

# The case for state-level drinking water affordability programs: Conceptual and empirical evidence from California

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## ABSTRACT

Informed by the design of a program in California, we make a three-part argument for why state-level governments might consider implementing direct bill-assistance programs for drinking water service to address growing affordability concerns for low-income households. State-level operation of bill-assistance programs represents a departure from the global trend of allowing water utilities to operate bill-assistance programs at their own discretion. We first explain the motivation for enhanced public sector support to help households pay for drinking water service. In state-level contexts such as California, we find that the basic household affordability equation has worsened due to an increase in the numerator of residential retail bills and a stagnation in the denominator of household incomes. We next demonstrate why direct bill assistance to households is necessary even with the presence of other system-level financial support or retail rate structure policies. Finally, we make the case that direct bill-assistance programs are best situated at the state level, due to substantial variation in systems' capacity and demonstrated willingness to run their own robust affordability programs for vulnerable customers.

## 1. Introduction

The impacts of poor water quality and physical water scarcity on household health are both intuitive and well-documented (Rocha and Soares, 2015; Jepson, 2014; Tarrass and Benjelloun, 2012; Howard et al., 2003). If water is unaffordable, low-income households will be forced to make tradeoffs by either consuming less water than is healthy and/or consuming less of other vital goods and services to pay for essential water (Martins et al., 2019; Morduch and Schneider, 2017; Varma et al., 2009). In Detroit, for example, 156,000 households struggled when water rates increased alongside necessary electricity costs for heating during a frigid winter. Households prioritized the immediate need for electricity over water, resulting in a high rate of shutoffs across the city due to non-payment (Filson and Avery, 2017).

Water service shutoffs are especially concerning because they can lead to water-related illnesses. A recent study released by Henry Ford Hospital examined the potential public health implications of water shutoffs in Detroit (Plum et al., 2017; Chambers, 2017). Due to such concerns, the Pittsburgh (PA) Water and Sewer Authority (2017) recently placed a moratorium on drinking water service shutoffs in the winter season. Households who cannot pay their water bills also face negative financial impacts on their credit scores and from the risk of property loss or eviction, as seen in Baltimore (Jacobson, 2016). In short, ensuring the affordability of a sufficient quantity of safe water is both a public health and social welfare priority.

While the United Nations' Millennium Development Goals championed the need for increased water access, the more recently enshrined Sustainable Development Goals explicitly call for affordability<sup>1</sup> as a

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<sup>1</sup> Affordability at the household level is typically measured as a function of the necessary expenditure for drinking water as a proportion of a household's economic resources. We do not propose a precise definition of this term, as we assert that affordability standards are best developed in the program context.

basic criterion in meeting the human right to water. Even before this international standard was adopted in 2015, the state of California became the first and currently only state in the U.S. to officially, albeit nominally, recognize the human right to water (September of 2012).<sup>2</sup> California's legislation states that "every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking and sanitary purposes" (CA Assembly Bill 685, 2012). Shortly after the passage of this legislation, California Assembly Bill 401 called for the consideration of a statewide Low-Income Water Bill Assistance Program (W-LIRA) and authorized the State Water Resource Control Board (the Board) to conduct a study to inform its program design (CA Assembly Bill 401, 2015). Specifically, California Assembly Bill 401<sup>3</sup> (AB 401) mandated that the Board develop a plan for the funding and implementation of a W-LIRA to support household-level drinking water affordability. This mandate was partly driven by gaps in household affordability support currently offered by individual water utilities.

Informed by our work to help develop this program in California, we first explain the motivation for enhanced public-sector support to aid households in paying for drinking water service. Some states, such as California, face rapidly rising retail drinking water bills and stagnating incomes of lower- and middle-income households; residential retail rates and household income represent the two essential parts of the affordability equation. A clear need exists for enhanced drinking water affordability assistance to address vulnerabilities and support health and livelihoods. Affordability relief can take many forms, and we demonstrate why direct bill assistance to households is necessary even with other system-level financial support or retail rate structure policies in place. Third, we make the case that water-related bill-assistance programs are best situated at the state level. Most of the reasons relate to gaps in capacity among individual systems to offer robust assistance programs. Wide variation in scale, water rates, poverty burdens, and legal authorities to operate W-LIRAs helps to explain differences among neighboring systems that could be overcome via a state-level approach.

## 2. Literature review

As a topic of increasing interest amongst policymakers and advocates, a number of researchers currently study drinking water affordability. There remain, however, few published assessments, and even fewer peer-reviewed studies, that systematically analyze the feasibility of different affordability program designs or scales.

