Water Rate Structures and Revenue Resiliency

May 7, 2015, Fort Worth, TX

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Dedicated to enhancing the ability of governments and other organizations to provide environmental programs and services in fair, effective, and financially sustainable ways through:

- Applied Research
- Teaching and Outreach
- Program Design and Evaluation

How you pay for it matters
Revenue Variability

Alameda County, CA

Loveland, CO

Davidson Water, Inc., NC

Metropolitan Water District of Southern California

San Antonio, TX

Gwinnett County, GA

Changing Revenues of 286 Texas Utilities

Total revenues that can pay for debt service, according to TWDB sources. Data analyzed by the EFC at UNC for *Defining a Resilient Business Model for Water Utilities* (Water Research Foundation report, 2014). The sample of utilities is consistent across all years. Data source: Texas Water Development Board.
Average Residential Water Use in Texas is Declining Over Time

Average Residential Water Use is Generally Declining in Texas
63% of 145 municipalities reported lower or same average water use in 2013 than in 2004

Average household water use is weighted by number of water accounts. The cohort of 145 municipalities is the same across all years. Data source: annual water and wastewater rates surveys by the Texas Municipal League. Data analyzed by the Environmental Finance Center at the University of North Carolina, Chapel Hill.
Raising Rates Do Not Equate to Proportional Rising Revenues

![Graph showing the change in total revenue versus the increase in the total monthly bill for 5,000 gallons from 2007 to 2010 across 103 TX utilities. The graph includes a dotted line representing CPI inflation between the two years.]

Data analyzed by the Environmental Finance Center at the University of North Carolina, Chapel Hill.
Data sources: Texas Municipal League annual TX water and sewer rate surveys (self-reported), Texas Water Development Board data from audited financial statements of utilities with outstanding loans.
Factors Affecting Revenue Resiliency

- Service Area Size and Diversity
- Water Use and Weather
- Economic Conditions
- Capacity Utilization
- Economic Regulation and Governance
- Financial Management Strategies
- Credit Rating Agencies

Rate Structure Design

Revenue Variability
Fixed vs. Variable Costs and Revenues

Alameda County Water District, CA
- Actual FY2011 O&M Expenses
- Actual FY2011 Customer Sales Revenues

Austin, TX
- Budgeted FY2012 Total Expenses
- Budgeted FY2012 Customer Sales Revenues

Data analyzed by the Environmental Finance Center at the University of North Carolina, Chapel Hill and Raftelis Financial Consultants, Inc. Data Sources: Alameda County Water District’s Financial Plan model and Austin Water’s FY2012 budget estimations in the Reference Material to the Joint Subcommittee on Resource Management Commission, Water & Wastewater Commission, and Impact Fee Advisory Committee.
How resilient are your utility’s revenues?
Water Utility Revenue Risk Assessment Tool

• Excel tool (simplified)
• Focus on residential revenues
• Utility inputs own:
  – Rate structure details (can compare 2)
  – Residential customer water use profile
  – Weather patterns
  – Assumptions on price elasticity
• Tool estimates the proportion of revenues that may be lost due to changes in water use patterns due to:
  – Rate increase, alone or plus:
  – Normal weather pattern changes, or
  – One-time, significant and sudden conservation effort

Free to download and use at
www.waterrf.org
www.efc.sog.unc.edu
How do the total revenues compare under both rate structures?

<table>
<thead>
<tr>
<th></th>
<th>REFERENCE Rates</th>
<th>COMPARATIVE Rates</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Annual Revenues</td>
<td>$15,408,000</td>
<td>$16,419,000</td>
<td>$1,011,000</td>
</tr>
<tr>
<td>From Base Charges</td>
<td>$4,322,000</td>
<td>$6,915,000</td>
<td>$2,593,000</td>
</tr>
<tr>
<td>From Volumetric Charges</td>
<td>$11,086,000</td>
<td>$9,504,000</td>
<td>-$1,582,000</td>
</tr>
</tbody>
</table>

The comparative rate structure is projected to generate $1,011,000 (6.6%) GREATER revenues than the reference rate structure. This assumes that no change in demand occurs besides residential customers reacting to the rate changes through price elasticity. Thus, no conservation, significant demand fluctuations or weather-related demand changes are modeled in this scenario.

MORE of the revenues would come out of the base charges in the comparative rate structure, increasing revenue resiliency against demand fluctuations.
Revenue Variability at 3 Water Utilities

Assessed and compared revenue risk of 3 utilities with different rate structures, climates, customer water use patterns, customer types.

