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Put Your Money Where Your Water Is: Building Resilience Through Rates

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PUT YOUR MONEY WHERE YOUR WATER IS: BUILDING RESILIENCE THROUGH RATES

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I. INTRODUCTION

California is in the fourth year of a record drought. Although the state has known drought before, this is being reported as "driest period in the state's recorded rainfall history" and scientists worry that this is just the beginning.[1] Thirty eight million people live in the state, and millions of acres of farmland are responsible for growing food that stock store shelves across the U.S.[2] As crisis sets in, many solutions are proposed including new, expensive technologies.[3] Although very expensive, the thought seems to be, "in an emergency, price becomes no object."[4] While perhaps an understandable sentiment, it is also ironic. Despite the current shortage, Californians currently pay very little for the water they still do have.[5] The average monthly water bill in Californian ranges from $40 - $70 depending on the region.[6] This is often much less than the average bill for cable, cellphones or broadband service.[7] Water bills are sure to rise once current water resources are gone, sending a price signal that is needed now. Unfortunately, this scenario is not unique to California.

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[1] Paul Rogers, *California Drought: Past Dry Periods Have Lasted more than 200 Years, Scientists Say*, SAN JOSE MERCURY NEWS (Jan. 25, 2014), http://www.mercurynews.com/science/ci_24993601/california-drought-past-dry-periods-have-lasted-more. "Megadroughts" have been recorded in California. *Id.*

[2] *Id.*

[3] *Id.*

[4] *Id.*

[5] Jane Wells, *West Coast drought: Why California water is so cheap*, CNBC (May 28, 2015), http://www.cnbc.com/2015/05/28/west-coast-drought-why-california-water-is-so-cheap.html.

[6] *Id.*

[7] *Id.*

Water resources are in crisis throughout many parts of the United States.[8] This is particularly true in drought-prone areas where population growth and demand are quickly outpacing supply.[9] New supply projects are often proposed to solve the shortfall; however, these programs may create new problems.[10] Expensive new supply technologies can greatly increase the price of water sending a price signal to consumers to use less water just as more is becoming available.

Utilities are challenged to meet future water demands.[11] To do this, they must accurately predict what a city's water needs will be. Traditionally, demand projections are calculated by extrapolating per capita for population projections.[12] The danger is that demand projections often assume traditional use and do not include maximum reduction through conservation and efficiency.[13] When usage changes either through implementation of these programs or from unexpected weather changes, demand alters dramatically, which can create a revenue shortfall.[14] Accordingly, many see any efforts to reduce usage as threats to the reliability of income to the utility creating an economic disincentive.[15] However, that is not true. Revenues can be maintained as usage is reduced as long as the uncertainties are minimized.[16]

To achieve supply longevity, customers should be aware of the importance of current supply and adjust their behavior accordingly. One way to affect demand before a shortage occurs is through appropriate pricing.[17] Before scarcity forces a change in behavior, a customer's only connection with water is its price.[18] As such, prices should reflect the value of current supply to encourage protection through conservation, efficiency and value-based use decisions.

Rates are usually based on the utility's cost of service.[19] The law requires the utilities to charge reasonable rates without discrimination

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[8] *See* Matt Ferner, *These 11 Cities May Completely Run Out of Water Sooner Than You Think*, THE HUFFINGTON POST (Dec. 4, 2013), http://www.huffingtonpost.com/2013/12/04/water-shortage_n_4378418.html.

[9] Doyle Rice, *Water Worries: Climate Change in the Desert Southwest*, USA TODAY, July 9, 2013.

[10] *See* PETER H. GLEICK ET AL., WASTE NOT, WANT NOT: THE POTENTIAL FOR URBAN WATER CONSERVATION IN CALIFORNIA (2003), *available at* http://www.pacinst.org/wp-content/uploads/sites/21/2013/02/waste_not_want_not_full_report3.pdf.

[11] ALLIANCE FOR WATER EFFICIENCY, BUILDING BETTER WATER RATES FOR AN UNCERTAIN WORLD: BALANCING REVENUE MANAGEMENT, RESOURCE EFFICIENCY AND FISCAL SUSTAINABILITY 28 (2014).

[12] *Id.*

[13] *See* GLEICK, *supra* note 10.

[14] *See id.*

[15] *See* ALLIANCE FOR WATER EFFICIENCY, DECLINING WATER SALES AND UTILITY REVENUES: A FRAMEWORK FOR UNDERSTANDING AND ADAPTING 3 (2012).

[16] *Id.*

[17] ROBERT B. EKELUND, JR. & ROBERT D. TOLLISON, ECONOMICS: PRIVATE MARKET AND PUBLIC CHOICE 11 (6th ed. 2000).

[18] Robert Glennon, *Water Scarcity, Marketing, and Privatization*, 83 TEX. L. REV. 1873, 1873 (2005).

[19] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 14.

allowing a fair rate of return.[20] Unfortunately, current cost-of-service models mandated in most areas dictate that citizens generally only pay for a utility's current costs, which may only include treatment and delivery and not a price for the actual water.[21] The existing pricing model is problematic because it does not value water until there is not enough to go around. In addition, the existing pricing model is flawed because there is no mechanism for a rapid rate adjustment to affect behavior and scale back demand in emergency situations.[22] This can lead to water shortages.

Water is critical not only to personal survival and to the survival of the economy and culture of a community as well as their various users such as power generators, agriculture and industry.[23] Society's ability to survive and thrive depends on the guarantee of sufficient water supplies, yet that is not a luxury upon which all locations can rely.[24] Sustainable water for all uses requires a hard review of how economics is applied to water. Any economic modeling must include value-based pricing that reflects intrinsic costs to ensure wise allocation decisions. Cost-of-service models must be broadened to allow pricing based on more than capital costs. Examples from the energy sector, which reflects increased pricing in times of high demand and strained supply, should be adopted by the water sector. Until the market currently applied to water reflects true valuation, water will continue to flow in ways that do not favor resiliency.

This paper examines the application of basic market principles to water transactions and the problems it creates. It considers how the basics of utility cost-of-service based rate structures can create inaccurate price signals resulting in water supply depletion and other unintended consequences. Part II examines the current economic situation of water markets and describes how current pricing of water disincentivizes source protection.[25] Part III explains the current utility economic model.[26] Included in this discussion are an explanation of why efficiency and revenue collection are not mutually exclusive, a description of the cost of service rate paradigm and its current limitations, and how revenues are collected through a combination of fees and rates.[27] This part also warns that low-income users deserve special consideration in the pricing conversation.[28]

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[20] JAMES C. BONBRIGHT, PRINCIPLES OF PUBLIC UTILITY RATES 50 (1961).
[21] Robert Glennon, *The Price of Water*, 24 J. LAND RESOURCES & ENVTL. L. 337, 340 (2004).
[22] *See e.g.*, Yvonne Wenger, *City Panel Gets Earful From Residents Angry About Rising Water Bills*, THE BALTIMORE SUN, June 26, 2013, http://articles.baltimoresun.com/2013-06-26/news/bs-md-ci-water-rate-increase-20130625_1_meter-and-billing-systems-rudolph-chow-water-bills.
[23] *See, e.g.*, SUSAN COMBS, TEX. COMPTROLLER OF PUB. ACCOUNTS, THE IMPACT OF THE 2011 DROUGHT AND BEYOND (Feb. 6, 2011), *available at* http://www.window.state.tx.us/specialrpt/drought/pdf/96-1704-Drought.pdf.
[24] A. DAN TARLOCK, LAW OF WATER RIGHTS AND RESOURCES 13 (2013).
[25] *See* discussion *infra* Part II.
[26] *See* discussion *infra* Part III.
[27] *See* discussion *infra* Part III.
[28] *See* discussion *infra* Part III.

Finally, Part IV of this paper proposes various best practices to this water pricing challenge.[29] The first recommendation is to expand away from a rigid interpretation of cost of service, which creates a reactionary pricing scheme.[30] Second, utilities need to adopt a more complex demand projection calculation that takes many factors into consideration including climate and demand response.[31] This paper also recommends rate structures that create a price signal for the consumer about the value of the resource while also providing a secure revenue stream for the utility.[32]

II. PRICE AND MUNICIPAL WATER SUSTAINABILITY

Water scarcity is a growing problem for many parts of the United States.[33] Although the American Southwest has been struggling with water challenges for many years, even traditionally water-rich areas face the threat of drought and demand increases.[34] "In the last five years, nearly every region of the country experienced water shortages. At least 36 states are anticipating local, regional, or statewide water shortages by 2013, even under non-drought conditions."[35]

One of the challenges with water is how little of it is actually available for use, even under normal conditions.[36] Less than one percent of the world's water is available for human use and much of that is located underground at varying depths.[37] Additionally, not only is the world using more water, it is being used in ways that often leave it unavailable for other users.[38] World water consumption has tripled in the last fifty years.[39] This combination of factors elucidates the depth of the water supply challenge. Unfortunately, water supply decisions are frequently based on factors such as availability, location, price and highest economic use rather than on long-term sustainability.[40] Water supply issues are particular challenging in growing cities.

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[29] *See* discussion *infra* Part IV.
[30] *See* discussion *infra* Part IV.A.
[31] *See* discussion *infra* Part IV.B.
[32] *See* discussion *infra* Part IV.C.
[33] Ferner, *supra* note 8.
[34] ENVTL. PROT. AGENCY, WATER SUPPLY IN THE U.S., http://www.epa.gov/WaterSense/pubs/supply.html (last visited Jan. 16, 2014).
[35] *Id.*
[36] WORLD BUS. COUNCIL FOR SUSTAINABLE DEV., WATER FACTS AND TRENDS 1, *available at* www.unwater.org/downloads/Water_facts_and_trends.pdf.
[37] ENVTL. PROT. AGENCY, *supra* note 34. Approximately 30% of the world's freshwater is underground, with varying levels of access challenges. WORLD BUS. COUNCIL FOR SUSTAINABLE DEV., *supra* note 36.
[38] ENVTL. PROT. AGENCY, *supra* note 34.
[39] *Id.*
[40] P. VAN DER ZAAG & H.H.G. SAVENIJE, WATER AS AN ECONOMIC GOOD: THE VALUE OF PRICING AND THE FAILURE OF MARKETS 15, 20–22 (July 2006).

A. The Municipal Challenge

Cities have a heightened challenge for water because their populations are booming.[41] The combination of population concentration and limited water in these areas could impact large amounts of domestic users as well as the industrial and commercial sectors.[42] Unlike their rural counterparts, urban dwellers depend on the municipality for the procurement and delivery of water to the point of use. This means the city is not only responsible for the securing supply, it must also build and maintain the infrastructure needed for delivery and ensure it can maintain this service for newcomers.

Drought exacerbates any existing issues with supply inadequacy. From 2011 to 2013, half of the United States experienced varying levels of drought.[43] At the beginning of 2013, sixty percent of the U.S. experienced moderate to exceptional drought.[44] While the drought has alleviated in some areas, other regions remain in peril.[45] Several major metropolitan areas located on the East Coast, the Midwest and the western United States, are at risk of a water shortage.[46]

Despite the varied array of uses and dependencies on water, existing legal allocation schemes often do not effectively work to ensure water sustainability.[47] As supply capacity declines, accountability between users increases and the market is often the only tool available. This can be problematic because the current water market is incomplete, which leads to price signals that do not send appropriate signals to users and can increase waste.[48]

B. The Distorted Price Signal

While scarcity affects all water users, water sustainability is not the primary consideration of allocation regimes.[49] At best, current permitting

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[41] WORLD HEALTH ORGANIZATION, HIDDEN CITIES: UNMASKING AND OVERCOMING HEALTH INEQUITIES IN URBAN SETTINGS 7 (2010) (stating that by 2050, seven out of ten people will live in urban settings), http://www.who.int/kobe_centre/publications/hiddencities_media/who_un_habitat_hidden_cities_w.pdf?ua=1.

[42] Grace Wyler, *All Around The US, Risk of a Water Crisis Are Much Bigger Than People Realize*, BUS. INSIDER, May 22, 2013, http://www.businessinsider.com/us-drought-water-scarcity-2013-5.

[43] *Id.*

[44] *Id.*

[45] *Id.*

[46] *Id.*

[47] *See e.g.*, Rogers, *supra* note 1.

[48] VAN DER ZAAG & SAVENIJE, *supra* note 40, at 9; Amy Hardberger, *Water Is A Girl's Best Friend: Examining the Water Valuation Dilemma*, 62 U. KAN. L. REV. 893, 912–31 (2014) (discussing the ways current markets would need to change in order to be effective tools for water allocation).

[49] Irwin v. Phillips, 5 Cal. 140, 147 (1855). In *Irwin,* often cited for creating the prior appropriation system, the court notes that the important aspect of the system is to preserve the rights of those who are first in time. *Id.*; TARLOCK, *supra* note 24, at 267.

systems are designed to react to a shortage rather than work to avoid one.[50] Existing water permitting relies either on proximity to a water source[51] or on a first come, first serve basis.[52] Unfortunately, due to the meteoric increase of population and consumption, the water landscape has changed dramatically from when the majority of rights were perfected or permitted.[53] Current projections for many areas show that increased demand coupled with climate change variations will create shortages even in non-drought years.[54]

Despite this reality, none of these regimes include a legal mechanism to reevaluate the wisdom or the efficiency of a use once the property right is perfected.[55] Legal systems may dictate reduced usage in times of drought, but this reduction is strictly temporary and not tied to any permanent prioritization of the best uses of the water.[56] The primary mechanism to shift permitted water from one user to another is markets; however, the buying and selling of water also does not guarantee protection of the best uses.[57] In fact, "[m]ore than for most commodities, social and cultural values relating to water are often [SIC] in conflict with economic values."[58] Some market changes are required to promote resource sustainability.

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[50] TARLOCK, *supra* note 24, at 269.

[51] P. FRITZ HOLLEMAN, WATER RIGHTS AND TAKINGS: INHERENT LIMITS ON THE PROPERTY RIGHTS AND CURRENT DEVELOPMENTS IN THE LAW, CLE INTERNATIONAL H-1, H-1–H-2, *available at* http://www.pbblaw.com/articles/Holleman%20-%20Water%20Rights%20and%20Takings%20%2800011376%29.pdf.

[52] *Id.* at H-1.

[53] In a prior appropriation jurisdiction, any proposed use in a permit application must be deemed "beneficial." The determination of a right as beneficial occurs at the time of the permit issuance or perfection of the right. Although the list of approved beneficial uses may change over time, any permit issued continues to be valid even if the use no longer considered beneficial. The permit is a property right; therefore, a revocation of a permit based solely on use would be generally be subject to a takings challenge. *Id.*

[54] Jonathan A. Adler, *Warming Up to Water Markets*, NAT. RESOURCES 14 (Winter 2008–2009), *available at* http://object.cato.org/sites/cato.org/files/serials/files/regulation/2008/11/v31n4-3.pdf.