### 2.1. Affordability measurement

Much of the scholarly focus to date has been on defining affordability. Gawel, Sigel, and Bretschneider (2012) provide helpful distinctions between conventional affordability ratio (CAR) approaches, potential affordability approaches (PAR), and residual income approaches to measuring affordability, despite their conclusion that none of these approaches is optimal (2013). Several studies in the European context critique conventional affordability approaches and employ potential affordability or residual-income approaches to measuring household-level affordability (Sawkins and Dickie, 2005;

García-Valiñas, Martínez-Españeira, R., and González-Gómez, 2010a; García-Valiñas, Martínez-Españeira, R., and González-Gómez, 2010b; Martins et al., 2019). In the U.S. context, Teodoro (2018) provided a framework for measuring household-level affordability that moves the policy discussion beyond the U.S. EPA approach of using community-level median income as a benchmark for affordability for its purposes. This framework combines elements of both potential affordability and residual income approaches at the household level. Teodoro also produced the only nationally-representative study of household-level water and sewer affordability in the U.S. (2019).

None of these works, however, address the feasibility of affordability interventions at any scale. Moreover, most of these studies imply or directly suggest that the determination of assistance program design should be left to individual water systems and the local communities that they serve, rather than be addressed by regional, state, or national policymakers.

### 2.2. Indirect affordability support

Beyond measuring affordability, scholars have focused on the affordability impact of rate structures, particularly in contexts such as California, where nearly all households receive piped water service (for instance, Favre and Montginoul, 2018). The relative emphasis placed on the fixed versus variable components of a bill can change affordability to customers. Generally, rate structures that place a greater emphasis on recovering revenue through the variable component of the bill implement increasing-block rates (charging lower variable rates for lower levels of consumption), which are sometimes classified as progressive rate structures. Even though they are applied to all ratepayers and not low-income ratepayers per se, well-designed, generally progressive rate structures can help keep rates low for low-income households with low levels of water consumption (Baerenklau et al., 2014).

There are multiple potential benefits to promoting affordability through progressive rate-structure design. First, progressive rates incentivize households to use water efficiently. Second, affordable rates can lessen the scope for additional affordability programs and thus sizable transfers of rate revenue from one set of (higher-income) customers to another set of (lower-income) customers via a programmatic subsidy. However, residential water demand is typically highly inelastic and households may not be able to realize savings via reduced consumption, as richer households do not necessarily consume substantially more water than poorer households (Nauges and Whittington, 2017).

Relying on progressive rate structures alone to provide affordability relief creates additional challenges for systems. Progressive rate structures can hinder a system's sustainability if they otherwise rely on proportionally large fixed charges to stabilize revenue and cover recurring system costs or sales shortfalls during droughts and other shortage events (Dinar and Subramanian, 1998; Wimpenny, 2005). Utilities in California face significant opposition from both high-use customers and the state's existing legislation (Proposition 26<sup>4</sup> and Proposition 218<sup>5</sup>). In particular, the latter may pose a challenging barrier if the courts rule that progressive rate structures are a form of cross-subsidization in violation of Proposition 218, and California is not alone in such legal concerns (University of North Carolina Environmental Finance Center, 2017).

### 2.3. Direct affordability program design

The recent water affordability literature includes several recently useful compendia and practice guides that review existing single-utility (or single-system) water bill-assistance programs in the U.S. (Water Research Foundation, 2010; U.S. EPA, 2016; American Waterworks

<sup>2</sup> In November 2002, the United Nations Committee on Economic, Social and Cultural Rights adopted a "General Comment on the Right to Water," which effectively ratified a human right to water for residents of 151 countries (Langford, 2005). By contrast, the U.S. has declined to ratify the UN's human right to water language on two grounds (UNHCHR, 2007). First, the federal government claims that the right is not valid under international law. Second, the government also claims that ensuring the practical components of the right is a state or local government issue, so a national statute is not deemed necessary.

<sup>3</sup> AB 401- Low Income Bill Assistance Program.

<sup>4</sup> Proposition 26, Supermajority Vote to Pass New Taxes and Fees.

<sup>5</sup> Proposition 218, The Right to Vote on Taxes Act.

Association, 2012). There exists in these reports, however, little critical comparison or analysis of optimal approaches or scales with respect to program design, except as they relate to extending benefits to hard-to-reach customers (Water Research Foundation, 2017). While several recently released reports survey affordability program prevalence in Maryland and Massachusetts (Campbell-Ferrari, 2019; Davis, 2019), the overall prevalence of bill-assistance programs offered by water utilities nationwide is unknown. More closely related to this study, a report by the University of North Carolina Environmental Finance Center assessed legal authorities to offer LIRAs for different types of water utilities in each of the 50 U.S. states (UNC Environmental Finance Center, 2017). This report similarly takes for granted that LIRAs should be offered by individual utilities, despite clearly showing varying gaps in legal and funding authority in the ability of utilities within and across states to offer robust affordability assistance.

