2.5 Economic and financial perspectives

Introduction

This section looks at the economic and financial principles that should underpin domestic water supply and sanitation policy, programmes, and projects; the role of economic and financial appraisal throughout the programme and project cycle; and recommended analytical approaches and techniques.

Economic and financial analyses have an important role to play in informing decisions at the *policy stage* of the cycle, at national or utility level. Key areas for analysis are the demand for different levels of service, the use and targeting of public subsidies, and how to reform tariffs and improve utility finances (e.g. in the context of a privatization programme).

Economic and financial analysis can inform decisions at the *project identification and preparation* stages by contributing to strategic choices for offering specific levels of service. At the *appraisal* stage the economic justification for water projects is typically based on cost-benefit analysis. In contrast it is usually much more difficult to quantify the benefits of sanitation projects, and the economic justification is more usually based on cost-effectiveness analysis. The financial appraisal should define financial viability, and hence project or programme financial sustainability. Both economic and financial appraisal are vital parts of project *monitoring and evaluation.*

Principles

2.5.1 The water sector

At the many international conferences, regional workshops, and other gatherings of water specialists in recent years there has been a growing consensus on the economic and financial principles that should underlie the formulation of a national water policy:

WS&S is a basic need Many people still lack access to safe drinking water and sanitation. The cost of under-provision is revealed in disease and in the human and financial costs of people making their own alternative arrangements. Enabling the unserved to obtain access to a basic water supply and safe sanitation should be the first priority of any country's water policy. As we saw in Section 2.4, domestic water use accounts for less than five per cent of total water consumption in developing countries, compared with agricultural consumption of around 90 per cent.

Past failure to attach a true value to water as an economic good or to implement cost-based charging policies for water and sanitation services has been a major factor in downgrading the financial viability of public service providers and discouraging private sector investment.

Water is an economic good In a large and growing number of countries, water is becoming scarce, in the sense that *at its prevailing price* demand is fast approaching supply. Scarce commodities and services have economic value. An appreciation of the economic value of water is essential to reduce waste and loss, encourage conservation, and move consumption towards higher value uses.

Correcting these failures by robust financial and economic analysis and monitoring at all appropriate stages of WS&S improvement programmes can contribute significantly to better progress in extending service coverage.

A crucial corollary to these failures, impacting adversely on sustainabilty, is an unnecessary boost to demand — water is seen as cheap and there is no incentive to cut waste.

Financial self-sufficiency Shortages of funds because of poor cost recovery are widespread in all kinds of water systems, at every scale. This is due to a combination of reluctance to charge fully for water, inefficiency in collecting amounts due, failure to control water losses and wasteful use, and a continuous growth in the demand for services. Financial viability is vital for system efficiency.

Sustainability This has technical, environmental, financial, social, and economic dimensions. *Economic* sustainability requires that users pay the full cost of their actions, including environmental costs and the full cost of replacing supplies in future. *Financial* sustainability requires that the system is able to meet its capital, operating, and maintenance costs.

2.5.2 Demand for improved water and sanitation services

No community can exist without a source of water. In rural and peri-urban areas households often have a variety of water sources available to them, each with different characteristics. Different sources may be selected for different domestic uses (e.g. drinking, cooking, bathing, and clothes washing), and they may vary seasonally. The demand curve for water is therefore an aggregation of individual demand curves for different purposes, which is considerably more complex than in developed countries.

A new water supply project is never the only water supply available. It simply changes the range of options available. Such an intervention may increase the quantity of water available to a community, the reliability, the convenience of the service provided, and/or the quality of water available. These changes in *quantity, reliability, convenience, and quality* may range from significant to modest. The economic value of a water supply project depends largely on the magnitude of these changes.

People can have very strong views on what *standard* of improved service they want, and are willing to pay for, and will use in preference to existing water sources (and sanitation facilities). It cannot be assumed that households will switch to a new water or sanitation system. This will depend on the combined effects of three

Programme planners should be aware that:

- The poor will not necessarily make use of newly installed facilities, for a range of reasons quite unconnected with their ability to pay for them.
- Householders commonly have more than one existing option or water source and will not automatically switch to a newly installed cheaper supply.

Why willingness-to-pay (WTP) for rural water supplies varies

- Poor households without good alternative supplies are often willing to pay much more for improved water supplies, in both absolute and relative terms, than richer families pay for their existing supplies.
- Time and monetary costs of obtaining water from alternative sources is a key influence on WTP for 'improved supplies'.
- Family characteristics, such as level of education and family size — thought to be related to the opportunity cost of time — will also influence the perceived attractiveness of improved supplies and affect WTP for different standards of service.
- Where people believe government should provide free water, WTP is very low.

- Poor householder willingness and ability to pay for service improvements is *not*, as often assumed, limited to the 3 per cent to 5 per cent range of income. In some circumstances WTP is effectively zero; where the service is closely associated to demand WTP can be over 10 per cent of income.

Poor householders without good alternative supplies are often willing to pay much more, in relative and absolute terms, than richer householders currently do for the good quality services they enjoy.

The best take up and use of new facilities is achieved if provision corresponds to what householders want after consultation on a range of cost-related options. The principal factors influencing demand for water improvements, particularly in rural settings, are the perceived cost or time savings.

Since health benefits are frequently not understood there is typically a lower demand for sanitation than for water supply. Initial subsidies are one route to promoting a change in thinking and realizing benefits for the individual and the wider community.