[55] *See, e.g.*, TEX. WATER CODE ANN. § 11.001 (West 2012) (defining water rights as a vested property right).

[56] Such a system can lead to challenging drought scenarios. In a prior appropriation system, many agricultural permits are senior to newer municipal and power generation permits. In drought conditions, the system prioritizing access based on the date of the permit and not the type of use; so, a power plant may need to power down to allow farmers to receive their full allocation.

[57] *See* ERIN SCHILLER & ELIZABETH FOWLER, PACIFIC RESEARCH INSTITUTE., ENDING CALIFORNIA'S WATER CRISIS: A MARKET SOLUTION TO THE POLITICS OF WATER 1 (1999), *available at* http://special.pacificresearch.org/pub/sab/enviro/watermkts/watermkts.html; ROBERT A. YOUNG, DETERMINING THE ECONOMIC VALUE OF WATER CONCEPTS AND METHODS 8 (2005).

[58] YOUNG, *supra* note 57, at 8.

1. The Basics of Supply and Demand

The supply and demand curve is one of the primary concepts taught in a microeconomics class.[59] This curve is an economic model of price determination in a competitive market.[60] Demand indicates what an item is worth to someone while supply reflects what something costs.[61]

Supply is the quantity of an item available in the marketplace at a given price.[62] It is directly related to price. The law of supply states that, all other things being equal, an increase in supply of a product or service will cause price of the item to decrease.[63] The inverse is also true.[64] Although many things can affect supply, "[t]he most important influence on the position of the supply curve is the cost of producing a good or service."[65] One example of this is a price reduction for goods because of the reduction of an input price, such as labor.[66] The opposite is often seen for water, as more expensive technology is required to provide adequate supply, price will increase.[67]

Demand is the quantity of a good that individuals are willing and able to purchase at a given price.[68] "The demand curve expresses an inverse relation between price of a good and the quantity demanded."[69] Similar to the relationship on the supply side, price and demand are inversely related: as one increases, the other decreases and visa versa.[70] While this is true of an individual's behavior, the focus for economists is more often on market demand, which is the amalgamation of individual demand for an item or service at alternative prices.[71] If the number of consumers increases, the market demand curve will also increase.[72]

Although supply and demand are separate and can work independently with price, they often work together to determine the market price of an

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[59] *See, e.g.*, EKELUND & TOLLISON, *supra* note 17 at 51–81; ROBIN BADE & MICHAEL PARKIN, FOUNDATIONS OF MICROECONOMICS 83–122 (2d ed. 2004); ROBERT H. FRANK & BEN S. BERNANKE, PRINCIPLES OF ECONOMICS 61–88 (Brief ed. 2009).
[60] EKELUND & TOLLISON, *supra* note 17, at 11 (stating a model requires assumption and abstractions from the real world).
[61] Michael Hanemann, *The Value of Water* 4 (2005), *available at* http://are.berkeley.edu/courses/EEP162/spring05/valuewater.pdf.
[62] EKELUND & TOLLISON, *supra* note 17, at 61–62; FRANK & BERNANKE, *supra* note 59, at 66.
[63] EKELUND & TOLLISON, *supra* note 17, at 61–62.
[64] *Id.*
[65] *Id.* at 63.
[66] *Id.* at 63–64.
[67] *See, e.g.*, Felicity Barringer, *In California, What Price Water?*, N.Y. TIMES, Feb. 28, 2013, http://www.nytimes.com/2013/03/01/business/energy-environment/a-costly-california-desalination-plant-bets-on-future-affordability.html?_r=0 (discussing the price of an expensive desalination plant in California).
[68] EKELUND & TOLLISON, *supra* note 17, at 54–55.
[69] *Id.* at 60.
[70] *Id.* at 61–62.
[71] *Id.* at 60.
[72] *Id.*

item.[73] In a competitive market, the unit price for a particular good will vary until it settles at a price point when the quantity demanded equals the quantity supplied.[74] This results in an economic equilibrium for both price and quantity for the item.[75] Markets are an effective system to allocate resources because when a good is in equilibrium, the price provides information to suppliers about the ideal price and demand of that good.[76]

The market approach can be applied to water. In fact, in the absence of any limiting polices, it is already happening to some extent.[77] While the initial permitting phase of water is dictated by governments, economics does come into play in post-permitting water conveyances as a buyer, without sufficient water (low supply, high demand), purchases water from an existing permit holder (high supply, low demand).[78] The price for the conveyance is presumably set based on this supply and demand relationship.[79] This transaction is simply a market transfer of a property right.[80] Therefore, the appropriate question is not whether this economic model can be applied to water, but how it can be done to meet community goals.[81]

2. Price as a Behavior Trigger

Since communities are already paying for water, it follows that price could be used to manage the amount of water used and ensure that water is going to the highest value use.[82] It is a basic principle of economics that people make choices based on a rational self-interest.[83] Based on this assumption, human behavior can be predicted once the costs and benefits associated with an option are ascertained.[84] Price is an obvious cost that might affect consumer decision-making.[85] It will affect what and how much of an item is purchased.[86] In order for a person to continue purchasing an

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[73] *Id.* at 65–72.
[74] FRANK & BERNANKE, *supra* note 59, at 68.
[75] *Id.*
[76] *Id.* at 84.
[77] TARLOCK, *supra* note 24, at 12–14.
[78] *Id.* at 13. *Compare* TEX. WATER CODE ANN. § 11.135 (West 2012) (listing the criteria required for surface water permit issuance in Texas), *with* Betsy Blaney, *T. Boone Pickens sells water rights to Texas water supplier for $103 million*, NEWSOK, June 24, 2011, http://newsok.com/t.-boone-pickens-sells-water-rights-to-texas-water-supplier-for-103-million/article/3579874 (describing a large water transaction).
[79] FRANK & BERNANKE, *supra* note 59, at 81–82.
[80] TARLOCK, *supra* note 24, at 13.
[81] Hanemann, *supra* note 61, at 12.
[82] FRANK & BERNANKE, *supra* note 59, at 178.
[83] EKELUND & TOLLISON, *supra* note 17, at 9.
[84] *Id.*
[85] *Id.* at 11.
[86] *Id.* at 11, 54; *see, e.g.*, Lisa Hymas, *How High do Gas Prices Have to get to Trigger Behavior Change?*, GRIST., Mar. 14, 2012 (discussing people's adjusted driving habits as a result of high gas prices for an extended time period).

item at an increased cost, the benefit must also increase for the same decision to make sense.[87] A consumer may also want to protect the environment through altruism and not just their own self-interest.[88] Many of these drivers are not included in current water market regimes.

"In a market economy, prices are essential signals that tell producers and resource suppliers what and how much to produce."[89] When a market goes out of equilibrium, price is what pulls it back.[90] It is the automatic regulator that manages the balance between supply and demand.[91] Prices also serve to allocate available commodities among competing end users.[92] Demand and price have an inverse relationship.[93] As prices increases, the quantity demanded falls.[94]

"In a perfect market, both buyers and sellers are numerous enough that no single buyer or seller can influence price."[95] This theory assumes that the quantity of items available for purchase is only reliant on sellers making the good available; however, for a resource like water this is not true.[96] Not only is there a fixed quantity of water in the world, events like drought can reduce the quantity available in a certain region.[97] According to economic theory, these supply reductions would eventually lead to a corresponding price increase.[98]

It is often assumed that water demand is fairly inelastic; however, that is only true of nondiscretionary uses.[99] Discretionary uses, such as lawn watering or wasteful indoor practices, are more elastic.[100] Although there is no substitute for water, the user can choose to avoid watering all together or increase efficiencies to reduce total demand.[101] Therefore, price elasticity of demand for water is only effective on certain types of uses.[102] In those areas, increased price can save a considerable amount of water.[103] In drier

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[87] EKELUND & TOLLISON, *supra* note 17, at 9.
[88] *Id.*
[89] *Id.* at 10.
[90] BADE & PARKIN, *supra* note 59, at 100.
[91] *Id.*
[92] EKELUND & TOLLISON, *supra* note 17, at 11.
[93] *Id.* at 55.
[94] *Id.* at 56. This rule assumes that other things, like income and supply remain constant.
[95] *Id.* at 65.
[96] *Id.*
[97] WORLD BUS. COUNCIL FOR SUSTAINABLE DEV., *supra* note 36.
[98] EKELUND & TOLLISON, *supra* note 17, at 61–62.
[99] Jonathan H. Adler, *Water Marketing as an Adaptive Response to the Threat of Climate Change,* 31 HAMLINE L. REV. 729, 746 (2008); VAN DER ZAAG & SAVENIJE, *supra* note 40, at 18.
[100] Adler, *supra* note 99, at 746. Outdoor water use can account for over 50% of household use, particularly in dry regions. ENVTL. PROT. AGENCY: WATER SENSE, OUTDOOR WATER USE IN THE UNITED STATES, http://www.epa.gov/WaterSense/pubs/outdoor.html (last visited Feb. 20, 2014). ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 4 ("In Phoenix, changeovers from turf lawns and high-water-demand plants to native desert landscaping are shifting water use patterns dramatically.").
[101] FRANK & BERNANKE, *supra* note 59, at 125–26.
[102] Adler, *supra* note 99, at 746–47.
[103] *See id.*

climates, discretionary uses account for over fifty percent of total water withdrawals during peak month creating a large opportunity to reduce usage through price triggers.[104]

One important aspect of price accuracy is the inclusion of externalities.[105] An externality "represents a connection between economic agents which lies outside the price system of the economy. As the level of externality generated is not controlled directly by price, the standard efficiency theorems on market equilibrium cannot be applied."[106] There are many externalities not included in the current price of water including scarcity, environmental consequences, and water quality degradation, just to name a few.[107] While all of these have both a monetary and a social cost, those costs are borne outside and unrelated to the market, which artificially deflates prices.[108] Although price can be used to affect demand, this will only be effective in a property functioning market. Unfortunately, the current water market may be incapable of sending accurate price signals

3. Flipping the Model: Conserving Too Late

Intrinsic in a working market is the assumption that price moves goods towards their highest value use and increases overall efficiency.[109] The ultimate goal of a market is to ensure that a good is obtained by the person who values it the most; however, with water another goal is critical: that water does not run out.[110] The hope is to use markets to effectuate this goal, but under current conditions price triggers to reduce demand would occur after the water is gone and it is too late.[111]

"Water usage is a function of available supply and the value of water."[112] Value in this quote actually refers to current cost.[113] The supply curve is based on the cost of production as well as demand.[114] The least expensive water is always the first to be used, which keeps prices low.[115] Once that

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[104] SAM MARIE HERMITTE & ROBERT E. MACE, TEXAS WATER DEVELOPMENT BOARD, THE GRASS IS ALWAYS GREENER…OUTDOOR RESIDENTIAL WATER USE IN TEXAS 4, *available at* http://www.twdb.state.tx.us/publications/reports/technical_notes/doc/SeasonalWaterUseReport-final.pdf.

[105] RONALD C. GRIFFIN, WATER RESOURCES ECONOMICS: THE ANALYSIS OF SCARCITY, POLICIES, AND PROJECTS 109 (2006); FRANK & BERNANKE, *supra* note 59, at 269.

[106] GRIFFIN, *supra* note 105, at 109.

[107] *Id.* at 216–20; Erin M. Tegtmeier & Michael D. Duffy, *External Costs of Agricultural Production in the United States*, 2 INT'L J. OF AGRIC. SUSTAINABILITY 1, 1–2, 5–14 (2004) (listing many negative impacts of agricultural production not factored into the price of goods).

[108] ALLIANCE FOR WATER EFFICIENCY, WATER PRICING PRIMER FOR THE GREAT LAKES REGION 7 (2010). *See* Tegtmeier & Duffy, *supra* note 107, at 1–2.

[109] FRANK & BERNANKE, *supra* note 59, at 178.

[110] *Id.*

[111] Glennon, *supra* note 18, at 1884–86.

[112] TARLOCK, *supra* note 24, at 14.

[113] *Id.*

[114] EKELUND & TOLLISON, *supra* note 17, at 63–64.

[115] Glennon, *supra* note 18, at 1873–74.

supply is gone, users turn to more expensive water alternatives and the corresponding cost increases.[116] This increased cost shifts the supply curve such that the market equilibrium will also move and the price per unit will increase.[117]

Increased price can be used to encourage efficient behavior.[118] A consumer with excess income might be willing to pay for a larger lawn even at a higher price; however; if price goes up and income stays the same, the average consumer will decrease their use to accommodate the price change.[119] The problem with using this model is that, assuming constant demand; price cannot increase unless supply decreases.[120]

Water can also be affected by changes in the demand curve.[121] Even if individual demand is constant, a growth in population can increase overall market demand.[122] If there is not a corresponding increase in supply, the price per unit will increase or individual demand will have to decrease to maintain market equilibrium.[123] These market scenarios can occur in a drought, where demand is challenged by a dwindling resource, or by the long-term problem created when a city grows beyond its current water resources and must turn to more expensive water options.

The problem with this model is two-fold. First, if the price of basic water needs goes up and income does not increase, low-income users only using water for non-discretionary uses will suffer.[124] Using the traditional model, a customer must either pay more or use less if they want their bill to remain constant after a rate increase.[125] Because water is necessary for survival, the system fails low-income users because someone without the means cannot simply live without water.[126] The second problem with this model is that price will increase only when costs increase, which is too late.[127] The goal is to affect behavior early enough to avoid new supply, not to change behavior because new supply is already required.

The existing model is particularly problematic in drought or emergency conditions because of its slow response to market needs.[128] Traditional rate

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[116] *See, e.g.*, Barringer, *supra* note 67 (discussing the price of an expensive desalination plant in California).
[117] EKELUND & TOLLISON, *supra* note 17, at 61–62.
[118] *See id.* at 9.
[119] FRANK & BERNANKE, *supra* note 59, at 125–26.
[120] EKELUND & TOLLISON, *supra* note 17, at 61–62.
[121] FRANK & BERNANKE, *supra* note 59, at 82, Figure 3.17.
[122] *Id.*
[123] *Id.*
[124] Deborah Sullivan Brennan, *SD Water Rates to Jump 15 Percent*, UT-SAN DIEGO, Nov. 21, 2013, http://www.utsandiego.com/news/2013/Nov/21/environment-water-rate-increase-san-diego/.
[125] FRANK & BERNANKE, *supra* note 59, at 82, Figure 3.17.
[126] *How Long Can We Survive Without Food or Water?* CBC NEWS, May 7, 2011, http://www.cbc.ca/news/canada/how-long-can-we-survive-without-food-or-water-1.1000898.
[127] EKELUND & TOLLISON, *supra* note 17, at 63–64.
[128] Rogers, *supra* note 1. BONBRIGHT, *supra* note 20, at 44 ("If the resources were not scarce, there would be no need to "economize" their use by means of a price system.").

models do not have a mechanism for a rapid adjustment to affect behavior and scale back demand in emergency situations nor is there a way to affect price in a proactive manner.[129] Instead, without regulatory drought measures in place, climate neutral pumping will occur at a time when additional conservation is especially important, thus depleting important supplies when they cannot be replaced.[130] This creates an economic inefficiency.

