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ATTACHMENT

Staff Proposal on Essential Service and Affordability Metrics

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Selected Glossary

Bill: the *expense* that a customer or ratepayer incurs on a regularly scheduled basis specifically for the provision of *utility service*. This may include both fixed and usage-based fees.

Cost: any dollar amount paid by a ratepayer or customer; not necessarily for *utility service*.

Expense*:* used synonymously with *cost*.

Quantity: the increment in which *service* is sold.

Rate: the dollar amount charged by a utility for a predetermined unit of *service.*

Service: the provision of energy, water, or telecommunications by a utility to a ratepayer or customer to be used for their own consumption.

Use/usage: the *quantity* of *service* used by the ratepayer.

Utility: a public utility.

1. Executive Summary

This staff proposal recommends: 1) definitions of essential service and affordability; 2) quantifications of essential service; 3) metrics to measure affordability of essential service; and 4) geography and data sources for those metrics. This proposal also discusses how the framework could be implemented once fully developed.

In developing this framework, staff aimed to adhere to the following principles:

- The framework should assess affordability across utilities and over time
- Decision-makers should be able to confidently use the framework
- The framework should consider the affordability of *essential* (rather than discretionary) utility service
- The framework should account for California's geographic and economic diversity
- The framework should be feasible for staff and the Commission to implement

The first goal of this framework is to establish what level of utility service is essential. Staff proposes the following definition:

Essential Service: *service* that meets a household's basic needs and is reasonably necessary for that household's health, safety, and full participation in society.[1]

a. **Energy essential service**: *service* required for home heating and cooling; lighting; cooking; personal hygiene; medical care; and meaningful participation in society, such as operating a computer or charging a mobile device. These amounts vary seasonally and regionally.
b. **Water essential service**: *service* sufficient for essential indoor usage, as required for human consumption; cooking; and sanitary purposes.[2]
c. **Telecommunications essential service**: voice and broadband *services* required for education; telehealth[3]; safety; and participation in society, such as completing job applications and accessing government assistance programs.

The second goal of the framework is to assess affordability as a function of 1) the expenses a ratepayer incurs for essential service, and 2) the ratepayer's ability to pay for those expenses. Staff proposes the following definition:

[1] Colton, Roger D. "Methods of Measuring Energy Needs of the Poor: An Introduction." Belmont, Massachusetts: Fisher, Sheehan & Colton, October 1993.
Colton's literature review explores several definitions of "need" and has been an invaluable resource for this framework. Specifically, Colton's review of a 1990 report by the State of Maine Executive Department served as the starting point for considering what constitutes "basic" or "essential" service.
[2] California Water Code §106.3
[3] The Health Resources and Services Administration defines telehealth as "electronic information and telecommunication technologies to support long-distance clinical health care, patient and professional health-related education, public health, and health administration."

Affordability: the degree to which a household can regularly pay for *essential service* of each public utility type on a full and timely basis without substantial hardship.[4,5]

As shown in **Table 1**, staff proposes a framework using three metrics that, together, measure affordability: Hours at Minimum Wage (HM),[6] Affordability Ratio (AR),[7] and Ability to Pay Index (API).[8] Using three metrics gives decision-makers greater confidence in relying on the results of the metrics to inform a decision. The three metrics are selected such that the strengths of one metric complement the weaknesses of the others. The metrics will be discussed further in **Section 4.** This framework is intended to give the Commission, as a decision-making body, the necessary context to evaluate the affordability of a rate request or other type of rate change. The framework is intended to be useful in presenting affordability information to the public and in Commission proceedings such as general rate cases, grant requests, and more.

[4] Colton, Roger D. "Best Practices: Low-Income Rate Affordability Programs. Articulating and Applying Rating Criteria". Montreal, Quebec: Hydro-Quebec Distribution Company, November 2007. p.v.

[5] Kessides, Ioannis, Raffaele Miniaci, Carlo Scarpa, and Paola Valbonesi. "Toward Defining and Measuring the Affordability of Public Utility Services." *Policy Research Working Paper 4915*. 21. April 2009. https://doi.org/10.1596/1813-9450-4915/. p.3.
Colton, 2007 provides the starting point for the affordability definition, which has been supplemented by Kessides and further amended by staff—in the context of Colton's 1993 exploration of basic service—to suit the needs of this framework specifically.

[6] Teodoro, Manuel. "Measuring Household Affordability for Water and Sewer Utilities." *Journal AWWA* 110:1. January 2018. https://doi.org/10.5942/jawwa.2018.110.0002/

[7] ibid.

