SUSTAINABLE WATER PRICING

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INTRODUCTION

The concept of sustainability seems intrinsically relevant to water pricing, but the connection is not always made. A sustainable water future depends on appropriate price signals (that is, prices based on marginal-cost pricing principles), but also on achieving a balance among other salient policy goals. In other words, basic economic principles provide necessary but not always sufficient input to the process of designing water rates.

A sustainable water price is a price that will (1) reflect true costs and thereby induce efficient water production and consumption, (2) promote optimization or the achievement of least-cost solutions to providing water service, (3) achieve equity in terms of incorporating cost-sharing practices as needed to enhance affordability, and (4) enhance the long-term viability of the water utility.

WATER SYSTEMS AS SYSTEMS

Water systems are systems in more than one respect. The conventional use of the term water system is used to describe the series of conveyances that supply treated water to customers. But water systems are systems in a much larger respect as well.

Whether or not pricing can achieve sustainability depends very much on the characteristics of a water system, particularly its size and composition, and whether or not it is organized and treated as a self-contained system. Sustainable water pricing suggests that the resources within the water system should support the cost of water system operations over the long term. Although it sounds simple enough, the concepts of sustainability and sustainable pricing raise a number of theoretical and practical issues, not the least of which concerns what constitutes a "system."

Systems theories are used to study creatures of nature, as well as creations of people. A system is a collection of entities and the relationships among them. The boundaries of a system can be defined in physical terms (such as spatially defined systems) or metaphysical terms (such as socially defined systems). Systems can be concentric, with smaller systems operating within larger systems. Systems also have a temporal or dynamic dimension.

Systems can be open or closed. An open system allows for causes and effects outside of the system's boundaries. In other words, external forces can come to bear on the system or the system can have an effect outside of its general boundaries. A closed system is self-contained; all activities and transaction are internal to the system. As a generalization, sustainability refers to a closed or bounded system.

In reality, of course, no system is perfectly closed. But the concept of sustainability suggests a high degree of self-reliance and the devotion of internal resources to systemic problems. The transition to sustainability often requires external resources or subsidies, perhaps phased out over an extended period, particularly when systems have limited resources to begin with and a history of unsustainability. An "investment in sustainability" can be very worthwhile for the provider and the recipient because it can yield long-term benefits that far outweigh costs. Sustainability also may require continuous adjustments within and among systems in order to achieve multiple policy goals.

SUSTAINABILITY AND RELATED GOALS

A sustainable pricing scheme will achieve a balance among multiple complex goals, namely the desire to:

- Induce efficient water production and consumption behaviors through cost-based prices.
- Promote optimal or least-cost solutions to providing safe and reliable water service.
- Address equity considerations, including the ability to pay and the need for cost sharing.
- Enhance the viability of water utilities in terms of long-term financial, managerial, and technical capacity.

This paper encourages consideration of sustainable pricing by water systems to balance multiple and sometimes competing policy goals. (See Figure 1.)

