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ANALYSIS

A comparison of life cycle cost analyses for a typical college dormitory using subsidized versus full-cost pricing of water

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Abstract

This study examines the impact of public policy on life cycle cost analyses for a hypothetical high-density residential dormitory. The specific public policy decisions considered in this study are (1) operating subsidies for municipal water production and treatment, (2) capital subsidies in the form of infrastructure grants to municipal water districts from state and federal governments, (3) deferred recapitalization and maintenance, and (4) technology improvements required by more stringent water quality standards. These four public policy influences create market imperfections, which "artificially" alter the price of water from its natural equilibrium. In this study, market imperfections are factored into the current consumer price of water to determine the full-cost price in four distinct municipalities. Results suggest that market imperfections created by public policy tend to undervalue life cycle cost analyses for efficient solutions. Implications of the results for researchers, public-policy makers, and management educators are discussed.

Keywords: Life cycle cost analysis; Water efficiency; Subsidies; Market imperfections; Public policy

1. Introduction

The United States Environmental Protection Agency of the United States of America (U.S. E.P.A.) recognized the year 2002 as the "Year of Clean Water." Internationally, 2003 has been designated as the "International Year of Water." Within the commercial building industry, the United States Green Building Council has included water efficiency credits within the Leadership in Energy and Environmental Design (LEED®) Rating System. The topics of full-cost water pricing, municipal infrastructure needs, and the use of water efficient plumbing fixtures and appliances are current topics of interest within the research and industry communities. Additionally, the proper management of the nation's water resources is important to protect the health of the population and the

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natural environment. Considering each of these factors, the management of our nation's water resources requires a transdisciplinary dialog.

From the perspective of a municipality, proper management of the nation's water resources includes establishing water pricing methods that collect sufficient funds to repair, replace and maintain municipal infrastructure as well as to supply sufficient funds to support new water and wastewater treatment technologies. From the U.S. EPA's perspective, proper management of water resources includes the development of standards and regulations to protect human and environmental health. Additionally, from the perspective of the general population, proper water management requires that a sufficient supply of affordable water is continually available to meet users' needs. With an increasingly urbanized population, population growth in water-scarce regions of the United States, and aging infrastructure, further study is necessary to determine if water can be used more efficiency and economically.

The purpose of this paper is two-fold. First, to review the current focus points of several stakeholders related to the management of water resources in the United States, including the US government, industry, and the research community. Then, quantitatively considering these focus points, the water consumption of three plumbing design scenarios for a college dormitory will be analyzed using life cycle cost analysis, contrasting current subsidized pricing versus full-cost water pricing methods. The goal of the analysis is to provide insight as to whether the use of full-cost pricing would encourage more efficient plumbing designs for high-density residential buildings.

2. Stakeholder focus points

Since water is a critical public good necessary for all forms of life, human health, and industrial/economic vitality, it is appropriate to analyze the market for water from a stakeholder perspective. Much has been written in the business and society literature regarding how to conduct a stakeholder analysis, however a thorough review of the stakeholder literature exceeds the scope of this paper. For the purposes of our paper, we will proceed with what Max Clarkson termed public stakeholders (Clarkson, 1995, page 106), specifically "...the government and communities that provide infrastructure and markets, whose laws and regulations must be obeyed, and to whom taxes and obligations are due." The three classifications of public stakeholders in this paper are the government, acting on behalf of the people and the environment, industry groups, which establish voluntary standards for consumption of water in the environment and the scientific community. The scientific community is defined broadly to include life scientists, engineers, political scientists, economists, and management researchers, and has been charged with keeping water healthy, plentiful, and affordable through the establishment of treatment standards, recommendations on water policy, etc. The focus of each stakeholder group will be reviewed in the following sections.

2.1. The government

Some topics the government of the United States of America recently has been focusing on are the determination of future municipal infrastructure needs, encouraging water efficiency practices, and promoting higher levels of water quality. More specifically, the government is currently working to develop a national water efficiency program and is continually developing water treatment regulations to protect human and environmental health. In addition, the U.S. EPA has recently completed a study called "The Clean Water and Drinking Water Infrastructure Gap Analysis" to assist community dialogue regarding investments in water infrastructure.

Considering water and wastewater infrastructure needs first, "The Clean Water and Drinking Water Infrastructure Gap Analysis" (Environmental Protection Agency, 2002) is a report that estimates the financial need to support capital, operation, and maintenance expenses for water and wastewater infrastructure from 2000 to 2019. For this study, infrastructure is defined as "the pipes, treatment plants, and other critical components that deliver safe drinking water to our taps and remove wastewater from our homes and other buildings." To complete the report, data from the Environmental Protection Agency, the Census Bureau, and the Congressional Budget Office was used. In broad terms, the report concludes that clean water and drinking water systems will need to use some combination of increased spending and innovative management practices to meet projected needs.