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# Economic Regulation of Water Companies

*Michael Klein*

The key to effective regulation of water companies is to generate information that allows the regulator to make good rules and allows the interest groups to watch out for improprieties by the regulator.

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## Summary findings

Both public and private water companies need regulation (of water price and quality) when real competition is not feasible. Piped water systems tend to be monopolies or to contain monopoly elements. To counteract monopoly power, regulatory mechanisms exist in all countries, as part of the executive branch of government or in more independent agencies. Regulators rule on issues of price and quality of services and sometimes also on investment performance. Pricing rules try to balance incentives to use water efficiently with social concerns, such as quality of the water supply, universal service goals, and subsidy schemes for the poor.

The regulator has a countermopoly to the water companies and may also be tempted to abuse that power. Because the regulator does not invest in fixed, immovable assets, it has more freedom than the private monopolist, who is exposed to pressures once a water system has been built. Under political pressure, the regulator may therefore be tempted to exploit the private investor by not granting prices sufficient to cover investment costs. Or the regulator may team up with the company and exploit the consumers. To guard against such behavior, the powers of the regulator should be carefully circumscribed. And the office of the regulator

should be set up so as to be able to resist improper influence by different interest groups (companies, consumers, and government).

The key to effective regulation is to generate information that allows the regulator to make good rules and allows the interest groups to watch out for improprieties by the regulator. The best way to generate information is to introduce multiple players in the water system in ways that enhance direct or indirect competition. In particular, it seems advisable to minimize exclusivity rights and to let companies compete for concessions with limited terms. Incentives to compete and to behave efficiently will be strongest when the owners have their own money on the line. For this reason, government-owned water companies could on average be expected to perform worse than investor-owned companies. Competent government-owned companies should be given a chance to compete on an equal footing with private companies rather than be sheltered from competition. An equal playing field will require that they not benefit from taxpayer subsidies (for example, through equity injections) but face a budget constraint as hard as that of private competitors.

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This paper — a product of the Private Sector Development Department — is part of a larger effort in the department to analyze issues arising from private participation in infrastructure. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Sandra Vivas, room G4-031, telephone 202-458-2809, fax 202-522-3481, Internet address [svivas@worldbank.org](mailto:svivas@worldbank.org). September 1996. (36 pages)

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**Michael Klein**



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# **Economic Regulation of Water Companies**

## **I. Introduction**

1. This paper provides an overview of approaches to the economic regulation of piped water supply and sewerage systems. The discussion emphasises the particular importance that quality issues take on in water systems relative to any other infrastructure sector. Water quality is obviously important for the consumer of water, but also to others, who may suffer from diseases spread through the water system. The paper first asks the question when and why regulation may be needed. This is followed by a review of options to structure water systems, which in turn affects the way regulation operates. The key regulatory rules that may be chosen are then discussed, followed by a brief survey of institutional options for carrying out the regulatory functions. The paper closes with a brief assessment of the implications of regulatory choices for financing of water projects.

## **II. Why regulate water companies ?**

### **II.1 Competitive markets vs. natural monopoly**

2. **Water vendors - competitive markets.** Water works and distribution systems were invented a long time ago. In China, Yu the Great, patron of hydraulic engineers tamed floods around 2200 B.C.. The Romans built famous aqueducts. In the late 18th century wooden underground pipes provided London with water from the river Thames and in Paris just before the French revolution the brothers Perrier built a piped water system. But the spread of piped water systems was slow. Water vendors were indispensable in every town in the world in the 18th century and continue to be so in many cities of the developing world <sup>1</sup>.

3. Where water vendors provide services, consumers have choice. They can bargain over price, they can check quality. In China, the boiling of suspect water was recommended and "vendors sold boiling water in the streets" (Braudel, 1979). Where vendors compete, consumers can thus judge the quality of water and switch suppliers when no longer satisfied with their current

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<sup>1</sup> Technology differed little across the world. "In China the water carrier used two pails, as in Paris, balancing them at each end of the pole" (Braudel, 1979 p. 230)

vendor. The vendors in turn are free to ask for prices that cover their costs, but consumers can turn to cheaper suppliers when price quotes are excessive. Inefficient vendors can go out of business, but consumers are interested in paying sufficiently high prices to keep as many vendors in business as needed<sup>2</sup>.

4. **Piped water - natural monopoly.** The advent of piped water drastically changes the situation. In piped systems, water can be supplied much more cheaply than by street vendors. Today, prices of piped water are often only 10 to 20 per cent of those charged by vendors, or even less (See World Bank, 1994b and Table 1, below). Even if one corrects for subsidisation of piped water systems, the cost of piped water remains significantly cheaper by at least 50 per cent and is more likely to be a fourth or less of the cost of vendors.

5. But at the same time choice is reduced, because it is normally inefficient to lay competing pipeline systems, which would provide consumers with choice. Initially, in the 19th century, competing water pipeline systems were laid in various towns in a number of countries, for example Canada and the United Kingdom. But whether as a result of free competition or municipal regulation, soon there were only single water monopolies left for each area supplied with piped water (Foreman-Peck and Millward, 1994 and Armstrong and Nelles, 1986).

6. Whatever the system of ownership, in a monopoly sector like piped water supply, prices are not set by bargaining between consumers and competing vendors. Without some controls that preserve the interest of consumers, the latter would be at the mercy of the monopoly and would have to pay excessively high prices. In fact, we do observe ways for monopolies to abuse their power in a number of cases (Lovel and Whittington, 1991). At worst, when the monopoly can freely exploit consumers, prices of piped water would be as high as those of competing street vendors and all the advantages of the low cost of piped water would accrue to those controlling the piped water system.

**Table 1**

<b>PRICES OF WATER VENDORS vs. PRICES OF PIPED WATER SUPPLY (in US cents/m<sup>3</sup>)</b>		
	vendors	piped water
Bandung	616	9.9
Jakarta	185	17.2
Manila	187	10.5
Karachi	175	7.5
Ho Chi Minh	151	7.6

*Source: Asian Development Bank, 1993.*

<sup>2</sup> In many countries water vendors de facto operate in free markets as described in this paragraph. However, in some countries, including China, prices charged by water vendors are at least officially subject to price controls, which undermine the forces of competition and render water vending a regulated business.



## **II.2 The regulatory challenge - balancing consumer and producer interests**

7. **Consumer representation.** Consumers, therefore, need some type of institution to oversee the water supply agency so as to limit abuse of monopoly power. In smaller water systems, consumers may form cooperatives to run the supply system "themselves" and attempt in this way to balance the legitimate interests of water consumers and suppliers. As systems grow larger, individual consumers have more limited ways to exercise direct influence. They have to rely on other forms of representation, for example through municipal offices or independent regulatory agencies. In the following such agencies are called regulatory agencies or regulators.

8. Regulatory agencies may exercise oversight over non-governmental providers of water, cooperatives or private ones. We find such systems in countries such as Argentina, England and Wales, France, Malaysia and the United States. Alternatively, governmental authorities may themselves own and operate the water system. The French revolutionaries of 1789 nationalised the pipelines of the brothers Perrier. The majority of countries and municipalities in the world did alike often driven by concerns for water quality, for example in the wake of cholera outbreaks in the United States. In the case of government-owned water companies the regulatory function is usually performed by some ministry or municipal office. In several Chinese cities, for example, the price bureau sets water prices and the planning bureau controls quality norms, while the water system is run under the auspices of the city's construction bureau or sometimes by a separate company (Baye, et al., 1994).

9. **Investor protection.** Once consumers are represented by a regulator, the balance of power may shift from the water company to the regulator. The regulator may be friendly to the water company and tolerate excessive prices or substandard performance. Alternatively it may be tempted to exploit the company once it has constructed a water system. When the water system is built the company can no longer walk away and take the pipelines with it, but is at the mercy of the regulator. If regulators are expected to abuse their power in this way, investors will not come to invest. In those cases governments tend to fall back on raising money from taxpayers and government ownership.