Applied each other’s rates on own customer base to identify relationships between revenue risk, rates and use.

Listed mitigation strategies.

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www.efc.sog.unc.edu
Findings at a Glance

Revenue Variability is an Inherent Component of Operating a Utility
- It is impossible to forecast exact revenues for a given year, but understanding factors that drive revenue variability allows a utility to project revenue risk exposure and prepare accordingly.
- Utilities have multiple strategies for “living” with revenue variability and with proper planning can still maintain a proactive rather than “reactive” response to variability that does not require sacrificing policy goals such as water conservation.

Revenue Variability Differed Significantly Across Utilities
- Pricing alone is not a complete predictor of revenue variability.
- Weather variability amplifies the inherent rate-induced revenue risk.
- Under aggressive conservation initiatives, pricing interacts with customer characteristics in influential ways. Based on its initial water use profile, a utility’s customer base has more or less potential to conserve. These differences can amplify revenue variability more than others.
- Because each utility faces a unique operating environment, utilities should individually model the potential effects of rate structures using their own customer and weather data. There are a number of free tools for undertaking this modeling exercise, including the Water Utility Revenue Risk Assessment Tool developed by the Environmental Finance Center at the University of North Carolina, Chapel Hill.

Utilities Can Influence Their Revenue Variability Through Rate Structures
- Pricing structures can mitigate the revenue impact of aggressive conservation initiatives.
- It is possible to construct a pricing strategy that incorporates financial incentives for water efficiency while at the same time providing revenue stability by assessing higher fixed base charges against a customer’s water use.
- Higher base charges reduce revenue risk (but may reduce the conservation signal).
- High base charges alone do not shield all utilities from revenue variability.
- Relying more heavily on variable rates as a conservation strategy can lead to significant revenue risk.
- Temporary pricing adjustments—such as drought surcharges—can provide an immediate relief to rapid demand curtailment.

There are Also Important Non-Price Strategies that Can Mitigate Revenue Risk
- Maintaining reserves has become one of the most common revenue volatility management strategies, but our analysis shows that specific reserve needs vary across utility environments and should be customized to meet local conditions.
- Maintaining reserves, combined with financial planning periods that are longer than a year, allow utilities to set rates that take into consideration unavoidable annual demand swings.
- Weather derivatives can provide external revenue hedging options as a strategy to deal with revenue variability and could shield water utilities from having to build considerable weather reserve funds.

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High-level findings on revenue variability:

- An inherent component of operating a utility
- Differs significantly across utilities
- Can influence through rate structures
- Can also mitigate through non-price strategies
What happens if you tweak the existing rates?
High Base Charges Alone Do Not Shield All Utilities from Revenue Variability

Although higher base charges will typically translate to greater revenue stability, high base charges alone are not be enough to guarantee revenue stability.

Figure 5: Monthly Water Base Charge & the Proportion of Annual Revenues Derived from Base Charges in the Three Utilities in 2013

Revenue Variability Differs Significantly Across Utilities

Figure 3: Revenue Variability Due to One-Time Significant Declines in Residential Demands

Southeastern Coastal Utility

Mountain Resort Utility

Urban Utility

Under Aggressive Conservation Initiatives, Pricing Interacts with Customer Characteristics in Influential Ways

Figure 6: Revenue Variability Due to One-Time Significant Declines in Residential Demands in the Three Utilities under the Same Rate Structure Design

Relying More Heavily on Variable Rates as a Conservation Strategy Can Lead to Significant Revenue Risk

Figure 9: Revenue Variability Due to One-Time Significant Declines in Residential Demands in the Mountain Resort under Different Increasing Block Rate Structures

Strategies for Addressing Revenue Variability & Incentivizing Water Efficiency

- Temporary pricing adjustments
- Customized reserve funds
- Conservative projections combined with efficiency based rebates/dividends
- Weather derivatives
- Base charges that include financial incentives for conservation practices

What if We Change the Way Utilities Charge Customers?

Base charge
(might include a consumption allowance)

+ Volumetric rates
(uniform rates or block rates)
National WRF study on current utility practices and alternatives for enhancing financial resiliency of water utilities

http://www.waterrf.org/Pages/Projects.aspx?PID=4366
Alternative Rate Designs

1. PeakSet Base Model
2. CustomerSelect Model
3. WaterWise Dividend Model

Described in the WRF report and EFC blog posts, and studied and simulated for multiple urban utilities.
Whiteboard Video

http://www.waterrf.org/Pages/Projects.aspx?PID=4366

NEW BUSINESS MODELS FOR THE WATER INDUSTRY
PeakSet Base Model

Under the PeakSet Base Model, most of the pricing signal for higher water use in a given year is sent the following year.