Variations in willingness-to-pay (WTP)

- In Chihota District in Zimbabwe, where water is relatively easily available from traditional wells, WTP is very low (0.5 per cent of income).
- In Newala District in Tanzania, where water is far away in the dry season, WTP is quite high (8 per cent of income).
- In Ukunda, a small market town in Kenya, most households prefer to spend over 10 per cent of their income buying water from vendors rather than fetching free water from a well, because of the high value they attach to their time.
- In rural Thailand, villagers were willing to pay 8-9 per cent of their income for yardtaps, but were unwilling to pay small amounts for maintenance of communal supplies.

sets of factors: characteristics of the supply, socio-economic characteristics, and attitudes to government policy (see box on previous page).

Nor can it be assumed that householders will automatically switch to a cheaper source of supply. There may be (a) reluctance to make a firm commitment to pay a water utility (or users' committee) a fixed sum every month, especially where demand will fluctuate seasonally; (b) mistrust of government's ability to provide a *reliable* supply; and (c) unwillingness to upgrade a rented property. It may also be that the level of service offered may not meet the aspirations of the intended users.

Income is therefore not the only determinant of willingness-to-pay (WTP). Poor householders without good alternative water supplies are often willing to pay much more, in absolute and relative terms, than richer households currently do for the good quality services they enjoy. The widely used rule of thumb that a household's *ability* to pay for water is some 3-5 per cent of income is simplistic and inaccurate (see box above).

Where the standard of service provided is not what people want, they soon abandon new facilities. The implication is that successful projects depend on *matching supply to demand.* Crucially, people should be given a *choice* over the type and standard of services offered. Water and sanitation systems should allow for a *range of facilities* to be made available, such as public standpipes, private house connections, different types of toilet, and sewage disposal facilities.

Demand for water reflects *perceived* benefits. These are primarily cost or time savings. People typically do not perceive health benefits. Improved sanitation is therefore often low on the list of rural peoples' priorities (it may be higher in crowded urban areas, where dignity and status are important criteria). Initially, to create demand, it may be necessary to subsidize sanitation services and/or facilities (but see also Section 2.5.15). In addition to meeting individuals' needs, domestic water and sanitation may also have public health benefits for the population as a whole.

Assessing demand by gauging willingness and ability to pay helps the poor by eliminating assumptions and misconceptions in these areas. Reliable assessment provides a sound basis for installing an affordable service that aims for cost recovery and thereby service sustainability.

2.5.3 Role of demand assessment

The importance of adopting a demand-responsive approach to water and sanitation projects has been demonstrated in the previous section. At the centre of a demand-responsive approach to the WS&S sector is the process of demand assessment, used to ascertain what levels of service users are willing and able to pay for. As we saw in Section 2.5.2, this varies much more widely than has been traditionally assumed. Demand assessment is important to inform decisions at both the policy stage of the programme and project cycle, and at the project identification, preparation, and appraisal stages. Detailed guidance on how to carry out demand assessment studies is provided in the 'Guidance Notes for DFID Economists on Demand Assessment in the Water and Sanitation Sector' (see DFID 1998 in Further Reading).

2.5.4 Demand assessment and poverty

Despite the focus of most demand assessment work on WTP (by which economists mean willingness *and ability* to pay), demand assessment studies can help with poverty reduction in several ways. Firstly, it cannot be assumed that all poor people are unwilling and unable to pay for private connections (see box below), and the strategy of providing *communal* water facilities and latrines ('some for all not all for some') may benefit the poor less than providing them with the level of service that they want. Evidence shows that unless people see the new facilities as providing on balance a more attractive service than the present one, they will not switch to them.

Secondly, cost recovery based on demand assessment can help to improve the financial, and thus the technical, sustainability of water supply systems. Where existing public systems offer a poor standard of service, characterized by low water pressure or irregular and unreliable supplies, it is usually the poor who are most adversely affected.

Targeting the poor

Lessons learned from the DFID evaluation 'Synthesis study of rural water and sanitation projects':

- At the appraisal stage of the Aguthi rural water supply project in Kenya, Danida found that demand for private connections was high but, to protect the poor, chose to supply a mix of water kiosks and private connections. Their ex-post evaluation found that all the kiosks had gone out of use, and more than 90 per cent of households had private connections.
- At the appraisal stage of the Sri Lanka rural water supply programme, Danida forecast demand on the basis of assumed *ability* to pay. At evaluation it was found that people were unwilling to pay their share of O&M costs for communal waterpoints. Many poor consumers had acquired house connections, independent of the project, and were limiting their consumption to within the level of the lowest tariff, so making it affordable.
- UNICEF reviewed 54 sanitation projects and concluded that success is determined principally by consumer demand, and that it cannot be assumed that demand will universally be for *low cost* sanitation.

White, 1997

WEDC/Sarah Parry-Jones

Water vending

Interventions to improve water supplies for the urban poor need to take particular note of the role of water vernding, as summarized below:

- Probably 25 per cent of the population of most Third World cities buy water from vendors.
- They spend typically 10 to 20 per cent of their income on water, and this money comes out of their food budget.
- The income elasticity and price elasticity of demand are very low, with the result that the poor pay the highest proportion of their income for water, and the price is very sensitive to change in supply.
- Vendors charge high prices, but rarely get rich; their prices reflect the high cost of their means of transporting water.