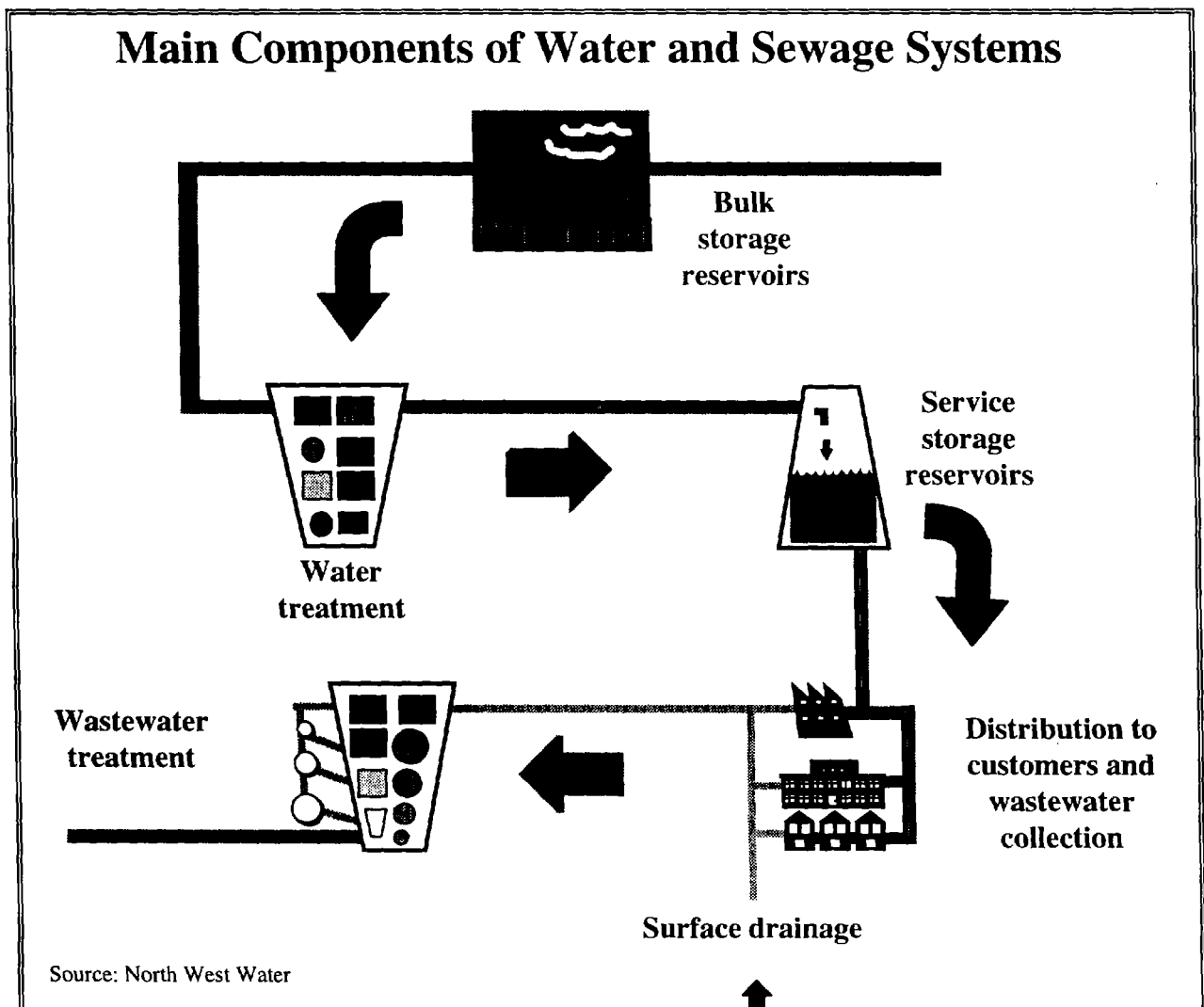
10. **Government ownership.** As many countries have found, government ownership per se - at whatever level of government - does not make it easier to limit monopoly power. Monopoly suppliers of all types are tempted to charge excessive prices or ask for excessive subsidies or provide low quality service or any combination of the above (World Bank, 1994b). At the same time even if the government owns the water company it may not allow it to cover costs and perform on a commercial basis. The key to protecting consumers and suppliers alike, therefore, lies foremost in the choice of the regulatory mechanism for the water supply companies.

### III. The choice of market structure

#### III.1 Structural options

11. **Water system components.** As in other infrastructure sectors, there are various ways to organise a water supply and sewerage system. A single company may be responsible for investment, finance and operations of a whole water and sewerage system as in many cities of the world. Alternatively, different part of the system (Figure 1) may be the responsibility of different companies. For example water and waste water treatment plants as well as pipelines and storage facilities may all be run by separate companies. Such is the case in China in several cities, such as Tanzhou, Guangzhou and Nanchang, where the water treatment plants are built and operated by joint ventures between the municipality and private water companies.

Figure 1



12. **The scope for competition.** The organisational structure of a network system like piped water should ideally introduce as much competition as possible. This would increase consumer choice and by the same token reduce the need for regulation. In some sectors, for example electricity and natural gas, it has recently become possible to structure systems so as to allow effective competition among suppliers (power generators and gas producers) who have fair access to a single transmission or pipeline system. In water it has not yet been possible to establish such a system.<sup>3</sup>

13. Several key reasons stick out - the cost structure of water systems and concerns about quality. First, in most systems the cost of water pipelines are a large part of total system costs. It is, therefore, precisely that part of a water system where most gains could be reaped, which would not be subject to competition contrary to the case of electricity where the most significant gains may be reaped in power generation, which often accounts for more than half of system costs. Competition would appear to bring major benefits only in areas where water is scarce and therefore expensive and where - at the same time - a sufficient number of water sources compete with each other, i.e. in fairly rare cases so far. The number of relevant water sources is also a function of economies of scale in treatment plants. Where the minimum optimal size of a treatment plant is such that no more than 3 or 4 plants could compete, effective competition may not be achievable.

14. Second, quality concerns are of extreme importance in water and sewerage systems. Where quality is difficult to observe, competing water suppliers may be tempted to sacrifice quality to survive in a competitive environment. To protect the consumers and more generally public health it may then be preferable to limit competition among water suppliers and accept higher costs in return for higher quality. However, most importantly the preeminence of quality points to the need for rigorous water testing by a regulatory authority and the imposition of effective penalties. For the time being, choices of organisational structure thus have to pursue more modest aims than the introduction of real competition over the pipeline network.

15. Competitive options in water systems are currently limited to competition at the boundaries of service areas and to some forms of bypass. For example, in areas where the territories of two water companies meet, it may be sensible to allow consumers to contract with either one of the water companies. In other cases it may be efficient, particularly for large customers to build their own water supply system, which may better match quality requirements.

16. Such types of limited competition or bypass of existing systems are possible when governments award service areas to water companies without the exclusive rights to service customers in the particular area. Some duplication of water pipes may also be justified by better price-quality combinations for the customer (Armstrong, Cowan, Vickers 1994). Duplication may in particular be cheaper when customers would otherwise be forced (by the inefficient performance of the water company) to resort to expensive street vendors or private supply options such as boreholes. In a few cases governments have judged it to be economical to lay parallel water

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<sup>3</sup> A water company in Chile has recently asked to invest in a water treatment plant, which would sell directly to end users on the basis of competitive access to the pipeline system.

systems for water of different quality. Such is the case of Hong Kong, where seawater pipes supply flushing water, while treated drinking water is supplied by another network.

17. Sewerage systems are in a sense complementary monopolies to water supply systems. Demand for sewerage services is highly correlated with demand for water. Sewerage systems pose similar problems for the introduction of competition. In addition, it is more difficult to enforce payment discipline in sewerage systems, because disconnection is not generally an option.<sup>4</sup> For these reasons payment for sewerage may often be collected together with the water tariff. In the following, the problems of sewerage regulation are generally assumed to be structurally similar to those of water system regulation.

18. Some level of competition may be obtained by letting water and sewerage companies bid for the right to service a particular area. However, such competitions cannot easily and effectively be repeated at regular intervals to obviate the need for regulation (para. 70 to 73). Different operators could also be allowed to bid for the right to perform some specific functions contracted out by the water and sewerage companies (eg. reading meters, collecting bills, maintaining or repairing the network etc...). In some cases, water and sewerage companies could themselves have to compete against such operators to undertake some specific activities.<sup>5</sup>

### **III.2 The implication of structural choices for regulation**

19. **Information for the regulator.** By allowing different parts of a water system to be run by different companies the following benefits may be obtained. First, more and better information about costs and performance of the various parts of the system are likely to be generated for the regulator, because ways to shift costs and revenues in company accounts are limited when each company keeps independent records and accounts. Second, by generating information about relatively well defined components of a water and sewerage system (e.g. treatment plants) it may be somewhat easier to compare company performance across jurisdictions. This would render it easier to detect poorly performing, high-cost companies and to set prices correctly i.e. not to reward high-cost companies with high prices.

20. **Promotion of rivalry.** Third, by creating several players in the water system, divergent interests among the companies may be exploited by the regulator, who would receive information from each from their differing perspective. Fourth, by allowing companies to run only small part of an overall system, non-performing companies may be easier to change than when they control all of a water system.

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<sup>4</sup> Once the city of Puebla in Mexico tried to deal with non-payment of water and sewerage bills by blocking household outlets for sewage, because disconnection of water users was illegal.

<sup>5</sup> This is, for example, the case in Morocco, where public water and sewerage companies compete with private entrepreneurs for the right to equip housing sites. Once the water and sewerage system is in place, however, only the public water and sewerage companies have the right to operate it.

21. **Benefits of integration.** On the other hand there may be real benefits from integrating different parts of a water system. Integration may save managerial and administrative overhead costs and render labour redeployment easier. System operations itself may also be slightly easier and less measurement and contracting at interfaces between the parts of the system will be necessary. In developing a water and sewerage system these costs have to be weighed against the benefits mentioned before. Some countries have tended to chose integrated systems, for example England and Wales, whereas others have a tradition of more unbundled systems, such as France.

22. **Trade-offs and conclusions.** Altogether, there is no simple recipe for the choice of water sector structure within a particular water system. However, in making choices decision-makers would be well-advised to consider the implications of sector structure for the effectiveness of regulatory oversight. Many countries de facto pursue separate ownership and/or operations of water and waste water treatment plants to facilitate new investment (Malaysia, Mexico, China). The latter approach yields the previously described benefits to regulation as an unintended by-product of the search for finance.

23. In all cases, it is advantageous to allow several companies to run different water systems in a country. In case of non-performance the authorities would then have the option of replacing non-performing companies with others that are already familiar with the country environment. Over time it may also be possible to generate yardstick information across countries.

#### **IV. The choice of regulatory rules**

24. **The scope of rules - quality and price.** Ideally, the regulator would limit oversight to issues of price and quality, while delegating investment and operating decisions to the water company, because the water company will generally know these matters much better than the regulator. The regulator would review prices and performance that may be agreed in contracts or set prices and performance requirements as part of regulatory rule-making<sup>6</sup>. No matter how detailed original contracts and rules may be, unexpected changes in operating or financial conditions will make it necessary for the regulator to adjust prices and performance standards from time to time or to rule on the desirability of negotiated adjustments.