By contrast, our study builds on the research used to inform the design of a statewide program in California to explore the case for state-level customer assistance as an alternative to the patchwork of affordability measures offered by individual systems. To the best of our knowledge and based on a comprehensive search, Massachusetts is the only state to have ever operated a low-income water ratepayer assistance program at the state level and did so for only a short time, without any published evaluations of this experiment. In the early 2000s, the Massachusetts Department of Housing and Community Development began operating the Low-Income Sewer and Water Assistance Program, until it was discontinued in 2014. Households received a benefit of up to 25% off their annual bills, with the same eligibility determinations as in the Low-Income Home Energy Assistance Program (Massachusetts General Law, Chapter 23B Section 24B). Little additional public information is available on the program (Berube, 2016).

Similarly, there has never been a federal-level program providing direct ratepayer assistance for drinking water service in the United States. National legislation introduced to the U.S. Congress as recently as February 2016 unsuccessfully attempted to establish a national “Low Income Sewer and Water Assistance Program” (U.S. HR 4542). More broadly, the relative role of federal financial support for water utilities nationwide has fallen since the mid-1970s, as compared to local and state government financial support. The federal government supported over 20% of total spending on water utility infrastructure through the early 1980s, but less than 5% by 2014 (Congressional Budget Office, 2015). Given this demonstrated lack of federal-level support, the likelihood of a U.S. national program remains quite low for the foreseeable future and as such, our analysis focuses on state-level and utility-level affordability programs.

### 3. Data sources and aggregation

This analysis uses three primary categories of data to reach its conclusions: 1) community water system socioeconomic, demographic, and operational data; 2) drinking water costs and rate structures, and 3) information compiled on existing household-level benefit programs already operating in California to meet drinking water and other basic needs. For our purposes in this study, we equate water systems with water utilities as the unit of analysis, even though we recognize that some utilities operate more than one system.

#### 3.1. Community water system data

We first collected a list of active CWS from the Board’s Drinking Water Watch Database (as of March 2016) and extracted the following for each system: water system name (used to characterize governance type), the principal county served, population served, and primary source water type. From the California Environmental Health Tracking Program (CEHTP maintained by the California Department of Public Health), we collected raw geographical boundaries in Geographic Information System (GIS) shapefile format. This dataset only contained

boundaries for roughly 50% of the approximately 3000 active CWS in the state. To describe household-level poverty we collected data on the socioeconomic status of the state’s residents from the five-year 2010–2014 American Community Survey (ACS),<sup>6</sup> published by the U. S. Census Bureau.

These data were at the block-group scale, the smallest geographical scale available, which allowed us to collect the full range of socioeconomic characteristics that were preliminarily considered relevant to the analysis. Our final analysis utilized only a selection of these characteristics: bracketed income, poverty level, and population data. Data were transformed from ACS block groups to system shapefiles using aerial apportioned, population-weighted spatial join techniques in ArcGIS and Microsoft Access, similar to techniques we have previously used in other analyses (Pierce and Lai, 2019).

The collection of system boundaries from the CEHTP is the most comprehensive source in the state; the included systems serve approximately 84% of the state’s population.<sup>7</sup> To account for the remaining 8% of residents served by systems lacking complete, reliable boundaries, we obtained a single, reliable address for each system from California State Water Resources Control Board’s Division of Safe Drinking Water Information System’s Drinking Water Watch (<https://sdwis.waterboards.ca.gov/PDWW/>). This address was matched to block-group characteristics available in the American Community Survey (ACS). For both subsets of water systems serving 92% of the state’s population, we performed subsequent quality checks on the joined data. We note that an additional 4% of the state’s population was served by community water systems for which we could not join locational data, and another 4% was served by private domestic wells and thus not included in the analysis.

#### 3.2. Contemporary and historic rate structure and cost data

We obtained 2015 retail pricing data from the Board’s Division of Drinking Water electronic annual reports (“EAR” data) system, which collects this data directly from large community water systems via an electronic survey embedded in annual reports to the Board. A total of 705 systems participated in the survey and answered a range of questions regarding their billing cycles, retail pricing levels for different customer classes, retail pricing structures, expenditure data at three residential consumption levels (6, 12, and 24 CCF), low-income household assistance, aggregate water sales, and conservation-oriented activities. While only 478 systems reported full, useable data, these systems served approximately 80% of the state’s total population in 2015. These data were collected alongside longer-standing rate data for a sub-set of California’s CWS, compiled and published biennially by the American Water Works Association’s California-Nevada Section. Based on the AWWA-Raftelis Water and Wastewater Rate Survey, the report series details average rates and rate structure information between 2007 and 2015, providing evidence of rising drinking water retail rates over the last decade. Data were merged from the retail pricing database to the water system shapefiles by a simple attribute join based on the system identification number.

<sup>6</sup> The ACS is not a true census of the population and yields less precise spatial and temporal estimates than the decennial census through the year 2000 (MacDonald, 2006). However, given the narrowing of the decennial census starting in 2010 with respect to socioeconomic attributes and the timing of our analysis, the ACS is the most contemporary and comprehensive survey of socioeconomic characteristics available for classifying communities.

