Detailed Water-Use Data Without Customer Involvement

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Accurate information about customers' water-use patterns and efficiency levels is essential for planning or evaluating any water conservation program—but obtaining high-quality data can be difficult. One approach uses mailed surveys in which the customer reports the types of water-using fixtures and appliances in the home. Another attempts to select random samples of volunteer homes for site visits and audits. What is needed is a truly random and anonymous procedure for collecting detailed end-use data from singlefamily homes that allows water use to be fully characterized. The results from a properly selected sample can be applied to the entire population to determine the remaining conservation potential.

Quality Data, Minimal Interference

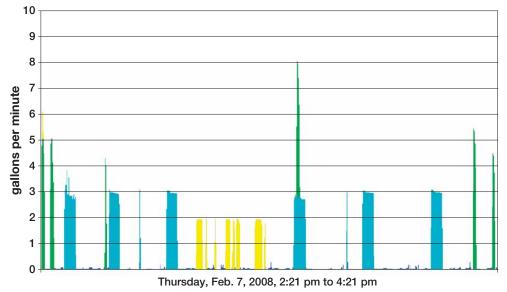
An example of such an approach is the California Single Family Home Water Use Efficiency Study funded by the California Department of Water Resources. Data collection and analysis were conducted from 2006 through 2008 on 780 homes statewide. While final results are pending, its methodology can be shared, including procedures for sampling and obtaining data and the information this type of study can provide.

Three main data sources are available, including the single-family billing database, flow-trace files collected from customers' water meters, and aerial photography of lots from GIS sources. None require customer involvement, so the entire study is conducted in a unbiased and controlled manner. Samples are chosen at random from the population of single-family accounts, and data are collected from sources that are either publicly available or owned by water agencies. All results are kept anonymous, thus maintaining customer confidentiality.

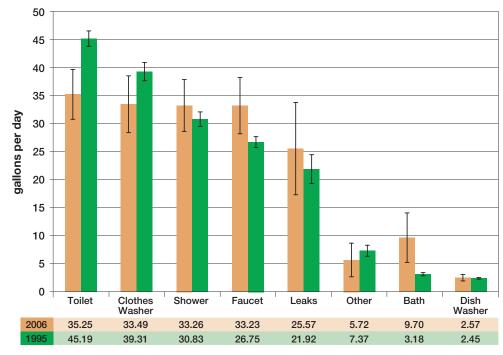
Flow Trace Tells All

The basis of this methodology is the flow-trace analysis using the Trace Wizard program developed by Aquacraft Inc. Most residential water meters have internal magnets that spin between 60 and 100 pulses per gallon of flow. The data loggers used for the study collect these pulses at 10-second intervals, providing a very accurate record of the flow versus time—the flow trace. Experience has shown that water-use events in flow traces can be categorized into individual end uses such as baths, showers, toilet flushes,

clothes washing, leaks, and dishwashers running, allowing indoor end use of water to be analyzed in detail. Gallons per household per day for each end use can be identified, as well as gallons per toilet flush or laundry load and flow rates of showers (see upper figure, below). Use also can be compared between groups (see lower figure), providing a level of detail that is impossible with other practical-to-implement techniques for analyzing water. The data can also



This typical flow-trace segment shows the water use of a clothes washer (light blue; two loads), toilets (green), faucets (yellow), and leaks (dark blue) over a two-hour period.



A breakdown of end uses for two study groups, one in 1995 (green) and one in 2006 (orange). Note that the 2006 set had lower water use for toilets and clothes washers, but higher use for most other categories.



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be used to determine how much of the population has adopted use of highefficiency fixtures and appliances.

Outdoor water use is determined as the difference between the metered annual consumption and projected indoor use from the flow trace (or in some cases from the minimum billing month). GIS analysis combined with local evapotranspiration data provide the theoretical irrigation requirement for lots in the study. This allows the application ratio and excess water used for irrigation to be determined for each home.

The flow-trace methodology applied to the California Single Home Water Use Study arose from data logger studies dating back to 1999. Techniques now permit highly detailed, anonymous studies to be conducted on the wateruse patterns of truly random samples of customers, providing accurate and detailed information that can be applied to the entire population to estimate system-wide savings potential. ■

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