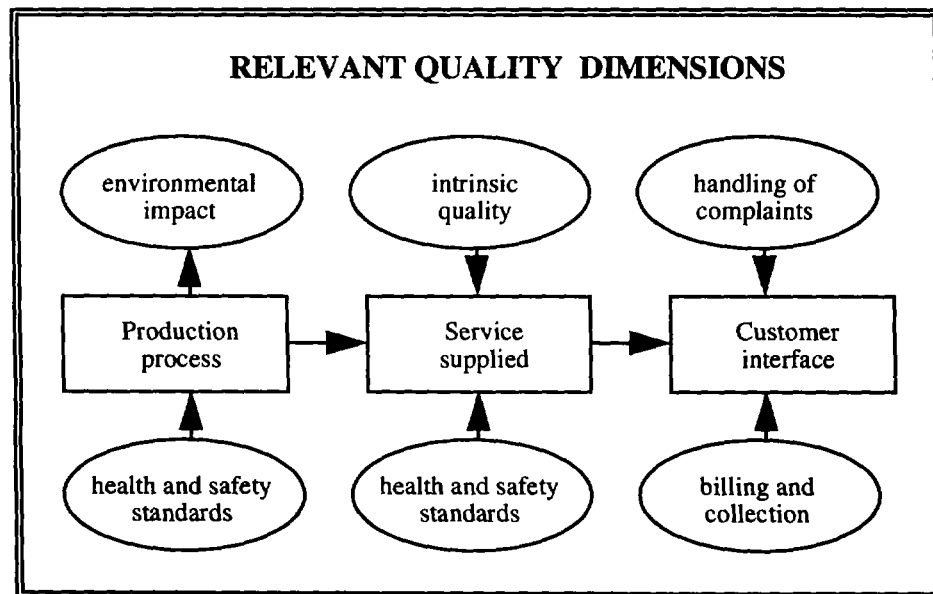
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<sup>6</sup> The difference between these methods is one of the scope for discretion.

## IV.1 Regulation of Quality

25. **Performance standards, penalties and bonuses.** Water contracts or regulations may specify performance standards including water quality and service standards, such as response time to complaints and the speed of repairs. Regulators monitor the observance of these performance standards. Violations of the standards may be subject to penalties, whereas over-fulfillment of standards may attract bonuses. Such incentives can provide the water company with strong incentives to achieve desirable performance standards, including the impact of water or sewage quality on third parties (external effects). Clearly, the details of quality testing are technical matters, which are not discussed in this paper in any depth. However, these issues are of paramount importance.

Figure 2



26. **Unobservable quality.** Sometimes it may be difficult to assess the achievement of performance standards. For example, the readiness of a water system for major fire-fighting has historically been difficult to test (Jacobson, 1989). In such cases, it may make sense to substitute requirements for investments and operating procedures. These would then be monitored by the regulator. The danger is that such relatively direct interference in management decisions will seriously undermine the advantages of delegating responsibility for construction and operation to specialist agencies.

27. In general, when quality is difficult to observe and/or can at best be observed only after the fact, the incentives for the company to provide quality water supply may be weakened when the company faces a fixed price or pricing formula. It may then be tempted to make profit by reducing

quality. To guard against this perverse incentive one may have to choose a type of cost-plus price regulation, where the company will expect to be reimbursed for all half-way reasonable expenditures (Laffont and Tirole, 1993). This may, of course, lead to the provision of excessive quality and high water prices. Germany may represent an example of this effect, where water tends to be of very good quality, but also very expensive by any international standards - several US dollars/cubic meter depending on the city.

28. **Reputation.** There is thus a great premium on ways to measure and monitor performance standards, because otherwise it is difficult to protect consumer interests effectively - both with regard to quality and to price. Another option to reduce the temptation of companies to reduce quality is to establish ways in which companies could lose the responsibility - and with it the rewards - for managing part or all of a water and sewerage system. This would provide the company with an incentive to maintain reputation and to perform even when quality is difficult to observe in a timely fashion (Laffont and Tirole, 1993).

## **IV.2 Regulation of prices**

### **IV.2.1 Price discovery mechanisms**

29. **The regulator's handicap - information.** It is usually difficult for regulators to ascertain what the correct price level and structure is that will protect consumers and provide firms with incentives to supply quality water efficiently. Regulators face this difficulty because they tend to be less well informed about costs and quality of water systems operations than the water company management.

30. **Price discovery through ownership.** Sometimes it is thought that state ownership of the water company could overcome this problem of information. But de facto it is generally not easier to obtain good cost information from a state-owned firm than from a private one. Therefore, other mechanisms of price discovery are needed for an effective system of regulation regardless of whether the water systems are run by governmental or non-governmental entities. In fact, non-governmental ownership may provide additional means to discipline water companies and thus allow the authorities to serve the population better (paras. 62 to 69). By the same token private investors will be reluctant to enter a business where they are exposed to severe sanctions until they have become comfortable with the risks surrounding such ventures, i.e. both commercial and political risks. For this reason it may be advantageous at times to introduce private participation gradually, e.g. by starting with simple management contracts, that may later lead to operating concessions and finally full private responsibility for investment and finance. Such an approach is de facto quite common and most clearly visible in the design of water contracts for Mexico City.

31. **Price discovery by way of auction.** One way to set prices is to auction off the rights to run a system to the bidder offering the lowest price of water - for a given set of performance parameters. Most prominently such an auction has been used for the Buenos Aires water and sewerage system in 1993. The winning bidders offered to deliver water at a price, which was about

27 per cent lower than the prevailing price under state-ownership, while annual investment commitments of about US\$ 200 million for the first five years were made compared to an investment level of only US\$ 20 to 40 million in the preceding years. Other examples - old and new - demonstrate that such auctions may well yield prices significantly below those prevailing before (Armstrong and Nelles, 1986). A recent example from France suggests that such results can also be found in well-developed systems. The mayor of a small town in southern France decided to call for bids from several water companies at the time of concession renewal and in October 1994 the winning bid offered a price of FF 1.7 per cubic meter compared to FF 3 before.

32. However, once a price has been chosen by way of auction, it may be renegotiated. Circumstances always change, unexpected events occur and a multitude of legitimate and illegitimate pressures arise to adjust prices and/or performance standards for the water company. Such adjustments will have to be subject to the scrutiny of a regulator to prevent monopoly power from creeping back in or to prevent exploitation of the investors once they have invested their capital and thus tied themselves to the municipality or country in question<sup>7</sup>.

33. Only if it were practical to repeat the auction frequently, for example every two years, might it be possible to resist pressures to renegotiate and reduce the need for regulation effectively. This is possible for solid waste collection schemes, where it is relatively easy to re-auction rights to collect garbage in a particular area quite frequently. If the incumbent of the garbage collection franchise loses he can simply move his equipment elsewhere and a new company takes over.

34. However, in the case of water systems where investments are tied to a particular area, the incumbent would have to obtain adequate compensation for his effort and investments. As will be discussed below in paras. 70 to 73 this may undermine incentives to maintain the water system and carry out new investments. Also, conducting new rounds of bidding frequently is very costly. The bidding for the Buenos Aires water concession is said to have cost each of the three bidders some US\$ 5 million. Consumers or taxpayers will ultimately have to pay these costs. It may, therefore, not be reasonable to re-auction rights to run water companies very frequently. De facto, such rights would be granted for long periods of time, at least 5 to 10 years for pure operating contracts and 20 or more years for arrangements where the water company shoulders investment responsibilities as well.

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<sup>7</sup> When the investor is a state-owned company, it is really the tax payers who are at risk. Their means to complain are limited and it might thus appear as if the issue of investor protection was less of a problem for state-owned companies. In fact, exploitation of the taxpayers can be sustained for a while but ultimately tends to limit fiscal revenues as taxpayers find ways to evade taxation. Then - as funds for the water company start drying up - the lack of investor protection will be reflected in substandard service.



35. **Price setting from cost data.** Economic regulation of some type is, therefore, unavoidable. The regulator has essentially two ways of obtaining data that will help him establish a reasonable level and structure of prices. The main source of data will be the regulated water company itself. It will have to provide the regulator with cost and demand data to allow him to set prices.

36. **Yardstick competition.** To check whether the company is providing accurate information the regulator can audit the data as well as compare them to data from other similar water companies - if these exist. Application of the latter technique is also called

benchmark or yardstick competition. As mentioned before (para. 19) the potential for yardstick competition depends on the market structure of the water sector. While benchmark information can help, the most intense attempts to use it for price regulation in England and Wales by the office of water regulation (OFWAT) have also demonstrated the limits of the technique (Booker, 1993). Individual company circumstances always vary sufficiently to require firm-specific information for efficient price setting. Chile is another case where the regulator uses long-run marginal cost calculations of a "model" company to set prices.

37. The regulator thus has to work with cost and demand data relevant to the firm it is about to regulate and transform these data into prices on the basis of sound economic principles. The basic principles concern i) incentives to use of water, ii) incentives for investors to invest and operate systems well, and iii) the best possible sharing of risks and rewards between investors, consumers and taxpayers.

**Table 2**

<b>REPORTED COSTS <sup>1/</sup> OF PIPED WATER SYSTEMS</b> <b>in US cents/m<sup>3</sup></b>			
	<b>Operating Costs</b>	<b>New Investment</b>	<b>Unaccounted for water (in %)</b>
Singapore	27.0	10.2	8
Hong Kong	38.5	14.6	26
Beijing	3.2	2.9	28
Shanghai	1.8	0.6	25
Guangzhou	1.7	2.8	N.A.
Seoul	16.1	13.6	42
Kuala Lumpur	33.8	46.1	37
Karachi	3.7	2.6	30
Bangkok	16.1	4.1	31

<sup>1/</sup> excluding cost of capital and depreciation/maintenance of existing capital stock  
Source: Asian Development Bank, 1993.

#### **IV.2.2 Incentives to use water**

38. **The function of prices.** Water prices provide a signal to water suppliers about how much water to supply. To consumers they provide a signal about how much to consume. Given a certain price water suppliers will expand supply until the cost of supplying an additional unit of water (marginal cost) is equal to the price, because this will maximise the suppliers' profit. Given a certain price consumers will expand consumption until they feel that higher consumption is no longer worth the price to them, i.e. their willingness-to-pay equals price. When prices rise suppliers have an incentive to supply more and consumers will want to consume less. The opposite happens when prices fall. Optimal prices balance demand and supply and consumers and suppliers adjust their supply and consumption decisions accordingly.