[8] Lin, Jessica. "Affordability and access in focus: Metrics and tools of relative energy vulnerability." Elsevier Inc.: *The Electricity Journal* 31:6. September 2018. https://doi.org/10.1016/j.tej.2018.06.005/

	Affordability Ratio (AR)	Hours at Minimum Wage (HM)	Ability to Pay Index (API)
What question does the metric answer?	After a household covers its housing expenses, how much of its remaining income goes to utilities?	How long does an individual need to work to afford basic utility services?	How economically vulnerable is a community (census tract) to high utility expenses?
Metric units	Percent of income after housing expenses that is spent on utility services.	Hours	0-1000 index of weighted tract-level distribution of income and housing burden
Strength	Sensitive to specific household income levels and budgets	Easy to understand	Provides relative spatial and historic context for affordability
Weakness	Available household-scale data compromises geographic resolution. Requires assumptions about household utility subscribership.	Adds little relevant information beyond the price of essential service, insensitive to household budgets	Insensitive to price of essential service, unit-less and not household-specific.

Table 1: Proposed Metrics Framework

2. Background

When establishing this proceeding, the California Public Utilities Commission (Commission or CPUC) stated that "water, energy, and telecommunications services should be affordable" for residential ratepayers.[9] Subsequently, the Commission established a staff working group comprised of staff from the water, energy, and communications industry divisions. This working group's goal is to develop a framework for the Commission to assess the affordability of public utility rates across utility types and services.

The Commission also has an obligation to ensure rates in California are "just and reasonable."[10] However, some ratepayers may still face difficulty paying bills under rates that have been determined "just and reasonable." Staff observes that affordability is not just a function of household expenses, but the ability to pay for those expenses. As such, an effective framework for measuring affordability must consider utility bills alongside a household's income and other essential expenses in order to highlight the tradeoffs that occur if a household is not "making ends meet." The more that a household's bills for essential utility services reduce a household's ability to pay for other essential non-utility needs, the less affordable the utility services.

Staff develop this affordability framework to enable spatial and temporal comparisons of affordability. We do not set forth criteria to determine in absolute terms whether bills are affordable or not. The proposed metrics may be used to describe, for example, the degree to which essential utility services become more or less affordable due to a proposed change, how much the affordability of bills has changed over time, and the degree to which utility services are more or less affordable in particular geographies.

Conceptions of essential service to some extent already exist within the CPUC. The California Public Utilities Code has provided for "an adequate supply of healthful water… at an affordable cost" since as early as 1993.[11] Tiered rate structures common in both the water and energy spaces reflect the idea of an essential quantity of service, and the CPUC already considers local voice service as essential. Still, the notion of essential service can differ greatly across utilities, in part due to differing assumptions of what is adequate or reasonable to meet essential needs. An appropriate idea of essential service should be applicable to all Commission-regulated utilities and flexible enough to evolve over time.

[9] Order Instituting Rulemaking (OIR) 18-07-006, p.2
[10] California Public Utilities Code §451.
[11] California Public Utilities Code §739.8.

3. Essential Service

For the purposes of this proposal, staff distinguishes the concepts of essential *service* and essential *use* or *usage*. Public utilities sell services to their ratepayer for a price. The amount of service that the ratepayer purchases from the utility determines the bill that the ratepayer pays to the utility.

Since utility use and utility service are dependent on a household's specific needs, the first step in determining essential service for each industry is to determine what needs can reasonably be considered *essential*. From there, this proposal determines a specific level of *essential service* that must be supplied by a utility to meet those needs. That level of essential service will correspond to an *essential service quantity* in units appropriate to the industry. An *essential service bill* for each industry multiplies utility rates by that industry's essential service quantity. Over time, ratepayer needs will evolve, as will the amount of utility service that those needs require, and staff intends for this framework to account for those changes.

a. Recommended Essential Service Quantities

i. Energy: Tier 1 baseline quantities

Staff proposes that electric Tier 1 and gas baseline quantities be used to describe essential service in this affordability framework. Baseline quantities are currently established for a residential customer or household. Until more robust determinations of essential service quantities can be made through essential use studies (discussed below), staff considers baseline quantities the best estimate of essential service quantities.

ii. Water: 50 gpcd

Staff proposes that 50 gallons per capita per day (gpcd) be considered essential indoor usage at this time. Work in determining essential service is underway elsewhere at the Commission as part of the rulemaking to evaluate the 2010 Commission objective of achieving consistency among Class A Water Utilities' Low-Income Rate Assistance Programs and Affordability (R.17-06-024), as well as at the State Water Resources Control Board (Water Board) as part of the implementation of Assembly Bill 401.[12] To that end, staff will continue to monitor essential water service and adjust the value of essential indoor usage as necessary to align with the Water Board and R.17-06-024.

iii. Telecommunications: 20 Mbps, 1024 GB/month, 100 minutes/month

Staff proposes fixed broadband with a minimum connection speed[13] of 20 megabits per second (Mbps) downstream / 3 Mbps upstream and capacity of 1024 gigabyte (GB) per month and fixed voice telephony with unlimited local calling or mobile voice telephony with 1000 minutes per month as essential telecommunications service for a single household. Staff proposes, at minimum, annual reassessment of these standards as technologies continue to emerge and digital needs for participation in society continue to increase.

