

Anniversary

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Water rates: Past, present, and new challenges

Methods to generate sufficient revenue to cover the cost of supplying water to consumers have been in place for millennia, although determining water rates has evolved into more complex processes that address more and equally complex needs.

In ancient times cities could develop only if sufficient water supplies were available, which necessitated the presence of rivers or wells. If water was not immediately accessible, means were devised to transport water into the cities from elsewhere. Jerusalem had a leaky aqueduct made of limestone blocks. The Greeks built masonry conduits to bring water to their cities, even boring tunnels by hand. A 4,200-ft tunnel (1,280 m) was built in Athens more than 2,500 years ago. Marcus Agrippa, appointed in 33 BC as the first water commissioner of Rome, is credited with the advancement of high-quality water transportation works. Eventually about 200 cities in the Roman colonies had aqueducts. A famous one, the Pont du Gard, still stands near the French city of Nîmes. In the beginning, these Roman public works projects would be financed from war pillage and from contributions of wealthy donors. Income from taxes became more common during subsequent centuries of the Roman Empire. An infrastructure benefit to the people, aqueducts were not expected to pay for themselves (Aicher, 1995). Overflow water could be sold to private citizens, and the rates charged for these water sales were an early form of water rates—possibly the earliest known record of water rates.



PAST TO PRESENT: WATER RATES IN THE UNITED STATES

In the United States, public and private water systems have evolved over time in response to fire suppression, domestic, or culinary water needs of communities. Fire protection services were often paid for through ad valorem taxes; domestic water use was often made available through the same system of taxes. With most water utilities now organized as enterprise funds, property taxes are still commonly used to finance at least a portion of the utility's revenue requirements, but the majority (and often just about all) of revenue is now derived from user charges and fees. Rate schemes, now called rate structures, have evolved over time. Figure 1 shows events that have shaped the evolution from past to present-day water rate structures.

Laissez faire and regulation. The phrase *laissez faire* is commonly defined as "Let things proceed without interference." In economics it means "practical economic conduct." In the developing economy of the United States of the 1800s, pricing for commodities, goods, and services was often conducted based on the *laissez-faire* principle. Owners could set the price however they wanted. But the development of railroads, a transportation utility, in the mid-1800s and the budding industrial might of Standard Oil Company thereafter resulted in intricate price-discrimination practices that, after public outcries, prompted the adoption of antimonopoly measures. When state laws proved ineffective to bridle price discrimination schemes, the federal government intervened and established a regulatory commission that eventually became the Interstate Commerce Commission (ICC). Under ICC tutelage, the concept of fair and just rates received more intellectual attention that became widely applied to other utilities. The 1890 Sherman Antitrust Act legitimized the fight against monopolistic price behavior. Further, natural monopolies, the sole providers of goods and services within a certain service area, should be regulated

to avoid monopolistic profits. A number of leading law cases set out the rules that water utilities still must follow in ratemaking. (*Water Rates, Fees, and the Legal Environment* [AWWA, 2010] is a handbook prepared by members of the AWWA committee charged with the review and development of standards for water ratemaking. This committee also prepares the

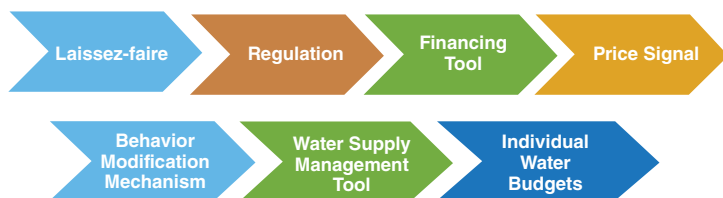
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standard for water ratemaking advice, *M1, Principles of Water Rates, Fees, and Charges* [AWWA, 2012]).

Financing tool. The advent of a utility enterprise approach, which requires the utility to become self-sufficient for its financial survival, brought with it the need to generate sufficient revenues to finance capital investment and pay for ongoing operations through use-related charges that were more equitable than flat rates. Setting rates to collect sufficient revenues (user-charge revenue requirements) is typically mandated in state laws under which utilities are organized.

Price signal. Until about the mid-1900s, flat monthly (or longer-period) user rates were common. With water service being relatively inexpensive, there often was no need for installing water meters to track consumption by individual customers. That condition rarely exists today, and the cost of receiving water service now is a noticeable cost item in many customers' budgets. With metering being nearly universal, a variety of price structures have been developed. A popular structure until about the 1980s was the decreasing block (tier, or slide), in which the rates charged to larger customers would result in lower average unit costs than for small customers. This

FIGURE 1 Background for today's rates



rate structure became less popular and was often replaced by unit cost by class, which resulted in each class being charged the same unit cost for all levels of use. A recent review of the history of water utility rate practices covering the 1882 through 2012 AWWA history in the United States may be found in *A Brief History of Water Rate Manuals & Publications* (Woodcock, 2013). The article reviews water rate issues reported from the second AWWA Conference in 1882, various New England Water Works Association publications from the early 1900s, and subsequent AWWA publications including all six editions of AWWA's *M1 Principles of Water Rates, Fees, and Charges* (AWWA, 2012).

With the price signal becoming ever more oriented toward providing stronger conservation signals, increasing rate blocks became more popular. In general, rate structures have often become more elaborate and are being used to accomplish more objectives than simply covering costs.

MANAGING WATER CONSUMPTION THROUGH RATES

Behavior modification. Two important purposes for charging customers for the volume of their water use is to drive home the messages that water service is not free and that customers can modify their behavior. Water service is not a free product and its availability comes at a cost to the customer. By being aware of the relationship between quantity of use and the cost charged through regularly submitted bills, rational customers are more inclined

to conserve water and will not delay needed repairs in their distribution system.

