

## AWE Clearinghouse Web Site

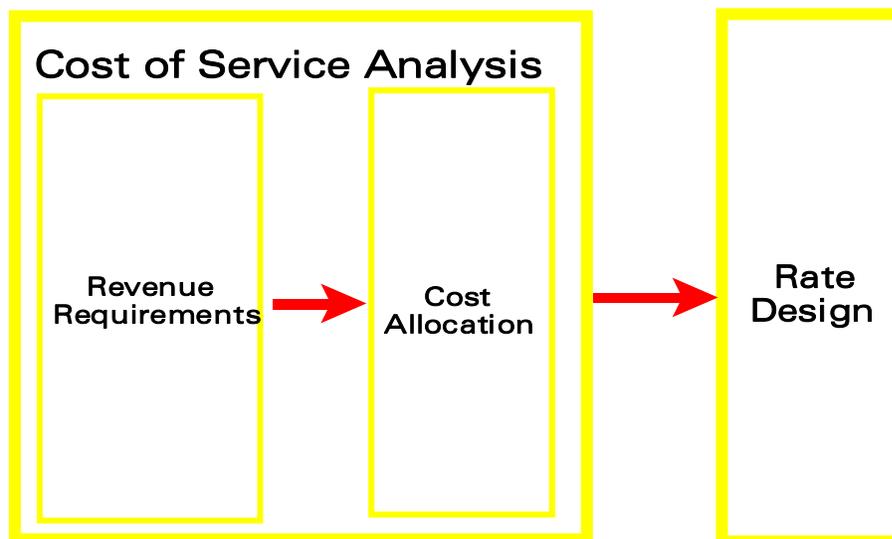
### Water Rates and Charges

#### RATE MAKING 101

Traditional ratemaking has involved three discrete, logical steps (Beecher and Mann, 1991; Raftelis, 1993)<sup>1</sup>:

- Step 1. Identify costs and the agency's revenue requirements;
- Step 2. Allocate costs to types of water usage; and
- Step 3. Design rates for each type of water usage to recover costs from customers.

Figure 1 displays these three different components of ratemaking.



**Figure 1: Components of ratemaking**

#### Revenue Requirements

To provide water service to its customers, a water agency must receive sufficient revenues to recover its costs, including operation and maintenance costs, capacity costs [represented either by depreciation allowances or by debt-related costs], customer costs, and administrative costs (American Water Works Assoc. Manual M1, 2000). The revenue adequacy objective is important because agencies that receive revenues substantially less than costs cannot, in the long run, stay in business. Adequate cost recovery is a necessary condition for maintaining a financially viable water agency.

---

<sup>1</sup> Portions of this Chapter have been adapted from the CUWCC Handbook for the Design, Evaluation, and Implementation of Conservation Rate Structures, 1996, with permission.

The process of determining an agency's revenue requirement involves an examination of annual costs, including both operating expenses and capital costs. Using prudent investment standards and least cost principles, a determination is made of the revenues required to meet prudently incurred costs (Beecher and Mann, 1993). This revenue requirement represents cost commitments of the water agency—payments to bondholders, wages to employees, and other expenditures necessary to the operation of the agency. The amount of revenue that a water agency should be permitted to earn through rates has been a controversial question. Very specific guidelines have been developed for the determination of revenue requirements.

## Cost of Service

After revenue requirements have been established, costs are allocated among different types of water users, and then rates are designed to reflect the cost of providing water service. The concept of cost of service ratemaking evolved out of electric utilities (Breyer et. al. 2002). The idea of cost of service ratemaking can be loosely stated: rates should be designed so that users pay in water rates for the costs they impose on the utility. Though the idea may be straightforward, considerable controversy can be engendered by any specific cost-of-service analysis. The practice of accepted “cost-of-service” methods is not a static picture and has evolved with both energy and water utilities.<sup>2</sup>

The key legal standards that have been set are that rates should be “just and reasonable” and that rates should not be derived on an “arbitrary or capricious” basis. These Supreme Court established principles for review of rates have, in practice, been interpreted in different ways<sup>3</sup>. One method of establishing “just and reasonable” rates is the standard that rates should not “unduly discriminate” against any customer or customer class. In practice, this “nondiscrimination” principle has been interpreted to mean that no customer or customer class should pay significantly more (or less) than the cost of providing service to that customer or customer class.<sup>4</sup> To avoid undue discrimination, rate analysts strive to achieve two forms of equity:

- Horizontal equity: Users with similar costs of service face similar rates.
- Vertical equity: Users with dissimilar costs of service face dissimilar rates.

