CHAPTER FIVE

Reforming the Water Sector

TWO FEATURES DISTINGUISH THE WATER SECTOR from other infrastructure. First, the supply is finite and location-specific. Second, because safe water is crucial for life and health, its availability and affordability for the entire population are of enormous welfare (and political) importance (ADB 2000). These features, combined with the sector's economic and technological characteristics, limit institutional options for supply, create regulatory challenges, and highlight water's significance in achieving social and economic development goals—especially poverty reduction and environmental sustainability.

Since the early 1990s there has been growing recognition that water should be managed as an economic good and that its scarcity requires policies and institutions that can achieve economically and financially sustainable provision (WMO 1992). At the same time, the inclusion of a water access target among the Millennium Development Goals—seeking to halve between 1990 and 2015 the portion of people without sustainable access to safe drinking water—underscores the sector's close link to social equity. The challenge for regulation is to meet both efficiency and social welfare objectives in the water sector, balancing the needs of operators, consumers, governments, and the environment.

The state of the water sector is far from where it needs to be in developing and many transition economies in terms of both services and efficiency. Globally, 1.1 billion people lack access to safe water supplies (31 percent of the rural population and 8 percent of urban) and 2.4 billion lack adequate sanitation (65 percent of the rural population and 23 percent of urban; WHO/UNICEF/WSSCC Joint Monitoring Program 2000).[1] But these averages are misleading because they do not reflect the quality, regularity, affordability, or convenience of services. For

example, an urban slum dweller is considered to have access if a public tap or latrine is within 100 meters of the home, even though it may be shared with hundreds of other residents (IIED 2003). Indeed, in the rapidly growing small cities of low-income countries, less than half the residents (many of whom live in informal, periurban settlements) have water connections (Hewett and Montgomery 2002).

One major cause of inadequate coverage is that water utilities, which mainly serve medium-size and large urban settlements, are often extremely inefficient in developing and transition economies. In many systems more than one-third of production is lost, overstaffing is pervasive, revenues do not cover operating costs, piped water flow and pressure are inconsistent, and water is often unsafe to drink.

Faced with poor service, high unmet demand, often deteriorating water resources, and an inability to finance needed rehabilitation and expansion, many countries and cities have embarked on reforms. But structural and policy changes in the water sector have been slower, less sweeping, and harder to sustain politically than those in other infrastructure sectors. Despite the significant scope for better performance, the sector's economic and technological characteristics disallow the possibility of an institutional "magic bullet" that would significantly increase efficiency. Ultimately, designing and sustaining effective water reforms depend on managing the political agenda.

Economics of Water Supply

THE ECONOMICS OF PROVIDING WATER SERVICES ARE determined by supply and demand, the high fixed costs of delivery systems, the sector's natural monopoly characteristics, externalities involving public health and the environment, the need for and features of sanitation, and technological changes in supply systems. The complexity and importance of these features, in turn, provide a rationale for sector regulation.

Supply and Demand

Water supplies are determined by basic water resources and by the location, quantity, and quality of freshwater available in a given area for

agriculture (which typically accounts for 80–90 percent of consumption), industrial and municipal uses, hydropower (which requires a steady flow), and often ignored ecological needs (such as wetland protection). The geographic radius of natural supply is determined by the cost of transporting surface water or pumping from aquifers.

The sustainability of a water resource depends on whether net extraction rates (including water returned to the source) are less than inflows. The quality of the water source determines the spending needed for treatment before use. A growing number of countries are experiencing economic water scarcity—meaning that the costs of capture, treatment, and transport make supply and distribution unaffordable. For most developing countries the supply problem is not an issue of absolute scarcity but of deteriorating resource quality, insufficient connections for a growing population—especially poor households—and unreliable services (ADB 2000).

Competition for water among users and economic sectors is often intense and rises with population growth, urbanization, and industrialization. Many countries do not recognize private ownership rights over water but do recognize use rights, which are the focus of legal and institutional protections. Urban demand for water has both quantity and quality implications: most population growth is urban, and urban users demand higher quality, but urban industrial and household discharges can harm the quality of water sources unless properly disposed of or treated (Saleth and Dinar 1999).

Sharpening competition for water has led many policy and institutional reforms to focus (though not nearly enough) on allocation issues, such as tradable water rights; on strategies for decentralized water management and control (while recognizing the need for integration and coordination across jurisdictions and user groups); and on ensuring the economic viability and physical sustainability of water provision.

Because water is essential for life, at a certain minimum level of consumption demand is price inelastic. But the minimum supply required to sustain life and health is very small: the World Health Organization guideline is 25 liters per capita per day. This is far below the level of consumption subsidized in many countries, where lifeline tariffs may extend up to 30 cubic meters a month per connection—or about 200 liters per capita per day for a five-person household (Boland and Whittington 2000).

Table 5.1 Ratios of Prices Charged by Water Vendors and Public Utilities

Country	City	Ratio
Bangladesh	Dacca	12–25
Colombia	Cali	10
Côte d'Ivoire	Abidjan	5
Ecuador	Guayaquil	20
Haiti	Port-au-Prince	17–100
Honduras	Tegucigalpa	16–34
Indonesia	Jakarta	4–60
	Surabaya	20–60
Kenya	Nairobi	7–11
Mauritania	Nouakchott	100
Nigeria	Lagos	4–10
	Onitsha	6–38
Pakistan	Karachi	23–83
Peru	Lima	17
Togo	Lomé	7–10
Turkey	Istanbul	10
Uganda	Kampala	4–9

Source: Bhatia and Falkenmark (1993).

Even in the poorest urban areas many water uses are not for subsistence, so consumption is somewhat price elastic. Thus demand management, especially to reduce waste under users' control, is a relevant policy objective (Noll, Shirley, and Cowan 2000).

Because they are typically underserved by formal providers, poor people often pay extremely high rates and large shares of their income for water—far above the levels spent by the better-off despite much lower consumption (table 5.1). Where utility water is of poor quality, even middle- and upper-income households buy from vendors (Komives, Whittington, and Wu 2001). Willingness to pay for water varies for poor people (reflecting desired quality and convenience) and must be assessed to achieve a financially sustainable system. Although there is ample evidence linking adequate water supply and quality—combined with sanitation—to health outcomes (Esrey 1996), private consumers' valuation of safe water and especially of sanitation's health benefits may be less than the social value of public health. Thus incentives (such as subsidies), coupled with public education, may be needed to ensure socially desirable minimum consumption.

High Fixed Costs

Water delivery systems involve four components: capture of the natural resource (for example, through reservoirs and wells), treatment to ensure adequate quality for use, transportation (for example, through aqueducts and mains—the primary network), and delivery to users (through pipelines and taps—the secondary network; Noll, Shirley, and Cowan 2000).[2] All these components require fixed capital investment in long-lived assets, many of them underground.

The fixed costs of water supply are typically high relative to variable costs, more so than for other utilities such as electricity. For example, fixed costs account for more than 80 percent of water supply costs in the United Kingdom (Armstrong, Cowan, and Vickers 1994). Such cost structures mean that most revenues in self-financing water utilities are returns to capital. It also implies that a water provider may be able to operate for many years without recovering fixed costs, and in such cases will likely face political difficulties when prices need to be raised. Accordingly, water providers have an economic incentive to extract monopoly rents—but at the same time are vulnerable to political pressures to keep prices low, preventing adequate returns that would permit capital replacement and attract new investment.

Natural Monopoly

Much of a water supply system involves engineering scale economies that contribute to conditions of natural monopoly, especially for water capture and transportation. But these economies do not necessarily dictate that an organizational monopoly is the most efficient structure throughout a system, even at the supply end. In a system with multiple reservoirs, for example, each reservoir could function analogously to an electricity generation facility in a large electrical grid (see chapter 3), enabling a decentralized wholesale water market in which competing reservoirs bid to furnish water to bulk water transportation networks or directly to user groups (Noll, Shirley, and Cowan 2000).

But unlike electricity, water is not a homogeneous product. Thus each supplier into the distribution network has to undergo quality monitoring. And because water has a low unit value relative to its transport costs, centralized transmission through a large national or regional

network—as with an electricity grid—is impractical. So, water systems tend to be highly decentralized geographically and often operate under local (municipal) or provincial jurisdiction (Foster 1996).

Although there is increasing experimentation with third party access, especially to service poor neighborhoods, the capture, treatment, transportation, and delivery of water from each natural source are generally a natural monopoly.[3] A single vertically integrated utility is the usual industry structure,[4] especially in small and medium-size markets. In metropolitan areas with larger markets and reliance on multiple water sources, several vertically integrated entities can coexist, with each operating a separate distribution network in a separate zone of the city. This arrangement can be seen in metropolitan Manila (the Philippines), which is served by two contiguous water systems.

