Water and Sewer Authority, NC
Sammamish Plateau Water & Sewer District, WA
Santa Cruz Public Works Department (Wastewater), CA
Scarborough Public Utilities Commission, ON
Spotsylvania County, VA
Woodinville Water District, WA
Ypsilanti Community Utilities Authority, MI

Utilities with Trained Peers

Many utilities have contributed to the development of the QualServe program. Three utilities piloted the program during 1996, and five more utilities piloted the program during 1998-2000 (more below). In addition, more than one hundred other utilities throughout North America donated the time and expertise of senior personnel to become members of the QualServe "peer teams."

These volunteer peers have been trained to visit participating utilities and conduct the peer review portion of the QualServe program. To date, more than one hundred and eighty (180) individuals have been trained as QualServe peers. Following is a list of the utilities that have contributed to this vital effort.

For more information on how to become a QualServe Trained Peer, please call Jim Ginley, QualServe Program Manager at 303-347-6247, or E-mail jginley@awwa.org.

Large Wastewater Utilities

Central Contra Costa Sanitary District (CA)
City of Atlanta Wastewater Services (GA)
City of Eugene Public Works (OR)
City of Fort Worth (TX)
East Bay MUD (CA)
Hampton Roads (VA) Sanitation District (VA)
Louisville / Jefferson County Metro Sewer District (KY)
Metro St. Louis Sewer District (MO)
Northeast Ohio Regional Sewer District (OH)
Sheboygan Regional Wastewater (WI)
Union Sanitary District (CA)
Unified Sewerage Agency (OR)
Western Carolina Regional Sewer Auth., (SC)

Medium Wastewater Utilities

City of Jacksonville Wastewater Utility (AR)
City of San Marcos (TX)
Delta Diablo Sanitary District (CA)
Frederick County Sanitation District (VA)
Gogebic-Iron Wastewater Treatment (MI)
Rogers Water Utilities/Pollution Control (AR)

Large Water or Joint Utilities

American Water Works Service Co. (NJ)
AQUALTA (AB)
Austin Water & Wastewater Department (TX)
Bexar Metro Water District (TX)
BHC Company (CT)
Boston Water & Sewer Commission (MA)
Brazos River Authority (TX)
Charleston Commission of Public Works (SC)
Charlotte County Utilities Dept. (FL)
Charlotte-Mecklenberg Utilities (NC)
Chesterfield County Water Utilities (VA)
City of Arlington Water Department (TX)
City of Calgary Waterworks Division (AB)
City of Carrollton Utilities (TX)
City of Colorado Springs (CO)
City of Detroit Water and Sewerage (MI)
City of Fort Lauderdale (FL)
City of Fort Worth (TX)
City of Gainesville Public Utilities (GA)
City of Houston Public Works (TX)
City of Lee's Summit (MO)
City of Naperville DPU (IL)
City of Oklahoma City (OK)
City of Phoenix Water Services (AZ)
City of San Diego Water Department (CA)
City of St. Louis Water Division (MO)
City of Sunnyvale (CA)
City of Tallahassee (FL)
City of Winnipeg Water & Waste Dept. (MB)
City and County of San Francisco (CA)
Cincinnati Water Works (OH)
Columbus Division of Water (OH)
Columbus Water Works (GA)
Contra Costa Water District (CA)
County of Henrico Public Utilities (VA)
Dallas Water Utilities (TX)
Denver Water (CO)
Des Moines Water Works (IA)
Durham Dept. of Water Resources (NC)
East Bay MUD (CA)
Eugene Water & Electric Board (OR)
Florida Cities Water Company (FL)
Gainesville Regional Utility (FL)
Halifax Regional Water Commission
Hampton Roads Sanitation District (VA)
Irvine Ranch Water District (CA)
IWC Resources Corporation (IN)
Kansas City Water Services District (MO)
Kansas City Water Services Department (MO)
Lansing Board of Water & Light (MI)
Las Vegas Valley Water District (NV)
Little Rock Municipal Water Works (AR)
Louisville Water Company (KY)

Madison Water Utility (WI)
Mass. Water Resources Authority (MA)
Maui Water Supply Board (HI)
Memphis Light, Gas, & Water (TN)
Montgomery Water Works/Sewer Board (AL)
Nashville Metro Water & Sewer (TN)
Palm Beach County Water Utilities Department (FL)
Philadelphia Suburban Water Company (PA)
Philadelphia Water Department (PA)
Portland Water Bureau (OR)
Pueblo Board of Water Works (CO)
Regional Municipality of Ottawa-Carleton (ON)
Regional Municipality of Waterloo (ON)
Salt Lake City Dept. of Public Utilities (UT)
San Francisco PUC (CA)
Spartanburg Water System (SC)
St. Louis County Water Company (MO)
Tampa Water Department (FL)
Topeka Water Department (KS)
Tucson Water Department (AZ)
United Water – Boise (ID)
Washington Suburban Sanitary Commission (VA)