39. **Pricing for efficiency.** On efficiency grounds water should be considered a different product depending on i) the location where it is produced and consumed, on ii) its quality including the effects water or sewage quality has on parties other than the consumer, and on iii) the time of day or year when it is supplied and consumed. For example, consumer demand and therefore willingness-to-pay may be high at certain times (peak periods) of the day or it may be high during dry seasons when plants need extra watering. The cost of supplying water obviously depend on the desired quality of water, the costs of transportation and the total volume to be transported at any given time.

40. Prices that balance demand and supply efficiently should, therefore, ideally vary by location, quality and time of use. For example when there are short peak periods the water supplier needs to build extra capacity into treatment plants and water pipelines to supply demand at these peak periods. Those who want water during these periods should pay for the extra cost of capacity expansion. If they are not prepared to do so, demand will be smaller - as it should be. By pricing water correctly the community will save on unnecessary investment and operating costs. These pricing principles and various methods of providing subsidies are discussed in more detail in Brown and Sibley (1985) and OECD (1987).

**Table 3**

<b>KEY FEATURES OF SELECTED WATER PRICING</b>	
<u>Price differentiated by:</u>	<u>Cities/Countries</u>
<ul style="list-style-type: none"> <li>customer class (e.g. residential, commercial, industrial)</li> </ul>	most cities
<ul style="list-style-type: none"> <li>volume consumed (based on metering)</li> </ul>	<u>increasing block rates:</u> many cities incl. Hong Kong, Singapore, Taipei, Seoul, Osaka  <u>declining block rate:</u> few cities incl. Brisbane, Denver
<ul style="list-style-type: none"> <li>connection charge <u>and</u> volume charge (two-part tariff)</li> </ul>	many cities
<ul style="list-style-type: none"> <li>time of day</li> </ul>	Antwerp, Le Havre
<ul style="list-style-type: none"> <li>season of the year</li> </ul>	some cities in France, Netherlands, USA
<ul style="list-style-type: none"> <li>quality of water (in dual supply systems)</li> </ul>	limited dual systems in Hong Kong, USA, Denmark, Japan, Germany, France, Australia, Italy
<i>Source:</i> OECD (1987), Asian Development Bank	

41. **Universal service.** In practice efficiency considerations are often overridden by social and political concerns. Typically, governments provide water companies with targets to serve a certain share of the population. Often this may be expressed as a target for universal service.<sup>8</sup> When prices are set to reflect costs, companies would in principle have the incentive to provide service to all consumers whose willingness-to-pay exceeds marginal cost. In this case, service requirements such as that of universal service would be redundant, particularly if the water company had no exclusivity rights and another company could compete to offer service.<sup>9</sup>

<sup>8</sup> Contracts with universal service requirements may, however, be qualified, by stipulating that universal service should be provided "where it is economic to do so", leaving the option open not to serve certain remote and high-cost areas or customers.

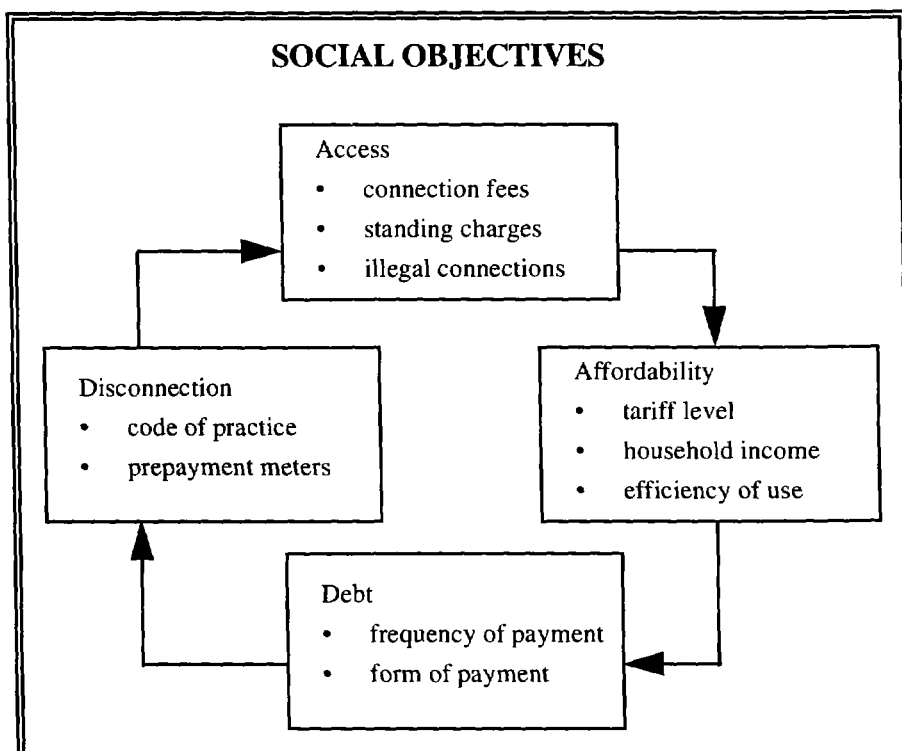
<sup>9</sup> When companies have exclusivity rights they may reduce effort and not exploit all economic opportunities aggressively.

#### 42. Uniform prices.

In many cases governments prescribe uniform prices for certain customer classes in a service territory. Even if the uniform price covers costs on average it may be insufficient to cover costs for outlying customers. In this case it would not provide any incentive to the company to provide the required service for all. On the other hand, customers that can be served very cheaply may have an incentive under uniform pricing to look for alternative water supply sources to lower their cost of service. For these reasons the attempt to combine uniform prices

with universal service obligations leads governments to provide exclusivity rights to water companies.

Figure 3



43. **Cross-subsidy schemes.** Exclusivity rights are one way to cross-subsidise customers. They allow the company to use revenue from low-cost customers to subsidise high-cost customers, i.e. to cross-subsidise. When cross-subsidies under an exclusive franchise are not allowed, the governments can still achieve universal service combined with uniform pricing. But the cross-subsidy would have to be raised through some form of tax and explicitly provided to high-cost customers.

44. **Subsidies.** Sometimes the community would like to provide poor users with a minimum of affordable water supply. In this case some type of subsidy system is required. Often it is argued that some minimum amount of water consumption e.g. the first 10 cubic meters should be sold at subsidised rates. Higher consumption should be priced to fully reflect cost and demand conditions so as not to provide consumers with incentives to consume excessive amounts of water.

45. A particularly interesting subsidy method, which tries to ensure that only poor people benefit from subsidies has been applied in Chile<sup>10</sup>. There, the municipality maintains a register of poor people. The water company charges these people a low rate for the first cubic meters of water consumption. The water company simultaneously presents a bill for the difference between the subsidised rate and the full price to the municipality, which reimburses the water company out of tax revenues, which may be obtained from various sources, possibly the water system itself. Poor customers, who have not paid, lose their right to the subsidy and are charged the full price.

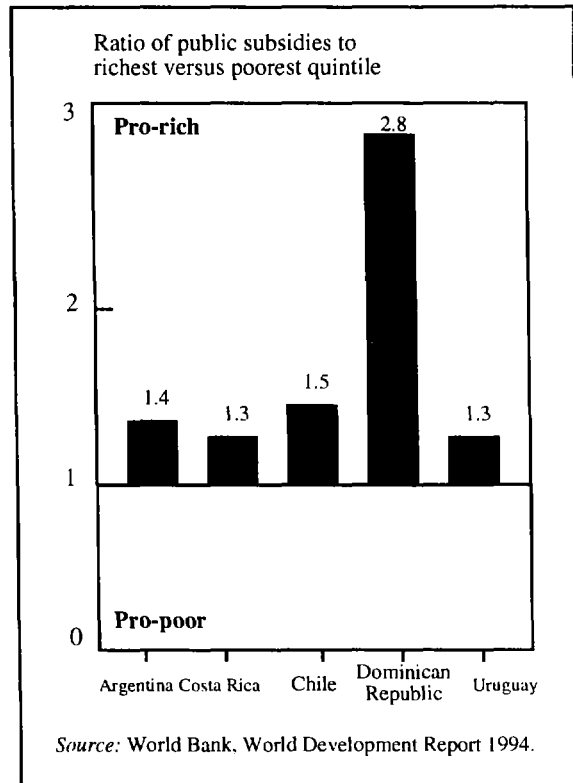
46. **Metering.** To be able to implement schemes under which prices vary, metering is required. The decision to meter itself depends on the cost of metering compared to the benefits obtained due to metering, for example reduced system expansion for peak supply or better targeted subsidies. In general, metering is, of course, more beneficial the scarcer water is and the more pronounced peak demand is. Pricing policies need to be carefully designed to obtain the right incentives for metering. For a discussion of issues arising and ways to deal with them see Warford (1966) and OECD (1987). One promising way of providing appropriate incentives to customers for metering would be to offer a menu of contracts to customers that reflect the costs and benefits of metering. Customers can then decide whether to purchase meters or not.

#### IV.2.3 Investor protection

47. **Marginal vs. average cost.** A good pricing structure should not only ensure that water is used efficiently. It must also ensure that the revenue for the water company is sufficient to cover all costs so that the water company has the resources to invest and operate the system well. Often the marginal cost of water may be lower than the average cost. For example, in an existing pipeline system with some spare capacity it may be very cheap to provide a little bit more water to consumers. If one follows the principle that price should equal marginal cost, the water company will then receive just enough revenues to cover the operating costs of supplying the extra water but not enough revenues to cover all the costs of building the pipeline network in the first place.

<sup>10</sup> In most subsidy systems in the world the middle classes and the rich benefit disproportionately from subsidies (Figure 4) - contrary to the official reasons given for subsidies (World Bank, 1994). Access for poor customers to piped water of good quality tends to be a much more effective way to help the poor than subsidies per se.

Figure 4



48. **Value-of-service pricing.** If one wants water users to pay for the cost of water one needs to set prices above marginal cost in this case. The question is whether all customers should pay a little more than marginal cost or whether consumers should face differing prices. Ideally, the pattern of water use under the new price structure should vary as little as possible from that under marginal cost pricing, which is the optimal. The pattern of use will vary least when customers who value water use highly are charged more than those who are willing to conserve water more drastically when prices rise. Such pricing is sometimes called value of service pricing, because prices are not strictly cost-based, but also reflect the different values that different consumers place on water use<sup>11</sup>. Sometimes it may be socially unacceptable that those needing water most, should pay most for it. In such cases, an appropriate subsidy scheme would have to be designed.

