



Billing Analysis for Revenue Stability

An exploration through the lens of a NC community

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Utilities often experience disruptions in their anticipated revenue streams as a result of common, but difficult to predict conditions. For example, a drought may cause a utility to enact watering restrictions in order to extend dwindling water supplies: forcing conservation and driving down revenues collected from rates. On the other hand, an unusually wet spring can also drastically reduce sales in reducing the need for irrigation at all. Utility revenues are heavily dependent on the volume of water sold, whereas in the short-term expenditures are largely fixed. As a result, lower than projected water sales often create financial hardship for utilities.

Different rate and pricing structures expose a utility to different levels of revenue volatility. Increasing block rate structures, or rate structures with a very low fixed charge component, can lead to much more significant revenue swings than uniform rate structures or rate structures with high base



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charges. Increasing block rate structures have gained favor lately as an economically fair way to promote responsible water use, oftentimes being referred to as conservation-oriented rate structures. Nearly a quarter of the utilities in North Carolina apply increasing block rate structures for residential customers; that percentage is steadily growing. When utilities restrict outdoor water use to protect their water supply or when hard economic times hit and people curtail discretionary uses of water, increasing block rate structures expose a larger portion of revenues to conservation.

A thorough understanding of household consumption behavior and utility rate structure design can help a utility assess their general revenue vulnerability and plan accordingly. This document outlines an example of how this analysis was applied using data from one North Carolina utility (Fayetteville Public Works Commission—PWC).

Determine baseline usage profiles

Many utilities can quickly tell you their average residential water use simply by dividing the total residential water use by the number of residential taps (or households). In fact, the NC Department of Water Resources requires that utilities report both these numbers in their Local Water Supply Plans. Given the complexity of many rate structures, knowing the average use and potential changes in the average use is no longer enough to accurately project revenue variation. A 10% drop in average use may have very different revenue implications for one utility than another utility based on pricing structure.

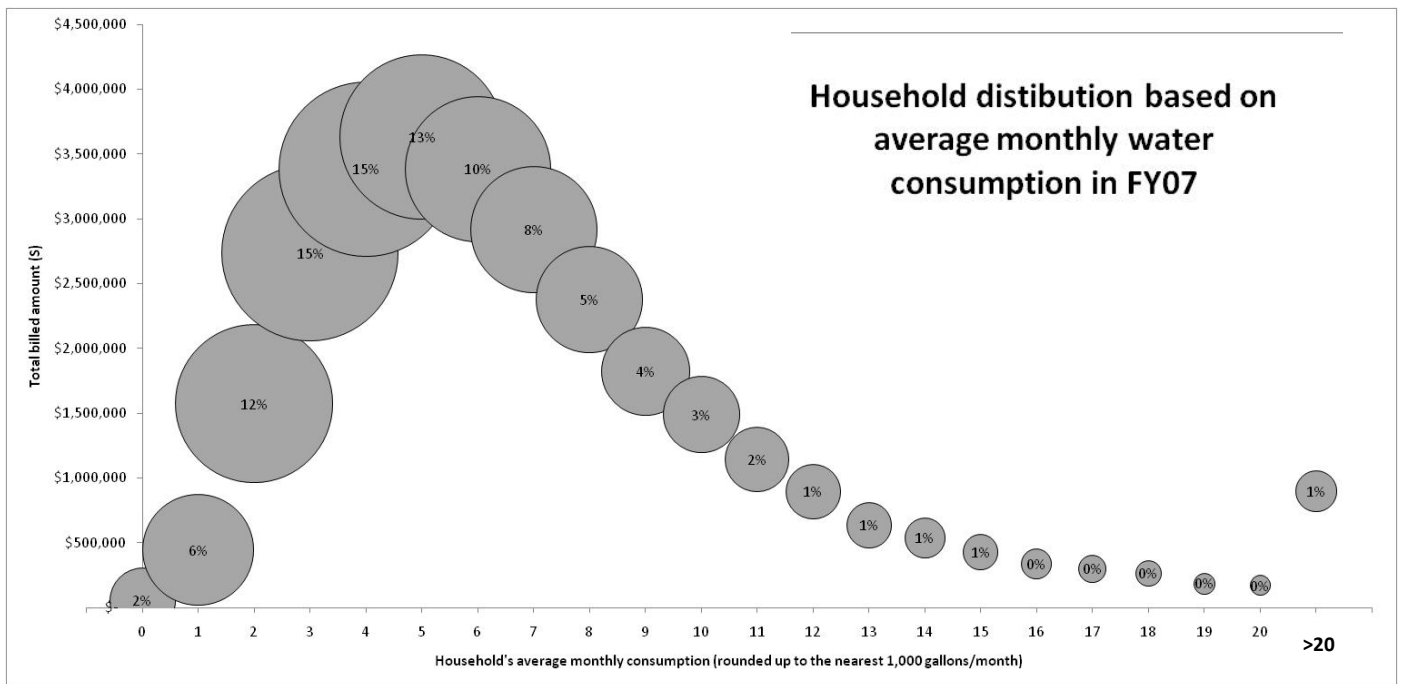
Equally important, usage changes over time are never uniform among households—some households will reduce (or increase) water use much more than others. The total revenue impact of all of these individual household reactions requires understanding of the relative revenue contributions of a utility’s own customer base before and after likely behavior changes. By tracking each household’s usage over time, one can understand the profile of their customer base and how changes to consumption by different groups of households are likely to affect the utility’s revenues. This is especially the case for a utility with increasing block rates, such as Fayetteville Public Works Commission.