A key choice in the cost-of-service analysis is whether or not to distinguish costs by “class” of customer. Customer classes—homogeneous groups of customers—have been justified by similarities in service requirements and demand patterns. Both service characteristics and use patterns affect the cost of service. The implication is that customers with similar service requirements and patterns of use should be placed in the same class of service. If customer-use

---

<sup>2</sup> Though many public utilities are not subject to formal rate regulation, some aspects of public utility ratemaking may be subject to judicial review, including “outside-City” or wholesale rates for service areas outside their jurisdictions. Though public water utilities may not be subject to the same kind of rate review that private water utilities are, the review of City Councils or Boards of Directors constitute a review process that some have interpreted as “quasi-regulation”.

<sup>3</sup> In the FPC vs. Hope case (1944) the majority opinion voiced by Justice Douglas stressed the adequacy of rates to maintain corporate credit. The dissenting opinion, voiced by Justice Jackson, stressed the need conserve the limited resource of natural gas for its most important uses—a distinctly conservation-oriented emphasis.

<sup>4</sup> “One of the reasons for the popularity of a cost-of-service standard of ratemaking no doubt lies in the flexibility of the standard itself. . . . A more important disagreement is that between those who identify cost of service with some kind of average or prorated total costs, and those who identify it with differential or marginal cost.” (Bonbright, 1988) p. 109.

patterns and service requirements are similar among customers, there is little reason to have multiple rate structures; if use patterns and service characteristics vary, then the establishment of customer classifications and multiple rate structures is warranted (Costanza, 1983).

*Fixed* versus *Variable* Costs: Many costing methods identify costs of water service as either *fixed* or *variable* based on the characteristics of the expenditures. *Fixed* costs are expenditures that remain relatively unchanged throughout the year, irrespective of the volume of water produced. Because large up-front capital costs are required to build capacity for meeting demand, some traditional costing methods classify all system expansion costs as fixed and refer to these costs as “demand” costs. *Variable* costs, also called “commodity costs,” are expenditures that vary directly with the volume of water produced or consumed; variable costs include purchased-water, electrical, and chemical costs. Marginal costing methods recognize that the dividing line between fixed and variable depends on the period of time used for the analysis. In the long run, fixed capital expenditures can and do change, thus becoming “variable.”

Standard ratemaking methods intentionally develop pricing on the basis of “cost causation” rather than the fixed/variable cost paradigm associated with cost accounting. The intent of AWWA rate methods are to impose costs on those responsible for their incurrence rather than as a reflection of capital-intensive cost structures.

#### **Cost of Service Analysis**

Traditionally water utilities (and regulators) use cost of service studies to allocate revenue requirements according to the cost of service (including capital and operating costs) associated with different patterns of water use. A cost of service study is used to identify, for example, variations in costs caused by seasonal and daily peak demands.

Three specific activities guide the allocation of costs:

- **Cost functionalization** separates costs into functional categories, such as source development, treatment, transmission, and distribution. The calculation of costs by functional category is provided directly by the accounting system or estimated indirectly using accounting information.
- **Cost classification** assigns functional costs to service characteristics. Several approaches are possible. The base-extra-capacity method assigns functional costs to average day, maximum day, and maximum hourly usage categories. The demand-commodity method allocates functional costs to demand and commodity usage categories. Other categories are often used for customer-related costs such as billing, metering, and fire protection. An important variation classifies costs by peaking period – peak versus non-peak.
- **Cost allocation** assigns each category of costs to customer classes. For example, customer related costs are usually allocated according to the number of service connections in each class. Capacity costs are allocated differently under the base-extra-capacity and commodity-demand methods. Costs are allocated to customer classes *in proportion to* the respective demands these customers place on the utility system.

