United States Environmental Protection Agency

Expert Workshop on Full Cost Pricing of Water and Wastewater Service

November 1-3, 2006
Michigan State University
Institute for Public Utilities

Final Summary Report

Office of Water (4606M)
EPA 816-R-07-005
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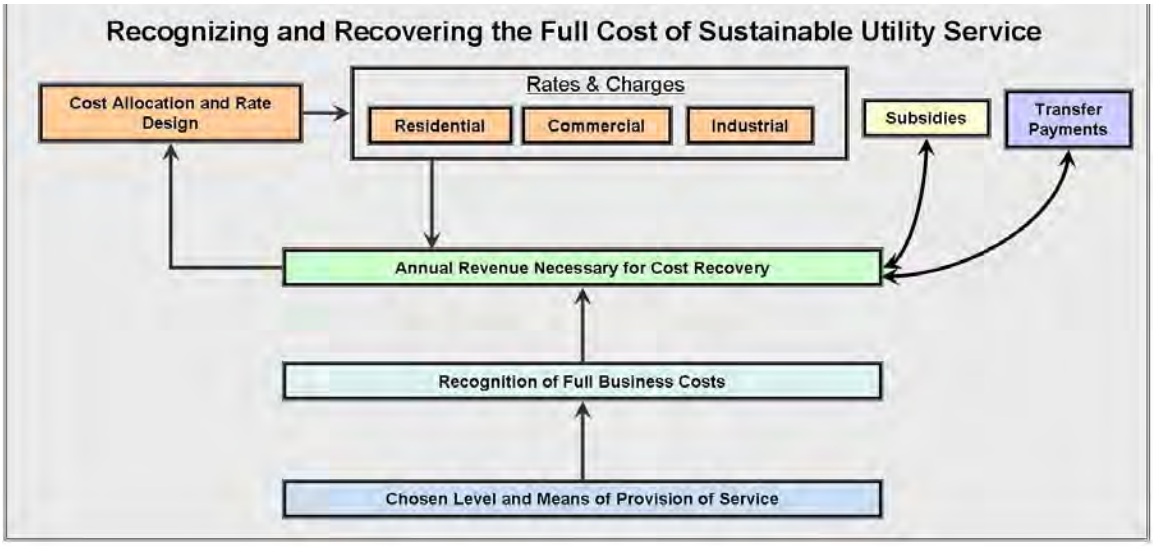
Executive Summary

The United States Environmental Protection Agency (EPA) convened an expert workshop of leading academics, water utility executives, Public Utility Commissioners and staff, utility rate setting practitioners, and other experts to explore the issue of "full cost pricing" for water and wastewater service. The workshop was held on November 1-3, 2006 at Michigan State University (MSU) and was co-hosted by MSU's Institute for Public Utilities.

Workshop participants generally agreed to the following definition and conceptual model for full cost pricing: Full cost pricing is a pricing structure for drinking water and wastewater service which fully recovers the cost of providing that service in an economically efficient, environmentally sound, and socially acceptable manner, and which promotes efficient water use by customers. The model below depicts the relationship between the level of service a utility provides and how it is structured to provide it; the full costs of doing business; the annual revenue necessary to recover costs; and cost recovery through some combination of rates and charges, subsidies, and transfer payments.



The Workshop consisted of formal presentations to frame key issues and extensive structured, facilitated discussion organized around the conceptual model. The formal presentations were:

- *History of the Safe Drinking Water Act, EPA's Sustainable Infrastructure Initiative, and the Full Cost Pricing Model*
- *History of the Safe Drinking Water Act and Clean Water Act Implementation and Evolution of the Water Industry*
- *The Water Industry Compared and Economic Regulation of the Water Industry*
- *The Investment Community Perspective on the Water and Wastewater Industry*
- *An Economist's First Impressions of the Water Industry*
- *Capital Efficiency in the Water Industry*
- *Level of Service: An Academic Perspective*
- *An Academic/Public Policy Framework for Understanding and Evaluating Alternative Institutional Structures for Provision of Desired Level of Service*
- *Framing Presentation on Asset Management*
- *Framing Presentation – A Local Elected Officials Perspective on Post Employment Benefits*
- *Framing Presentation on Cost Allocation and Rate Design*
- *Framing Presentation on Decoupling Revenues from Sales*

These presentations were used to tee up issues and concepts for open discussion among participants. The Expert Workshop brought together different perspectives on the fundamental questions related to full cost pricing of water and wastewater service. The objective of the Workshop was to achieve a deeper understanding of these issues from a variety of perspectives. The Agency will use the results of the Expert Workshop to help better frame the issue of full cost pricing for further deliberation and provide insight into a variety of possible approaches to facilitating industry movement toward sustainability.

Workshop participants generally agree that complete achievement of full cost pricing will be possible and successful only in an efficiently structured and managed water and wastewater sector. Embedded in the current structure, management, operations, and oversight of the water and wastewater sector are potentially significant inefficiencies. Eliminating these inefficiencies will help to minimize future cost increases and the magnitude of future rate increases. Comprehensive sectoral reform is needed and EPA's role should be to initiate, inform, enable and facilitate a broad national dialogue among all stakeholders about how to achieve our national public health and environmental protection goals in a cost-effective and socially acceptable manner.

As the workshop drew to a close, participants agreed that a number of key specific themes and issues had emerged in the discussions. The group identified and organized these themes and issues as presented in the diagram below to assist EPA and other stakeholders in better framing future thinking and discussion of full cost pricing and water & wastewater system sustainability.

Expert Workshop on Full Cost Pricing of Water and Wastewater Service

Key Issues Identified

"Meta-Issues"

1. Least Cost Achievement of Environmental & Public Health Protection Goals Across Watersheds.
2. Role of Economic vis-à-vis Environmental & Public Health Regulation.
3. Public Education & Building Public Support.
4. Role of Federal & State Subsidies.
5. Impact of Global Climate Change.

Industry Structure

1. Consolidation
2. Ownership and Management Contestability
3. Level of Service

Utility Management

1. Best Practices for Operational Efficiency
2. Asset Management to drive to least-cost
3. Risk Recognition & Management
4. Cost of Capital
5. Alternative Capital Project Delivery Methods
6. Uniform System of Accounts
7. Information Resources to Support Ownership and Management Contestability
8. Pricing Pardigm

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1.0 Background

The United States Environmental Protection Agency (EPA) convened an expert workshop of leading academics, water utility executives, Public Utilities Commissioners and staff, utility rate setting practitioners, and other experts to explore the issue of "full cost pricing" for water and wastewater service. The workshop was held on November 1-3, 2006 at Michigan State University (MSU) and was co-hosted by MSU's Institute for Public Utilities.

Full cost pricing is one of four major themes under EPA's Sustainable Water Infrastructure Initiative. The other themes include: management of utilities; promoting a watershed based approach to infrastructure planning; and promoting the efficient use of water. Taken together, the Agency believes that these four "pillars" of sustainable infrastructure will help enhance the efficiency of the water and wastewater sector in the United States and ensure achievement of our nation's public health and environmental protection objectives. The industry is entering an era characterized by significant infrastructure replacement need and new investment for enhanced public health and environmental protection. Overwhelmingly, the costs of these investments will be borne by the utility ratepayers.

The Expert Workshop brought together different perspectives on the fundamental questions related to full cost pricing of water and wastewater service. The objective of the Workshop was to achieve a deeper understanding of these issues from a variety of perspectives. The Agency will use the results of the Expert Workshop to help better frame the issue of full cost pricing for further deliberation and provide insight into a variety of possible approaches to facilitating industry movement toward sustainability.

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2.0 Workshop Participants

Janice Beecher, PhD
Director, Institute for Public Utilities
Michigan State University

Jack Betkoski
Commissioner, Connecticut Department of Public Utility Control

Tom Chesnutt, PhD
President, A&N Technical Services

Julius Ciaccia
Commissioner of Utilities
Cleveland, OH

Don Coursey, PhD
Professor of Public Policy Studies
University of Chicago

Debra Coy
Water Sector Research Practice Leader
Janney Montgomery Scott LLC

John Cromwell
Managing Economist
Stratus Consulting

Paul Foran
Vice President, Regulatory Programs
American Water

Joe Gehin
Director of Utilities
Wausau, Wisconsin

John Guastella, Sr.
President, Guastella Associates

John Guastella, Jr.
Director of Rates and Valuations, Guastella Associates

Heather Himmelberger
Director, New Mexico Environmental Finance Center
New Mexico Institute of Mining and Technology

2.0 Workshop Participants (Continued)

Christine Hoover
Pennsylvania Office of Consumer Advocate

John Huber
General Manager, Louisville, KY Water

Ralph Jones, PhD
CEO, The Cadmus Group, Inc.
Watertown, MA

Edna Loehman, PhD
Associate Professor of Agricultural Economics
Purdue University

Patrick Mann, PhD
Professor of Economics
West Virginia University

Myron Olstein
Independent consultant

John O'Neil
Wastewater Administrator, Johnson County (Kansas) Wastewater

Kathy Pape
Vice President, Treasurer and Rate Counsel, Aqua America, Inc.

Dave Sheard
Assistant Administrator, Wisconsin Public Service Commission

David Williams
Director of Wastewater, East Bay Municipal Utilities District (California)

3.0 Workshop Structure

In advance of the workshop, participants received a 5-page "Background Paper on Full Cost Pricing" which introduced a preliminary conceptual model for full cost pricing. The Workshop consisted of a small number of formal presentations to frame key issues and extensive structured, facilitated discussion organized around the conceptual model. The background paper and workshop agenda are presented in appendices A and B, respectively.

In order to promote full and open discussion, EPA decided to summarize the meeting without attribution of discussion comments to specific participants. Thus, participants were encouraged to speak freely and to represent their own professional opinion, not the institutional opinion of the organization with which they are affiliated.

In this summary report, individual comments by workshop participants are paraphrased and presented in bulleted lists organized by topic of discussion. These summaries of comments are intended to capture the breadth and depth of the workshop discussions. No attempt has been made to reconcile conflicting comments. The objective of the workshop was to elicit a variety of perspectives. This summary seeks to preserve and accurately reflect the substance of the discussions.

At the end of the workshop, participants did agree to an overall summary of the major issues identified. These workshop conclusions are presented in Section 9.0 of this report.

The Expert Workshop on Full Cost Pricing of Water and Wastewater Service was held at the Kellogg Conference Center on the Michigan State University Campus in East Lansing, MI.

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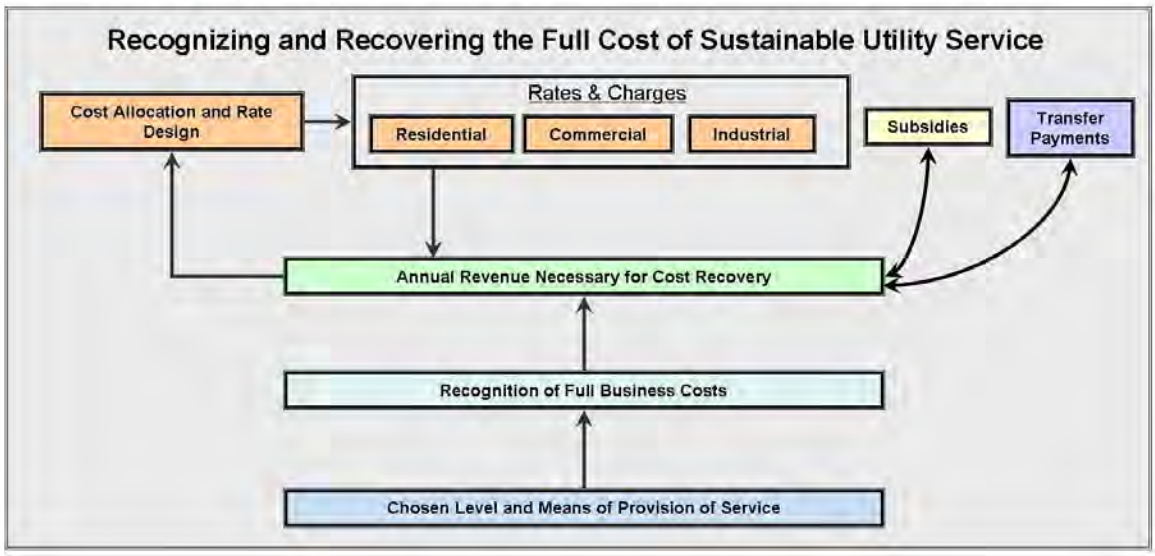
4.0 Definition and Conceptual Model for Full Cost Pricing

The following draft definition of full cost pricing was offered to facilitate discussion at the expert workshop:

Full cost pricing is a pricing structure for drinking water and wastewater service which fully recovers the cost of providing that service in an economically efficient, environmentally sound, and socially acceptable manner, and which promotes efficient water use by customers.

The conceptual model for full cost pricing is presented in Exhibit 1. The model depicts the relationship between the level of service a utility provides and how it is structured to provide it; the full costs of doing business; the annual revenue necessary to recover costs; and cost recovery through some combination of rates and charges, subsidies, and transfer payments.

Exhibit 1: Preliminary Conceptual Model for Full Cost Pricing of Water and Wastewater Services



The model posits that the fundamental determinants of the full cost of water and/or wastewater service are the level of service the public desires and the way in which a utility (or utilities) is structured and managed to deliver that level of service. Table 1, below, presents examples of issues and questions helpful in thinking about level of service and utility structure and management.

Table 1: Level of Service and Utility Structure and Management Considerations

System Type	Example Level of Service Issues	Example Utility Structure and Management Issues
Water	• Does system provide fire protection? • What peak flow demands can the system meet? • Number and duration of service interruptions per year. • Number of water main breaks per year (and damage caused by breaks). • Quality of water delivered to customer. Does it comply with federal/state health based regulations? Does it meet the aesthetic demands of customers? • Time to respond to customer complaints or questions. • Nature of system's "environmental footprint"—is it a "green" system? • Outreach and public education. • Opportunities for customer input and involvement.	• Utility ownership: public or private? • Utility scope: water or wastewater only? Both? Both including other? • Institutional structure: If public; line department of city government? Enterprise fund? Special district? If Private; is it a publicly traded corporation or a private owner? • Utility management: public or private? If owner does not manage, what is the nature of the contractual agreement under which some other party manages the system/utility? • Geographic scope of utility: Is it system or community specific or regional in nature?
Wastewater	• Number and duration of service interruptions (such as backups) experienced by customers. • Number of times and quantity of untreated wastewater discharged per year. • Quality of treated effluent: Does it comply with federal/state standards? Does it satisfy community expectations? • Time to respond to customer complaints or questions. • Nature of system's "environmental footprint"—is it a "green" system? • Outreach and public education. • Opportunities for customer input and involvement.	

A central question implied by the model is the cost effectiveness with which the selected utility structure and management is able to deliver the desired level of service. Is the desired level of service being obtained at least cost or the most appropriate cost? If not, is it being obtained in a manner optimizing appropriate social outcomes? According to whose perspective?

Assuming an appropriate level of service is being provided in a manner optimizing desired social outcomes, the model next reflects the need to fully identify all business costs associated with the provision of that service. At this point, the insights from the Better Management Pillar of the Sustainable Infrastructure Initiative are needed. In particular, a comprehensive asset management program or a similar planning practice through which the utility can estimate its long-term capital and operating costs. In this context long-term is defined as the life cycle of the assets of the utility. The planning process employed should address the lumpy nature of infrastructure investment and the

intergenerational equity issues associated with that. Critical issues will involve how capital projects are delivered (traditional vs. design-build for example), the cost of capital, financing alternatives, treatment of depreciation, and the optimum mix of maintenance vs. capital replacement in the real world operating environment of the utility.

Once the full business costs of providing the service have been determined, the annual revenue stream necessary to fully cover those costs must be calculated. If systems are under the jurisdiction of their State Public Utilities Commissions, this process will be governed by the established policies and procedures of the commission.

Once the annual revenue stream necessary to sustain the desired level of service has been determined, the model moves into the cost allocation and rate design process. Principles of cost allocation and rate design are well established. A critical question for the expert workshop is the current state of practice in cost allocation and rate design. Is there a need for significant innovation in this area? If so, of what nature? How important are cost allocation and rate design as opposed to the issues considered earlier in the model to achieve full cost pricing?