In this situation, any interventions which reduce the cost of water to the poor are likely to improve their nutrition and hence their health. These include:

- more accessible piped water for the poor (standposts);
- reduced queuing time for vendors when filling up; and
- credit schemes to help more vendors to enter the market.

Cairncross and Kinnear, 1988

Tariff structures and subsidy policy are formulated on demand assessment information, ideally allowing incorporation of appropriate payment mechanisms for the poor which may include cross subsidies from better-off households.

Cost recovery policies informed by demand assessment studies can also be structured to provide cross subsidy to low-income or low-volume consumers.

Thirdly, demand assessment studies can help in the design of payment mechanisms that are appropriate for poor people by identifying, for example, their preferences for weekly as against monthly payments, or for credit arrangements to spread over time the capital costs of connection fees. They can also indicate the WTP of better-off households to pay the full costs of metered private connections. Allowing such households to on-sell water may improve the access to water of poor people who would otherwise have to buy water from vendors or from public taps. And by demonstrating people's WTP for different levels and types of water and sanitation services, demand assessment studies can help to obtain political endorsement for pricing reform and greater cost recovery. This can facilitate improved services for the poor, as described above, and attract new investment.

2.5.5 Household benefits from water and sanitation

Householders can benefit from WS&S improvements by, amongst other things, saving time and/or money, and enjoying better health and a more convenient service.

The main benefits to households from improved water and sanitation are:

Financial savings Households can spend less money on water supply (e.g. from vendors) or on storage tanks.
Time savings Households spend less time collecting or queuing for water.
Convenience Water supplies are more reliable and accessible, and sanitation arrangements provide adequate privacy.
Health benefits Increasing the quantity of water used, and combining better water access with sanitation and hygiene

promotion is usually more important than improving water quality. We saw in Section 2.3.7 that unless the return-trip time to fetch water is less than three minutes or more than 30 minutes, the quantity of water used (and hence the health benefits felt) varies little. Some potential health benefits are unperceived by households, and some are external in the sense that they depend on others' actions too.

Consumer surplus Benefits may arise when households consume more water because it is available much more cheaply from the improved supply than previously.

2.5.6 Economic appraisal of water and sanitation projects

Health

Health is the benefit most commonly used to justify drinking water and sanitation projects. But there are serious practical and theoretical difficulties in measuring the health benefits that may arise from an individual project,[1] although health impact studies, taken as a *whole*, provide firm evidence of a link (see Section 2.3). The key policy implication is that expected health impacts are not an operational tool for the 'fine tuning' of interventions, or for ex-post evaluations. Results from individual studies are too unpredictable.

[1] The exception to the rule is guinea-worm, for which reasonable estimates exist for the reduction in incidence which improved water supplies can offer, and for the economic value of such disease reduction.

Economic justification for projects is commonly based on health benefits. They are difficult to quantify. For rural water projects an indirect assessment can be made by allotting a monetary value to the time saved in water carrying, for example, when a source is provided closer to dwellings.

An alternative approach is to try to maximize health benefits, without attempting to quantify them. Broad patterns of disease, and their associated economic and social costs, should help guide the overall strategy. Health benefits can be expected to be maximized where existing water sources are furthest away and water consumption is lowest, and people are most likely to feel a need for improved (that is more convenient) water. Those who would benefit most in terms of convenience — that is where time savings are greatest — are the most likely to switch to the improved water supplies, with potential health benefits. Typically, the economic value of time savings in these cases is high enough to justify the cost of rural water schemes, and give a positive economic rate of return. (See Briscoe & de Ferranti, 1988 and Churchill et al., 1987).

The difficulty of measuring health benefits from improved water and sanitation has led to the development of proxy indicators, for use in monitoring and evaluation (see WHO, 1983). As Section 2.3 makes very clear, the likelihood of health benefits occurring is significantly diminished where there is no reason to believe hygiene behaviour will change.

Cost-benefit or cost-effectiveness analysis

Assessments for water projects in general are preferably derived from cost benefit analysis.

The preferred method for assessing economic justification for a water project is cost-benefit analysis. Demand assessment surveys using Contingent Valuation (CVM) and/or Revealed Preference (RP) methods should form the basis for benefits estimation for most water projects. Table 2.1.2 compares these with other assessment methods. The basic steps in using CVM and RP surveys are outlined in the

'Guidance Notes for DFID Economists in the Water and Sanitation Sector' (DFID, 1998). Traditionally, tariffs have been used to value water benefits for urban piped water schemes, but typically these seriously underestimate benefits. For rural water supply projects, estimated time savings, converted to a monetary value based on the assumed economic and social value of time, can be used as a measure of benefits. For both urban and rural schemes, financial cost savings may also be an important additional component of project benefits.

The costs and benefits that should be included are not only the capital and running costs of the project and the direct benefits, but also those which are external to the project (see the following sections on Water pricing for economic efficiency and on use of public subsidies).

Sanitation projects, where economic benefits are hard to measure, more usually depend on cost-effectiveness analysis. The same technique is used for water and sanitation projects where there is no demand assessment study.

Cost-effectiveness analysis is an alternative approach where benefits cannot be estimated. It involves comparing the costs of meeting the assumed demand for water or sanitation and identifying the 'least cost' option. Conventionally, sanitation projects have been justified in economic terms by cost-effectiveness analysis, because of the lack of satisfactory measures of the economic benefits of improved sanitation. This method is still recommended for both water and sanitation projects where demand assessment studies are not justified.