## Rate Design

After revenue requirements are set and cost analyses performed, the rate analyst can begin to design the rate structure. The revenue requirement gives the design point for rates (how much revenue should be produced) and the cost analyses determine the appropriate price signal. Designing a rate structure that meets both revenue and cost allocation objectives is not, in general, enough to meet the agreed upon objectives which are typically defined early on in the ratemaking process as discussed below. There are other aims and other stakeholders in the ratemaking process. Analysts must make choices within each step. (Beecher and Mann, 1990, Raftelis, 1993).

There are several rate setting guidance documents that present a decision-theoretic approach to selecting a rate structure, including the AWWA M1 Principles of Water Rates, Fees, and Charges (2000). The AWWA M1 manual (Chapter 9) sets forth a three step selection process:

- Step 1. Defining Goals and Objectives of the Rate Structure
- Step 2. Evaluating Available Alternatives in Meeting Objectives
- Step 3. Understanding and Communicating Potential Effects on Customers

Step 1. Defining Goals and Objectives. The first step is defining the objectives that a rate structure is supposed to accomplish. These objectives both guide the design of a rate structure and form the standard against which alternative rates can be evaluated. The M1 manual lists potential rate objectives but provides limited discussion. Additional review of rate objectives can be found in Bonbright (1988), Chesnutt et al. (1996), or Raftelis (1993). In a public involvement process, these objectives are often elicited. Typical objectives might include:

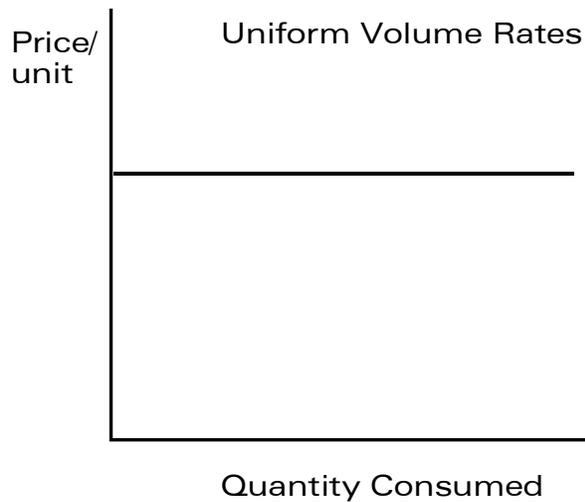
- ▶ Revenue Effects—revenue sufficiency, net revenue stability
- ▶ Consumption Efficiency— Water rates send price signals to customers about the worth of reducing or augmenting water consumption. This includes load management (efficient utilization of existing facilities)
- ▶ Resource Conservation— From the consumptive decisions of customers, agencies are sent signals about the worth of additional or improved water service. Rates should also balance costs that do not directly appear on utility financial books (externalities.) For example, water supply development costs likely understate the true economic costs of these supplies in that development costs do not reflect environmental and social costs incurred outside a market context.
- ▶ Consistency with cost-of-service principles—users whose service requirements impose costs on the utility should pay for those costs
- ▶ Administrative cost coverage—utilities incur direct costs in administering rate structures
- ▶ Institutional support—rates often must be approved by a city council, board, or public utility commission
- ▶ Affordability—Low income customers may have difficulty paying their water bills. Since some amount of water is a basic human need, many water utilities attempt to address the broader social goal of providing affordable water service.

- ▶ Public acceptance—Water rate structures must be accepted by customers.
- ▶ Equity—The perceived “fairness” of the rate structure is a key determinate of public acceptance. There is more than one valid definition of “fairness”.