As an essential component of this analysis, the model calls for explicit consideration of the role that external subsidies (such as federal or state interest rate subsidies or grants) and transfer payments (such as movement of funds between a city's general fund and the utility) will play in meeting the annual revenue requirement. Subsidies will decrease the amount of revenue that needs to be recovered from ratepayers. Transfer payments from the city's general fund into the utility will also reduced the revenue that needs to be collected. The opposite will hold if the transfer payment is from the utility to the city's general fund. (The model is descriptive, not normative. External subsidies and transfer payments are reflected in the conceptual model to improve the model's ability to describe how costs are actually recovered by some systems. The model describes *how* external subsidies and transfer payments may play a role in utility cost recovery; the model does not, nor does it seek to, suggest the role that subsidies and transfer payments *should* play.)

After any correction for subsidies and/or transfer payments and after application of the selected cost allocation and rate design methodology, the annual bill for each user can be determined, assuming (if necessary) a given level of water use or wastewater generation. At this point, decision makers may conclude that the household rates, necessary to support the existing or desired level of service under the selected management and operational structure, are economically or politically not feasible. This would require a return to the beginning of the model to revisit decisions about level of service and/or the utility's structure and management/operations.

4.1 Discussion of Definition of Full Cost Pricing

- The proposed definition and model are sound and offer an excellent point of departure for this workshop.

- To get a better grip on full cost pricing, we need to know what it is not. What is the relationship between full cost pricing and full cost accounting? Also, what's the difference between full cost pricing and efficient pricing? What's the relationship with this and triple bottom line accounting?

- The definition of full cost pricing presented refers to economic efficiency. We need to give more thought to this as the definition is further fleshed out.

- I have a concern that including subsidies and transfer payments in the conceptual model tends to make it appear as if subsidies and transfer payments should be recognized as a legitimate part of the full cost of service pricing paradigm, when I'm not sure they are in fact consistent with it. One of the main goals of full cost pricing should be to send more accurate pricing signals to customers so that more informed and rational decisions can be made about consumption and better resource allocation and supply choices can be made. Rather than reflect subsidies and transfer payments as part of the full cost paradigm, perhaps it would be better to recognize them as issues that need to be addressed in terms of affordability and the need to perhaps target relief more specifically to those that need it rather than being part of the general pricing structure.

5.0 Summary of Framing Presentations

The workshop opened with 6 formal presentations designed to help frame the full cost pricing issue for discussion during the workshop. The framing presentations were:

1. History of the Safe Drinking Water Act, EPA's Sustainable Infrastructure Initiative, and the Full Cost Pricing Model.
2. History of the Safe Drinking Water Act and Clean Water Act Implementation and Evolution of the Water Industry
3. The Water Industry Compared and Economic Regulation of the Water Industry
4. Capital Efficiency in the Water Industry
5. The Investment Community Perspective on the Water and Wastewater Industry
6. An Economist's First Impressions of the Water Industry

Summaries of each presentation follow.

5.1 History of the Safe Drinking Water Act, EPA's Sustainable Infrastructure Initiative, and the Full Cost Pricing Model

Peter E. Shanaghan, USEPA

Early Federal oversight of drinking water dates back to the 1912 Common Cup Standard issued by the Public Health Service. This standard prohibited the use of a common cup for drinking water aboard interstate common carriers (trains and ships). Regulatory standards for the quality of drinking water aboard common carriers soon followed. As the 20th century progressed, the Public Health Service issued non-enforceable guidelines for the quality of tap water. States independently established their own regulatory programs for drinking water. In 1969, the General Accounting Office documented that only 60% of water systems delivered water meeting the PHS guidelines and over 50% of water treatment facilities had significant deficiencies.

In 1974, growing concern about the safety of tap water and the uneven patchwork of regulatory programs led to passage of the Federal Safe Drinking Water Act (SDWA). The SDWA authorized USEPA to develop enforceable public health protection based standards for drinking water quality. The law sought to build upon existing State regulatory programs through the concept of primacy. States having primacy for a Federal regulation have demonstrated the legal and institutional capability to enforce the Federal standard and assume the day-to-day oversight responsibilities for implementing that regulation.

From 1974 to 1986 EPA promulgated regulatory standards for 23 contaminants and 48 States obtained primacy. In 1986, Congress, impatient with what they felt was EPA's slow pace developing regulations, passed a set of SDWA Amendments that mandated regulatory standards for 83 contaminants within 3 years and standards for an additional 25 contaminants every three years thereafter. EPA, State drinking water programs, and water utilities all struggled to meet the ambitious agenda established by the 1986 amendments. By the mid-1990's it had become clear that the prescriptive formulation of the 1986 amendments was not working well and Congress significantly amended the law in 1996.

The 1996 SDWA Amendments emphasized comprehensive, multiple barrier public health protection. The amendments preserved the fundamental public health protection focus for standard setting and provided for a much more focused and science based approach to identifying the contaminants needing to be regulated. The amendments also established important new programs aimed at preventing unsafe drinking water. These included water system capacity development, operator certification, and source water protection. Furthermore, the amendments established the only Federal financial assistance program for water utilities focused on regulatory compliance, the Drinking Water State Revolving Fund (DWSRF) Loan Program. The DWSRF is designed to provide States with exceptional flexibility to tailor the program to their unique needs, including provisions authorizing optional set-asides which can be used to support

implementation of the new prevention programs as well as the base drinking water program.

The SDWA has consistently required that regulatory standards be set as close as feasible to the level at which no known or anticipated adverse health effects would occur with an adequate margin of safety.

Under the SDWA, any water system providing water for human consumption through pipes or other constructed conveyances, which serves at least 15 connections or an average of at least 25 persons per day, for at least 60 days per year, is defined as a Public Water System (PWS). There are presently 158,000 PWS's in this country. About 53,000 of them serve permanent communities and are referred to as Community Water Systems (CWS's). About 19,000 serve institutions such as schools or factories having their own water supply serving the same group of people over extended terms, and are referred to as Non-Transient Non-Community Water Systems (NTNCWS's). Finally, about 86,000 serve establishments such as road side rest stops, providing service to different people every day and are referred to as Transient Non-Community Water Systems (TNCWS's).

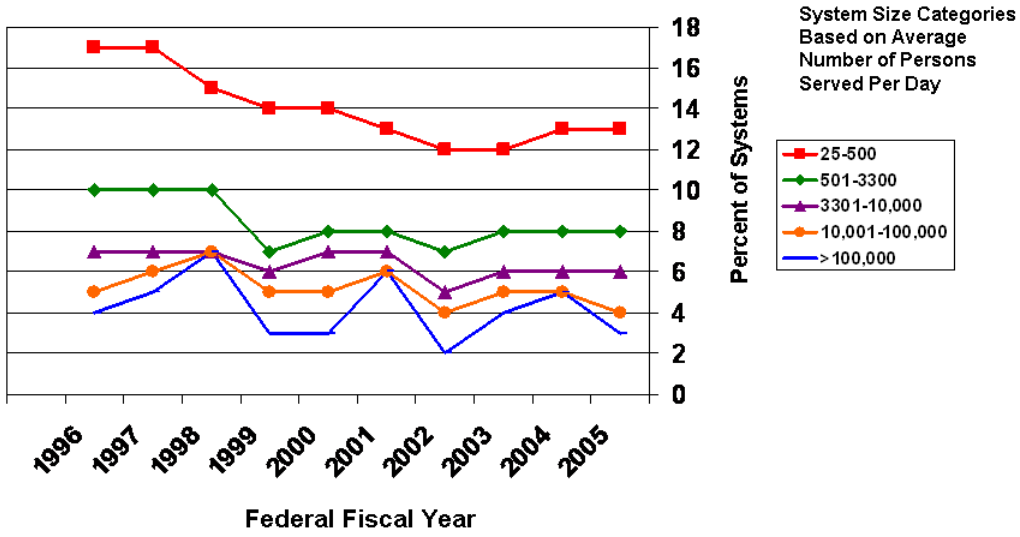
CWS's are overwhelmingly quite small. About 1/3 of the 53,000 systems serve fewer than 100 people each. Another 1/3 serve between 100-500 people each. Nearly 9 out of 10 serve fewer than 3,300 persons each. In addition to their small size, CWS's are institutionally diverse. 43% are publicly owned; 33% are privately owned; and 24% are mobile home parks or similar systems operated as part of a larger business enterprise. Of the 33% that are privately owned, about half are investor owned systems, about 35% are systems owned by homeowner associations, and the remaining 16% by individuals and others. Institutional diversity is most pronounced among systems serving fewer than 500 people each. About 40% of these systems are mobile home parks, 40% are private (overwhelmingly associations and individuals), and only 20% are publicly owned.

From 1997 through 2005 the number of CWS's decreased by nearly 4% while the total population served by all CWS's increased by 12%. CWS's now serve 95% of the population in the United States. The decrease in number of CWS's has been entirely in the number of systems serving fewer than 1,000 persons each. The number of systems serving fewer than 100 persons declined by about 13% during this period. The numbers of systems in larger size categories increased, in some cases by as much as 20-25%. It appears consolidation of smaller systems is occurring slowly and that population growth is being accommodated by larger systems.

If one postulates that Total Coliform Rule monitoring and reporting is a crude operational proxy for "system capacity" and operator competence; then it appears that larger systems do perform better than smaller systems as demonstrated in the chart below.

National Perspective

Percent of Systems Within Each Size Category With TCR M&R Violation(s) 1996-2005



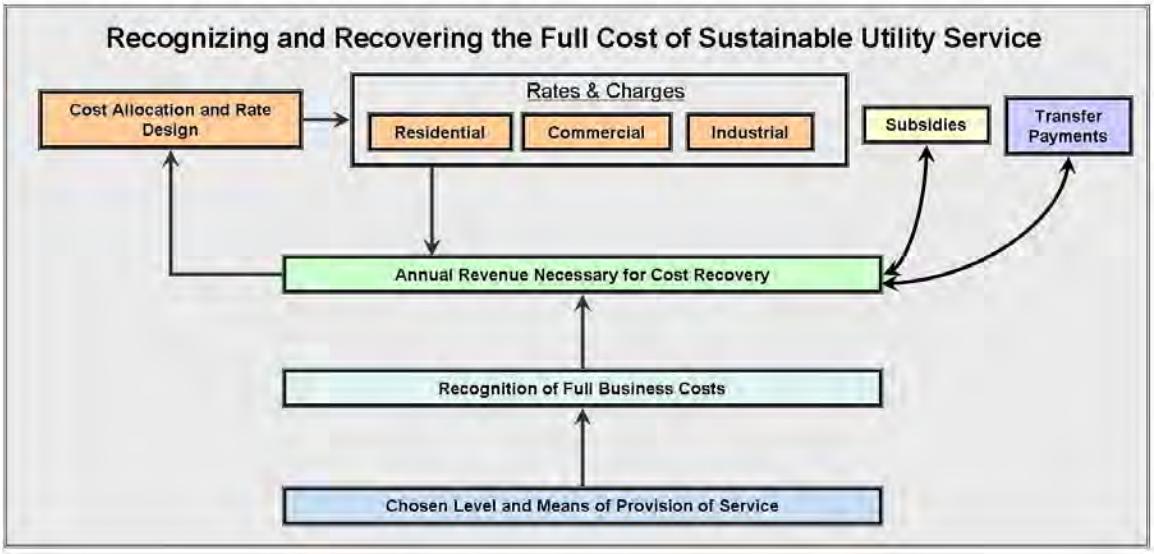
EPA's 2002 Clean Water and Drinking Water Infrastructure Gap Analysis documented that the 21st century will be marked by a significant need to replace drinking water distribution system pipe and wastewater collection system pipe that will reach the end of its useful life. Expenditures for capital replacement and operations and maintenance will need to annually grow by 3% above the rate of inflation in order to prevent the emergence of a spending "gap" with serious public health and environmental protection outcomes.

In response to these findings, and in consultation with stakeholders, the Agency established a long-term strategic focus of "sustainable infrastructure". The objectives of this strategic focus are to increase the efficiency of the water and wastewater sector (through better utility management, water use efficiency, and a watershed based perspective) and to facilitate movement of the sector to full cost recognition and recovery through full cost pricing.

Full cost pricing is a pricing structure for drinking water and wastewater service which fully recovers the cost of providing that service in an economically efficient, environmentally sound, and socially acceptable manner, and which promotes efficient water use by customers.

The following conceptual model for full cost pricing served as the basis of discussion at the workshop:

Exhibit 1: Preliminary Conceptual Model for Full Cost Pricing of Water and Wastewater Services



The model posits that the fundamental determinants of the full cost of water and/or wastewater service are the level of service the public desires and the way in which a utility (or utilities) is structured and managed to deliver that level of service. Table 1, below, presents examples of issues and questions helpful in thinking about level of service and utility structure and management.

Table 1: Level of Service and Utility Structure and Management Considerations

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Wastewater	• Number and duration of service interruptions (such as backups) experienced by customers. • Number of times and quantity of untreated wastewater discharged per year. • Quality of treated effluent: Does it comply with federal/state standards? Does it satisfy community expectations? • Time to respond to customer complaints or questions. • Nature of system's "environmental footprint"—is it a "green" system? • Outreach and public education. • Opportunities for customer input and involvement.	

A central question implied by the model is the cost effectiveness with which the selected utility structure and management is able to deliver the desired level of service. Is the desired level of service being obtained at least cost? If not, is it being obtained in a manner optimizing appropriate social outcomes? According to whose perspective?

Assuming an appropriate level of service is being provided in a manner optimizing desired social outcomes, the model next reflects the need to fully identify all business costs associated with the provision of that service. At this point, the insights from the Better Management Pillar of the Sustainable Infrastructure Initiative are needed. In particular, a comprehensive asset management program or a similar planning practice through which the utility can estimate its long-term capital and operating costs. In this context long-term is defined as the life cycle of the assets of the utility. The planning process employed should address the lumpy nature of infrastructure investment and the intergenerational equity issues associated with that aspect. Critical issues will involve how capital projects are delivered (traditional vs. design-build for example), the cost of capital, financing alternatives, treatment of depreciation, and the optimum mix of maintenance vs. capital replacement in the real world operating environment of the utility.

Once the full business costs of providing the service have been determined, the annual revenue stream necessary to fully cover those costs must be calculated. If systems are under the jurisdiction of their State Public Utility Commissions, this process will be governed by the established policies and procedures of the commission.

Once the annual revenue stream necessary to sustain the desired level of service has been determined, the model moves into the cost allocation and rate design process. Principles of cost allocation and rate design are well established. A critical question for the expert workshop is the current state of practice in cost allocation and rate design. Is there a need for significant innovation in this area? If so, of what nature? How important are cost allocation and rate design as opposed to the issues considered earlier in the model to achieve full cost pricing?

As an essential component of this analysis, the model calls for explicit consideration of the role that external subsidies (such as federal or state low interest rate loans, loan subsidies or grants) and transfer payments (such as movement of funds between a city's general fund and the utility) will play in meeting the annual revenue requirement. Subsidies will decrease the amount of revenue that needs to be recovered from ratepayers. Transfer payments from the city's general fund into the utility will also reduce the revenue that needs to be collected. The opposite will hold if the transfer payment is from the utility to the city's general fund. However, such subsidies and transfer payments can also mask the full cost of service, skew price signals to customers and generally undercut the concept and goals of full cost of service pricing. A key question for the expert workshop is the role that subsidies and transfer payments do and should play in the pricing of water and wastewater services.

After any correction for subsidies and/or transfer payments and after application of the selected cost allocation and rate design methodology, the annual bill for each user can be determined, assuming (if necessary) a given level of water use or wastewater generation. At this point, decision makers may conclude that the household rates, necessary to support the existing or desired level of service under the selected management and operational structure, are not economically or politically feasible. If additional subsidies and/or transfer payments are not available, the only option is a return to the beginning of the model to revisit decisions about level of service and/or the utility's structure and management/operations.

5.2 History of the Safe Drinking Water Act and Clean Water Act Implementation and Evolution of the Water Industry

Ralph Jones, PhD; The Cadmus Group, Inc.

Federal involvement in the regulation of drinking water and wastewater came in the last quarter of the 20th century. Prior to the passage of the Clean Water Act (CWA) in 1972 and the Safe Drinking Water Act in (SDWA) 1974, regulation of both drinking water and wastewater was a State responsibility. Generally, State programs for both water and wastewater were located in a Department of Health since the primacy concern of the State programs was public health and sanitation, specifically to reduce or eliminate the spread of disease by waterborne contaminants.

Each of the federal statutes had its own unique history. In the case of the Clean Water Act, it had become clear that the 1965 Water Quality Act had failed. States were required to set water quality standards, but there was no effective enforcement of those standards. In 1969, the nation witnessed a burning river. The Cuyahoga River in Cleveland was so contaminated with flammable materials that it caught on fire. The Congress decided to launch a federal program to make waters of the United States fishable and swimmable by expanding the federal role, especially in enforcement.