The current business model actually creates a negative feedback loop.[131] Price goes up based on scarcity and the need for new expensive technology signaling people to use less as new supply comes on line.[132] Financial commitments to new projects often disincentivize conservation programming efforts because sale of water is necessary to pay for the project.[133] This can further increases demand and the need for even more supply.

The primary mechanism of markets creates the biggest problem that arises when markets are applied to water. As previously discussed, a market transfers goods to those who value them the most.[134] Intrinsic in this are two important assumptions.[135] First, that everyone who values water has the money to purchase it, and two, that people are the only essential recipients of water. Both are false assumptions.[136] Obviously, every human values water highly especially for basic needs; however, not everyone can pay for it at any price.[137] An unregulated, open market would punish low-income users simply because they could not participate in the market allocation of resources.[138] Finally, in other markets, life can continue without the good or it can be substituted for another, similar good. That is clearly not true here. An illustration of these concerns can be found in cities across the U.S.

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[129] *See e.g.*, Missouri Public Service Commission, RATE MAKING PROCESS, *available at* http://psc.mo.gov/General/Ratemaking_Process (last visited Feb. 20, 2014) (describing the arduous process of changing rates through a rate case).
[130] Rogers, *supra* note 1.
[131] *See id.*
[132] Norimitsu Onishi, *Arid Australia Sips Seawater, but at a Cost*, N.Y. TIMES, Jul. 10, 2010, at A6, *available at* http://www.nytimes.com/2010/07/11/world/asia/11water.html?_r=0.
[133] Mark Schliebs, *Mothballs at the ready for $1.8bn desal plant*, THE AUSTRALIAN, Mar. 27, 2013, *available at* http://www.theaustralian.com.au/national-affairs/state-politics/mothballs-at-the-ready-for-18bn-desal-plant/story-e6frgczx-1226607172584#.
[134] FRANK & BERNANKE, *supra* note 59, at 178.
[135] *See id.*
[136] *See id.*
[137] JULIET CHRISTIAN-SMITH, ET AL., PACIFIC INSTITUTE, ASSESSING WATER AFFORDABILITY A PILOT STUDY IN TWO REGIONS OF CALIFORNIA (2013), *available at* http://www.pacinst.org/wp-content/uploads/sites/21/2013/08/assessing-water-affordability.pdf.
[138] *See id.* at 1–2.

III. THE BROKEN BUSINESS MODEL: THE CURRENT WATER UTILITY LANDSCAPE

As a society, continued prosperity and survival is predicated on a sustainable water supply.[139] One way to accomplish this goal is to ensure that water is used wisely and no one uses more than what she needs. Markets can help achieve this; however, price must be an accurate indicator of value to be successful.[140] Many argue that markets should not be applied to public goods like water.[141] While there are good arguments for that idea, it is highly unlikely that the United States will stop pricing water.[142] In addition, zero valuation can lead to wasteful usage and result in a tragedy of the commons.[143]

True value of water is not always reflected by market price.[144] Many items that are not marketed commodities still have an economic value.[145] Price often does not match value because market value changes based on circumstances.[146] At any given time, market value is dependent on many factors including supply (permanent and temporary) and demand (time of year, weather).[147] True value is more stable than market value.[148] While a market system regime is not naturally protective of water resources, policies can be adjusted to ensure markets incorporate currently absent considerations to strengthen valuation accuracy.

One of the primary ways people purchase water is through municipal utility service billing.[149] In this situation, a city provider, or other similar entity, holds legal access to the water and they disseminate the resource to their customers for a price.[150] Utilities are organized to be financially self-

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[139] TARLOCK, *supra* note 24, at 13, 15.
[140] Hanemann, *supra* note 61, at 3. JEFFERY A. HUGHES & SHARLENE LEURIG, ASSESSING WATER SYSTEM REVENUE RISK: CONSIDERATIONS FOR MARKET ANALYSTS 6 (2013) ("[M]any water systems are seeing evidence that customers are more price-responsive.").
[141] YOUNG, *supra* note 57, at 89.
[142] *See id.*
[143] Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968), *available at* http://www.sciencemag.org/content/162/3859/1243.full. Tragedy of the commons is the economic theory that argues, if permitted to do so, individuals will act independently on a common resource according to each one's self-interest and deplete the resource contrary to the group's long-term best interests. *Id.* FRANK & BERNANKE, *supra* note 59, at 284 ("When a valuable resource has a price of zero, people will continue to exploit it as long as its marginal benefit remains positive.").
[144] Hanemann, *supra* note 61, at 3. The actual or market price is the price for which an item is sold. ADAM SMITH, AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS 30 (1776). The market price can be above, below or at the natural price. *Id.*
[145] Hanemann, *supra* note 61, at 3.
[146] *Id.* at 4.
[147] *Id.*
[148] *Id.*
[149] ALLIANCE FOR WATER EFFICIENCY, FUNDAMENTALS OF WATER RATE MAKING 1–3 (2008), *available at* http://www.allianceforwaterefficiency.org/WorkArea/DownloadAsset.aspx?id=720.
[150] *See e.g.*, SAN ANTONIO WATER SYSTEM, EDWARDS AQUIFER—PUMPING RIGHTS ACQUISITION, http://www.saws.org/Your_Water/WaterResources/projects/edwards.cfm (last visited Feb 20, 2014).

sufficient and not require income from other sources such as taxes.[151] They usually function as a monopoly; therefore, their rates are regulated as a substitute for open market competition.[152]

Suppliers are only allowed to earn a reasonable rate of return, so rates are generally calculated based on their costs.[153] This can create several problems. First, rates cannot be increased until costs increase, which is often an indicator of water shortage.[154] Second, under the traditional rate model, utilities are motivated to sell water, which can actually create the shortage.[155] These perverse market incentives threaten both utility and water sustainability.

A. Efficiency v. Revenues: A False Conflict

The problem is simple. Water providers are tasked with selling water.[156] Utilities cannot stay in business if they do not generate revenues to maintain their capital-intensive business.[157] In many cases, these revenues also help to fund city budgets, further incentivizing sales over conservation.[158] Despite this motivation to sell, per capita water consumption revenues have been trending downward while costs increase.[159] Current water use is equivalent to the amount used in the 1950s.[160] While revenues may be variable, many costs are not.[161] The obvious result of these trends is that more utilities are or will experience financial difficulties.[162] Over time, this movement can affect the utility's self-sufficiency and debt service.[163] In addition to budget shortfalls, volatile revenue streams create general utility instability.[164]

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[151] WATER RESEARCH FOUNDATION, DEFINING A RESILIENT BUSINESS MODEL FOR WATER UTILITIES 19 (2014).
[152] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 18.
[153] *Id.*
[154] *See id.* at 14.
[155] *See id.*
[156] *Id.* at 7.
[157] *Id.* at 7, 11; WATER RESEARCH FOUNDATION, *supra* note 151, at 31.
[158] *See e.g.*, Rebecca McCutcheon, *City Budget Expected to Increase Due to Utility Sales, Sale Tax Collections*, WINFIELD DAILY COURIER, July 31, 2015, *available at* http://www.winfieldcourier.com/news/article_f5ddf95c-37da-11e5-9ef4-fbeaee749e01.html.
[159] Shadi Eskaf, *Trends for Operating Expenses Relative to Operating Revenues for Local Government-Owned Water Utilities*, UNC ENVTL. FINANCE BLOG, May 22, 2013, http://efc.web.unc.edu/2013/05/22/trends-in-operating-expenses-relative-to-operating-revenues-for-local-government-owned-water-utilities/.
[160] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 7. WATER RESEARCH FOUNDATION, *supra* note 177, at xxv ("Between any given consecutive years between FY2004 and FY2011 revenues decreased from 14%-37% for a cohort of 485 utilities from across the country.").
[161] WATER RESEARCH FOUNDATION, *supra* note 151, at 32. Many fixed costs are determined by debt service payments. *Id.* at 32–33. When water revenues decrease, the obligation to pay investors who financed new water projected does not change. *Id.*
[162] Eskaf, *supra* note 159.
[163] *Id.*
[164] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 11.

The relationship between sales and revenue leads to flashy headlines concluding that water conversation bankrupts utilities.[165] Fortunately, it is not that simple. Budget shortfalls are more often the result of bad planning, not good citizenship.[166] Research shows that uncertainty is the real threat to utility resilience, not conservation.[167] "The tension between pricing to encourage less consumption versus pricing to encourage more sales and more revenue can lead to battles between water system managers and elected boards, and even within water systems between conservation program directors and financial directors."[168]

This does not have to be the case. The key, often-forgotten, variable is that new supply costs money too and may not even be available when needed.[169] Giving value to existing supply and avoided new supply can shift the conversation from one of public policy to economics.[170] "The time has come for the whole industry to shift from a paradigm of growth to a paradigm of sustainability . . . . Building sustainable utilities is more important than addressing revenue losses alone."[171]

1. Is Water Conservation Really the Enemy?

The largest source of revenue is costumer sales.[172] The inability to predict sales accurately leads to variable revenues. While utilities can plan for some level of uncertainly, a drastic delta between predicted and actual sales can threaten the business model.[173] The key to reliable revenue projections is the reduction of uncertainty through conservation not in spite of it.

In many cities, conservation is only encouraged or required during dry periods.[174] Although compliance may occur, the pattern reverts in times of plenty when utilities collect as much revenue as possible and the conservation ethic is lost.[175] This causes problems in the long-term because

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[165] *E.g.*, Katherine Shaver, *Water Utilities Charge More to Offset Low-flow Toilets, Faucets and Shower Heads*, WASH. POST, Aug. 3, 2014, at A1; Neena Satija, *Texans' Water Conservation Reward: Higher Rates*, TEX. TRIBUNE, Feb. 10, 2014.
[166] ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 3 (contrasting the experiences of Seattle and Denver to illustrate that a utility can be successful even with declining demand as long as it is built into the business model).
[167] *Id.*
[168] Hughes & Leurig, *supra* note 140, at 10.
[169] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 7, 12.
[170] Hughes & Leurig, *supra* note 140, at 16.
[171] ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 9.
[172] WATER RESEARCH FOUNDATION, *supra* note 151, at xxv.
[173] *Id.*
[174] ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 2.
[175] *Id.* Some cities are trying to stop this cycle by permanently adopting drought restrictions reasoning the community is already accustomed to the practice and it reduces revenue fluctuations. Caty Hirst, *Typical Fort Worth Water and Sewer Bill May Rise $3.31 a Month*, FORT WORTH STAR-TELEGRAM, Aug. 21, 2014, at A2.

the overall availability of water resources is also declining and more supply may not be available when needed; therefore, consistent nonuse of water is the best way to ensure its availability.[176]

Unfortunately, because effective conservation strategies reduce revenues, people make the mistaken conclusion that conservation and efficiency measures are responsible for rising water rates.[177] "In contrast, money spent on efficiency stabilizes the long-term rates customers pay by limiting capital expenditures for new treatment facilities, water storage and transmission capacity."[178] Attacking conservation creates future conflicts by not focusing on the relationship consumers need to have with water to ensure reliability.[179] The real issue causing a financial shortfall is increased costs, not decreased revenues.[180] Of course, increased costs and conservation are related in utility financials, but the necessity to update infrastructure can challenge finances even with stable water sales.[181]

The solution is to reexamine the economic model, not vilify conservation. To achieve economic resilience, utilities need to generate revenues lost through conservation from other sources or avoid costs.[182] One way cities are attempting to stabilize revenues is to shift a larger portion of income away from consumption revenue to fixed fees.[183] For example, Fort Worth, Texas is increasing the percentage of their income from fixed fees from seventeen to twenty-five percent of their budget.[184] This helps cover the expenses that are not variable, including infrastructure costs needed to deliver water and treat wastewater.[185] Fixed fees can be increased in a way that is conservation oriented if they are tied to total use.[186]

Utilities need to be cautious to avoid stating that conservation will reduce bills.[187] That may or may not occur.[188] A distinction must be made between rates and bills.[189] The reality is that operation and maintenance of existing systems is becoming more expensive which may maintain bill amounts; however, conservation can avoid future rate increases.[190] Utilities

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[176] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 12.
[177] ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 3; *E.g.*, Shaver, *supra* note 165, at A3.
[178] SHARLENE LEURIG, WATER RIPPLES: EXPANDING RISKS FOR U.S. WATER PROVIDERS 13 (2012).
[179] Mary Ann Dickinson, *The Real Relationship Between Conservation and Rising Water Rates*, NATIONAL GEOGRAPHIC, Oct. 5, 2014, http://voices.nationalgeographic.com/2014/10/05/the-real-relationship-between-conservation-and-rising-water-rates/.
[180] *Id.*
[181] Amy Silverstein, *Is Water Conservation Really Bankrupting Texas Cities, or Are They Just Bad at Planning*, DALLAS OBSERVER, Feb. 19, 2014, at A1; Hirst, *supra* note 175; Dickinson, *supra* note 179.
[182] ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 3.
[183] Hirst, *supra* note 175.
[184] *Id.*
[185] ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 5.
[186] Hirst, *supra* note 175.
[187] ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 5.
[188] *Id.* at 6.
[189] *Id.*
[190] *Id.*

should strive to message the full impact of avoided supply and infrastructure.[191] While utility costs may continue to increase based on the need for infrastructure replacement and upgrades, better decision making now could decrease the amount of infrastructure cities need to fix in the future reducing and exponential increase in costs over a time horizon.[192] In a startling example, a study in Westminster, Colorado showed that conservation programs implemented in 1980 yielded citizens a whopping 91% savings in rates compared to what they would currently be had the programs not started.[193] If customers are not educated about this issue, they may feel as though they are being punished for using less when rates increase.[194]

One of the keys is to consider water saved through conservation as a type of water supply.[195] "Every gallon saved is water that does not have to be pumped, treated and delivered – and the saved water can then be allocated elsewhere to accommodate new growth."[196] Supply created through saved water will most likely cost much less than new supply obtained through expensive technologies such as desalination or pipeline projects.[197] In Fort Worth, drops in demand allowed for delays in plant expansions saving the city $20 million a year in borrowing costs.[198] Once the situation is fully understood, it is clearly wiser to manage declining demand by designing

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[191] *Id.* In Fort Worth, Texas city council attempted to explain to citizens that rate increases were not a penalty, but a guard against further increases. Hirst, *supra* note 175.

