Water Conservation Pricing

Background

Water conservation pricing is the use of rate structures to encourage efficient use and discourage the waste of water. Water conservation pricing provides economic incentives to customers to use water efficiently. It is possible to achieve full-cost pricing of water while using water conservation pricing principles.

Appropriately designed and implemented water conservation pricing can:

- Reduce water consumption while limiting negative impacts on utility revenues.
- Reward customers for making cost-effective changes in water appliances and water use behavior through greater savings.
- Target inefficiency in discretionary water uses such as landscape irrigation.
- Delay costly and perhaps unnecessary water supply expansion projects.
- Avoid financial hardships on low-income customers.

Applicability

This BMP is intended for all water systems ("utility") wishing to send price signals to customers that will encourage water conservation. A water system may have already accomplished this BMP if it currently has a conservation price structure that has resulted in water conservation at the desired rate. The objective of the desired rate should be to show both a declining usage measured on a per customer or per capital basis, and to achieve a lower seasonal peaking factor.

Description

Water conservation pricing is the use of rate structures to provide for the financial security of a water system and encourage efficient use and discourage the waste of water. Conservation pricing structures often increase unit prices with increased consumption (increasing block rates), charge higher rates during high-use seasons (seasonal rates), and/or impose water shortage response plan-linked temporary surcharges during water shortage periods. The goal of conservation pricing is to use price signals, based on the extra costs necessary to meet peak demands caused by elective usage, to encourage more efficient long-term usage patterns by customers. For example, high water use imposes greater costs to the utility in terms of capacity and should be charged higher rates. Using this BMP, water systems should consider establishing rates based on long-run marginal costs, or the cost of adding the next unit of capacity to the system. An established cost of service methodology should be followed whenever rates are developed or proposed for change. For a typical system, where elective usage is not a significant portion of total usage, or total usage for a given customer class (i.e. residential), less drastic pricing signals or price differentials, combined with appropriate tier cut-offs, can be highly effective.

This BMP addresses conservation pricing structures for retail customers. For water systems supplying water and sewer service, the principles contained in this BMP can be applied to the pricing of both services. The way to support tiered rates for residential customers is to avoid having the sewer rates based on a capped level of water flows, so the sewer rate continues to reinforce the higher water rates as customers reach higher usage levels. A capped sewer rate structure for residential customers does serve to undermine some tiered structures. Water systems that supply water but not sewer service should make good faith efforts to work with sewer agencies so that these sewer agencies do not provide sewer services using a pricing structure that conflicts with the objectives of the water pricing structure.

For conservation pricing structures to be effective, customers should be educated on the type of rate structure the water system uses and be provided feedback through the water bill on their water use. Most customers do not track water use during the month because of the difficulty and inconvenience of reading the meter. When customers read their bills, they often just look at the total amount billed. Conservation pricing has the advantage of providing stronger feedback to the customers. Customers will see a larger percentage increase in their water bill that will appear disproportionate to their increase in water use. Water systems should move toward using billing software that allows customers to compare water use on their bill with average water use for their customer class, as well as the household's water use for the last 12 months. The rate structure should be clearly explained on the water bill, including information about the block sizes and rates if applicable.

It is not recommended that a minimum monthly water allotment be included in the minimum bill. The American Water Works Association's (AWWA) M1 Manual notes that minimum charges are often considered to work counter to conservation goals and are unfair to those who use less than the monthly minimum. A customer in a small house with all efficient fixtures and appliances may be able to consume less than 1,000 gallons per month and may be inclined to increase their water use if a minimum bill includes charges for at least 1,000 gallons.

Implementation

Conservation pricing is best if introduced over time and in multiple steps. Some of these steps include:

- Implementing reporting procedures.
- Monitoring and documenting usage patterns for various sectors of users.
- Educating consumers on the value that the utility provides.

Successful adoption of a new rate structure may necessitate developing and implementing a public involvement process in order to educate the community about the new rate structure. The new rate structure should adhere to all applicable regulatory procedures and constraints. If the conservation pricing structure to be implemented is substantially different from current practices, then a phased-in approach may be

appropriate.

Public involvement in the development and implementation of conservation rates can help assure that the goals of the conservation pricing initiatives will be met and accepted by local constituents. Public meetings, advisory groups and public announcements are among ways to generate public involvement.