The Safe Drinking Water Act had no preceding federal statute. States set standards for drinking water quality, and the nation's utilities were (by and large) providing a high-quality product. Two events changed the course of history. First, the Public Health Service conducted a survey of community water systems in 1969. It reported that many water systems, especially the small ones, did not produce water that met federal public health standards. Second, in the City of New Orleans, research suggested a causal relationship between contaminants in the city's water supply and elevated levels of cancer in city residents. It therefore was time for federal standards and enforcement.

The federal role in funding infrastructure began much earlier than the federal regulatory programs. In the 1930's, construction of wastewater treatment plants and collection systems was part of the Works Progress Administration (WPA). Even after the WPA, the federal role continued. In 1965, the Water Quality Act initiated a construction grants program. This program was substantially enlarged in the 1972 Act when the Congress sought to invest in upgraded treatment of municipal wastewater. The federal government built Publicly Owned Treatment Works (POTWs). There was no comparable investment in infrastructure for drinking water.

Since 1980, there has been a steady decline in federal investment in water and wastewater infrastructure. In 1980, the investment was $10 billion. By 1988, it had dropped to $4 billion, on its way to $2B in 1995. The major change came in 1987 when the Clean Water Act was reauthorized. Authorization for the construction grants program was ended. In its place, Congress authorized capitalization grants for State Revolving Funds (SRF). After funding at an annual pace of about $4 billion, appropriations began to decline in 1993. Funds increased slightly in 1996 with the passage of the SDWA

Amendments which authorized the creation of a Drinking Water SRF (DWSRF).

Reflecting on the implications of federal investment in water and wastewater infrastructure, it is clear that the funding of the Clean Water SRF (CWSRF) was consistent with the objectives of the 1972 Act which was an ambitious statute designed to achieve significant improvements in water quality as fast as possible. The POTWs substantially reduced contaminants in receiving waters. At the same time, however, economic historians note that the rapid expansion of federal funding displaced, to some extent, local and state investment that would have taken place in this period.

When one compares the current federal programs for drinking water and wastewater, there are striking differences. One major objective of the CWA is to permit dischargers in a manner that will enable receiving waters to achieve water quality standards. Municipal dischargers (POTWs) are a portion of the regulated community. EPA currently regulates about 16,000 POTWs, plus hundreds of thousands of private dischargers.

The drinking water industry is comprised of about 200,000 entities that provide drinking water to the public (defined as any system that serves more that 25 people or more than 15 connections). The industry has both publicly owned systems and privately owned systems. Water systems are needed to provide piped water to any dense development. These same developments can rely on septic systems for wastewater disposal.

The histories of these two programs has implications for full-cost pricing. Wastewater systems were constructed with substantial federal funding. They are "publicly owned" treatment works. When it came to developing rates, most systems emphasized the costs of operations and management. Insufficient attention was paid to the need to plan for eventual rehabilitation and replacement. It is not surprising that the National Association of Clean Water Agencies (NACWA) continues to advocate for enhanced federal investment in wastewater infrastructure.

For drinking water systems, adjustment to full-cost pricing may be a bit easier. These systems were built without substantial federal investment. The DWSRF provides loans (not grants), and it is only a decade old. Drinking water systems traditionally have been forced to consider both O&M and infrastructure as they established rates. The only weakness in current behavior of water systems is that they may not be properly accounting for the replacement cost of their legacy infrastructure, e.g., distribution pipe installed 100 years ago which will soon need replacement.

5.3 The Water Industry Compared and Economic Regulation of the Water Industry

Janice Beecher, PhD; Michigan State University

Utilities provide: products; services; commodities; infrastructure; networks; access; economic foundations (development); strategic targets (terrorism); comforts (heat, light, safe drinking water); and, basic human rights (subjectively).

The structural status of the public utility sector can be viewed along a spectrum, with the water industry as arguably the most monopolistic utility, due to market failures. The electricity sector is less monopolistic; restructuring has introduced competition (with mixed results). Less monopolistic still are the gas and telecommunication sectors. The gas sector has seen the development of competitive wholesale markets. The telecommunications sector is arguably the least monopolistic sector, primarily due to technology.

In the private sector, water and sewer have a comparatively small share of the economy (0.07% of the gross domestic product [GDP], compared with 2.35% for electricity distribution, and 2.27% for wired telecom carriers). In reality, however, the water and wastewater industry is a $100 billion business (water utilities accounting for $33.8 billion, wastewater utilities for $32.6 billion, equipment and chemicals for $23.6 billion, and engineering and consulting for $10 billion).

Key characteristics of the water and wastewater industries include:

- Their highly essential nature (drinking water, wastewater service, fire protection).
- The quality/safety/health dimension.
- Technical/resource constraints (e.g., weight, hydrogeology, and transience).
- Economies of scale/scope.
- Capital intensity and the long lives of assets.
- Cost profile (rising costs; t&d).
- Demand patterns (flat, inelastic, peaks).
- Pricing and (under)pricing practices.
- Fragmented and bifurcated industry structure; limits to networks, competition.
- Regulatory environment (quality, quantity, price, and jurisdiction issues).

It's difficult to find comparable statistics within other industries. It is difficult to compare the water and wastewater industry with the electricity sector, for example, because water is a storable commodity for which there is no real-time pricing. In addition, there is a strong seasonal component—the source of supply is depleted when demand is greatest. Available data show great economics of scale with water, though some economies are lost in the distribution network. The smallest systems struggle the most. Telecom equipment depreciates very rapidly, while the water industry has extremely long-lived assets with very long depreciation schedules. Compared with other industries, the water and wastewater industries are extremely capital intensive and therefore fundamentally different in nature; capital intensity is also trending upwards.

Water utility revenue and expense data (from the National Association of Water Companies [NAWC], 2004) demonstrate how heavily the industry relies on residential business (which accounted for 63% of revenue). In addition, the water industry's industrial customers have adopted conservation and efficiency practices (according to NAWC, industrial customers accounted for only 4% of revenue in 2004). NAWC expenses include depreciation (12%), taxes (16%), deductions (10%, including debt), dividends (9%), and operations and maintenance (O&M) expenses (50%). Net income was limited (3%).

Comparing the O&M expenses of an electric utility with that of a water utility, it is evident that the electric utility is focused far more on source and supply, while the primary focus of the water utility is transmission. Source of supply and production-related O&M expenses account for nearly 90% of the electric utility's expenses and less than 5% of the water utility's expenses. Treatment, transmission and distribution, and pumping expenses account for the majority of the water utility's O&M expenses, followed by administrative and general (A&G) expenses.

When looking at household expenditures, water and sewer service are still a relative bargain (0.75% of household expenditures, compared with 2.38% for electricity and 2.19% for telephone). Overall, the percentage of household incomes going to utilities is relatively stable. As household incomes increase, so does spending on utilities. However, the percentage of income spent on utilities is much higher for lower-income households. Between 1970 and 2005, water/wastewater was one of the only industries (in addition to cable television and garbage services) with price trends above the rate of inflation.

There are several key pressures impacting water prices:

- Rising costs coupled with flat or declining demand.
- Combined water, wastewater, stormwater costs.
- Infrastructure replacement needs.
- Regulatory compliance costs.
- Impact of energy markets and costs.
- Historic under-pricing (public systems).
- Incentives for conservation and efficiency.
- Rate shock and rate design options.
- Affordability and regressivity.
- Comparison to other utilities and to bottled water.

The water industry itself is fragmented (there are many water systems nationwide), bifurcated (by size and ownership), and pluralistic (there are many interests invested in the industry). The industry's structural character is defined in terms of size and ownership of assets, management of operations, and interconnection (in limited local and regional instances).

A water "system" is not always a utility—utilities may own multiple systems and some systems are interconnected and purchase water on a wholesale basis (about 15%).

Municipal gas utilities in the U.S. are generally breaking even, while municipal electric utilities may even be losing money. Municipal wastewater utilities are conceivably undercharging customers, as are municipal transportation authorities and water utilities. Cities are subsidizing and undercharging for certain services.

Surprisingly, the private share of the water market has remained very stable. Many very small systems (those serving 500 or fewer persons) are privately owned, while the majority of small, medium, large, and very large systems are publicly owned.

Water quality regulation at the federal level is the responsibility of Congress and EPA. At the state and local levels, Safe Drinking Water Act (SDWA) primacy agencies and local health departments oversee water quality. Water quantity issues are regulated to a limited extent by river basin commissions (for interstate matters), and to a greater extent by state resource commissions and water management districts (at the sub-state level). Ultimately, regulation of the water industry is done primarily at the local and state level. All but five public utility commissions (PUCs) have jurisdiction over water pricing; there may also be additional local controls on pricing.

Key considerations on the economic regulation of the water industry include the following:

- Economic regulation by the states is based on persistent market failure in the form of monopoly (private, some publics).
- Forty-five states regulate about 8,000 jurisdictional water utilities and about 1,000 sewer companies (including combined utilities).
- Commission jurisdiction covers about 20% of all community water systems; some are "multi-system utilities."
    - About half are investor-owned (private); the rest are divided evenly between municipals, water districts or authorities, and nonprofits and cooperatives.
- Many non-jurisdictional utilities (municipal utilities) follow the lead of regulators on accounting (Uniform System of Accounts and Records [USOA]), ratemaking, and other practices.
- Economic regulation focuses on prudence, profits, prices, but PUCs may also impose service-quality standards, including water pressure and aesthetics (color, taste, and odor).
- In the presence of persistent market failure—particularly monopoly—economic regulation is a proxy for competition to prevent abuse of market power.

Overall, we have seen the introduction some auctioning/and competitive bidding/metering/outsourcing, but ownership of assets and operation remains fundamentally monopolistic. This is not necessarily a bad thing, as long as accountability remains.

5.4 The Investment Community Perspective on the Water and Wastewater Industry

Debra Coy, Janney Montgomery Scott

The global water market is $350-$400 billion, dominated by municipal water and wastewater utilities. From an investor standpoint, these utilities are viewed as having steady/moderate growth, tied to the rate of investment and population growth. There is more investment interest in higher growth areas related to these industries, such as new technologies and infrastructure supply and equipment; there is more net profitability in the latter areas.

Why are investors looking at this industry? Reasons include: the need for investment in infrastructure and supply; an increase in political, public, and media awareness; an increase in the number and types of companies entering the water business. However, many consumers don't understand the economics of water provision.

Technology industries are being brought into the water industry through more sophisticated treatment (UV, membrane filtration) and other technologies (e.g., automated meter reading).

U.S. and international water utility and equipment stocks have dramatically outperformed broader market indexes, but have also become more volatile. This is partly related to uncertainties about politics and pricing of water. There have been recent corrections due to excess valuation and concerns about slowing economic growth and rising interest rates. The rebound in market earnings has somewhat assuaged investor fears.

The perception of risk in the water industry is rising; it used to be viewed as a sleepy/slow growth investment. Now, however, there is pressure on critical supplies, costly regulations and infrastructure, more security concerns, high capital expense requirements and low depreciation, tariff lag effects (low rates - takes a long time to recoup investment), local political risks. This is a quandary for investors not used to investing in companies with a disparate (capital expense) gap.

The pros to investing in this industry include the following: water is an irreplaceable commodity; utilities have a natural monopoly; stable municipal service; high capital expense requirements drives need for investment; large project opportunities, technology development is accelerating industry growth; the active mergers and acquisition market drives valuation

The cons to investing in this industry include the following: political risk; the limitations that government controls place on profitability; insufficient market pricing; higher capital intensity creating the risk of lagging return; significant project risks; industry fragmentation (with many small companies); mixed industry experience with corporate business strategy execution.

Ultimately, this is a very small industry relative to the gas and telecommunications industries. In addition, it is difficult to turn a social good into a business/commodity.

Due to high capital intensity and flat per capita usage (plus low prices), industry investment needs consistently outpace cash flow. Most utilities can't finance their own operations from internal cash flow, let alone invest in growth—they require frequent infusions of capital. How can this be sustainable? Investors have concerns about constantly having to provide new infusions of capital (debt or equity).

Investors need to get comfortable with the regulatory compact; that is, that PUCs will continue to allow reasonable returns on ongoing investment, supporting perpetual negative cash flow. Water utility investors understand that high capital expenditure generates asset expansion and earnings growth, as long as reasonable returns are allowed. There is significant regulatory risk for investors; the regulatory structure doesn't allow for a smooth pattern of earnings with ongoing demand.

Again, tariff lag also creates uncertainty. Capital spending needs are increasing while rate increases won't keep up with spending. Delays or unfavorable treatment of mergers and acquisitions can also have a large impact on returns, impacting utility consolidation efforts.

There are also local political issues concerning who should own the assets and setting prices, opposition to rate increases and private sector involvement, regular changes in political and personnel structure of local governments and PUCs.

The sources of capital are also finite and limited, and include: government funding (SRFs/earmarks/state grants); debt, which requires debt service coverage (municipal or corporate bonds, project finance debt, vendor financing); equity, which requires a return on investment (public equity, private equity funds); and user fees, the ultimate source of funding.

The relative cost of various sources of capital may not always be as it appears due to tax implications, administrative costs, operating efficiencies, and equity valuation.

IOUs are generally approximately 50% equity funded. Municipal systems are almost all funded by debt. There is not much equity going into the market, but this is starting to change. We are seeing a lot of large infrastructure funds being raised (upwards of $10 billion) by larger banks and companies; these institutions are looking at buying companies and investing directly in local infrastructure. This represents a new pool of capital on the equity side, coming into the industry, with interesting implications. Equity won't go anywhere without return and the new market players understand that this is a business in which they can expect a 10-12% return on equity. If more investors are willing to accept this return, this may expand the pool of investors in the industry.

The industry has limited political visibility for industry; we have done a fairly poor job educating the public about the full value of water.

Equity investors have shorter term views than debt investors, which does create new pressure on performance and may create some additional potential volatility, as equity moves more quickly in and out of markets. However, the perception that all equity investors only look at short-term returns is incorrect. We're seeing that with the pension fund industry, which are attracting investors who want steady long-term returns. As we move through the learning process, there probably will be some volatility as investors become more educated.

5.5 An Economist's First Impressions of the Water Industry

Don Coursey, PhD; University of Chicago

I've been asked to offer future perspectives on full cost pricing. In the past, I've been involved with some water-related issues, trying to apply market-based solutions to public policy questions. Currently, I'm working on developing water trading systems in water basins in New Mexico.

The rationality and efficiency of a market is tied to the notion that both partners are better off from the exchange. I have been taking this concept and trying to apply it to much larger public policy questions. On the surface is a bid; below the surface, there are many constraints. One example of the solutions realized through market development is energy trading, which has led to incredible amounts of efficiency gains.

Looking ahead 20 years in the drinking water industry, there are a number of questions and issues that arise. Why do so few systems serve so many people, and why are there so many systems serving so few people? Should EPA be providing above market subsidies for water systems to consolidate? While deregulation was blamed for the California energy crisis, Californians' electricity costs are approximately a quarter of those for Midwesterners. In New Mexico, people pay about one-half as much for water as those in the Great Lakes area. In my own community, water is drawn from Lake Michigan and filtered. With new security measures around the facilities, water costs have quadrupled. The water industry and consumer costs are being impacted by homeland security and electrical reliability.

We need to put costs for water and wastewater in context; people are willing to pay far more for soft drinks and other beverages than for tap water. In addition, Americans tend to understand the bigger environmental issues such as global warming and deforestation, but do not understand local issues such as sources of local resources and how water, electricity, etc., is delivered to them. Public education focuses on bigger problems, leaving most with no sense of connection to their local utilities and how they operate. In addition, people generally also have no sense of how much water costs; even examining local utility bills, it can be difficult to understand. The prices of other resources (e.g., gas) are far more obvious and visible.

We also need to consider peak load pricing—would it be difficult to do some of the things we've seen in the electric industry, such as peak load shifting? I have never heard of an industry in which the base load was decreasing while the peak load increased. Full cost pricing will not be a complete solution until it includes peak load pricing.

The education issue seems to be dire. The public's understanding of the sources, price, etc., of water is so limited and there is a lack of transparency with water pricing. We need to remind the public that they will always be paying for water in some way, either through taxes or otherwise. Is it more efficient to pay the full cost directly, through rates, or to send money through the state and local government through other fees and taxes before it goes back to the water system?