49. **Cost components.** As mentioned above total revenues should be sufficient to cover all costs. The costs that have to be covered are:

- operating costs i.e. the cost the pipeline company may pay for buying water and for managing the water system, including workers' wages;
- the cost of constructing new pipelines, water plants etc. suitably depreciated;
- depreciation or maintenance of existing investments; and
- the cost of capital.

50. **The cost of capital.**

Clearly, operating and construction costs have to be reimbursed to the water company, either by the consumers or by taxpayers. But what is the cost of capital? Suppose that consumers pay for all costs, just before the water company has to pay its own bills.

In this case water tariffs would be very high in years with a lot of construction and low in other years. But the water company would not need to borrow money nor would it need its own capital.

Capital would be provided by consumers. Alternatively the

**Table 4**

ELEMENTS FOR PRICE-SETTING			
Cost of capital	x	Asset valuation: Rate base	= Required profits
Asset valuation : Depreciation	x	Depreciation rate	= Depreciation charge
Operating costs			= Operating costs
Capital expenditure (CAPEX)	x	Cost of capital and depreciation rate	= CAPEX charge
			<hr/> Total required revenue

<sup>11</sup> In economic terminology this is known as Ramsey pricing.

water company could borrow funds to finance construction and ask consumers to pay rates that fluctuate very little over time.

51. In both cases, somebody - consumers or banks or other lenders - would provide capital to the water company to enable it to proceed with construction and operations. This capital has a cost, namely the rate of return the lender could have earned on it by investing it in some other venture instead of the water company. If there are many good alternatives to investing in the water company, the cost of capital will be high, if not it will be low. In an incorporated company the cost of capital will consist of the return on shareholders' capital and the interest on debt instruments. In whatever way one looks at it the consumers (or taxpayers) will have to pay for the cost of capital, either by explicitly paying for the cost of interest and the return on equity or by foregoing to invest in more profitable ventures elsewhere in the economy or by foregoing consumption that they might have preferred. In large water systems companies fund themselves with debt and equity and consumers (or taxpayers) have to pay for the cost of capital as part of the water tariff (or subsidy).

52. When regulators set water prices they have to estimate what the cost of capital is that is required for water companies. The ways to do this will depend on the interest rate on debt instruments in the economy, on the cost of equity and on the specific risks of the water company, which will be borne by debt and equity investors. Estimates are comparatively easy when capital markets exist where the cost of capital is freely established by the interplay between demand and supply of funds. In systems with more administered financial systems more rough and ready methods will need to be used to estimate the cost of capital. For more detailed discussions on how to estimate the cost of capital see Alexander (1995b) and for cost-benefit analysis of the price of capital Little and Mirrlees (1969).

Table 5

<b>ENGLAND AND WALES</b> <b>UNIT COSTS OF WATER AND SEWERAGE SYSTEM</b> <b>1994-1995 (in US¢/m<sup>3</sup>)</b>				
	cost to customers	cost to operations	cost of capital maintenance	Return on capital
<i>weighted average</i>				
water	94	48	20	23
sewage	120	45	28	48
<i>Min-max range</i>				
water	69-170	36-80	8-36	12-87
sewage	87-226	34-89	19-47	33-108
Note: Exchange rate used is 1.56 \$ per £				
Source: OFWAT (1995).				

#### IV. 2.4 Price adjustment and risk allocation

53. **Exogenous vs. endogenous shocks.** During the life of a long-term water supply arrangement unforeseen events will occur. Some of these will be outside the control of the water company (exogenous), such as price increases in equipment costs or changes in interest rates. Others will be due to actions of the water company (endogenous), such as deterioration of operating efficiency. Finally, even in the case of uncontrollable events the company may bear some responsibility for exposing itself to excessive risk (partly exogenous). For example, if exchange rate risks are very important the company may be acting imprudently by relying heavily on foreign currency financing.

54. In principle, prices and other terms should be adjusted when they reflect events outside the control of the company, but not otherwise. In practice it is difficult to draw an exact line between such events. A key reason, therefore, why regulatory schemes are required is to make judgements about what does and does not constitute a legitimate reason for price adjustments.

Table 6

PRICE ADJUSTMENT FORMULAE	
$P_{t-1} = \sum_i \alpha_i C_{i,t-1}$	
$P_t = \sum_i \alpha_i C_{i,t-1} \left[ 1 + \left( \frac{I_{i,t} - Z_{i,t}}{100} \right) \right]$	
where $\sum_i \alpha_i = 1$	
Price in period t ( $P_t$ ) equals the weighted sum of cost factors at time t minus 1 ( $C_{i,t-1}$ ) adjusted for an index of cost inflation for cost factor i between period t and t-1 ( $I_{i,t}$ ) and a factor reflecting expected efficiency gains between t and t-1 ( $Z_i$ ).	

55. **Price indexation.** In practice all regulatory schemes try to define as best as possible the criteria for price adjustments. Often the price itself will be indexed to various cost factors. In the simplest case, prices would periodically be adjusted in line with inflation. More complex adjustment formulas are also possible. In some cases prices are first decomposed into various cost elements. Each cost element is then adjusted with indices that reflect changes in those costs. For example, operating costs may be adjusted with an index of wage costs, maintenance costs with a weighted average of wage and equipment costs and financing costs with interest rate and exchange rate movements reflecting the currency mix of finance.

56. **Indexation principle - Ability to hedge risks.** Whenever prices are adjusted for changes in certain cost factors, whether by indexation or regulatory decision, the risks of cost changes are shifted away from the water company to the consumers. In designing price adjustment mechanisms



one should, therefore, ask which party, consumer or investor, is better able to cope with a particular risk and shift the risk to that party. For example, where companies can hedge the cost of foreign exchange in currency markets, the pricing formula should not be indexed to foreign exchange movements.

57. **Indexation principle - Neutrality of price adjustments.** Furthermore, sound price indexation should not bias operating, investment and finance decisions. For example, price may be indexed in the following way: The component reflecting the cost of domestically purchased equipment is adjusted with inflation and that of imported equipment with exchange rate movements. If the water company has a favorite supplier of equipment abroad, it will be tempted to use imported equipment, because it is insured against exchange rate adjustments even though locally produced equipment may be cheaper. It would, therefore, be preferable to use a more "neutral" criterion to adjust prices.

58. For example, one might adjust that component of water prices that reflects the cost of non-tradeable<sup>12</sup> goods with inflation and the component that reflects the cost of tradeable goods with the exchange rate - regardless of whether the goods have actually been imported or domestically produced. Because in open economies prices of all tradeable goods would tend to adjust with exchange rate changes the company would be protected against exogenous price changes, but have no special incentive to purchase either imported or domestic goods or services. The adjustment formula above also happens to be neutral relative to the decision to seek domestic or foreign currency financing<sup>13</sup>.

59. **Extraordinary price adjustments.** Several cost factors do not lend themselves to indexation. For example, if in the course of water pipeline construction a company encounters unforeseen soil or sub-soil conditions or if new environmental, health or safety standards are imposed, costs may change significantly. The price of water may then have to be adjusted to reflect these costs. The regulator will need to make a judgement whether the event giving rise to cost increases actually was outside the company's control and how to compensate the company for the change in costs. Both the United Kingdom and France have rules embedded in their regulatory schemes that allow price adjustments in cases of major unforeseen events - "interim determinations" and "bouleversement" respectively. For symmetry, there are also cost clawbacks in the United Kingdom. For example, in the years 1992 to 1994, the regulator decreed lower price increases than foreseen under the 1989 price indexation formula, because construction costs had dropped due to recession in the United Kingdom (Armstrong, Cowan and Vickers, 1994).

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<sup>12</sup> Tradeable goods and services are those that are traded across borders, i.e. where prices reflect world market conditions. Non-traded goods and services are not traded outside certain geographical regions and prices reflect only demand and supply conditions in the relevant region.

<sup>13</sup> The discussion also highlights that the considerations that go into establishing price indexation formulae should reflect country-specific circumstances, e.g. whether or not the economy is open to world trade.

**60. Price cap and rate of return regulation.**

When costs do not change due to events outside the company's control, the prices of water should not be adjusted. This would give the company an incentive to perform efficiently, because lower costs would increase profits, whereas higher costs would reduce it. One way of preserving such incentive consists in fixing a cap on the prices which can be charged for a particular service. The level of the cap is usually fixed by reference to some

variation from a general price index, with the level of the variation reflecting estimates of potential cost reductions to be achieved by the firm. The cap is normally fixed in that way for a relatively long period of time in order to motivate the firm to implement productivity improvements which are more important than those expected by the regulator. This is called price cap or incentive regulation. Rate of return regulation, on the other hand, focuses on limiting profits by specifying a maximum return that can be earned on the capital required to provide the service. Under a "pure" rate of return regime, the classes of capital and expenditures that comprise the rate base are precisely defined and prices are frequently reviewed to ensure that actual returns coincide with the allowed rate. De facto, all regulatory systems try to maintain prices or price formulas fixed for some time. In some systems (United Kingdom and France) price reviews - except for extraordinary interim changes (interim adjustment or bouleversement) - are scheduled to occur at regular intervals of generally five years. In the United States, the period between normal price adjustments is variable, but the price reviews combine features of the regular and extraordinary price review. In practice the difference between the various systems of regulation is not one of principle but one of degree only.

