

# WATER EFFICIENCY

## Water Use Estimates

### How Water Sales and Research Studies Can Be Used to Predict Future Needs

#### Quick Facts

- Utility data are useful for analyzing water use trends, but have limitations
- Research studies on residential water use show an overall decline in consumption over time
- New methodologies, standardization of customer categories, and improved documentation will improve use estimates

#### Overview

Utilities need a comprehensive understanding of the many uses of potable water in order to meet current and future water supply demands. Water sales have been used to understand and predict demands and are based on periodic readings of the customer's meter. However, water meter data has limitations because utilities don't use uniform customer categories, lack detailed water use information, readings may not occur frequently enough to be useful, and not all customers have a meter. Research studies can provide more detailed water use measurements and averages. When combined with non-sales information, such data can help elucidate customer sales.

#### National Water Use Estimates

The national effort to collect water use information is conducted every five years by the U.S. Geological Survey (USGS). In the latest report, the USGS estimated that in 2010 the total water used in the United States was 355 billion gallons per day, a decrease of 13% from 2005. The largest uses of water were thermoelectric power (45%), irrigation (33%) and public supply—residential, commercial, and industrial freshwater uses (12%) (Maupin et al. 2014).

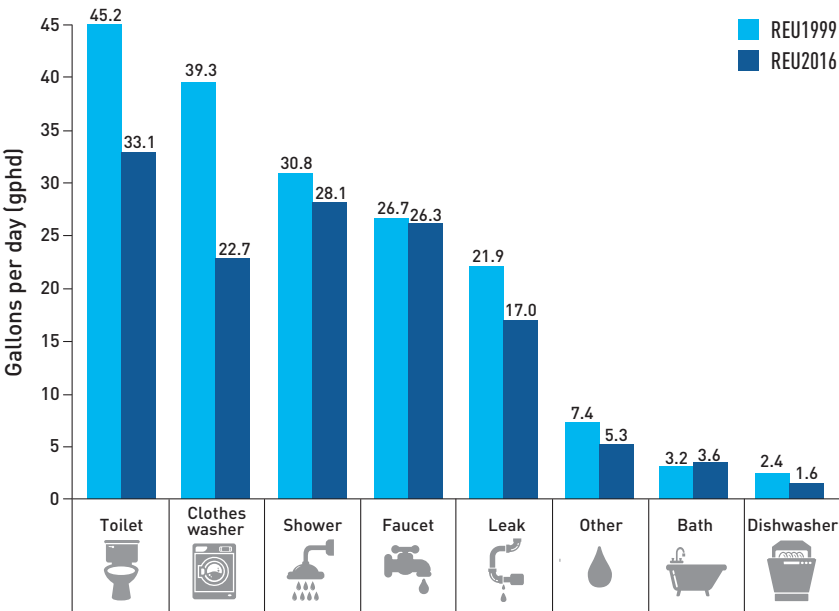
#### Utility Data On Water Use

Utilities do not use uniform categories and sub-categories for customer sales, thus water use trends analysis is hampered by a lack of accurate and consistent data. The

Water Research Foundation (WRF) report, *Evaluation of Customer Information and Data Processing Needs for Water Demand Analysis, Planning and Management*, recommended the development of standardized customer classification. It also recommended that utilities geographically reference water customers with their unique locations and maintain at least a 10-year record of customer water use and billing information (Kiefer and Krentz 2016). Some advances in data aggregation of water use information is underway, in part spurred

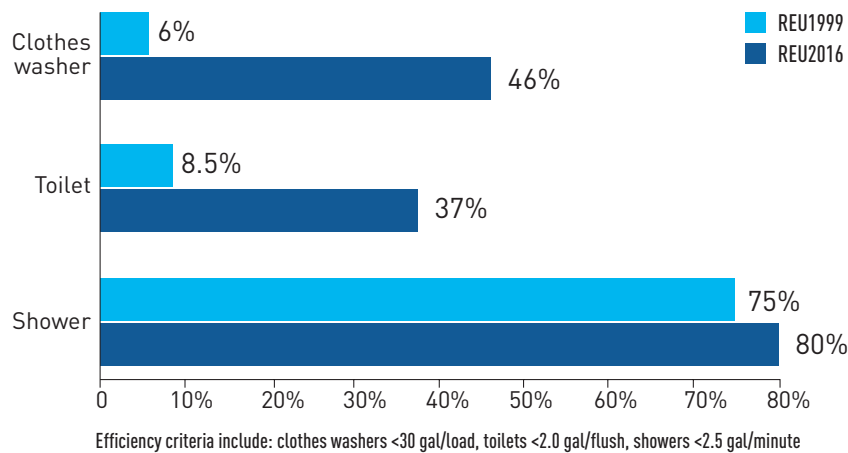
by advanced metering infrastructure and the recognition that data analytics could inform water use trends analysis. Using water sales data, American Water Works Association (AWWA) (2015) calculated “total per capita” consumption at 121.3 gal/person/day and “domestic per capita” consumption at 66.6 gal/person/day. Research studies can provide more detailed measurements of water use.