Water supply management tool. As observed in other utilities, pricing can be used as a supply tool—for example, when seasonal supply costs exceed average annual costs and the rate structure reflects this through higher peak-season rates, a relatively higher cost for water use in the peak season will promote a reduction in water usage, or “peak-shaving.”

Individualized water budgets. For many water utilities where water supplies are becoming more scarce and the cost of new water supplies is ever higher, utilities have adopted water-saving practices. Relatively new, and mostly applied in water-limited areas, water budgets have been adopted as a means to have customers adopt water-wise, efficient consumption practices. This starts by having the utility determine an efficient level of water use for the customer, which involves a significant amount of data development and analysis. For example, water use can be separated between indoor (domestic) and outdoor use. Indoor use can vary with the number of occupants; outdoor use can depend on lot size, type of landscaping, temperature, and humidity levels. Usage deemed to be excessive can be charged in tiers, with successively higher unit costs within each tier. Rate structures can be elaborate, and tiers of use can be set at a class level or based on each customer's use patterns. Clearly the utility's objective has switched from simply collecting its user-charge revenue requirements to meeting a variety of goals. Many of the objectives that concerned early ratemakers more than 100 years ago are being addressed today. (Objectives, or classes-of-rate criteria, are referred to as attributes in this article and are also known as community values, goals, or rate-design criteria.) Attributes are used in the development of a rate structure. A sound economic theory for developing defensible rates was explained by James C. Bonbright, co-author of a leading academic reference source on the theory of

utility ratemaking (Bonbright et al, 1988). Note that practical ratemaking manuals, such as the AWWA's *M-1 Principles of Water Rates, Fees, and Charges* (AWWA, 2012), use the term "criteria" for attributes as used in this article. Attributes may include equity, customer-related, financial, conservation, and implementation criteria. Each attribute can be further delineated by specific criteria for setting water rates. Table 1 provides examples of commonly used attributes and criteria.

NEW CHALLENGES: BETTER BALANCING OF ATTRIBUTES AND MANDATORY RATE CRITERIA

The balancing of all possible criteria can be a daunting undertaking, and the weighting of criteria is not equal; some are more important than others, and some are legally required. A new rate structure should comply with all applicable legal requirements. The requirement that rate revenues be based on actual utility costs is a well-known legal standard, for instance. Other criteria may not be as well known, such as the requirement that there should be no subsidization of customers within one customer class by other customers in that class. This has often happened under the guise of conservation-oriented rates in which tier rates are arbitrarily escalating and not based on a demonstrable cost nexus for each tier.

Avoiding intraclass subsidizations will likely receive more attention in the future.

Related to this is also the question of the emphasis on the minimum billing amount versus the collection of revenue requirements through the volumetric portion of the bill. Both water conservation goals and the often-present community implementation goal of minimizing bills for low-income households are in play here, and rate design can accommodate this political/community goal substantially in this case.

Water service is not a free product and its availability comes at a cost to the customer.

Examples of other challenges are readily noted, and there are questions that will likely require more attention in the future by rate analysts and decision-makers. If users have paid system development charges (SDCs) such as connection, impact, capacity, and capital fees, what is the implication of this for rate design, especially for conservation rates? Furthermore, should the relative magnitude of the initial SDC dictate the respective amount of water to be provided in the lowest-tier rate? This second question refers to an example of an intergenerational rate-equity criterion issue that recognizes the principle that a customer has purchased a certain amount of capacity in the system and should not be subsequently penalized

TABLE 1 Commonly used attributes and individual criteria for setting water rates

Attributes					
Criteria	Implementation	Equity	Customer	Conservation	Financial
	Administrative burden	Interclass	Affordability	Average-day savings	Revenue sufficiency
	Public understanding	Intraclass	Economic development	Peak-season savings	Revenue stability
	Public and political	Intergenerational	Rate shock/volatility	Peak-day	Rate stability
	Risk of implementation	Inside/outside city	Understand bill	Sustainability	Rate predictability
	Legal defensibility	Industry standards			Financial risk
	Policy durability				Efficiency

through the rate structure for using the capacity that was paid for in the customer's earlier SDC; chapter 6 in *Water Rates and the Legal Environment* (Corssmit, 2010) addresses this.

These complex questions are beginning to be addressed in a few regions. The balancing of conservation criteria with equity criteria has recently received attention in California. Assembly Bill 2882, which became effective state law in 2009, requires that rates that promote water conservation still must be cost-based. A good cost-of-service study is the key to establishing legal defensibility. Furthermore, all tiers in a water rate structure must adhere to cost of service standards (Corssmit, 2010). For conservation-oriented rates, that means that the traditional fixed fee or minimum charge must have a rational basis such as meter size; a basic use charge must be based on volumetrically measured necessary/indispensable indoor and outdoor use; and additional conservation charges, if any, can be charged in a higher rate tier in which conservation-related costs are added to the basic-tier established rate. A next tier could result in even higher rates when more excessive conservation costs are included.

Early tests of AB 2882 in court rulings have upheld these laws. A 2013 ruling upheld the need for water rates to be based on a cost-of-service nexus for each step in the water rate structure. This enhances the need for using well-thought-out cost-of-service analyses that pay attention to all three forms of rate equity—i.e., interclass, intraclass, and intergenerational equity, the principles of which were laid out in the seminal work by Bonbright and his co-authors (1988).

CONCLUSION

Setting of water rates has always presented difficult questions that have not been easy to tackle; those questions have become more complex and, as the various AWWA M1 manuals have attested (AWWA, 2012), cannot produce generic prescriptions that fit all needs. With water scarcity becoming ever more significant and the relative cost of water service escalating

beyond average consumer price trends, developing legally defensible sets of water rates will require diligent and often complex cost-of-service work and carefully considered application of this information by utility management and policymakers.

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