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Electricity in the 1970's, Water in the 2020's

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ABSTRACT

This articles discusses the parallels between the past trends in the US electricity sector with forthcoming trends in the water sector.

How much does it cost you to take a shower? Unless you have too much time on your hands or are an expert on the water utility industry, you probably do not know and it's reasonable to not know. Water from a typical water utility costs about 1 cent per gallon. Given a 20-minute shower and a one-gallon-per-minute showerhead, the water costs of your shower is 20 cents. Most consumers do not know the price that they pay for water and many do not recall the amount of the bill that they pay. Although we have not done a formal survey on this matter, ask anyone you know "what is the water cost of taking a shower or flushing the toilet," the two largest typical end uses of water in a household. Almost all people except for industry experts have no idea. Water is still too cheap to get the attention of consumers as a proportion of their budgets except for businesses where water is a large portion of their production feedstock, for example, farmers, canned soup and vegetable processors and water parks.

We all know what gasoline costs per gallon but why not water when we use so much more of it? If two people take a shower every day and flush a toilet four times a day each (at 1.5 gallons per flush) that is $190 a year. If two people drive the average 12,000 miles per year and have an average 25 miles per gallon gasoline consumption, that is 960 gallons at $3 per gallon which is almost $3000. Not all water bills are that low. For example, a March 15, 2018 Wall Street Journal started that water prices have increased an average of 5.5% annually during the last ten years. This article showed that average water bills for households in some communities in California are $500 to $600 per month. We can speculate that wherever there is arid weather conditions and little or no local water supply water prices and bills are very high.

The too-cheap-to-notice water price and bill is changing rapidly. Utility rate increases for water are typically in the double-digit percent increases. When electricity prices started their acceleration in the 1970's, federal legislation known as the Public Utility Regulatory Policy Act of 1978 was enacted that required that electric utilities collect hourly meter data from a sample of all of their customers (load studies) to understand at a detailed level how customers used electric power. Also, that legislation required that electric companies start performing "cost-of-service" studies that are used to determine which customer types were most responsible for the cost increases so that they pay their fair share. Currently, some investor-owned and publicly-owned water utilities perform cost-of-service studies in states that require them but even they are based on old rules-of-thumb usages rather than their own customers' load studies. Why now the requirement? Water bills are starting to become materially large relative to household incomes similarly for electric back in the late 1970's and 1980's. We expect that within the decade or so, water bills will reach the level of electric bills. Closely associated with water usage and costs are obviously wastewater costs. It really has not been discussed much yet except in the UK, but the next policy initiative and discussion that may be forthcoming in the water utility industry when the rate shocks materialize is the deregulation of portions of the water industry to reduce costs through competition in supply or alternative providers of wastewater treatment. It is not hard to imagine that there may be many cost-effective pipeline projects that could be developed by alternative purveyors of water supply or wastewater treatment to take business from incumbent utilities.

According to the US EPA's 2011 Drinking Water Infrastructure Needs Survey and Assessment Report, by 2030 the industry will require $384.2 billion at 2011 dollars in system upgrades to maintain safe drinking water service. At 2030 dollars using 3% inflation a year, or $600 billion (which is actually low as it is the upper end of some current estimates in today's dollars), a 5% cost of capital (mix of investor owned and local government costs of capital) and 20-year straight line depreciation, which involves writing down 1/20 of the $600 billion

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every year for 20 years, that would be a $60 billion carrying cost by 2030, or, almost $171 per capita per year or $682 per year for a household of four people and a US population of 350 million. Note that this is just the *increase in bills for capital costs alone* and does not include the additional operations and maintenance costs and taxes.

The US water utility industry is already in a capacity crisis due to inadequate investment that will last for many years. The impact of large capacity additions will undoubtedly create rate shock and generate heightened awareness by consumers as well as regulators on water rates, cost allocation, and "used and useful" capital expenditures. The water utility, regulators and policymakers can wait until the rate shock arrives, which has already started, or the utility can "be prepared" as the Boy Scouts motto states, be proactive and have hard data on hourly load shapes of their own key customers and groups to better understand, quantify and substantiate cost causation and capital expenditures.

