Water conservation

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Water conservation can be encouraged with price or non-price instruments.

Water prices are more often directed at cost recovery than water conservation. They vary with location and use. A farmer pays one price to receive water from an irrigation ditch, a family pays a different price to receive drinking water at its tap, an organization might pay a variety of prices to buy water that is then left to flow in-steam for environmental purposes. Prices may be found in an auction, determined by the average cost of utility service, or set through an administrative procedure. An increase in price often results in a reduction in demand, but the elasticity of this response varies with the price level, use of water, availability of substitutes, and incidence of water prices. This last factor is driven by political or regulatory decisions that explain the existence of block prices, social tariffs, sectorial cross-subsidies, regulatory exemptions, and other "adjustments" that distort consumption decisions and conservation investments.

For the sake of this article, assume that it costs one dollar to receive one cubic meter of drinking water (265 gallons), a number that's close to three dollars per ccf (hundred cubic feet of water, or 748 gallons); see Zetland and Gasson (2012) for a global survey of water prices. Wholesale water buyers usually pay far less for water (e.g., $100 for one million liters, or 0.81 acre foot) because the water is neither suitable for drinking nor typically pressurized for 24/7 delivery through a distribution system.

A 20 percent price increase, from $1.00 to $1.20 per cubic meter may be "too low to notice" for retail users. The same percentage increase may produce a noticeable response from a farmer who can pump his own groundwater or no response from a farmer who is busy "finishing" his crop before harvest.

These responses can be attributed to sliding up a demand curve to a new consumption point where quantity demanded is lower. A direct increase in water conservation (a decrease in water consumption) results from shifting the demand curve inwards. Shifts occur -- all else equal -- from changes in income, technology or taste. Higher income increases direct and indirect water demand, via respective increases in irrigated landscaping or meat consumption, for example. High-efficiency appliances or fixtures can reduce water consumption. Greater "awareness" or education can lead people to shut off faucets while brushing teeth or replace water-thirsty lawns with non-irrigated local plants.

Note that the net conservation impact of each response is affected by offsetting forces. A low-flush toilet may take two flushes to clear the toilet bowl. Low-flow showerheads may lead people to shower more to remove soap or merely enjoy their virtuous act; they may even wash their car more often. These responses will not be easy to predict in cases where people lack a water meter or see their water use every other month, due to our psychological tendency to put more weight on virtuous acts and less weight on vices (Ariely, 2009).

Water meters, in fact, improve water conservation by making volumetric pricing relevant (non-zero price elasticity) and triggering a behavioral response to measurement of use. Smart water meters that deliver consumption data on short intervals inside one's house strengthen this response by increasing the frequency with which price signals are received and behavior is noted. They also make it easier to spot leaks and change prices in response to surges or drops in demand. It's possible to promote water conservation without meters by mandating the installation of high-efficiency appliances, banning outdoor watering, or educating people to use less, but these command and control methods are less efficient than meters. A higher price for metered water will reduce use; a mandated low flow showerhead in the guest bathroom does nothing. That said, meters may not be efficient where the opportunity cost of water use or price of water is low relative to the cost of installing meters. In those circumstances, it makes sense to, respecteively, ignore water use or rely on non-price mechanisms. A master meter on a multi-family building and some neighborly coercion may be more efficient than meters on each apartment (Barraqué, 2011).

Rebound effects can be even stronger with wholesale or bulk water consumption. Farmers who install drip irrigation systems often divert "conserved" water to other crops or other land parcels (Ward and Pulido-Velazquez, 2008). Such diversions must be put into the proper context. Frederiksen and Allen (2011), for example, divide off-stream use into consumed water, non-consumed recoverable water, and non-consumed, non-recoverable water to clarify that consumed water reductions may be beneficial while reductions in recoverable water that reduce return flows -- thereby impairing the rights of downstream users -- may not be. Meters that reduce diversions at the trunk canal give them an incentive to minimize or eliminate tailwater flows that previously percolated into groundwater or flowed downstream to neighbors and ecosystems. Meters or higher prices for thermoelectric or industrial users can make it cost-effective to invest in recirculating cooling systems or closed-loop processes. These investments may not be socially efficient if they are exceptions to an otherwise lax attitude to conservation in a service area or watershed where industry shares water with urban and agricultural users, first, because they may result in a overly-high cost per unit of water conserved; second, because they may result in distorted substitutions to or from labor, energy, capital and so on.

People often want examples of success and failures in water pricing and conservation. Las Vegas is a notable failure not because of its program to subsidize lawn removal (and thus reduce water used for outdoor irrigation) but because it charges one of the lowest prices for water in the western US (about 30 cents per cubic meter) at the same time as "the threat of imminent water shortage" is used as a justification to spend $800 million to bore a deeper "third straw" intake into Lake Mead (Brean, 2012). For examples of success, consider how Australians dramatically reduced their water consumption – mostly through demand shifts – in the middle of their ten-year drought or how water managers in Santa Barbara used a combination of very steep prices and public awareness to reduce demand by 50 percent in the middle of their 1987-1991 drought; demand returned to 60 percent of pre-drought levels when water supplies returned and prices were reduced; see Cart (2009) and Loaiciga and Renehan (1997), respectively.

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