

# China – UK, WRDMAP Integrated Water Resources Management Document Series

## Advisory Note 5.4: Tariff Setting for a Small to Medium Size Water Supply Company

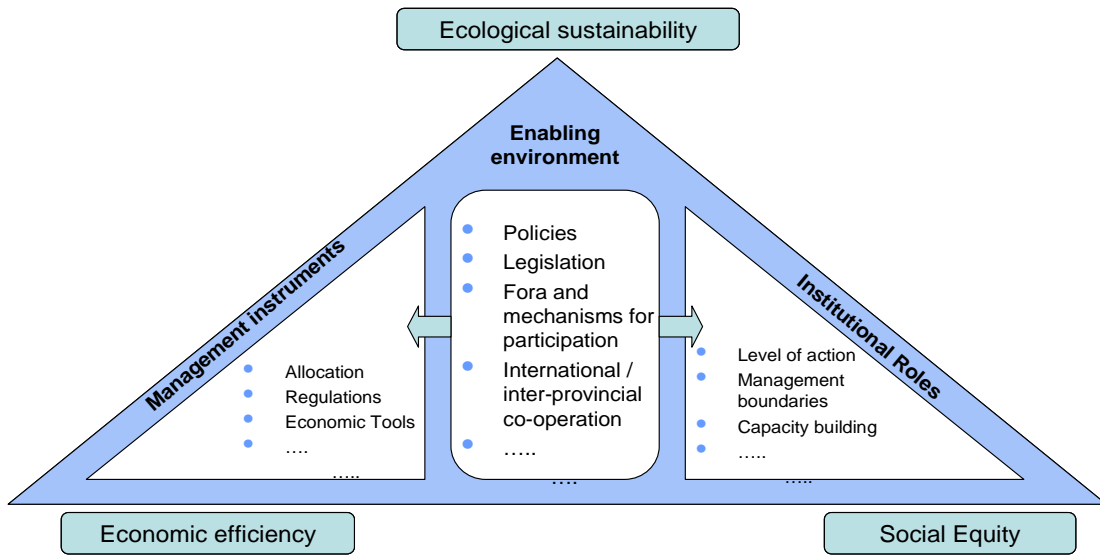
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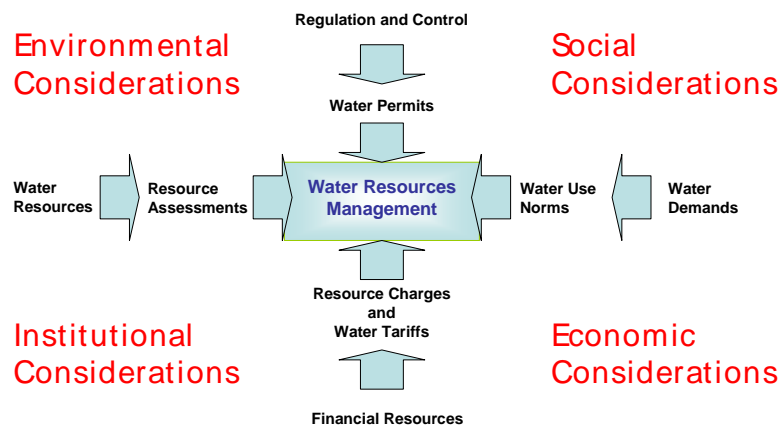


# Integrated Water Resources Management (IWRM)

*(Basics after Global Water Partnership)*



## Driving Elements of Integrated Water Resources Management



*(Second figure after WRDMAP)*

**Summary:** There is an increasing need to manage demand for water rather than just increasing supply, whether for domestic consumption, industry and commerce, or agriculture. Water pricing can be an effective means to reduce demand for, and improve the economic efficiency of, water use. In China water prices are still below the requirements for financial cost recovery and are generally too low to reflect its scarcity value and therefore do not have sufficient impact on demand for water. This has made it difficult for many water utilities to maintain infrastructure or expand their service to outlying and poorer areas or to operate in a manner that meets environmental standards.

This guidance was developed by the Ministry of Water Resources to help the management of small to medium size water supply companies (WSCs) to adopt demand management strategies as part of the ongoing development of Water Saving Society. Tariff setting is also an area of interest to WAB and WRD responsible for achieving demand management targets.

The guidance covers the following topics:

- Tariffs explained
- National guidelines
- Information about customers
- Information about the WSC business
- Understanding the customer base
- Developing a tariff setting process
- WSC performance and efficiency
- Revising tariffs
- Water pricing policy

The Ministry of Water Resources have supported the Water Resources Demand Management Assistance Project (WRDMAP) to develop this series to support WRD/WAB at provincial, municipal and county levels in their efforts to achieve sustainable water use.

## 1 Introduction

Water shortages, water pollution, and flooding have constrained economic development and affected public health and welfare in many parts of China. Northern China is already a water-scarce region and the effects of rising population, continued economic growth and rising demand for water mean that China as a whole will soon join the group of water-stressed countries. Given these trends and the pattern of industrialisation and urbanisation, the pressures on the country's water resources are likely to worsen. The combined impact of the widening gap between water demand and limited supplies and the deteriorating water quality caused by widespread pollution suggests that severe water scarcity is emerging.

There is an increasing need to manage demand for water rather than just increasing supply, whether for domestic consumption, industry and commerce or agriculture. Water pricing can be an effective means to reduce demand for and improve the economic efficiency of water use. It has a potentially important role to play in China and water tariffs have been rising gradually since the early 1990s. However, in general, water prices are still below the requirements for financial cost recovery and are generally too low to reflect its scarcity value and therefore do not have sufficient impact on demand for water. This has made it difficult for the water utilities to maintain infrastructure adequately or expand their service to outlying and poorer areas or to operate their infrastructure in a manner that meets environmental standards. Thus, the first step toward setting prices right should be at least meeting the utilities' financial performance requirements.

Appropriate and well-designed tariffs for water will allow water supply utilities to meet objectives for financial performance and sustainability and will promote demand management among consumers.