<sup>7</sup> Because of errors or inaccuracies introduced by those drawing shapefile boundaries, approximately half of the drinking water systems showed overlapping boundaries when in fact they are spatially discrete. However, most of these overlaps were very small in spatial extent. We took several steps to remedy this problem using ArcGIS software.

### 3.3. Existing bill-assistance programs

No comprehensive list of bill-assistance programs offered by CWS exists at the state or national scale. Given the absence of a comparable state-level program for water bill assistance in the U.S., we performed a comprehensive review of a) single-system or single-utility water bill-assistance programs in California, b) prominent standalone bill-assistance programs offered in cities outside California, and c) state and federal assistance programs offered for other basic services, such as electricity, natural gas, telecommunications, housing, healthcare, and food. To conduct this review, we drew on primary documentation regarding these programs or correspondence with program administrators, in addition to incorporating existing scholarly analyses of similar programs as necessary.

## 4. The increasing problem of household level water affordability

A growing body of research shows that insufficient access to drinking water causes detrimental effects to health but also to general household welfare. Affordability at the household level is measured as a function of the necessary expenditure for drinking water as a proportion of a household's economic resources. In this section, we show that while drinking water has historically been inexpensive for consumers, low-income households in areas such as California face both rapidly rising retail prices for drinking water and stagnating incomes. As a consequence of these dual constraints, households face increasing challenges in obtaining affordable water, and the growing nature of this problem merits increased policy support.

### 4.1. The affordability numerator: the rapidly-rising retail cost of drinking water

Understanding household drinking water affordability requires consideration of the necessary expenditure for water paid by a household, the income of the household, as well as the costs of other vital goods and services. Water affordability becomes a more pressing issue for households as retail water service rates rise.

Using Water Board data for estimation purposes, the average California household in 2015 paid about \$60 per month for 12 CCF of drinking water service. To understand the trend in water rates, we consulted a longstanding series of water rate surveys published biennially. An AWWA-Raftelis survey reports that the retail price of water in California has risen 45% above the pace of inflation from 2007 to 2015. Financial analysts further project the retail price of water to rise significantly in California (and the U.S. more broadly) over the coming years (Carroll, 2015).

### 4.2. The affordability denominator: stagnating incomes for low and middle-income households

Rising income inequality coupled with California's high cost of living means that households increasingly struggle to meet basic needs, including utility services. One-third of Californians, roughly 13 million people, live in households with income under 200% of the federal poverty line, which was about \$49,200 for a family of four in 2015. An analysis of U.S. Census data reveals the 2017 real median household income in California was lower than in 2007.<sup>8</sup> Over the last thirty years nationwide, including in California, real incomes for low-moderate income earners have stagnated, with a lack of movement of households out of poverty conditions (Desilver, 2018; Gold, 2015).

At the same time, housing costs (the largest essential costs of living) have shown rapidly expanding divergence from household income since

2000 (California HCD, 2017). 2010–2014 American Community Survey data suggest that nearly fifteen percent of California households have an income below the Federal Poverty Level (FPL) and more than one-third of California households have an income below 200% of the Federal Poverty Level, roughly corresponding to the national averages. Fig. 1 illustrates the combined effects of stagnating incomes for low- and moderate-income households and rising retail drinking water costs in California from 2007 to 2015. While the average water bill for customers rose 45% after adjusting for inflation, the state's median income fell 6% over this same period.

## 5. The value of direct household-level assistance

After demonstrating that drinking water affordability poses an increasing concern for low-income households, we now ask how local or state policy might best address this problem. In this section, we outline how state and federal funding to enhance system-level management and operations of CWS does not usually translate to positive outcomes in household-level water affordability, despite providing desirable outcomes in water quality and efficiency objectives. Moreover, while rate structure design, which we consider a form of indirect assistance, is a commonly-employed and effective strategy to support affordability, we outline its conceptual and practical limitations. The gaps in these two policies motivate a focus on direct bill assistance to ensure household-level affordability.

### 5.1. Providing household-level vs. system-level assistance

As the fundamental building blocks of the water supply network, community water systems (CWS) provide water service to at least 96% of all households in California (see Johnson and Belitz, 2015). A CWS's financial capability differs from the affordability of its service to residential customers. Financial capability or capacity is generally defined as the capacity of a water system to collect sufficient revenue to cover its capital and operations and maintenance costs, while affordability refers to customers' ability to pay for drinking water service (see Shanaghan et al., 1998). Despite the inextricable link between system-level financial capability and household-level affordability, there are at least two reasons to focus on households rather than systems.

First, while states already maintain numerous dedicated funding streams and programs geared toward enhancing system-level technical, managerial, and financial (TMF) capacity (or capability) (such as California's State Drinking Water State Revolving Fund, and the bond measures of Propositions 1<sup>9</sup> and 68<sup>10</sup>), these have not been shown to beneficially affect households. In fact, in cases where systems need state-level TMF assistance, funding helps systems deliver higher quality and more reliable water service, but may have a neutral or even negative effect on household-level affordability due to increased capital investment and maintenance outlays which need to be covered by revenues in some form, usually rates.