Step 2. Evaluation of Rate Alternatives. The second step is rate evaluation where alternative rate structures are evaluated to determine how well they stack up against the objectives. What are the available rate structure alternatives and how should they be evaluated? One way to divide the universe of rate structures is to distinguish fixed charges (fees, taxes, or some constant dollar amount) from volumetric rates (price per unit volume). A *rate structure* can be composed of both fixed charges and volumetric rates.

When designing rates, utilities must determine whether to recover costs through *rates*, which vary with usage, or *fixed charges*, which do not vary with usage. The revenue collected through commodity charges varies with the amount of water used by customers; revenues from fixed charges are not sensitive to use. Examples of fixed charges include service charges and “readiness-to-serve” charges. Rates can send a message that consumers should conserve water; fixed charges provide no incentive to reduce water use. A common practice in rate design is to allocate costs that are sensitive to usage (such as pumping costs) to a volumetric rate, while allocating costs that are not based on usage (such as connection costs or customer costs) to the fixed charges. This research does not focus on the determination of fixed charges or on the allocation of costs between fixed charges and variable rates. Instead, this report will assume that a determination of the revenue required from volumetric rates has been made for the customer class in question. That is, we will assume that the revenue requirements from sales of water is known.

To understand water budget-based rates, two types of volumetric rates will be distinguished. Figure 2 depicts the simplest type of volumetric rate--a uniform rate where the same unit price (dollars per gallon or cubic foot) applies to all water use. A variation to a single uniform rate for all customers is uniform rates by customer class, where the rate varies by customer class but not within each class. Uniform rates are relatively simple, easy for customers to understand, and typically involve low administrative costs. Uniform rates are generally compatible with prevailing notions of equity and fairness. Uniform rates also recognize that certain unit costs of water provision (for example, treatment) remain relatively constant with increasing water use.



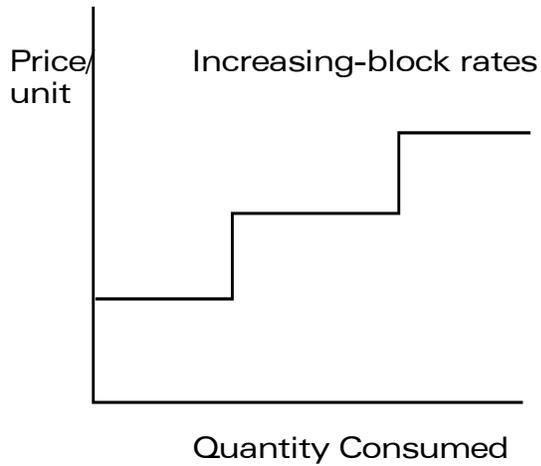
**Figure 2: Uniform rate structure**

Figure 1 depicts an increasing-block rate structure, the applicable unit price increases with the higher use blocks or tiers. The conceptual basis for the increasing-block rate as a conservation rate form is the belief that unit capacity costs associated with system expansion will increase with more costly supply sources. The argument in favor of increasing block rates, lies not in some intrinsic merit to charging different prices for different units of water consumed at the same point in time. Rather, the strongest argument for increasing block rates is practical: Under a revenue constraint, increasing block rates allow agencies to charge efficient prices (equal or close to the long run marginal cost) to more customers than would otherwise be possible.<sup>5</sup> Price increases associated with inclining blocks may also be used to reflect the costs of peak period use as much as the increasing costs of supply.

In actual practice, increasing block rate designs often have precious little to do with marginal cost pricing. Many utilities simply do not have a good idea of what marginal costs they face, and even fewer have consciously attempted to tie their pricing to these costs. In spite of the theoretical underpinnings, the reality on the ground is that most inclining block rates attempt to provide a politically acceptable conservation price signal.