The graph below shows the type of information that can be gained from “mining” household consumption data. For this graph, we used individual household consumption data to track

every single household’s monthly water use from July 2006 through June 2007 and determined each individual household’s average monthly use. The percentage of Fayetteville households that average each consumption amount is indicated by the bubble size in the graph below. The graph also reveals each group’s contribution to the utility’s revenue in FY07. While the largest number of households averaged 3 kgal/month, the graph shows that those averaging 5 kgal were actually contributing the most to Fayetteville’s revenue.

This graph shows that over half of Fayetteville’s households averaged less than 6 kgal/month, while a significant portion of the total residential revenue came from the few households that averaged more than 20 kgal/month. During this year, Fayetteville had increasing blocks for its water with a cutoff at 6 kgal/month. The first 6,000 gallons were billed at \$2.29/kgal, each additional kgal was billed at \$3.23.

Entering into the new fiscal year, Fayetteville probably had some premonition that drought conditions may drive the need for water use restrictions—and they would have been right! Although Fayetteville has restricted lawn watering to an odd-even mandatory schedule from May 1st to September 30th every year since 2002, this restriction was expanded to include the entire year in FY08. In addition, for six months out of FY08 (November through April), the utility banned car washing, driveway and street cleaning, and pool filling, and gave each resident a conservation goal of 10%.



Superimpose your baseline on your rate structure

A fixed percentage reduction in use by a household that uses a lot of water impacts revenue at a different degree than the same percentage of conservation by a household that uses much less water. The impact is dependent on the water and sewer rate structures.

revenue received by the utility) charged to low-use households by only 4-8%, whereas bills to high-use households would be lowered by more than 10%. Projecting the overall impact to Fayetteville’s residential revenues hinges on which households conserve (and by how much).

In FY08, Fayetteville changed their blocks in their increasing block water rate structure. The new water rate structure charged residential customers \$2.20/kgal for the first 5,000 gallons, the next 5,000 gallons at \$3.23/kgal, and all consumption

Utilities, including Fayetteville PWC, often set general customer-wide conservation targets as part of their outreach program. For example, Fayetteville PWC set a conservation target of 10% for all of their customers during much of FY08.

Tier		1					2					3											
Households’ average monthly consumption		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	>20
FY07 baseline	% of households	62.2%					29.8%					7.2%										0.8%	
	% of billed amount	39.9%					40.5%					16.5%										3.0%	
Total water and sewer volumetric rate	FY07	\$6.49/kgal					\$7.43/kgal					\$7.43/kgal											
	FY08	\$6.40/kgal					\$7.43/kgal					\$8.08/kgal											
% reduction in FY08 total bill when household conserves 10%		0%	4.2%	5.9%	6.8%	7.4%	7.8%	9.2%	9.3%	9.5%	9.5%	9.5%	10.2%	10.2%	10.3%	10.3%	10.3%	10.2%	10.2%	10.2%	10.2%	10.2%	10.2%

over 10,000 gallons at \$3.88/kgal. The sewer uniform rate was not changed in FY08; the cumulative monthly base charge was raised from \$6.54 to \$8.92. So not only did Fayetteville implement greater restrictions, but it also changed the incentive for (and the revenue impact of) conservation compared to FY07. The table above shows the bill reduction that each of Fayetteville’s would have households received if they conserved 10% during the fiscal year of 2008.

While these targets convey a sense of fairness towards households, actual behavior is likely to veer from the targets and revenue projections should rely on information about what is likely to occur. Superimposing the utility’s baseline, we can see that if all of their current households achieved a uniform 10% conservation target, the majority of the residential revenue would be decreased by less than 10% (the weighted average is actually 7.8%). Projecting revenues when the impact of conservation is variable among households requires being able to reasonably predict the likely variability of use by different households at different ends of the pricing spectrum.

The table shows that Fayetteville’s new rate structure resulted in a much stronger conservation pricing signal for high users than for lower water users (<10 kgal/month). These households account for nearly 80% of Fayetteville’s residential revenue. The rest of Fayetteville’s households, those in Tier 3, received stronger economic incentives to conserve, “exposing” nearly 20% of their FY07 residential revenue baseline to more discretionary demand reductions.