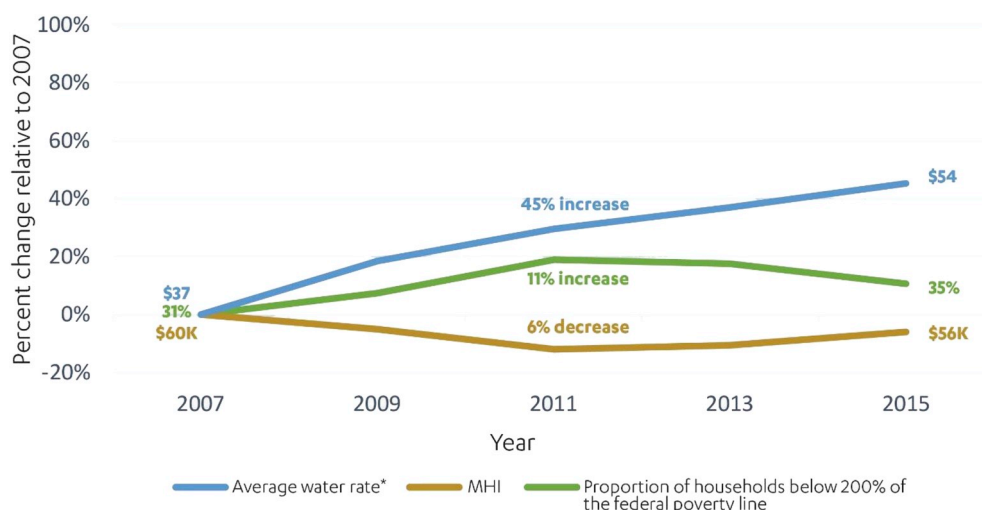
Second, many water systems that are not in need of system-level TMF assistance still serve large numbers of low-income households who struggle to pay their water bills (see California Water California State Water Resources Control Board, 2019). Low-income households served by systems that are not candidates for state-level TMF assistance can still receive support for their water bill through household-level programs like progressive rate structures, water-saving technologies, or direct monetary assistance.

<sup>9</sup> Proposition 1-The Water Quality, Supply, and Infrastructure Improvement Act of 2014.

<sup>10</sup> Proposition 68 – California Drought, Water, Parks, Climate, Coastal Protection and Outdoor Access For All Act of 2018.

<sup>8</sup> Similarly, the percentages of households under 100% or 200% of the federal poverty line are slightly higher in 2015 than they were in 2005.





\*This average derived from 4 regions in the AWWA California Water Rate Survey 2015.

Fig. 1. Changes in water rates relative to median household income and the proportion of low-income households since 2007 (adjusted for inflation).

## 5.2. Utilizing rate structures to provide indirect assistance

One means of indirect affordability assistance could involve extending guidance to water systems to employ more progressive rate structures and thus increase opportunities for customers to have lower bills. Progressive rate structures include “lifeline” rates for eligible customers that offer a free or discounted rate for an initial or baseline quantity of water to cover a household’s basic needs.

Lifeline rates provide relief to eligible low-income households by reducing the household cost of non-discretionary water; water in excess of this is charged consistently with other customers. Like other forms of assistance, lifeline rates must be adjusted for household size because low-income households do not necessarily consume little water; that is, the relationship between water consumption and income is positive but nonlinear (Whittington et al., 2015).

Water-budget rate structures are uniquely assigned to each household based on a customer’s estimated water needs, usually defined by irrigable areas and household size. This rate structure type has the advantage of adjusting for household size in its first-tier allocations, potentially reducing the water bill for larger households compared to other rate structures, but such structures often raise their own economic efficiency and social equity concerns (Beecher, 2012).

While most water systems in California apply a two-part rate structure (Table 1), the design and proportions of the fixed and variable components can vary widely. We use data obtained directly from 441 community water systems’ electronic annual reports (“EAR” data) submitted to the State Water Board’s Division of Drinking Water in 2015

(serving at least 62% of state’s population) to characterize water rate structures and bill components across California.<sup>11</sup> These data included information about system retail pricing levels for the single-family residential customer class, retail pricing structures, and expenditure data at three consumption levels (6, 12, and 24 CCF).

Table 1 summarizes the percentage of systems reporting each of the three billing types. Most rate structures include both fixed and variable components, but a significant proportion of systems maintain only fixed fees or only variable rates, and some report using other rate structures. Seventy-three percent of all systems’ residential bills contain some fixed-charge component<sup>12</sup>.

