Evaluating Customer Water Use to Create Effective Conservation Programs

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Conservation programs work best when they are targeted to the biggest water users. To save the most water at the lowest operational cost, each utility needs to evaluate its customers' water use before determining appropriate conservation programs.

One process for characterizing customers is to gather, prepare, and analyze existing data. The process varies among utilities, depending on available information, time, and expertise. If data and time are lacking, a utility could begin with single-family residential accounts, leaving nonresidential accounts for later examination.

Phase 1 – Gather Data   **Phase 2 –** Prepare Data   **Phase 3 –** Analyze Data

Phase I: Gather data

To illustrate this process, we analyzed data from 17,774 residential accounts from 2009 to 2013. Table 1 shows the water use (in gallons) by customer category as assigned by the utility.

The data included:

- Billed consumption by account (available from the utility)
- Individual property information (available from a local appraisal district)

Other data could include demographics from the US Census Bureau and spatial information from the city or appraisal district.

Table 1. Aggregate use distribution by customer category 2009–2013

| Use	Accounts #	Accounts %	Aggregate use (gallons)	Aggregate use %
Residential	27,597	87.48%	15,695,280,600	47.62%
Municipal utility district	34	0.11%	5,481,213,300	16.63%
Commercial	1,317	4.17%	4,494,147,800	13.64%
Commercial irrigation	564	1.79%	2,841,524,200	8.62%
Apartment	215	0.68%	2,261,232,100	6.86%
County	169	0.54%	937,189,200	2.84%
Outside city	1,521	4.82%	882,865,400	2.68%
Government	76	0.24%	300,977,000	0.91%
Fire hydrant (GC meter)	38	0.12%	11,039,800	0.03%
Industrial	6	0.02%	31,720,300	0.10%
Residential irrigation	11	0.03%	23,078,500	0.07%
Total	**31,548**	**100%**	**32,960,268,200**	**100%**

Phase II: Prepare the data

To prepare the data for analysis, we removed nonessential accounts, separated the accounts by customer category, and integrated property data into the consumption information. This data preparation made it easier in the next phase to identify account characteristics across a wide range of consumption levels.

The next steps were to determine seasonal (monthly outdoor) use and winter (indoor average) use by calculating each account's winter average.

Phase III: Analyze the data

First, identify the characteristics of high-consumption accounts. Compare annual consumption with aggregate consumption by ranges of property build-dates and assessed home values. These distributions help identify the characteristics of high-consumption accounts.

Assign both seasonal (monthly outdoor) and winter-use (indoor average) levels to each account to characterize their consumption. Then make a cross-comparison to further categorize customer accounts by similar consumption trends. Determine the annual and aggregate number of accounts, and from that information, calculate the annual and aggregate change in the number of accounts.
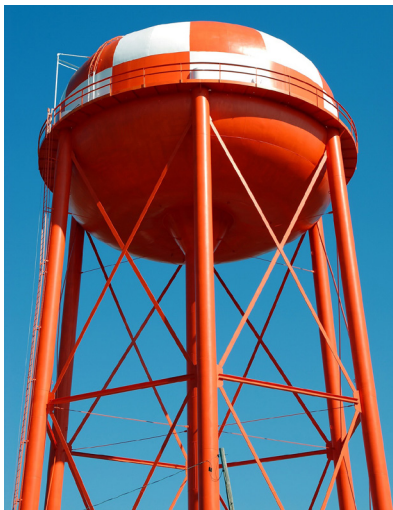
Results

Assign a use level to each customer account based on percentiles of seasonal and winter monthly averages. Compile the customer-use levels into one data set of annual consumption. This data set will help you divide the customers into groups of similar consumption trends and determine where to target conservation programming. Table 2 shows the final, prepared data set for the 17,774 open, residential accounts used in our analysis example.

To see how consumption changed over time, calculate the 5-year change in the number of accounts within each category (Table 3). The goal is to increase the number of lower-consumption accounts and decrease the number of higher-consumption accounts.

Then determine which groups used the most water during the 5-year period (Table 4). These groups offer the greatest opportunity to achieve water savings.

The average annual consumption per account (Table 5) is based on aggregate consumption data for all 5 years. The blue baseline (estimated indoor need) shows those accounts whose annual consumption indicates *efficient* consumption—they are using only what they need.

Table 2. Levels of average monthly consumption (gallons)

Level	Seasonal minimum	Seasonal maximum	Winter minimum	Winter maximum	Data set percentile
1	0	300	1,101	3,267	10th
2	301	2,742	3,268	4,542	25th
3	2,743	7,367	4,543	6,400	50th
4	7,368	13,933	6,401	9,367	75th
5	13,934	22,633	9,368	14,100	90th
6	22,634	183,467	14,101	98,333	MAX

Table 3. Change in number of accounts in 2009–2013

				Winter			
	Level	1	2	3	4	5	6
Seasonal	1	335	370	413	366	166	14
	2	283	377	340	268	113	2
	3	-6	-54	-79	24	42	-8
	4	-88	-126	-402	-347	-127	-74
	5	-29	-112	-174	-271	-169	-111
	6	-58	-63	-173	-250	-202	-190

Adopting this or a similar customer characterization process makes it easier and faster to target conservation efforts to the accounts using the most water.

Table 4. Aggregate water use (gallons) in 2009–2013

		Winter					
	Level	1	2	3	4	5	6
Seasonal	1	46,705,000	85,194,500	160,479,200	215,686,300	175,388,300	286,015,600
	2	137,394,100	201,067,200	317,712,000	300,393,200	153,280,400	99,461,100
	3	182,537,700	319,658,500	550,043,800	555,398,100	313,562,100	185,887,200
	4	200,032,300	363,540,300	677,666,800	733,017,000	456,321,100	251,226,500
	5	161,716,100	298,675,900	567,206,200	628,713,400	430,724,100	261,971,200
	6	122,272,400	250,091,900	508,652,600	642,458,900	498,008,400	521,150,300

Table 5. Aggregate annual water use (gallons) per account in 2009–2013

		Winter					
	Level	1	2	3	4	5	6
Seasonal	1	31,219	45,123	60,600	81,955	110,162	188,584
	2	45,204	56,309	73,313	98,240	134,307	215,716
	3	59,886	74,852	92,384	117,920	155,433	230,359
	4	91,629	106,463	123,935	150,029	187,713	268,435
	5	134,283	150,516	168,295	191,515	230,958	311,548
	6	212,486	226,501	247,633	276,367	326,755	442,092

Baseline: 64,824 gpcd = 2.96 (pphh)*60 (gpcd)*365 (days/year)

Acknowledgments

New