AN OPERATIONAL DEFINITION OF WATER DEMAND MANAGEMENT

by:

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ABSTRACT
An operational definition of water demand management is proposed with five components: a) reducing the quantity or quality of water required to accomplish a specific task; b) adjusting the nature of the task so it can be accomplished with less water or lower quality water; c) reducing losses in movement from source through use to disposal; d) shifting time of use to off-peak periods; and e) increasing the ability of the system to operate during droughts. This definitions brings out the drivers of water saving and permits tracking of gains by the source of the saving. It is also applicable to nations at different stages of economic development. And it shows how goals of greater water use efficiency are linked to those of equity, environmental protection, and public participation. Taken together, these goals make water demand management less a set of techniques than a concept of governance.

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INTRODUCTION AND PURPOSE

Water Demand Management (WDM) is slowly coming to be recognized as an essential complement to supply management if fresh water is to be used in a sustainable manner. Traditionally not just secondary but very much secondary to supply management, WDM has been shown to yield economic benefits through increasing efficiency as well as, in many cases, greater equity, reduced environmental damage, and greater public participation. Unfortunately, lack of clarity about what constitutes water demand management – and how it can be effectively introduced in different of sectors, regions, and cultures – is blocking its ability to play as great a role as it should in water policies and programs around the world.

Problem and Purpose

As both local water managers and senior water decision makers try to plan for demand management, they face the twin problems of needing to:

1. make quantitative measurements of the effectiveness of specific programs and policies intended to enhance water demand management in a specific region or sector; and

2. identify the drivers of change in the quantity or quality of water demanded by that region or sector.

It not only is, but likely always will be, easier to measure changes and identify drivers with supply management than with demand management. However, the difference between the two is unnecessarily increased by the absence of a definition of water demand management that is comprehensive and that elucidates rather than hides its several dimensions. The purpose of this article is to propose a definition for fresh water demand management that can respond to the two problems faced managers and decision makers.

Energy and Water: Partial Analogs

Much of the work on water demand management is built on earlier studies relating to energy demand management. Water and energy share many characteristics, not just as physical substances, but also in the ways in which human beings have developed them to provide for their lives and livelihoods (Brooks, 2004). The gradual shift from simple to complex technologies, from individual to centralized systems, and from free good to economic commodity has typified both resources (though all these shifts have proceeded much further for energy than for water). The analogy between water and energy is not perfect, but, as stated by Stiles (1996, page 3):

> . . . the analogy works despite its imperfections: water is often oversupplied relative to demand, generally underpriced relative to its intrinsic and economic values, and governed by institutions geared to augment supply rather than to manage demand.

Indeed, many of the authors now writing about sustainable water management were, at earlier stages in the careers, concerned with sustainable energy management. And the years of experience in energy demand management offer us an archive of great value as we turn toward appropriate concepts and means for water demand management.

One point at which the analogy between energy and water breaks down involves the ecological and cultural demands for water. Analysts are fond of saying that no one wants a kilowatt-hour of electricity or a barrel of oil for itself, but only for what it can do to satisfy a human demand. This is not true for water. Water is essential for a wide variety of ecological services, and it is also desired for itself. We take pleasure from a tumbling waterfall or a tranquil lake. Therefore, the definitions of water demand management proposed below focus on the use of water for human purposes rather than the (larger) volumes of water that must be left in situ to provide ecological services and satisfy aesthetic and cultural needs. Only in the second last section of the paper is reference again made to the role of water in ecosystems.

OLDER AND SIMPLER DEFINITIONS

In its simplest sense, water demand management means getting the most from the water we have (Brooks, 2002). In somewhat more elaborated form, WDM includes any action that reduces the amount of fresh water we use, or that keeps water cleaner in the course of that use than it otherwise would be.

In a review paper Grover (2002) identified several other definitions of water demand management:

- any socially beneficial action that reduces or reschedules average or peak water withdrawals or consumption from either surface or groundwater, consistent with the protection or enhancement of water quality (Tate, 1993), where "socially beneficial" is defined in an earlier report to mean "that the benefits to society of adopting the measures should outweigh the costs of adoption (Tate, 1990);

- a practical strategy that improves the equitable, efficient and sustainable use of water (Deverill, 2001);

- the development and implementation of strategies aimed at influencing demand, so as to achieve efficient and sustainable use of a scarce resource (Savenjie and van der Zaag, 2002).

Stiles (1996; page 22) differentiates between demand management and demand-side management. He uses the former term to refer to "a broad range of techniques and processes based on the end-use requirements of water consumers rather than on the supply requirements of water providers." In contrast, he restricts the latter term to a "narrower set of activities and principles that are initiated by the resource provider (typically, a utility) as part of its corporate-planning and capital-investment process." Demand-side management is a useful way to level the playing field (at least within the utility) between supply augmentation and demand reduction, and it can have a significant impact, particularly in resource-constrained utilities. However, it is demand management in its broader sense, not demand-side management, that is the focus this article.