5.6 Capital Efficiency in the Water Industry

Myron Olstein, Consultant

Water and wastewater are two of the most capital-intense industries; capital is the single largest cost of water utilities and capital needs are increasing. Some utilities can increase their capital efficiency (amount of dollars in plant required to generate $1 of revenue): 7.03 for water; 7.85 for wastewater (vs. 1.61 for electric, 0.94 for gas distribution, 1.11 for telecom, and 0.35 for S&P 500) Usually half or more than half of a typical utility's costs is capital–related (far more than O&M).

What does a high asset ratio mean? That the utility is not efficient? That its rates are too low? Is it impossible to compare these industries, because water and wastewater assets are very long-lived? Are other industries underfunding their needs?

Capital costs are a large and growing percentage of utility costs. Debt service as a percentage of annual revenue requirements is also on the rise. At the same time, capital needs are increasing (as reflected in the sudden jump in the needs estimated in the 2003 Drinking Water Infrastructure Needs Survey).

In addition, bids are coming in significantly above (up to two times) engineers' estimates. Several factors are driving this: dramatic increases in the price of raw materials (China is doubling its use of raw materials; the price of pipe has increased significantly); aging skilled construction workers; supply-demand conditions (if two adjacent communities put out simultaneous bids, they are drawing from same pool of contractors—the communities will either get an inflated bid or no bid); stacking of subcontractors (there has been an increase in the parsing out of risk; more subcontractors marks up the bid); surety driven pricing (sureties demanding that contractors put in bigger contingencies).

Other factors include: increasing interest rates (debt service will be more expensive); the retirement of senior utility personnel and loss of their knowledge of their systems; and, declining federal support.

Why isn't problem the being noticed? High growth utilities are being funded by developer fees; while the impact is not being felt today, it will over time. In addition, utilities are not seeing significant resistance to rate increases. This year, New York City went in for a 9.4% increase without much resistance. New York City surveyed rate increases at 24 large water systems and found that the average was a 9.2% increase.

What are the solutions? Increased federal support is a possible option, though unlikely to happen (in addition, more money to the market can lead to dramatic construction cost increases). Asset management systems will help, once systems are able to use their infrastructure data to become more capital efficient. In the meantime, however, most utilities are seeing capital costs increase when they implement asset management as they will identify needs that they were previously unaware of.

In the 1990s, there was a focus on O&M efficiency that resulted in unit staffing reductions. However, this trend is reversing and NACWA surveys indicate that O&M costs are increasing once again. With O&M cost increases and factoring in the rate of inflation, rates will have to increase at up to three times the rate of inflation to keep up with increasing costs.

Non-construction/light construction alternatives are more likely to be cost-effective. ***The single biggest area where utilities can lower capital costs is in achieving a fairer allocation of risks in their contracts.*** Current contracts typically put all the risk on the contractors, which can result in no bidders for contracts.

AwwaRF is currently documenting case studies that treat conservation as an alternate source of supply (New York City has spent $330M to save $1 billion in water supply expansion costs); foreign utilities generally have higher levels of capacity utilization, smaller footprints, and more zealously pursue alternative project delivery.

6.0 Level and Means of Provision of Service

6.1 Framing the Level of Service in Terms of Full Cost Pricing

The conceptual model posits that the fundamental determinants of the full cost of water and/or wastewater service are the level of service the public desires and the way in which a utility (or utilities) is structured and managed to deliver that level of service. Table 1, below, presents examples of issues and questions helpful in thinking about level of service and utility structure and management.

A central question implied by the model is the cost effectiveness with which the selected utility structure and management is able to deliver the desired level of service. Is the desired level of service being obtained in the most cost-effective manner? If not, is it being obtained in a manner optimizing appropriate social outcomes? According to whose perspective?

Table 1: Level of Service and Utility Structure and Management Considerations

System Type	Example Level of Service Issues	Example Utility Structure and Management Issues
Water	• Does system provide fire protection? • What peak flow demands can the system meet? • Number and duration of service interruptions per year. • Number of water main breaks per year (and damage caused by breaks). • Quality of water delivered to customer. Does it comply with federal/state health based regulations? Does it meet the aesthetic demands of customers? • Time to respond to customer complaints or questions. • Nature of system's "environmental footprint"—is it a "green" system? • Outreach and public education. • Opportunities for customer input and involvement.	• Utility ownership: public or private? • Utility scope: water or wastewater only? Both? Both including other? • Institutional structure: If public; line department of city government? Enterprise fund? Special district? If Private; is it a publicly traded corporation or a private owner? • Utility management: public or private? If owner does not manage, what is the nature of the contractual agreement under which some other party manages the system/utility? • Geographic scope of utility: Is it system or community specific or regional in nature?
Wastewater	• Number and duration of service interruptions (such as backups) experienced by customers. • Number of times and quantity of untreated wastewater discharged per year. • Quality of treated effluent: Does it comply with federal/state standards? Does it satisfy community expectations? • Time to respond to customer complaints or questions. • Nature of system's "environmental footprint"—is it a "green" system? • Outreach and public education. • Opportunities for customer input and involvement.	

The discussion of level of service and means of provision of service was preceded by two formal presentations to help frame the issues:

1. Level of Service: An Academic Perspective
2. An Academic/Public Policy Framework for Understanding and Evaluating Alternative Institutional Structures for Provision of Desired Level of Service

Summaries of these presentations follow.

6.2 Level of Service: Economic Perspectives on the Range of Social Choices

Edna Loehman PhD; Purdue University

Types of management decisions that must be made regarding water supply include short term decisions (supply quantities, supply sources); medium term decisions (operations, maintenance, and reliability, level of source and treatment quality); and long term decisions relating to sustainability (infrastructure needs; development of new sources; environmental considerations; community acceptability of the management system). For example, long term sustainability may require investment in infrastructure such as aquifer storage and retrieval, advanced water treatment for recycling and re-use, dual piping systems, desalination, etc. Particularly for the longer term issues, EPA studies have shown that decisions involve great cost, complexity, and require value judgments.

Social choices associated with making such decisions exhibit a wide range: management, organization, and institutions; decision criteria, analysis methods, and decision methods; and funding methods. Below issues about application of these means are summarized, emphasizing the potential contributions of economics.

● Types of Economic Goods and Implications

Economists have identified different types of economic goods with an eye toward making prescriptions about appropriate economic institutions and organization. For water systems, different types of goods include:

- ○ consumption goods (one person's consumption excludes another's);
- ○ public goods (all consumers experience the same quality);
- ○ shared facilities (outputs produced in common facilities);
- ○ externalities (decisions can have downstream impacts);
- ○ inter-temporal goods (infrastructure is shared over time);
- ○ common pool goods (for groundwater, one generation's choices can affect another's);
- ○ risky goods (e.g., supply needs subject to weather).

From welfare economics concepts: different types of pricing rules and production arrangements are needed for different types of goods. While private production and markets are appropriate for pure consumption goods, more complex decision processes and economic institutions are needed for externalities, public goods, inter-temporal goods, and risky goods.

In particular, "level of service" , i.e. quality aspects of water supply, has the nature of a public good and so cannot be correctly determined via only market forces. However, the alternative is not purely government determination and provision. Participants in water management and decisions include: water suppliers, water consumers, local health departments, hydrologic region water managers, state

environmental quality agencies, and federal agencies, i.e. involvement in management is poly-centric. If change in the level of service is considered socially desirable, it will be accomplished through a mix of government, private, and non-profit participation.

● Economic Organization

Organization has to do with assignment of decision-making, resources, and rewards. Economic principles for organization — brought into focus by Oliver Williamson — concern the transactions costs associated with different types of organization, and reducing transactions costs is desirable. The nature of hierarchy has been a focus, and more generally, centralization versus decentralization of production and decision-making. Decentralization is thought to reduce information and incentive costs.

The scale of organization has also been of interest (see Werner Hirsch). Economies of scale in service provision have been studied in police services, health care, and education). Generally, there is a scale for which total costs — when both provision and transactions costs are included — are minimized.

Both transactions costs and scale questions are relevant for water provision. To reduce costs of water provision –including information, monitoring, and enforcement costs as well as direct water supply costs – we need to consider the appropriate scale of organization. For example because of resources, continuity, and quality control, data management and modeling may be more appropriately carried out by state or federal agencies rather than by a local agency. On the other hand, some supply aspects may need to be locally tailored, e.g. supply issues are treated differently in eastern and western regions because of geographic and legal differences; contamination sources are different for rural and urban areas.

To identify more specific improvements in water provision, it may be helpful to think about water provision as an economic system. Generally in an economic system, functions include production, allocation, finance, income distribution, monitoring, enforcement, transactions and administration. Additional functions carried out by organizations include planning and investment, information and research, and education. A paradigm for water management/ organization design is to determine which agent – among governments, private producers, non-profit agencies – would be best suited to carry out each function. Criteria for adoption of improved management include implementation costs, transaction costs, effectiveness, fairness, and freedom of choice/flexibility/resilience. Economists add the criterion of efficiency to this list.

● Economic Institutions

Economic institutions – or rules of the "game" – are important tools for water management. Such tools include: contract design; pricing rules; methods of finance; cost sharing rules (government subsidy for improving efficiency, or several parties sharing costs of a joint project); and trading institutions to help allocate water among public and private uses (e.g., "cap and trade", water banking, and other exchange process).

Economic institutions may not have been given sufficient attention for water provision. For example, until recently cost recovery for water services has been predominantly with flat rates. Adoptions of increasing block rates indicate new attention to conservation concerns among water providers.

Cost recovery and finance methods are of great interest for water provision. Without cost recovery for needed service improvements, water systems will not be sustainable. Besides recovering costs, users paying full costs of service is an important economic incentive: inefficient consumer choices may be made if user costs are subsidized, because users are then not comparing their benefits with cost of service. On the other hand, subsidies may be appropriate when smaller communities cannot afford the costs of quality service, when a level of quality is deemed necessary for the public good.

Appropriate institutions can help to integrate decisions of public, non-profit, and private agencies. For example, a contractual arrangement between a local government and a private water supplier – with appropriately specified terms and incentives – may result in reducing cost of water supply. Government as a representative of the public trust should be involved in specifying quality aspects for contracts as well as providing incentives and enforcing contract terms. In turn, the involvement of citizen groups may reduce the cost of monitoring service quality.

- Economic Analysis Methods

According to Douglas North, social change occurs when perceived benefits of change exceed perceived costs. The problem is to determine the balance ex ante.

Benefit-cost analysis can be a useful tool to help identify desirable changes. Not only is benefit-cost analysis relevant for evaluating investment alternatives, it can also be applied to evaluate regulations (as EPA has done) and to evaluate alternative types of organization and institutions for water provision. In this case, not only direct supply costs but also costs of transactions, information, monitoring, and enforcement are relevant.

In any application, the analysis should include appropriate accounting for non-market goods, temporal goods, risky goods, and discount rate(s). In benefit-cost analysis for non-market goods such as public and quality goods, methods of valuation of willingness to pay (or accept compensation) are required. The discount rate reflects the willingness to pay for returns at various time periods relative to up-front costs. The dollar amount that a person is willing to pay (or accept) for a good may differ from a market value because it is a reflection of personal values and priorities as well as personal ability to pay. Because such values are personal, they are difficult to measure.

EPA has conducted many studies of non-market values and costs to help make decisions about quality-related goods. EPA frequently uses the method of “benefit transfers” to avoid difficulties and costs of specialized measurement. It remains to be seen whether the benefit transfer method adequately reflects values at a local level.

- Collaborative Process

"Experts" aren't necessarily suited for making choices about social organization and management. In the face of difficulties of governments and experts in establishing desired management/ organization and institutions, a deliberative process or collaboration among citizens, governments, and experts could help to identify and adopt appropriate means. Collaboration refers to the direct involvement of relevant publics in determining a common future, aimed at finding voluntary agreement over mutually chosen outcomes.

When there are difficulties in formal analysis and differences in value systems, a deliberative process can replace the need for formal analysis if relevant values and costs are well-represented in the process. Frank Fisher has been a proponent of the ability of citizens to deal with complexity and incomplete or uncertain information.

There are certain difficulties that arise regarding selecting and adopting changes in water management and organization. First, there are multiple interest groups who may have different concepts about desirable outcomes as well as different notions of appropriate roles for government. Some of these differences may be attributed to complexity and lack of information, but some have to do with basic values. There are also issues of property rights as well as resistance to trying new things.

Though the notion of a collaborative approach appears idealistic, experiments have shown that people appear to place a value on achieving a successful group outcome, i.e. the deliberating group reaching agreement. Agreements found by "values juries" show that people can give up strict self interest if they feel that they are contributing toward the common good in a difficult social situation. Agreement among diverse groups can be based on identifying shared meaning and common ethics. Education and direct communication among interested parties can help to develop these shared values.

Because good decisions should be science-based – i.e., based on knowledge of human and natural systems as well as good logic – it is essential to incorporate the physical and social sciences into deliberative process. In this context, we need to consider which types of communication, information, and opinion tools will be most efficacious. Correspondingly, process may need to be modified according to the kinds of issues and situations under deliberation.

Related needs for government involvement in water supply provision are to act as organizers and facilitators of deliberative process, developers of information and education materials, and providers of funding for such purposes.

[It should be noted that public participation in hearings and public reviews is not the same as collaboration. For public participation, there are concerns about what is done with public input (i.e., how should it impact decisions), inadequate time for interchange and information exchange, and inadequate levels of participation.]

6.3 An Academic/Public Policy Framework for Understanding and Evaluating Alternative Institutional Structures for Provision of Desired Level of Service

Janice Beecher PhD: Michigan State University

The structural dimensions of the water industry include:

- Ownership versus operation
- Large versus small
- Wholesale versus retail
- Regulated versus nonregulated

The 1996 SDWA Amendments do include restructuring incentives, including:

- Capacity assurance—technical, managerial, financial—for new and existing water systems (§1420)
- Consolidation Incentive - Enforcement (§1455)
- Variances (§1415)
- Exemptions (§1416)
- State Revolving Fund (§1452)
- Research (§1420)

The institutional options for publicly owned/nonprofit water systems include:

- Government owned
    - Municipalities and states
    - Districts (local)
    - Authorities (regional)
- Associations
- Cooperatives
- Nonprofit organizations and corporations

The institutional options for privately owned water systems include:

- Private/single owner (private but not publicly traded)
- Publicly traded (a utility that operates multiple systems and issues stock)
- Holding company/multistate utility (a utility organized as a holding company that operates multiple utility companies, usually in several states)

Other hybrid institutional options include:

- Municipal corporations
    - Epcor in Alberta
    - Louisville, Kentucky
        - City of Louisville is the sole stockholder
        - Not organized as a municipal agency
        - The system is publicly owned and privately operated as a for-profit agency with an appointed board of directors
- Public trust (i.e., assets are placed in public trust, as with the Citizens Gas Company of Indianapolis)

There are numerous rationales for privatization. There are philosophical underpinnings to some arguments for privatization, including (in increasing order):

- Populist rationales (privatization will be better for society in general)
- Ideological rationales (privatization will limit government involvement or the need for government institutions)
- Pragmatic rationales (privatization leads to great efficiency)
- Commercial rationales (privatization generates more business)

Additional rationales for privatization include the following:

- Privatization complements competition and contestability
- Privatization provides an influx of private-sector resources
- Privatization introduces a profit motive to achieving social, environmental, and other goals
- Privatization promotes operational efficiency (e.g., labor, energy, chemicals)
- Privatization encourages innovation in management
- Privatization contributes to labor-force professionalism and mobility.

When considering the "ethics" of the public versus private debate, there are several key positive and negative arguments for both options. The positive aspects to keeping utilities in the public sector can be seen from a public service perspective, and include: openness and accountability, fairness and equity, and environmental stewardship. The negative aspects relate to the political and bureaucratic elements of necessary oversight of public utilities, including: rules and regulations, patronage and expediency, and inefficiency and stagnation.

The positive aspects to the private sector option include performance-optimizing practices such as efficiency practices, technological innovation, and entrepreneurship. On the other hand, private sector utilities also aim to maximize profits, which may result in a neglect of public goods, a tendency towards monopoly, and secrecy and inaccessibility.