[192] *See* Leurig, *supra* note 178, at 9; Dickinson, *supra* note 179; Shaver, *supra* note 165, at A3 ("The new fees would ultimately save customers money by slowing the trajectory of future rate increases."). The problem is that people rarely want to discuss infrastructure despite its importance. *Id.* ("The cost of infrastructure is annoying and boring."); WATER RESEARCH FOUNDATION, *supra* note 151, at 31 ("Rate increases can be politically challenging, and many utilities face pressure to delay increasing their charges for service for as long as possible."). In Fresno, California, where water is already very inexpensive, residents pushed back on higher rates to fund a new water project that would diversify their water source and protect the aquifer. Nelson D. Schwartz, *Water Pricing in Two Thirsty Cities: In One, Guzzlers Pay More, and Use Less*, N.Y. TIMES, May 6, 2015, at A5. Maintaining existing rates to the detriment of existing infrastructure has its own price. Cynthia Barnett, *It's Time for America to Talk About the Price of Water*, HUFFINGTON POST, Oct. 7, 2014. In Los Angeles, promises of flat rates created backlash when an aging pipe broke spilling twenty million gallons of water into the street during a severe drought. *Id.* at A1. In fact, many recent rate increases are actually the cumulative result of long-ignored infrastructure. *Id.* at A3.

[193] Dickinson, *supra* note 179.

[194] Shaver, *supra* note 165, at A3. ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 6 ("Particularly vexing is the potential association of efficiency and conservation with higher rates, which can undermine support for efficiency goals as well as the public's trust.").

[195] Dickinson, *supra* note 179; Silverstein, *supra* note 181, at A2 (using San Antonio, Texas as an example of a city who was able to meet financial obligations by categorizing conservation as part of their supply portfolio).

[196] Dickinson, *supra* note 179.

[197] Silverstein, *supra* note 181, at A1–A2.

[198] Brett Walton, *Price of Water 2014: Up 6 Percent in 30 Major U.S. Cities; 33 Percent Rise Since 2010*, CIRCLE OF BLUE, May 7, 2014, at A2. ("If the three projects has been built according to the plan set forth in 2005, residential water rates today would be 10 percent higher."))..

water rates that encourage consumers to conserve while collecting revenues to cover all necessary costs and keep finances stable.[199]

One distinction that often is not made in this discussion is the difference between conservation or efficiency savings and drought rules. It is imperative that they not be used interchangeably as the former is far more predicable than the latter. Long-term efficiency measures should motivate permanent behavior shifts, creating less reactivity in rates. For example, an efficient toilet uses over five gallons less water per flush than a traditional one.[200] Therefore, a utility can calculate the approximate savings that will be yielded from a large-scale replacement program. Drought, on the other hand, is more difficult to calculate because the extent to which it will affect revenues is often unknown.

2. The Drought Challenge

During times of drought, water utilities often need to impose water use restrictions that can severely decrease revenues.[201] Because no one knows exactly when drought will hit or how long it will last, utilities are challenged to effectively plan for the resulting financial penalty.[202] This does not have to be the case. Inelastic demand will largely stay the same because, by definition, it does not change.[203] The key to fiscal survival during weather variations is to truly understand and minimize elastic demand during normal years.[204] Once this is accomplished, less variation will occur during drought restrictions and revenues will be steadier.[205]

Some utilities save in advance for reduced revenue during droughts, while others charge a drought surcharge to make up the revenue difference during reduced usage.[206] In 2014, the water utility in Austin, Texas proposed a drought fee to recover revenues lost due to once-a-week watering

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[199] Dickinson, *supra* note 179.

[200] Steve Maxwell, *Low-Flow Toilets: Half the Water, Twice the Flush!*, MOTHER EARTH NEWS, Aug./Sept. 2006, *available at* http://www.motherearthnews.com/green-homes/low-flow-toilets-zmaz06aszraw.aspx.

[201] Hughes & Leurig, *supra* note 140, at 16.

[202] *Id.*

[203] Very extreme drought might fall outside this statement. Drought rules that require shower water to be used in washing machines or other extreme measures would reduce what is traditionally considered inelastic or basic demand.

[204] Hughes & Leurig, *supra* note 140, at 19. During the Texas drought of 2011-12, cities that had strong water efficiency programs experienced more stable demand and revenues than those who did not. Leurig, *supra* note 178, at 1, 6. Investors are beginning to understand that although water might be a public good, not all uses are essential. *Id.* at 4.

[205] Interestingly, the same tactic might also be the solution for managing unexpected heavy rainfall when people no longer feel the necessity to water their lawns. *See, e.g.*, Emily Sides & Sky Chadde, *Recent rainfall cuts into cities' water revenue*, THE MONITOR, Jul. 13, 2015, http://www.themonitor.com/news/local/recent-rainfall-cuts-into-cities-water- revenue/article_374bac84-29be-11e5-af7d-fb3659dd2120.html.

[206] Hughes & Leurig, *supra* note 140, at 14.

restrictions necessitated by a prolonged drought.[207] The utility argued that the fee as well as a rate increase was necessary to pay for their extensive fixed costs.[208] Interestingly, in 2014 the city opened a new water treatment plant capable of treating fifty million gallons per day at a cost of over $350 million.[209] The controversial plant was approved citing increased demand and population growth.[210] It is entirely feasible that the extended Texas drought would have required similar rate increases, but a different demand calculation that included increased conservation might have resulted in avoiding some of the supply costs now encumbering the utility.

While drought will always impact water revenues, the amount of that impact can be minimized and managed by a utility. The more a utility strives to manage demand on a daily basis, rather than in reactivity to weather events, the less volatility will be experienced during times of no or excessive rain.[211]

3. The Devil is in the Demand Projections

One of the biggest challenges to ensuring utility resiliency is uncertainty.[212] Uncertainty can come in many forms, but perhaps the most important unknown is how much water will be needed by customers in the future. Demand projections are used by utilities to determine the design and operation of their system and new supply needs.[213] Because these decisions will lead to costs passed on to the customer, accuracy is critical.[214]

Despite the critical importance of demand projections, many utilities do not even attempt to calculate them.[215] Many others assume that per capita water use will be the same as that of their current customers.[216] These utilities forecast demand by applying historic use data to population projections.[217] The accuracy of these numbers is predicated on the

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[207] Sarah Coppola, *Budget Cut, 'Drought Fee' on Utility Agenda*, AUSTIN AMERICAN-STATESMAN Jun. 4, 2014.
[208] *Id.*
[209] Ashley Goudeau, *Water Treatment Plant 4 Up and Running*, KVUE, Dec. 2014, *available at* http://www.kvue.com/story/news/local/2014/12/19/water-treatment-plant-4-up-and-running/20640667/.
[210] *Id.*
[211] Leurig, *supra* note 178, at 16. If not financially prepared for drought impacts, cities may be forced to raise rates during drought essentially punishing users for adhering to drought restrictions. *See, e.g.*, Monica Ching, *City Council: Water Rates Stable, For Now*, SAN ANGELO STANDARD, Feb. 18, 2014 ("'If in six months and it doesn't rain, then we may need to look at increasing some rates,' Mayor Dwain Morrison said.").
[212] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 16; Hughes & Leurig, *supra* note 140, at 3.
[213] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 28.
[214] *Id.* Hughes & Leurig, *supra* note 140, at 15 ("Clearly, one of the defining pricing challenges faced by utilities is balancing the need for sufficient revenue and stability with demand management goals.").
[215] Leurig, *supra* note 178, at 12–13.
[216] *Id.*
[217] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 33; Leurig, *supra* note 178, at 12–13. Population estimates can be estimated linearly, as an annual percentage (exponential growth) or can be more nuanced based on demographer's predictions. PACIFIC INSTITUTE, WATER RATES: WATER

assumption that water will be used in the future the same way it was used in the past.[218] Not only does this not allow for new technologies and cultural shifts, it may actively discourage them.[219] This can spell financial disaster for utilities.[220] Consumers do not use water in the same way they did fifteen to twenty years ago; so, it is logical to assume that their relationship to water will continue to evolve.[221] Simply ignoring this natural progression, or worse, not attempting to generate that shift can lead to expensive, unnecessary capital expenditures.[222]

A recent example of this problem occurred in Seattle, Washington.[223] There, a suburban water agency openly admits that they misinterpreted future demand leading to negative financial consequences.[224] Forecasting that residents would require more water, the agency entered into a contractual agreement for water supplies at a premium price.[225] Contrary to their assumptions, per capita water use in the area actually declined twenty to fifty percent as a result of more efficient usage, price increase, weather patterns and code changes.[226] Accurate demand projections would have prevented this expensive mistake.[227]

Demand is not static.[228] Weather is less and less predictable throughout the U.S., which can greatly affect water resources.[229] Predicting growth and how people will use the water is also a challenge.[230] Therefore, the process of forecasting demand should be iterative rather than linear to allow for adjustments based on price and other factors.[231] Demand forecasting should move away from point projections towards risk modeling that includes a range of factors including population, pricing, climate, elastic uses and new

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DEMAND FORECASTING 1, http://pacinst.org/wp-content/uploads/2013/01/water_rates_water_demand_forecasting.pdf.

[218] ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 3 ("Past methods of straight-line extrapolation of per-capita consumption are no longer valid."); PACIFIC INSTITUTE, *supra* note 217, at 1.

[219] ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 3.

[220] *Id.* *See* Leurig, *supra* note 178, at 12–13. The amount to which inaccurate demand projections will affect the utility bottom line depends on the extent rates are tied to consumption. PACIFIC INSTITUTE, *supra* note 217, at 2.

[221] Leurig, *supra* note 178, at 11.

[222] *Id.* at 13.

[223] ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 3.

[224] *Id.*

[225] *Id.*

[226] *Id.*

[227] *See id.*

[228] Hughes & Leurig, *supra* note 140, at 5. Overall per capita usage has dropped due to more efficient appliance technology, better plumbing standards, and conservation programs; however, land use patterns such as new developments with irrigation systems mean that new homes often use more water than old housing stock. *Id.*

[229] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 16.

[230] *Id.* Advanced metering is an important tool for accurate demand projections. ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 3. Although expensive, smart meters may ultimately save money by providing critical use information to utilities. *Id.* at 3.

[231] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 28.

regulations.[232] Experts agree that it is time to rethink the utility business model and understanding demand must be at the heart of that change.[233]

The timelines of demand projections and system design are not always the same.[234] While a utility might be planning on a fifty-year horizon, demand might be impacted by short-term events like extreme weather variability or economic changes.[235] "Long-term forecasting is typically more useful for infrastructure and capital planning whereas short-term forecasts are more useful for setting water rates."[236] Water rates are only set every few years so agencies need to be able to anticipate future needs.[237] "Regulatory lag [] is a well-known and understood problem- and, in fact, valuable in controlling monopolistic effects- but not one that is readily manageable. To put lag into operational terms, it is not uncommon for two years to pass from the completion of a cost design to actual revenue collection."[238]

Many permanent water supplies are procured for limited periods of peak demand, which often occur during the hottest portions of the summer months.[239] Managing these peak needs can avoid supply costs and level out revenue volatility.[240] "Better pricing can help utilities shift "load" and improve capacity utilization by smoothing out the peaks and valleys of usage over time."[241] Peak shaving has been very successful in the energy industry by avoiding expressive new power plants that are only necessary on the hottest days of the year.[242] Properly understanding demand and the

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232 ALLIANCE FOR WATER EFFICIENCY, SALES FORECASTING AND RATE MODEL, App. B 4 (Aug. 2014) (providing sample formulas for complex modeling); ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 9; PACIFIC INSTITUTE, *supra* note 217, at 1; Hughes, *Rate Structures Don't Kill Budgets, Inaccurate Projections Do*, UNC ENVTL. FINANCE BLOG (Oct. 9, 2012), http://efc.web.unc.edu/ 2012/10/09/rate-structures-dont-kill-budgets-inaccurate-projections-do/. *Id.* ("At the end of the day its [sic] just math, albeit somewhat complicated math given some of the complicated rate structures many utilities have adopted."). *Id.*

233 *See generally* ALLIANCE FOR WATER EFFICIENCY, *supra* note 15.

234 WATER RESEARCH FOUNDATION, *supra* note 151, at 31. Short-term costs include expenditures such as costs related to amount of water processed, treated and delivered that do vary and other short-terms costs that do not vary. Long-term costs include labor and capital costs for new infrastructure usually vary on the long-term horizon. *Id.* at 31–32.

235 ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 28. Another complicating and conflicting timeline is that of politics. Barnett, *supra* note 192. Short-term office holders do not want to be responsible for rate increases to fix infrastructure when benefits may be realized until long after their term is complete. Much of the skyrocketing costs we currently see are actually the result of ignored infrastructure. *Id.*

236 PACIFIC INSTITUTE, *supra* note 217, at 1.

237 *Id.*

238 ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 4.

239 *Id.* at 3.

240 *Id.*

241 ALLIANCE FOR WATER EFFICIENCY, *supra* note 108, at 8.

242 THE REGULATORY ASSISTANCE PROGRAM, ELECTRICITY REGULATION IN THE U.S.: A GUIDE 3, 48–49 (2011), http://www.raponline.org/docs/RAP_Lazar_ElectricityRegulationInTheUS_Guide_2011_03.pdf. The peak period for energy usage is usually in the early morning and just after work on very hot or very cold days depending on the area of the country. *Id.* The equivalent for water is usually during very hot months, when outdoor irrigation demand spikes. Passing along these costs to consumers

reduction of elasticity can prevent a utility from making unnecessary capital investments and increase revenue resilience.[243]

B. Cost of Service & Reasonableness Limitations

Water utilities have the daunting responsibility to ensure water is available for customers not just today, but into the future.[244] Part of meeting that requirement involves the obligation to recover their costs.[245] "Traditional water utility financing focused on generating sufficient revenue to enable construction of the required water infrastructure and to fund operations and maintenance expenses under forecasts of steadily increasing water demand and known and stable costs."[246] These systems of continuing to build infrastructure and passing along the costs to the growing customer base has become more complex as water supply alternatives diminish and growth exceeds expectations.[247]

Utilities are essentially monopolies.[248] They are the only available seller in a given market with the power to control price and supply.[249] Because they provide essential services without competition, pricing must be managed.[250] Although, utilities set their own rates, statutory obligations often limit what utilities can charge.[251] In addition to cost recuperation, rates for services rendered are also limited by due process and equal protection

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captures the marginal cost of that unit of product in an effort to send a price signal and either collect more revenue for that product or shave that peak demand. *Id.* at 47–48.

[243] WATER RESEARCH FOUNDATION, *supra* note 151, at xxix.

[244] SCOTT HEMPLING, REGULATING PUBLIC UTILITY PERFORMANCE 4 (2013).

[245] *Id.* at 14. Part of the "reasonableness" determination is whether current rates allow the utility to perform the functions assigned to it by law. BONBRIGHT, *supra* note 20, at 41.

[246] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 14. Cost of service is also used to cover the costs of financing these projects, which is a critical component to planning new infrastructure and supply projects. HUGHES & LEURIG, *supra* note 140, at 9. It is also important for the utility's ability to pay back bonds to finance past projects. *See id.* at 9. Increased revenue volatility can affect debt service and utility bond ratings. *Id.* Fort Worth's bond rating was reduced citing reduced water sales. Silverstein, *supra* note 181.

[247] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 14–15.