This Note is about setting tariffs to assist a small Water Supply Company (WSC) achieve its financial objectives (in particular medium to long term financial sustainability) and to promote water saving and water demand management. It may be relevant for a WSC seeking to reform and rationalise its water tariff or for a new WSC setting a tariff for the first time. However, it is appreciated that Price Bureau have to have a regulatory control on prices in the different provinces.

## 2 What are Tariffs and Why are They Needed?

A tariff is the price charged by a water supply utility for the water supplied to its customers. Any tariff has a structure which describes the relationship between prices charged to different categories of customer and to different groups within any category, and tariff rates which are the prices actually charged to each category of customer per unit of water consumed.

There are a number of common ways in which tariffs can be structured. The simplest form of tariff is a fixed charge per person or per household or connection, regardless of how much water is consumed. More often, water charges depend at least partly on the

volume of water consumed. The main ways in which tariffs are structured are described briefly in Table 1.

It is also common for a tariff to be structured with separate systems of rates for domestic customers (households) and non-domestic customers (business, government and public institutions, industry, etc.) since these two groups have different consumption characteristics. Different types of tariff could be used for domestic and non-domestic customers – e.g. a block tariff could be used for households and a seasonal tariff (either with a flat rate or block rates) for businesses and industry. The domestic tariff could be structured as a straight block tariff and the non-domestic tariff could be structured as a two-part tariff, and so on.

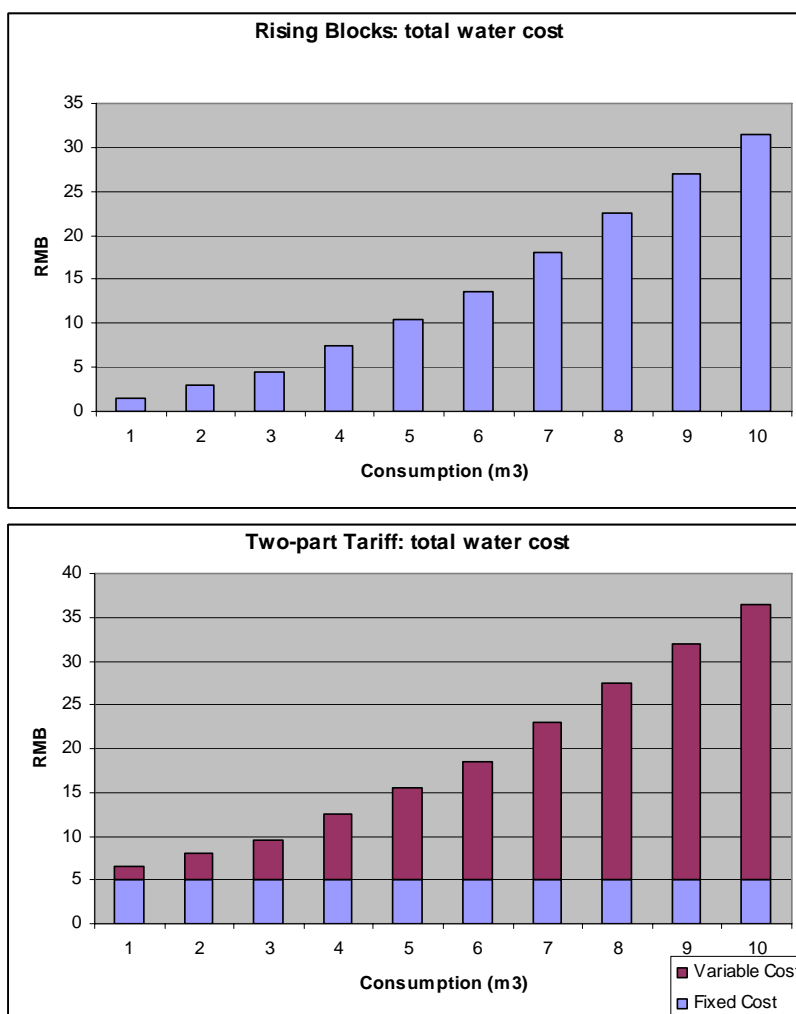
Within non-domestic customers, groups of customers may be defined according to their consumption characteristics.

Careful tariff design (including subsidies, if needed) is important to promote production and distribution efficiency and the sustainability of all parts of the water supply system. Tariffs provide resources for operating and maintaining systems as well as the resources for long term sustainability – that is, for the recovery of capital costs and the eventual replacement or upgrading of plant and equipment. When tariffs are usage related they can provide incentives for users to limit demand and consumption

Table 1: Common tariff types

Type of Tariff	Basis	Description
non-volumetric	customer	a fixed charge per person or per household
flat rate tariff	consumption	uniform volumetric charge – same rate per unit regardless of total consumption
block tariff	consumption	different rates apply for successive discrete blocks of consumption; if rates rise for successive blocks of consumption it is a rising block tariff
two-part tariff	connection capacity	a fixed charge per period to cover fixed costs
	consumption	volumetric charge to cover operating costs, which may be a flat rate or rising blocks
seasonal tariff	consumption	i) a volumetric tariff with different rates for each season – lower rates for seasons of water abundance or demand is low, higher rates when water is more scarce or demand is high
		ii) may also be structured as flat rate, two-part or block tariff

Figure 1: Examples of tariff types



### 3 National Guidelines on Water Tariffs

The National Guideline on Water Tariffs (NGWT), formulated by the State Developing Planning Commission (SDPC) and the Ministry of Construction (MOC), was issued as SDPC notice no. 1810 on 23 September 1998. The NGWT is a state ministry and commission administrative regulation that derives its authority from provisions for water tariffs in the Price Law (1997) and the Urban Water Supply Regulation (State Council order No.158, 1994 10 01). Implementation of the NGWT was promoted by the SDPC and MOC in SDPC Notice no. 611 issued on 2 June 1999.