[12] California Water Code §189.5 directs the State Water Resources Control Board to create a plan for a statewide Low-Income Water Rate Assistance Program.

[13] The minimum connection speed is the actual connection speed to be maintained at all times and differs from advertised or maximum speed.

b. Discussion

i. Energy

1) Baseline Quantities as a Proxy for Essential Service Quantity

Electrical and gas corporations regulated by the Commission[14] are required by statute to file a schedule of rates and charges providing baseline rates. Residential tiered electricity and gas rates have an inclining block structure, wherein monthly usage is broken into tiers by volume. Usage in the lower tiers is charged lower rates than usage in the higher tiers. The first tier volume, or "baseline quantity," is defined by statute as a quantity "necessary to supply a significant portion of the reasonable energy needs of the average residential customer." Electric baseline quantity for residential customers is defined by statute as 50% to 60% of average residential consumption of electricity.[15] All-electric residential customer[16] and gas residential customer baseline quantities are defined by statute as 60% to 70% of average residential electric or gas consumption, respectively, during the winter heating season.[17]

The Commission establishes baseline quantities as part of each Investor-Owned Utility's (IOU) General Rate Case (GRC) proceedings. Electric Tier 1 baseline quantities for each IOU,[18] expressed as usage in kWh, are derived by analyzing ratepayer billings for each IOU across IOU-defined baseline territories and summer/winter seasons.[19] IOU-defined gas baseline quantities, expressed as usage in therms, also differ across baseline territories and summer/winter seasons.

Baseline territories are drawn based on climactic variation and may also be referred to as climate zones. The same baseline quantity is assigned to every residential ratepayer in a given baseline territory, irrespective of a ratepayer's household size, dwelling type, appliance type, efficiency, etc. While baseline quantities are intended to represent the reasonable energy needs of the average residential ratepayer in each baseline territory, current baseline quantity methodologies do not make a determination of essential or discretionary energy usage. For the time being, staff accepts baseline quantities as a reasonable estimate of essential energy use. There are several essential use studies underway, discussed in the following section, which should provide more accurate determinations of essential energy service and eventually replace baseline quantities.

2) The Essential Use Studies

In order to better evaluate the essential electricity needs of both Pacific Gas and Electric Company (PG&E) and Southern California Edison (SCE) residential ratepayers, recent decisions in PG&E and SCE's

[14] These electrical and gas corporations include: Pacific Gas and Electric Company, Southern California Edison Company, San Diego Gas and Electric Company, Southern California Gas Company, Southwest Gas Corporation, Liberty Utilities (CalPeco Electric) LLC, Bear Valley Electric Service, and PacifiCorp.

[15] This type of baseline quantity is commonly called "basic" baseline quantity. A household taking electric service with basic baseline quantity may be taking gas service with gas baseline quantity as well.

[16] "All-electric residential customers" is defined by statute as "residential customers having electrical service only or whose space heating is provided by electricity, or both" (California Public Utilities Code §739). All-electric baseline quantities are generally applicable to service to customers with permanently installed electric heating as the primary heat source.

[17] California Public Utilities Code §739.

[18] PG&E and SCE Tier 1 is 100% of baseline; SDG&E Tier 1 is 130% of baseline.

[19] Certain adjustments may be made as part of each IOU's methodology, such as removing negative or zero billings before deriving baseline quantities based on average residential usage.

General Rate Case (GRC) Phase II proceedings[20] concluded that it is necessary to determine the essential amount of electricity for residential ratepayers instead of relying on baseline quantities as a proxy of essential service quantity. The decisions ordered PG&E and SCE to develop a study plan for developing a model of what constitutes essential usage for residential energy ratepayers (also referred to in this staff proposal as an essential use study).[21] While San Diego Gas and Electric Company (SDG&E), Southern California Gas Company (SCG), Southwest Gas Corporation (Southwest Gas), Liberty Utilities (CalPeco Electric) LLC (Liberty CalPeco), Bear Valley Electric Service (BVES), and PacifiCorp have not been ordered to complete an essential use study, the results of the PG&E and SCE electric essential use studies could yield methods relevant to other utilities.