[248] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 18; HEMPLING, *supra* note 244, at 14. There are some examples of utility deregulation and migration away from the monopoly model, but this has been more on the electric side and is unusual for water providers. *See* THE REGULATORY ASSISTANCE PROGRAM, *supra* note 242, at 3–4, 8; HEMPLING, *supra* note 244, at 70–71.

[249] HEMPLING, *supra* note 244, at 11.

[250] BONBRIGHT, *supra* note 20, at 8–9 (distinguishing necessary utility services from luxuries or mere conveniences).

[251] *Id.* at 34; HEMPLING, *supra* note 244, at 5. "Utilities have the substantive right to charge rates that provide a reasonable opportunity to earn a fair return . . . ." *Id.* Because necessity was recognized, government regulation was supported even when other types of government interference with business was disfavored. BONBRIGHT, *supra* note 20, at 8. Public utility status and pricing regulations act as a substitute for open market competition. *Id.* at 10.

considerations.[252] Charges for services are limited to "just and reasonable" and must be done in an equitable and nondiscriminatory way.[253]

Utility revenue is primarily generated to pay basic costs associated with service, including infrastructure capital costs, staff, operation and maintenance etc.[254] These are often referred to as cost of service. Because each of these inputs have variability, estimating future needs based on professional judgments can be a difficult, creating further challenges to different approaches to rate design.[255] "At the heart of the issue is the inherent mismatch between the largely fixed cost structure of drinking water service providers and the highly variable revenues they receive, which depend largely on the amount of water their customers use."[256]

Because cost of service is cost based, it is largely reactive. In addition to recovering past costs, the only future costs included are for projects planned in the immediate future, which are often motivated by over usage of existing sources. These limitations may prohibit critical price signals when they are needed.[257] The threat of scarcity will not be included until it has arrived creating problems with ongoing supply needs and resulting in higher costs on the long-term. Ideally, prices should help optimize when new supply and infrastructure are built.[258]

While cost of service is the tool used by most utilities, the legal obligation for rates is the broader requirement of reasonableness.[259] Generally speaking, a prudence review of a utility's costs requires that imprudent costs be disallowed in a cost of service revenue rates recovery paradigm.[260] Rates that greatly exceed costs are open to accusations of "unreasonableness."[261] This could be interpreted to mean that a water utility is obligated to procure the lower cost water and pass those costs through low rates. Unfortunately, low rates do not create a price signal to users to encourage efficiency. Courts have also interpreted that the prudence responsibility should also "secure efficiency in the allocation of

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[252] HEMPLING, *supra* note 244, at 214. While these are often seen as separate obligations, lack of discrimination or preference among consumers is arguably an extension of the reasonable pricing requirement. BONBRIGHT, *supra* note 20, at 33.
[253] HEMPLING, *supra* note 244, at 219. Nondiscriminatory rates require that similarly situated customers be treated similarly. *Id.* at 288–89.
[254] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 19. "Public utility companies are permitted to impose charges for their services largely in order to induce and enable them to supply these services . . . and for their required expansion." BONBRIGHT, *supra* note 20, at 49–50.
[255] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 34. Utilities must project both fixed and variable costs. *Id.* at 35.
[256] HUGHES & LEURIG, *supra* note 140, at 3.
[257] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 18.
[258] R. Quentin Grafton et al., *Optimal Water Tariffs and Supply Augmentation for Cost-of-Service* 34 UTILS. POL'Y 54, 54 (2015).
[259] BONBRIGHT, *supra* note 20, at 50.
[260] HEMPLING, *supra* note 244, at 235–36.
[261] BONBRIGHT, *supra* note 20, at 67.

resources."[262] These seemingly at-odds requirements appear to create a conundrum for utilities.

In addition to recouping costs, reasonable rates can include a return on investment to ensure a good credit rating.[263] Good credit is critical for a utility to procure new capital for future projects.[264] Key in this is the understanding that utilities are not only obligated to provide service in the short term, but must continue to serve the community in the future as well.[265] Reasonable rates do not necessarily dictate the lowest rates needed to meet a utility's obligations.[266] There are other functions that rates can serve including affecting customer behavior and encouraging efficiency.[267]

Lack of competition can provide a lack of incentivization for "efficiency in the allocation of resources."[268] To counteract this, the principal of prudence evolved, acting as a substitute for competitive market forces.[269] "If a competitive enterprise tried to impose on its customers costs from imprudent actions, the customers could take their business to a more efficient provider. A utility's ratepayers have no such choice. A utility's motivation to act prudently arises from the prospect that imprudent costs may be disallowed."[270] Costs that might be deemed imprudent include those that cause an unreasonable increase the revenue requirement.[271] Utilities that seek cost recovery through rates must choose the most reasonable cost alternative.[272]

Similarly, the lack of competition inhibits the price signal to the user to encourage efficient use.[273] In an unregulated market, price will adjust itself automatically based on consumer decision-making and consumption.[274] In a regulated monopoly no such response occurs.[275] Instead, this price adjustment must be the function of rate regulations.[276] The challenge in this system is determining the appropriate price of future costs.[277]

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[262] Midwestern Gas Transmission Co. v. E. Tenn. Natural Gas Co., 36 FPC 61, 70 (1966).
[263] BONBRIGHT, *supra* note 20, at 50.
[264] *Id.*
[265] *Id.*
[266] *Id.* at 52. "Just and reasonable" represents a zone of permissible rates not a fixed point. HEMPLING, *supra* note 244, at 220.
[267] BONBRIGHT, *supra* note 20, at 50–51. The hope is that pricing can be used to force customers to self-ration to avoid the necessity for required limits on consumption. *Id.* at 55. In a system where a utility provides a free or very inexpensive product, waste is likely to occur forcing the utility to choose between imposing use restrictions or price the product. *Id.* at 55–56. Allowing people to choose how much they want or need to use subject to the obligation to pay gives consumers sovereignty. *Id.* at 57.
[268] HEMPLING, *supra* note 244, at 235.
[269] *Id.*
[270] *Id.*
[271] *Id.* at 236.
[272] *Id.*
[273] BONBRIGHT, *supra* note 20, at 57.
[274] *Id.*
[275] *Id.*
[276] *Id.*
[277] *Id.*

C. Water Rates 101

Utilities are designed to be stand-alone financial entities.[278] Because they do not receive money through taxation or other sources, sufficient revenues must be generated to remain financially solvent.[279] Total revenues are the result of rate levels and rate structures.[280] There are many characteristics of an ideal rate structure.[281] The two most germane here are: 1) revenue stability and 2) rate blocks that discourage waste.[282]

Operating revenues are often made through two primary sources.[283] The first is consumption-based rates.[284] This is the most significant source of income.[285] Although some amount can be predicted, these revenues vary because they are based on consumer usage.[286] The other, less variable, major revenue source is fees.[287] These can be assessed for a number of things including one-time connection charges, monthly service charges, late payment penalties, and drought surcharges.[288] Larger utilities may also gain income from practices not associated with operation such as interests and dividends on property, property sales, rental payments, or possibly power generation.[289]

Accurate rates and rate structures are critical for utility health and longevity.[290] In addition to generating revenues to pay for expenses, rates also need to create a price signal for the customer about supply.[291] The goal is to ensure that the price signal creates a balance between efficient use and utility reliability.[292] Effective ratemaking is the cornerstone to balancing financial stability while encouraging the efficient use of water.[293] "Water

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[278] WATER RESEARCH FOUNDATION, *supra* note 151, at 19.
[279] *Id.*
[280] CHARLES F. PHILLIPS, JR., THE REGULATION OF PUBLIC UTILITIES.: THEORY & PRACTICE 409–11 (1988). Rate structure is the assemblage of fees and volumetric charges. *Id.* Rate level is the magnitude of each item within the rate structure. *Id.*
[281] *Id.*
[282] *Id.* (citing BONBRIGHT, *supra* note 20, at 291 (listing eight criteria for an effective rate structure)).
[283] WATER RESEARCH FOUNDATION, *supra* note 151, at 20, 22. Revenues are also generated for wastewater collection, but that will not be included in this conversation.
[284] *Id.* at 20. Most utilities charge different rates for different customer categories including commercial, industrial and residential. HEMPLING, *supra* note 244, at 219. This section focuses on generalities of rate structures while recognizing there can be some variation based on use class.
[285] WATER RESEARCH FOUNDATION, *supra* note 151, at 20. Customer sales usually comprise ninety percent of total operating revenues. *Id.*
[286] *Id.* at 20, 22. "By nature, variable revenue is more vulnerable to fluctuations from year-to-year." *Id.* at 24.
[287] *Id.* at 20, 22.
[288] *Id.* at 20.
[289] *Id.*
[290] *Id.* at 43.
[291] WATER RESEARCH FOUNDATION, *supra* note 151; *Id.* at 44.
[292] *See id.*
[293] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 14.

ratemaking defines where the rubber meets the road between water supply and water demand."[294]

Traditionally, the ratemaking process involved three steps. First, utility revenue requirements must be established.[295] These costs are then allocated to different classes of customers including residential, commercial and sometimes industrial.[296] Finally, rate systems are created to recover the costs identified in the first step.[297] In addition to per-unit consumed charges, fixed charges may also be incurred such as a meter charge.[298] The purpose of this charge is to pay for the utility's fixed charges that do not change based on use.[299] Ratepayers may also incur a demand charge that reflects each customer's cost of meeting peak demand.[300]

1. Consumption Based Rate Structures

In a non-competitive market, utilities function as monopolies.[301] As such, a utility is legally limited in its ability to generate revenue by its costs.[302] They have the right to only charge "just and reasonable" rates that "provide a reasonable opportunity to earn a fair return."[303] Ideally, prices meet the obligation of compensating the seller for their services while inducing efficient use of the resource.[304] "Water efficiency and careful ratemaking are tolls that help utilities meet [] levels of service and improve prospects for a financially sustainable future."[305]

City dwellers might think that water already has a price because they receive a monthly water bill; however, they are often not paying for the water itself.[306] Instead, utilities bill for the infrastructure's capital and operating costs.[307] Because there are traditionally no costs associated with the actual

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294 *Id.* at 17.
295 *Id.* at 27.
296 *Id.*
297 *Id.*
298 HEMPLING, *supra* note 244, at 218. In Shoreline, Washington, rates include usage charges. These one-time fixed fees are paid at the time of connection or equipment installation. City of Shoreline, *Utilities Rates and Charges Assessment* Report, http://www.cityofshoreline.com/home/showdocument?id=17926.
299 HEMPLING, *supra* note 244, at 218.
300 *Id.*
301 *Id.* at 14.
302 *Id.* at 5, 216.
303 *Id.* at 5. "Just and reasonable" does not have fixed meaning, but the goal of pricing should be fairness to the buyer and supplier of the good. *Id.* at 219–20. Rather than a particular price point, there is a zone of reasonableness. *Id.* at 232.
304 *Id.* at 7.
305 ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 14.
306 Glennon, *supra* note 21, at 337, 340.
307 Glennon, *supra* note 18, at 1883. This is known as cost of service and what costs can be passed on to ratepayers is limited and defined by the state government code. *Id.*; GRIFFIN, *supra* note 105, at 255; *see, e.g.*, TEX. WATER & UTIL. ANN. § 572.061 (West 2014).

water, overall prices have been kept low.[308] A fact that is likely to change in future.[309]

The vast majority of rates are based on consumption.[310] Within this category, municipal rate structures can vary considerably.[311] While some charge a price regardless of use, others seek to penalize high volume users by charging more based on usage.[312] "The most common method of naming and distinguishing rate structure relies on how the variable charge changes as a customer uses more water."[313] Traditionally, utilities charged uniform rates.[314] These flat rate structures assigned a price per user regardless of amount used.[315] Every user paid the same monthly amount.[316] This created a predictable income for the utility; however, it often did not match true price to value or provide price signals to users based on their usage.[317] These rate systems often led to wasteful behavior because variations in consumption were ignored.[318] Subsequently, this system was replaced by tiered rates. Flat fees can also be coupled with usage fees that vary based on amount used.[319]

Another type of rate system is uniform volumetric rates.[320] Unlike flat fees, this system charges based on the level of use; however, the price per volume of water is the same regardless of overall use.[321] In this system, users pay more for higher use, but the price increase is proportionally equal

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[308] Glennon, *supra* note 18, at 1883. Because water rates are based on cost of service they can be highly variable depending on local conditions. Walton, *supra* note 224. For some cities, paying for water use is a new concept. Gene Haagenson, *Nearly All Fresno Homes Now Have Metered Water*, ABC NEWS – FRESNO (Dec. 27, 2012), http://abclocal.go.com/kfsn/story?id=8934000. For example, in Fresno, California controversial legislation required the installation of water meters. *Id.* Even in cities where water meters are the norm, multifamily units are often not individually metered giving residents no way to measure their monthly usage. Alexis C. Madrigal, *The Simple Gadget That Could Slash Apartment Buildings' Water Use*, THE ATLANTIC (Nov. 4, 2011), http://www.theatlantic.com/technology/archive/2011/11/the-simple-gadget-that-could-slash-apartment-buildings-water-use/247965/. Extreme drought in California focused the conversation on the mismatch between value and price of water. Barnett, *supra* note 192.

[309] Glennon, *supra* note 18, at 1883.

[310] *See e.g.*, Hirst, *supra* note 175 (discussing the city's efforts to shift more revenue to fixed charges).

[311] Kristina Donnelly & Dr. Juliet Christian-Smith, *An Overview of the "New Normal" and Water Rate Basics*, PACIFIC INSTITUTE, June 2013, at 7–10, *available at* http://www.pacinst.org/wp-content/uploads/2013/06/pacinst-new-normal-and-water-rate-basics.pdf.

[312] *Id.* at 7-9.

[313] HUGHES LEURIG, *supra* note 166, at 10.

[314] Phillips, *supra* note 280, at 428.

[315] Donnelly & Christian-Smith, *supra* note 311, at 7.

[316] *Id.*

[317] *See id.*

[318] PHILLIPS, *supra* note 280, at 428.

[319] DONNELLY & CHRISTIAN-SMITH, *supra* note 311, at 7.

[320] *Id.* at 8. While many cities have moved away from this system some places have maintained this antiquated system in order to have more predictable revenue. An ironic example of this is Fresno, California, which charges a flat amount per hundred cubic feet. FRESNO MUNICIPAL FINANCIAL SERVICES, WATER UTILITY FINANCIAL PLAN AND RATES STUDY 1-3 (2015), www.fresno.gov/NR/rdonlyres/.../fno_2015_wtr_rpt_f11.pdf. While some critics praise the state's drought preparedness, a closer look reveals additional conservation measures are needed. Charles Fishman, Op-Ed., *How California is Winning the Drought*, N.Y. TIMES (Aug. 14, 2015).