The network features of water systems imply, as in other infrastructure sectors, a need for system coordination—especially to control the quantity and quality of water intake. The large amount of capital stock underground also means that information on system conditions and operations is not easily observed or compared, creating a challenge for regulation.

Health and Environmental Externalities

Water provision and use involve extensive externalities in terms of public health and environmental impact. Excessive water offtake from private wells leads to costly building subsidence. Poor disposal of untreated wastewater contaminates groundwater and degrades natural resources in the region, such as watersheds and coastal habitats. Water spillage and pooling from bad drainage contribute to disease risks.

Many of these negative effects can be diffuse and long term, making them difficult to identify and prevent. Water and sanitation reform has historically received political impetus when the health dangers from inadequate provision have spilled beyond individual (usually poor) neighborhoods to affect middle-class and business interests—as with the cholera epidemic in Lima, Peru, in 1991 and the spread of typhoid in Santiago, Chile, in the late 1980s (Shirley and Menard 2002).

Policies governing water use rights, command and control regulations, and tax- or fee-based restrictions ("polluter pays") may be appropriate to limit harmful externalities and achieve socially desirable outcomes. But specifying and enforcing such rules and charges correctly—without

under- or over-restricting behavior—are difficult. Command and control approaches are often less effective than financial incentives at curbing pollution, or than institutional pressures such as monitoring and public exposure of polluters' performance by citizen groups or the media (World Bank 2001b).

The Case of Sanitation

Much of what has been said about the cost structure and natural monopoly characteristics of water supply also pertains to piped systems of sanitation, namely sewerage, and to stormwater drainage. There are economies of scale in sewerage and economies of scope in combining water and sewerage transportation and delivery (Armstrong, Cowan, and Vickers 1994). But cost recovery is harder for sanitation than for water, partly because piped sewerage is costly and because more of the benefits are external to individual users.[5] Few lower-middle-income countries have been able to meet the necessary conditions—adequate piped water flow, consumer willingness to pay, and fiscal ability to sustain financial subsidies for revenue shortfalls—to provide access to sustainable sewerage to more than a small minority of the urban population. Demand for piped sewerage is stronger at higher income levels, where users place more value on convenience, amenities, and environmental impacts.

Satisfactory health benefits can be obtained from less sophisticated sanitation methods—such as ventilated pit latrines, shallow (condominial)[6] sewers, and septic tanks—that are only partly or not at all networked but require correct construction and maintenance.[7] The benefits and costs of these less expensive technologies are still not fully internal to households, so provision and use of such systems often require organization at the neighborhood level and may justify public subsidies for construction costs. Regulation or oversight is usually best provided by communities, nongovernmental organizations (NGOs), or local governments (PPIAF/WSP 2001). The rest of this chapter focuses on water supply and sanitation activities that are integral to a water utility.

Technological Changes in Delivery

A significant difference between water supply and most other infrastructure is that water has seen much less technological change over the

past few decades, and the change that has occurred has had less effect on the underlying economics of supply. Unlike in telecommunications, there has been no revolution in the product and in underlying costs. Unlike in electricity generation, there have been no new production methods. And unlike in some segments of transportation, there have been no fundamental improvements in operations, management, or availability of critical information.

The most significant technological innovation in conventional water systems has been the widespread introduction of metering at the point of consumption, which enables utilities to set tariffs that reflect the marginal cost of water used and to bill for actual consumption. For metering to be worthwhile, the efficiency gains from encouraging customers to conserve water must be as great as the transaction costs of meter installation and meter-based billing. Thus metering is most attractive in situations of water scarcity. In addition, if a water system faces high costs from externalities (for example, if there are serious problems with drainage or wastewater pollution), metering can permit usage-based prices to internalize these externalities (Noll, Shirley, and Cowan 2000).

Overall, for reasons of efficiency, conservation, and externalities, metering of consumption is recommended in most developing and transition economies. But metering can also bring political advantages, by making information about consumption and pricing more widely available. In Santiago metering is seen as giving consumers more control, by informing them of their consumption and making billing more transparent (Clarke 2001). In Guinea the extension of metering to all administrative connections after 1996 helped reduce government water bills and consumption—but also underscored the seriousness of official nonpayment (Menard and Clarke 2000).

In response to the demands of poor consumers for better access to water, cheaper technologies have become more common in urban water systems.[8] For the most part these innovations were not the result of organized research and development by formal utilities or government agencies, but rather a recognition and legitimization of existing alternative arrangements for self-provisioning and small-scale private distribution. Low-cost pipe technologies, some based on small pipes laid above ground, have reduced the economies of scale of secondary distribution. When they purchase bulk water from the utility, these small-scale providers benefit from the network economies of scale and the utility's water treatment (Tynan 2000).

But even if the chemical quality of the water is the same as that from the main system, it is not identical for consumers because of lower pressure. Alternative providers meet a segment of user demand typically not served by the network and provide contestability to the utility within this market. In the El Alto area of La Paz, Bolivia, when consumers were required to connect to the utility (which had exclusivity rights), they resisted because they preferred to maintain alternative arrangements, which provided satisfactory service (Komives 1999).

Rationale for Regulation

The existence of natural monopoly and the importance of fixed costs, externalities, and social welfare concerns create a strong rationale for government regulation in the water sector, to protect both producers and consumers. Water provision is not highly contestable, and consumers cannot assess whether water is safe to drink. Regulation in the public interest aims to guard against extraction of monopoly rents and ensure adequate water quality while guaranteeing that investors earn a necessary return on long-lived assets. Government ownership of water systems is no substitute for regulation because public monopolies also have incentives to overcharge consumers with no alternative supply, and to run down the capital stock and underinvest.

It is a major challenge to establish effective regulation that avoids the many problems of government control (see chapter 1 and 2). Ensuring that water supply can keep up with demand in a sustainable manner requires institutional arrangements that introduce competition wherever possible and improve access to information for the regulator and consumers, to instill incentives for efficiency. The next two sections discuss how options for market structure and regulatory rules may meet these objectives. The final section describes recent experiences with structural and regulatory reform.

Options for Competition and Market Structure

ALTHOUGH THERE IS LESS SCOPE FOR COMPETITION IN water than in other infrastructure sectors, encouraging competition is still a good principle when setting the structure of

Table 5.2 Institutional Options for Water Supply

Option	Ownership	Financing	Operations
Service contract	Public	Public	Public then some private
Management contract	Public	Public	Private
Lease contract	Public	Public	Private
Concession	Public	Private	Private
BOT (build-operate-transfer) contract	Private then public	Private	Private
BOOT (build-own-operate-transfer) contract	Private then public	Private	Private
Reverse BOOT	Public then private	Public	Private
Joint ownership	Private and public	Private and public	Private and public
Sale	Private	Private	Private

Source: Ringskog (1998).

the market. Local conditions will determine which structural options are relevant, with the most important being the size of the water market, the fixed costs of accessing water resources, and the minimum efficient size of the treatment facility. The system's attractiveness to private investors and the possible benefits from privatization will also depend on regulatory arrangements, which are discussed in the next section.

The natural monopoly character of water supply is so strong that structural unbundling is rare, making vertical integration of utilities dominant even in industrial countries. Horizontal integration is also common, in the sense of a single utility being responsible for an entire urban market (multiple utility providers within a city are relatively rare, though more likely in large cities). Three options for direct competition are discussed below: direct competition for specific services, competition within the product market, and competition for the market. Competition for the market is the main area of involvement by the international private sector. Indirect competition, known as yardstick competition, is discussed later as a mechanism of regulation. The main institutional options for water supply are summarized in table 5.2.

Laying the Groundwork for Competition: Decentralization and Corporatization

When it comes to managing water supply, there is widespread consensus on the need for subsidiarity—that is, assigning responsibility to the

lowest level possible relative to the area affected (WMO 1992). Decentralization poses a tradeoff between locating allocative decisions close to sources of demand and relevant information, thereby increasing accountability and efficiency, and losing control over coordination and spillover effects. Some urban water companies remain owned by the national government (as in Honduras) or provincial government (as in São Paulo, Brazil). But in many countries ownership and control have been transferred to local governments as part of comprehensive political and fiscal decentralization, as in Hungary (Lobina and Hall 1999).

A common structure, especially in Sub-Saharan Africa and Central America, is a single water company responsible for several or all of a country's water services, rural and urban (box 5.1). The intent is usually to cross-subsidize systems in small towns with revenues from larger cities. But in Africa this setup has not been effective in extending service relative to a more decentralized structure. Service coverage is lower in capital cities and other urban areas in African countries with a single water provider than in countries where provision is organized locally. Coverage outside capitals is also no higher in countries with a single provider. These results suggest that cross-subsidies have been ineffective and that monopoly supply, at least at the national scale, has not expanded service (Clarke and Wallsten 2002).