**Table 7**

<b>PRICE CAP VERSUS RATE OF RETURN</b>	
Pure rate of return	Pure price cap
<ul style="list-style-type: none"><li>• frequent discretionary reviews</li><li>• current prices based on previous year's costs</li><li>• regulator fixes price level and price structure</li><li>• relatively low risk</li></ul>	<ul style="list-style-type: none"><li>• infrequent mandatory reviews</li><li>• future prices based on cost projections</li><li>• regulator fixes level of price index</li><li>• relatively higher risk</li></ul>

**IV.3 Additional sources of discipline for regulated companies**

61. The regulator effectively attempts to provide regulated companies with incentives (bonuses and penalties) to perform well, while limiting prices to consumers. However, when the regulated company is performing very badly and has lost much of its capital, it may no longer be responsive to penalties, because things cannot deteriorate further for management. It may also not be turned around by bonuses, because it may be incompetent. This applies to government- or investor-owned companies alike, unless their management faces additional disciplines.

### IV.3.1 Investor-imposed disciplines

62. **Shareholder control, take-overs and bankruptcy.** As long as the regulators set prices reasonably well, companies will make low profits or lose money, when they are inefficient. The low profitability is a sign to debt and equity investors that the company is not performing well and that management changes are required. Shareholders may directly provide better incentives to management or change managers. Alternatively, outside investors may buy shares, take over the company and exercise a new type of corporate control. Finally, if the company actually goes bankrupt, debt investors, for example banks, may govern the company for an interim period and install new management.<sup>14</sup>

63. **Concerns over service and limits on market discipline.** In practice, governmental authorities tend to restrict the rights of investors to take over the company and change management. The authorities are normally concerned about service continuity. They fear that outside debt and equity investors may just try to get their money back without paying due attention to service provision (Alexander 1995a). The authorities therefore tend to restrict the mechanisms that would normally discipline firms in competitive markets so as to retain rights to safeguard the public interest in case of service problems. Out of concern about service continuity, the authorities may thus weaken the incentives for the water company to perform efficiently.

64. **Government ownership.** The authorities may also try to change management. For this they would need to exercise ownership rights in the company. When the company is government-owned the shareholders are the taxpayers. They do not receive dividends and hardly exercise any control over the water company. Instead the control is exercised by people in government, who do not have their own money at stake and who often have very weak incentives to improve the water company's management.

65. For all these reasons water companies generally are subject to lesser disciplines than companies operating in truly competitive markets. This is usually true when companies are owned by government. Investor-owned companies tend to have a stronger incentive to earn a reasonable profit. But discipline for them is also weakened as long as managers need not fear that the water company go bankrupt or be subject to takeovers.

### IV.3.2 Government-imposed disciplines

66. Suppose that the water company has an incentive to earn an adequate return, for example because investors impose discipline. That return can be the result of i) efficient operations or ii)

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<sup>14</sup> Note that a pure price-cap regime without interim adjustments would entail serious bankruptcy risks. The cost of capital would thus be high and there would have to be widespread acceptance of the possibility of bankruptcy.

excessively high prices or iii) substandard quality. Therefore, the regulator and the issuer of the license still need to provide incentives for efficient performance and maintenance of adequate quality standards. As described before, the regulator does so through price and quality controls, which provide bonuses for good and penalties for bad performance. However, the issuer of the license or contract has the additional option of terminating the license or contract.<sup>15</sup>

67. **Termination of licenses or contracts.** In the absence of effective discipline brought about by investors through takeovers and bankruptcy, a possible control mechanism for the authorities is to terminate the "contract" with a water company and replace it with another. For this to be effective, the water company - whether government- or investor-owned - must not be tied to a particular jurisdiction, but be able to compete for contracts in many different cities.

68. **Causes for termination.** In that case the issue becomes, under which conditions one may terminate a contract with a water company. Generally, termination is allowed when the company or the governmental authority violates the contract i.e. performs badly in some way. However, it may not be possible to prove breach of contract in some cases of substandard performance, because it is very difficult to define exactly all possible cases of non-performance. For this reason there tends to be the option to terminate contracts without cause. Normally such termination may occur only once the concession term has at least been half completed. In addition the governmental authority is required to provide notice of termination several years in advance - ten in the United Kingdom, two to three in France. Furthermore, several systems (e.g. Germany and France) have fixed concession periods, so that for example after fifteen or twenty years the contract with the water company automatically ends and a new contract needs to be entered into, either with the same company or a new one.

69. **Reputation.** If termination is a real possibility, the need to compete for renewal of contracts provides an incentives for companies to perform well, because otherwise they might lose their reputation and have difficulty obtaining new contracts. But there is also a drawback related to the incentives of companies just prior to contract termination.

70. **Incentives at termination.** In the period before termination the water company may be tempted not to perform well, if it believes that it might lose the contract and does not believe that misbehaviour will be detected or does not care about future business. Two types of incentives are at work. The investments and efforts of the water company holding the contract (the "incumbent"), create two types of assets. Some can be transferred to the new company that may win the contract (the "entrant"), such as physical investments. Others may not be transferrable such as knowledge about customers and system management.

71. When assets can be transferred, the incumbent needs to be compensated adequately at the end of the contract to maintain incentives to invest. Compensation will be determined by valuing the assets. But accounting valuations may not properly reflect the economic value of the assets. To establish the economic value of the assets is a problem that is similar to that of actually regulating a

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<sup>15</sup> Quality and price regulation may be carried out by the same or separate agencies. Also the license may be issued by the regulator itself or separate government office.

company.<sup>16</sup> To ensure that the incumbent will continue to invest efficiently in transferable assets one may need to provide a bias in favour of the incumbent at the time of contract renewal. On the other hand knowledge that cannot be transferred gives the incumbent an advantage in the competition with new entrants. Whether this advantage is sufficient to compensate for the incentive problems arising with transferable assets is an empirical question (Laffont and Tirole, 1993).

72. In most cases of transfer of a concession, the new entrant will not only take over the physical assets of the incumbent but also many of the staff, particular the good ones, in whom much of the system-specific knowledge is embodied. It may therefore be prudent to assume that the problem of transferable assets is the dominant one and that some bias in favour of the incumbent is required, if the behaviour of the incumbent cannot be well monitored. The question is how to provide it.

73. No perfect solution exists, which allows consumers to be the prime beneficiaries of rebidding.<sup>17</sup> To protect consumers the best option would be to develop efficient monitoring mechanisms for the incumbent performance so that the problem of bias in bidding for a new contract is not so serious. Alternatively, the authorities or the regulator would have to be given some authority to bias the award procedure for the new contract. The extreme form of this is the current French system, where the municipality has total discretion over how to award the contract and tends to renew contracts with the incumbent. However, this may not protect consumers well for the same reason that public ownership may not be desirable (para. 64). In fact, French municipalities have often been tempted to require water companies to provide extra services including political funding at the expense of the consumers. Altogether it may be most prudent for governments to establish efficient monitoring capabilities and to provide companies with incentives to develop reputation by requiring periodic competition for concession renewal.

## V. The choice of regulatory institutions

74. **The core issues - Revealing information and managing discretion.** The regulator should balance the interests of producers and consumers and prevent collusion of either party with governmental authorities. To do this well, the regulator should be able to obtain the necessary information to arrive at good decisions, which reflect the legitimate interests of the various affected

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<sup>16</sup> One would have to determine the alternative use of resources that the incumbent has (cost of capital), determine the investments it is making (rate base) and provide a return on investment in the water system that is at least equal to alternative investments so that the incumbent continues to invest and operate the system efficiently (Williamson, 1976).

<sup>17</sup> One option used in Argentine electricity distribution concessions is to allow renewed bidding for the rights to run the electricity distribution system. The method presumes that the bidders can form adequate expectations about the future of price regulation, which are needed to formulate a bid. The winning bidder would pay the bid price to the incumbent. The incumbent can always bid more than everybody else, because he would pay himself. But the incumbent has an interest not to bid more than the value the contract has for it. If somebody offers a higher value it will prefer to take the money and leave. The value of more efficient operations then goes to the incumbent, not the consumer.

interest groups. At the same time he should be able to resist improper influence from companies, consumer groups and governmental authorities alike.<sup>18</sup> In the following, ways to circumscribe the regulator's discretion are first discussed followed by ways to obtain information (For more detail see Klein and Smith, 1994).

## V.1 Managing discretion - design options for regulatory institutions

75. **The relationship between price and quality regulation.** Prices and quality may be regulated by the same or separate agencies. When agencies are separate the regulators of quality are less likely to accept trade-offs between the search for better quality and lower prices (Armstrong, Cowan and Vickers, 1994). The opposite is more likely to be the case when a single agency regulates both prices and quality. Decision-makers should thus consider whether affordability or quality is foremost on their mind.

76. One way of addressing the trade-off is to treat drinking water supply and other water separately<sup>19</sup>. In the case of drinking water quality is paramount. At the same time drinking water can be relatively efficiently provided through vendors, for example in jerricans or bottles. Price formation can thus be left to the market and the regulator can concentrate on quality. Water supply for other purposes does not generally require the same quality standards. Affordability and adequate quantitative supply may be more important. This would prima facie imply that price and quality regulation for non-drinking water should be combined, because quality-price trade-offs would be acceptable.

77. **The geographic boundaries of responsibility.** The regulator may be responsible for water companies in the whole country or only certain areas in a country. In general, the regulators responsibilities should be a function of the nature of the regulatory problem. If issues are confined to a municipality the regulator may be set up at this level. This is the case

Table 8

### DESIGN OBJECTIVES FOR REGULATORY INSTITUTIONS

independence, supported by

- financial autonomy
- fixed terms of office
- prespecified appointment criteria
- avoidance of conflicts of interest

commitment, supported by

- inflexible rules
- international guarantees

accountability, supported by

- clear regulatory mandate
- transparency of decisions
- judicial review

flexibility, supported by

- clear regulatory mandate
- transparency of decisions
- judicial review

⇒ inevitably trade-offs arise

<sup>18</sup> All countries need to develop economic regulation of water companies with the requirements of river-basin management (see OECD 1987). This paper is, however, only concerned with economic regulation of water companies.