Advocates of privatization have hypothesized that public water systems:

- Experience more construction-cost overruns
- Postpone improvements
- Overcapitalize (even more than private systems)
- Overutilize debt
- Incur higher capital and operating costs
- Are less efficient in procurement and scheduling
- Innovate slowly if at all
- Provide longer tenure
- Have greater debt capacity and access to capital
- Are more risky and realize lower returns
- Subsidize or receive subsidies from other local government entities
- Set rates further from costs (and marginal costs)
- Favor voters, businesses, and organized groups

Private sector involvement can occur along a continuum from limited involvement to complete privatization. Options along this continuum include: limited partnerships; lease financing; build and transfer; build, own, and operate; contract operations; merchant facilities; and, complete asset sale.

There are two distinct models of privatization—contracts and ownership. Under the contracts model there is: public ownership with "delegated" management; limited use of private capital for major projects; intense short-term competition for contracts. With this model, there is public ownership and the competitive market "substitutes" for regulations (i.e., there is very limited review by state regulators). Potential advantages to the contracts model include efficiency and professional expertise, lower cost of capital for infrastructure, and the perception of local control. Potential disadvantages include: the decoupling of ownership and operations, costs, and rates; lack of accountability and the associated potential for the abuse of monopoly; and, the potential for conflicts of interest.

Under the ownership model, ownership is in the hands of investors and private capital is used for major projects. There is limited (structured) competition and state regulatory oversight through public utility commissions. Potential advantages to the ownership model include private capital investment and long-term commitment, cost-effective regionalization, and accountability via independent regulatory oversight (assuming it is effective). Potential disadvantages include concerns about lack of local control and responsiveness, ownership instability, foreign ownership, private control of vital resources and assets.

Since 1980, the private market share of the U.S. water market has stayed relatively flat, but annual water utility revenues have continued to increase.

We have seen several hard lessons of privatization, including Indianapolis and Atlanta.

Municipal systems *are* spending money on capital, however, and bond issues have increased significantly. However, there is still a significant gap between charges and revenues at municipal systems.

Reasons for the rate disparities between private and public utilities include: profits (need return on equity; taxes (which usually overwhelm profits); financing; subsidies; costing (depreciation expense); rate practices (outside rates); charges (system development); investment deferral; cost differentials; and, economic regulation (cost of service).

Subsidies include tax revenues, general revenue bonds, intergovernmental transfers, below-market financing rates, federal and state grants, and water projects. In addition, subsidies sometimes flow from the utilities and are used for social goals. Informed decisions and transparency are critical.

There is also the consideration of whether subsidies should be provided to systems or households.

Subsidies can potentially weaken or undermine price signals, causing inefficient behavior.

Public policy considerations regarding privatization include:

- Delineating core government functions (ownership, operation, or regulation)
- Determining the appropriate roles of the public, nonprofit, and private sectors in achieving long-term societal goals
- Understanding the tradeoffs involved in alternative privatization models
- Developing capacity for economic regulation, as well as health and resource regulation and mechanisms of coordination
- Establishing and maintaining standards, accountability, and incentives for performance

When we do privatize, we do have to look at our capacity for oversight and regulation. The State Environmental Resource Center in Wisconsin noted that: "Lack of government oversight and public scrutiny has been one of the strongest criticisms of water privatization. Without proper government supervision, privatization will not address issues related to conservation, water quality, or fair access to water regardless of income. To ensure public-private water agreements are carefully designed and implemented to protect public interests concerning these issues, strong public regulatory oversight should be a fundamental requirement before a public agency shifts its responsibility for water utilities to a private entity." (http://www.serconline.org/waterPrivatization/index.html)

Key considerations on privatization and public monopolies include the following:

- Competitive bids and private contracts do not alter the basic public monopoly
- There is the potential for mutual exploitation (city and contractor)
- Control over rates is not necessarily responsive
- Decoupling of costs and rates can lead to inefficiency and inequity for ratepayers (subsidization)
- Significant private involvement in a public monopoly raises accountability issues
- Profits raise legal and tax implications (e.g., tax-exemption)
- Requires an informed, engaged, and mobilized public – with political acumen and clout
- Can you really "throw the bums out" (local officials)?
- Regulation of the ultimate monopoly (city) may be justified by public-interest considerations

In the context of privatization, regulation can provide:

- The legitimacy, authority, and accountability of state oversight
- Review of costs and prices and promotion of cost-based pricing

- The opportunity to ensure contract prudence
- A level playing field for structured competition
- A degree of certainty for private investors
- More oversight capacity than local governments and economies of centralized regulation (freeing local resources)
- An expeditious forum for hearing disputes and resolving complaints among utilities, contractors, and customers
- Additional regulatory safeguards for cities and customers
- Less need to micromanage utility decisionmaking; fewer opportunities for coercion, corruption, or politicization
- Attention to long-term social, environmental issues

Ownership may be less important than other factors affecting performance. Ownership and profit incentive are somewhat important to performance; competition or regulation are more important factors. The most important factors affecting performance are economies of scale and efficiency practices.

Neither the public nor the private model is the "better" model or a panacea. A good public-sector water system follows "good business practices" while a good private-sector water system acts as a responsible "public steward" and is relatively transparent. The two models share much in common—indeed, their commonalities may be greater than their differences.

Ultimately, we have yet to discover the ideal institutional form.

6.4 Summary of Open Discussion

Drinking water quality and service reliability

- There are many points where level of service decisions can be made, including system staff, a governing body, and customer surveys. How many agencies actually put a price tag on meeting level of service? How many have told customers that having great tasting water 100% of the time will cost $X, having great tasting water 95% of the time will cost $Y, etc. Agencies rarely put a price tag on these services for customers; they only get feedback on customers' desired level of service.

- We take a different approach to level of service. To determine level of service we consider customer satisfaction (which determines rate capacity), which we measure and track across the board. Another key consideration is having equal levels of service for different customers. We also considered investments in taste and odor control. If there is a taste and odor event, customer satisfaction will drop; it takes a long time to recover customer confidence after just one taste and odor event, as it makes customers question the quality of their water. We want to meet the regulations and manage health risks. If something creates a health risk, how can you manage it to the optimum point **beyond regulation**, looking at costs and benefits? We also want to minimize risks from those issues on the current regulatory agenda.

- We consider outages to be unacceptable. Ultimate reliability is very important for our city government; this is achieved through redundancy.

- From the capital investment standpoint, the question is where can there be additional economies in capitalization? Systems could be sharing assets rather than installing new ones.

- We have a customer advisory council to offer input on any significant issues.

- Survey results confirm that people are willing to pay more to avoid some level of service outage from main breaks, up to a point. Customers will accept breaks, as long as they know that water service will be returned quickly. Customers are not accepting of taste and odor or pressure performance problems.

- Aesthetic issues really illustrate how tricky water economics are. People are willing to pay high amounts for bottled water, but there is a disconnect between that and their willingness to accept a more economical approach to improving taste of tap water. Ultimately the issue goes back to engaging and educating the public.

- Studies on risk preferences show that the unknown affects confidence; if consumers smell or taste something in their water, it will trigger a strong reaction and impact their trust.

- Fundamentally, we consider our utility to be in the business of building public trust. If that trust erodes, it's a huge problem.

6.4.2 Nature of Customer Base

- Now, when looking at capital efficiency and capital investment per capita, we are seeing much smaller household sizes. We're serving the same number of people, but spread over more households. More investment is needed to serve the same population. Also, with recent drops in interest rates, people living in multi-family homes have acquired single family homes; apartment vacancy rates are also much higher in some communities now.

6.4.3 Peak flow issues

- While the base load is decreasing, peak demand is increasing

- Customers still use a lot of water even in drought conditions. The peak is determined by outdoor water use and the base is determined by indoor water use.

- Systems losing large industrial customers will have very different characteristics than those based on large residential customer bases.

- The trend is towards more efficient plumbing and appliances, so consumption of water for indoor use is trending downward. However, systems still have to build plants to accommodate maximum daily use (driven by fireflow and outdoor uses) even if revenue and consumption is decreasing.

- The need for increases in pipe size are based more on increasing demand for fire protection than anything else. My utility is growing and one level of service issue that has to be addressed is accommodating fire protection for new customers.

6.4.4 Wastewater level of service issues

- The biggest capital driver at my utility is a combination of growth and more stringent effluent limitations.

- My utility faces different pressures. Our capital costs are being driven by infrastructure rehabilitation and replacement costs, sanitary sewer overflow issues, and third party lawsuits.

- Our treatment plants have a lot of capacity, due to the loss of the high strength industrial waste generators in the area. The system is doing resource recovery by bringing in many new and different waste types (e.g., animal processing waste, fats, oil, and grease, etc.). Flow has remained fairly steady for the past 20 years, though it can vary based on whether the year is very wet or dry. There has been a slight trend in flow dropoffs, due to conservation.

6.4.5 Institutional Structure

- Ownership may not be the top factor affecting performance. More important is competition or regulation and economies of scale and efficiency practices.

- Neither the local government nor investor ownership model is panacea for the water industry.

- On the issue of full cost pricing and the ability to achieve it versus the desire to do it—from the municipal system perspective, ability and desire are not related. The system's governing body is sometimes elected and their primary job is to get reelected. They will compare their utility's rate and rate structure to those of other local utilities. In my area, some utilities haven't raised their rates in 10 years—the board won't want to raise rates when no other local entity has done the same.

- Problems aren't limited to municipal systems; small private systems are also struggling.

- If you're looking at municipal systems and the amount of dollars spent on capital compared to revenue, part of what you see is related to less efficient municipal management of asset acquisition and contracting.

- Investor Owned Utilities (IOUs) also have the records to put asset management systems in place and place controls on costs. It's easier for them to set rates and establish the full costs of providing service. If they don't make the best decisions, management and stockholders are at risk. Who controls cost considerations for municipal systems?

- The public ownership/contract operations model sounds good in theory, but in reality it can be very limited and uncompetitive. Contracts are often renewed very quietly without bidding, transparency, or public knowledge. When you disconnect ownership and operation, you have very skilled and well intended operators that are still dependent on the city for funding. This introduces potential inefficiencies.

6.4.6 Public Education

- We've gone around to towns and used local newspapers to educate the public on water rate increases. We've been able to get newspaper endorsements for rate increases. At public hearings, we've been able to get water companies to present on the reasons for rate increases. People will still be upset about the increases, but not to the same extent.

- The education process is still very fragmented and local.

- Part of the issue is that IOUs have been traditionally run by managers and top executives who were very focused on technology, producing a service, and putting money into the ground. Public Utility Commissions (PUCs) are more focused on public awareness.

- The telecommunications and gas industries do know how to market. The water industry can't make the leap to focus on how they're perceived by the public.

- Marketing is the one thing the industry could spend money on with great benefit.

- Effective marketing could shift the whole argument. If people don't understand the value of something, they won't place *any* value on it. It's difficult to come to conclusions on things like affordability when you don't understand the value of the product.

- The education issue seems to be dire. The public's understanding of the sources, price, etc., of water is so limited and there is a lack of transparency with water pricing. We need to remind the public that they will always be paying for water in some way, either through taxes or otherwise. Is it more efficient to pay the full cost directly, through rates, or to send money through the state and local government through other fees and taxes before it goes back to the water system?

- Behavioral economists and public finance experts don't abandon the neoclassical model that assumes rational actors, but recognize that decision-making isn't always rational. Understanding the biases involved can inform our understanding and how we use economics to overcome these problems.

- A technique called "cue methodology" looks at how people frame their values. People may have the same ultimate goal but different reasoning for why that is their goal; the latter can be just as important to examine as the former.

6.4.7 Economic Regulation

- At least for systems not subject to PUC jurisdiction, there's no entity (other than possibly the state drinking water program) to help people recognize existing opportunities for more efficient deployment of capital. Is there an institutional option missing from the equation?

- Rate regulation has done a great service to rate payers, providing limited profit margins and turning IOUs into very efficient machines. If they don't make the best decisions, management and stockholders are at risk.

- Wisconsin's regulatory model has been in place for a long time, and the state has regulated water supplies (mostly municipal systems) since 1907. The PUC regulates construction, customer standards, and sets rates.

- If full cost pricing is a realistic goal, there is a level of authority or decision making capacity that's missing. What does "full cost pricing" mean? What costs are included and how are they determined? If you don't have that capacity, there will be no consistency to the application of full cost pricing. We also need a level of transparency and access to data to make sure the full cost pricing process is working. The absence of a body to consistently define terms, the absence of data access, and the lack of consistently maintained data are significant roadblocks.

- My State Public Utility Commission regulates some publicly owned systems. The state program is underfunded and the staff are underpaid and don't have the time to closely examine proposed projects.

- It's all about cost of capital and how much it costs you to get the money and put the infrastructure in place. There's a lack of oversight to put capital to efficient uses. Rating agencies are paying more attention to this, but have been less vigilant historically; as long as they were assured that there would be coverage of debt service, they hadn't cared. The overall capital allocation processes put into the industry are random and very inefficient. We need rational capacity planning and some basic level of operating requirements applied regionally or on watershed basis, along with some basic public education as to why it was necessary.

- We've been seeing these trends develop over a long time. What's the right direction to go in? A Federal Energy Regulation Commission (FERC)-type structure that deals with federal water policy? State PUCs? Municipal level regulation?

- Look at the Securities and Exchange Commission (SEC) model. The SEC does not set the price of stocks and only requires entities to go through the SEC for access to the publicly traded equity and debt market, which comes with certain requirements (transparency for investors). We need to move away from micromanagement.

- The alternative to government and regulations are the industry associations. Are they serving any function here?

- We've been doing a lot of work with sustainability. Ultimately, if you fail to properly conduct your business, you will be regulated. As an industry, we need to take heed from that and work through professional organizations and public outreach to get people on board. Regulation is a sign that your system isn't working right.

- Investor-owned utilities (IOUs) have targeted profits but are constrained by regulations; they have to be very efficient in how they spend their money. They look for the lowest cost construction because it comes out of the stockholder bottom line.

- Municipal systems need to be more efficient with how they spend their money.

- I've never been strong proponent of economic regulatory oversight, but if it prompted recognition of the need to increase rates to maintain infrastructure, it could be beneficial. It's probably best to limit regulation to that one aspect. I do strongly support the idea of combining the economic and environmental regulatory oversight.

- The Public Utility Commissioner's job is to serve the public interest, and therefore they need to set rates to cover the full and adequate cost of service provision. If rates are set below costs, the utility will under-earn and cost of capital will be too high. The challenge for utilities is to find the optimal balance where they're seeing a return on their investment and attracting capital at the lowest cost. The returns for equity investors suffer if rates are inadequate.

- Now, faced with an impending increase in the rate of infrastructure replacement, there is an enormous need for capital in the industry. The cost of capital will to some extent depend on whether rates achieve full cost recovery. We need regulatory agencies to do a better job of establishing cost of service provision and ensuring that rates cover this cost. If not, customer rates will be even higher in the future.

- One key problem is that you can't base 2007 rates on 2006 costs. Still, some states refuse to base their rates on anything other than historical information. Utilities have to be efficient to generate reasonable profit margins for stockholders (IOUs). Changes in the rate setting process can only come from rate

regulators, not utilities. The trick is to get more states to adopt innovative methodologies. The suggestion of combining economic and environmental regulators is ideal. Right now, we're seeing a whipsaw action between the two, but for the first time there is the true opportunity to meet in the middle.

- On the jurisdiction issue—in Indiana, cities can choose to be regulated. Sixty-odd cities chose to be regulated and can now blame the regulators when they have to raise rates. This also builds in an audit function and accountability to some extent.

- Just because adjustments are made to a utility's original rate filing does not mean that rates are not set to recover the full cost of service. My concern is that removing the snapshot of the test year starts to disassemble the ratemaking process. There are areas for discussion on whether there are additional innovations or improvements that could be made, though.

- Another aspect to this is that risks are increasing and existing risks have not been thoroughly recognized in ratemaking process. Even with enhanced efficiency, rates won't go down, they'll just increase more slowly.

7.0 Recognition of Full Business Costs & the Annual Revenue Necessary for Cost Recovery

7.1 Framing Presentation on Asset Management

John Cromwell, Stratus Consulting

In Australia, asset management was driven by institutional change and widespread restructuring in the entire utility sector as a part of the process of preparing the national economy to participate more broadly in a freer world trade environment envisioned under the Global Agreements on Tariffs and Trade (GATT) that were under negotiation at the time the reforms were implemented. State and local monopolies were commercialized, and the municipal utilities converted to "commercial" status. In the "commercialization" model of utility reform, the state or local government is the sole shareholder of assets, but the utilities have autonomous finances and practice full cost recovery through rate revenue with state oversight of pricing. The utilities are run completely as commercial businesses. State rate regulators and environmental regulators both have a role in rate setting.