Objectives of the NGWT include improving the financial sustainability of water supply companies, assuring water services are affordable for the urban poor, encouraging water conservation, and protecting the consumer. Key topics covered in the guidelines include:

- water tariff administration
- water tariff formulation and calculation
- application and approval of tariff adjustments
- implementation and monitoring of tariff adjustments

The Guidelines are promoted as a good model to follow. The key elements in the guidelines with regard to the objectives and structure of tariffs are becoming more widely adopted and cities in China are now adopting rising block tariffs for domestic consumption and rates for non-domestic tariff categories aimed at conserving water and promoting the sustainability of water utility

companies. The objectives of these water tariffs are:

- recovery of all costs
- achieve a reasonable profit for water utilities
- promote water conservation
- equity among users.

Tariffs are recommended to be structured either as two-part tariffs combining a fixed capacity tariff aimed at recovering capital costs and a volumetric tariff to recover operating costs, or as a volumetric tariff only. For domestic customers, a rising block tariff is adopted to facilitate the provision of affordable basic needs water to all households in the lowest block while allowing for greater consumption at a higher price for those who can afford it and at the same time promoting water conservation.

### 4 Information about Customers

Customers include both domestic and non-domestic customers. In China, the usual categories for non-domestic customers are i) industry, ii) government agencies and institutions, iii) commerce and services, and iv) special services (which usually means high volume water using businesses such as car wash shops, bath houses, hair dressing salons, etc.) These categories are also mandated in the National Guidelines on Water Tariffs. Some cities have minor variations of this list and the businesses included in the special services category varies from place to place. In some cities the second and third categories are effectively merged by charging the same rate for both. These categories should be used unless there are good reasons for any variation from it.

## 4.1 Domestic customers

The main factors determining consumption of water by households are income and the number of people living in the household (assuming there are no constraints such as limited hours of supply, very low water pressure, etc.). The following information about domestic customers is required for the setting of water tariffs:

1. Current water charges: for existing domestic customers, including both the structure and rates for any existing tariff
2. Domestic connections: the total number of existing domestic connections and the numbers which are metered and not-metered (connections with meters that are broken or do not work should be noted separately); if an expansion of the supply system is planned, then also the number of new domestic connections expected upon completion of the proposed expansion.
3. Water consumption: the consumption and distribution of consumption of households connected to the existing system. If possible organise this data by consumption blocks of 1 m<sup>3</sup> (i.e. 0-1, 1-2, 2-3 m<sup>3</sup> per month, etc.) with the number of households in each block. Larger consumption blocks could be used, but smaller blocks will provide better results. This data should be collected for the previous 3-5 years, if available, so that recent patterns and trends in consumption can be traced.
4. Household size: the average number of persons in each household
5. Household incomes: data on household incomes and the distribution of incomes is needed in order to assess affordability for lower income households and also to ensure that tariffs are set at a reasonable level for all households. Preferably, the data will be average household income by deciles (i.e. average income for each 10% of the population from the poorest 10% to the richest 10%). Data for income quintiles (20% blocks) can be used if data for deciles is not available. At least income data for the lowest two deciles is needed as these will be most affected by issues of affordability. Income data may be obtained from secondary published sources, but it is also possible that a separate assessment may be necessary. If the water supply system is to be expanded, data on household incomes should include both existing customers and potential new customers.
6. Other sources of supply: If households are not currently connected to the water supply system or if households already connected to the system have other sources of supply for water, then information is needed about these sources and how much households are paying to obtain water from these sources.
7. Demand forecast: a medium term demand forecast for the domestic sector is required.

This can be made based on current average per person consumption and an estimate of population growth in the coming 5 to 10 years combined with the effects on consumption of rising incomes and any price increases during the forecast period. To estimate the income effects on water consumption an income elasticity of 0.5 can be used, unless a site or region specific estimate is available. This means that for every 10% increase in income, water consumption will increase by 5%. For price elasticity for water a value of -0.13 can be used, implying that a 10% increase in the price of water will induce a 1.3% decrease in consumption, unless a more up to date estimate appropriate for the location is available.



*Domestic customers*

## 4.2 Non-domestic customers

Corresponding information is required for non-domestic customers. Consumption by non-domestic customers is a function of activity and size. For example, some industrial processes use large amounts of water and others use almost none; a school

or hospital where there are many people using water each day will use much more water than a retail shop in the market. Information required:

1. Non-domestic categories and current water charges: the categories into which non domestic customers are divided and the current water charges for each category.
2. Non-domestic connections: for each category, the total number of connections, the numbers which are metered and not metered. The number of connections with broken or non-functioning meters should be noted separately.
3. Water consumption: for each category of non-domestic customer, water consumption and the distribution of consumption across customers. Consumption bands for collating data must be decided on a case by case basis. The pattern of consumption will vary significantly between categories. Commercial customers are likely to use relatively small amounts of water (perhaps similar to households) while large institutions and some industries will be very large consumers. This data should be collected for the previous 3 to 5 years.
4. Availability of other sources of supply: this information may be relevant, especially for industries or other large consumers of water that may have their own tube wells or other source of water, since a tariff rate increase may lead to increased use from the alternative sources.

5. Demand forecast: forecasting demand for commercial, special commercial and institutional categories can be based on forecasts for population growth in the town or city and current average consumption for these categories. No adjustment needs be made for price or income effects unless relevant elasticity estimates for these types of non-domestic consumers are available. For industrial users, forecasting demand is much more difficult since future increases in demand may be associated with new factories or expansions of existing factories, leading to significant one off jumps in demand at unpredictable intervals.

## 5 Information about the Water Supply Company Business

The amount and level of information about the water supply company business that is required for setting tariffs assumes that the objectives of the tariff setting process include the long term financial sustainability of the company.

Assessing the effects of different tariff structures and tariff rates on the medium to long term financial position of the company cannot be done without a functioning financial management model for the company. Properly established, such a model uses demand projections, tariff revenues, production and distribution costs and capital financing costs to estimate future financial positions. It can therefore be used to show whether or not particular sets of tariff rates will

enable the company to progress towards financial objectives.