[321] DONNELLY & CHRISTIAN-SMITH, *supra* note 311, at 8.

to the increase in gallons.[322] This system is problematic in that it does not charge differently for discretionary and non-discretionary uses.[323] While every household may need a certain quantity of water at an affordable rate, quantities above this should cost more if a price signal to minimize waste is desired.[324]

An increasingly popular system is block or tiered rates.[325] In this system, the unit price changes according to level of use.[326] Blocks can be decreasing or increasing; however, decreasing block structures actually reward high water users.[327] In contrast, increasing block rates charge higher prices for higher use, while still allowing water for basic needs to be available at a low rate.[328] There is no set number, size, or configuration of the rate blocks required.[329] The utility can determine the appropriate quantity of the first, least expensive block and the steepness of the block increase.[330] Ideally the first block is for necessary indoor use and subsequent blocks are for increasing amounts of outdoor or other discretionary uses.[331] When structured appropriately, these rates can be punitive to the small percentage of high discretionary water users and encourage conservation based on price signals.[332]

There is a tremendous amount of variability possible in inclining rate structures in how fixed costs are apportioned, number and steepness of tiers.[333] The goal is to design block sizes to target how different classes of customers value the service.[334] In addition, the increasing need for a conservation price signal can create punitive prices for high volume users. The difficulty is determining how steep of an increased cost is steep enough to affect behavior.

Another benefit of tiered pricing is that it avoids further regulation and government intervention. If someone wants to use a higher quantity of water, they just have to pay for it.[335] Santa Fe, New Mexico has extremely

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[322] *Id.*
[323] *Id.*
[324] *Id.*
[325] *Id.* at 8–9. A recent survey completed by the Alliance for Water Efficiency revealed that, of the utilities examined, 82% implemented either decreasing block structures or uniform rates. ALLIANCE FOR WATER EFFICIENCY, *supra* note 107, at 10. Only 18% use increase-block rates. *Id.*
[326] DONNELLY & CHRISTIAN-SMITH, *supra* note 311, at 8–9.
[327] *Id.*; Griffin, *supra* note 105, at 246–247. Decreasing or declining rates systems have a block system in which higher tier blocks are actually less expensive that the base tiers, thus rewarding wasteful behavior. PHILLIPS, *supra* note 280, at 766, 771. These structures are also not reflective of current cost of service models because utilities do not experience decreasing unit costs with increased usage. *Id.* at 771.
[328] DONNELLY & CHRISTIAN-SMITH, *supra* note 311, at 8–9.
[329] *Id.*
[330] *Id.* The steeper the block increase, the more punitive it is to high end users. *Id.*
[331] *Id.*
[332] *Id.*; GRIFFIN, *supra* note 105, at 247.
[333] Hughes & Leurig, *supra* note 140, at 15.
[334] PHILLIPS, *supra* note 280, at 428.
[335] Schwartz, *supra* note 192.

steep tiers with the highest users paying three to four times more per gallon than those in the base tiers.[336] Implementation of this rate structure reduced consumption by twenty percent even as population increased ten percent.[337]

Currently, conditions such as scarcity, environmental protection, and time of year are not built into prices. Water is inexpensive where supply is plentiful or infrastructure is inexpensive regardless of what the future portends.[338] As water becomes scarcer necessitating increased infrastructure, technology costs, or water purchases, prices will increase accordingly.[339]

2. Fees and Pass-Through Costs

Most utility costs are fixed. This is why variations in revenue threaten business model stability. "Because the majority of systems' costs are fixed, declines in customer use typically require systems to increase the rates they charge."[340] "According to a recent survey by the American Water Works Association 70% of water utilities are not fully recovering their costs."[341] Yet, as systems increase, the price charged per unit of water is less. To make up for lost revenue, the water system needs to increase the cost of service; however, the amount a water system increases its rates may not be proportionate to the revenue increase it experiences.

As discussed, steep increasing tiered rate structures can provide more affordability to low-use customers and send a better price signal. However, they also result in volatile revenues for the utility, particularly during extreme weather patterns.[342] "[I]ncreasing block rate structures lead to feast or famine years" if not coupled with predictable income.[343] One solution to this disconnect is the addition of fixed fees to generate a more dependable revenue stream.[344] Fees are allocated on a per-customer basis and not a per-unit consumed basis.[345]

Many systems employ a two-part system that includes a low base charge and a variable volumetric charge based on consumption.[346] One benefit of

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[336] *Id.*

[337] *Id.* Per capita usage went from 140 gallons a day in 2001 to about 100 gallons a day. *Id.* Tiered structures were paired with generous conservation rebate programs to encourage in-home efficiency retrofits. *Id.* The conservation success also shows that the community appreciates the need to protect precious water resources. *Id.*

[338] Hanemann, *supra* note 61, at 19.

[339] Glennon, *supra* note 18, at 1900; Donnelly & Christian-Smith, *supra* note 310, at 2–6.

[340] Leurig, *supra* note 150, at 12.

[341] ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 8.

[342] *Id.* at 3.

[343] Hughes, *supra* note 232. "A back of the envelope calculation can show that potential weather swings can lead to 5-10% revenue swings for many utilities." *Id.*

[344] WATER RESEARCH FOUNDATION, *supra* note 151, at 32.

[345] HEMPLING, *supra* note 244, at 218.

[346] HUGHES & LEURIG, *supra* note 140, at 10.

increasing flat fees is revenues are better matched to flat costs.[347] Although fees can help stabilize revenues, there are some drawbacks. First, high service charges can punish low-income and low-use customers because higher unit costs are only partially tied to amount used.[348] Second, because these costs are not tied to use, the price signal present in progressive rates can be lost.[349]

Fees partially decouple revenues from usage so there is no longer an incentive for utilities to encourage sales to generate money.[350] This concept has been adopted by many energy utilities, but could be easily adopted by water providers, as they are increasingly motivated to reduce usage.[351] Because income generated by fees is revenue, it is governed by the same legal obligation of reasonableness.[352]

Although there are several methods of decoupling, the customer's bill is never fully decoupled from consumption.[353] In addition to stabilizing revenues, decoupling also gives utilities more flexibility and avoids frequent rate cases, which can be expensive and time consuming delaying price reactivity.[354] Decoupling and flat fees are not without their critics. If not properly deployed, fees can reduce a utility's incentive to keep costs low because they know a certain revenue stream is guaranteed.[355] However, limited decoupling in concert with conservation-based rated structures can help stabilize revenues while maintaining a consumption-based price signal.[356]

For example, a water district in Southern California implemented a steep tier structure that successfully reduced the top tier of users by 50%.[357] The structure included a 500% price increase between the lowest and highest use

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[347] WATER RESEARCH FOUNDATION, *supra* note 151, at 32.
[348] *Id.* at 24.
[349] *Id.*
[350] NATIONAL RENEWABLE ENERGY LABORATORY, DECOUPLING POLICIES: OPTIONS TO ENCOURAGE ENERGY EFFICIENCY POLICIES FOR UTILITIES 1 (2009).
[351] *See id.*
[352] *Id.*
[353] *Id.* at 4. Decoupling can be applied to all or only a portion of sales variations to make up for revenue shortfalls. *Id.* "Decoupling begins with a general rate case . . . . Thereafter, rates are adjusted periodically to ensure that the utility is actually collecting the allowed amount of revenue, even if sales have varied from the assumptions used when the previous general rate case was decided. If sales decline below the level assumed, rates increase slightly, and vice-versa." THE REGULATORY ASSISTANCE PROGRAM, *supra* note 242, at 61.
[354] NATIONAL RENEWABLE ENERGY LABORATORY, *supra* note 350, at 1–2; MARY TIGER ET AL., UNC ENVIRONMENTAL CENTER, DESIGNING WATER RATE STRUCTURES FOR CONSERVATION & REVENUE STABILITY 11 (2014).
[355] Lino Mendiola, *The Erosion of Traditional Ratemaking Through the Use of Special Rates, Riders, and Other Mechanisms*, 10 TEX. TECH. ADMIN. L.J. 173, 180-81, 184 (2008).
[356] NATIONAL RENEWABLE ENERGY LABORATORY, *supra* note 350, at 4–5; ALLIANCE FOR WATER EFFICIENCY, *supra* note 108, at 9. "In general, the higher the percent of residential water bill that is "fixed", the weaker the conservation signal and stronger the revenue stability." TIGER ET AL., *supra* note 354, at 16 (*emphasis omitted*).
[357] ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 7.

tiers.[358] Despite a total water demand decline of 30% over five years, the utility was able to maintain full cost recovery by funding fixed costs through fixed revenues and appropriately tiered rates.[359]

Flat fees can be applied for several purposes. A connection charge is a common example. A new customer pays this one-time fee based on the size of the meter connection.[360] Another example of a flat fee is a pass-through that occurs when new equipment such as a meter is installed.[361] Service fees are also common. Service is a broad term that can include activities such as meter reading, billing, or other costs that would the same for each customer.[362] Utilities can also pass through costs that are equal for each user.[363] These are particularly useful to for environmental protections such as habitat protection costs.[364]

Drought surcharges also qualify as possible flat fees.[365] These are similar to the fuel fees that were common when gasoline prices skyrocketed.[366] The purpose of these charges is to account for a temporary cost burden and send an immediate price signal while maintaining underlying service pricing.[367] These fees can be removed when the temporary impediment, such as drought, ends.[368]

D. Who pays? New Growth, Existing Ratepayers & Low Income Users

Although cost of service studies are predicated on the notion that those for whom costs are incurred should pay, this is usually done at a macro level.[369] All ratepayers pay for new infrastructure and even though new residents primarily drive increased demand. While it can be argued that existing citizens benefit from growth, increasingly expensive supply can put an unfair burden on existing ratepayers.

While utilities are required to avoid undue discrimination across user groups and avoid subsidies, the persistent increase of utility pricing necessitates a focus on low-income users. Rate structure design and raising

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[358] *Id.*
[359] *Id.*
[360] CITY OF SHORELINE, *supra* note 298, at 1–2; FRESNO MUNICIPAL FINANCIAL SERVICES, *supra* note 345, at 1–3.
[361] CITY OF SHORELINE, *supra* note 298, at 1.
[362] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 40.
[363] WATER RESEARCH FOUNDATION, *supra* note 151, at 212.
[364] *Id.*
[365] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 21, 25.
[366] Brad Tuttle & Jacob Davidson, *5 Kinds of Businesses Still Tacking on a Fuel Surcharge*, TIME (Jan. 13, 2015), http://time.com/money/3664414/fuel-surcharge-cheap-gas/.
[367] *Id.*
[368] *Contra id.*
[369] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 36.

rates must include protection of low-income users.[370] Expansion of water services may have the goal of encouraging economic development; however, this should not be done at the cost of existing rate-payers who may be priced out of basic services.[371] "We subsidize water for the largest users in the United States, including agriculture and energy plants, yet we do not ensure a basic amount of water for the poorest citizens."[372]

Recognizing affordability needs does not imply a requirement that service rates need to be excessively inexpensive or free.[373] Such a system would require significant cost subsidization.[374] "If the prices chargeable for all necessities were to be based on the standards of ability to pay rather than on standards of cost pricing, then a reorganization of the country's entire price system would be in order."[375] However, the importance of water does necessitate some affordability adjustments.

"Since 2007, city water prices have risen at rates faster than the overall cost of living."[376] The price of water increased thirty-three percent since 2010.[377] In 2014 alone, the price increased six percent.[378] This trend is expected to continue because of projected infrastructure and supply projects.[379] While high-priced top tier rates can promote conservation through price, it also can increase revenue volatility.[380] Utilities may be tempted to increase the costs of the lowest tiers, which usually represent quantities needed for nondiscretionary uses.[381] As such, they create a stable income stream.[382] Unfortunately, this can force low-income users to decide between water and other essentials.

There are several alternatives to protect low-income users. Lifeline rates allow those who qualify to get a basic amount of water at a special rate.[383] The usefulness of these often depends on the complexity of the application system and who can qualify. Other utilities use bill payment assistance for

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[370] Walton, *supra* note 198. Milford, Massachusetts proposed an 82% rate increase to fund a new water treatment plant. Matt Harris & Peiffer Brandt, *Rates Flood: Rising Water Bills*, UNC ENVTL. FIN. BLOG (Oct. 12, 2012), http://efc.web.unc.edu/2012/10/23/rates-flood-rising-water-bills/.
[371] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 30.
[372] Barnett, *supra* note 192.
[373] BONBRIGHT, *supra* note 20, at 9.
[374] *Id.*
[375] *Id.*
[376] Barnett, *supra* note 192. Despite these increases, the water sector says will not be enough to cover the $1 trillion needed for repair and growth. *Id.* Much of that is likely to come from ratepayers. *Id.*
[377] Walton, *supra* note 198. This is the equivalent of a $45 bill increasing by $15. *Id.* Some cities have seen a much greater increase. *Id.*
[378] *Id.*
[379] *Id.* It is expected that the annual increase in revenue will exceed the Consumer Price Index by double to fund utilities. *Id.*
[380] Walton, *supra* note 198.
[381] *See id.*
[382] *See id.*
[383] Stacey Isaac Berahzer, *The Increasing Need to Address Customer Affordability*, UNC ENVTL. FIN. BLOG (May, 29, 2012), http://efc.web.unc.edu/2012/05/29/the-increasing-need-to-address-customer-affordability/.

low-income users.[384] A utility can assist the user in reducing water use through affordability programs services provided by the utility.[385] This is similar to the weatherization programs in the energy sector. Often, it is the generosity of others that end up protecting at-risk users.[386] Utilities can apply for grants or offer donation opportunities to allow other ratepayers to donate towards the bills of those who cannot pay.[387] While this is very generous, it may not be reliable for the long term particularly as rates continue to rise.

One challenge of affordability alternatives can be state law. In many states, rate revenues cannot be used to finance assistance programs.[388] For example, in North Carolina water utility revenues cannot be used for the administration of support programs.[389] This essentially carves these costs out of cost of service costs that can be recovered from ratepayers.[390] As prices rise, legal changes may need to be made to protect low-income users.