Australian reforms also involved appointment of independent boards composed of business people to govern the utilities and run them as businesses. The utilities pay taxes and earn full commercial returns on their assets. Board members observed that to be sustainable, a capital intensive business has to be able to continually attract capital. This is the business definition of sustainability. Utilities were given 5 years to develop a comprehensive asset management plan demonstrating that the utility was on track with this concept of sustainability. To make this demonstration, it was necessary to show, on one hand, that rates were not being artificially suppressed by investing too little in infrastructure renewal and allowing a deterioration in the level of service quality delivered to customers. On the other hand it was also necessary to demonstrate that rates were not any higher than they needed to be as a result of investing too much in infrastructure renewal – that is, by not using capital assets as efficiently as possible and getting the most value out of them on a total lifecycle cost basis before retiring them (while maintaining the level of service to customers). The form of these twin demonstrations was the asset management plan which had to show that the amount of rate revenue required for asset management (including both capital and operating expenditures) was, in effect, a "Goldilocks" solution – not too little and not too much, but just right.. When the asset management plans were approved, the state and local owners of the utilities received significant amounts of trade adjustment dollars from the federal government as an incentive to spur the reform process.

Infrastructure is tremendous risk factor for the industry and threat to sustainability. The upcoming replacement costs have never been seen before. This raises a risk management question: do you know what costs are coming at you and can you handle them?

Asset management is seen as a risk management problem. The first step is identification and characterization of the risk. For this, the utility must consider both reinvestment and maintenance costs for assets and must understand the concept of each asset's economic life. The utility needs to project replacement needs and wear-out costs (increases in maintenance, repair, and operation costs). These are the two cash flows that go into asset management. Both need to be considered and refined to determine what the least cost option is. Ultimately, much of the job entails getting the most out of assets rather than just replacing them.

We often hear that utilities should replace 1% of their pipes per year, but from the patterns we see, it's clear that this has no relation to the true demographic pattern. Also we often hear that utilities should replace their oldest mains first. However, utilities have to study their assets and problems to see where the greatest replacement needs lie.

Deferred replacement is generally thought to be bad, but if you can push some of it back, it can save you money. As long as the asset can be kept in service economically and is delivering the level of service required, you'll get more value out of the assets without needing as significant a replacement budget. It is the same thing as trying to get the most value and satisfaction out of a family automobile. If it has lots of miles of good service left in it, maybe it's not time to replace it yet.

The Australian example also shows that you don't necessarily need to replace all assets before they break; critical assets may need to be replaced sooner, but the majority of assets do not. Also, we've learned that no mater how much a system optimizes, main break rates can't be held constant because of the demographic bulge that is headed towards us in the echo wave of replacement needs. Other lessons learned from the Australian example is that utilities shouldn't benchmark spending against other utilities because the optimal approach to asset management is unique to each location and that having a Capital Improvements Plan in place does not constitute asset management because asset management involves optimizing the relationship between capital and operating expenditures.

Ultimately, system infrastructure is not in dire straits; it is not all failing at once and does not need to be replaced all at once; we are just at the dawn of the infrastructure replacement era. We are at a turning point when we have to make critical decisions about managing and addressing the risk. There's no one solution to the problem for any utility; solutions will be developing over decades and allowing time to continually improve asset management and lower the cost of meeting infrastructure renewal needs.

Financial risk is a true threat, but it can be managed. Continuous improvement of data to support these analyses is key. Opportunities to economize are myriad and paybacks are compelling. Priorities are clear and are uniquely local to each utility; utilities should progress into asset management gradually based on where the risks are, rather than striving for comprehensiveness; some asset management challenges pose greater risks that need attention first.

In the U.S. we now need to put into place the right processes to start and sustain asset management.

The second step to asset management is risk management. This is defined as: managing assets to minimize the total costs of owning and operating them while delivering the level of service that customers desire. Asset management maximizes value by identifying the most economical intervention strategies to deliver the desired level of service. The desired level of service is achieved by balancing three levels of expenditure: diagnostic and preventive maintenance, rehabilitation and replacement, and reactive maintenance. These defining principles of asset management are wholly consistent with the business definition of sustainability stated above. This is why the Australian reform process elevate asset management plans as the true test of sustainability.

The final step in asset management is risk communication. This is the step where utilities need to fully recover their costs and convince customers that it is in their best interest for the utility to move forward with asset management. Asset management plans help guard against false economies. An arbitrary cut in diagnostics and preventive maintenance must be balanced by spending on the other two components or customers must accept a lower LOS. Ultimately, a utility cannot cut one level of expenditure without increasing the other two.

If a utility is following these asset management principles and has found a least cost/full cost strategy, they should be able to reflect this in their financial reporting in a way that makes sense and gives investors/shareholders the assurance they were looking for in an asset management plan.

The GASB 34 depreciation approach is not useful and the depreciation approach used by IOUs isn't much better. Many Australian utilities are using replacement costs accounting, which is a work in progress.

The number one performance criterion for Australian utilities is the rate of return on assets, which ties back in directly to the business definition of sustainability. The public deserves to get full market facing rate of return on capital. Utilities that are not delivering this are not doing their job as efficiently as it could and should be done.

7.2 Framing Presentation – A Local Elected Officials Perspective on Post Employment Benefits

Ralph Jones PhD, The Cadmus Group Inc.

One development that may help to shape the future of full-cost pricing is the implementation of GASB Statement No. 34. Its purpose was to improve public accounting in a manner that would increase information about public officials' long-term stewardship of public assets. The required reporting on assets was designed to enable an enlightened public to hold their officials accountable for the condition of these assets. In the drafting of GASB 34, two alternative positions were considered. The first option was to have public entities include depreciation on their balance sheets. As implemented, this approach has not produced information that the public can readily use to increase accountability. The second (called the "Modified Approach") public officials would need to produce an asset management plan that provided sufficient information so that readers could understand whether the net value of public fixed assets was increasing or decreasing. Failure to invest sufficiently in infrastructure would be evident when net asset values were declining.

Another recent development that may have an impact on full-cost pricing is increased sophistication of credit analysis. As one credit analyst recently explained:

> "Credit analysis has moved beyond a simple current rate comparison between the utility's rates and its income levels or the utility's rates and those of its neighbors. [The] key question is whether rates will be set such that the available revenues are consistently sufficient to meet all of the ongoing needs and obligations of the utility, now and in the future."

As credit analysts look with increased sophistication at debt offerings, water and wastewater systems will need to demonstrate that they have long-range infrastructure plans and rate revenues to fund that plan.

In 2008, public utilities and municipalities will have to report, in their financial statements, an actuarial estimate of the size of unfunded "other post-employment benefits," primarily retiree health insurance. Utilities and municipalities already must disclose the actuarial estimate of their unfunded pension liabilities. As these disclosures begin to appear, the public is going to hear some shocking numbers. Experts in the field estimate that unfunded *pension* liabilities for state and local governments could range from $300 billion to $800 billion. Unfunded OPEB estimates are $600 billion to $1.3 trillion, and these liabilities are increasing at a double-digit rate as health care costs increase.

Because water and wastewater utilities are capital-intensive, the impact of personnel-related unfunded liabilities is less important for them than for the rest of state and local government. Nevertheless, from my experience with local enterprise funds for water and sewer, if my local government decided to fully fund pension obligations by 2028 and OPEB obligations by 2038, it would double the cost of fringe benefit expenses (from 45% to 90%) in ten years. If that happened, it would have a significant impact on rates.

Another way to look at the implications of pensions and retiree health care is to consider the impact of these costs on the average rate payer. Ratepayers also are taxpayers. Therefore, if uncontrolled, the costs of pensions and retiree health care are going to hit the consumer/taxpayer first in increased taxes for general government (which is much less capital-intensive). That will leave even less room for the increases that will be required eventually to fund increased O&M costs for utilities.

7.3 Open Discussion

7.3.1 Cost-Drivers

- In terms of O&M expenses, increases are also linked to pensions and increasing health insurance costs. Utilities used to only have to think about capital costs when increasing rates. Now they have to account for increasing capital costs and increasing O&M costs.

- One additional reason for the increase in cost is the costs of road restoration. The increases in pipe replacement are disproportionately the result of increased costs in road restoration.

- The biggest capital driver for my wastewater utility is a combination of growth and more stringent effluent limitations.

- My wastewater utility's capital costs are being driven by infrastructure rehabilitation and replacement costs, sanitary sewer overflow issues, and third party lawsuits.

- With water, you can't substitute any other resource.

- We also need to consider the demands placed on public utilities to achieve broader social objectives (for example through targeted contracting); these can lead to higher costs.

- Low income customers are usually not the ones driving peak demand, which impacts the costs.

- Utility risks are increasing and existing risks have not been thoroughly recognized in ratemaking process. Some people think as we become more efficient rates will go down. The cost drivers are such that rates keep going up, efficiency gains simply slow the pace of the increase.

- Water utilities are in a rising cost environment.

- In the IOU industry, for every dollar in expense that goes up, it takes 8 dollars in capital that you can't spend.

- The big drivers in O&M costs are labor, energy, and chemicals. Labor alone accounts for about 40% of O&M cost.

- The big drivers in capital cost are materials, skilled labor, and risk management.

7.3.2 Post Employment Benefits

- We've seen that there is often a tendency to equate FAS87 reporting for accounting purposes with minimum funding requirements. FAS87 is just a recording convention. The Employee Retirement Income Security Act (ERISA) establishes funding requirements. We're looking at the funding requirements under ERISA as the least cost method for ensuring the viability of a pension while placing the least burden possible on customers to cover that.

- In Massachusetts, we're required to fully fund pensions in accordance with GASB 87 by 2028. Every year, each employee earns every year one-30th of what you're promising them when they retire. We're just trying to keep straight who's subsidizing whom. These liabilities can be very burdensome on general government and could result in substantial increases in taxes.

- In my utility the retirement/pension piece is appropriately funded but health care benefits were added when the stock market was strong. We are required to make a contribution in accordance with the actuarial study. The contribution on the employee's side has grown from 7% to up to 14% next year. By 2016, we estimate the contribution will be 21% of an employee's salary. We're also proposing a 6.5% rate increase. We explained the problem to our customer advisory and got support to some extent, but customers do not understand why they're paying for pensions and retiree healthcare benefits that are more extensive that what most employers provide.

7.3.3 Asset Management

- I was impacted by the idea that all is not yet lost (perhaps not quite the crisis we sometimes paint it) and there is yet time to address the "ramping up" needs if system managers take it to heart...soon. We are embarking on a new era relative to infrastructure replacement. The Australia model and the use of Asset Management to develop a better picture of what it may take to ramp up to full cost pricing models that will adequately service future infrastructure replacement needs is one interesting approach. There is much need for more debate and understanding on all these related issues and approaches.

- We look at what our peak season is for main breaks and look to see what we can do with our assets to shave those peaks. We haven't seen the peaks disappear anywhere, but we have seen peak dampening. Every year, we're looking for more ways to improve efficiencies and costs. We're shifting away from reactive maintenance to planned maintenance, but the typical U.S. utility is primarily reactive.

- Australian utilities went through a reform process in the mid-1990s driven by preparation to enter into world trade. There was a unique opportunity to start

from scratch, using trade investment money. Our job is to look at what they did and see what we can adapt (at the process level). We can't erase the board like they did. Australian utilities all underwent competitive transformation and the asset management process together. U.S. utilities began with competitive improvements and asset management came along later. Seattle is grafting asset management on top of their current model. Every utility in the U.S. is in a different place. Australia had the benefit of undergoing a sweeping trade-driven reform process across the board.

- Hunter Water is a leading Australian utility. For them, every investment choice is driven by lifecycle cost/business case. It's called "whole life optimization," addressing external costs. They are working heavily on customer service side and examine the whole spectrum of options, from repair to replacement (for critical assets). They are using the full suite of available technology. Everyone understands asset management principles and the reasons for searching for least-cost solutions. They understand that it's a risk management issue and a continuous improvement process.

- A lot of people are saying that we need to focus on asset management and efficient use of capital. Australia developed a model that encouraged finding the most efficient means of addressing each problem. How can we incentivize innovation and efficient use of capital? A utility's ability to recover costs may not be as limited if they're spending more efficiently.

- The asset management plan is where a utility outlines its solution to the tradeoff problems for each class of assets and shows how they'll deliver the expected performance for each class.

- Asset management helps you figure out objectively where you are and what your options are. You then take that knowledge to the public and figure out what you're going to do with it and how you'll fund it. There are also technical tradeoffs that affect intergenerational equity. A lot of utilities have pipe replacement programs that involve abandoning pipes more than they involve replacing them. This is a legacy that remains a problem.

- There are 2 distinct aspects to the Australian approach—one is using asset management to identify the full least cost of doing business---the other is a choice to set rates based on replacement cost accounting to fully recover cost, or a "pay as you go approach". Either one could be employed:
    - Pay as you go – Some Australian utilities have tried to use replacement cost accounting so the depreciation cash flow funds replacement. They do not incur debt for mains but do for treatment plants and cost spike-type assets.
    - Annuity option – Using the results of comprehensive asset management planning, the projected cost over the life cycle of the assets is annualized

- There's a compelling argument for more research—the more you understand about the life of your assets, the better understanding you have of your utility's needs.

- Full costs have to be separate from rates. My concept of rate-setting is that municipal systems are driven by coverage and IOUs are driven by the rate of return. We need to keep looking towards getting a better understanding of asset lives and how long assets will last before they're repaired or replaced. Only then can you do full cost pricing. Right now, anything that happens beyond 10 years from now is pure guesswork.

- There are still serious issues with the speculative nature of valuing the assets. This can undermine the incentive innovation and for efficient asset management looking forward and lose some incentive for innovation.

- We may have to accept that our planning will always be an approximation.

- If you opt to repair or renovate assets rather than repair, replacement has to occur some other time. This presumably will increase the cost of replacement.

- Our asset management programs are not focusing on improving the ability to predict the remaining life of assets or on capital cost reduction. One theory of why we're sidetracked is that we were unlucky to have the interest in asset management occur at same time as the implementation of GASB 34—we got hung up on inventorying and assessing condition.

- Equity considerations may be a constraint on cost functions. There's a long-standing debate on what "least cost" means in utility sector. Some people use the term "best cost" instead.

- Affordability is starting to appear in more cases, in terms of safety nets. The new way of thinking in this area is to acknowledge that households having problems with water bills are likely having problems paying any and all bills.

- In surveys of utility practices, we have seen that utilities can take steps to reduce capital costs up to 30 to 40%.

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8.0 Cost Recovery Through Rates, Charges & Other Sources

8.1 Framing Presentation on Cost Allocation & Rate Design

Patrick Mann PhD; West Virginia University

There has been very little done on **integrating incremental and average costing**, but you can't have efficient pricing if you don't have efficient operations. Integrating these two will allow a system to meet their costs and sent efficient price signals. There is additional work needed in the area of estimating the incremental costs of capital and estimate avoided costs.

There is also the issue of whether we want to retain **declining block rates or uniform rates**. Washington Suburban, for example, uses an increasing step rate (not a block rate – all usage is charged at a set rate).

We're also seeing the **emergence of seasonal rates**, which are being used as a conservation pricing mechanism. Now we're thinking about applying it to second home communities. This raises the question of fairness—who pays for peak usage, the year-round residents or second-home owners?

A fourth issue is **rate differentials for user classes**, which would eliminate a singular rate schedule for large utilities. The issue would be one of choosing between lifeline rates, inclining block rates, uniform rates or implementing seasonal rates.

Another issue is **single tariff pricing versus zonal rates**. Single tariffs are very contentious, especially when a large system acquires a system with higher costs. The issue is: why pay higher rates to subsidize the customers of the acquired system.

Vintage rates are a bad idea. There is a tradeoff between efficiency and fairness. Vintage rates may reflect economic costs and let systems protect current customers from the effect of growth, but they are abused.

There is also the issue of **incorporating fairness into rate design criteria**. An investor owned utility (IOU), would keep it out of the rate proceeding because it interferes with cost of service. For municipal systems, however, this issue can never go away. "Fairness" can be a very ambiguous concept. We have to think about phase-in plans for rates to limit the impact of and customer reaction to rate increases.

On **non-rate financing**, we need to rely more on system development and availability charges.

On **affordability**, we have the question of whether we need to think about alternative standards (versus the traditional 2.5 % Median Household Income [MHI] standard that EPA uses). Data on MHI can be distorted and unreliable. Should we apply

an MHI percentage to water and wastewater combined? There are also alternative standards to consider. Using county data or ZIP code data can distort the income picture. There is also the impact of second home communities on the income statistics.