Box 5.1 Water Systems in Small African Towns and Rural Areas

CÔTE D'IVOIRE AND SENEGAL EACH RELY ON A single operator to run their water systems. This setup is designed to generate cross-subsidies between regions, with capital cities providing most of the revenues to cover the costs of serving smaller urban areas. In Côte d'Ivoire this system has done a decent job of incorporating towns into the service area of the national water company, SODECI. But villages are starting to outgrow their community management systems, and the national operator has been unable to expand to all small communities—making apparent the limitations of this system.

Côte d'Ivoire and Senegal both plan to decentralize water services and strengthen incentives for competitive private providers to improve services in smaller markets. In Senegal the national entity's failure to expand services to rural communities has stimulated the development of community water systems headed by village water committees. Reforms are raising the legal standing of the village committees and creating a system that could promote local small-scale private providers. Some small towns on the perimeter of the formal network have opted to continue controlling water services locally, even preferring to pay higher tariffs if the revenues are used to support community activities.

Source: Tremolet, Browning, and Howard (2002); Tremolet (2002).

In many countries reform of urban water management involves separating the water business from government departments and creating autonomous, self-financing, utility-type entities (World Bank 1994b), as in the European Union (Hall 1998a), Brazil, Chile, China, Mexico, and Morocco (Saleth and Dinar 1999). Though publicly owned, these corporatized and commercialized structures offer the minimum conditions for competition—direct or indirect—by making the business of water supply more transparent.

Encouraging Competitive Procurement by State Enterprises

Water utilities can introduce a focused form of competition by contracting specific functions. When potential contractors bid for such work to standards specified by the utility, it can increase efficiency and bring the utility new skills and practices. Service contracts typically have short durations (several months or one to two years) and can be subject to frequent rebidding. But without open bidding, service contracts do not encourage increased efficiency.

Competitive contracting is the simplest form of private participation because the utility remains responsible for operations and fixed assets (box 5.2). The practice can help "break the ice" for public-private collaboration and elicit valuable information about operational costs

Box 5.2 Problems with Service Contracts in Mexico City

IN 1993–94 MEXICO CITY ISSUED SERVICE CONTRACTS TO FOUR PRIvate companies for meter installation, reading, and billing. The main objective was to make water and sewerage operations more efficient by reducing waste and increasing revenues. Another goal was to acquire better information on the condition of physical assets, as a prerequisite to a full management concession (which has since been delayed indefinitely). The contracts covered different zones of the city, but their specifications and bids were not sufficiently comparable to benchmark costs and performance across the zones.

Source: Haggerty, Brook, and Zuluaga (1999).

(Idelovitch and Ringskog 1995). Before its partial divestiture Empresa Metropolitana de Obras Sanitarias (EMOS), the public water utility in Santiago (Chile), contracted billing, meter reading, planning studies, construction and rehabilitation, general repair and maintenance, computer and payroll services, public relations, and industrial relations (Alfaro 1996). In Chennai, India, the Metropolitan Water Supply and Sewerage Board has achieved cost savings of 45–65 percent by contracting private operators for its sewage pumping stations (World Bank 1999b).

Privatized and concessioned utilities often procure goods and services at preferential rates from their subsidiaries. This need not be a concern if the concession was awarded competitively and the contract promotes the right overall incentives. But if a private operator exhibits excess reliance on its subsidiaries, it can undermine public trust in the utility.

Competition in the Market

There have been few instances of competing utility companies operating in the same water market. In Paris (France) and Manila (Philippines), two large metropolitan areas, the water market is split into service areas covered by companies that do not compete directly but that can be compared by a regulator (yardstick competition). In addition, competition for customers can occur at the boundaries of such service areas.

Most product competition in water markets occurs between piped and unpiped sources (such as vendors and wells), although piped water can be provided much more cheaply. But customers may seek unpiped alternatives if utility water is overpriced or of poor quality. Utility networks may also be bypassed by large customers able to provide their own supply systems.

Australia and the United Kingdom have tried to foster product competition in their water markets by allowing third party access to network infrastructure. But because transporting water is extremely expensive, common carriage and cross-border competition are not very economical—and so are uncommon (ADB 2000; Cowan 1997).

Competition in a water market can become significant only if a utility does not have an exclusive right to service customers in a particular area (Klein 1996b). Exclusivity is often awarded to enable cross-subsidies and to make concessions or equity shares more attractive to

private investors. Governments may also use exclusivity to discourage consumers from using unsafe water sources and to avoid negative externalities from private well drilling. But exclusivity can work against the public interest if water coverage is low and utility performance is poor—as in most cities in low-income countries.

In Paraguay independent small-scale operators use low-cost small pipes to distribute water in periurban neighborhoods not connected to the main network (Solo 1998). Alternative providers are also at least tolerated in many African cities (Collignon and Vezina 2000). Formal utilities typically have little experience providing standard connections to poor people's unplanned, quasi-legal settlements, which are often characterized by extreme density, difficult topography, erratic layouts, and unclear land tenure. In cities where many residents live in such conditions, encouraging alternative operators (as well as utilities) to extend service using innovative methods is vital to providing poor people with water in a reasonable time at a reasonable cost (PPIAF and WSP 2001).

Competition for the Market

In addition to the long-lasting concessions that are the main form of private participation in and competition for the market of network utilities, the water sector also involves two less common types of private involvement: management contracts and leases. Management contracts last about five years and are limited to operations and maintenance. They are fee-based and do not entail any financial risk for the contractor or responsibility for investment. The potential for management contracts to increase operational efficiency largely depends on how performance targets are defined, what incentives are provided for the operator, and how the contract is monitored.

As with other forms of private participation, management contracts require a supportive institutional and political environment. Mexico City, for example, does not have an institutional structure conducive to successful management contracts. There is no single regulator for water supply; instead, responsibilities are fragmented across numerous agencies and 16 municipal governments. Moreover, there is no legal basis for cutting service to nonpaying customers. Although service contracts were awarded in the mid-1990s, delays in preparing for the next stage

reduced the government's credibility with the private sector and undercut support for issuance of a broader management contract.

In the late 1990s in Johannesburg, South Africa, the municipal water service was corporatized and bid out for a management contract at the same time, because public opposition precluded attempting a long-term concession. The contract includes several incentive provisions that are paid only if a reputable international firm gives an independent, positive assessment of the utility's performance (PPIAF and WSP 2001). A management contract is also being used for water services in the West Bank and Gaza, and seems to be working well.

An operations concession is generally longer than a management contract—usually lasting 15–20 years—and covers operations and maintenance as well as some asset replacements. The operator receives all revenue and is the residual claimant, meaning that it keeps whatever cash it receives after paying operations and maintenance costs and a preset fee to the public utility related to investments (which are the utility's responsibility).

This fee can be structured in various ways. In the classic *affermage* contract, as developed in France, the fee is proportional to the volume of water sold. (The operator collects this part of the tariff on behalf of the public utility.) In a typical lease contract the fee is a fixed periodic payment. Variations are possible. For example, bonuses can be offered for good performance. Moreover, there is no sharp distinction between an operations concession and a full concession, because under an operations concession the operator can be made responsible for a limited range of investments.

Among developing and transition economies, water leasing has operated longest in Abidjan, Côte d'Ivoire (since 1957), and is being practiced (among other places) in Guinea, Mozambique, Niger, Poland, Senegal, and Turkey.

In concessions the contractor acquires a long-term right (typically 20–30 years) to use all utility assets, as well as a responsibility to finance new investments with specified performance targets. The assets are returned to the public utility at the end of the contract, and the contractor is compensated for own investments not fully amortized. In developing and transition economies water concessions (including sewerage in some cases) are functioning in Bucharest (Romania), Buenos Aires (Argentina), Lima (Peru), Manila (Philippines), and Sofia (Bulgaria), as well as for water and electricity services in Gabon (making it the first

true concession in Sub-Saharan Africa). Given their long duration, concessions require government credibility and should allow adjustments in major contract parameters (see below).

Water supply, wastewater, and water treatment utilities have also been established under build-operate-transfer (BOT) and build-own-operate-transfer (BOOT) concessions in Chengdu (China), Ho Chi Minh City (Vietnam), Pusan (Republic of Korea), and west Bangkok (Thailand; Haarmeyer and Coy 2002). These contracts, which typically involve greenfield facilities rather than investments in existing water systems, have take or pay provisions (revenue guarantees) that can subject governments to contingent liabilities. Moreover, investing in bulk water supply without curbing waste in distribution may worsen utility performance and environmental damage. Although projects for new supply are often easier to negotiate than system reform and restructuring, they underscore the urgency of adjusting retail tariffs and demand management (ADB 2000).

Privatization of Ownership

Sales of equity shares in water companies, with or without restructuring or regulatory changes, are also occurring—though less often than in electricity and telecommunications. In 1999 Chile initiated equity sales in several water companies, including Santiago's EMOS (subsequently renamed Aguas Andinas), which had one of the best performance records of any public water enterprise in a developing country. The sales were intended as a prelude to concessions, but political resistance halted further reforms.