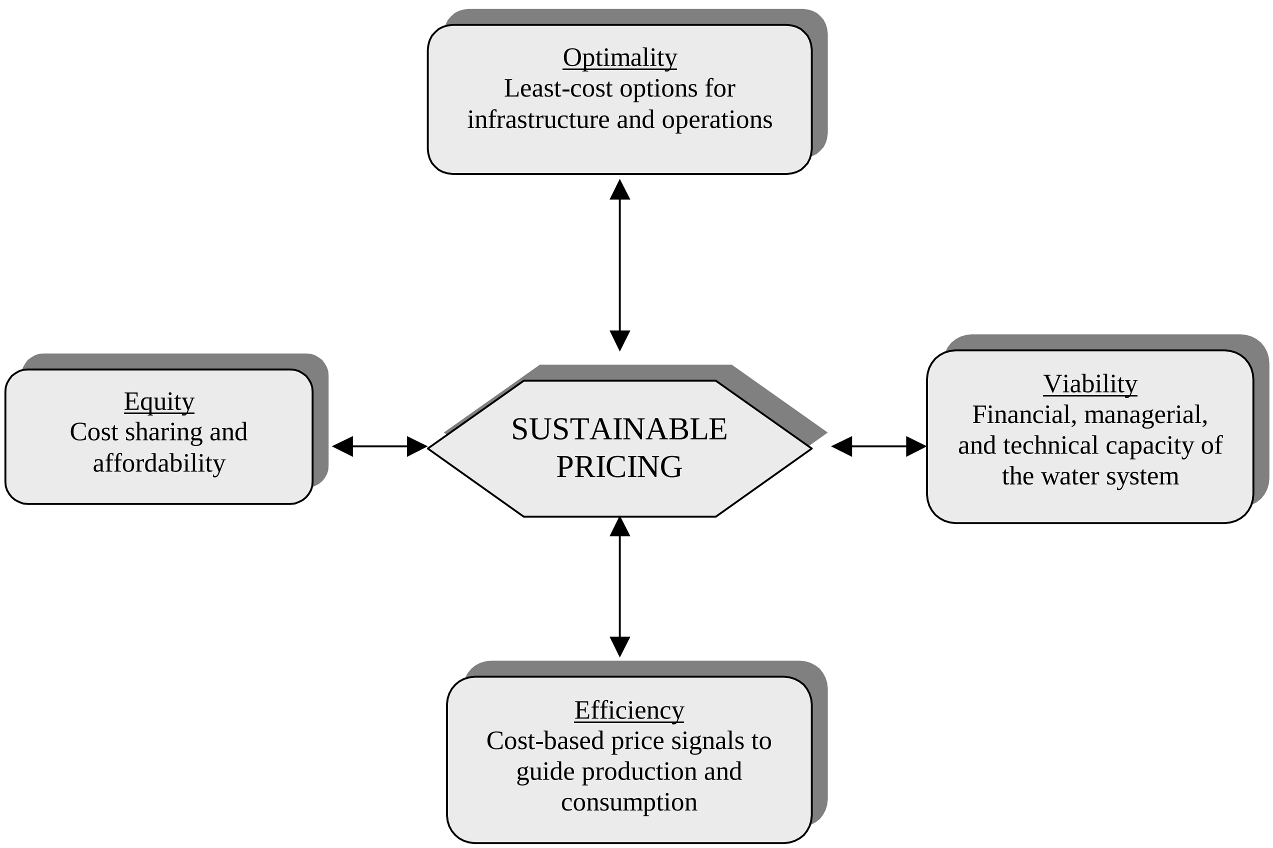

Figure 1. Sustainable Pricing and Related Goals

Efficiency

Economic theory argues for utility pricing that promotes overall *efficiency* for society. An efficient price signal leads consumers to consume, and producers to produce, an appropriate amount of a good or service. Prices that are too low can lead to underproduction (and overconsumption); prices that are too high can lead to overproduction (and underconsumption). (See Table 1.) This mismatch of supply and demand, and the "welfare loss" associated with it, has rippling effects throughout the economy because in using excessive resources to produce a good, or spending too much for that good, society foregoes opportunities to use those resources or expenditures elsewhere.

Economists long have argued for prices that reflect costs and against subsidies that distort price signals. Modern pricing theory more specifically calls for pricing based on marginal costs; that is, prices should reflect the incremental cost of producing an additional increment of a good. Prices based on long-term marginal costs will help achieve long-term efficiency in deploying resources. Even in an industry with high fixed costs, all costs are variable in the long run. Prices for water also should reflect cost escalation due to scarcity.

Table 1
Pricing and Efficiency

Pricing	Implications for Water Systems	Implications for Water Customers
Underpricing	❒ Jeopardizes financial capacity by reducing revenues. ❒ Can lead to postponement of necessary expenditures. ❒ Inflates need for supply. ❒ Can be politically motivated and difficult to overcome.	❒ More affordable water bills. ❒ Induces inefficient levels of consumption.
Overpricing	❒ Allows subsidies to other functions or services, or excess profits. ❒ Enhances financial capacity in the short term. ❒ Harmful to financial capacity in the long-term by dampening demand and inducing bypass.	❒ Less affordable water bills. ❒ Impairs the quality of life by unnecessarily constraining usage.
Sustainable pricing	❒ Ensures financial capacity. ❒ Encourages maintenance of the system over time. ❒ Facilitates sound decisions about future capacity needs. ❒ Reduces the need for outside subsidies.	❒ May or may not be considered affordable. ❒ Sends an appropriate price signal, inducing usage based on prices that reflect the cost of service.

Source: Authors' construct.

Efficient prices will promote efficient water usage. The demand for goods and services is partly a function of prices. Over time, prices affect patterns of demand, which in turn affect supply, which in turn affects costs. Of course, demand is not a function of price alone. But prices are considered essential to efficient use.