Due to the legal constraints introduced by Proposition 218 in California, very few systems currently employ rate structures sufficient to ensure affordability for low-income households. Given the global lack of consensus on the definition of affordability and the vast variability across California’s more than 3000 water systems, defining and describing satisfactorily progressive standards would prove challenging. Even if standardization in progressive rates could be achieved, the tariff would require frequent monitoring and adjustment to ensure minimal impact on water system finances in the event of further reductions in water consumption, as seen in the state’s most recent drought.

The magnitude of the fixed charge as a proportion of the total bill is a key determinant of household-level affordability and the progressive impact of a rate structure. We measure this in terms of the fixed charge levied by the system as a percentage of a residential customer’s bill. Table 2 illustrates the prevalence of systems using fixed charges, highlighting that, at both the 6CCF and 12CCF consumption levels, a wide majority of systems rely on revenues comprised of more than 25% fixed charges. The proportion of fixed charges at the 12 CCF consumption level is 44%, or nearly half of the average customer bill.

In other words, relying on current water system rate structures to provide affordability assistance to low-income households may not be effective since many systems have only mildly progressive rate structures. Because of relatively high fixed costs, rate structures may not yield enough rate relief to low-income households to be deemed a sufficient means of affordability assistance. Under existing rate structures,

Table 1

California water systems’ self-reported rate structure types.

Rate Structures	Proportion of Reporting Systems
Mixed	70%
Volumetric Only	13%
Fixed Only	9%
Other	9%

Source: 2015 EAR data

<sup>11</sup> The EAR distinguishes between volumetric and non-volumetric billing to identify more than ten types. We simplified this information into three useable categories.

<sup>12</sup> This breakdown represents the subset of systems reporting to the Water Board that they billed residential customers.

**Table 2**

Magnitude of the fixed-charge component in California water systems' rates at 6 and 12 CCF consumption levels.

% of Bill which is a Fixed Charge	6 CCF	12 CCF
0–25%	17%	26%
26–50%	25%	38%
51–99%	43%	24%
100%	15%	12%

households cannot realize enough savings by limiting their water use through conservation to make their water bill affordable.

Fig. 2 illustrates this by using the example of two water systems with very similar monthly bills for residential customers using 12 CCF of water: The City of Mountain View (\$92) and the Tahoe City Public Utilities District (\$93). Despite comparable total bill amounts, the two systems maintain vastly different balances between fixed and variable charges in their rate structures. The City of Mountain View attributes 16% of their 12 CCF bill revenues to fixed charges, whereas the Tahoe City Public Utilities District's fixed charges account for 75% of the monthly bill. The two systems' different emphases on the fixed charge component of the total bill means that when customers lower their consumption to 9 CCF (a 25% reduction), they realize dramatically different monetary savings. Customers of The City of Mountain View would experience a 22% reduction in their bill from a 25% reduction in consumption, a nearly one-to-one difference. Conversely, customers of the Tahoe City Public Utilities District would experience only a 7% reduction in their bill from a 25% reduction in consumption. In short, systems with lower fixed charges as a percentage of the total bill provide greater ability and incentive to low-income households to conserve and improve monthly water bill affordability. One caveat is that, as noted above, while income and water consumption are positively and strongly correlated at the household level, one cannot assume that low-income households can automatically reduce their consumption dramatically in response to progressive rate structures. Low-income households tend to be larger on average than higher-income households, and are more

likely to have special medical needs associated with higher water use (Nauges and Whittington, 2017).

Finally, another compelling disadvantage of rate structure strategies is that they are limited in their reach, as benefits may never reach needy households without individual water bills. We estimate that 60% of the state's low-income households reside in multi-family dwellings and thus do not directly receive a water bill. It is unlikely that benefits could be accurately disbursed to tenants without state involvement due to administrative and oversight challenges with mandating and verifying landlord actions.

In the absence of standardized design, relying on existing rate structures to provide affordability assistance to low-income households would be insufficient. We are not suggesting here that the many differences in cost and rate structure across systems are not well-founded. Rather, we are arguing that system-level differences in rate design and implementation further reinforce the need for affordability support at a regional or state scale in order to achieve greater parity among low-income households.

## 6. Advantages of affordability program operation at the state level

In this final section of our argument, we illustrate the relative advantages of operating direct affordability assistance programs at the state level. We make the case for this scale of operation largely based on the demonstrated drawbacks of system-level program operation, and the absence of momentum toward a national-scale program. (see Cromwell et al., 2010). The precedent set by similar statewide affordability programs operating to help meet basic needs at the household level reinforces our argument.

### 6.1. The limitations of standalone utility-level LIRA operations

Although about 3000 community water systems (CWS) operate in California, more than 80% of the population is served by the 400 largest utilities, many of which already have LIRA programs. The least administratively burdensome option for providing a standardized LIRA program would be the establishment of state-level standards for minimum assistance and program performance to which individual standalone CWS programs would be required to conform. This approach would maintain some level of decentralized local control and decision-making of drinking water system planning, allowing systems to build on historic experience from operating existing water LIRA programs.