Development of conservation-based rate structures is more than just a selection of arbitrary usage breaks for increasing block rates. The process requires consideration of the effect on water demand and water system finances.

Basic rate structure considerations should include rates designed to recover the cost of providing service and billing for water and sewer service based on actual metered water use. Conservation pricing should provide incentives to customers to reduce average and peak use. The conservation rate structure can be designed to bring in the same amount of revenue, often termed revenue neutral, as the previous rate structure.

Only one form of conservation pricing is required for this BMP. Conservation pricing is characterized by one or more of the following components:

- Rates in which the unit price ($/1,000 gallons) increases as the quantity of water used increases are called *increasing block rates*. A water system should analyze historical records for consumption patterns of its customers. The first block should typically cover the amount of water for normal household health and sanitary needs. Rates for single family residential and other customer classes may be set differently to reflect the different demand patterns of the classes. To increase the effectiveness of this rate structure type, the additional revenue from the higher blocks should be associated with discretionary and seasonal outdoor water use.

    - The price difference between blocks is important in influencing the customer's usage behavior. Price increases between blocks should be no less than 25 percent of the previous block. For maximum effectiveness, the price difference going from one block to the next highest block is recommended to be at least 50 percent of the lower block. For example if the third block of a four block rate structure is $4 per 1,000 gallons, the fourth and final block should have a rate of at least $6 (50 percent higher) per 1,000 gallons. Any surcharge based on water usage should be included when calculating these percentages.

- Rates based on individual customer water budgets, in which each customer is charged according to an increasing block rate structure in which each block size is determined by that individual customer's water needs, often called *budget-based rates*. Water budget rate structures are based on the philosophy that each customer has a unique amount of water that is needed for public health and is adequate for all necessary uses (drinking, cooking, washing, etc.), and uses

above that amount are considered discretionary and charged as excessive (irrigating lawns, washing cars, etc.). Typically, there should be an indoor and an outdoor component to a water budget.

- For residential rates, the indoor component should be based upon estimates of the household's average wintertime use. The outdoor component is based upon landscape area. For business customers, water budgets will often be based on historical average for indoor water use, and the outdoor component based on landscape area.

- To qualify as a conservation rate, water systems that implement water budget based rate structures typically begin excess rate charges for landscaped areas at no more than 80 percent of average annual reference evapotranspiration replacement rates.

- Rates based upon the long-run marginal cost, or the full-cost of providing water.

  - Conservation pricing should use a consumption charge based upon actual gallons metered. The base charge ("minimum bill") for service should be based on the fixed costs of providing that service which generally includes administrative and meter-reading and billing charges, plus a portion of debt service and other capacity costs. Including an allotment for water consumption in the minimum bill does not promote conservation. It is recommended that if an allotment is included, it should not exceed 2,000 gallons per month. Water systems including a water allotment in the minimum bill should consider eliminating that allotment within five years of implementing this BMP.

  - Adoption of lifeline rates neither qualifies nor disqualifies a rate structure as meeting the requirements of this BMP except that the minimum bill guidelines should be followed. Lifeline rates are intended to make a minimum level of water service affordable to all customers. Lifeline rates should not be applicable past the first 2,000 gallons of use.

  - The water system should educate customers about the rate structure and use billing software that allows the customer to compare water use on his or her bill with average water use for his or her customer class, as well as his or her household water use for the last 12 months. The rate structure should be clearly explained on the water bill. The water system may want to consider implementing the Public Information BMP in conjunction with this BMP in order to provide customers information on how to reduce their water bill under a conservation rate structure.

  - In order to set up an effective irrigation rate, all water used through irrigation meters should be charged at least at the highest block rate, if

applicable. If you charge for water and sewer, keep in mind that by installing an irrigation meter, the customer will no longer be paying wastewater rates for that volume of water, and the total price for high units of water will decrease. Charging irrigation rates at or above the highest block rate for indoor water allows you to specifically target this type of discretionary water use. The water system must adopt rules or ordinances requiring customers serviced after July 1, 2009, with in-ground irrigation systems to install separate irrigation meters, as required by G.S. 143-355.4, and should consider retrofitting customers serviced prior to July 1, 2009, with separate irrigation meters. It is important for these customers to have a separate irrigation meter, so it is more apparent how much water they are using for irrigation.