Information about the WSC business needed for setting tariffs includes at least the data listed below. Data should preferably be available for 3 to 5 years operations, so that trends and patterns can be observed.

1. Water volumes: water production and sales, system losses and other unaccounted for water
2. Sources of water: in particular if the cost of water varies among sources (for example, if there are both ground and surface water sources)
3. Revenues: water billed, collection ratio, revenues other than water revenues
4. Production costs: cost of water, treatment costs, all other production and distribution costs, number of staff and staff costs
5. Capital costs: assets, capital expenditures, depreciation, financing costs
6. Other financial data: subsidies from government, if any
7. Investment plans: short, medium and long term capital investment plans for the upgrading the existing supply system to improve efficiency, reduce losses, etc. or for expansion of sources of supply (reservoirs, transmission pipelines) and the distribution system

A financial management model is essential for financial planning and for

assessing the potential impact on the WSC of various tariff scenarios. A model can be used to plan the tariff rate changes necessary for the WSC to achieve and maintain financial sustainability over time. If the WSC does not already have a financial planning model one should be prepared based on a suitable standard outline model. There is a companion guidance document in this series on financial models: Thematic Paper 5.7 'Financial Management and Modelling in Small and Medium Water Supply Companies'.

## 6 Building an Understanding of the Customer Base

The objectives of a successful WSC include meeting customers' demand for water, providing an acceptable level of water service and achieving this in a manner that is financially acceptable to customers and financially sustainable for the WSC.

In order to meet these objectives, the WSC should understand the demand for water, patterns of consumption within different customer categories, the level or service required by different customer groups and what the different groups are willing and able to pay for this service. This knowledge can be built up through analysis of its own sales data, from listening and responding to customers' requests and complaints, from formal and informal surveys of different customer groups and from collecting relevant data and studies from external sources. Information on demand and service levels assists the WSC with:

- the planning of maintenance, operation, upgrading and expansion of the water supply system and its parts

- financial planning for the company
- designing price and non-price mechanisms for demand management and to promote water savings

Information can be obtained through:

- formal household surveys and surveys of non-domestic customers
- systematic recording of comments, complaints and suggestions from customers
- discussions with groups of customers
- interviews with key informants (e.g. urban community leaders, business groups, and others)

Discussion groups and interviews with key informants can be useful for gaining information on water demand and desired service levels and for understanding problems experienced by different categories of customer or by those in different parts of the distribution system, and so on.

Formal interviews may be more appropriate for periodically obtaining information on how much customers (especially domestic customers) are willing and able to pay for water and about the level of service they prefer.

For industrial and institutional customers a procedure for notifying planned increases in demand to the WSC may be necessary, since increases in demand from these customers are often periodic and discontinuous – e.g. a new industry in the WSC service area may result in a large, one-off increase in demand.

## 6.1 Ability to pay

The ability to pay (ATP) for water supply services is the capacity of a household or business to make payments for these services. “Ability to pay” is about affordability. For the non-domestic sector affordability is not usually an issue, although it could be if tariff rates were set too high. In the domestic sector, it is mostly concerned with low income rather than higher income households.

The standard approach to determining affordability for water services for households is to set a limit on the acceptable share of water bills as a proportion of total household income and to structure the tariff to ensure that low income households do not have to spend more than the limit.

A number of indicators exist which are intended to indicate acceptable levels of affordability. Some of these are:

1. a maximum of 3-5% of any household income on water supply and sanitation services,
2. the water bill for households at the top of the lowest income quintile (i.e. poorest 20%) should not exceed 5% of household income,
3. the water bill for the poorest decile (i.e. poorest 10%) should not exceed 4% of average income of these households.

It is practical to use 3-5% of household income as a simple guide to ATP when setting tariff rates.

When setting tariffs, ATP considerations always focus on the ability of lower income households to afford an acceptable level of basic water needs. The “basic needs” for

water have to be defined and agreed upon and have to take account of the minimum quantities of water required for good health and good public health. Tariff rates for at least the basic needs volume of water need to be set so that it does not cost more than the defined fixed percentage of income for average low income households.

If water is not affordable for low income households, it may result in very low consumption levels, which may have health and public health consequences. Lack of affordability, if it results in very low consumption or low collection rates, may also have financial consequences for the WSC.

## 6.2 Willingness to pay

Willingness to pay (WTP) is different from ability to pay. WTP is defined as the maximum amount that an individual states he or she is prepared to pay for a good or service – in this case for water supplied to their residence or place of business – and it may be different from what he or she wants to pay.



*Understanding customers' willingness to pay is key*

WTP can be assessed through an appropriate survey process, most probably one that uses a contingent valuation methodology to assess WTP. WTP surveys can be time consuming and relatively expensive. They do not need to be carried out whenever an

adjustment in the water tariff is being prepared. But it is very useful to carry out a WTP survey when any major adjustment in the service level to be provided to customers by the WSC is planned, when a major restructuring of the tariff is planned or when an expansion of the supply network is planned.

When customers have both ATP and WTP at a given price – i.e. when they have both the ability to pay for water at the given price and they would do so given the opportunity – then this is described as Ability and Willingness to Pay (AWTP) and is the effective demand for those customers.

## 7 Developing a Process for Setting Tariffs

Tariffs and the charges resulting from the tariff should be clear and understandable to customers, so that they can understand how they might modify their use of the service. The tariff should be easy for the WSC to calculate, both in terms of the total sum to be recovered and of the charge to be levied on each customer. Complex tariffs may be more costly to implement.

The tariff should not disrupt otherwise rational user decisions, especially investment and other decisions with long term implications. This means that decisions made by consumers based on current tariffs should not be negated when the tariff is changed. Therefore, once a new tariff has been implemented, subsequent adjustments in its structure should be relatively minor. Where possible, the tariff structure should be developed in consultation with service users and other stakeholders.

### 7.1 Gathering information

The data specified in the preceding sections needs first of all to be brought together. If any surveys are needed before the tariff can be established, these need to be planned and implemented.