Gas and power utilities use Low Income Home Energy Assistance Programs (LIHEAPs), a potential model for the water industry. In the water industry, we have to consider whether subsidies should go to the customers or to the systems?

The **longevity of assets** is another concern. Up until about 20 years ago, the Butte, Montana water company had some wooden mains.

8.2 Framing Presentation on Decoupling Revenues from Sales

Paul Foran, American Water

Revenue decoupling is a form of ratemaking designed to separate a utility's revenue from its sales; it has primarily been implemented in the gas and electric industries. This process can reduce the financial incentive to promote consumption and reduce the financial disincentive to promote conservation. The approach is not inconsistent with full cost pricing, but is certainly different than approaches used in the past. It has its advocates and opponents.

Mechanisms for decoupling sales from revenue include increasing fixed cost recovery through rates (rather than linking rates to volumes), revenue adjustment mechanisms, and surcharges.

We have an underlying social responsibility to use water resources wisely, which decoupling can help do. It can also help control long term costs to customers by positively impacting source of supply, treatment and distribution costs..

One of the biggest challenges is to overcome the idea that the public will be paying more for less. Even if you explain that costs are reduced in the long-term, it can still be a hard sell.

There are some decoupling initiatives under way in the water industry but there is no widespread implementation—traditional ratemaking is still most prevalent approach to pricing. American Water is currently proposing certain rate designs that would allow for some decoupling.

We have to be careful with comparing levels of capital intensity among the various utility services, such as electric, gas, water, and telecommunications, and equating it with efficiency. The facilities necessary to provide safe and reliable water service are inherently more capital intensive than for the other utilities and the level and cost of those facilities is greatly affected by geographic location and weather. American Water has systems all over the country, serving over 29 million persons on a regulated and unregulated basis in every topography and climactic zone. From 1980 through 2005, water use per customer has remained constant or decreased (between 1990 and 2004, decline in indoor water usage was 30% per capita) while net plant investment per customer has skyrocketed in response to SDWA and the condition of aging infrastructure. As a result, the unit price of water is rising. We can't expect to be able to fund those increases through increased per capita demand, which is not and likely will not be occurring.

The drivers of reduced consumption include plumbing codes (national codes came into effect in 1998), fewer people per household, higher average age of household occupants, public education on wiser water use, price elasticity, fixture retrofit and rebate programs, water audits, and full value pricing.

Seventy percent of all water utility costs are fixed and approximately 25% are variable. However, the revenue structure is reversed—72% of revenues are variable (based on quantity sold) and 28% are recovered through fixed charges on bills.

Conservation reduces demand and revenue but our capital needs are unchanged—we have to examine rate structures. Decoupling is part of the answer to realizing the benefits of conservation but has wider implications and potential benefits including rate stability, timely recovery of capital investment, and capital attraction.

8.3 Open Discussion

8.3.1 Decoupling Revenue from Sales

- NRRI has put out a paper on decoupling and the gas industry. You can also better align fixed and variable costs, but that undermines the price signal to conserve.

- In the water industry, there is usually a far greater divergence between the private value of water and the social value. This is a much bigger issue with water than with gas.

- Decoupling isn't a panacea and there are many different tools available.

8.3.2 Cost Allocation & Rate Design

- We know that energy prices are rising, because the cost of the raw sources of energy is increasing. For drinking water, we aren't paying for the raw water; we're paying for the service

- Part of the issue is differentiating rates from household costs. With conservation, you can increase rates but you can't increase household costs. It presents a conflict for the utility: should we pursue conservation if it's going to decrease our revenue stream, causing rates to increase at a more accelerated pace?

- I'd disagree that there's customer opposition to conservation and full cost pricing. But utilities are expected to do things other than just sell a product—we have conservation and watershed management responsibilities. Separating costs puts utilities in a position to sell a product and be socially and environmentally responsible.

- Moving from flat rates to metering sent signals to customers, but now we're telling them that rates will still go up, even if they moderated their usage. Utilities have to do a lot of talking to customers and explaining their long term goals.

- Setting individual rates by customer class is important—it supports conservation and sends price signals.

8.3.3 Affordability

- In most low-income houses, the amount of money they spend on water *is* a significant percentage, compared to their overall income. Many low income households are struggling to pay any of their utility bills; there are health trade-offs, since many people will put off doctor visits in order to be able to cover

utility bills. This may only be happening in a small proportion of households, but there is a tangible health effect that we need to be aware of.

- A new AwwaRF project will compare practices across utilities and the banking industry on how to help low-income customers and what kinds of assistance programs to apply

8.3.4 Subsidies

- In many cases, current subsidies may disincentivize good behavior. The systems with the greatest problems get the money.

- It's valid to have subsidies for quality issues, but we shouldn't be rewarding bad management. In all things, auditing and public information is one of the more powerful things we can have.

- If some kind of physical or non-physical consolidation or regionalization is not possible, there are limited options. You can let people drink unsafe water, you can abandon the system, or you can subsidize systems.

- In the U.S., access to safe drinking water can be considered a basic human right. Providing subsidies to provide access to safe drinking water as a basic human right could be one reason to provide subsidies, but I can't think of any other.

- If you have subsidies now, how can you do the least harm with them and how can you begin to reform them? Why are subsidies the least cost path and what are the other alternatives?

- The endpoint is sustainability—you can use the incentive part of subsidies to get sustainable solutions. So the perfect subsidy program is one that has the endpoint of putting itself out of business (but providing a safety net for extreme situations).

- We can't let people choose to keep drinking contaminated water.

- There are health-based regulations related to source water quality that have nothing to do with how the water system is being run. We could possibly provide subsidies for those types of problems, just to fund the incremental part of ensuring that the water is safe to use.

9.0 Workshop Conclusions

Workshop participants generally agree that full cost pricing will be possible and successful only in an efficiently structured and managed water and wastewater Sector. Embedded in the current structure, management, operations, and oversight of the water and wastewater sector are potentially significant inefficiencies. Eliminating these inefficiencies will help to minimize future cost increases and the magnitude of future rate increases. Comprehensive sectoral reform is needed and EPA's role should be to initiate, inform, enable and facilitate a broad national dialogue among all stakeholders about how to achieve our national public health and environmental protection goals in the least cost and most socially acceptable manner.

As the workshop drew to a close, participants agreed that a number of key themes and issues had emerged in the discussions. The group identified and organized these themes and issues as presented in the diagram below to assist EPA and other stakeholders in better framing future thinking and discussion of full cost pricing and water & wastewater system sustainability.

Expert Workshop on Full Cost Pricing of Water and Wastewater Service

Key Issues Identified

"Meta-Issues"

1. Least Cost Achievement of Environmental & Public Health Protection Goals Across Watersheds.
2. Role of Economic vis-à-vis Environmental & Public Health Regulation.
3. Public Education & Building Public Support.
4. Role of Federal & State Subsidies.
5. Impact of Global Climate Change.

Industry Structure

1. Consolidation
2. Ownership and Management Contestability
3. Level of Service

Utility Management

1. Best Practices for Operational Efficiency
2. Asset Management to drive to least-cost
3. Risk Recognition & Management
4. Cost of Capital
5. Alternative Capital Project Delivery Methods
6. Uniform System of Accounts
7. Information Resources to Support Ownership and Management Contestability
8. Pricing Pardigm

The issues and themes were organized into three major categories: "meta issues", issues related to industry structure, and issues related to utility management. These categories and the individual issues within them are further discussed below.

“Meta Issues”

Workshop participants identified 5 issues which share the characteristics of being high-order issues and being issues requiring action from many other major stakeholders to address. These are issues which utilities and utility regulators cannot address on their own. The group classified these issues as “meta issues”.

1. ***Least Cost Achievement of Environmental and Public Health Protection Goals Across Watersheds.***

At the watershed scale, participants believed that significant opportunities exist to identify least cost (or some would say best cost) approaches to achieving environmental and public health protection goals. Decision making at a lesser scale misses such opportunities and fails to achieve economic efficiency, resulting in greater cost to society to achieve given environmental and public health protection goals than is necessary. Recognizing that significant cross jurisdictional cooperation and coordination (at the utility, local government, and regulatory agency levels) would be necessary to undertake decision making at the watershed scale, participants characterized this issue as a “meta issue”.

2. ***Role of Economic vis-à-vis Public Health and Environmental Regulation.***

Workshop participants generally believed that the major issues standing in the way of greater progress toward utility sustainability are issues of utility organization, ownership and management and the terms and conditions under which utilities provide service. These issues are generally the province of economic regulatory authorities (in the United States, Public Utility Commissions). Participants agreed that a robust, well informed dialogue among all appropriate stakeholders about the potential role of economic regulation or oversight (or some other application of the insights and principles of economic regulatory oversight) vis-à-vis existing public health and environmental regulation would be an important step in advancing application of full cost pricing.

Existing PUC practice regarding regulation of the water sector varies greatly from State to State, offering many different examples and models which could form the basis for further dialogue.

Participants did not collectively endorse or recommend expansion of existing Public Utility Commission authority and oversight. They did endorse a systematic, robust and well informed dialogue within each State on how economic regulatory oversight of the water sector might change and how such changes might advance attainment of sustainable public health and environmental protection.

3. ***Public Education and Building Public Support.***

Workshop participants expressed a strong belief in the need for greater water sector emphasis on public education about infrastructure issues and on building public support for the rate increases necessary to achieve full cost pricing. Participants believe the public education mission is largely, although by no means exclusively, a utility responsibility. Since public education arguably includes the need to educate decision makers, and others influencing public opinion, at all levels, it is characterized as a "meta issue" in recognition of the need to broadly engage diverse stakeholders in the effort.

4. ***Role of Federal and State Subsidies***

Unconditional, uncoordinated, and untargeted subsidies distort utility behavior, and, in the opinion of many workshop participants, represent a serious barrier to progress toward full cost pricing and sustainability. Of particular concern were subsidies with no explicit tie to requirements for utility actions to move toward sustainability. Some participants noted the essential role of subsidies in helping make water and wastewater service affordable for low income households. A commonly expressed concern about subsidies provided to the utility is that the benefit of the subsidy accrues to all customers, regardless of their need. Most participants agreed that such subsidies should best be delivered to the household, not the utility, and that delivery through an existing program such as LIHEAP (low income heating and energy assistance program) would be most efficient.

Another subsidy of significant concern to participants is that provided through earmarked Federal and State appropriations. Such subsidies seriously distort utility behavior by encouraging utilities to ignore well structured financial assistance programs offering subsidies conditioned on movement toward sustainability in favor of essentially unconditional assistance provided via the political process.

5. Impact of Global Climate Change

Utilities participating in the workshop report experiencing extreme weather events at significantly greater frequency in recent years. The impacts of global climate change on the quantity and quality of source water available to utilities is a matter of study, discussion and conjecture at present. It appears plausible that utilities may in the future face additional capital and/or operating costs associated with mitigating the impacts of global climate change on the hydrologic and quality characteristics of their source waters.

Industry Structure Issues

Workshop participants identified significant issues associated with utility size, scope, ownership, management and capabilities. These issues are grouped together as issues related to the structure of the water and wastewater industry.

1. ***Partnerships & Consolidation***

From an economic and business perspective, workshop participants agreed that the present structure of the drinking water industry, with 2/3 of systems serving fewer than 500 persons and many of them being owned and operated by entities not principally focused on potable water provision, is not sustainable. Even among larger systems, participants identified unexploited potential efficiencies of closer coordination and partnership that would more fully utilize existing infrastructure and operational/management capabilities.

The drinking water sector offers many different models of successful utilities. Public ownership, private ownership, and many operational and management approaches across the public-private spectrum are all in place today. Workshop participants identified the urgent need for ongoing rigorous reexamination of the status quo by utilities and regulators with an eye to enhancing efficiency and looking for ways to partner with other utilities for mutual benefit. The efficiencies thus realized will reduce the extent to which rates will have to go up to achieve full cost pricing and sustainability.

Workshop participants identified an important nexus between this issue and the "meta issue" related to economic regulation. In many States, there appears to be a vacuum in terms of an oversight, advisory, or other agency or entity to help utilities see potential partnerships across greater geographical scales. Participants emphasized the importance of the "match making" function, in addition to the importance of economic and public health/environmental regulation.

2. Ownership and Management Contestability

Workshop participants identified ownership and management contestability as a key market force that can help drive the industry to exploiting partnerships and consolidation efficiencies. Ownership and management contestability requires that the industry have viable and vigorous players in both the public and private sectors and that opportunity for healthy competition exist between them. If there is a viable and realistic option for private owners or managers to displace public ones, or vice-versa, then both will be incentivized to perform at optimal efficiency.

3. Level of Service

Level of service was identified by workshop participants as a very important consideration at the individual utility level and at the level where utility decisions about structure are reflected in the overall structure of the industry. Level of service is understood in a broad sense, encompassing all aspects of the utility's connection to and interaction with its customers. Of fundamental importance is an effective dialogue between the utility and its customers about the level of service customers desire and the cost of that service, including options available to the utility to deliver that level of service at the least cost.

Utility Management Issues

Practical utility management issues associated with delivering the target level of service at least cost were one of the major topics of discussion at the workshop.

1. Best Practices for Operational Efficiency

Both water and wastewater utilities have demonstrated significant operational efficiency improvements in recent years. Workshop participants attributed these efficiency gains to 2 major forces. The first was the widespread interest in the potential for privatization in the late 1990's. The second was the concurrent availability and application of effective telemetry systems such as Supervisory Control and Data Acquisition (SCADA) Systems. Such systems allow for much more efficient deployment of labor.

Many specific practices have been documented and techniques developed to assess operations to identify potential efficiencies. As an essential first step towards sustainability, all utilities should be employing the best practices for operational efficiency and should continue to seek further efficiency gains as part of a continuous improvement culture.

2. Asset Management to drive to least-cost

Delivering the target level of service at the least cost requires that the utility effectively optimize its mix of capital replacement and operation and maintenance. Asset management is a tool that enables utilities to assess and optimize this mix. Workshop participants emphasized the importance of applying asset management for this purpose. Participants noted the danger of utilities satisfying themselves with asset inventories, and failing to achieve least cost optimization. Another important point is that utilities won't necessarily see immediate cost savings from applying asset management. In fact, it will probably result in a much fuller understanding of infrastructure investment need , and in the short term appear to possibly increase costs.

3. Risk Recognition & Management

Workshop participants emphasized the importance of utilities recognizing and managing the business and operating risks they face. Some utilities perceive their risk exposure is growing, for example the reliability of the electric grid is decreasing, placing utilities at greater risk of losing power. Recognizing and managing risks is an essential component of providing service at least cost or "best cost". Many publicly owned utilities may be seeking to transfer all risks associated with capital projects to their contractors when in fact the utility itself may be best able to assume some of those risks. Transferring risk to another party increases costs, and to minimize cost risks should be parsed out to the party best able to manage them.

4. Cost of Capital

Minimizing the cost of capital is one of the core requirements for achieving least cost provision of service. Effective risk recognition and management is an important element of minimizing the cost of capital. For investor owned systems, the ability to actually earn the allowed rate of return is key. For all systems, the better managed the system is, and the stronger the system is institutionally, the lower will be its cost of capital.

5. Alternative Capital Project Delivery Methods

Participants noted the potential cost savings available from more widespread utilization of alternative capital project delivery methods. The traditional approach of separating project design and construction leads to inefficiencies. Approaches such as design-build, applied effectively, can eliminate such inefficiencies. However, some State procurement laws will not allow State funds to be used for design-build projects.

6. Uniform System of Accounts

The National Association of Regulatory Utility Commissioners (NARUC) has developed a uniform system of accounts for use by commission regulated, investor owned utilities. A number of workshop participants felt that development of an analogous system of accounts for publicly owned systems would be beneficial. Many participants were concerned about how depreciation is treated in publicly owned utilities. A set of systems of accounts that would more readily facilitate comparison of utility financial performance, regardless of ownership, is seen as an important step forward.

7. Information Resources to Support Ownership and Management Contestability

A number of workshop participants noted that public sector decision makers need better information products to assist them in evaluating, negotiating, and managing contracts with the private sector. Equipping public sector decision makers to effectively evaluate contract proposals is an essential element of maintaining ownership and management contestability.

8. Pricing Paradigm

Workshop participants noted that pricing water and wastewater service to fully recover the cost of providing that service may require broader application of innovative approaches to cost allocation and rate design. This is especially true as concerns about the impact of rising rates on the poorest of households receives greater attention.