2.5.7 Water pricing for economic efficiency

Leaving aside for the moment questions of income distribution and poverty, economic theory argues that setting the price of water to reflect its full cost will give incentives to use water in the most efficient way for the economy. The full cost should be estimated in economic prices (reflecting the impact on the economy as a whole) rather than in financial prices (which may not be the same, for instance because of tax and subsidy arrangements).

The full cost of water has three components:

There are several very good reasons for basing water pricing on full costs. The results of under pricing are that:

- public utility service providers are left short of funds;
- the private sector will not invest;
- users take and waste more
- there is a lack of incentive to prioritize water allocations to the higher value uses.

(i) **Long-run marginal costs of supply** They are 'long-run' because they include capital as well as running costs. They are 'marginal' because they are based on the cost of expanding the supply.

(ii) **External costs** These are 'external' to the water users' main concern. The main components are:

Economic externalities These are where water use has an impact on others 'upstream' or 'downstream'. Examples are the cost of disposing of wastewater (where pollution of other water sources leads to higher costs for downstream producers), or the cost of over-extraction from an aquifer or lake (which may raise the water salinity levels, and costs, of downstream water supplies). Externalities may be positive too (for example where irrigation leads to the recharge of an aquifer and reduces salinity).
Public health externalities These are health costs imposed on others because of polluted wastewater.
Environmental externalities These are costs imposed on ecosystem health.

(iii) **Opportunity costs** These are the costs to the economy when scarce water used in one way pre-empts its use for a higher value purpose elsewhere. Typically domestic water has a high value relative to other uses, so the opportunity cost to be applied in calculating the cost of domestic water is zero. (The opportunity cost concept can be very important, however, for policy discussions about intersectoral allocation of water. The opportunity cost of water used in agriculture can be high when this pre-empts domestic use.)

Pricing must encourage the most efficient use of the resource for the national economy as a whole. Prices must reflect true economic cost, accounting for both the external impacts and opportunity costs of specific uses as well as the current capital and operating costs and those needed to expand the supply system.

Where water is under-priced, public sector agencies responsible for the operation and maintenance of water supplies will typically be short of funds, and the private sector will be discouraged from investing in water utilities. The likely result will be a decline in the quality and reliability of water supplies.

In addition, where water is under-priced, little incentive is created for users to avoid excessive use and wastage of water, which may lead to over-investment, as new projects are brought forward to prevent demand outstripping supply. Finally, under-pricing will not encourage the allocation of water to more essential and valuable purposes, such as domestic use.

2.5.8 Use of public subsidies

International recognition of the realities of the growing scale of WS&S needs means a move to cost recovery and away from the heavy subsidy policies currently built into charging systems.

Public subsidies are used extensively to meet both the capital and the running costs of water and sanitation schemes. In practice, subsidies have often been allocated primarily to reflect political objectives. From the economic viewpoint the main justifications for using subsidies are on income distribution grounds, that is to reduce poverty, and where significant external benefits are expected.

Subsidies may still be necessary to aid the poor, rectify price inequities, and encourage service expansion. A justifiable case for subsidy can be made where individual and community health benefits are not apparent to householders but are apparent to those competent to make judgements from a wider perspective.

For *water supply* schemes, any proposed subsidies should normally be justified on income redistribution grounds, not on direct health benefits, because the link with water investment is very complex. Subsidies can be used to provide water at a lower cost, either by charging a lower tariff or by providing a water source which is closer to home, or more reliable.

For *sanitation schemes*, subsidies may be needed to correct for 'market failure' which arises because inherent demand (the market) does not to lead to the level of investment in and use of sanitation services which would be most efficient for the economy and society. Market failure occurs because people do not know that their own health and welfare could be improved by better sanitation facilities and hygiene practices (and potential providers of products and services do not know that there is market potential in this sector); and because improved sanitation and hygiene practices in individual households can contribute to improved health in the wider community.

Typically, public financial resources for the water and sanitation sector are scarce compared to need, so a higher level of subsidy per capita is possible only at the cost of subsidizing fewer people. This

It is essential that subsidies built into any pricing strategy are transparent and have clear objectives and targets. They must be sustainable by being covered through other elements of the charging structure.

highlights the importance of a *transparent* subsidy policy so that there is clarity about the *objectives* of the use of the subsidy; the *targets* for cost recovery and/or financial performance of the utility; the *criteria* for deciding where and how much subsidy will be allocated and for what purpose; including definition of the target group of consumers; and the *procedures* to ensure accountability on the use of the subsidy.

Scarcity of public financial resources also emphasizes the need to avoid subsidizing consumers who are willing to pay the full costs of the service proposed, and where there is no compelling social reason for subsidy. Lastly, it argues for action to attract more private sector investment into the water and sanitation sector, and to aim for higher cost recovery from users who are willing and able to pay for the services provided.

It is important that subsidies are sustainable, for example covered by surpluses generated elsewhere by the utility, or funded from earmarked revenue sources. See also Sections 2.5.12 and 2.5.13.

Practice

2.5.9 Demand assessment

The importance of making WS&S interventions effective by associating them closely to user demands and preferences is a central theme of this manual. There are established and recognized methodologies for assessing demand, of which the two most recommended are *Revealed Preference* and *Contingent Valuation* (CVM). Between these two the latter has some major advantages but it has the serious disadvantage that, unless an experienced CVM expert is involved in the design, implementation, and analysis of the study, the outputs can be biased and misleading.
Two approaches *not recommended* are the *benefit transfer* and *affordability rule of thumb* methods.