## Residential Customers: Single-Family, Detached Homes



Source: DeOreo et al. 2016

Figure 1. Indoor per household water use



Source: DeOreo et al. 2016

Figure 2. Percent of homes meeting EPA's WaterSense efficiency criteria

Single-family detached homes typically are the largest category of customers, both by volume of water consumer and revenue generated. These homes have the most direct record of water sales since each is individually metered. In the WRF reports, *Residential End Uses of Water* (Mayer et al. 1999) and *Residential End Uses of Water, Version 2* (DeOreo et al. 2016), water use per household was calculated from billing data and detailed water use information was collected for two weeks, which allowed for identification of water use by specific fixtures, appliances or water using behavior (like irrigation). Comparing water use amongst utilities is difficult with billing data alone because it includes irrigation and varies widely based on local climate conditions. The studies focused on comparing residential “indoor” water use since this is more comparable. In the 2016 report, the average indoor water use was 138 gallons per household per day (Figure 1) and 58.6 gallons per capita per day.

### Comparing Residential Water Use Over Time

*North American Water Usage Trends* analyzed 25 years of national sales data from 43 utilities, beginning in 1992. Residential water use per customer (house) declined 389 gallons per year. Reasons for water use declines in various study locations may differ because they are affected by the local economy, demographics, age of housing stock, and growth patterns (Coomes et al. 2010).

Comparing *Residential End Uses of Water* in 1999 and *Residential End Uses of Water*,

Version 2 in 2016, water use has declined 22% per household, from 177 to 138 gallons per household per day (gphd), or 15% per capita (from 69.3 to 58.6 gallons per capita per day [gpcd]).The decline in indoor water use resulted in part from the increased prevalence of more efficient toilets and clothes washers (Figure 2) (DeOreo et al. 2016).

The change in the occurrence of water-efficient appliances and fixtures is being studied in WRF’s ongoing project, “Integrating Water Use From Efficient Technology and New Building Codes into Demand Forecasting” (Cooley and Heberger, forthcoming).

**Multi-Family Residential Water Use**

The multi-family housing sector, larger in urban areas, is a component of most utilities’ sales and may be increasing. About 34% of housing units are some form of multi-family housing (U.S. Census Bureau 2013). Water use per unit is not well-documented because most units are not individually metered (Mayer et al. 2004).

It’s a commonly held idea that indoor water use from single family homes might be a proxy for use in multi-family housing units, but that has not been proven. Estimates of multi-family housing water use from research studies is 121-217 gallons per day per housing unit (Mayer et al. 2004, DeOreo and Hayden 2008). “Water Use in the Multi-Family Housing Sector” will develop and recommend strategies for estimating multi-family water use (Kiefer, forthcoming).

**Commercial, Industrial, And Institutional (CII) Water Use**

The CII sector of customers makes up about one-third of utility sales. Understanding such sales is complicated because not all businesses are individually metered, and their diversity prevents creation of homogenous groups of customers.

In the WRF study, *Commercial and Institutional End Uses of Water*, usage was calculated for popular categories of non-residential customers (Table 1). While size or magnitude of operations was accounted for, the study did not take into account variables such as the number of customers or employees (Dziegielewski et al. 2000)

Two WRF projects further the study of water use estimates for non-residential customers. *Methodology*

*for Determining Baseline Commercial, Institutional and Industrial End Uses of Water* developed analytical elements and developed data collection methods for differentiating among the CII groupings (Kiefer and Krentz 2015). The study suggested using 13 primary categories as a starting point: lodging, office building, school/college, health care facility, eating/drinking establishment, retail store, warehouse, auto/auto service, religious building, retirement/nursing home, manufacturing, other commercial/institutional, largest individual users, or dominant end uses. In the ongoing study, “Developing Water Use Metrics and Class Characteristics for Categories in the CII Sector,” goals include setting benchmarks for select CII customer categories (Fedak, forthcoming).


Typical water sales data based on monthly or bi-monthly readings of meters and have limitations because of non-uniform customer categories, lack of detailed water use information, and the lack of 1:1 relationship between meter and customer account. Research studies provide more detailed studies of water use by customer type, but are limited snapshots in time. Advances in

Table 1. Water use for non-residential customers from billing data	
	Average annual daily use*
Hotels and motels	7,113
Laundries / laundromats	3,290
Car washes	3,031
Urban irrigation	2,596
Schools and colleges	2,117
Hospitals / medical offices	1,236
Office buildings	1,204
Restaurants	906
Food stores	729
Auto shops	687
Membership organizations	629

\*gallons per day per utility customer

Source: Dziegielewski et al. 2000



technology (like advanced metering infrastructure) and practices (such as using standardized customer categories and geocoding customer accounts) will help improve the industry's understanding of water use trends and drivers. 

**There is a need to improve the usefulness of customer data for analyzing water use trends.**

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