### 7.2 Setting the tariff structure

The establishment of a tariff is divided into two parts, firstly setting the structure of the tariff (including both domestic and non-domestic categories) and secondly the setting of tariff rates.

The goals of the tariff now have to be clearly specified. They are assumed to be financial sustainability for the WSC and measures to influence the demand for water. These objectives may be changed or additional objectives may be added, but any changes may have implications for the operation, maintenance or management of the water system.

Issues that may need to be decided include such things as the extent of cross subsidies from non-domestic to domestic customers and from higher to lower income households, whether or not there is a case for seasonal tariffs for any category of customer, and so on.

#### *Domestic tariff*

In practice there are three options for the structure of the domestic tariff: i) a single flat rate, ii) rising blocks, or iii) a two-part tariff with the volumetric part structured either as a flat rate or rising blocks (see Table 1).

#### (i) Flat rate

A flat rate tariff has the advantage of simplicity, it can be easily understood

by all customers and it is easy for the WSC to calculate. However, a flat rate is unlikely to maximise WSC revenue and at the same time meet social affordability objectives. It is also unlikely to be an effective mechanism for managing demand for water.

#### (ii) Rising blocks

The NGWT recommends the gradual introduction of two-part tariffs for domestic consumers consisting of a volumetric tariff (which may be a block tariff) to cover operating costs and a fixed tariff, related to capacity, to cover fixed asset costs. (see Section 2) Two-part tariffs are not yet common, but rising block tariffs are replacing flat rate tariffs and becoming more common in Chinese towns and cities.

The use of increasing block tariffs follows practice in many countries where they are adopted their conservation and consumption reducing effects. For example, by 1998 57% of Japanese water utilities were using increasing block tariffs and by 2002 37% of water utilities in the USA were using them. They have also been adopted in many other countries.

In China, block tariffs are a way for water companies to achieve financial objectives and promote water conservation among domestic customers while also providing basic water needs to the population at an affordable price. A well designed block tariff can reflect the scarcity value of water and promote efficient use of this scarce resource by households. The structure of the tariff is designed to assist in achieving the tariff objectives. In a rising block tariff with three blocks, each of these priority objectives, is addressed directly by one of the blocks:

- meeting the basic water needs of the population, in particular of poor households, at an affordable price (first block)
- financial sustainability for the WSC so that it can continue to meet its obligations to supply water to the community over the long term (second block)
- water demand management and promoting the objective of conserving water in the context of overall water scarcity. (third block)

#### (iii) Setting tariff blocks

To set up a rising block volumetric tariff (or revise an existing one), the data on consumption mentioned in Section 4 is required. A breakdown is needed for domestic consumption, showing levels of consumption per billing period and the number of households consuming at each level (i.e. the consumption distribution of households). The household consumption levels used in this analysis may depend on how records are kept in the WSC. The data for households should be averaged over a whole year and the data should be collated for several years (at least three) so that trends and patterns can be verified. The number of households at each consumption level can then be expressed as a percentage of the total number of domestic customers to obtain a consumption distribution.

Tariff consumption blocks may be expressed as m<sup>3</sup> per household or capita per month.

The consumption distribution data can be used to set the size of the tariff blocks. In a three block tariff, the first block will probably be set to cover basic water needs. Basic water needs may be established from an external standard, such as that set by the

WHO. Alternatively, a comparison of consumption distribution with household income data may make clear a local “basic needs” level – i.e. an average consumption level for low income households.

As noted above, the second block generated revenue for the WSC and the third block focuses on demand management. The line between these two blocks will be decided based on the pattern of consumption in the WSC service area and what is considered the limit above which consumption is to be discouraged – this will depend on local factors such as the available water supply, the investment cost of expanding supply and overall local and

national demand management objectives. To be effective in this demand management role, there is no point in setting the consumption boundary of the third block so high that very few customers reach it or are at risk of reaching it.

Table 2 shows the consumption distribution for Beipiao in Liaoning Province. This data is based on the WSC’s billing records for 2004, 2005 and 2006. The distribution of the consumption of the relatively large proportion of non-metered households (almost one third of the total) has been inferred from the data on total water sales.

Table 2: Distribution of consumption in Beipiao, Liaoning Province

Consumption (m <sup>3</sup> /hh/month)		Consumption (m <sup>3</sup> /cap./month)		Distribution	
from	to	from	to	Metered	Non-Metered
0.00	2.50	0.00	1.00	21%	10%
2.51	5.00	1.00	2.00	42%	80%
5.01	7.50	2.00	3.00	24%	10%
7.51	10.00	3.00	4.00	10%	
10.01	12.50	4.00	5.00	3%	
12.51	15.00	5.00	6.00		
15.01		6.00			

Source: Beipiao WSC

In this case, 63% of households with meters and most of those without meters consume 2 m<sup>3</sup> per person per month (or about 5 m<sup>3</sup> per household) or less. This is 67 lpcd or less (compare with the WHO basic needs definition of 40 lpcd). On the other hand, very few households consume more than 4 m<sup>3</sup> per person per month (10 m<sup>3</sup> per household per month), although as incomes rise in the town more households are likely to move up to this level of consumption. The data

suggests that in this case the natural blocks to use for a rising block tariff are 0 – 2, 2.01 – 4, and >4 m<sup>3</sup> per person per month.

The pattern of water consumption may not always be so straightforward. Other factors that can help to determine the block structure include overall water availability and a need to limit sales and revenue targets. An iterative process including various tariff

rates may be necessary to determine the final block structure.

#### (iv) Two-part tariff

A two-part tariff is made up of a fixed part charged on a per connection basis and a volumetric part charged for the amount of water consumed. Usually, the fixed part is intended to cover the fixed (capital) costs of the water production and distribution system while the volumetric part pays for the system operating and maintenance costs. The volumetric part may be either a flat rate tariff or a block tariff.