Schedule

Water systems pursuing this BMP should begin implementing it according to the following schedule:

- The water system should follow applicable regulatory procedures and adopt a conservation-oriented rate structure within the first 12 months. The conservation rate structure should be designed to promote the efficient use of water by customer classes. Additional suggestions and guidance on setting up conservation-oriented rate structures are provided in *SWIC-Recommended Guidance for North Carolina Utilities Attempting to Support Water Conservation in the Long-Term through Rate Structure Design and Billing Practices* available at http://www.ncwater.org/Water_Supply_Planning/Water_Conservation/SWIC_11-22-10.pdf.

- At least annually, a water system should review the consumption patterns (including seasonal use) and revenue and expense levels to determine if the conservation rates are effective. The system should make appropriate, regular rate structure adjustments as needed.

- At least annually, the water system should provide information to all customers on the conservation rate structure.

- If not already in place, within five years or when the water system changes billing software (whichever is sooner), the water system bill should provide customers with their historical water use for the last 12 months and a comparison of water use with the other customers in their customer class. The rate structure should be clearly indicated on the water bill.

Scope

To accomplish this BMP, the water system should implement a conservation-oriented rate structure and maintain its rate structure consistently with this BMP's definition of

conservation pricing and implement the other items listed in the section above.

Documentation

To track this BMP, the water system should maintain the following documentation:

- A copy of its legally adopted rate ordinance or rate tariff that follows the guidelines of this BMP.
- Billing and customer records which include annual revenues by customer class and revenue derived from commodity charges and fixed charges by customer class for the reporting period.
- Customer numbers and water consumption by customer class at the beginning and end of the reporting period.
- If a water allotment is included in the minimum bill, a cumulative bill usage analysis similar to Figure 1 (C-3) in the AWWA M1 Manual. (See below.)[3]
- A copy of the educational materials on the conservation rate sent to customers for each calendar year this BMP is in effect.
- An account of all system costs as identified in the Implementation Section.
- A water system bill meeting the parameters and schedule in the Schedule Section.
- Optional provisions:
    - A copy of the rule or ordinance requiring all customers after July 1, 2009, to install separate irrigation meters for in-ground irrigation systems.

    - Implementation and schedule for an irrigation meter retrofit program for in-ground irrigation customers prior to July 1, 2009, or a feasibility analysis for such a program.

[3] *Principles of Water Rates, Fees, and Charges (M1 Manual)*, AWWA, 2000.

(1) Usage Block *Ccf*	(2) Number of Bills in Block	(3) Cumulative Bills Through Block	(4) Total Use of Bills Stopping in Block *Ccf*	(5) Cumulative Use of Bills Stopping in Block *Ccf*	(6) Total Use to This Block of All Bills Passing Through Block *Ccf*	(7) Cumulative Billed Usage *Ccf*	(8) Cumulative Billed Usage %
0	4,134	187,836	0	0	0	0	0
1	11,531	183,702	11,531	11,531	172,171	183,702	14.6
2	18,013	172,171	36,026	47,557	308,316	355,873	28.4
3	24,317	154,158	72,951	120,508	389,523	510,031	40.7
4	20,089	129,841	80,356	200,864	439,008	639,872	51.0
5	20,065	109,752	100,325	301,189	448,435	749,624	59.8
6	17,141	89,687	102,846	404,035	435,276	839,311	66.9
7	13,807	72,546	96,649	500,684	411,173	911,857	72.7
8	11,468	58,739	91,744	592,428	378,168	970,596	77.4
9	14,909	47,271	134,181	726,609	291,258	1,017,867	81.1
10	7,943	32,362	79,430	806,039	244,190	1,050,229	83.7
11–15	13,149	24,419	167,764	973,803	169,050	1,142,853	91.1
16–20	5,635	11,270	92,309	1,066,112	112,700	1,178,812	94.0
21–25	2,817	5,635	60,576	1,126,688	70,450	1,197,138	95.4
26–30	784	2,818	22,823	1,149,511	61,020	1,210,531	96.5
31–50	1,389	2,034	49,027	1,198,538	32,250	1,230,788	98.1
51–100	564	645	39,569	1,238,107	8,100	1,246,207	99.4
101–250	72	81	11,617	1,249,724	2,250	1,251,974	99.8
251 and over	9	9	4,584	1,254,308	0	1,254,308	100.0

Figure 1. Development of cumulative billed usage residential class-annual number of bills and usage – 5/8-in. meters.