Advantages and disadvantages of different methodologies

Two common approaches to demand assessment which are *not* recommended are:

- **An affordability rule of thumb,** which is the widely used assumption that people will be willing to pay three to five per cent of their income on water has been shown to be a poor guide to WTP for service improvements. One of the key findings of demand assessment studies to date (undertaken by the World Bank Water Demand Research Team) is that income is only one among several determinants of WTP for improved water (see box 'Why WTP for rural water supplies varies' in Section 2.5.2). Differences in characteristics (quality, cost, reliability, etc.) between the improved and alternative sources of supply are very important, as are socio-economic characteristics of the household and attitudes to government policy. Households' WTP as a proportion of cash income consequently varies widely, from effectively zero to over 10 per cent.
- **Benefit transfer,** under which results in one location are used to estimate benefits in a 'similar' location. This can lead to seriously erroneous conclusions as WTP varies considerably even between apparently very similar locations. The conditions under which benefit transfer is valid are rigorous, and rarely met.

Demand assessment is best undertaken by:

- **Revealed Preference** methods, which measure demand indirectly by examining current behaviour, for example the price paid to water vendors, other expenditure on water services such as private pumps, storage tanks, or boiling water, and time taken fetching water.

- **Contingent Valuation** methods (CVM), in which people are asked directly what they would be willing to pay for different water and sanitation services specified in a carefully designed and realistic 'hypothetical scenario'.

Choice of method depends on project-specific criteria. In some instances different approaches may be preferable at different stages of a programme. Criteria affecting choice of method are summarized in the boxes on pages 110 and 111.

Either method can be used for focus group discussions, for small, non-random surveys, and for large surveys on randomly selected samples. CVM has two big advantages over Revealed Preference. Firstly, it can assess demand for a variety of possible improvements (i.e. different standards) to water and sanitation services, for example, individual yardtaps versus public standpipes, pit latrines versus indoor toilets, as well as demand for improved reliability to existing water supplies. Secondly, it can accurately estimate what proportion of households are likely to switch to improved service levels at given tariff levels.

A serious disadvantage of CVM is that unless an experienced CVM expert is involved in the design, implementation, and analysis of the study, the results are likely to be biased and misleading. Using CVM adds significantly to the cost of (and time needed for) focus group or small survey demand assessment studies, but the incremental costs of a CVM approach will be relatively modest if a large random sample survey is to be undertaken in any case. CVM household surveys may not give a full picture of demand where money decisions are taken by men, but the views of women are important, as women bear the time costs of water collection and have gender-specific needs or views in relation to sanitation. CVM may need to be complemented by other investigations, such as focus group discussions with women or men.

It is important that options presented under CVM hypothetical scenarios are based on sound engineering advice of what is technically

DFID/R Lokanadham

Small rural water projects

Where there are few levels of service options and costs are low:

- The cost of a large survey and a CVM expert may not be justified for project-level decisions.
- Care still needs to be taken to ensure schemes respond to demand. Many rural schemes have been abandoned because their designers failed to do this. In villages where there is no water vending, and households spend little time, effort, or money on collecting or storing water, improved water services are not a high priority, and supply-driven water supply projects are likely to fall into disrepair through poor cost recovery. Providing water supply to these communities is likely to be a poor use of public funds.
- Full community participation is vital in the selection of technology and location; in determining arrangements for operation and maintenance; and in meeting O&M costs and at least a part of capital costs, in order to ensure that schemes match demand.
- Proxy measures for demand such as village size (population to be served), return trip time to existing water source(s), and price paid to vendor, may be useful to assess where demand is likely to be highest.

Urban or large rural water schemes

The case for using a CVM approach at some stage rather than just revealed preference studies is stronger where:

- there is a range of different, technically feasible 'levels of service' options which can be made available to consumers, for which there is likely to be some demand, even if charged at full cost, but which have significantly different implications for project design, e.g. whether to plan only for public standposts or for a growing proportion of private connections. The drainage infrastructure needs and therefore the costs of some level of service options are likely to be high, because of high density of housing and water demand (i.e. water volume supplied per hectare);
- the charges that users will be required to pay for some service-level options are likely to be high. In such cases, the financial viability of the utility and the economic justification for the project may be heavily dependent on how people respond to the options at the prices to be charged, for example, how many people opt for private connections and how much water all those with private connections will use;
- there are middle-income and commercial and industrial users with significantly higher WTP than poor people, and who might have the capacity to cross-subsidize the latter. Since poor people, particularly those served by standposts, use less water, this is likely to require only a marginal increase in the tariff for the larger consumers; and
- there is scope for providing private connections to households WTP full costs in areas where they are likely to sell water to poorer neighbours. This can be a useful component of a strategy to improve access to safe water among poor people.

feasible, and at what cost. In the case of water supply improvements the cost of associated drainage must also be taken into account. Indeed the capital cost of the latter can be as high as that for water supply, where water consumption per unit area is high.

2.5.10 Demand assessment: Water

An important factor to consider in all water demand assessment work is how far demand changes seasonally. In particular, it is important to identify all wet and dry season traditional water sources, since women often resort to wet season sources, when these are close, in preference to improved water supplies that are further away. Changing seasonal patterns of demand also influence households' willingness-to-pay on a regular basis for improved water supplies.