#### **Non-domestic tariff**

Consumption by individual customers within non-domestic categories may vary widely for reasons associated with their particular activities and uses of water: one industry may use very little water, but the next one may use very large amounts. This means that a block tariff structure cannot usually be applied because there is no fair and reasonable way to set blocks. A block structure would only be possible for a non-domestic category if all customers in the category were engaged in similar activities or had relatively similar consumption patterns. Commercial customers in some cities might have consumption patterns like this. In this case, a two block tariff might be appropriate, with the first block for normal consumption and the second block designed to discourage high levels of consumption.

Flat rate tariffs are mostly used for non-domestic tariff categories. Non-domestic tariffs could also be structured as two-part tariffs (with fixed and volumetric parts) or as seasonal tariffs (see Section 2, above).

#### Box 1 Two-part tariffs with penalty rates

In Chaoyang, Liaoning Province, non-domestic customers have agreed consumption norms with penalty rates applying for consumption above the norms. The rapid rise in price in this example can have a strong impact on water use efficiency and water demand.

Consumption % over norm	Penalty rate – tariff rate multiple
up to 10%	x2
10 - 20%	x3
20 - 30%	x4
etc	etc

A system of rising tariffs is used in some towns and cities for large water users. A normal level of consumption for each period is agreed between the WSC and customer and if consumption goes over this level, penalty rates are applied. Penalty rates may be at a flat rate for all consumption over the agreed norm, or it may be on a rising scale, with the rate increasing as consumption over the norm increases. Consumption norms are negotiated separately with each customer brought into the system.

### **7.3 Setting the domestic tariff rates**

The setting of tariff rates must be linked to estimates of customers' ability and willingness to pay for water. Clear and appropriate estimates of AWTP are necessary to set tariff ceilings and devise tariff structures and subsidies that:

- protect the poor and other vulnerable groups
- allow well conceived and managed water sector investments to be financially viable and sustainable

A transparent and robust method of estimating AWTP is also likely to help build stakeholder support. This means undertaking careful analysis of data, conducting surveys, consulting with customers at all levels, publicising results and other similar measures to ensure widespread understanding of and agreement with the water price measures that are implemented.

**Box 2 Instances of overcharged un-metered households**

In Beipiao, Liaoning Province, un-metered households are charged at the rate of 3 m<sup>3</sup>/person/month but average household consumption in the city is less than 2 m<sup>3</sup>/person/month. Since a high proportion of un-metered households are in lower income sections of the city, where consumption tends to be below average, these households are significantly overcharged for water. This is reflected in the anomaly where the flat rate domestic tariff is RMB1.50/m<sup>3</sup> but the estimated average tariff for domestic customers is RMB1.88/m<sup>3</sup>.

For a volumetric tariff to be applied, all domestic and non-domestic customer connections should have functioning water meters. In some cities, where not all customers have meters, domestic customers without meters are charged for a standard fixed volume of consumption per household member per month. In such cases there is a risk that these households will be overcharged, compared with those with meters. The standard fixed volume used for charging these un-metered households should properly reflect the actual water consumption in the respective WSC service area.

**Flat rate domestic tariff**

If a flat rate domestic tariff is to be applied, then the rate must either be

set at a level that is affordable for low income households or it may be set at a higher level and a system of rebates applied for low income households. Setting a flat rate tariff at a level affordable for low income households will usually mean that the WSC foregoes revenue that it might otherwise have received from a tariff set at a higher level and which more closely reflects the costs of production and distribution of water.

**Affordable water for basic needs**

Affordability is an important consideration in setting water tariffs for low income domestic customers. Two ways to ensure it are described below.

(i) Rising block tariff

In a rising block tariff, the rate for the first block is set to meet the need to provide basic water needs for households at an affordable price. This usually means a price that is affordable for low income households. The size of the consumption block will be based on an assessment of the amount of water required to meet basic needs and data on the incomes of the lowest quintile in the WSC service area. There may be local variations in the “basic needs” amount depending on local supply and consumption patterns, but in most cases 3 m<sup>3</sup> per person per month would be a generous allocation in this price block. The price of water in this block will be below the cost of provision and therefore cross-subsidies from other, higher priced domestic blocks and possibly from non-domestic customers are implied.

Table 3 shows the maximum affordable tariff rates that could apply for given per person monthly consumption levels and a range of income levels, assuming an average

household size of three. Since the ability to pay criterion refers to the lowest income quintile, the household income for those at the top of this group needs to be known. Water must then be affordable for households with incomes below this level. Where households also pay wastewater charges, the water tariff plus wastewater charge should not exceed 5% of income.

The numbers in the table suggest that the rate for the first block in a block tariff should probably not be more than about RMB2/m<sup>3</sup> at present. This is

generally consistent with existing rates in various cities.

#### (ii) Rebates

Structuring the water tariff with a low cost lifeline tariff is an inefficient way to deliver subsidies to poor households because all households benefit from the low cost, including those who could afford to pay a higher price for this amount of water. A lifeline tariff does not target only the poor and it reduces WSC revenue compared with what it would be if all households could be charged what they are willing to pay.

Table 3: Low income households – maximum tariff rates (RMB/m<sup>3</sup>)

Household Income (RMB/month)	2.0 m <sup>3</sup> /person/month		3.0 m <sup>3</sup> /person/month	
	ATP 5%	ATP 3%	ATP 5%	ATP 3%
500	4.2	2.5	2.8	1.7
750	6.3	3.8	4.2	2.5
1000	8.3	5.0	5.6	3.4

Note the maximum tariff rates for given levels of basic needs consumption and maximum affordability levels of 5% and 3% of monthly household income for a 3 person household.

An alternative method to meet the needs of poor households is to provide them with a direct rebate to cover some or all of the cost of water. The amount of the rebate can be calculated in a simple way, for example as a percentage of the basic tariff rate multiplied by the volume of water required for basic needs. In order to keep administrative costs to a minimum. A rebate can be financed by the WSC or by an agency such as the Social Affairs Bureau. In either case, a practicable criterion must be established to determine a household's eligibility. A direct rebate could also be combined with the lifeline tariff, perhaps set at a higher rate than otherwise, as a way to provide

additional assistance to the very poorest households.