*Under the PeakSet Base Model, most of the pricing signal for higher water use in a given year is sent the following year.*
If Utility Had Implemented PeakSet Base

Generated more revenue (and more fixed revenue) even though water use declined

&

More customers would have lowered their bills

Slightly more customers would have decreased (rather than increased) their total annual charges under PeakSet Base
Winners and Losers under PeakSet Base

The average water bill for **high-water using customers** would increase more substantially than for **low-water using customers** under PeakSet Base with Dividend.

Customers averaging 0 in water use would see an increase in fixed charges.

- **94%** of customers using 0 gallons would see an increase of 100%.
- **48%** of customers using 1-2000 gallons would see an increase of 50%.
- **51%** of customers using 2001-5000 gallons would see an increase of 25%.
- **54%** of customers using 5001-10000 gallons would see an increase of 12.5%.
- **51%** of customers using 10001-15000 gallons would see an increase of 6.25%.
- **61%** of customers using >15000 gallons would see an increase of less than 6.25%.

**PSB with Dividend increases the average bill for customers with high peaking ratios more than for low-peeking customers.**

- **17%** of customers with a peaking ratio of 1-1.5 would see an increase of 17%.
- **29%** of customers with a peaking ratio of 1.6-2 would see an increase of 29%.
- **37%** of customers with a peaking ratio of 2.1-2.5 would see an increase of 37%.
- **46%** of customers with a peaking ratio of 2.6-3 would see an increase of 46%.
- **68%** of customers with a peaking ratio of >3 would see an increase of more than 68%.

These results include the use of a simple dividend model in addition to the PeakSet Base model, but the effect of dividend model on high using and high peaking customers is small (and exaggerates the increase in bills for small using and small peaking customers substantially).
CustomerSelect Rate Model

Individual customers choose plan that best works with their consumption and pay an overage fee if the household uses more than the plan.

CustomerSelect Charges vs. Existing Water Charges in 2012

- Plan 1
- Plan 2
- Plan 3
- Plan 4
- RY12 Water Rates
If Utility Had Implemented CustomerSelect

Generated more revenue (and more fixed revenue) even though water use declined

&

Equal portions of customers would have “won” or “lost”

Approximately the same number of SFDUs would have decreased or increased their total annual water charges under CustomerSelect
Winners and Losers under Customer Select

The average water bill for low-water using customers would decrease under CustomerSelect.

Low water users (low average) & low peaking users would have reduced their water bills.

CustomerSelect increases the average bill for customers that have high discretionary water use (high peaking ratio) significantly, while reducing the average bill for customers with lower peaking ratios.

High users & high peakers would pay more.
WaterWise Dividend Model

• Customers are “members” of utility
• Utility clearly defines its total revenue needs (including O&M, debt service, capital reserves, etc.)
• Charge full cost prices, plus additional rates to guarantee revenues (add to base charge)
• At end of the year, keep the revenues that are needed and then return any excess funds to the customers
• Can be combined with most rate models (best partnered with budget-based rates)
• Inspiration = co-op models
Calculating the Dividend

Simple Dividend:
- Equally among customers (per month/service)

or

Return more to WaterWise customers:
- Proportional to reduction in demand from last year
- Customers who meet a water budget target
How Customers would Fare Under: Simple Dividend Model

How SFDU Customers' FY2012 Total Charges Would Have Changed under SIM DIV Model

- Increased by more than 25%: 0%
- Increased 21%-25%: 0%
- Increased 16%-20%: 1%
- Increased 11%-15%: 6%
- Increased 6%-10%: 26%
- Stayed within +/-5%: 67%
- Decreased 6%-10%: 0%
- Decreased 11%-15%: 0%
- Decreased 16%-20%: 0%
- Decreased 21%-25%: 0%
- Decreased by more than 25%: 0%
How Customers would Fare Under: WaterWise Dividend Model

How SFDU Customers' FY2012 Total Charges Would Have Changed under FB Dividend Model

- Increased by more than 25%: 23%
- Increased 21%-25%: 4%
- Increased 16%-20%: 4%
- Increased 11%-15%: 5%
- Increased 6%-10%: 5%
- Stayed within +/-5%: 9%
- Decreased 6%-10%: 5%
- Decreased 11%-15%: 5%
- Decreased 16%-20%: 5%
- Decreased 21%-25%: 4%
- Decreased by more than 25%: 33%
Models Show Alternative Rates Would Increase Revenue Resiliency