Broad and relatively simple definitions of demand management are still useful. Their breadth is part of their strength. They remain applicable regardless of whether it is less water per unit of output or service; or less water because of lower rates of population or economic growth, different technologies, or changes in consumption patterns or habits. They are the same whether talking about surface water or ground water; the same whether talking about average or peak demand.

Convenient as they may be, such broad definitions do not adequately reflect the shift of focus that is needed for water demand management to play a full role in sustainable water management. For operational or policy purposes, we must think about water demand management less as a technology than as a policy; less a matter of piping, valves and filters than a tool for changing the ways and the rates by which water is used. This change of focus does not mean that the techniques and practices are any less important. However, it does mean that, in essence, water demand management is a governance concept. It is about governing (in both senses: moderating and managing) our demands for good quality fresh water. And, for this purpose, a finer and more comprehensive definition of water demand management is needed.

Such a definition must be able to deal with the wide range of water demand management initiatives – from education and information at one end to regulation and sanctions at the other; from individual actions to repair leaky valves to national policies to regulate water-intensive industries; from local community organizations to national institutions and international treaties. As well, the initiatives include the critical issues of water pricing, and various forms of economic incentives for water use, re-use, and conservation, all of which serve as necessary (though seldom sufficient) conditions for effective water demand management.

A NEW OPERATIONAL DEFINITION

A comprehensive definition of WDM must reflect both the series of steps that brings water from source to use and also the time and space dimensions of water use. Therefore, water demand management can be defined as any method -- whether technical, economic, administrative, financial or social -- that will accomplish one (or more) of the following five things:

1. reduce the quantity or quality of water required to accomplish a specific task;

2. adjust the nature of the task or the way it is undertaken so that it can be accomplished with less water or with lower quality water;

3. reduce the loss in quantity or quality of water as it flows from source through use to disposal;

4. shift the timing of use from peak to off-peak periods;

5. increase the ability of the water system to continue to serve society during times when water is in short supply.

In this five-part definition, quantity and quality of water are treated equally. The advantages of reducing the quantity of water used to achieve any service are obvious. However, losses in quality are almost equally important in physical and economic, and certainly in ecological, terms. Higher quality water can be used for many purposes and even substituted for lower quality water, but the reverse in not true. Lower quality water is not acceptable for many purposes without added costs for treatment and upgrading. In addition, because water is conveyed to us by systems with capacity limitations, and because system efficiencies generally decrease as capacity is strained, water demand management must also incorporate conveyance efficiency as it varies between times of high and low demands. Finally, sharp differentials between wet and dry seasons are typical of semi-arid areas. Even in humid areas, rainfall will vary by season, and sporadic droughts will occur. Therefore, demand management also includes methods that add resilience to water systems to permit them to cope with shortage.

Each of the five components of the definition implies the goal of saving water, or saving higher quality water. However, given the nature of developing nations, much of the "saved" water will immediately be used by others, such as women and small farmers, who previously had less water than they needed for their lives and their livelihoods. Such shifts in water use patterns that result in improved equity are important forms of water demand management even if they do not result in lower absolute levels of water use. Water demand management in developing countries is as much about equity as about efficiency.

EXPLORING THE OPERATIONAL DEFINITION OF WATER DEMAND MANAGEMENT

Key Characteristic

The most distinctive characteristic of water demand management (just as with demand management for energy), and the one that most sharply separates demand from supply management, is that implementation is extraordinarily decentralized. In many cases, it involves literally every household or firm or activity that uses water, and this in turn implies that it involves as much attention to behaviour as to technology. For these reasons, success with demand management often depends less on decisions themselves than on the ways in which those decisions are made – not on what is decided but on how it is decided. Trumbo and O'Keefe (2001; 2005), for example, show how intentions and information interact to yield results in demand management campaigns. Connors (2005) describes how utilities operating in particularly difficult situations "muddle through" to extend services to more people. Farmer involvement is almost everywhere essential to the introduction of water-saving irrigation methods (Brooks, 2002).

Corollary Characteristics

As shown by the IDRC Forums, in most countries, and particularly in developing countries, water demand management is pursued for other goals as well as for saving water. The most important goal is usually saving money (typically, reducing deficits) at the water utility, with getting rid of wastewater a common secondary goal. (Further information on the IDRC Forums is available at: www.idrc.ca/wadimena.) However, WDM is commonly supportive of other socio-political goals, even when not designed with that intention. Most WDM measures will also contribute to or permit:

- improvements in equity

- wider participation in decision-making
- reduced environmental impacts.

These aspects are highlighted by Savenjie and van der Zaag (2002), who indicate that water demand management can be achieved by:

- stressing equitable access to water, reflected in a strategy that is specifically designed to improve service delivery to the poor;
- treating water as both an economic as well as a social good, and managing and pricing it accordingly;
- balancing the management of losses and consumption with the development or expansion of supplies; and
- managing a change in organizational culture from being technology focussed and supply driven, to one that puts people first and is demand responsive.