Several limitations exist to system-level management of LIRAs by some systems. These include lack of technical capacity to manage a subsidy program, insufficient economic base to successfully raise revenue internally to subsidize customers, legal obstacles, and their potential to fail, as demonstrated by many CWS's sub-standard track record in program offerings.

Variation in existing water rates indicates some CWS may not be able to manage their own system-level programs. While our data set finds the average California household in 2015 paid around \$60 per month for 12 hundred cubic feet (CCF) of drinking water service, tremendous variation also existed. A sizeable number of systems charge rates considerably higher than the state average, with some charging one and a half (175), two (28), or three times (4) the state average cost for this amount of water. Utilities with extraordinarily high rates may require exceptional amounts of assistance to their low-income ratepayers, and may not be able to collect sufficient revenues for assistance or effectively manage benefit dispersion.

Even well-managed water utilities may face high levels of need due to a large proportion of low-income (eligible) to upper-income (ineligible) households within their boundaries. To operate a LIRA program in these systems, the outsized program costs would need to be paid by the limited number of ineligible households within each CWS. While more prevalent in small or very small CWS, even relatively large systems can

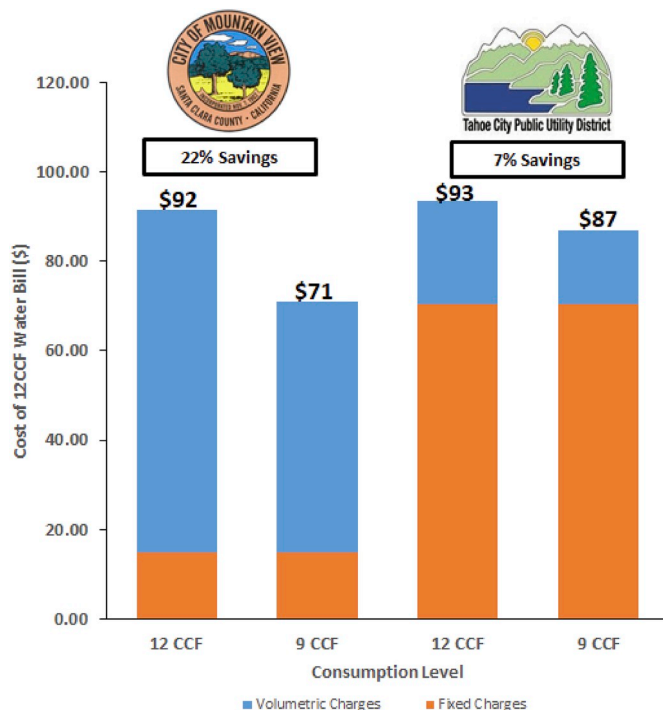


Fig. 2. Simulated savings for 3CCF reduction proportional to 12CCF bill, comparison of the city of mountain view and tahoe city public utilities district water systems (2018 Q1 rates).

have proportionately high burdens. In California, more than 22% of systems throughout the state would have eligibility burdens of more than 50% of residential customers, if eligibility is defined at 200% of the federal poverty line (FPL) (the eligibility threshold suggested by AB 401, see [California Water Board, 2019](#) for more detail). By contrast, the comparable statewide average proportion of eligible (34%) to ineligible (66%) households appears a more manageable ratio for internal subsidy. This same ratio forms the basis of bill-assistance funding for the California Alternative Rates for Energy program operated by electric utilities (California Water [California State Water Resources Control Board, 2019](#)).

In the absence of an independent funding stream, ineligible customers in each system would effectively pay for the LIRA assistance offered to eligible households. [Table 3](#) demonstrates that some CWS would bear vastly higher burdens than others in order to provide the same level of assistance to each household. Given the challenges facing these systems, a statewide LIRA appears a more feasible solution, as it effectively draws from a wider pool of ineligible customers to reduce costs to otherwise burdened individuals and systems.

Furthermore, existing system-level LIRA programs are inadequate to provide sufficient bill assistance to meet the needs of eligible households in the state of California. Using 2015 data collected by the Water Board, we estimate that approximately 46% of the entire California population is served by a water system offering some type of bill assistance. The presence of a bill-assistance program in a water utility does not mean that the program adequately addresses the affordability need experienced by its population. The biggest obstacle faced by existing programs is their limited reach and inability to support those households most in need, either through low enrollment levels or insufficient financial support. Among the LIRA programs we reviewed, including those regulated by the CPUC, none reported enrollment levels above 60% of eligible customers.

In addition, with the exception of the investor-owned water utilities, non-rate revenues fund the existing LIRA programs to avoid violation of California's Proposition 218. These sources can be limited and insufficient to provide benefits if more eligible households enroll. [Table 3](#) shows annual LIRA expenditure data for drinking water systems that serve 31% of the state's population in 2015. All of these systems offered LIRA programs and were most likely to have high enrollment rates as compared to other water systems. Total annual expenditure for the LIRAs of these systems, however, only amounted to \$57.2 million. As shown in [Fig. 3](#) below, even if this level of coverage and enrollment were applied to the entire state population (an unrealistic expectation given those systems most capable of providing a program have already done so) the level of annual expenditure on drinking water LIRAs in the state pales in comparison to that for other services.