A number of cities in China have implemented rebate systems for poor households. For example, in Zhangjiakou in Hebei families that receive welfare from the Social Affairs Bureau also receive direct financial assistance in the form of a cash rebate equivalent to the cost of 5 m<sup>3</sup> per month. In Chengdu, qualified poor families receive a credit against their water bill covering the cost of basic domestic water needs. In both cases, the rebates are funded by the WSC and are recovered from other consumers through the water tariff.

This approach to the provision of water for poor households depends on the WSC being able to fund the rebates out of revenue from other customers. This is possible where there is a large customer base with a relatively small proportion of households that receive rebates, but it would be difficult where eligible poor households make up a large proportion of the customer base or where the non-domestic sector is not large.

### **Other tariff blocks**

The objective of the second tariff block is revenue generation for the WSC. The level at which the rate is set will depend on the revenue requirements of the company. The rate must also be seen as “reasonable” by customers. Among existing block tariffs, a ratio between the rates for the first and second blocks of between 1.5 and 2.0 is common.

#### Box 3 Ratios between block prices

Some examples of the ratios between block prices for domestic tariffs in cities in Liaoning Province are:

Chaoyang (1:1.56:3.12)

Fushun (1:1.48:2.22)

Yingkou (1:1.72:2.23)

Jinzhou (1:1.41:1.82)

Buxing (4 blocks - 1:2:3:4)

The objective of the third block is to assist water demand management by discouraging consumption above the level defined by the consumption boundary between the second and third blocks. To have this demand management effect, the price for this block must be sufficient to discourage

consumption and encourage water saving. It should probably be at least three times the rate for the first block. Data from a WTP survey may provide guidance for the setting of the rate for this block – only a small proportion of households should be willing to pay for water at this price.

From the point of view of simplicity and clarity, a simple relationship between the block prices is to be preferred. For example, the ratio between block prices might be 1:1.5:3 or 1:2:3 or 1:2:4, etc.

### **Two-part tariff**

The fixed part of the two-part tariff is usually intended to cover the fixed costs of providing water. This can be estimated as the annual depreciation and financing costs of the water production and supply system assets divided by the number of connections. The fixed cost may be linked to the capacity of individual connections, so that those with large capacity connections pay proportionately more than those with lesser capacity connections. If domestic connections all have the same capacity, this will mean that there is single fixed charge for households and fixed charges for non-domestic customers that are related to connection capacity.

The rates for the volumetric part of a two-part tariff are estimated in the same way as described above, except that the costs to be covered by the volumetric tariff are annual operations and maintenance costs only.

## **7.4 Setting the non-domestic tariff rates**

Any assessment of WTP should include non-domestic as well as domestic customers. Open and transparent consultation with non-

domestic customer groups would also provide useful information to the WSC and help build support for tariff adjustments. Water is not commonly a significant business cost and issues of ability to pay should rarely be critical for non-domestic customers, except perhaps for some institutional customers such as hospitals and schools which have large numbers of water users and restricted budgets.

The setting of non-domestic tariff rates should be guided, firstly, by the WSC's revenue requirements (given the objective of long term financial sustainability) and, secondly, by demand management considerations. Some broad principles that might guide the setting of non-domestic tariffs include:

- all non-domestic tariff rates should not be less than the second domestic block rate (or greater than the domestic tariff rate if that is a flat rate tariff)
- the pricing of all non-domestic tariffs should include demand management elements, either through the application of penal rates for excess consumption or through a block tariff with two blocks (for small non-domestic consumers)
- the base price for the special commercial category will be significantly higher than for other categories
- the relationship between the rates for the non-domestic tariffs should be established on some rational basis, depending on local social, economic, development, water saving, environmental and other priorities.

水费(机井电费)结算				单位: 元, 亩, 小时		
年	月	日	亩均费用 (时均费用)	应交	实交	收款人 盖章
2000	5	4	夏水		126.2	艾玉成
	10	4	冬水		224.5	艾玉成
2001	5	4	夏水		246.4	
2001	12	20	秋水		128.0	
2002	5	5	夏水		20.20	
2002	7	14	夏水		24.8	艾玉成
	12	29	冬水		226.40	

*Varied non-domestic rates for irrigation, based on season*

## 7.5 Using a financial management model

The financial management model can be used to assess the impact on revenues and the future financial position of the WSC of different tariff structures and rates. In the case of a domestic block tariff, this is particularly relevant for determining the most appropriate level of the rate for the second block. The financial management model also assists in setting appropriate level for non-domestic rates.

Given that a financial management model has been set up for the WSC, with an up-to-date demand forecast and production and cost data a wide range of tariff scenarios, including estimated future rate adjustments, can be tested to identify that which will best suit the needs of both the WSC and its customers.

## 7.6 The approval process

Changes in tariff rates must be applied for by the WSC through the relevant Price Bureau. Design of the water tariff and the determination of the proposed rates is the responsibility of the WSC but approval is required before they can be applied.

The approval process is governed by the relevant decrees and regulations of the State Development and Planning Commission.

The Price Bureau at each level of government is responsible for implementation of the regulations.

An application for a change in the water tariff is made in writing to the Price Bureau and includes information on the following:

- the current and proposed price
- the basis for formulating the proposed price and its justification
- an assessment of the impact of proposed price on relevant sectors and consumers
- financial and other information about the applicant covering the previous three years, including operational conditions, number of staff, changes in costs, financial statements, production value per employee, wages and salaries, comparison of prices with other relevant sectors, supply and demand conditions and the potential for future development
- any other information that may be required by the Price Bureau.

If the application is accepted by the Price Bureau and the local government a public hearing into the application must be arranged within 3 months. Comments from the public hearing must be taken into account by the Price Bureau in deciding whether or not to approve the proposed tariff changes. The Price Bureau also carries out its own assessment of the proposed price changes, with a particular focus on affordability for households in the community. The final price determination is submitted to the People's Government at the

corresponding level or Price Bureau at the next higher level of Government for approval.