The water sector does not exhibit wide variation or innovation in market structure, and private participation has been modest (box 5.3). Although competition is inherently limited, opportunities are often not fully tapped. For example, major private concessions in the Czech Republic, Hungary, Poland, Timisoara (Romania), and Jakarta (Indonesia) have been awarded without competitive tendering (Bayliss, Hall, and Lobina 2001; Lobina 2001). Few long-term concessions have been terminated by governments or lost by the original winners during rebidding and renewal. Internationally bid contracts are dominated by two large French multinational corporations (Vivendi and Suez-Lyonnaise, which together hold two-thirds of the world's privatized water market) and several smaller European companies (Société d'Amenage-

Box 5.3 Private Sector Transactions in Water and Sanitation

PRIVATE INVESTMENT IN WATER AND SANITATION IS FAR BELOW that in other infrastructure sectors, accounting for just 5 percent of global private investment in infrastructure in developing and transition economies during 1990–2001. Private flows for water supply and sanitation averaged $4.6 billion a year in 1999–2001, down from a decade high of $9.3 billion in 1997 (all measured in 2001 dollars). Latin America has the most private water and sanitation projects, while East Asia has the most investment. All other developing regions trail well behind. Concessions are by far the most common type of project in the sector, accounting for more than 80 percent of investments in the 1990s. Over half of private water and sanitation projects, and three-quarters of investment, has gone to just six countries, including Argentina and Brazil.

Source: World Bank, Private Participation in Infrastructure Database; Izaguirre (2002).

ment Urbaine et Rurale, Thames, Anglian, and International Water Limited; Hall and Lobina 2002). But these companies collaborate as often as they compete, since they frequently form partnerships to win contracts (Bayliss, Hall, and Lobina 2001). Thus regulatory design and enforcement are crucial determinants of water sector performance.

Choosing Regulation

WATER REGULATION NEEDS TO ACHIEVE THREE ECONOMIC and social welfare goals, the weight of which will depend on local water conditions, economic development, and politics:

- Efficiency—producing and delivering water at the lowest possible cost, maintaining assets, and conserving supply.
- Equity—ensuring that all residents have access to affordable, quality service.
- Environmental sustainability—minimizing pollution and damage to natural resources.

The main challenges for regulators involve dealing with insufficient information and balancing the interests of investors, consumers, and taxpayers. Asymmetric information on costs is a bigger constraint in water than in other infrastructure sectors because of limits on competition as a discovery mechanism and because a lot of water infrastructure is underground and not readily observable. Similarly, consumers can only partly assess the quality of water (in terms of clarity, taste, and smell); complete assessment requires regular expert testing.

To satisfy investors, regulators must provide credible assurances of adequate returns on long-lived capital assets, which implies curbing public sector performance risk. To protect consumers, regulators must ensure that water will remain safe and affordable. And for taxpayers, regulator assurances must extend to future generations without creating undue fiscal or debt burdens or irretrievably damaging natural resources. This section focuses on pricing regulation but also discusses other regulatory efforts (particularly quality and other performance targets, especially as they relate to service expansion) to establish incentives and behaviors consistent with these concerns.

Pricing Policy

As in all infrastructure sectors, successful water reforms require efficient pricing policies. But water pricing policy is especially controversial because of the conflicting objectives of such policy (box 5.4) and because of the severe problems in measuring elasticities of demand—that is, how price changes affect the amount of water consumed by different groups of customers and their decisions to connect or remain connected to the water system.

There are two basic structures for water tariffs: a single-part tariff and a two-part tariff. Under a single-part tariff a consumer's water bill is based on a fixed charge or a water consumption charge. With a two-part tariff the bill is based on both a fixed charge and a consumption charge.

Single-part tariffs. The simplest single-part tariff is the fixed charge, where the water bill does not reflect the volume of water consumed. In the absence of metering, fixed charges are the default tariff structure. They are still used in many countries with abundant water resources.

Box 5.4 Objectives of Water Tariff Design

WATER TARIFFS ARE DESIGNED TO ACHIEVE THE FOLLOWING GOALS:

- *Cost recovery.* Tariffs must be consistent with revenue adequacy—that is, they should generate revenue that covers the financial cost of water supply.
- *Economic efficiency.* Prices should provide signals for efficient actions by consumers, suppliers, and investors. In particular, prices should indicate to consumers the financial and environmental costs that their consumption decisions impose on the economy.
- *Equity.* Consumers with similar characteristics should be treated similarly.
- *Affordability.* Given its importance for well-being, water should be provided at minimal cost to poor people, through well-targeted subsidies if needed.

Source: Whittington, Boland, and Foster (2002).

Fixed charges can vary across households or groups of customers. For example, more valuable residences and businesses might be assigned higher fixed charges because of their likely greater consumption of water, greater ability to pay, or both. Fixed charges might also be differentiated based on the diameter of the pipe connecting users to the water system.

The main disadvantage of fixed charges is that they provide no incentive for consumers to economize on their water consumption. Moreover, if some households lack a connection, connected users could resell water—frustrating the utility's cost recovery efforts.

A single-part tariff can also be based on the amount of water consumed. There are three types of consumption charges:

- Uniform volumetric charge—the household bill is the product of the quantity of water consumed multiplied by a uniform price per unit.
- Block tariff—the unit price is fixed for a specified quantity (block) of water but shifts up (increasing block tariff) or down (decreasing block tariff) for water consumed beyond that quantity and up to the limit of the second block, and so on.

- Increasing linear tariff—the unit price increases linearly with the quantity of water consumed.

An important advantage of the uniform volumetric charge is its simplicity. In addition, it can send a clear signal about the marginal cost of consuming water.

In theory the increasing block tariff could achieve the goals of affordability (by setting a low rate for the first "subsistence" block), economic efficiency (by aligning rates for higher blocks with marginal costs), and cost recovery. But increasing block tariffs often fail to achieve these goals, partly because of design problems. Many poor urban households share water connections, and their combined consumption can place them in the highest price block—causing them to pay higher unit prices than rich households. Increasing block tariffs may also fail to achieve economic efficiency and cost recovery goals because the prices of the higher blocks are not set high enough or the subsistence block is so large that most households do not go beyond it (Whittington 1992).

Under an increasing linear tariff water prices increase continuously with the quantity consumed. Not only is each additional unit of water more expensive, but all preceding units are sold at the last (high) price. Thus this type of single-part tariff sends a powerful signal that increased water consumption is costly. As such, it represents an effective tariff structure for dealing with water shortages. But increasing linear tariffs bear no direct relationship to marginal costs and so generally conflict with the goal of economic efficiency.[9] Especially for large-volume industrial and commercial users, they could drive prices well above marginal costs.

Two-part tariffs. In most cases the economically efficient pricing structure for water is a two-part tariff, with the first part being a fixed capacity charge and the second reflecting marginal costs. This second part, a volumetric consumption charge, is more important when water is scarce (Noll, Shirley, and Cowan 2000). Ideally the consumption charge should vary to reflect periods of peak demand relative to supply.

If properly designed, two-part tariffs can achieve the goals of economic efficiency and cost recovery. If marginal costs are low because of recent capacity expansion, the fixed component can be set to recover the costs of expansion and the variable component can be aligned with

marginal costs. Thus the fixed component allows prices to reflect marginal costs (as allocative efficiency requires) while ensuring recovery of the firm's fixed costs. This is a distinct advantage over single-part tariffs. In similar circumstances a single-part tariff could not recover costs without distorting the price signal contained in the volumetric charge.

Imposing a uniform fixed charge to recover "nonmarginal" costs—that is, the shortfall between total costs and the revenues from pricing water at marginal costs—might cause poor consumers to drop out of the system. That outcome is inefficient because such consumers might be willing to pay marginal costs for some units of water. It is also undesirable on distributional grounds.

On the other hand, it is desirable to keep prices close to marginal costs for reasons of allocative efficiency. Striking a balance between economic efficiency and social equity would call for a marginal price somewhat above marginal cost and a correspondingly lower fixed charge. Alternatively, different two-part tariffs could be used. For example, a tariff with a low fixed charge and higher consumption charges (especially after a given level) could be aimed at the low-demand end of the market, while a tariff with a high fixed charge and lower consumption charges could be applied to customers who consume more water (Armstrong, Cowan, and Vickers 1994).