Economists believe that a price is not only *efficient* but also *equitable* if costs are allocated to the "cost causers." Using this concept, equity essentially serves efficiency goals. Ratemaking allows for "due discrimination" when costs among customer groups vary substantially. Taking a longer view, intergenerational equity holds that one generation of customers should not be forced to cover costs imposed by another generation.

Different kinds of water use and different kinds of water users present different kinds of costs. For efficient pricing, it is essential to allocate an appropriate share of cost to peak water users who account for the costs associated with meeting peak demand. This approach argues for seasonal and other rate structures that vary rates based on peak periods of water usage.

The use of pricing as a tool for promoting efficiency has limitations. For lower-income households, usage will be less responsive to changes in price. Discretionary water use by poor households also will be constrained by the lack of income. Therefore, pricing will be a less effective signal. In fact, price increases can cause hardship on households when choices about usage are constrained. Efficient prices frequently will raise equity issues.

Efficiency is a fundamental goal but it is not the only goal of utility pricing. Pricing also must help achieve a delicate balance between the interests of the utility and the interests of ratepayers, and in doing so pass the public interest standard. Efficiency is a necessary but not a sufficient element of sustainability. A sustainable price also must be affordable to water customers within the system's service territory (as discussed below).

Optimality

The costs on which efficient prices are based should reflect the least-cost means of investing in capital facilities, operating the water-delivery infrastructure, and complying with applicable standards. Finding least-cost solutions requires water systems to stretch beyond the usual spatial and temporal boundaries of planning and explore creative and even unconventional approaches.

Least-cost options can be found through technological and institutional means, and often the two combined. A key strategy for making any system more sustainable is to optimize size. Given very favorable circumstances, small systems can be sustainable. In the water business, however, very small systems suffer from a lack of economies of scale that typically preclude least-cost solutions.

Larger water systems have an advantage in terms of lower unit costs of production because of economies of scale. Economies of scale are a function of the volume of water produced. Even a small number of high-volume users can benefit the entire water system and the communities it serves. But larger systems have other advantages as well. For a larger system, costs can be allocated over a larger and more diverse customer base. More customers generally mean more diversity in terms of ability to pay (income). Larger systems are better able to cope with ability-to-pay problems within the service community. Rate design and assistance programs generally are more feasible for larger systems. Regionalization and consolidation of systems can achieve a variety of goals more effectively. Regional water systems can achieve economies of scale in financing, management, planning, source-water development and protection, and many aspects of utility operations. Some utility functions, such as water treatment, demonstrate substantial economies of scale. Importantly, some significant economies can be achieved for noninterconnected and even noncontiguous water systems. Commonly managed systems can avoid duplication of expenses associated with stand-alone management. In others words, groups of water systems can be combined to constitute a larger and more sustainable system.

Water systems also face size limits, however. A system that exceeds its optimal size due to technical constraints (such as barriers to long-distance wheeling) will be inefficient and impose environmental externalities as well.

Because water systems are very monopolistic in character, oversight agencies must continually provide encouragement and incentives for systems to seek least-cost solutions. In particular, water systems should be encouraged to explore cost effective means of restructuring, including consolidation and regionalization to achieve economies of scale.

Equity

Most economists seem to assert that efficient solutions are equitable. Political and policy scientists define equity much more broadly in terms of much softer and often less quantifiable terms – justness, fairness, and affordability. As costs rise, a sustainable future for the provision of safe and reliable drinking water requires some reconciliation of the efficiency and equity conundrum. Sustainable water pricing simultaneously addresses efficiency and equity considerations.

For competitive goods and services, the concept of economic efficiency encompasses equity in terms of willingness to pay. An equilibrium price reconciles supply and demand, which in turn reflects the producers' willing-to-produce and the consumers' willingness to pay for a good or service.

A critical distinction when considering affordability and sustainability is the difference between *willingness-to-pay* and *ability-to-pay.* Willingness-to-pay reflects consumer preference about purchasing a quantity of goods or services relative to prices. As prices rise, particularly for essential goods and services, consumers may demonstrate a reluctance or unwillingness to pay. A price-responsive consumer, for example, might reduce water usage in response to a rate increase. Put differently, willingness-to-pay is based on people's perception of the *reasonableness* of a price relative to their perception of the quality of a good or service.