In the course of developing sector policy and then project identification and design, it may be appropriate to use more than one demand assessment approach. Which approach is most appropriate depends on circumstances. For policy-related studies to inform politically contentious decisions such as tariff structures and levels, cost-recovery levels, and the structure and targeting of subsidies, it is likely to be important to conduct a large randomly selected survey in order to produce results which are statistically robust. Results from a small survey or focus group discussion, though much cheaper, will

carry much less weight. The factors that will influence the decision on the appropriate demand assessment approach at project level are summarized in the boxes on the previous two pages.

2.5.11 Demand assessment: Sanitation

As part of the formative research for a hygiene promotion and sanitation promotion programme (see Section 2.8), Revealed Preference approaches will be important to ascertain current expenditure and time spent on sanitation. But it will be useful to complement this with a CVM approach to assess preferences and WTP for new sanitation options which can be offered. CVM has been successfully used in this way, using descriptions of the characteristics of unfamiliar options (privacy, convenience, etc.) rather than of their technical design options (Altaf and Hughs, 1994). It should be noted, however, that using CVM to estimate WTP for sanitation is likely to understate the full economic benefit because of both public health externalities and respondents' misperceptions about the links between sanitation and family health.

2.5.12 Subsidy analysis

Subsidy analysis can inform policy dialogue, and lead to clearer subsidy objectives and criteria for use. The first issue to consider is the scale, purpose, and direction of fiscal subsidies. Here it is useful to distinguish between the source of the subsidy (domestic budget or donor financed), the end-user (utility, municipality, or other agency), and what is to be subsidized (capital and/or running costs). Secondly, who will benefit from the *financial subsidy*, and by how much? This requires comparing, for different classes of users, the financial cost of supply with how much they pay. Thirdly, what are the *economic subsidies*? This requires comparing the full cost of supply in economic prices for different classes of users with how much they pay.

Decisions on subsidy require a quite separate assessment and analysis and, given the financially weak state of many developing world utilities, are not infrequently tied into wider discussions covering essential tariff reforms and financial restructuring designed to give the company a viable, sustainable future.

Some key findings from experience in these areas are:

- Inadequate cost recovery breeds low standards and prevents system expansion.
- Recovery of O&M costs from users aids increased reliability of existing systems.
- Water coverage to the poor could be increased by using public subsidy for capital costs in conjunction with full cost recovery from existing users willing to meet them.
- Communal facilities make cost recovery difficult.

2.5.13 Water: Cost recovery, tariff reform, and use of subsidy

Weak cost recovery is the root cause of both low standards and low coverage of water systems. The reliability of existing systems is more likely to be increased if users meet operation and maintenance (O&M) costs. Greater coverage of safe water supply to many more poor people could be achieved if available public funds were used to subsidize capital costs, and if full costs (including capital costs) were recovered from existing users who were willing to meet them. Note, however, that cost recovery from consumers taking supplies from communal standposts is a more difficult or expensive, than cost-recovery from those with yardtaps or home connections. This is especially true in rural areas where weak local institutions may have no sanctions they can apply to non-payers.

For *small rural schemes* for water supply, simple cost-recovery targets may be appropriate, such as requiring communities to provide labour, materials, and a fixed cash sum as their contribution towards construction costs, and to meet O&M costs subsequently. These may

- In urban schemes variations in service levels and types of consumers introduce new possibilities and complexities into cost recovery.

or may not include occasional, major, maintenance costs, depending on public subsidy policy.

In *urban schemes*, especially where a range of water and sanitation services is provided to a variety of customer types, cost-recovery policy is more complex. Often many existing customers are middle- and upper-income households and commercial and industrial businesses who would be willing and able to meet the full cost of supply. Typically only a small proportion of system costs are recovered, and sometimes not even O&M costs, so the utility is financially weak, and the standard of service to existing consumers is very poor.

In summary poor households and communities are unlikely to benefit from an expansion of existing water systems where utilities are in need of the reforms described above; and those reforms must be accompanied by better billing and collection systems and more widespread metering of supplies.

In this situation poor people are unlikely to benefit from system expansion to cover (more) low-income areas, *unless steps are taken to tackle the financial and operational weaknesses of the utility as a whole*. Investment to improve the sustainable access of the poor to safe water must therefore be *complemented* by comprehensive reform of the utility to make it financially self-sustaining. The aim should be to meet all capital and O&M costs, except those met by transparent public subsidy (targeted, for example, on expanding the system to low-income settlements).

Improved cost recovery will usually require the setting of clear objectives for cost recovery and the use of subsidy; reforming of the tariff structure and levels to meet revenue objectives (and provide incentives for consumers to conserve water); greater attention to billing, collection, and enforcement; and more extensive metering of consumers.

The basis for tariff reform should be an analysis of the utility's financial costs and the economic costs of supply (and of necessary wastewater collection, treatment, and disposal), complemented by an analysis of consumers' WTP for water, and a financial analysis of existing and future subsidies. General guidance on public enterprise pricing and financial management is given in DFID's Technical Note No.5, (1992), and more detailed guidance on tariff systems and the accounts of water enterprises is contained in Appendix 3 of the *Manual for the Appraisal of Rural Water Supplies* (ODA, 1985). On-Lending Guidance is contained in DFID's Technical Note No.6 (1992). Revenue projections should be based on analysis derived from WTP studies which assess how existing users will respond to tariff rises and how many new consumers will connect to the system.