<sup>19</sup> Small systems of this type exist in a number of countries including Germany, Japan, Hong Kong, the United Kingdom, the United States (OECD 1987).

in government-owned water systems in the United States and in the private or public systems in France. However, in England and Wales the Government decided to create water companies that encompass all water supply and sanitation functions within relevant river basins to facilitate integrated management of the river basins.<sup>20</sup> The economic regulator was also set up at the national level with a single agency overseeing all water companies. The oversight of several companies may help the regulator gain better yardstick information. This is also an advantage of the system in the United States, where privately owned water companies are regulated by state-level commissions.

**78. Separation of regulator from issuers of licenses and contracts and government as owner.** Regulators adjudicate disputes between various parties, e.g. government authorities who issue licenses, water companies and consumers. To avoid conflicts of interest the regulator should be reasonably independent of these parties. It may thus be best for the regulator not to be identical with the issuer of the license nor with the government in its role as owner of a water company. One attempt to create such a system is found in Argentina, where the regulator is separate from the issuer of the license. However, in practice we also find systems, where the issuer of contract or license conducts regulation, for example in France (municipality) and - in the energy sector - in the United States (the Federal Energy Regulatory Commission).

**79. Insulation from the executive branch of government.** In some countries regulatory functions are performed in offices of the executive branch of government with the regulator reporting to a minister or mayor (e.g. Chile, France, Germany, Hong Kong). In such systems, pressures to set prices on the basis of political expediency may be strong and investors may not be well protected. Historically, in many cases price-setting has been subordinated to short-run political interests and undermined the financial viability of water companies. This is most obvious in the case of state-owned water companies, which face severe financial problems in most countries where they exist (World Bank 1994). To minimise the potential for politicians to interfere in water regulation it may be advisable to establish regulatory agencies outside of the executive branch of government.

**80. The powers of the regulator.** One argument in favour of keeping regulatory agencies within the executive branch is that ministers or mayors have many powers (and instruments to exercise these powers) outside the water sector. That may give them more options to resolve regulatory issues by striking various bargains in return for resolution of the regulatory issue. This is really an argument about the instruments that should be available to the regulator. Clearly, with more instruments, he can in principle achieve more goals. However, it may be more difficult to hold the regulator accountable. Also it may be preferable to provide the regulator itself with more instruments if that is deemed desirable rather than relying on the proper exercise of discretion by a powerful government agency.

**81. Appointment of regulators.** To provide checks and balances in the appointment process a variety of mechanisms have been put in place. For example, the legislative branch may suggest a shortlist of candidate from which the executive may choose. The choice itself may again be subject to legislative approval. This is the system for federal level United States regulators. In some parts of the United States consumers have traditionally elected regulators directly. However, experience

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<sup>20</sup> There also existed 21 smaller private water supply companies in 1994.

suggests that elected regulators do not adequately take company interests into account, reinforcing the general point that good institutional design needs to grant a measure of independence of the regulator from all parties, government, firms and consumers.

82. **Composition and term of regulatory bodies.** To provide regulators with some independence from political pressures the terms of office for individual regulators are often longer than the term of office of the government authorities that make the appointments. In the United Kingdom single persons exercise the powers of the various regulatory agencies for water, gas, electricity and telecommunications. In the United States and Argentina commissions of up to five persons exercise those powers to provide more balance within the commission. The terms of individuals on these regulatory commissions are staggered so that commissioners are replaced one by one and not all at the same time. Together with individual terms that exceed that of the government authorities who make the appointments this further limits the possibility of governments to appoint only politically convenient regulators<sup>21</sup>.

83. **Funding of regulatory agencies.** Funding of agencies may be out of general tax revenues or special levies on the regulated industries without giving the industry a say in budgetary matters. In Argentina for example, the regulatory agencies derive income from an earmarked levy on the revenues of regulated companies. In this way the funding source is independent of congressional appropriations. However, the expenditure budget of the agencies is still subject to congressional approval.

84. **Appeals.** All systems of regulation provide options to appeal against decisions by the regulator. The appeals may be directly to the courts (e.g. federal energy regulation in the United States) or to intermediate bodies (e.g. monopolies and mergers commission in the United Kingdom with subsequent appeal to a minister of the executive branch).

85. **Sectoral coverage of regulatory agencies.** The closer a regulatory agency is tied to a single regulated company, the more likely it may be that it would pursue the interests of this company. It may therefore be desirable to allow a regulator to oversee various agencies, both in a particular sector and across sectors. This would not only help generate better yardstick information, but also motivate the regulator to apply consistent principles across sectors. This in turn would limit special deals for a particular water company.

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<sup>21</sup> When new regulatory authorities are established it is often argued by the old water company that people with experience in the company should join the new regulatory body. While a level of technical expertise is clearly necessary, there are many cases where such "old-timers" have effectively undermined the effectiveness of the new system. The key in regulation is mastery of politics while respecting sound economic principles. Technical expertise can more easily be hired from outside.



## V.2 Means to generate information

86. **The problem of information.** Regardless of how well designed the regulatory institutions are, the regulators are still dependent on information provided by companies, who tend to know the business better and hold superior information. When the regulator faces a single company it is at a disadvantage in terms of information and it may have to accept many of a companies arguments, because there is no alternative supply source. The strength of regulators is thus particularly dependent on the ability to find better sources of information, partly by playing differing companies against each other. The choice of market structure is of prime importance for the emergence of rival businesses in the water system, although the scope for real competition is limited.

87. **Using interest groups and rivals to generate information.** Better information can be generated by public hearings and consultations for arriving at regulatory decisions. For example, when information about equipment costs provided by a water company is public, competing equipment suppliers may be able to detect overpriced supply contracts and complain. Equally various interest groups will provide information to support their various claims. Where various companies compete for water contracts - even if only from time to time - the regulator may benefit from information generated by an aggressively bidding competitor. Together with yardstick information otherwise obtained and share price information from companies quoted on the stock market, the regulator would then get the fullest possible set of data to arrive at good decisions.

## VI. Implications for finance

88. Whether projects can be financed depends on

- the nature of regulation;
- the credibility of the regulation; and
- macro-economic and financial sector developments.

89. **Design of regulatory rules.** Clear regulatory arrangements and rules including adequate tariff levels are essential to obtain finance at fairly low cost, because they determine the cashflow prospects and creditworthiness of the regulated company. In systems with well-established rate-of-return regulation, the United States and Hong Kong, the cost of capital for regulated utilities may be very close to the risk-free rate of return in the economy, i.e. the government borrowing rate. Where regulation is well established but more discretionary (Germany, France), the cost of capital tends to be higher. In new systems experimenting with price cap regulation (United Kingdom, Chile, Argentina, telecommunications in the United States) the cost of capital can be similar to the average cost of equity funds in the economy i.e. the risk-free rate plus the average equity premium (Alexander 1995b).

90. **Credibility of regulatory rules and creditworthiness.** Clearly the design of regulatory rules is important for the cost of capital, but the most important aspect of this is the implementation and credibility of the rules. If prices are set at reasonable levels, but the water company cannot collect the tariffs from users or if a water treatment plant is not paid by the municipal utility, because the latter is not creditworthy, then the best designed regulatory system is useless.<sup>22</sup>

91. **Guarantees.** Implementation and the establishment of credibility are matters of political will. To some extent it may be possible to guarantee to investors that certain rules will be followed and that, for example, payment obligations by municipal utilities will be honored. Such guarantees are not available from commercial insurance companies, precisely because they insure against political misbehaviour and not against random acts of nature. Such guarantees, therefore, have to be backed by taxpayers either in the host country or by some other country, possibly intermediated by a development bank like the World Bank. The issue here is to what extent and under what circumstances taxpayers should bear the risk of creditworthiness of the municipality or the risk of regulatory failure.

92. **Financial market risks.** Finally, financing will be costly or unavailable if macro-economic conditions are highly unstable, such that the cost of capital is very high and volatile. In such circumstances there may be no adequate local finance available or it may be very expensive and interest rates highly volatile. By the same token, foreign finance would be subject to large exchange rate risk. Such interest rate and exchange rate risk can be shifted to consumers through water tariff indexation up to the point that the cost of water remains lower than willingness-to-pay of consumers. However, there remain some risks, for example, in the case of foreign finance, the ability to exchange local currency earnings into foreign currency and the ability to transfer the foreign currency abroad. These risks, which are a function of regulatory rules governing the financial sector are again uninsurable in commercial markets. Guarantees of such risks require some form of taxpayer support raising similar issues as raised in the previous paragraph.

## VII. Conclusion

93. The regulation of price and quality is relevant for public and private water companies alike, when real competition is not feasible. Piped water systems contain significant monopoly elements. To counteract monopoly power, regulatory mechanisms exist in all countries - whether as part of the executive branch of government or in more independent agencies. Regulators rule on issues of price and quality of service and sometimes also on investment performance. Pricing rules try to balance i) incentives to use water efficiently with ii) social concerns, such as quality of water supply, universal service goals and subsidy schemes for the poor.

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<sup>22</sup> In some cases this may argue for privatising water or waste water treatment plants first, because they do not depend directly on consumers from whom collection may be difficult. But for the same reason, public water utilities may not be creditworthy and private operators may find it easier to enforce collection from households than from public companies.

94. The regulator has a counter-monopoly to the water companies. Therefore the regulator may also be tempted to abuse its power. Because the regulator does not invest in fixed, immovable assets it has more freedom than the private monopolist, who is exposed to pressures once a water system has been built. Under political pressure, the regulator may therefore be tempted to exploit the private investor by not granting prices that are sufficient to cover the costs of investment. Alternatively, the regulator may team up with the company and exploit the consumers. To guard against such behaviour the powers of the regulator should be carefully circumscribed. The office of the regulator should be set up so as to be able to resist improper influence by the different interest groups (companies, consumers, government).