The issue of *ability* to pay, however, falls squarely in the realm of equity and raises another host of issues. Ability-to-pay focuses not on whether consumers *will* pay for water service, but whether consumers *can* pay for water service. The ability to pay is primarily a function of income related to the cost of living, which in turn is primarily a function of employment. Some measures of income (weighted by the cost of living) and employment often are used in estimating a community's socioeconomic conditions and the related ability of consumers to support utility costs. For low-income households, the higher proportion of income allocated to fixed expenditures for essential goods and services - housing, food, utilities - can make paying bills more difficult. The availability of income assistance or bill-payment assistance programs can mitigate this problem.

One of the most difficult issues raised in the context of drinking water standards is the fundamental tradeoff between affordability and quality. Sacrificing even a slight degree of quality for affordability for some citizens raises salient and potentially far-reaching equity issues. Sustainability can help avoid the need to implement inequitable solutions.

No set of costs points necessarily to a single rate structure. As costs rise, more systems may find it necessary to implement more progressive rate structures (such as lifeline rates) in order to address equity considerations and keep water affordable. Broader solutions seek to share costs among more customers, as can be achieved in a consolidated rate (single-tariff pricing) for a group of systems under common ownership and management.

An affordable rate does not necessarily undermine efficiency goals. A specific rate can achieve a degree of cost sharing while sending an appropriate signal (that is, incorporating marginal costs in the portion of the rate, or tail block, associated with peak usage). In sum, a sustainable price must be high enough to meet the utility's revenue requirements and send an efficient signal to customers, but low enough for customers to afford so they can support the system over time. (See Figure 2.)

<u>Viability</u>

Sustainability, affordability, and viability are intrinsically related. If water costs are exorbitant and the water rate required to cover the cost of service is considered unaffordable to the customers served, long-term viability is jeopardized. In other words, a sustainable rate must meet the needs of both customers (in terms of affordability) and water systems (in terms of revenue sufficiency).

The Safe Drinking Water Act (SDWA) provides a strong rationale for sustainable water pricing without dictating pricing policy. The law clearly points to the importance of building the capacity of water systems to comply with standards. Capacity is defined in terms of the financial, managerial, and technical capability of water systems.

Water systems can draw on economic theory to guide pricing strategies. Sustainable pricing is grounded in marginal-cost pricing theory, which stresses economic efficiency as a fundamental goal. Efficiency is a necessary but not a sufficient element of sustainability. A sustainable price also is an affordable price. A system that cannot provide service at an affordable price cannot be sustained by its customer base over time.

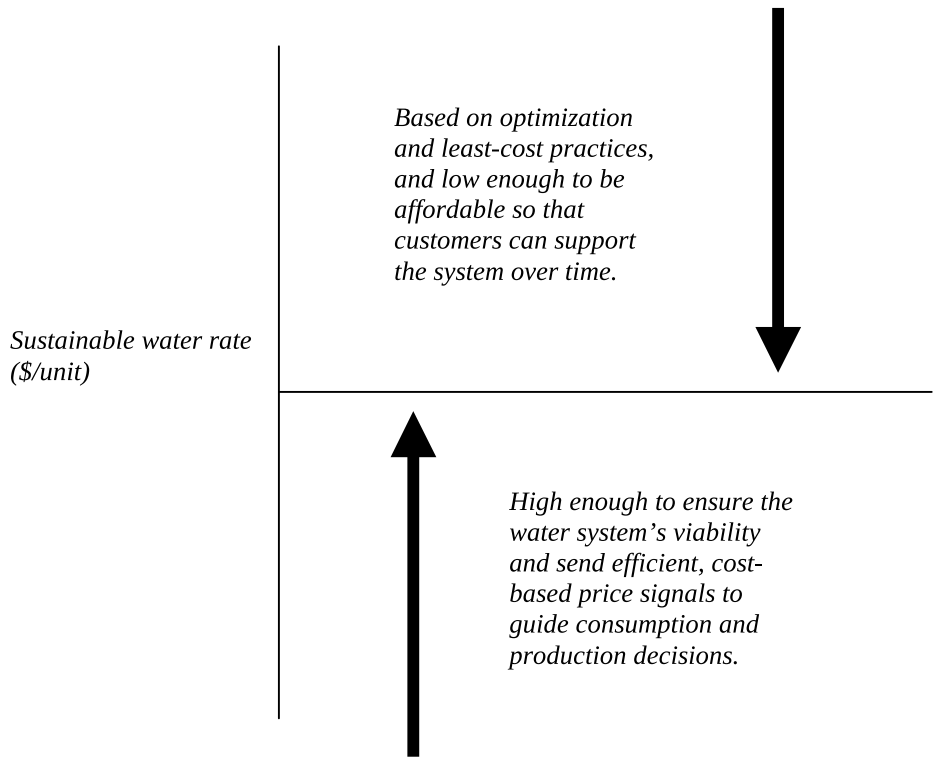

Figure 2. A sustainable price balances optimality, viability, equity, and efficiency.

