

Demand management theory

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Abstract

Demand management is an alternative to increased water supply to meet growing demand. Control of water usage can be effected by the supplier or the consumer. The supplier can use physical methods to limit supply or economic, and the consumer can adjust his way of living either voluntarily or under pressure by the supplier. The classical supply-and-demand curves are applied to water supply, considering also the effects of metering, and marginal vs. average costing.

Introduction

South Africa is a water-scarce country and as a result unit water consumption is expected to be less than in water-rich countries. Although there are water resources in the region sufficient to meet present requirements, the distances required to pump water, and the storage required to meet droughts, make the cost of obtaining new sources higher and higher. The cost of additional water is therefore likely to increase exponentially. In addition, the expected increasing living standard of many of the population will mean that greater volumes of water are needed, even though consumption will be at a minimal level. A balance will therefore have to be achieved between consumption and new supplies (see e.g. Rademeyer et al., 1997). This cannot be achieved except by considering marginal costs and variable tariffs. The occasions when water tariffs need to be considered will also effect the instrument used to control usage. During crises (e.g. drought) short-term tariff increases may be applied, whereas in the long-term the average tariff will depend on the marginal cost of new sources.

Water consumption management

Water consumption can be limited by physical, sociological or economic means (instruments). Physical means include cutoffs or pressure control by reduced pumping or constrictions in pipes, e.g. orifices or washers. The latter costs money in waste of energy and cost of installations. On the other hand, it may even out the water drawoff variations by making consumers take water over more hours per day and provide in-house storage to meet peak consumption. The former (curtailing supply over periods of hours), could result in higher peaks when supply is resumed, but this will in turn reduce pressure and therefore peak drawoff. Demand control by pressure reduction could result in different drawoff patterns. Roof tanks could be filled at night. This will save distribution pipe costs but not necessarily reduce total volume of use. It may also be possible to reduce supplies to uneconomical, no longer valued consumers with compensation, in preference to newer consumers. In the long term, water-saving plumbing devices could be installed. These include small and double action cisterns, low-volume showers, and automatic tap closers.

Sociological methods include appeals, way of living or legal action. Appeals, through the media or on accounts rarely last long before consumers forget the urgency. Long-term changes in ways of life to reduce water consumption will generally be caused by increasing water costs, together with public relations campaigns. Legal enforcement of water restrictions, if associated with fines, can be effective but costly to apply. It may mean inspectors checking on consumers, or relying on spying neighbours. Then fines would have to be imposed by courts unless incorporated in water accounts. Such methods include prohibiting use of water on gardens on specified days, banning filling of swimming pools or use of hosepipes or flushing of drives, etc. Consumer awareness can encourage local reuse of grey water, e.g. wash-water for gardening.

Economic methods include water tariffs, metering or charges on discharges. Theoretically the best system would be to charge prices which reduce the usage to meet availability. This is, however, an unknown equation since the true value of water may not be known to the supplier or even the consumer. It may also involve tiered tariffs. That is, successively increasing consumption will be charged at higher rates so that the basic requirements of consumers, particularly domestic consumers, are met and more luxurious uses are charged at higher rates. This assumes there will be no trading between consumers (Moore, 1989). It may also encourage consumers to seek alternative sources which, although they may be more costly in total supply, may be cheaper to individual consumers.

Apart from the socio-economic objectives of providing water, there is a long-term value of water. If the world population and standards of living continue to increase, water will become scarcer. It may also occur that climatic change requires more careful use of water owing to reduced availability or greater variability in rainfall.

The traditional approach to supply management is to meet demands with successively more expensive schemes until the demand balances the supply. However, unless marginal pricing is applied, the average supply cost will always be less than the marginal additional cost of water, so that the demand will continue to increase asymptotically.

Theory of supply and demand

A fundamental concept in economics is the law of supply and demand. Figure 1 shows theoretical supply and demand for water. At higher prices, producers would be willing to supply more but consumer demand would decrease; at lower prices,

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