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Integrating data for water demand management

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Abstract

Although utilities have access to land use and demographic data, often little is known of water users, except for their billing class. The present study integrated this data with water billing records of three Canadian municipalities, using it to define benchmarks and targets for conservation. Integrated databases were created for easy storage and updating. Results were presented in a summary tool. Access to an organized and condensed version of the extensive water, land use, and demographic data facilitates system assessments. The integrated database and the summary tool provide actionable information for utilities seeking to increase the sustainability of their systems.

Keywords: integrated database; water use; conservation; land use; demographics

1. Integrating Data

Advances in technology and information exchange have progressively facilitated data collection (Maidment, 2008). The value of this data, however, depends on how it is managed. Information might indeed be power, but excessive unutilized data is inconvenient. Yet data can provide actionable information for utilities to strategize and improve performance. It supports claims that were once only based on years of experience. It also provides insight into the most important driving factors of consumption. In order to reap the benefits of data collection, information must be organized and integrated. UNEP (2012) reviewed worldwide applications of integrated approaches to water resource management and recognized the need for better information management, stating that "Information

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is the foundation of good decision-making and planning", with reference to integrated water resources management in Agenda 21.

Because water resources issues are not isolated in one sector, but are shared by agriculture, sanitation, industry, urban development, etc., and create repercussions in the economic, social, and environmental spheres, integrated management is key (UNCED, 1992). Obstacles to better integration, according to Hussey and Pittock (2012), are: data (missing or disorganized), existing policies and frameworks (fragmented, inconsistent, lacking review), and cultural inertia/path-dependency (silo mentality). The present study focuses on data as a pathway to resolve the latter two. It integrates data with the objective of facilitating performance management and conservation, as well as creating substantiated arguments for changing current policies and frameworks.

Demographics, dwelling characteristics, and household composition all directly influence water consumption, conservation intention, trust, perceived behavioral control, perception, and habits (Jorgensen et al., 2009). For instance, large lots increase water demand, due to increased outdoor use and longer lengths of pipe. Low-density housing also increases leakage, demand, and costs (US EPA, 2006). Approaching water use through the lens of urban planning not only helps explain demand but can also improve the effectiveness of water conservation targeting (Shandas and Parandvash, 2009)

EPCOR (2012) developed a targeted water conservation strategy for the city of Edmonton. Water consumption information was linked to EPCOR's GIS system, with property lot size. This was further combined to demographic information available from the city's planning and development department and to the number of units available from the waste management branch. Specifically for ICI customers, North American Industry Classification System codes were linked to each customer record. Specific business categories were selected as water conservation targets based on wide ranges in consumption and high number of customers.

Although Canadian municipalities have access to land use and demographic data from the Municipal Property Assessment Corporation (MPAC) and Statistics Canada (StatsCan), respectively, many times little is known of the users except their billing class, i.e. residential, industrial, commercial, and institutional. This classification is not descriptive, and does not allow for the definition of more homogeneous groups of users, which are more suitable for analyzing trends, establishing benchmarks, and targeting conservation. Accordingly, the present study seeks to define benchmarks and targets for water conservation, based on integrated water consumption, land use, and demographics data.

2. Water Demand Management and Benchmarks

Since water demand is influenced by a number of consumer and infrastructure related issues, these circumstances should be accounted for if demand variations are to be understood and managed. The increase in population continues to stress water resources and establish water scarcity as a key priority. Given recent economic and climate-related concerns, public water systems are no longer viewed as low risk investments. Nonetheless, consumer awareness has increased, building codes have been improved, and water demand per capita has decreased in many North American municipalities (Leurig, 2012). This creates grounds both for relief and sometimes unease. While the reduction in demand may mean deferring expansions and reducing capital expenditure, if not expected, it could signify a deficit due to the reduced amount of revenue. This is further aggravated by the climbing capital costs caused by aging infrastructure (AWWA, 2012). Reduced demand also implies less flow in pipes, increasing residence times and the potential for water quality issues.

According to Javier (2011), world's water systems are currently unsustainable, inflexible, or lack the robustness needed to meet growing water demands. Population growth, increasing urbanization, industrial growth, climate change, and deteriorating and insufficient water infrastructure are five key macro trends that are simultaneously impacting water supply. In order to manage water scarcity, approaches vary from improving water quality to decreasing demand (OECD, 2009). Kayaga et al. (2007) emphasize the need to apply water demand management at the end-use level, in addition to the supply-side. Motivations for such are numerous: deferring and reducing capital works, and downsizing treatment plants and distribution upgrades; reduced cost of pumping due to decrease in frictional energy losses; and flexibility of demand-side solutions in terms of adjusting a given program to meet changing circumstances (Sahely and Kennedy, 2007).