The concept of sustainability raises the issue of whether and when subsidies to a system or within systems are appropriate (Table 2). In ratemaking, and in other policy arenas, "subsidy" can have a highly pejorative meaning. In reality, many activities within geopolitical systems are subsidized through taxes and other means. Indeed, all rate structures that group customers and average costs among them embed minor subsidies. The distinction between "cost sharing" and "subsidy," even within the narrow context of ratemaking, is largely subjective.

As suggested above, a sustainable water system should not require a subsidy for operating costs from external sources. A water system that is sustainable by virtue of pricing would not require subsides from any source other than ratepayers. The system requires revenues from customers in order to provide service to customers. For example, a municipal system that is fully sustained by rates or user charges would not need or use revenues from local sources (such as taxes and fees) or nonlocal sources (such as grants or loans). Water utilities can take several practical steps toward sustainability. (See Table 3.)

CONCLUSIONS

This paper suggests that the concept of sustainable water pricing may be important to the future of the water sector and the achievement of multiple policy goals. Sustainability can achieve a balance among goals and a whole that is larger than the sum of the parts.

As a generalization, larger water systems are more sustainable because they can achieve *optimal* solutions and spread the cost of service in a manner that maintains the *viability* of the water system through rates that are *efficient* and *equitable* for the customer base. Thus, the role of industry restructuring in achieving sustainability cannot be overemphasized.

Sustainable pricing may require an evolution from the somewhat rigid doctrine that guides pricing today. Marginal-cost pricing principles, while sound, do not speak to the real needs of water systems and the communities they serve. Sustainability can promote the goal of efficiency within a broader policy framework. Further theoretical and empirical research in these areas should be welcomed.

Table 2
Types of Subsidies

Types of subsidy	Provides the subsidy	Receives the subsidy
Internal Subsidies		
Intraclass	Residential ratepayer A	Residential ratepayer B
Interclass	Nonresidential ratepayer	Residential ratepayer
Intrasystem	Higher-cost customers	Lower-cost customers
Payment assistance to individuals	Ratepayers through voluntary contributions	Residential ratepayer
External subsidies		
Financial assistance to water systems	Governmental agency	Water system
Payment assistance to individuals	Governmental or charitable organizations	Residential ratepayer

Source: Authors' construct.

Table 3
Practical Strategies for Sustainable Pricing

1. Establish a long-term plan. Pricing and financial planning should go hand-in-hand with coordinated long-term planning to guide system management, investment, maintenance, improvement, and pricing decisions.

2. Seek optimal solutions. Achieving least-cost operations provides the basis for long-term efficiency. Least-cost solutions can be found in alternative technologies, alternative institutions, or a combination of the two.

3. Know the system's true costs. Knowing the true cost of water service is at the heart of sustainable water pricing. Many water systems, perhaps especially smaller system, may not fully appreciate the marginal cost of water service.

4. Understand the cost-price-demand linkage. Pricing obviously will determine whether revenues will cover costs. But pricing also will influence demand patterns over the long term.

5. Practice goal-oriented pricing. Making sustainability an explicit ratemaking goal will facilitate the development of effective rate structures.

6. Send accurate price signals. Prices that reflect true or marginal costs induce sustainable levels of supply and demand.

7. Communicate with customers. Water systems rely on well-informed customers; customer support for the utility's pricing choices is essential.

8. Address equity concerns. Policy choices have distributional consequences that should be understood and addressed. Equity and affordability are valid considerations in utility management and ratemaking.

9. Work with oversight bodies. Many systems are accountable to local or state governmental authorities, which may place particular requirements on the rate design process.

10. Monitor costs and revenues. Some rate design alternatives introduce more uncertainty into the system's revenue profile. Monitoring can help identify issues that require attention. Long-term sustainability requires continuous monitoring.

11. Make needed adjustments. No rate structure will produce theoretical results. Adjustments will move systems closer to sustainability and related goals over time.

12. Explore new approaches. Modern water systems can explore an expanding range of rate design options, many of which are very consistent with sustainability goals.

Source: Authors' construct.

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