Another factor complicating pricing is flat or declining base demand at a time of rising costs. Discussion of the concept of decoupling revenue from sales is just beginning. An informed and robust discussion of the options available for establishing rates will be essential.

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Appendix A

Background Paper on Full Cost Pricing

United States Environmental Protection Agency
Office of Water

Sustainable Infrastructure Initiative

Full Cost Pricing Expert Workshop

November 1-3, 2006
Institute for Public Utilities-Michigan State University

Background Paper on Full Cost Pricing

Summary

The United States Environmental Protection Agency (EPA) is convening an expert workshop of leading academics, water utility executives, Public Utilities Commissioners and staff, utility rate setting practitioners, and other experts to explore the issue of "full cost pricing" for water and wastewater service. The industry is entering an era characterized by significant infrastructure replacement need and new investment for enhanced public health and environmental protection.[1] Overwhelmingly, the costs of these investments will be borne by the utility ratepayers.

Full cost pricing is one of four major themes under EPA's Sustainable Water Infrastructure Initiative. The other themes include: management of utilities; promoting a watershed based approach to infrastructure planning; and promoting the efficient use of water. Taken together, the Agency believes that these four "pillars" of sustainable infrastructure will help enhance the efficiency of the water and wastewater sector in the United States and ensure achievement of our nation's public health and environmental protection objectives.

The Expert Workshop brings together different perspectives on the fundamental questions related to full cost pricing of water and wastewater service. The objective of the Workshop is to achieve a deeper understanding of these issues from a variety of perspectives. The Agency hopes the Expert Workshop will help us better frame the issue for further deliberation and provide insight into a variety of possible approaches to facilitating industry movement toward sustainability.

[1] This paper uses the following definitions to distinguish between the physical infrastructure and the ownership/management of that infrastructure:

Water System: The physically interconnected infrastructure designed to deliver potable water to individual retail connections. The simplest water system consists of a well, hydropneumatic tank, and distribution piping to about 15 household connections. The most complex systems consist of multiple large treatment plants (treating hundreds of millions of gallons per day or more) feeding into enormous distribution systems containing hundreds of miles of pipe and providing service to a full array of residential, commercial, and industrial users as well as wholesale service to other water systems.

Water Utility: The physical infrastructure designed to deliver potable water to individual wholesale or retail connections together with the organizational entity legally responsible for the ownership and management of the infrastructure and the quality of the water delivered to the customer. A water utility may own and operate a large number of physically separate water systems.

Defining Full Cost Pricing

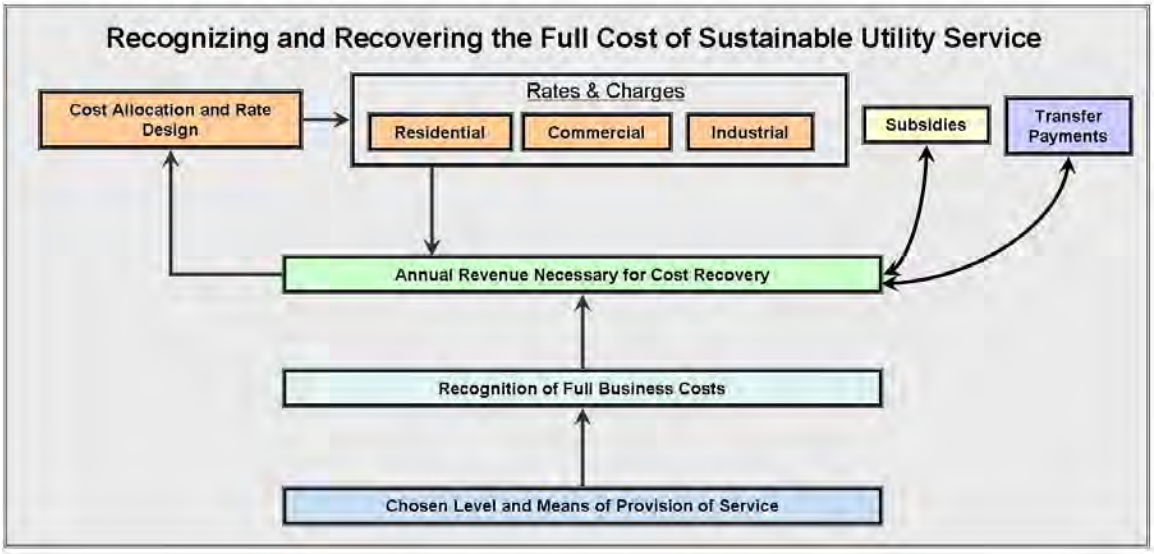
The following draft definition of full cost pricing is offered to facilitate discussion at the expert workshop:

Full cost pricing is a pricing structure for drinking water and wastewater service which fully recovers the cost of providing that service in an economically efficient, environmentally sound, and socially acceptable manner, and which promotes efficient water use by customers.

EPA's Preliminary Conceptual Model

The internal EPA Working Group on Full Cost Pricing has developed a draft definition and preliminary conceptual model of full cost pricing to facilitate discussion of what full cost pricing means and how it relates to other major elements within the Sustainable Infrastructure Initiative. The Agency hopes the definition and preliminary conceptual model will prove useful to the expert workshop participants as tools around which they may organize their thoughts and discussion on the subject. A brief description of the model (Exhibit 1) and some related questions for participants to consider in preparing for workshop discussions is included below.

Exhibit 1: Preliminary Conceptual Model for Full Cost Pricing of Water and Wastewater Services



The model posits that the fundamental determinants of the full cost of water and/or wastewater service are the level of service the public desires and the way in which a utility (or utilities) is structured and managed to deliver that level of service. Table 1, below, presents examples of issues and questions helpful in thinking about level of service and utility structure and management.

Table 1: Level of Service and Utility Structure and Management Considerations

System Type	Example Level of Service Issues	Example Utility Structure and Management Issues
Water	• Does system provide fire protection? • What peak flow demands can the system meet? • Number and duration of service interruptions per year. • Number of water main breaks per year (and damage caused by breaks). • Quality of water delivered to customer. Does it comply with federal/state health based regulations? Does it meet the aesthetic demands of customers? • Time to respond to customer complaints or questions. • Nature of system's "environmental footprint"—is it a "green" system? • Outreach and public education. • Opportunities for customer input and involvement.	• Utility ownership: public or private? • Utility scope: water or wastewater only? Both? Both including other? • Institutional structure: If public; line department of city government? Enterprise fund? Special district? If Private; is it a publicly traded corporation or a private owner? • Utility management: public or private? If owner does not manage, what is the nature of the contractual agreement under which some other party manages the system/utility? • Geographic scope of utility: Is it system or community specific or regional in nature?
Wastewater	• Number and duration of service interruptions (such as backups) experienced by customers. • Number of times and quantity of untreated wastewater discharged per year. • Quality of treated effluent: Does it comply with federal/state standards? Does it satisfy community expectations? • Time to respond to customer complaints or questions. • Nature of system's "environmental footprint"—is it a "green" system? • Outreach and public education. • Opportunities for customer input and involvement.	

A central question implied by the model is the cost effectiveness with which the selected utility structure and management is able to deliver the desired level of service. Is the desired level of service being obtained at least cost? If not, is it being obtained in a manner optimizing appropriate social outcomes? According to whose perspective?

Assuming an appropriate level of service is being provided in a manner optimizing desired social outcomes, the model next reflects the need to fully identify all business costs associated with the provision of that service. At this point, the insights from the Better Management Pillar of the Sustainable Infrastructure Initiative are needed. In particular, a comprehensive asset management program or a similar planning practice through which the utility can estimate its long-term capital and operating costs. In this context long-term is defined as the life cycle of the assets of the utility—in the case of pipes 70+ years. The planning process employed should address the lumpy nature of infrastructure investment and the intergenerational equity issues associated with that. Critical issues will involve how capital projects are delivered (traditional vs. design-build

for example), the cost of capital, financing alternatives, treatment of depreciation, and the optimum mix of maintenance vs. capital replacement in the real world operating environment of the utility.

Once the full business costs of providing the service have been determined, the annual revenue stream necessary to fully cover those costs must be calculated. If systems are under the jurisdiction of their State Public Utilities Commissions, this process will be governed by the established policies and procedures of the commission.

Once the annual revenue stream necessary to sustain the desired level of service has been determined, the model moves into the cost allocation and rate design process. Principles of cost allocation and rate design are well established. A critical question for the expert workshop is the current state of practice in cost allocation and rate design. Is there a need for significant innovation in this area? If so, of what nature? How important are cost allocation and rate design as opposed to the issues considered earlier in the model to achieve full cost pricing?

As an essential component of this analysis, the model calls for explicit consideration of the role that external subsidies (such as federal or state interest rate subsidies or grants) and transfer payments (such as movement of funds between a city's general fund and the utility) will play in meeting the annual revenue requirement. Subsidies will decrease the amount of revenue that needs to be recovered from ratepayers. Transfer payments from the city's general fund into the utility will also reduced the revenue that needs to be collected. The opposite will hold if the transfer payment is from the utility to the city's general fund. A key question for the expert workshop is the role that subsidies and transfer payments do and should play in the pricing of water and wastewater services.

After any correction for subsidies and/or transfer payments and after application of the selected cost allocation and rate design methodology, the annual bill for each user can be determined, assuming (if necessary) a given level of water use or wastewater generation. At this point, decision makers may conclude that the household rates, necessary to support the existing or desired level of service under the selected management and operational structure, are economically or politically not feasible. This would require a return to the beginning of the model to revisit decisions about level of service and/or the utility's structure and management/operations.

Discussion Topics

The objective of the Workshop is to hear from a variety of perspectives to achieve a deeper understanding of the broader implications of full cost pricing. Therefore, we are also hoping to discuss a broad range of key issues that tie into the elements of full cost pricing as presented in the model. These include:

- Accounting for future infrastructure costs
- The impact of utility decision making on costs
- Equity considerations

- Affordability
- Institutional options (e.g., private-public partnerships)
- Framing the argument for full cost pricing to reduce customer resistance
- Implementing a full cost pricing structure
- Addressing cases in which repayment does not match the useful life of the asset
- Whether utilities can charge for goods and services that have been free
- Unfunded pension and other post-employment benefit (OPEB) liabilities
- The link between full cost pricing, home values, and economic development
- The implications of Governmental Accounting Standards Board (GASB) 34

Appendix B

Workshop Agenda

Agenda
EPA Expert Workshop on Full Cost Pricing for Water and Wastewater Service
The Kellogg Hotel and Conference Center at Michigan State University
East Lansing, MI
November 1-3, 2006

Wednesday, November 1, 2006		
5 p.m.	**Meet & Greet and Workshop Check-in** Room 101, The Kellogg Center	
6 p.m.	**Dinner** The State Room Restaurant	
7:30 p.m.	**Framing Discussions** Room 101, The Kellogg Center	
	History of the Safe Drinking Water Act, EPA's Sustainable Infrastructure Initiative, and the Full Cost Pricing Model	Peter Shanaghan, *EPA*
	History of Safe Drinking Water Act and Clean Water Act Implementation and the Evolution of the Water Industry	Ralph Jones, *The Cadmus Group*
	The Water Industry Compared and the Economic Regulation of the Industry	Jan Beecher, *MSU IPU*
	Capital Efficiency	Myron Olstein, *Independent Consultant*
Thursday, November 2, 2006 – Room 103A/B, The Kellogg Center		
8:30 a.m.	**Framing Discussions, continued**	
	The Investment Community Perspective on the Water and Wastewater Industry	Debra Coy, *Janney Montgomery Scott, LLC*
	An Economist's First Impressions of the Water Industry	Don Coursey, *University of Chicago*
9:15 a.m.	**Determining Level of Service**	
	Overview of Key Issues – Framing level of service in terms of full cost pricing	Peter Shanaghan, *EPA*
	Level of Service: An Academic Perspective • *Where are decisions on level of service made?* • *Trade-offs between different levels of service* • *The economic impact and benefits of chosen level of service*	Edna Loehman, *Purdue University*
	Panel Discussion: Utility Level of Service Perspectives • *Actual experiences with level of service issues*	David Williams, *East Bay MUD* Julius Ciaccia, *Cleveland Utilities* John Huber, *Louisville Water* Joe Gehin, *Wausau, WI Utilities* John O'Neil, *Johnson County, KS Wastewater* Kathy Pape, *Aqua America* Paul Foran, *American Water*
	Panel Discussion: Economic Regulatory Level of	Jack Betkoski, *Connecticut DPUC*

	Service Perspectives • *Actual experiences with level of service issues*	Dave Sheard, *Wisconsin PSC* Christine Hoover, *PA Office of Consumer Advocate*
	Open Discussion	All participants
10:45 a.m.	**Break**	
Thursday, November 2, 2006 – Room 103A/B, The Kellogg Center (continued)		
11:00 a.m.	**Means of Provision of Service – Institutional Structures**	
	Overview of Key Issues – Framing the issue from a national perspective	Peter Shanaghan, *EPA*
	An Academic/Public Policy Framework for Understanding and Evaluating Alternative Institutional Structures	Jan Beecher, *MSU IPU*
	Panel Discussion: Public/Private – The Utility Perspective	David Williams, *East Bay MUD* Julius Ciaccia, *Cleveland Utilities* John Huber, *Louisville Water* Joe Gehin, *Wausau, WI Utilities* John O'Neil, *Johnson County, KS Wastewater* Kathy Pape, *Aqua America* Paul Foran, *American Water*
	Panel Discussion: The Academic Economists' Perspectives on Alternative Institutional Structures	Edna Loehman, *Purdue University* Patrick Mann, *West Virginia University* Don Coursey, *University of Chicago*
12:15	**Lunch**	
12:45 p.m. (Working Lunch)	*Panel Discussion: The Economic Regulators' and Consumer Advocates' Perspective on Alternative Institutional Structures*	Jack Betkoski, *Connecticut DPUC* Dave Sheard, *Wisconsin PSC* Christine Hoover, *PA Office of Consumer Advocate*
	Open Discussion	All participants
1:30 p.m.	**Break**	
1:45 p.m.	**Recognition of Full Business Costs**	
	Overview of Key Issues	Peter Shanaghan, *EPA*
	Using Asset Management to Understand the Full Long-Term Costs of Doing Business	John Cromwell, *Stratus Consulting*
	The Local Elected Official's Perspective on GASB 34 and Unfunded Pension and Other Post-Employment Benefit Liabilities	Ralph Jones, *The Cadmus Group*
	Open Discussion	All participants
3:45 p.m.	**Break**	
4:00 p.m.	**Annual Revenue Necessary for Full Cost Pricing**	
	Overview of Key Issues	Peter Shanaghan, *EPA*
	The Effect of Demand Depression on Revenue Requirements	Paul Foran, *American Water*
	Panel Discussion: Cost of Service	John Guastella, *Guastella Associates*

		Tom Chesnutt, *A&N Technical Services* Dave Sheard, *Wisconsin PSC*
	Open Discussion	All participants
5:30 p.m.	**Adjourn**	

Friday, November 3, 2006 – Room 103 A/B, The Kellogg Center

8:30 a.m.	**Cost Allocation and Rate Design**	
	Overview of Key Issues • *The role of rates and charges vis-à-vis subsidies and transfer payments* • *Addressing concerns regarding household affordability*	Peter Shanaghan, *EPA*
	Cost Allocation and Rate Design: Major Issues and Considerations	Patrick Mann, *West Virginia University*
	Panel Discussion: The Utility Perspective	David Williams, *East Bay MUD* Julius Ciaccia, *Cleveland Public Utilities* John Huber, *Louisville Water* Joe Gehin, *Wausau, WI Utilities* John O'Neil, *Johnson County, KS Wastewater* Kathy Pape, *Aqua America* Paul Foran, *American Water*
	Panel Discussion: The Consultants' Perspective	Tom Chesnutt, *A&N Technical Services* John Guastella, *Guastella Associates* John Cromwell, *Stratus Consulting* Heather Himmelberger, *NM EFC* Myron Olstein, *Independent Consultant*
9:45 a.m.	**Break**	
10:00 a.m.	*Panel Discussion: The Economic Regulators' Perspective*	Dave Sheard, *Wisconsin PSC* Christine Hoover, *PA Office of Consumer Advocate*
	Open Discussion	All participants
11:00 a.m.	**Concluding Open Discussion** • *Major themes* • *Next steps: How to advance adoption of full cost pricing by utilities? What is the federal role? What is the policy research agenda? What is the technical research agenda?*	All participants
12 p.m.	**Adjourn**	