The short-run marginal costs of consuming a unit of water include variable operations and maintenance costs as well as a resource or opportunity cost (from withdrawal of water from alternative uses, such as agriculture) and a discharge cost (of untreated wastewater to the environment). Including the discharge cost in the tariff would make it possible to internalize the externalities of water use. Payments for the opportunity cost and externalities of water consumption can be collected with the tariff but should not be kept by the utility. Instead they should be kept by the owner of the water resource, such as a water management authority. But few water systems (especially in developing and transition economies) charge for all these elements of true marginal costs—even when environmental impacts and cross-sectoral allocations are burning issues (PPIAF and WSP 2001).[10]

Indeed, tariff revenues often fail to cover even basic operations and maintenance costs. As an extreme illustration, in Lima (Peru) in 1989, operating costs were 50 percent higher than operating revenues (Alcazar, Xu, and Zuluaga 2000). Because of the high ratio of fixed to variable costs noted earlier, in a self-financing utility a large share of rev-

enue is quasi-rents. Whether a utility is publicly owned or private and regulated, political pressures will be strong to expropriate these quasi-rents by imposing low prices. Even if expropriation does not occur through prices, it may occur through government nonpayment of its water bills—as has been a major problem for water companies in Abidjan (Côte d'Ivoire) and Conakry (Guinea), where chronic payment arrears by public customers undercut tariff schemes (Shirley and Menard 2002).

Information Handicap

Even when supported by the strongest political will, a regulator will have a hard time committing to efficient water prices because it will have less information than the operator. In the face of information asymmetries, regulation can be a blunt instrument insensitive to the basic economic parameters underlying the industry. As a result regulation will likely veer from efficiency.

Simple cost-plus pricing regulation is common because it relies on what the operator reports—but it does not provide incentives to increase efficiency. In Guinea the regulator of the water supply lease has limited authority to demand information from the leaseholder, SEEG. External audits showed that because of this weakness and political interference, the cost-plus formulas used to adjust tariffs had been misapplied, resulting in excessive price increases (Menard and Clarke 2000). Two approaches are used to combat information asymmetry and reveal cost information: auctioning and yardstick competition.

Auctioning. Auctioning is especially appealing in the water sector because it can be applied to all the contract arrangements described earlier. Successful auctioning requires careful design and a minimum number of bidders. In 1993 Buenos Aires, Argentina, auctioned its water and sewerage concession to the bidder offering the lowest water price for a defined set of performance parameters. The winning bidder agreed to deliver water for 27 percent less than the prevailing price and committed to annual investments in the first five years well beyond those under state ownership (Klein 1996b). In 1988 Côte d'Ivoire renewed its lease contract with SODECI without rebidding, but used the

threat of an auction to win a 20 percent cut in the real tariff—an outcome that suggests the company was enjoying high rents (Kerf 2000).

Because lack of information can also deter private operators, making system information available to potential bidders is critical to a competitive tender and a major responsibility of due diligence prior to inviting private participation. And even when the water price has been set by auctioning a long-term contract, it may need to be renegotiated in response to changed circumstances beyond the operator's control. Investors need assurance that they will be covered in case of adverse external circumstances, while the regulator needs to keep pressure on the operator to sustain high efficiency and pass on to consumers or taxpayers part of the gains from external or unforeseen cost reductions.[11] This tension has turned some water concessions into a battle of wills even where economic and institutional conditions should ensure success (box 5.5).

Rebidding a major franchise is too costly and disruptive to be a practical approach to price adjustment, so between auctions the regulator needs a more calculated method of adjustment. The shortcomings of rate of return regulation are discussed in chapter 2, and for the water sector this approach is far too information-intensive. An alternative increasingly considered more appropriate for the water sector, first adopted in 1990

Box 5.5 An Aborted Attempt at Water Concessioning in Atlanta, Georgia

IN THE UNITED STATES 94 PERCENT OF MUNICIPAL water systems—some 5,000 separate utilities—are publicly controlled, and most require extensive repair and rehabilitation. In an effort to improve operating efficiencies and access to private capital, more than 1,000 of these systems have turned to private long-term concessions (up from 400 in 1997). Atlanta, Georgia, undertook the largest such concession in 1999, signing a 20-year contract with United Water, a subsidiary of Suez. United Water was to make $800 million in repairs over five years. But by January 2003 both sides conceded failure and agreed to cancel the contract.

What happened? In the three years under the concession, city residents and officials complained that service was poor and unresponsive, fraught with water main breaks and safety failures leading to occasional "boil before drinking" alerts. But United Water argued that the system's infrastructure was in a much worse shape than it had been led to believe when the concession was signed, and that it lost $10 million annually under a $22 million a year contract that the city refused to renegotiate.

Source: Douglas Jehl, "As Cities Move to Privatize Water, Atlanta Steps Back," *New York Times,* 10 February (2003).

by OFWAT (the Office of Water Regulation in England and Wales), is a price cap method of adjustment (known as RPI–X) that can encourage increased productivity. During its first periodic (five-year) review of prices under the formula, OFWAT determined (in the face of consumer dissatisfaction) that the approved prices had been too high and tightened the parameters in the formula. The transparency of this method reduces the risk that the regulator could abuse such a review (ADB 2000).

Yardstick competition. Even under a price cap, information on efficiency and other parameters is still needed for the regulator to monitor a utility's performance. In the face of information asymmetries and incomplete observability of actions, yardstick competition—where regulated monopolies in different markets or regions enter into virtual competition through the regulatory mechanism—is an attractive regulatory option (Shleifer 1985).

Yardstick regulation is based on relative efficiency and entails indirect or proxy comparison among actual or stylized providers. Agents (regulated firms) are effectively forced to compete with a (nonexistent) "shadow" firm whose performance is determined by the industry average or best practice. Incentives make the rewards of agents contingent on their own performance as well as that of other agents. By making rewards dependent on a firm's performance relative to other firms, yardstick competition strongly encourages efficiency: because a firm's price depends on the cost performance of other firms, it retains part of the surplus generated by its cost-reducing activities. The incentives for cost efficiency mitigate the problem of information asymmetry. Although regulated firms do not transfer information directly to the regulator, informational rents are extracted.

Two requirements must be met to apply yardstick competition. First, firms must operate in similar environments and face similar technological opportunities, so that cost conditions are correlated across regions. Second, firms should not be able to collude. The comparability requirement is likely to prove too demanding in many cases because of substantial firm heterogeneity. Even though a regulator can capture certain factors of firms' heterogeneity, the application of yardstick competition remains inherently subjective. There is no objective basis for attributing unexplained cost differences to inefficiency (Williamson and Toft 2001).

Moreover, obtaining relevant comparators is not easy because the required information may be specific to a firm or a water system. Using partial indicators of productivity can lead to inconsistent rankings of performance across utilities; where possible, regulators should use estimates of the industry's overall efficiency frontier (Estache and Rossi 2001). OFWAT has relied on benchmarking most intensively for price regulation, while Chile's regulator relies on long-run marginal cost calculations for a model company (Klein 1996b).

Balancing Interests and Allocating Risks

A general principle of risk allocation is that each party should bear the risks it is best able to mitigate. Contracts and regulations should require the operator to bear commercial risks (of demand and payment) but be able to cut off delinquent customers, construction risks (for concessions), and risks that can be hedged, such as normal foreign exchange and interest rate risk.

Households should be required to pay for services, but within a social contract where costs of connection and minimum consumption are shared for those unable to pay. The government (taxpayers) should bear these social commitments. Individuals should also be responsible for their own behavior related to water and sanitation use and disposal—but again, where basic hygiene education and access to minimum services are inadequate, the public sector must correct these failures. Risks associated with political change, water resource quality, and major macroeconomic setbacks are best borne by government (ADB 2000). In practice, however, the magnitude and cost implications of external shocks are not always immediately evident and may require some burden sharing among the government, the utility, and its customers.

Interests of investors. A clear mechanism for adjusting prices can curb risks for an investor, but only if the public utility and regulator make credible commitments—so that the investor can be assured that political pressures will not undermine the best-laid plans through expropriation. Credibility can be established through rules that separate regulation from the government's ownership role, protect the inde-

pendence of the regulator, and strengthen the legal security of investors (see chapter 2). Further commitment devices include public sector performance bonds, dispute resolution mechanisms (such as international arbitration in major cases), and roles for consumer representation. Multilateral institutions have helped back government commitments—as in Guinea, where the World Bank provided partial financing for a revenue subsidy during a period of phased tariff hikes.

Because international experience with concession design is still evolving and each situation is different, flexibility on the part of the regulator is important. Side-by-side water concessions instituted in west and east Manila in 1997 were generally considered well prepared and designed (ADB 2000). But one feature allocated the debt portfolio of the parent utility to the west Manila concession, obligating the east to seek new financing for its larger investment requirements. This setup had the unanticipated effect of saddling west Manila with massive foreign exchange losses stemming from the 1997 East Asian financial crisis, which struck shortly after the contracts were signed. The consortium for this concession has demanded a doubling of the prices agreed at initial bidding (Public Services International 2000). Resolving this financial problem, which could not have been fully foreseen, may be critical to continuing the west Manila concession.