Medium Water or Joint Utilities

Anniston Water Work & Sewer Board (AL)
Beaufort – Jasper Water Authority (SC)
Carmel Utilities (IN)
Central Lake County JAWA (IL)
Consumers Illinois Water Company (IL)
City of Boynton Beach (FL)
City of Cranbrook, (BC)
City of Crystal (MN)
City of the Dalles (OR)
City of Fargo (ND)
City of Fayetteville (AR)
City of Flagstaff (AZ)
City of Fort Collins (CO)
City of Iowa City (IA)
City of Kissimmee (FL)
City of Newark (OH)
City of Saint John (NB)
City of Salina (KS)
City and Borough of Sitka (AK)
City of Springfield Utilities Department (OH)
City of Wyoming (MI)
Dedham-Westwood Water District (MA)
Fair Oaks Water District (CA)
Fraser Valley Regional District (BC)
Georgetown County Water & Sewer District (SC)
Grand Forks Water & Sewer Department (ND)
Jonquire City (PQ)
Kauai County Water Supply (HI)
Kingston Water Department (NY)
Lehigh County Authority (PA)

Lucas County Sanitary Engineering (OH)
Manitowoc Public Utilities (WI)
Marshalltown Water Works (IA)
Medford Water Commission (OR)
Mt. Pleasant Waterworks & Sewer Commission (SC)
Mountain Water Company (MT)
Mukilteo Water District (WA)
Oak Creek Water & Sewer Utility (WI)
Orange Water & Sewer Authority (NC)
Park Water Company (CA)
Portage County Water Resources (OH)
Village of Ridgewood Water Department (NJ)
Salt Lake County Water Conservation District (UT)
Seminole County Water & Sewer Utility (FL)
SJWD Water District (SC)
South Fork Water Board (OR)
South Tahoe Public Utility District (CA)
Washington County Service Authority (VA)

Small Water/Wastewater Utilities

Bigfork Water & Sewer (MT)
Blue Ridge Rural Water Company (SC)
Central Utah Water Conservation District (UT)
City of Newton Public Works (NC)
City of Knoxville (IA)
Eielson AFB (AK)
Metropolitan Sub-District B (SC)
Umpqua Basin Water Assoc., Inc. (OR)

APPENDIX E

Table E.1 ASAT 2003 TARIFFS

ASAT GENEL MÜDÜRLÜĞÜ YEAR 2003 TARİFFS						
Water Tariffs	**January February**	**March April**	**May Juni**	**Juli August**	**September October**	**November December**
	Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
Customer Types						
Municipal						
1-50 **m³**	1.398.294	1.398.294	1.398.294	1.538.123	1.538.123	1.538.123
51 **m³** and over	3.008.094	3.008.094	3.008.094	3.308.904	3.308.904	3.308.904
Office						
1-15 **m³**	2.350. 074	2.350.074	2.350.074	2.350.074	2.350.074	2.350.074
16 **m³** and over	3.133.431	3.133.431	3.133.431	3.446.775	3.446.775	3.446.775
Industrial	2.136.431	2.136.431	2.136.431	2.136.431	2.136.431	2.136.431
Public	2.193.402	2.193.402	2.193.402	2.412.742	2.412.742	2.412.742
Governments	1.566.716	1.566.716	1.566.716	1.723.387	1.723.387	1.723.387
Parks, gardens	1.250.000	1.250.000	1.250.000	1.375.000	1.375.000	1.375.000
City Toilets	2.350.074	2.350.074	2.350.074	2.585.082	2.585.082	2.585.082
Schools, hospitals	1.566.716	1.566.716	1.566.716	1.723.387	1.723.387	1.723.387
Metering	1.500.000	1.500.000	1.500.000	1.500.000	1.500.000	1.500.000

APPENDIX E

Table E.2. ISKI 2003 TARIFFS

ISKI GENEL MÜDÜRLÜĞÜ YEAR 2003 TARİFFS						
Water Tariffs	**April**	**May**	**June**	**October**	**November**	**December**
	Period 4	**Period 5**	**Period 6**	**Period 10**	**Period 11**	**Period 12**
Customer Types						
Municipal						
1-15 **m³**	1.254.000	1.260.000	1.280.000	1.304.000	1.327.000	1.343.000
16-100 **m³**	2.072.000	2.116.000	2.150.000	2.191.000	2.222.000	2.258.000
Over 100 **m³**	4.338.000	4.319.000	4.419.000	4.490.000	4.575.000	4.713.000
Office	4.338.000	4.319.000	4.419.000	4.490.000	4.575.000	4.713.000
Industrial	4.338.000	4.319.000	4.419.000	4.490.000	4.575.000	4.713.000
Parks, gardens	2.072.000	2.116.000	2.150.000	2.191.000	2.222.000	2.258.000
City Toilets						
Schools, hospitals	2.072.000	2.116.000	2.150.000	2.191.000	2.222.000	2.258.000

CURRICULUM VITAE

Zeynep Akgün was born on the 25th August in 1976. She finished her primary education in 1987 in Mustafa Necati İlkokulu.Than she started to Cağaloğlu Anadolu Lisesi. After she finished Cağaloğlu Anadolu Lisesi, she started to İTÜ Civil Engineering Faculty Environmental Engineering Department and finished it in 1999 and became an Environmental Engineer. In 2000 she started graduate program at the same faculty about Benchmarking in Environmental Sectors.