Another alternative to reduce the financial load on existing ratepayers is the use of impact fees. "Impact fees are payments required by local governments of new development for the purpose of providing new or expanded public capital facilities required to serve that development."[391] These one-time fees pass along the cost of new infrastructure to the people who will most benefit from the expansion.[392] Traditionally, impact fees took the form of exactions and were often limited to specific in-kind, on-site capital costs, but some states have expanded them to include off-site infrastructure needs as well.[393]

State law limits costs that can be included and the total amount of impact fees possible.[394] Fees are often limited to capital improvement costs and are capped at a percentage of the total.[395] As such, conventional water supplies typically did not fall within the permissible statutory definition. However, as existing water supplies become depleted, dependence on new, expensive technology increases. These new water supply projects have large capital

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[384] *Id.*
[385] *Id.*
[386] *Id.*
[387] *Id.*
[388] *Id.*
[389] Berahzer *supra* note 383.
[390] *Id.*
[391] AMERICAN PLANNING ASSOCIATION, POLICY GUIDE ON IMPACT FEES (1997), https://www.planning.org/policy/guides/pdf/impactfees.pdf.
[392] Arthur C. Nelson & Mitch Moody, *Paying for Prosperity: Impact Fees and Job Growth*, The Brookings Institution Center on Urban and Metropolitan Policy, vi (June 2003), *available at* http://www.brookings.edu/~/media/research/files/reports/2003/6/metropolitanpolicy-nelson/nelsonimpactfees.pdf.
[393] *Id.* at 1.
[394] *See e.g.*, TEX. LOC. GOV'T CODE ANN. §§ 395.012 & 395.015 (West 2014).
[395] *See e.g.*, *id.* In addition to capital costs, an important inclusion is projected interest charges and other finance costs. *Id.* at §395.012(b). This is very important for cities who are constructing project with bonds and can add up to a lot of money that ratepayers will not have to pay. *Id.*

demands, which are appropriate for impact fees. Expanding or just applying permissible impact fees can be an effective way to both encourage smart growth and alleviate the cost impact of new supply on existing users, particularly those on a limited income.[396]

IV. UTILITY PRICING FOR EQUITY AND RESILIENCE

Water is a critical resource necessary for both survival and economic success. To achieve these, water supplies must be sustainable into the future. While current legal regimes seek to achieve these goals, the focus on revenue collection often threatens the ability to ensure water is used most efficiently. Sale of water can actually create a disincentive to protect water resources, which can have long-term consequences. Applied properly, markets can be used to prevent these concerns. Upon closer examination, there is a false conflict between sales and resource protection. Shifting away from the traditional utility demand projections and billing models allow utilities to stay in business and help maintain water supply into the future.

A. Expand Cost of Service

Perhaps the most frequent water transaction is the sale of water from a water utility to a municipal domestic and commercial user.[397] In the U.S., over three hundred million customers receive their water from a utility.[398] This provides a huge opportunity to affect behavior through price and an equally large chance that water is being used inefficiently. Proper rate structures can send appropriate signals to users to minimize wasteful behavior particularly for discretionary needs.[399] When low rates are the only price signal received by millions of city dwellers, there is no incentive to conserve until it is too late.[400] This is not an effective use of markets to ensure product efficiency. In order to provide an effective price signal, limitations on what costs a utility can pass through to ratepayers must be expanded from the current alternatives.[401]

Currently, rates are determined based on a limited cost of service analysis.[402] Depending on the jurisdiction, rates can only be used to recoup

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[396] Nelson & Moody, *supra* note 392. at vi, 2. *See e.g.*, Amy Hardberger, *SAWS Impact Fees Represent More Than Meets the Eye*, THE RIVARD REPORT (May 22, 2014), http://therivardreport.com/impact-fees-represent-meets-eye/ (discussing the recent impact fees debate in San Antonio, where the primary issue was whether existing rate-payers should foot the bill for new growth and suburbanization).

[397] *See* U.S. CENSUS BUREAU, STATISTICAL ABSTRACT OF THE UNITED STATES 602 (2012), *available at* http://www.census.gov/compendia/statab/2012/tables/12s0959.pdf.

[398] *See id.*

[399] Adler, *supra* note 99, at 746.

[400] *See id.*

[401] *See contra*, TEX. WATER & UTIL. CODE ANN. § 572.061 (2014).

[402] Glennon, *supra* note 18, at 1883.

utility's costs for items including current operation and maintenance, capital costs, and debt service.[403] This constrains rate collection, which is the price placed on water, to costs that have already been incurred.[404] Once inexpensive water resources are depleted and the utility is forced to seek new expensive supply, increasing rates.[405] Changing the cost of service paradigm could also change this result.

One of the problems with current cost of service models is that the ratemaking is based on historical costs rather than future costs.[406] The goal with a broader model is to make an effort to capture at least some of those costs to send a price signal earlier and avoid a capacity overinvestment. Even with increasing rates based on increased capital costs, most rates are still reactive.[407] In order to send the appropriate price signal, rates need to include costs of extra production and treatment that will be necessary if water is not used efficiently.[408] This incorporation of avoided supply costs at least in part would make the water market more reflective of water in its high value capacity.[409]

The purpose of rate setting is to provide enough income to allow the utility to provide services without the need of government subsidies as well as manage demand.[410] The current market approach to pricing excludes many factors, which does not fully inform market drivers. Price does not reflect water's full intrinsic value.[411] This inaccurate price signal creates unintended consequences.[412] Externalities that currently are not given value including extraction or development costs should be included in a cost of service analysis and included in rates or additional fees.[413]

"Cost" requires a definition broader than what might be traditionally used.[414] Diversifying what is considered would allow rates to both achieve the utility's revenue requirements while informing consumers of the non-monetary costs of their use such as private and social impacts of expanded

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[403] *See, e.g.*, TEX. WATER & UTIL. CODE ANN. § 572.061 (2014).
[404] Glennon, *supra* note 18, at 1883.
[405] *See id.* at 61–62.
[406] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 32.
[407] *See id.* at 19.
[408] *Id.*
[409] *See* discussion *supra* Part III.A.1 (explaining that reduction in usage can save ratepayers exponentially in the future).
[410] BONBRIGHT, *supra* note 20, at 70.
[411] *See* discussion *supra* Part II.B.
[412] *See* discussion *supra* Part II.B.
[413] ALLIANCE FOR WATER EFFICIENCY, *supra* note 108, at 7. Other costs associated with new supply may include land impacts, energy, and pollution costs. *See e.g.*, WATEREUSE ASS'N, SEAWATER DESALINATION POWER CONSUMPTION 2 (Nov. 2011), *available at* http://www.watereuse.org/sites/default/files/u8/Power_consumption_white_paper.pdf (last visited Feb. 22, 2014); Heather Cooley, et al., *Desalination of Seawater Can Do More Harm Than Good*, PACIFIC INSTITUTE (2013) http://pacinst.org/publication/desal-marine-impacts/; Bill Hanna, *Tarrant Water District to Take Parcel From Pipeline Opponent by Eminent Domain*, STAR TELEGRAM (Feb. 19, 2014), http://www.star-telegram.com/2014/02/18/5580027/water-district-votes-to-use-its.html.
[414] BONBRIGHT, *supra* note 20, at 70.

development and delivery.[415] If buyers understood, through price signals, that adopting efficient uses now could bypass that end result, their behavior might change accordingly.[416] A more expansive definition that includes avoided supply could be defended as prudent or reasonable under the legal standard.[417] In essence, ratepayers are paying a small price up front to avoid an emergency later.[418]

While rate design is legally required to remain revenue neutral, limiting utilities to a fair rate of return, an inclusive calculation of costs allows for a broader cost of service determination.[419] So long as the projected costs are measurable and defensible, they should be legally included.[420] Precedent exists for a more liberal interpretation of COS.[421]

Cost of service like value has many meaning.[422] As such, flexibility for its application is built-in.[423] This flexibility is seen in one of the scholar Bonbright's criteria for rate design. He states rates should reflect both present and future private and social costs.[424] Bonbright argues that one purpose of rates is to control demand through pricing with the goal that customers will weigh the total cost of using a resource.[425] This also obligates the inclusion of externalities, which cannot be accomplished through reactionary rates that use a limited interpretation of cost.[426]

One way water utilities could build avoided shortage into the cost of service in a proactive way is to use a process used by electric utilities called Integrated Resource Plans (IRP). "In an integrated resource plan ("IRP"), a utility evaluates available resources and forecasted demand over an extended period of time to determine the optimal mix of resources to reliably meet customer load requirements at the lowest reasonable cost."[427] IRPs move

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[415] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 22.
[416] YOUNG, *supra* note 57, at 135–37.
[417] *See* BONBRIGHT, *supra* note 20, at 70–71. "A cost is always a cost *of* something *to* some individual or group of individuals." *Id.* at 72. An internalization of the external costs of supply depletion would significantly change a cost of service paradigm. *See* Hardberger, *supra* note 48, at 932-34; BONBRIGHT, *supra* note 20, at 72.
[418] *See, e.g.*, Paul Rogers, *California Drought: 17 Communities Could Run Out of Water Within 60 to 120 Days, State Says*, SAN JOSE MERCURY NEWS (Jan. 28, 2014, 6:28PM), http://www.mercurynews.com/science/ci_25013388/california-drought-17-communities-could-run-out-water.
[419] *See* ALLIANCE FOR WATER EFFICIENCY, *supra* note 108, at 10. In April 2015, a California state appellate court ruled that a tiered pricing system may violate state laws by charging more for services that their costs are to provide the water. Schwartz, *supra* note 192. These limited views of cost of service do more harm than good.
[420] ALLIANCE FOR WATER EFFICIENCY, *supra* note 108, at 12.
[421] HEMPLING, *supra* note 244, at 230–33.
[422] BONBRIGHT, *supra* note 20, at 69.
[423] *Id.*
[424] *Id.* at 72–73. "Only in this way can the customers be put in a position . . . to ration themselves by striking a balance between benefits received and sacrifices imposed." *Id.* at 69.
[425] *Id.* at 72.
[426] *See id.* at 70.
[427] Inara Scott, *Teaching An Old Dog New Tricks: Adapting Public Utility Commissions To Meet Twenty-First Century Climate Challenges*, 38 HARV.ENVTL. L. REV. 371, 409 (2014).

away from keeping costs as low as possible until a shortage occurs, they actually "compare the costs and risks associated with a variety of portfolios."[428] By doing this, utilities can better optimize when new supply technologies should be built and well as send a price signal to customers to slow down that obligation, while still allowing them to ultimately save money on the costs of avoided supply.[429]

An inclusive reading of costs, particular those that include societal costs of depletion could be defensible under a broader reasonableness standard.[430] Rates that protect water resources and save ratepayers future rate increases should qualify as prudent actions.[431] Because the prudence review is the substitute for market competition, the utility would in essence be telegraphing a market signal that would not normally exist because of the utility model.[432] Although this is not the traditional way "prudent" has been interpreted by courts, the limited nature of water resources should dictate a new understanding of the term.[433]

B. Diversify Demand Projections

Demand projections are the basis for water supply decision-making and subsequent ratemaking. If a utility underestimates, there will not be enough water for their customers. If they continue to overestimate, as they have historically, customers will foot the bill for unnecessary expenses and the business model becomes threatened.[434] The trend of increased costs and declining sales seen across the U.S,, forcing a new look at how demand is calculated.[435]

Traditionally, utilities used very limited methodology to predict demand. Future water needs were ascertained by estimating population growth and extrapolating using present per capita demand. The problem with this method is that it assumes water will be used in the same way as it has in the past, leading to inaccurate results. Appliances use less water than before and, as water prices increase, customers respond by using less threatening financial ruin for the water provider.

Customer consumption is the basis for future sales. "A customer's demand is based upon the need or desire for the service, the ability to pay for it, and the availability of substitutes.[436] Determining demand in a more

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[428] *Id.*
[429] *Id*; Grafton et al., *supra* note 258, at 54–55.
[430] HEMPLING, *supra* note 244, at 230–33.
[431] *See id.* at 235.
[432] *See id.*
[433] *Contra* HEMPLING, *supra* note 244, at 238–42.
[434] WATER RESEARCH FOUNDATION, *supra* note 151, at 139. In addition to the obvious threat lack of revenue creates, financial institutions will downgrade utilities that over-predict demand. *Id.* at 140.
[435] *Id.* at 139.
[436] PHILLIPS, *supra* note 279, at 412.

complex and integrated way will lead to more accurate rate predictions and infrastructure build-out. To do this, historical assumptions must be replaced with accurate information about customers' demand patterns broken down to individual users or segments of user.[437] This includes examining not only who is using the water, but also which portions of those uses are elastic versus inelastic.

In lieu of linear numeric extrapolations based on population, multi-faceted demand modeling can allow a utility to add in factors that are locally relevant. In addition to population, some additional factors for consideration include local climate, customer usage data, rates and rate structures, demographic shifts, conservation programming and policy changes such as new land use limitations. Price elasticity will also need to be included in any calculation.[438]

The non-profit group Alliance for Water Efficiency (AWE) recently released a user guide for their sales forecasting model. The model allows users to apply billing data to rate structures to estimate performance and compare that to revenue goals.[439] The model consists of two modules: the rate design module and the revenue simulation model.[440] The simulation attempts to address deficiencies in tradition demand projection calculations by including customer demand variability,[441] demand response, drought pricing, probability management and fiscal sustainability.[442] In addition to the AWE model, several other software options provide the ability model these more complex scenarios.[443] Although these programs require more effort that traditional rate modeling, they could lead to increased resilience and rates protection in the long run.

C. Adopt Rate Setting Best Practices

Rates are an opportunity for a utility to communicate with their customers by using price as an indicator of demand and trigger behavior accordingly. However, to be effective, rates must be constructed using best practices and must be seen as more than a mechanism for basic cost recovery. Traditional rate structures that are not tied to consumption or those that keep prices artificially low create volatility in the revenue stream that can threaten long-term sustainability. This is particularly true during extreme weather situations when consumers respond to the natural

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[437] WATER RESEARCH FOUNDATION, *supra* note 151, at 140.
[438] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 64–65.
[439] ALLIANCE FOR WATER EFFICIENCY, *supra* note 232, at 5.
[440] *Id.*
[441] The model divides annual water use into peak and off-peak seasons. *Id.* This helps the utility identify the inelastic demand, which is critical in predicting demand response. *See id.*
[442] *Id.* The revenue module allows the utility to run a weather-based scenario, such as a wet year, to see how that would affect revenue goals. *Id.* at 9.
[443] PACIFIC INSTITUTE, *supra* note 217, at 3–4.

environment to the detriment of an ill-prepared utility. Balancing price signals with tools that stabilize revenue while protecting low-income users can create community and utility sustainability.

1. The Steeper the Better

When determining a rate structure, utilities should adopt one that provides the biggest price signal to consumers, while still maintaining low prices for a basic quantity of water. This means that the rate system needs to be consumption based.[444] Arguably any rates that are predicated on usage encourage conservation; however, some send more effective price signals than others. An inverse tiered system is generally the most conservation-oriented structure particularly when they are more punitive to high use customers. However, tiers alone will not create the necessary price signal.[445] Rate levels are as important as the structure itself and rate structures should be tailored the local behavior.[446]

Tiered rate structures should target the elastic or discretionary portion of water demand particularly in areas with a high peak demand.[447] One factor that determines price elasticity of demand is the income effect of a product.[448] When a price increases, people usually cannot afford to buy the same amount of that product as they could at the previous price.[449] The greater the proportion of an individual's income needed to purchase the item, the greater the impact of the price increase on consumer demand.[450] That demand is elastic.[451] The lower the need for a product or ability to pay, the more elasticity.[452] Elasticity is also greater when a customer can buy the same or similar product from another supplier.[453]

Basic uses of water are inelastic. A user cannot simply require less water for health and hygiene because the price goes up, but those uses account for a very small percentage of household uses.[454] Some indoor uses can be reduced through more efficient plumbing or behavior modifications, but the

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[444] *See* discussion *supra* Part C.1.