Determination of Water Savings

The effect of conservation pricing implementation is specific to each water system. Elasticity studies have shown an average reduction in water use of between 1 percent and 3 percent for every 10 percent increase in the average monthly water and sewer bill. When implementing a conservation pricing structure, consideration should be given to the following factors:

- Average price is better than marginal price in explaining the quantity of water demanded by customers.
- Customers are typically unaware of their block rates.
- The water savings that accompanies a switch to a block rate may be lost in subsequent years if water rates are not increased to keep up with rising costs.
- Customers do not understand the link between water use and sewer billing. As such, customers do not tend to factor sewer prices into their water use decisions.
- Many studies and reports indicate price elasticities for the Southeastern United States of approximately -0.30, which translates into a reduction of 3 percent in water use for a 10 percent increase in price.

The water system should focus on a rate design that sends the appropriate price signal to customers to reduce discretionary water use. To remain effective, the rates need to be analyzed annually and adjusted periodically to account for rising costs and changes to the system's capital plan and operations.

Cost Effectiveness

The effectiveness of a water-conserving rate structure depends on how well it is designed and implemented. Each utility has a unique mix of single-family residential profiles and other customers and circumstances to consider. A cost effectiveness analysis can be done by comparing the cost of implementing this BMP to the anticipated water savings from adopting the conservation rate structure. The costs for implementing a rate structure change are associated with managing a stakeholder involvement process and costs for consultant services, if needed, and there may be one-time costs associated with developing and adopting ordinances and enforcement procedures. There may be significant costs associated with reprogramming the billing system if this step is necessary.

Other Considerations

While conservation pricing is a valuable tool to ensure the utility has adequate water for its customers, the utility must also ensure that the rates are adequate to provide for the day-to-day operations of the water system and the funds necessary for long-term system repairs and replacement.

The June 2012 Journal of AWWA, contained an article by H. Edwin Overcast entitled "*Is it time for water utilities to rethink pricing?*" In the article, Mr. Overcast discussed how utilities face declining per capita consumption as a result of conservation measures, unpredictable weather patterns, and implementation of increasing-block rate structures. Faced with generally declining use per customer, water utilities are confronted with the unfortunate fact that revenues may not be sufficient to cover the cost of operation, maintenance, and debt service needed to keep the system of reservoirs, treatment plants, pumps, pipes, valves, fire hydrants and meters running.

One solution that Mr. Overcast discusses is recovering fixed capital cost associated with local infrastructure (distribution system-related fixed cost) through fixed monthly charges and recovering traditional volumetric-related cost through volumetric charges. This option, called straight fixed-variable rate design has been adopted by other types of utility providers. Shifting customer cost from volumetric charge to fixed charge would likely require a phase-in period of a few years in order to mitigate the impact of such changes on the bills of the smaller-volume users.

For comments or questions regarding the Water Conservation Pricing BMP, please contact the water efficiency specialist of the Water Supply Planning Branch at 919-707-9021.

References

- Principles of Water Rates, Fees, and Charges (M1 Manual), AWWA, Sixth Edition 2012.
- Residential End Uses of Water, AWWA Research Foundation, 1999

- Setting Small Drinking Water Systems Rates for a Sustainable Future, EPA Office of Water, January 2006.
- Water Price Elasticities for Single-Family Homes in Texas, Texas Water Development Board, August 1999.
- Designing, Evaluating, and Implementing Conservation Rate Structures, California Urban Water Conservation Council, July 1997.
- Effectiveness of Residential Water Price and Nonprice Programs, AWWARF, 1998.
- Is it time for water utilities to rethink pricing?, Journal AWWA, June 2012
SWIC-Recommended Guidance for North Carolina Utilities Attempting to Support Water Conservation in the Long-Term through Rate Structure Design and Billing Practices, http://www.ncwater.org/Water_Supply_Planning/Water_Conservation/SWIC_11-22-10.pdf, November 2010.
- North Carolina Water & Wastewater Rates and Rate Structures Report, University of North Carolina Environmental Finance Center, http://www.efc.unc.edu/projects/NCWaterRates.htm, March 2012.