---

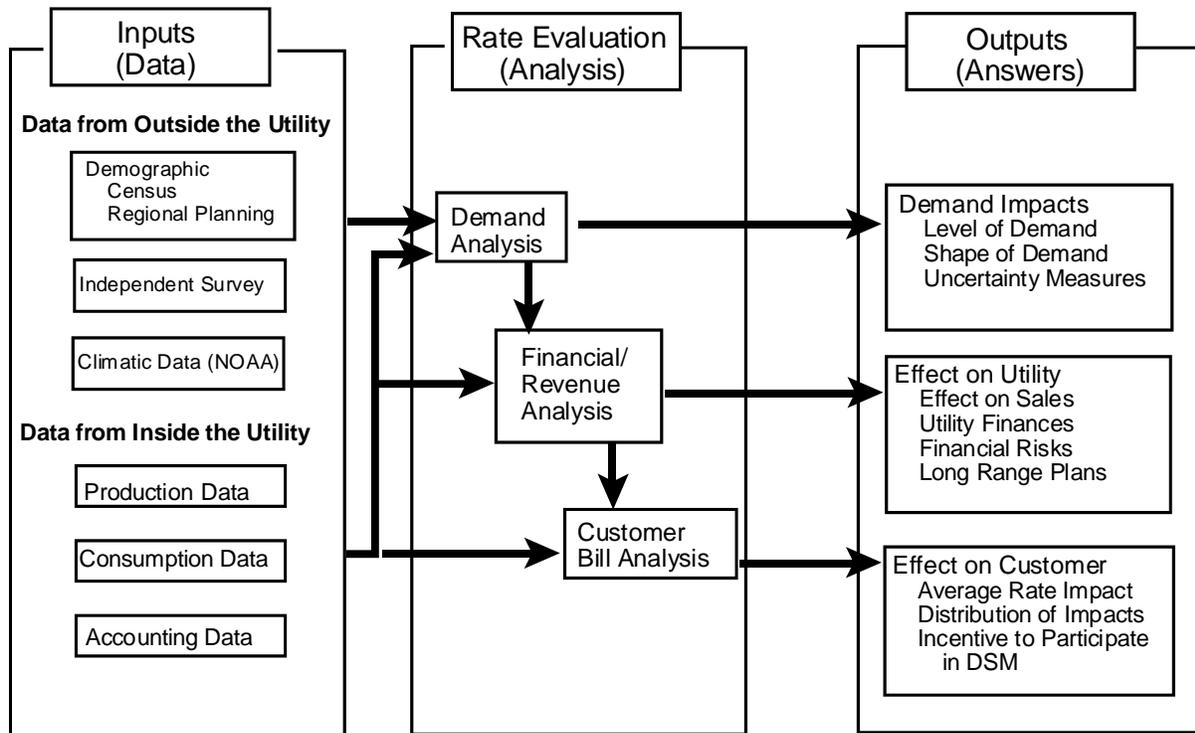
<sup>5</sup> If the cost structure of the water industry is characterized by increasing costs, an efficient price would reflect the higher (forward-looking) costs. Reflecting this higher cost in a price on all units of consumption would result in excess revenues—revenues collected on all units of consumption (based on a higher forward looking price) would exceed the revenue required for current costs (incurred from a mix of older costs that are lower and newer costs that are higher.) Increasing block rates collect less revenue from the first units of consumption while charging a higher and more efficient price for later units of consumption. In this way, they can send a more efficient price signal to more customers without over-earning.



**Figure 1: Increasing block rate structure**

Other variations of volumetric rates include seasonal rates (where higher prices are charged in peak seasons when costs are higher and/or supply reliability is lower) and drought pricing (where higher prices are charged during periods of scarcity to more efficiently allocate in times of shortage.)

Once a range of alternative rate structures have been defined, they can be evaluated against the selected criteria. Figure 2 displays one depiction for how rate structures can be evaluated. Water utilities entertaining water budget-based rate structures may need to allocate more time and resources to rate evaluation to obtain a better idea of their relative costs and benefits.



**Figure 2: Rate evaluation**

Step 3. Communication . The third step is understanding and communicating the potential effects of a rate structure on customers. Increased attention has been placed within the water industry to customer communication imperatives—improving customer understanding of both the rate structure that generates a customer bill and the service paid for by their water bills.