[445] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 42. "Poorly designed inclining block rates can be less effective in promoting efficiency than well-conceived declining or uniform volume rates, and they can impose profound inequities." *Id.* at 44.

[446] *Id.* at 41–42.

[447] *See* Adler, *supra* note 99, at 746; ALLIANCE FOR WATER EFFICIENCY, *supra* note 108, at 7.

[448] BADE & PARKIN, *supra* note 59, at 116.

[449] *Id.* "The sensitivity of customers to price changes depend on income and the availability of alternative sources of supply." Hughes & Leurig, *supra* note 140, at 19.

[450] BADE & PARKIN, *supra* note 59, at 116.

[451] *Id.*

[452] PHILLIPS, *supra* note 279, at 412.

[453] *Id.*

[454] *See* ENVTL. PROT. AGENCY, WATER SENSE, OUTDOOR WATER USE IN THE UNITED STATES (2013), *available at* http://www.epa.gov/WaterSense/pubs/outdoor.html (last visited Feb. 22, 2014).

largest and most elastic water uses occur outdoors.[455] Pricing structures need to target discretionary use through a block system that prices the nondiscretionary uses very low in the first pricing tier, but penalizes uses that are clearly optional by making the higher use tiers exponentially more expensive.[456] The proper punitive price signal could result in significant savings both in the short and long term because many users may forgo that use entirely based on cost.[457] While effective, these rate structures can create revenue volatility so they should be coupled with other income streams.[458]

2. Drought Pricing & Peak Shaving

A natural goal related to water allocation protocols is to ensure the resource does not disappear.[459] To achieve this, water must be used in the most efficient way possible, particularly under drought conditions.[460] Unfortunately, under the current market scheme, price cannot guarantee the best use of water. Instead, price may only respond once the water runs out.[461] At this point, price impacts can be severe, because both the cost of using less water and the price to purchase and import water would be far higher.[462] It is beneficial to send a price signal earlier and include the cost of inaction in the current price and avoid the crisis altogether.

One alternative is to levy an additional fee during times of shortage when the utility needs to send an immediate price signal unrelated to traditional rates.[463] This temporary drought surcharge would help avoid shortages and more closely align water with its appropriate value under the circumstances.[464] It also avoids the need for a long, politically difficult rate case, which is not necessary if the shortage is temporary.[465]

This fee can either be the same for all customers or can be prorated based on use. Customers with bills in the lower tiers are charged a lower fee, while those who use the most water pay a higher fee. This methodology is legally defensible because the latter group is continuing to use discretionary water

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[455] *Id.* NAT'L WILDLIFE FED'N & THE SIERRA CLUB, WATER CONSERVATION BY THE YARD: ESTIMATING SAVINGS FROM OUTDOOR WATERING RESTRICTIONS 6 (2015); ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 44.
[456] Donnelly & Christian-Smith, *supra* note 311, at 8–9.
[457] *Id.*
[458] WATER RESEARCH FOUNDATION, *supra* note 151, at 132.
[459] TARLOCK, *supra* note 24, at 15–16.
[460] *See id.*
[461] *See* discussion *supra* Part II.B.3.
[462] *See* discussion *supra* Part II.B.3.
[463] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 53–54.
[464] *See e.g.*, Steve Raabe, *Rising Cost of Gasoline Sparks Return of Fuel Surcharges*, THE DENVER POST (Mar. 11, 2011), http://www.denverpost.com/ci_17588061.
[465] *See e.g.*, Yvonne Wenger, *City Panel Gets Earful From Residents Angry About Rising Water Bills*, THE BALTIMORE SUN (June 26,2013), http://articles.baltimoresun.com/2013-06-26/news/bs-md-ci-water-rate-increase-20130625_1_meter-and-billing-systems-rudolph-chow-water-bills.

even at a critical time. Drought surcharges should be designed to affect high users to not punish people who only use basic needs.

In most regions, warmer summer weather is associated with an increase in demand caused by outdoor watering even when drought is not occurring. These seasonal peaks can drive water supply development and motivate utilities to procure capacity that is unutilized for the remainder of the year.[466] When this happens, prices are either increased to make up for the capital costs or the utility must encourage the sale of water. Targeting discretionary use during these peak times may reduce annual supply demands by reducing these peak periods.[467] Mirroring time-of-day pricing seen in the electric industry, the price reflects that actual costs at the time of use, inclusive of resource depletion.

Seasonal rates are distinct from drought fees or surcharges.[468] The former anticipates the peak requirements of a certain season regardless of rainfall.[469] A surcharge on the other hand, is more suited to specific, temporary circumstances.[470] Customers can also be rewarded for reducing their peak load through peak rebates.[471]

3. Utilize Flat Fees

Steep increasing rate structures can provide more affordability to customers and send a better price signal, but can result in volatile revenues for the utility, particularly during extreme weather patterns.[472] In contrast, high fixed charges and decreasing rate blocks provide more revenue stability but may or may not encourage less usage.[473] The key is to blend revenue from these two sources in a way that maintains a price signal while increasing predictability for the utility.

One alternative to balance base and volumetric charges is to set the amount of base charge as a certain percentage of the total bill.[474] A customer's base rate would be set based on a three-month average or the maximum month of consumption, which would protect low-income users that do not overuse, reward low-use customers and give some revenue

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[466] ALLIANCE FOR WATER EFFICIENCY, *supra* note 108, at 10–11.
[467] *Id.* ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 41.
[468] *Id.* An energy sector corollary to this proposal is critical period pricing, which is an add-on to already commonly utilized time-of-day pricing model. THE REGULATORY ASSISTANCE PROGRAM, *supra* note 242, at 55. These additional costs would be limited to times of high stress and shortage is threatened. *Id.* The process would include notification of the customer to allow for a demand shift coupled with higher pricing for those who continue to use. *Id.* This serves to both avoid shortfalls and shave peak demands through price. *Id.*
[469] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 41.
[470] *Id.* at 45.
[471] THE REGULATORY ASSISTANCE PROGRAM, *supra* note 242, at 56.
[472] ALLIANCE FOR WATER EFFICIENCY, *supra* note 15, at 6.
[473] *Id.*
[474] WATER RESEARCH FOUNDATION, *supra* note 151, at 45, 149–51.

predictability.[475] The remainder of the bill would come from variable consumption-based rates.[476] Other flat fees that can be integrated into billing are connection service fees as well as environmental protection fees appropriate for a given area.[477] Flat fees are particularly useful for the installation of new equipment, such as a meter. This ties the cost to the utility with the property necessitating it.[478]

In addition to protecting the price signal, fees must consider the low-income user.[479] Because fixed charges are more regressive, they can consume a larger portion of a customer's income for the same amount of water purchased through consumption-based rates.[480]

4. Protect Low-Income Users

Although water rates have historically been low, they are rising rapidly.[481] Rate increases can disproportionately impact low-income customers. As all utility rates climb, some citizens face difficult decisions about where their limited income should be allocated.[482] While utility models move towards using price as a means to affect behavior, these citizens must be considered. Prohibitions against undue discrimination in rates require that similarly situated customers are treated similarly, but that does not mean there are not protective options.[483] A low-income customer may not be subject to a different rate structure than someone of higher income, but they can be treated differently based on use patterns, which often has the same effect.[484] Other protective mechanisms are also possible.

The first category of low-income alternatives can be found in the actual rate systems. Lifeline rates are based on the understanding that certain low-income and fixed-income elderly customers should be provided an affordable rate because they cannot afford basic necessary.[485] Low-income affordability subsidies can take several forms. There can be a separate

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[475] Mary Tiger, *PeakSet Base: A Pricing Model for Utility Revenue Stability and Customer Conservation*, UNC ENVTL. FINANCE BLOG (July 10, 2012), http://efc.web.unc.edu/2012/07/10/peakset-base-a-pricing-model-for-utility-revenue-stability-and-customer-conservation/.

[476] *Id.*

[477] For example, fees can be useful to help fund costs associated with habitat conservation plans in regions with endangered species concerns. WATER RESEARCH FOUNDATION, *supra* note 151, at 212.

[478] *See* discussion, *supra* Part III.C.2.

[479] ALLIANCE FOR WATER EFFICIENCY, *supra* note 108, at 9.

[480] *Id.*

[481] LEURIG, *supra* note 178 at 14. Water rates recently surpassed cable television as the most rapidly rising household service. *Id.* In Fort Worth, the cost of raw water increased almost ten percent in one year and city officials expect it to double over the next ten years, all of which will impact rates. Hirst, *supra* note 175.

[482] *See* HUGHES & LEURIG, *supra* note 144, at 19.

[483] Hempling, *supra* note 244, at 288–89. Many states have passed affordability acts permitting subsidy rates. WATER RESEARCH FOUNDATION, *supra* note 151, at 190.

[484] Hempling, *supra* note 244, at 288–89.

[485] Phillips, *supra* note 280, at 425.

discounted rate for a limited qualities or a percentage discount can be applied to the total bill.[486]

Low-income protection can be also accomplished by setting bottom tier rates very low for all users.[487] Some experts have suggested the bottom tier should be provided for free.[488] Fees can also be waived in lieu of a consumption-based subsidy.[489] The goal is to supply a basic amount of non-discretionary water at a very affordable rate.[490] Critics of this system feel that lowering the price dilutes the price signal; however, this system could arguably promote conservation as more people try to qualify for that rate reduction by using less water.[491]

Utilities that are not legally permitted to have lifeline rates or prefer to avoid them, citing concerns that the price signal will be weakened, may offer cost relief through non-pricing mechanisms.[492] One example of this is providing home audits and subsidization for any available retrofits.[493] Although this has an up-front cost, it is short-term and leads to ongoing savings so may be less expensive in the long-term. One of the challenges presented by any affordability programs is determining who must pay for the assistance program or the revenue shortfall produced by someone paying less than the cost of service.[494] Some utilities make up this shortfall through revenue earned from the highest tier users. Another alternative is to simply provide direct financial assistance through bill payment aid through the utility itself, other municipal sources, or local charities.[495]

A combination of programs is highly recommended to ensure maximum support of at-risk communities. For example, Portland, Oregon provides a low-income bill discounts; crisis assistance in cases of emergencies; budget billing, which allows customers to pay in a way on a schedule that works for them; and bill write offs in special circumstances based on employee discretion.[496] In addition to bill-specific assistance, the city also works with community members to reduce their water usage through education and

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[486] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 52.
[487] THE REGULATORY ASSISTANCE PROGRAM, *supra* note 242, at 94.
[488] Glennon, *supra* note 21 at 311, 340. Although some groups question this methodology, affordability is defined by the Environmental Protection Agency to be less than 2.5% of a community's median household income. WATER RESEARCH FOUNDATION, *supra* note 151, at 186–87.
[489] THE REGULATORY ASSISTANCE PROGRAM, *supra* note 242, at 94.
[490] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 52.
[491] It is also worth noting, that low-income customers are rarely wasteful or high water users. WATER RESEARCH FOUNDATION, *supra* note 151, at 196. Affordability programs may actually save the utility money through avoided disconnection and mitigation of past due balance accruals. *Id.*
[492] ALLIANCE FOR WATER EFFICIENCY, *supra* note 11, at 99.
[493] *Id.*
[494] Phillips, *supra* note 280, at 426.
[495] WATER RESEARCH FOUNDATION, *supra* note 151, at 188, 190. Some have suggested a direct charge on all bills to fund affordability programs. *Id.* at 191. Where this is not possible, customer donation programs can be established. *Id. See* THE REGULATORY ASSISTANCE PROGRAM, *supra* note 242, at 95–96 (providing examples bill-assistance programs in the energy sector).
[496] WATER RESEARCH FOUNDATION, *supra* note 151, at 189.

subsidized retrofits.[497] "Affordability programs provide flexibility to utilities seeking revenue resiliency."[498]

Before determining which programs a utility wishes to implement, the utility must quantify the number of ratepayers who might qualify for the program. This will provide the total cost to the utility for each program. Without reliable estimates, a utility risks a large, unexpected shortfall.[499] In addition, they may not adopt programs best suited for their community.[500]

Finally, existing users should not be burdened with the costs of new growth that is creating the demand. Permitting and implementing impact fees shift the costs where they belong and alleviate at least some of the financial impacts on low-income users. Ultimately, the goal is to balance revenue resilience, conservation, economic growth and affordability.[501] Although, on the surface some of these appear to be in conflict, their interrelation dictates that they be planned in tandem.[502]

V. CONCLUSION

Growing populations, limited resources, and climate change challenge municipal water supplies across the U.S. Historically, water has been undervalued providing a perverse incentive a utility to sell water rather than save it. Markets can help fill this void and increase efficiency by assigning an accurate value to the good sending a price signal that impacts behavior.[503]

Current markets lack the ability to send accurate price signals that reflect the true value of water.[504] This erroneous information leads to unintended consequences that could rapidly deplete resources rather than protect them.[505] The need to ensure market accuracy is particularly important for water because it is a basic resource for which nothing can be substituted. In order for a market to be a useful tool in water planning and protection, adjustments must be made to ensure that all costs are included.[506] Once that happens, then price signals are correct and consumer decisions can be made accordingly.

This economic reality can create a disconnect when a water utility's revenues are predicated on sales. Although on the surface it seems as though conservation and efficiency measures would challenge the utility business

[497] *Id.*
[498] *Id.* at xxx.
[499] *Id.* at 192–95.
[500] *Id.*
[501] TIGER ET AL., *supra* note 354, at 8.
[502] *Id.*
[503] *See* discussion, *supra* Part II.B.
[504] *See* discussion, *supra* Part II.B.
[505] *See* discussion, *supra* Part II.B.
[506] *See* discussion, *supra* Part II.B.

model, this is not necessarily the case.[507] Revenue shortfalls are often a function of not enough conservation, not too much.[508] When utilities manage water needs through conservation, including price signals, they minimize the amount of elasticity and create more predictable revenues.[509]

Water shortages are becoming more common as competition for access increases. As populations shift to municipal areas, it is critical that water providers adopt more complex demand projections that better understand market reactions and predict supply needs.[510] Market adjustments need to be made in the municipal business model to ensure a revenue stream while targeting discretionary uses, such as outdoor watering.[511]

Utilities also need to be given the ability to set their rates in a way that does not simply recoup costs, but actually encourages conservation and efficiency.[512] Water providers need the ability to charge more for existing, less expensive supplies to avoid the need to build more expensive technologies that may disincentivize conservation programs, which saves money over the long-term.[513] Additional fees can be collected regularly or just during drought periods on a pro rata basis to trigger an immediate demand response.[514] Adopting best practices can both ensure a secure water supply while reducing business volatility.

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[507] *See* discussion, *supra* Part III.A.
[508] *See* discussion, *supra* Part III.A.
[509] *See* discussion, *supra* Part III.A.
[510] *See* discussion, *supra* Part III.A.3.
[511] *See* discussion, *supra* Part III.
[512] *See* discussion, *supra* Part IV
[513] *See* discussion, *supra* Part IV.
[514] *See* discussion, *supra* Part IV.