95. The key to good regulation is the generation of information that allows the regulator to make good rules and allows the interest groups to watch out for improprieties by the regulator. The best way to generate information is to introduce multiple players in the water system in ways that enhance direct or indirect competition. In particular it would appear advisable to minimise exclusivity rights and to let companies compete for concessions with limited terms. Incentives to compete and behave efficiently will be strongest when the owners have their own money on the line. For this reason government-owned water companies could on average be expected to perform worse than investor-owned companies.<sup>23</sup>

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<sup>23</sup> A number of government-owned companies have very experienced and competent managers and personnel and perform as well as private companies. Such competent companies should be given a chance to compete on an equal footing with private companies rather than be sheltered from competition. An equal playing field will require that they do not benefit from taxpayer subsidies e.g. through equity injections, but face a budget constraint that is as hard as that of private competitors.

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## WATER SECTOR STRUCTURE IN SELECTED COUNTRIES

UK	GERMANY	FRANCE	SPAIN
<p>Vertically integrated companies under river basin management.</p> <p>England and Wales: 10 regional water and sewerage companies; 23 additional water only companies. All privately-owned companies.</p> <p>Scotland: Water and sewerage owned and administered by local authorities, although in process of being transferred to regional public boards.</p> <p>Northern Ireland: Central government controls and owns.</p> <p>All of above are regional monopolies, with very limited competition by "inset appointments" which allow operator to supply water to large users in another's area.</p>	<p>The 6,000 autonomous municipalities select form of supply for their area.</p> <p>Municipalities may form own companies or associations or contract with private companies.</p> <p>There are 50,000 municipal water works, 899 municipal companies, 240 intermunicipal associations, and 160 private and mixed companies.</p> <p>Municipalities own 96% of industry, municipalities and private companies jointly own 3%, and private companies own 1%.</p>	<p>Mix of public and private management, with public ownership dominating.</p> <p>There are 37,000 municipalities served by 15,000 different operators; municipalities can jointly enter into contracts with operators.</p> <p>Four large private firms--1) General des Eaux; 2) Lyonnaise des Eaux Dumez; 3) Saur; and 4) Cise--manage 70% of water supply and 35% of waste water treatment.</p> <p>Public companies manage 29% of water supply; 64% of waste water treatment.</p>	<p>Most raw water publicly owned (by national or regional government), with remainder belonging to private property owners.</p> <p>Municipalities are responsible for residential water supply.</p> <p>Water supply and waste water treatment managed by local public companies or private operators under concession or franchise agreements as local service monopolies.</p>
USA	CANADA	ARGENTINA	CHILE
<p>All aspects of water supply and waste water treatment traditionally viewed as natural monopolies. Local utilities accept some form of regulation in exchange for its monopoly status.</p> <p>As of 1986, 45.5% of water systems publicly owned, 28% privately owned, 26.% ancillary systems associated with mobile home parks, schools, hospitals, and so on.</p> <p>Water utilities may be corporations, partnerships, or sole-proprietorships.</p>	<p>Almost all water utilities are publicly owned. Almost all domestic, municipal, and industrial needs supplied by groundwater. There are 35,000 people served by 41 municipal wells, 93,000 people served by 35,000 private wells.</p>	<p>Greater Buenos Aires Water Sanitation Company Empresa de Obras Sanitarias de la Nación (EOSN) privatized via concession to international consortium, Consorcio Internacional Aguas Argentinas (owned by Argentine, French, Spanish, and English investors) in 1993. Has use of assets for 30 years, without any concession fee.</p> <p>Water concessions have also been let in at least four provinces.</p>	<p>There are 13 state-owned stock companies.</p> <p>Five private companies serve primarily small community systems; one average-size private company serves 20% of Santiago.</p> <p>Most are vertically integrated concession holders of all parts of the water and sewage system.</p> <p>There is more than one concession holder only in Metropolitan Area of Santiago and in Valparaiso.</p>

NORWAY	SWEDEN	FINLAND	AUSTRALIA	NEW ZEALAND
<p>Mix of private/co-operative and public ownership.</p> <p>Urban-based municipal companies are publicly owned; smaller, rural based-systems privately owned.</p> <p>Mix of services differs between municipalities.</p> <p>Service delivery across municipalities common, e.g. OSLO inter-communal company treats effluent from three communities in the area.</p>	<p>Majority of water and sewage works are publicly owned, with trend towards corporatization; private ownership in rural areas.</p> <p>Ten (including Stockholm) of 292 water and sewage works are limited companies, owned by municipalities; others are municipal departments.</p> <p>Approximately 1,200 small water supply co-operatives, approximately 1,600 unregistered water supply systems (&lt;10 households).</p>	<p>Mix of private/co-operative and public ownership.</p> <p>All municipal water works publicly owned.</p> <p>Smaller non-municipal water suppliers.</p> <p>Trend towards integration of water and sewage works.</p> <p>Widespread cooperation between municipalities in water distribution, water collection, and waste water treatment; 21 works (~25% of customers) serve several municipalities.</p>	<p>Most rural water industry assets have traditionally been government-owned and managed but in some jurisdictions, assets are being privatized or being passed to producer-controlled entities.</p> <p>All major metropolitan suppliers of water services are generating real returns on their assets, but rural governments tend to charge prices sufficient to maintain capital.</p>	<p>Supply and distribution carried out by water departments of local councils.</p> <p>In Auckland, provided by public company (Watercare Services Ltd) owned by public trust (Auckland Regional Services Trust), which is elected body representing ratepayers in the region. Wholesale operation that sells to local council which then distribute to final consumers.</p> <p>Other regions: Public ownership, with responsibility lying with water departments of local authorities to collect and distribute to final consumers.</p>
PHILIPPINES	JAPAN	HONG KONG	MALAYSIA	
<p>Public ownership.</p> <p>Until 1987, the Local Water Utilities Administration (LWUA) handled cities and municipalities with a population of 20,000 or more. Rural Waterworks Development Corporation (RWDC) dealt with rural areas and smaller provincial urban communities.</p> <p>In 1987, RWDC was abolished, and LWUA took over its role.</p>	<p>Sewerage and sewage treatment are regulated separately by Construction Ministry in conjunction with local authorities. That industry is undergoing transition, with network coverage low but increasing. Main regulatory activities are focused on building and funding new works rather than on process control.</p> <p>Industry is vertically structured in local authority supply areas or in amalgamations of local authority areas.</p> <p>The only horizontal aspect of the structure is separation between drinking water supply (including resources) and sewerage and sewage treatment.</p> <p>Industry is overwhelmingly publicly owned. Water supply infrastructure is owned predominantly by local authorities.</p>	<p>Government owned monopoly for water supply and sewerage services.</p> <p>Water supply is vertically integrated and provided throughout Hong Kong by the Water Supply Department, within the Works Branch.</p> <p>Water drainage is provided by Drainage Services Department, within Planning, Environment and Land.</p> <p>Since 1960, water has been purchased from China.</p>	<p>Under federal constitution of Malaysia, water supply is responsibility of individual states and all states have their own water supply legislative enactments, passed by their respective state legislative bodies.</p> <p>State-owned facilities are being privatized. In 1994, National Sewerage Scheme (to be completed in 2010) and 27 Seangor water treatment plants were privatized. Another 5 states have privatized all or part of their water supply industry: Kedah, Johor, Negri Sembilan, Perak, and Sabah.</p>	



# MAIN REGULATORY ENTITIES FOR THE WATER SECTOR IN SELECTED COUNTRIES

MAIN REGULATORY INSTITUTIONS FOR THE WATER SECTOR IN SELECTED COUNTRIES				
UK	GERMANY	FRANCE		SPAIN
England and Wales: Director General of Water Services (DGWS) (heads Office of Water Services - OFWAT), National Rivers Authority (NRA), Drinking Water Inspectorate (DWI)	Three tiers of responsibility: Environment Department; District Presidency (intra-municipal issues); and Municipal administration (local authorities who select appropriate means of delivery of water).	Municipalities	Ministry of Public Works and Transport	
Scotland: Secretary of State, Regional and Island Councils, Central Scotland Development Board (CSWDB); River Purification Boards	Cartel Office	Ministry of Environment	River Basin Authorities	
Northern Ireland: Department of Environment, Water executive	Länder's Ministries of economics, trade, and so on, have extensive powers, especially with regard to water supply.	Ministry of Health	Regional autonomous governments	
			Municipalities	
USA	CANADA	ARGENTINA		CHILE
State public utility commissions (46)	Interdepartmental Committee on Water	Ente Tripartito de Obras y Servicios Sanitarios (ETOSS - Tripartite Body of Sanitary Works and Utilities) regulates Buenos Aires water/sanitation service.	Superintendency of Sanitary Services	
Interstate water agencies (15)	Parliament		Economics Ministry	
Congress	Alberta: Alberta Public Utilities Board (APUC)	Ministry of Economy, Public Works and Utilities.		
	Nova Scotia: Nova Scotia Utility and Review Board (NSURB)	Also municipal governments of other areas.		
	Municipalities			
NORWAY	SWEDEN	FINLAND	AUSTRALIA	NEW ZEALAND
Ministry of Social Affairs and Health	National Food Administration (Ministry of Agriculture)	Ministry of Health and Social Affairs	NSW: Sydney Water Board (SWB) and Pricing Tribunal	Commerce Commission.
Ministry of Environment	National Environment Protection Agency (Ministry of Environment)	Municipal Water Courts	Victoria: Office of the Regulator-General; Minister for Water Resources.	No sector-specific regulator, but threat exists if restructured utilities take advantage of light regulatory scheme, industry-specific regulation or regulator will be introduced.
Local governments	Water Rights Appeal Court (Ministry of Environment)	Local governments		Local council and regional authorities.
	Municipal Government			
PHILIPPINES	JAPAN	HONG KONG		MALAYSIA
Ministry of Public Works and Highways	Water Supply and Environment Department of the Ministry of Health and Welfare (MHW)	Water supply: Secretary of Works Branch of Water Supplies Department	Public Works Department, Federal Water Supply Branch	
	Local authorities have shared responsibilities for water supply and sewerage.	Water sewerage: Secretary of Planning Environment and Land Branch	State Public Works Departments (PWDs), State Water Supply Departments (WSDs) or Water	

**PHILIPPINES**

**JAPAN**

**HONG KONG**

**MALAYSIA**

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