The extent to which any proposed measure for water demand management is compatible with these other goals cannot be assumed. Linkages between these goals and WDM measures must be verified, and, if appropriate, the measures adjusted to permit – better yet, promote – greater equity, greater participation or reduced environmental damage. In particular, “pro-poor” approaches must be built in explicitly (Balanyá et al., 2005), just as do measures to assure that women and other disadvantaged groups get a fair share of the saved water (van Koppen, 1999; Gender and Water Alliance, 2003).

Overlap with Supply Management

An action or process that serves directly to reduce the use of water clearly falls within the concept of demand management. But so does an action or process that makes better use of a pre-existing supply. Consider rainwater harvesting: Whether from rooftops for household use or in the field for agricultural use, it is really a form of supply management. However, rainwater harvesting techniques are typically adapted for use at individual houses or farms, and they are most effective when linked to techniques to limit demand. It is difficult to decide where supply management ends and demand management begins. Is the technology for storing water so that it stays clean a part of supply management or demand management? When water harvested in the field is directed to crops at critical times in the growth cycle (“supplementary irrigation”) is it supply management or demand management? Are the terraces built to retain water on hillside fields a supply or a demand management technique?

Such questions do not have to be answered definitively. For many purposes, it is simply more convenient to treat local forms of supply management as if they were demand management (Brooks, 2002). They achieve the same purposes, they share the same key and corollary characteristics, and they are put into effect by the same people. The same approach can be taken for water reuse and recycling. A line can be conceptually drawn around the farm or factory (or around a group of closely connected farms or buildings). Water reuse and recycling can be treated as demand management if they take place within that line, but as supply management if transferred or sold across the line.

Measurement

Breaking down water demand management into its separate components increases the understanding of the sources and drivers of change, and also permits measurements of the sources and the extent of change. This is an important area of discussion, but it is too large a subject for this article. Gleick and his colleagues at the Pacific Institute (2003) have shown how changes in urban water use can be measured and tracked, and de Loë (2005) has made a start at the particularly difficult task of measuring and tracking changes in agriculture. Neither of these studies is built upon the definition suggested here, but links can be made between their quantitative analyses and the first four, if not the fifth, components of demand management suggested above.

WATER EFFICIENCY AND WATER CONSERVATION

Finally, it is useful to consider two terms, water efficiency and water conservation, both of which are common in the literature. Though sometimes used interchangeably, water use efficiency and conservation are really different concepts. Efficiency is a general term for various ways of measuring the productivity of water used for specific purposes. Conservation, in contrast, has two separate meanings. In older use, it refers to ways to maintain the quantity and quality water in ecosystems either for its own sake or for maintaining ecological services. In this sense, conservation refers back to the development vs. preservation debate, and is not, therefore, very useful for analytical purposes intended to identify better options for water demand management.

A more useful approach distinguishes between water efficiency and water conservation on the basis of differences in the nature of the decision (Brooks, 2005b). Efficiency includes all the measures and actions that would be taken by a rational decision-maker in response to price signals within the usual neo-classical constraints of existing technology, preferences, distribution of income, etc. Conservation, in contrast, reflects actions that are taken because one or more of the neo-classical constraints is removed. For example, consumers of water may decide that they prefer to save more water than they otherwise would in order to avoid the need to expand their existing water supply system into a park area. New techniques (or new rules) may induce factories or farms to adopt different wastewater disposal options. More formally, gains in water efficiency reflect a move onto the production possibilities curve; gains in water conservation reflect a shift in the position of the curve. Less formally, efforts to increase water efficiency ask how to use water for a given end use; efforts to conserve water ask why we are using water to serve that end use.

In general, efficiency and conservation generally work together to reduce per capita and per dollar use of water in the economy. However, efficiency approaches alone are unlikely to be sufficient to reduce absolute levels of withdrawals and consumption far enough to achieve sustainable water use. It will probably be necessary for conservation to play an even greater role, and, if it does, society will then achieve "conservation" in the older sense of protecting ecosystems and preserving the recreational, cultural and aesthetic benefits or retaining fresh water in situ.

CONCLUSIONS

Water demand management promises to be as important in this century as water supply management was in the last. Though new water supplies will continue to be developed and new water systems installed, particularly in the developing world, neither the Millennium Development Goals nor the secularly growing demands for food will be met from actions on the supply side alone. Not just more demand management but very much more will be required to complement additional water supply.

In order for water demand management to play the role that is needed, those involved in delivery – analysts, policy makers, utility managers and others – will have to learn more about how to ensure that it is efficient and effective. Which measures save water and which mainly change its allocation? When, where and by whom are selected measures adopted? How can information best be matched with incentives? To what extent are adverse environmental effects reduced by demand management. In effect, we have to start treating water demand management as a method of governance in addition to a set of techniques.

The five-part definition of water demand management proposed in this article is intended to be part of the process of learning how to manage water demand management. The definition incorporates changes in water quality as well as quantity, and is therefore applicable to lower quality or brackish water as well as to potable water. In contrast to definitions that focus on urban uses, this definition is intended to be equally applicable to agriculture and to rural areas, and particularly to rural areas of developing countries. Perhaps most importantly, by breaking down the several ways in which water demand management operates, the proposed definition will permit its impact to be at least partially measured and tracked.

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