Interests of government (taxpayers). A contrary risk to expropriation, and one greater from the perspective of taxpayers (and consumers), is the risk of regulatory capture.[12] Capture is evident in some long-term concessions where the public authority has been reluctant to challenge the incumbent. But capture has not prevailed in the face of extreme political opposition to a concession's performance.

For example, in Tucuman, Argentina, a 30-year water concession granted to a subsidiary of Générale des Eaux (now Vivendi) in 1995 was terminated in 1998 because consumers rebelled against the doubling of tariffs and the company failed to meet investment and quality targets. Water service in the province has since been returned to public operation (Hall and Lobina 2002). However, in Cochabamba (Bolivia) and Szeged (Hungary), as well as in Tucuman, multinational concessionaires have pursued legal claims for compensation after disputes, which could make it costly and difficult for governments to end such contracts (Bayliss, Hall, and Lobina 2001).

A regulator can be captured by powerful interests other than the utility, such as user groups or suppliers. To guard against excessive influence by any well-organized party, it is essential for regulation to allow open access to information on its decisions and procedures, provide opportunities for all stakeholders to voice their concerns, and submit to judicial reviews (Noll, Shirley, and Cowan 2000).

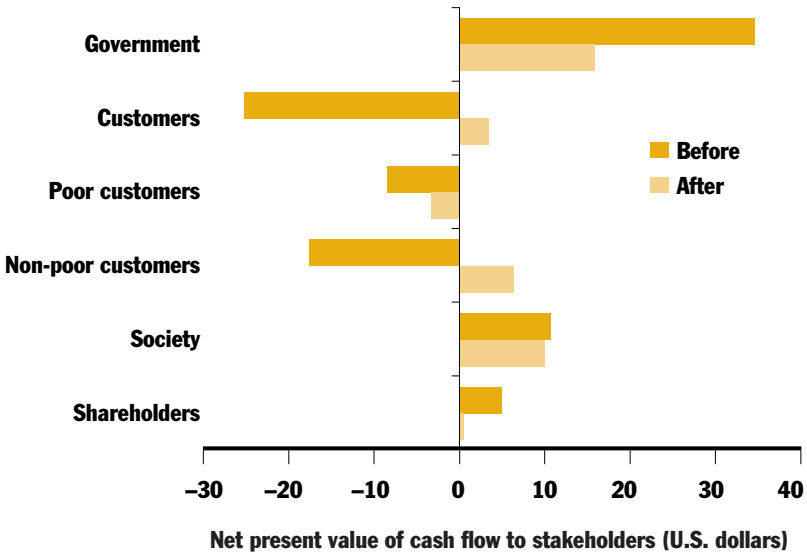
Interests of consumers. In addition to tending to the basic structure and level of water tariffs, the regulator is also concerned with their application to different groups of customers. Like electricity and some transportation services, many water systems subsidize households with revenues from industrial and commercial users. The general drawbacks of internal subsidies are discussed in chapter 1. Subsidies are especially problematic for the water sector when large shares of the population are very poor or lack connections. In such cases subsidies impose an enormous burden on certain groups of customers—such as large firms—and could entice them to leave the network (as in Lima and Mexico City).

Pricing and regulatory policies for households in developing and transition economies should encourage sustainable, affordable water consumption for all, with incentives for residents to avoid waste and for the utility to extend coverage to unserved areas. To that end, regulation should be carefully examined to see how its benefits and costs affect different consumers. For example, in Parana, Argentina, several proposed water concessions were subjected to stakeholder analysis to determine how they would affect the government and consumers. The analysis found that the initial regulatory terms featured a tariff structure favorable to existing users but weak provisions for funding new connections. Moreover, the strongest gains were anticipated to accrue to the government through fees paid by concession operators (figure 5.1). The concession was redesigned to convert net losses to customer groups to net gains—except for the poorest customers, for whom further tariff reform was needed (van den Berg 2000).

Ensuring Access and Affordability for Poor Households

The urgency of meeting the needs of poor households through urban water sector reform has been getting increasing international recogni-

Figure 5.1 Winners and Losers before and after Adjustments to a Water Concession in Parana, Argentina



Source: van den Berg (2000).

tion (PPIAF and WSP 2001). In many cities of the developing world more than half the population lives below local poverty lines (World Bank 2003). And while official data on access to water often suggest that most urban residents are already serviced, these averages mask major gaps and inadequacies.

Residents of quasi-legal and periurban settlements—representing millions of people in many large cities—are often not considered part of urban jurisdictions and so are not included in official data. Moreover, many residents with nominal connections have extremely poor water access and quality. For example, coverage data in Conakry, Guinea, include people using standpipes, which in Africa serve an average of 15 people. And when Lima, Peru, began reforming its state-owned water company in the early 1990s, 48 percent of the connected population received water for less than 12 hours a day—and 28 percent for less than 6 hours (Shirley and Menard 2002).

Subsidies and other support. Policies aimed at promoting access and affordability for poor customers have included guarantees of free

Box 5.6 Creative Management of South Africa's Commitment to Free Water

SOUTH AFRICA RECENTLY PASSED A LAW THAT PROvides every household with 200 liters of free water a day. Thus Durban Metro Water does not bill households for the first 6 cubic meters of water consumed each month. But instead of allowing this subsidy to impose a financial burden on customers who consume more or rationing water through poor service or insufficient connections, the utility has applied innovative low-cost schemes to meet the needs of its poor customers. In partnerships with two private firms (Lyonnaise des Eaux and Vivendi) responsible for designing and managing projects to test these schemes, the utility is developing a range of service levels geared to customers' actual demand. Options include semi-pressure systems with water tanks on household roofs, which permits smaller mains than usual, and metered delivery. Low-cost sanitation, complementary to the semi-pressure water systems, includes improved latrines and condominial sewers maintained by communities. Arrangements restrict water flow to minimize waste and theft, include provisions for credit to pay for connections, and incorporate user education and community mobilization. In addition, sanctions for nonpayment are enforced.

Source: Brocklehurst (2001).

minimum service, increasing block tariffs, direct (nontariff) subsidies, community service obligations, and performance incentives and fiscal transfers for utilities (Clarke and Wallsten 2002; Chisari, Estache, and Laffont 1999). Durban, South Africa, has used the country's free water policy to encourage innovation (box 5.6). In Côte d'Ivoire and Senegal social tariffs cover consumption up to 18 and 20 cubic meters per household per month, respectively, and each country's government absorbs connection costs for eligible households (Tremolet 2002). Otherwise, increasing block tariffs are used—that is, tariffs that rise progressively with consumption.

Increasing block tariffs are widely used in developing countries because they are perceived as being fair and discouraging excessive consumption. In reality, though, they can have perverse effects (Boland and Whittington 2000). As noted, if many poor households share a connection, such tariffs can shift these users into higher rate categories. They can also discourage private operators from extending service to low-volume consumers (PPIAF and WSP 2001) and can be maintained only under exclusivity. A uniform volumetric charge is more equitable but may be less popular politically.

In most countries water subsidies provided through social tariffs are regressive, ineffective at reaching poor people, and (when inadequately funded by government) contribute to utility deficits and water ration-

ing. In Belem, Brazil, in the mid-1990s the poorest fifth of the population received no subsidy spending, the second fifth received 12 percent, and the richest fifth absorbed almost 40 percent (Alfaro and others 1997; World Bank 1994b).

Chile is one of the few developing countries to provide a direct water subsidy that is means tested and administered by municipal governments. The nationally funded subsidy is transferred to the utility and subtracted from the water bills of eligible customers, who must remain in good standing. Despite being one of the best examples of subsidy design, this model has not been widely replicated—possibly because it requires strong administrative capacity (Foster, Gomez-Lobo, and Halpern 2000).

If subsidies are required to ensure affordable water for poor people, ideally they should focus on access rather than consumption, to avoid distorting incentives for efficient use. Connection costs typically pose a greater barrier to affordability than do normal tariffs (Tynan 2000). In recent years lease and concession contracts have encouraged new connections using various approaches, with mixed success. Whatever the approach, incentives for consumers (affordability) and investors (profitability) need to be right, and contracts should encourage flexible, innovative approaches to meeting service targets.

After a rocky start, Buenos Aires, Argentina, has found a satisfactory way to finance new connections, though expansion has been slower than expected (box 5.7). In the parallel water concessions in east and

Box 5.7 Making New Connections Affordable in Buenos Aires

THE 1993 WATER CONCESSION IN BUENOS AIRES, Argentina, set targets for new connections, with priority given to poor areas. A fee was introduced to cover the new connections, payable by the new customers over two years. But poor households could not afford the fee, and new customers considered it unfair because before the concession the costs of connections were shared by all customers. Although the fee was adjusted several times, affordability concerns and resentment led to renegotiation of the concession in 1997. As a result a bimonthly charge was introduced for all customers, and connection charges were reduced and made repayable in interest-free installments spread over five years.