2.5.14 Meeting poverty objectives while restructuring utility cost recovery policy

Full cost recovery from all water consumers is not necessarily in conflict with reducing poverty. Many studies have found that poor people in some circumstances are willing to pay high prices and a significant proportion of their income for water supply. The full cost charges of the water supply from the utility may be less than they currently pay anyway, for example if they buy water from vendors.

When reforms are in hand policies can be tailored to accommodate the essential water needs of the poor and not necessarily by compromising the aim of cost recovery.

There are more complexities involved in justifying the need for sanitation projects than for water supply improvements, and also in justifying the need for and level of subsidies.

User demand for sanitation is less because, without understanding of health issues, the perceived benefits are less or even absent.

There may be good grounds for subsidized sanitation on public health grounds but special care must be taken with sewerage. Sewerage systems often serve the middle- and high-income sections of the community best able to pay the cost of the service. In addition, treatment works should not be subsidized for public health unless their contribution to this goal is clear; most sewage treatment is for environmental protection, not public health benefit.

Ways should be sought, however, to ensure that the poor have access to a minimum volume of water necessary to meet their basic needs at an affordable price. Possible approaches, ideally within the context of reform of a utility's cost-recovery policy, are shown in the box below.

However, 'lifeline tariffs' and 'rising block' tariff structures will work to the detriment of the poor in certain circumstances, as the following example from Accra in Ghana demonstrates. In Accra, most low-income households do not have private connections, so they do not benefit from the 'social tariff' (for consumption below 3000 gallons per month). They have to buy water from vendors or neighbours. The vendors charge high prices for water, not only because of scarcity, but because as wholesalers of large volumes of water, they have to pay high rates themselves under the 'rising block' system. As a result, households that purchase water from vendors pay between 2.5 and 6 times more for their water than those with private connections. (See also Section 2.6.17.)

2.5.15 Sanitation: Cost recovery and use of subsidy

For *sanitation* improvements, subsidy may be justified on the basis of significant external benefits, that is on public health grounds. Where to concentrate sanitation subsidy should be determined by examining the pattern of disease and hygiene practices, and assessing the likely benefits from sanitation and hygiene promotion programmes. Decisions on whether to subsidize sewerage schemes should take into account that every £1 spent on subsidy for sanitation is probably £1 less subsidy for water supply.

If a sanitation scheme is to be subsidized, it is better to subsidize the overheads of the project, particularly the promotion activity, rather than subsidizing the construction of facilities themselves. In that way

Meeting poverty objectives within utility full cost-recovery policy

Options include:

- cross-subsidy — charging better-off users more than the cost of supplying them;
- avoiding reverse cross-subsidy — ensuring poor people are not charged more for their water than better-off users;
- 'lifeline tariff' — charging a low (often a flat) rate for low-income, or low-volume, users. Low-income users may be classified by type of supply, e.g. shared rather than individual connection, or by location, e.g. township or slum location. To identify low-volume users requires metering. A typical ceiling for the lifeline tariff would be 6-8 litres per capita per day (0.9-1.2 cubic metres per month);
- 'rising block' tariff structure — charging higher rates for larger volume users; and
- easing the cost of individual connections for low-income households by subsidizing connection costs, or by allowing connection fees to be spread over a longer period, and included in monthly water bills.

the number of families who can benefit is not limited by the size of the subsidy budget.

Households can gain health benefits from following sound sanitation and hygiene practices themselves, regardless of what other households do (see Section 2.3.8). Sanitation has significant convenience benefits (for example privacy) which people are willing to pay for if suitable products and services are made available. It may be more appropriate and sustainable to subsidize the start-up costs of small businesses to provide products and services than to subsidize the products directly.

When considering *sewered systems* it is important to distinguish wastewater collection from its treatment. The economic benefits for these two stages may differ greatly, for instance when disposal or treatment is distant from population centres, so that public health risks from non-treatment are low. Treatment may not be economically justified, even if collection is.

If there is a subsidy to the O&M costs of the water and sewerage utility, it will usually be inequitable for this to go to the sewered customers, who typically are middle- and upper-income households and commercial and industrial users who can afford to pay full costs. If the sewerage network is being expanded, sewered customers should pay at least the long-run marginal cost of the network. The usual cost-recovery method is to add a sewerage surcharge to the water bill, rated on water consumption, which has the added benefit of discouraging excessive water use.

Further reading

Core references

Relevant chapters of *Planning Development Projects* by G. Bridger and J. Winpenny (HMSO, 1983) and *Values for the Environment* by J. Winpenny (HMSO, 1991).

* Papers marked with an asterisk are available to DFID staff from the Development Economics Research and Enterprise Department. They include papers presented at a DFID seminar on the use of demand assessment in the water and sanitation sector held in London 15-16 December 1997.

*DFID (1998), 'Guidance notes for DFID economists on demand assessment in the water and sanitation sector', Department for International Development, London.

*Pearce, D. (1997) 'Demand assessment in the water and sanitation sector in developing countries'.

A clear summary of water valuation issues and techniques.

*Griffin, C.C., Briscoe, J., Singh, B., Ramasubban, R. and Bhatia, R. (1995) 'Contingent valuation and actual behaviour: Predicting connections to new water systems in the State of Kerala, India', *World Bank Economic Review* Vol.9 No.3, pp.373-95.