Case Study for Water Conservation Pricing

Orange Water and Sewer Authority (OWASA) Carrboro, North Carolina

Background

OWASA was established in 1977 to consolidate the water and sewer facilities and operations previously owned and operated by the University of North Carolina at Chapel Hill, and Carrboro in southeastern Orange County. OWASA is governed by a nine-member board of directors appointed by the two towns and Orange County. It now serves about 80,050 people through nearly 21,000 customer accounts.

OWASA is financially self-sustaining and funded primarily by customer revenues from monthly water and sewer charges and from one-time service availability fees (system buy-in charges) paid by new customers when they connect to the water, sewer and/or reclaimed water system. Revenues remaining after the payment of current operating expenses and debt service are used to pay for rehabilitation, replacement, improvement, and expansion of the utility systems. Unlike other local government utilities, OWASA's revenues cannot be used for non-utility related purposes.

OWASA does not receive any tax revenues, but it has received some limited state and federal grant funds to offset certain capital expenditures.

In 2001, OWASA completed a comprehensive water and sewer master plan which identified the need for water and wastewater system infrastructure capacity expansions to meet projected increases in local water and sewer service demands. At that time, the peak-day water demand ratio was about 165 percent, and the ratio of wastewater flow during the maximum month to the flow during the average month was about 140 percent.

In May 2002, OWASA implemented a seasonal water rate structure to replace the previous year-round uniform block rate structure. The utility put the seasonal water rate structure in place to reduce peak-day demands, defer the need for future capacity expansions, and promote greater conservation of the community's essential water resources. Coincidentally, the new seasonal rate structure was followed by the drought of record, which reduced the remaining supply in OWASA's Cane Creek Reservoir and University Lake to an all-time low of less than 32 percent of total storage.

The seasonal rate structure remained in place for all OWASA customers until May 2007, when OWASA implemented a five-tiered increasing block rate structure for individually-metered residential customers. Seasonal rates remained in place for all other customer classes. OWASA also adopted a new system of water rate surcharges under which water rates would increase as the severity of a declared drought increases. As occurred in 2002, implementation of these new conservation pricing policies was followed by an extreme drought.

As other utilities have experienced, OWASA's usage charge revenues declined as water sales dropped. OWASA offset a portion of the revenue reductions by deferring or eliminating certain operating, maintenance and capital expenditures. However, rate increases were required to pay for increasing expenses while ensuring financial stability in the face of reduced water sales. The increased rates sent an even stronger pricing signal to OWASA customers, and have likely further contributed to the substantial demand reductions across all customer classes. For a typical residential customer billed for 4,000 gallons of water and sewer service each month, OWASA's combined charges have increased from $34.12 a month in 2001 to $70.66 a month in 2012. That is a compounded rate of increase of about 6.25 percent a year.

OWASA's conservation rates, together with education and outreach efforts, implementation of a new reclaimed water system, and installation of water efficient fixtures by many OWASA customers, have resulted in a dramatic reduction in raw water pumping requirements and average-day use by OWASA's customers.

Since 2002, OWASA's customer base has increased by about 11 percent. However, average-day water sales declined by more than 25 percent during that same period, while the accounted for water ratio has remained constant. The average billed water use per metered connection (including both drinking water sales and reclaimed water sales) has declined from about 470 gallons per day in 2002 to about 350 gallons per day in 2011.

There have been similar reductions in the peak demands on OWASA's water and wastewater infrastructure. During the past five years, the average peaking ratios for the water plant and wastewater plant have declined to less than 145 percent and 120 percent, respectively.

This has enabled OWASA to revise its capital improvements plan to defer plans for expansions of its water and wastewater treatment plants. It has also reduced the amount of energy and chemicals needed to meet the community's water needs. The reductions in drinking water demands have helped reduce the community's risk to extended droughts.

All these benefits will be important as OWASA strives to meet local water and sewer service demands in a more sustainable manner.

For more details about OWASA's water conservation pricing, go to
http://www.owasa.org/client_resources/customerservice/owasa%20is%20well%20positioned%20for%20the%20future--%202011%20owasa%20customer%20letter.pdf.