## 6.2. Comparable affordability programs in other sectors

The final potential justification for the creation of a statewide drinking water LIRA in California is that robust statewide programs already subsidize a number of other services at the household level,

## STATE AND FEDERAL ASSISTANCE FOR THE AFFORDABILITY OF HOUSEHOLD BASIC NEEDS IN CALIFORNIA



**Fig. 3.** State and federal program assistance for the affordability of household basic services in California (2015).

despite the fundamental and essential nature of drinking water service. If insufficient support is provided for all essential services, households may be forced to make hard tradeoffs ([Martins et al., 2016](#); [Martins et al., 2019](#)).

As shown in [Fig. 3](#), which was compiled using publicly available program expenditure data from 2015 (see California Water [California State Water Resources Control Board, 2019](#)), robust, relatively-longstanding mandated programs at the federal and state levels subsidize the affordability of basic energy and telecommunications services for all low-income households who apply.<sup>13</sup> For instance, electric utilities in California have operated household-level assistance programs subsidizing up to 35% of monthly bills for low-income customers since the 1990s. Given the established nature of these programs, some have proposed expanding energy assistance programs themselves to include assistance for water service affordability ([Cromwell et al., 2010](#); California State Water [California State Water Resources Control Board, 2019](#)). Housing and food assistance programs, funded primarily at the federal level, have assisted households with these needs for more than half a century.

Data from the 2017 American Housing Survey show that the median California household pays double the amount for energy (natural gas and electricity) than it pays for water. The median renting household pays for rent roughly twenty times what it pays for water ([American Housing Survey, 2017](#)). Yet even when adjusting for the higher median household expenditure on these other needs, there remains a substantial relative underspending on drinking water affordability compared to its expenditure burden on households (see [Fig. 3](#)).

## 7. Discussion

The phenomenon of stagnating incomes and rising water bills across systems is not unique to California, as evidenced by recent bill surveys in the Chicago and Vancouver metropolitan areas ([Gregory et al., 2017](#); [Honey-Rosés et al., 2016](#)). Given the low likelihood of a national-scale water affordability program, state-level programs warrant serious consideration in California and elsewhere.

Rather than leaving affordability solutions to individual water systems, as past studies have suggested, our work shows that affordability

**Table 3**

LIRA program expenditure for a sample of water systems in California (2015).

Water Systems	% Population Served by System Type	Amount spent on LIRA
Los Angeles Department of Water and Power	10%	\$26 million
CPUC's 10 "Class A" Regulated Water Systems	14%	\$27 million
24 Other Large Urban Public Water Suppliers	7%	\$4.2 million
Total	31%	\$57.2 million

Sources: LADWP and CPUC financial reports, and a survey of municipal systems conducted directly by the study authors

<sup>13</sup> This does not include first-come, first-serve or discretionary subsidy programs run at state and federal levels to ensure household-level transportation and housing affordability, among other areas of need.



requires direct bill-assistance provided across the state. Encouraging or mandating individual water systems to provide affordability assistance would likely leave households in need; a sizeable number of CWS with exceptionally high water rates or high eligibility burdens would simply not be able to operate an effective bill-assistance program. By contrast, state-level programs have the potential to work within the bounds of existing legal limitations present in many states, while also leaving existing water system operations largely unaffected. Although challenges of a state-level approach include the administrative costs of designing and implementing a new program, as well as managing any unintended incentives or consequences that might develop for systems or customers.

While this study motivates the further consideration of direct affordability programs for drinking water by state-level governments, it does not fully specify the nature of program eligibility, benefit levels, benefit delivery, and revenue collection mechanisms required for program design. A companion paper to this study analyzes these considerations, outlines practical and political implementation challenges, and discusses means to overcome them in order to implement direct affordability programs at the state-level.

## 8. Conclusion

In summary, this study finds that due to rising bills and stagnating incomes, water affordability is an ongoing and growing challenge for residential customers in California. This trend has also been observed elsewhere and should motivate water sector policymakers at all levels to consider means to support household level affordability. Indirect means (such as system-level financial assistance and rate-structure policies) have merits but also demonstrate shortcomings in fully addressing household affordability. Thus, the provision of direct benefits in the form of monetary assistance to households remains necessary. Several factors, such as high internal cost burdens, geographic consistency, legal impediments, the poor performance of current programs, and the precedent of existing affordability programs for other basic services at the state level, support the case for a state-level program as opposed to the existing regime of disparate utility-level programs. Most notably for long-term program sustainability, a state-level program can reduce substantial inequalities in the program costs borne by moderate- and higher-income households.

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