So what actually happened? Did everyone save 10% across the board? The short answer is no. In fact, Fayetteville experienced an overall slight increase in water use, both system-wide (which may be partially explained by serving more households in FY08) and on an average per-household level. As a result, Fayetteville’s total billed amount for residential water customers increased from \$29.6 million to \$32.9 million.

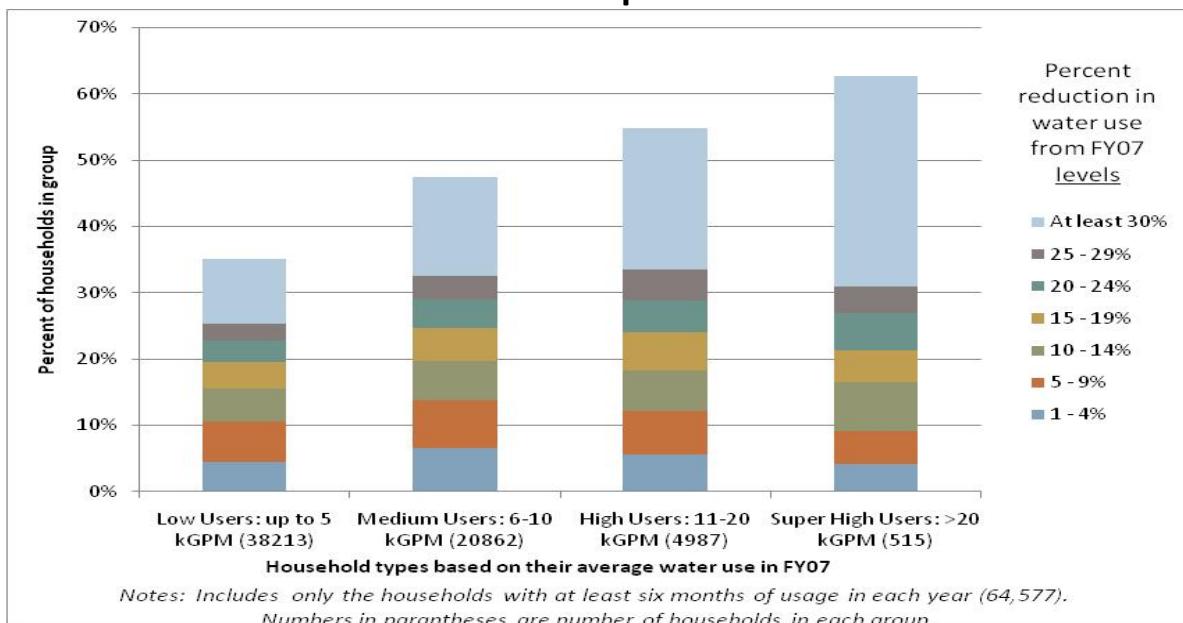
The last column shows that a 10% reduction in consumption would lower the bill amounts (and

Analyze actual response and create a historical perspective for future planning

But despite the overall slight increase in water use, many households reduced consumption at varying degrees. Forty-one percent of the households reduced their average consumption in FY08 from FY07, with a median water use reduction of 19% among the conserving. When we break down Fayetteville's households into groups based on their average water use in FY07, the data clearly show that a greater percentage of the high-use households reduced their usage during the year and that the typical reduction percentage for these households was much greater than for the low-use households. In fact, 63% of the 515 households in

this sample that averaged more than 20,000 kgal/month of use in FY07 (super high users) reduced their consumption in FY08, compared to only 35% of the 38,213 households that averaged less than 5,000 kgal/month (low users). One-third of the 515 super high users reduced their water use by at least 30% in FY08, compared to only 10% of the 38,213 low users. Because of their higher rates and greater volume reductions, the 324 conserving high users contributed twice as much to the overall revenue reductions as the nearly 13,374 conserving low users.

Households that reduced consumption in FY08 from FY07 levels



Conclusions

- Knowing your customer baseline allows you to determine the proportions of households that may be influenced by different types of conservation measures.
- Superimposing your baseline on the sensitivity of your combined rates to usage changes allows you to predict potential revenue impacts based on varying levels of usage changes.
- Historic data can be used to inform how different types of households change their usage, providing a more accurate starting point to predictions on potential revenue impacts.
- Price signals are important. Fayetteville lowered the volumetric rate for low water use, and raised it for high use in FY08, and set to achieve an overall 10% reduction of water use through non-pricing strategies. While high users responded strongly, the low and medium users seemed to respond more to the economic disincentive to conserve than to the broadcast goal. Because high users are in a minority, the potential revenue loss witnessed by Fayetteville was offset by their higher rates and the increased water use among the majority of low users, raising overall revenues.