The American Water Works Association Rates Manual (commonly known as the "M1 Manual" in the water utility industry) includes generic rules-of-thumb guidelines that are used by many utilities as the inexpensive alternative to load studies to perform cost allocation. It is not going to be acceptable when the dollars at stake are large enough. Just a few years ago, we had completed a water load study in Virginia that was ordered by the utility regulators there since some customer groups strongly felt that they were subsidizing others. Obviously, the water bills and prices were high enough to create customer awareness and cause the study to be done. This particular utility's price levels were due to the "newness" of the entire system (about 30 years old as a recently new development) and the bills reflect current costs of the system. Utilities are likely to be ordered to undertake a load study once rate shock comes home to roost from a neglected system. The utility may be ordered to absorb a substantial portion of the rate shock until a load study and sot-of-service study are done, which takes a full year just for collecting hourly meter data. Project set-up including study design and meter installation can easily take months before any data is collected. After the year of data collection, it will take a few months to perform the load analysis. Therefore, it can reasonably be expected to take two years from the time the decision is made to the report delivery.

Consumer load shapes are dynamic as water-saving devices are diffused into the system and consumer behavior changes over time. During recent years, water sales have been dropping on a per capita basis due to behavioral changes and the adoption of water efficient appliances. Therefore, the load study should become an ongoing data gathering process rather than a one-time event or an event repeated every time a rate case is coming. The system can be expanded beyond the meter to major water end-uses such as showers and toilet use, similarly as is done with electric for large end-uses such as space cooling and water heating, to understand where the water volume attrition and growth is occurring. It can also be used to isolate unaccounted for volumes if designed to address that issue among others. Such data would also have insights for sewer flows and sewer utilities as most wastewater flows are not metered at all.

Customers and regulators will not and should not be satisfied with a one-time study. Regulators could be notified and requested to approve or at least "buy into" informally the expenditure for a load study system. Once the system is in place and operating, the only ongoing costs to be incurred are for data collection and monitoring. Therefore, systems are there to stay once installed. We have been involved with load studies for well over 30 years and have yet to see a system dismantled once installed unless they were specifically used to measure impacts of an efficiency program in the energy industry and even then, they were kept in place for multiple-year data collection.

It is difficult to justify a project with initial project costs of hundreds of thousands of dollars that does not directly and immediately add revenues or reduce costs, especially for small systems. Water utilities generate very low revenues from a dollar of assets as it is, therefore water utility management typically invest no dollar before it's an absolute must with regulators and interveners readily agreeing. Unfortunately, this approach has brought us to the current infrastructure crises, deteriorating water distribution systems, regulatory decisions that are based primarily upon setting the lowest customer water rates possible. A load study expenditure is a cost that is coming anyway as it did with the electricity utility industry when they faced rate shocks starting in the late 1970's. The question is whether the industry will wait until ordered to do the project or have such data in hand before rate shock hits the utility and its customers.

As regulators and rate proceeding interveners try to affect the outcome of a rate proceeding, the "used and useful" test for capital expenditure and cost of service may take center stage by all parties as they try to avoid rate shock to their specific constituents. In addition to "used and useful" asset tests, cost causation and allocation to different groups of customers may emerge as the most contested issue in a rate case.

A robust course suggested here to protect the overall interests of all customers, employees, owners (whether shareholders or a local government), regulators, the community and regional economy, is to have the most relevant data to support the needs for capital expenditure and assigning costs to customer groups.

A proactive strategic path for proper capital expenditure planning, developing efficient, equitable and defendable water rates, identifying and understanding volume changes, is to use hourly interval load shape information. This data can be used to quantify load patterns by key customer segments that cause capital expenditures, rate levels, as well as explain the current annual water sales attrition that is being experienced by many water providers. Hourly load shapes can be used to measure, disaggregate, and predict growth/decline rates in volumes as well as peak loads at regional as well as customer group levels. These data can be used to better plan and justify capacity upgrades to the system and understand which groups of customers should bear the costs of capital additions. Therefore, such data should be a key driver of the overall strategic plan of a water or wastewater utility.

The recent installations of smart water meter reading systems (AMR) reduce billing meter data collection costs but, unfortunately, many were not designed to have the capability of obtaining hourly meter reads. Such data collection requires meter readers to be dedicated solely to do the "drive-by" to collect and then clear the memory of a meter on a regular basis to fit the 720 meter reads per months, rather than one. There are some fixed water utility AMR systems that can remotely read hourly data for all customers with a few simple programming updates and memory maintenance. We are working with one such forward-thinking relatively large water utility in Pennsylvania that collects data for all of its customers on an hourly basis. The efforts of this proactive water utility demonstrates there is a better approach to identify, assign and recover the capital and operational costs of providing service to their customers.

The value of water load research is that it is a pre-emptive tool to plan capacity upgrades with appropriate load data justification for internal capital expenditure decisions, regulators and customer groups. The rates that could be developed by customer groups are more closely based on actual cost causation, not rules of thumb. Finally, "used and useful" tests of capacity addition denials in rate recovery will result in "déjà vu all over again" as Yogi Berra said, only this time it will be water, not electricity. Actual load shape data can proactively address such issues before they arise.