Although these changes cut the average water bill by three-quarters for households in poor neighborhoods, affordability remains a problem. There are also concerns that the contract renegotiation lowered expansion targets, which will mainly affect poor neighborhoods.

Source: PPIAF and WSP 2001; Alcazar, Abdala, and Shirley (2000).

west Manila, the concessionaires are allowed and even encouraged (under certain circumstances) to relax their exclusivity by awarding service licenses to third parties, such as a bulk provider. Retail sales by these licensees are counted toward the concessionaires' coverage targets (PPIAF and WSP 2001).

Implications of quality and other performance regulations. Water regulation typically includes standards that utilities must meet for water safety, pressure, service levels, equipment, technologies, and procedures (such as for billing). Though well intentioned, such standards often make it impossible for a utility to incorporate cheaper approaches or provide a menu of services in line with poor households' willingness to pay, as shown by the experience in El Alto, Bolivia (box 5.8).

Especially where large shares of the population do not have connection, regulators need to take a flexible approach to standards to en-

Box 5.8 Adapting Quality Standards to Permit Extensions of Low-cost Service in El Alto

IN LA PAZ, BOLIVIA, THE SUEZ-LED WATER CONCESSION AWARDED in 1997 to Aguas del Illimani contained explicit targets for connecting poor households but did not provide adequate financial incentives for the company to do so. Moreover, the government did not provide targeted transfers to ease affordability. The concession contract stated that metered, in-house water and sewer connections were the only acceptable technology, which put service out of reach of poor households and essentially guaranteed that the company would fail to meet its ambitious target of universal water coverage within four years. Recognizing this dilemma, the regulator and the company agreed to experiment with a cheaper condominial technology for water and sewerage. The technology was found to be acceptable to the unserved population, and has allowed affordable service to be extended in the poor neighborhood of El Alto. In 2001 the condominial technology was legitimized by the Bolivian Institute for Technical Norms and Standards.

Source: Hall and Lobina (2002); PPIAF and WSP (2001); Komives (1999).

Box 5.9 Providing Incentives to Extend Service in Côte d'Ivoire

THE WATER LEASE CONTRACT BETWEEN THE GOVernment of Côte d'Ivoire and SODECI, a private company, contains provisions to expand service among low-income households. To aid such efforts, the government promotes the installation of "social connections" in households that meet eligibility criteria. These connections are financed by a charge, separate from the water tariff, that SODECI collects from all customers. The proceeds are deposited in a separate account, and the company retains the same profit as on regular connections. Since the lease was renewed in 1988, more than 300,000 new connections have been established—90 percent of them social connections.

Although SODECI has no financial disincentive to serve new customers, a major drawback of the lease contract is that the company is allowed to install connections only in legal settlements. Yet an estimated 70 percent of the unserved population are guest workers and immigrants living in illegal settlements.

Source: PPIAF and WSP (2001).

courage innovation. To provide the strongest incentive for a utility to seek creative and efficient approaches to meeting targets, quality and performance regulations should be output-based rather than input-based (PPIAF and WSP 2001). Minimum health standards for water quality and pressure should not be compromised—but these are often below the levels imposed by regulation. Legal restrictions on a utility, such as exclusivity provisions or proscriptions against connections to households without formal land title, can be formidable barriers (box 5.9). Rigid business practices, such as monthly billing, can also exclude customers with low purchasing power (Baker and Tremolet 2000).

Organizing Water Regulation and Ensuring Enforcement Capacity

As with other infrastructure sectors, water can be regulated at the national, regional, or local level.[13] Because water is usually provided as a local service that (especially after decentralization) is the responsibility of local governments, these authorities must be well represented in the regulatory agency. Few municipal governments have the capacity to design competitive contracting or carry out regulation, so obtaining expert advice may be essential to ensure balanced negotiations with more knowledgeable private partners.

Municipalities have agreed to guarantee concessionaries against revenue losses in the Czech Republic and Hungary, creating a major risk for taxpayers (Hall 1997). Municipal involvement in the regulatory

board of Buenos Aires and interference by several municipalities in Mexico City undermined regulatory autonomy and contributed to problems of politicization (Shirley and Menard 2002). Because municipalities are often water providers, conflicts of interest need to be avoided. In the water lease for Gdansk, Poland, the city is both the regulator and a contractual party, owning 49 percent of the consortium that holds the contract (Ringskog 1998).

Unclear relationships between levels of government can create problems for water regulation. In the water concession for Cordoba, Argentina, poorly defined responsibilities for the provincial government, which owned the infrastructure, and the municipality, which retained responsibility for making residential connections (the concessionaire was responsible only for extending the primary network), undermined the public sector's regulatory role (Nickson 2001). Such circumstances can strengthen the private operator's bargaining power. Sometimes the regulator has been bypassed entirely in critical decisionmaking—as in Buenos Aires, where the Ministry of the Economy and Department of Natural Resources renegotiated the water concession in 1997 without any involvement by the regulator. The outcome was appealed by consumer associations and the national ombudsman, partly because the process undercut the regulator's credibility (Conte Grand 1998).

Consumer involvement in water regulation can be an invaluable way to provide information to the regulator (especially on the needs of poor consumers) and create oversight of regulatory and operator behavior. Consumer representation in regulatory reviews is more common in industrial countries than in most developing and transition economies (even those that have implemented water reforms). Indeed, limited public disclosure of key information and contract provisions is common, and advocated by multinational corporations to protect commercial secrets.

For example, documents about the Budapest Sewerage Company, in which a consortium made up of Vivendi and a German company holds an equity share, are not available even to the city council, and matters concerning the company are debated in closed council sessions (Public Services International 2000). Transparency and two-way flows of information with the public on system performance, coupled with sound policies and institutions supporting regulation (including the rule of law, checks and balances, and protection of property rights and contracts), may be the best way to ensure that regulation fairly balances the interests of multiple stakeholders.

Reform Experiences and Lessons

STRUCTURAL AND REGULATORY REFORMS AND PRIVATE PARTICIPATION are more recent and less common in water than in other infrastructure sectors, making it harder to obtain a clear picture of outcomes. Most large public-private partnerships are only about five years old (with a few much longer-lived exceptions such as the water lease in Abidjan, Côte d'Ivoire, and the water concession in Macau, China—which was launched in 1982 as the first of its type in Asia, but built on decades of experience with private provision). Assessing reforms is also complicated because changes in institutional arrangements, especially those that convert public operations into formal contracts with private providers, make explicit conditions that may have been hidden—such as nonpayment of water bills by government agencies, other implicit taxes and subsidies, and backlogs in system maintenance.

Any assessment of reforms and institutional arrangements should take full account of sector and economic conditions and of regulation as applied. Such thorough analysis is not available for many cases over time, especially not in a form that allows comparisons among regulatory and contractual regimes. This section summarizes findings from the comparative analyses (across cities, countries, and institutions) that have been done to date. Definitive conclusions about success or failure are not yet possible, but many of the factors contributing to positive and negative outcomes are becoming better understood.

Comparing Water System Reforms

Shirley and Menard (2002) compare the content and outcomes (through 1996) of six water system reforms initiated between 1988–93: the concession in Buenos Aires, service contracts in Mexico City, state ownership and operation in Lima (where a concession was planned but not implemented) and Santiago (including contracting), and leases in Abidjan and Conakry. Initial conditions in the six cities are summarized in table 5.3. Connection rates were lowest for the two African cities, which were also the poorest and fastest growing. Water stress (unsustainability of resources) was most severe in Lima and Mexico City.

Table 5.3 Initial Conditions and Reforms in Six Water Systems

Indicator	Buenos Aires	Mexico City	Lima	Santiago	Abidjan	Conakry
Year reform started	1993	1993	1992	1989	1988	1989
Type of reform						
Planned	Concession	Management contract	Concession	Sale	Lease[a]	Lease
Implemented	Concession	Service contract	State owned	State owned	Lease	Lease
Population in service area at start of reform (millions)	8.7	8.4	6.4	4.6	2.0	1.0
National GDP per capita at start of reform (U.S. dollars)	8,861	7,647	3,462	7,101	1,582	1,398
Population connected at start of reform (percent)						
Water[b]	70	97[c]	75	99	60	38[d]
Sewerage	58	86[c]	70	88	35	10
Annual population growth, 1980–95 (percent)	1.5[e]	3.1	2.4	1.8	5.1	5.6
Annual water production at start of reform (millions of cubic meters)	1,402	1,113	527	478	67	163

a. Before reform, the lease in Abidjan had characteristics similar to a management contract.
b. Includes private taps in yards of dwellings. These were predominant in Abidjan and Conakry, important in Mexico (20 percent of connections) and probably Lima, and minimal in Santiago and Buenos Aires.
c. 1990.
d. Includes people with access to standpipes or neighbors' taps.
e. 1980–91.
Source: Shirley and Menard (2002).