Preliminary analysis by the Environmental Finance Center at UNC, Chapel Hill. Modeled revenue-neutral alternative rate models on actual residential customers (using actual billing data) in a utility in North Carolina (2014). Actual customers reduced water use in FY2012, resulting in lower-than-projected revenues with increasing block rates.
These are not just hypothetical ideas

Some utilities already have unique (less common) base charges:

- By location
- By premise characteristics
- Based on current water use
- Based on historic water use

Several blog posts on the Environmental Finance blog summarizing unique base charges

http://efc.web.unc.edu/
(search for “base charge”)
City of Davis, CA Tried to Implement “Consumption-Based Fixed Revenues” (akin to PeakSet Base)

City of Davis, California’s Proposed Consumption-Based Fixed Rate

This rate structure was set to be effective in January 2015, but was voted down in a referendum on June 3, 2014.

- Customer pays a distribution charge + supply charge + variable charge each month
- The **distribution charge** is a fixed monthly charge based on meter size ($10.21/month for 3/4” meter)
- The **supply charge** is the new piece. Each customer’s total water use in the six-month May through October period of the previous year is determined, and then multiplied to a rate ($0.32/ccf) to determine the customer’s supply charge that is applied to the next 12 months. E.g.: a household that uses a total of 102 ccf between May and October of last year would pay $32.64/month (=102 ccf * $0.32/ccf) as their supply charge next year.
- The **variable charge** is a uniform volumetric rate applied to the customer’s water volume above 0 ccf ($0.86/ccf)

Ocracoke Sanitary District in North Carolina has a historic consumption-based fixed charge of a different sort for its customers. Each customer’s average use between June and September of the previous year places the customer in one of the following three rate structures for the next year (rates effective during FY2014):

- **Step A** – for customers averaging less than 5,000 gallons/month in previous summer: Base charge of $16.00/month including an allowance of 2,000 gallons, or
- **Step B** – for customers averaging 5,000 – 9,999 gallons/month in previous summer: Base charge of $42.87/month including an allowance of 5,000 gallons, or
- **Step C** – for customers averaging at least 10,000 gallons/month in previous summer: Base charge of $94.37/month including an allowance of 10,000 gallons,

plus the volumetric rates charged in an increasing block rate structure.

DC Water Refunded Customers for Excess Revenue (akin to Dividend Model)

DC Water Refunds Customers

DC Water will issue a one-time credit to customer bills in early 2013. Depending upon bill cycle and account status, customers may receive the credit as early as January or late as April.

DC Water relies on customer bill payments to fund its operations and capital projects. Each year, management takes a long-term look in developing a proposed budget and a rate structure to support that budget. Through exceptional management and sound financial planning, DC Water expects it finished Fiscal Year 2012 (which ended September 30, 2012) with a surplus.

“Our customers trust us to spend their money wisely,” said General Manager George S. Hawkins. “We take that stewardship responsibility very seriously. This year, our teams did the job with a little less than we
Communication Strategy Recommendations

• Communicate the change in annual charge – not month to month
• Highlight benefits of a more predictable bill
• Spend a lot of time on peak month education
• Ease-in period? Communicate charges under new rate structure a year before adopting them
Next Steps

• Modeling and customizing alternative rate models for more utilities to assess revenue impacts
• Discussions with Boards, Managers, Finance Committees
• Focus groups of customers to judge reactions and interest, and tailor program
• Pilot implementation at a utility to monitor effects and customer response
Follow the research on our blog

http://efc.web.unc.edu/

Environmental Finance
at the University of North Carolina

Trends in Operating Expenses Relative to Operating Revenues for Local Government-Owned Water Utilities

By Shadi Eskaf, on May 22nd, 2013

A couple of months ago, we blogged that water utilities’ operating revenues are generally continuing to grow every year, but that there was a slowdown of revenue increases in recent years, particularly after 2008. At the same time, expenses are also rising. Does this mean that expenses have caught up to revenues and that the majority of utilities are now experiencing revenue shortfalls?

As part of the research for Water Research Foundation project #4358, we (the Environmental Finance Center at UNC and Battelle Financial Consultants, Inc.) collected and analyzed financial data for local government water and wastewater
Acknowledgements

Our partner water and wastewater utilities
Discussion (Suggested Topics)

• Reactions
• Benefits and Challenges to the Utility
• Benefits and Challenges to the Customers
• Benefits and Challenges to Water Efficiency
• Further analysis? Focus groups, pilot implementation?
• Other rate models