The water utility industry and rate regulators for those utilities that are rate regulated, have understandably staved off large rate increases for decades by putting off needed but not critically needed upgrades at the time. Regulators' and customers' desired lower water bills caused shortfalls in the ability to attract capital or for that matter the ability to repay capital required for the much-needed infrastructure upgrades. Decisions on which upgrades should be made and who bears the cost will sooner or later be based on load studies as the magnitude of the costs make it compelling to do so.

The question for water utility executives, whether for investor-

owned or publicly-owned systems, is whether they will be prepared to answer "used and useful" and cost responsibility questions with actual data or face increased litigation budgets and be ordered to do the load study anyway. A water load study provides several management tools that can save valuable water resources, plan for future plant and service territory expansions, identify profitable or nonprofitable service to the various classes of customers and help explain the reasons for water sales attrition. A water load study can be used to develop customer rates that strategically address adequacy of future rate *structures*. Finally, load studies can be used to vastly improve sales and demand forecasts with more information on the pattern of volumes and demands as well as the level of each.

Further reading

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Dr. Richard A. Michelfelder is clinical associate professor of finance at Rutgers University, School of Business – Camden and President of EXP 1, LLC, an international public utilities consulting firm. He has almost 35 years of experience performing electric, gas, water and sewer cost of service, rates, and load studies. Previously to Rutgers and EXP 1, LLC, Dr. Michelfelder was CEO and Chairperson of the Board of Quantum Consulting, Inc., an international energy efficiency and public utility consulting firm specializing in load research and energy efficiency studies and Quantum Energy Services and Technologies, LLC., an energy services company that he co-founded. During its start-up years, as vice president, he helped to co-found and build Comverge, Inc. ("IPOed" on the NASDAQ then taken private), currently one of the largest demand response firms in the world. He was vice president of Conectiv Solutions, LLC and Director of Energy Services at Atlantic Energy, Inc., which he founded and built into a highly successful energy and water service company as a division of Atlantic Energy, Inc. Richard has also held executive and management positions at Atlantic Energy, Inc. and was also Chief Economist at AUS Consultants. During his tenure at Atlantic, he also has been responsible for the holding company business plans reporting to the CEO, integrated resource planning, electric cost of service, load research, and demand-side management. He has testified before a number of state regulatory agencies and the FERC on issues related to gas utility acquisitions, water load research, the cost of service, the cost of capital, energy efficiency, and incentive rate mechanisms that encourage energy efficiency programs by utilities. He has published numerous articles in economics, finance, entrepreneurship, and the economics of utility resource planning, most recently in the Journal of Mathematical Finance, Journal of Sustainable Finance and Investment, Journal of Regulatory Economics, the Journal of Economics and Business, Multinational Finance Journal, Quantitative Finance, The Electricity Journal, and Managerial Finance. He holds a Ph.D. in economics from Fordham University.

Gary D. Shambaugh is currently the Managing Principal of Shambaugh Utility Consulting, LLC a public utilities financial consulting firm. Mr. Shambaugh has over 46 years' experience in providing consulting services to electric, natural gas, water, sewer and cogeneration clients in numerous states, Canada and England. Prior to the creation of Shambaugh Consulting, Mr. Shambaugh was an Executive Vice President and Managing Principal of AUS Consultants, Inc. a nationally recognized utility consulting firm. In that role, he has testified in over twenty states in federal bankruptcy courts, before utility regulatory commissions and in state common pleas courts. His expertise is all encompassing in the regulatory arena and includes, but not limited to, the development of annual revenue requirements, depreciation, cost of service, customer tariff rate design, water load studies, business enterprise valuations, cash working capital, utility regionalization studies, rate base determinations and has performed the financial due diligence related to the sale and acquisition of water and sewer systems. Mr. Shambaugh's testimony (regarding water and sewer rates) was reviewed by the Mississippi State Supreme Court and affirmed. He was appointed by a New Jersey court to serve as an arbitrator involving litigation related to the forced sale of a privately-owned water utility. He is an accounting graduate of Harrisburg Area Community College and has further studies in utility accounting, depreciation, and cost of service. Mr. Shambaugh has authored several articles over the years and has been a guest speaker at numerous utility conferences and seminars. One such article, The Pricing of Regulated Utilities: Water Rates was published by the Margret Chase Smith Center for Public Policy of the University of Maine. Mr. Shambaugh also taught the advanced water and wastewater course for the New Mexico State University's Center for Public Utilities.