Regulation. Competition occurred only in Buenos Aires, Abidjan, and Conakry, through competitive bidding. With the only concession, regulation in Buenos Aires imposed a fuller range of financial risks on the operator (investor) than did the other systems. But the two leases also provided for efficiency pricing and full metering, with tariffs

covering marginal costs as in Buenos Aires. Every city but Santiago provided cross-subsidies from high-volume to low-volume customers. Only Santiago both set expansion targets for the operator and made it affordable for poor people to connect (although this improved in Buenos Aires after contract renegotiation). None of the regulatory regimes had a very strong or formal institutional structure (commitment devices, regulatory neutrality, enforcement mechanisms, consumer representation), but Santiago had the best—which, perhaps ironically, represented state ownership and operation.

Results. Changes in economic welfare after the reforms—combining the effects to government, consumers, workers, and domestic investors—can be estimated and compared to a counterfactual (no reform) scenario. For the cases where data permit, the per capita welfare gains are estimated to be largest in Buenos Aires ($150 in 1996 prices), followed by Santiago ($64) and Conakry ($12). If Lima's concession had been implemented as designed, welfare gains are estimated at $85, compared with $8 in the actual case (see Shirley and Menard 2002).

The results of a few years of reform can be seen by comparing before and after indicators of efficiency and other performance measures. After reforms, labor productivity (measured in employees per connection) increased and operating costs dropped in every city (with operating costs falling below revenues everywhere except Mexico City). In addition, water and sewerage coverage expanded everywhere except Lima, though expansion would have occurred there if the concession had not been abandoned (table 5.4). New connections grew at a faster pace in every city except Lima, where the growth rate stayed the same. And unaccounted-for water—a measure combining physical losses (due to poor maintenance) and commercial losses (due to poor financial management or illegal use)—fell significantly in Buenos Aires, Lima, and Santiago but the improvement was less evident in the other three cities.

Quantitative Studies

Few studies have subjected performance data from different water systems to econometric analysis to determine factors driving better or worse outcomes. One such study by Estache and Kouassi (2002) derives

Table 5.4 Effects of Reforms on Access and Waste in Six Water Systems
(percent)

Indicator	Buenos Aires	Mexico City	Lima without concession	Lima with concession[a]	Santiago	Abidjan	Conakry
Water coverage[b]							
Pre-reform	70	95[c]	75	75	99	72[d]	38[e]
1996	81	97[f]	75	85	100	82[d]	47
Sewerage coverage							
Pre-reform	58	86[c]	70	70	88	35[d]	g
1996	62	91[f]	70	83	97	g	9[f]
Annual growth in new connections							
Pre-reform	2.1	n.a.	4.0		2.9	4.0	–0.1
Post-reform	2.8	5.1	4.0		3.8	6.7	8.5
Unaccounted-for water							
Pre-reform	44	37–47	42	42	34	13	35–60
1996	34	37	36	30	20	16	50

Note: Pre-reform refers to the year before reform started; see table 5.3. Post-reform refers to a span of dates.
a. Estimates based on draft concession contract.
b. Does not include public standpipes.
c. Data are for 1990.
d. Data are for all urban areas served by private operators.
e. Data are for 1989.
f. Data are for 1995.
g. Though data are not available, sewerage coverage in Abidjan and Conakry is not believed to have changed much.
Source: Shirley and Menard (2002).

a combined productivity indicator for 21 African water utilities and determines how each compares with an estimated "production frontier" for the group. The analysis finds considerable heterogeneity in performance and large scope for improvements. The authors conclude that a country's institutional capacity and quality of governance are key factors determining efficiency, and are more important than private participation in itself.[14] In a study of alternative efficiency measures for 50 Asian water utilities, Estache and Rossi (2001) find statistically significant evidence that private operation is correlated with greater efficiency.

Clarke and Wallsten (2002) compare the performance of African water systems in terms of their piped water coverage of urban house-

holds headed by individuals with different education levels (used as a measure of household welfare). This analysis finds that in countries with public operators, coverage of households where the head has no education is lower (25 percent) than in countries with established private operators (31 percent). Similar conclusions emerge when comparing the share of connected households with uneducated heads to the share of connected households whose heads have secondary education (thus controlling for the country's level of development). This study also concluded from cross-country analysis that there was no evidence that water and other infrastructure reforms harm low-income consumers, and that poor people seem to benefit in terms of having better chances of becoming connected to network services.

Lessons

In many countries the political economy of water has not been highly favorable to reform, which partly explains why the water sector is behind electricity, telecommunications, and transportation in restructuring and privatization. Major water reforms have tended to be provoked by public health crises and by fiscal and macroeconomic pressures that reduce water revenues. Inflation, mounting budget deficits, and rising government debt contributed to the reforms in Buenos Aires, Conakry, Lima, Mexico City, and Santiago in the late 1980s and early 1990s (Shirley and Menard 2002).

The condition that mattered most to the course of reform in the cities analyzed above was the relative power of potential winners and losers. Water reform typically has high social benefits but low political benefits, especially relative to other utility reform (Menard and Shirley 2001). The political benefits may come from expanded coverage, typically to poor urban households, and better service for middle-income groups. But these political gains may be smaller than the risks from necessary price increases and employment cutbacks in public utilities. Water reforms have been politically most difficult to sustain in cities where the marginal supply price of water is increasing quickly and wastewater creates large externalities—as in Lima and Mexico City. In Buenos Aires, by contrast, a cheaper, renewable water resource made it possible to cut water prices and still attract private investment (Noll, Shirley, and Cowan 2000).

Although it is too early to draw firm conclusions about what kinds of water reforms and institutional arrangements are most effective in different circumstances, the following observations can be made:

- Identifying winners and losers in advance, and adjusting the balance where possible, may increase the sustainability of reform. A perception of fairness is important—as evidenced by protests in Buenos Aires when newly connected households were charged fees that existing customers had not incurred.
- Price increases can be acceptable when customers see that quality and service are improving, when they are well informed, and when they can control their consumption. Where supply is limited, higher prices can help expand coverage and so benefit poor people.
- Where expanded coverage to poor households is a policy objective, it must be a deliberate focus of regulatory and contract design. Where necessary, subsidies should be provided to support connections—not consumption—and regulation should favor innovation and competition by providers.
- Lack of information is a major constraint to the private sector (especially potential entrants), to the public sector as regulator, and to consumers. Improving access to information may ease distrust and defuse political volatility.

Notes

1. "Safe" water includes water obtained through a household connection, public standpipe, borehole, protected dug well, or spring water and rainwater collection. "Adequate" sanitation includes connection to a public sewer or septic system, or possession of a pour flush, simple pit, or ventilated improved pit latrine.

2. Wastewater capture and treatment may be considered the fifth and sixth components of supply, or a separate system of their own (possibly also including sludge disposal).

3. Water treatment and transportation are most likely to be the bottleneck elements of natural monopoly in urban water systems (Noll, Shirley, and Cowan 2000).

4. Vertical integration can also be justified as well as a way of internalizing the environmental externalities of sewage discharge and of permitting cross-

subsidization of sewerage costs by water payments, since sewerage services cannot be disconnected for nonpayment (Foster 1996).

5. In Durban, South Africa, for example, a conventional household water connection costs about $180, while a sewerage connection costs $800 (McLeod 2002).

6. Condominial sewers involve small bore pipes at a shallow depth running through yards linking household connections to a neighborhood receptor. The system requires neighbors to maintain the network and so substitutes an institutional input (collective action) for capital (the physical assets).

7. These methods are not suitable for very dense settlements or some geological conditions because they can contaminate underground water.

8. Although in rural areas non-networked water provision has long been the norm, the low-cost technologies becoming more formally recognized in urban areas may be linked to the network.

9. Increasing linear tariffs do not necessarily assign marginal cost responsibility in a causal sense because a utility's marginal cost of providing water does not change appreciably as a household's water use changes.

10. Because some users are not able to participate effectively in water markets and because of collective action problems, poorly defined property rights, and transactional and information costs, water pricing can take into account only some opportunity costs and externalities (Noll, Shirley, and Cowan 2000).

11. In the United Kingdom periodic cost adjustments for unforeseen circumstances can include price reductions if external factors generate significant savings for the utility (Klein 1996b).

12. Most of the research literature on the politics of regulation focuses on risks of capture, not expropriation (Noll, Shirley, and Cowan 2000).

13. Issues related to water resource management, however, often need to be addressed at a high level, which may be cross-regional and even cross-border.

14. The sample of 21 utilities included only 2 that involved the private sector (through leases). According to the analysis of efficiency, these were not the best-performing companies during the period under study.