Demonstrates the reliability of CVM by ex-post comparison of behaviour with predictions based on CVM survey.

*The World Bank Water Demand Research Team (1993), 'The demand for water in rural areas: Determinants and policy implications' *World Bank Research Observer,* Vol.8 No.1, pp.47-70.

Draws general conclusions from careful fieldwork in several countries.

*Whittington, D., Davis, J., and McClelland, E. (1998) 'Implementing a demand-driven approach to community water supply planning: A case study of Lugazi, Uganda', *Water International* (forthcoming).

Compares results using CVM in surveys and community meetings.

Winpenny, J. (1994) *Managing Water as an Economic Resource*, Routledge for ODI, London.

A readable book written from a water economics perspective making the case for water demand management and for integrated water resource management.

White, J. (1997) 'Evaluation Synthesis of Rural Water and Sanitation Projects', DFID Evaluation Report EV 596, Department for International Development, London.

Reviews experience of DFID and other donors' projects.

Evans, P. (1992) *Paying the Piper: An overview of community financing of water and sanitation*, IRC Occasional Paper No.18, IRC International Water and Sanitation Centre, The Hague.

Kamminga, E. (1991) *Economic Benefits from Improved Rural Water Supply: A review with a focus on women*, IRC Occasional Paper No.17, IRC International Water and Sanitation Centre, The Hague.

WHO (1994) Financial management of water supply and sanitation.

Other references

Warford, J. (1994) 'Marginal opportunity cost pricing for municipal water supply', *Economy and Environment Program for Southeast Asia*,

Good review of economic principles to underpin pricing rules.

*Pearce, D. (1997) 'Rapid Appraisal Techniques: Benefit Transfer',

A note on the formal requirements which must be met for benefit transfer to give reliable results.

Rogers, P., Bhatia, R. and Huber, A. (1996) *'Water as a social and economic good: How to put the principle into practice'*. Draft Paper prepared for the meeting of the Technical Advisory Committee of the Global Water Partnership in Namibia.

Presents general principles and methodologies for estimating costs and values in the water sector, discusses prices and tariff setting, and provides a summary of best practice in water demand management.

Winpenny, J.T. (1997a) *Water Policy Issues*, Occasional Paper No.2, DFID Engineering Division, Department for International Development, London.

Winpenny, J.T. (1997b) 'Draft DAC Guidance on the treatment of aid financed projects in the water sector', DCD/DAC/FA, Development Assistance Committee, OECD, Paris.

Whittington, D. and Swarna, V. (1994) 'The economic benefits of potable water supply projects to households in developing countries', Economics and Development Resource Centre, Asian Development Bank.

Discusses the concept of economic benefits in the water supply sector and presents several approaches which can be used in their estimation.

Whittington, D., Lauria, D.T. and Mu, X. (1991) 'A study of water vending and WTP for water in Onitsha, Nigeria', *World Development* Vol.19 No.2/3, pp.179-98.

Case study demonstrating that reliability is a key factor in WTP, and how tariff policy can satisfy equity and efficiency objectives.

Whittington, D., Mu, X. and Rock, R. (1989) *The Value of Time Spent on Collecting Water: Some estimates from Ukundu, Kenya,* World Bank Policy Planning and Research Staff Paper, Report INU 46, World Bank, Washington DC.

Case study showing that most households spend 10 per cent of their income purchasing water, in preference to fetching free well water, as they value time highly.

Whittington, D., Lauria, D.T., Wright, A.M., Kyeongae, C., Hughes, J.A., and Swarna, V. (1992) *'Household Demand for Improved Sanitation Services: A Case Study of Kumasi, Ghana,* UNDP-World Bank Water and Sanitation Report No.3', UNDP-World Bank, Washington DC.

The use of WTP to elicit demand for different levels (and costs to consumers) of sanitation services.

Altaf, M.A. and Hughs, J.A. (1994) 'Measuring the demand for improved urban sanitation services: Results of a contingent valuation study in Ouagadougou, Burkina Faso', *Urban Studies,* Vol.31 No.10.

Briscoe, J. and de Ferranti, D. (1988) *Water for Rural Communities: Helping people help themselves*, World Bank, Washington DC.

Reflects the state of the art before WTP studies. Argues that project success depends on giving people what they want and are willing to sustain, and that time savings provide insight into likely response of users to project.

Churchill, A. et al. (1987) *Rural Water Supply and Sanitation: Time for a change,* World Bank Discussion Paper No.18, World Bank, Washington DC.

Examines reasons why a high proportion of rural water supply projects failed to meet their objectives. Advocates economic appraisal of projects to be based on cost-benefit analysis which quantifies time savings, but not health benefits.

WHO (1983) *Minimum Evaluation Procedure (MEP) for Water Supply and Sanitation Projects,* WHO, Geneva.

Narayan, D. (1993) *Participatory Evaluation: Tools for managing change in water and sanitation,* World Bank Technical Paper No.207, World Bank, Washington DC.

Guidelines for evaluation using proxy indicators for health benefits based on community use of facilities and associated changes in hygiene behaviour.

Yining, L., and Warford, J. (Co-Chairmen) 'Natural resource pricing in China: Water supply, coal and timber', Working Group on Resource Accounting and Pricing Policy, China Council for International Cooperation on Environment and Development.

A detailed review of how to meet the multiple objectives of economic efficiency, social equity, and sustainability in policy reforms.