## 8 WSC Performance and Efficiency

Over time, WSC tariffs may be increased to achieve full cost recovery and long term financial sustainability. WSCs need to ensure that they are operating as cost effectively as possible, meeting financial and other performance targets and providing a satisfactory level of service to customers. Customers should not be charged higher tariffs just to pay for the inefficiency of the WSC. Achieving and maintaining efficient operations will require:

- controlling water losses within the distribution system and reducing UFW as much as possible
- improving staff efficiency and controlling staff costs
- setting and maintaining service targets and standards to ensure customers receive the service they need
- assessing customer satisfaction on a regular basis
- implementing cost management and control procedures to ensure cost effective operations and maintenance within the water production and distribution system.

## 9 Revising the Tariff

According to the NGWT, a WSC may apply for an adjustment to water tariff rates when:

1. the water tariff cannot recover water supply operating costs

2. the WSC has losses after government subsidies, or
3. the WSC does not receive reasonable compensation for its investment in the expansion of productive capacity.

Furthermore, tariff adjustments should be subject to the principles of:

1. benefiting water supply development, economic development and people's living needs,
2. benefiting water conservation,
3. social affordability, and
4. cost control in the WSC

When preparing a proposal for tariff reform and restructuring, a WSC may set out a programme of multi-year tariff adjustments to move gradually towards financial sustainability. It is to the benefit of both domestic and non-domestic customers to know in advance how tariff rates are expected to change in the short to medium term. This facilitates acceptance and for business customers it facilitates business and investment decision-making.

If the water tariff has been well set up, it should not often be necessary to restructure it. Revisions will usually relate only to adjustments of tariff rates. The structure of the tariff should not normally be changed. Maintaining the relationships between tariff categories and prices will least disrupt rational user decision, especially those relating to business and investment.

## 10 Water Pricing Policy (within national guidelines)

### *General issues for consideration*

Pricing policy should normally have three key objectives, namely:

- Tariff levels should be sufficient to cover operation and maintenance costs, to meet the cost of system expansion to serve new customers and to cover the larger of debt service or depreciation.
- The water tariff should contribute to economic efficiency within the national economy.
- The tariff structure should support social equity (promote widespread access to water, affordability to all income groups, and billing and collection from all users).

It is important to note that the incremental cost of supplying water to new or sparsely populated areas is likely to be higher than increasing supplies in already established areas. This is because the new areas usually do not benefit from economies of scale, existing facilities or high population densities. Under these circumstances decisions have to be made regarding the optimum strategy to adopt in order to ensure the long-term sustainability of water supply. One of a number of strategies could be considered, including:

- The provision of a government subsidy to ensure the proper operation of facilities and adequate levels of service in high cost water supply areas. However, the sustainability of this practice would in itself have to be carefully assessed.

- With a uniform regional tariff level, increase the average tariff to cover the increased overall average cost due to new supplies. In effect consumers of water in lower cost areas will subsidise those in higher cost areas. This approach may cause objections from consumers in lower cost areas who object to subsidising those in the higher cost areas. However, it could have the affect of redistributing incomes from urban areas to the relatively poorer rural areas.
- Introduce differential tariffs to reflect the actual costs of providing water in the higher cost areas. This will undoubtedly result in objections from those affected on the grounds that a uniform standard of water supply should be provided for all at a uniform price. Additionally this approach could lead to affordability problems amongst the less well off in higher cost areas. The introduction of a more comprehensive increasing block tariff designed to ensure that even the poorest consumers are able to afford enough water to meet their basic requirements is a possible structural adjustment that could be utilised under a differential tariff system to address affordability problems.
- Accept that the standard of water supply service in small secondary and tertiary centres can be reduced to lower the cost of service in these centres. A reduced standard of service is likely to be more acceptable than no service at all.

Whatever strategy is adopted for pricing within the water supply and wastewater sector, operating revenues (and non-operating revenues in the case of a subsidy) for use in maintaining water supply systems should not be allowed to fall below the operating costs associated with maintaining an adequate level of service.

## Document Reference Sheet

### Glossary:

Price elasticity	Responsiveness of the demand for water to the increase or decrease in its price. Normally, sales increase with a drop in prices and decrease with a rise in prices. As water tariffs rise demand for water (except for that portion used for basic needs such as drinking and cooking) would fall if incomes do not rise also
Income elasticity	Proportionate change in the demand for water in response to a change in income. It is reflected in how people change their consumption habits with changes in their income levels. As incomes rise in China, per capita demand for water rises accordingly
Ability to Pay (ATP)	The capacity of a household or business to make payments for water supply services. ATP is about affordability, especially for low income users.
Willingness to Pay (WTP)	The maximum amount that an individual states he or she is <b>prepared to pay</b> for a good or service

### Bibliography:

'Reform of Water Tariffs in Chongqing: A Case Study Review', World Bank Analytical and Advisory Assistance (AAA) Program, 2006

Zhang Shiqu et al, 'Study on Water Tariff Reform and Income Impacts in China's Metropolitan Areas: the Case of Beijing', World Bank, 2007

### Related materials from the MWR IWRM Document Series:

Thematic Paper 3.2	Urban Water Supply Demand Management
Example 5.4	Tariff Setting for Beipiao Water Supply Company
Advisory Note 5.5	Willingness to Pay Surveys (Urban Water Supply)
Example 5.5	Willingness to Pay Survey for Beipiao Water Supply Company
Thematic Paper 5.7	Financial Management and Modelling in Small and Medium Water Supply Companies
Manual 5.7	The Development and Use of a Model for Financial Analysis of a Small to Medium Size Water Supply Company in China

### Where to find more information on IWRM – recommended websites:

Ministry of Water Resources: [www.mwr.gov.cn](http://www.mwr.gov.cn)

Global Water Partnership: [www.gwpforum.org](http://www.gwpforum.org)

WRDMAP Project Website: [www.wrdmap.com](http://www.wrdmap.com)

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