As part of the essential use studies, PG&E and SCE were ordered to collect information on household size (square footage and number of residents), building features (age, construction materials, insulation, etc.), and appliances (efficiency and usage). The decision ordering the PG&E essential use study did not define the term "essential use," but recommended that PG&E and interested parties consider which indoor temperature should benchmark a safe living environment in order to derive an essential amount of electricity consumption. Staff believes that with that statement, the Commission has signaled that health and safety are essential needs to be considered in quantifying essential use.

The timeline for completion of the essential use studies has not yet been proposed, as PG&E and SCE's upcoming GRC Phase II applications have not yet been filed. Staff recommends that SDG&E, SCG, and the Small Multi-Jurisdictional Utilities (SMJU)[22] be required to also develop essential use determinations by no later than the essential use study submitted by SCE.

ii. Water

As part of the framework outlined in *Measuring Progress Toward Universal Access to Water and Sanitation in California*, a September 2018 paper published by Pacific Institute, Laura Feinstein outlines an end-use study of the necessary volume of water for essential indoor use.[23] Feinstein uses data from the "California Single Family Water Use Efficiency Study"[24] to calculate usage requirements and adjusts this data based on usage trends[25] to reach an essential indoor use value of 43 gpcd given current conditions in California. The total indoor usage was estimated to be 52 gpcd, with 43 gpcd for essential indoor usage and 9 from leaks.

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[20] See D.18-08-013 (PG&E) and D.18-11-027 (SCE).

[21] The study plan for the development of this model must be submitted with PG&E's next General Rate Case (GRC) Phase II application, and with SCE's next rate design window (RDW) or GRC Phase II application, whichever comes first.

[22] The SJMUs are: Southwest Gas, Liberty CalPeco, BVES, and PacifiCorp. Like the major IOUs, the SMJUs file GRC applications; however, they operate on a smaller scale compared to the major IOUs.

[23] Feinstein, Laura. *Measuring Progress Toward Universal Access to Water and Sanitation in California: Defining Goals, Indicators, and Performance Measures*. Oakland, California: Pacific Institute, September 2018. pp. 29-32.

[24] DeOreo, William B., et al. "Residential End Uses of Water, Version 2." 4309. Water Research Foundation, 2016. http://www.waterrf.org/Pages/Projects.aspx?PID=4309/

[25] DeOreo, William B, et al. "California Single-Family Water Use Efficiency Study." Boulder, Colorado: Aquacraft Water Engineering and Management, 2011. http://water.cityofdavis.org/Media/PublicWorks/Documents/PDF/PW/Water/Documents/California-Single-Family-Home-Water-Use-Efficiency-Study-20110420.pdf/

Feinstein's estimate assumes that water usage has declined in part because of increased use of more water-efficient household appliances. Given that populations with greater affordability concerns are generally less able to upgrade old, leaky, or inefficient appliances, staff recommends assuming more leaks and less water-efficient appliances to better address affordability for economically vulnerable populations.

Staff's also examined existing legislative efforts to determine essential service. Assembly Bill 1668—a cornerstone of Governor Brown's "Conservation as a Way of Life" water management plan—establishes the essential indoor service level of 55 gpcd until January 1, 2025.[26] From January 1, 2025 to January 1, 2030, the usage reduces to 52.5 gpcd or a standard recommended by the State Water Resources Control Board, whichever is greater. After January 1, 2030, the usage reduces further to 50 gpcd or a standard recommended by the State Water Resources Control Board, whichever is greater. While there is a case for synchronizing with AB 1668 levels directly, the current AB 1668 levels are based on a 20% reduction in per capita usage from 2009 and do not necessarily represent essential service.[27]

Staff believes that Feinstein and DeOreo's estimates should form the basis for essential service, since they are derived from end-use studies examining how much water a set of needs actually requires. However, with the considerations of leaks and inefficient appliances that disproportionately affect more economically vulnerable households, Feinstein's value is best used, in the context of affordability, as a lower bound for essential service. The Conservation as a Way of Life legislation sets a compelling upper bound for essential service, especially as it decreases to synchronize with staff efforts in the coming years. Staff believes 50 gpcd strikes an acceptable balance between conservation and ensuring that a sufficient quantity of water is affordable for the most economically vulnerable populations.

iii. Telecommunications

Absent of any recent study, staff examined various benchmarks to determine on essential service for telecommunications. In the context of telecommunications, essential service needs to enable members of a household to access telehealth records, contact family and first responders in case of emergencies, and complete activities necessary for school, telecommuting, and participating in government assistance programs.

Staff believes that fixed broadband is an essential service for Californians to be able to participate fully in society. For example, telehealth usage had a 1,202% growth between 2012 and 2017.[28] In addition, the Federal Communications Commission (FCC) states that "[a]ccess to broadband has become essential for students in all levels of education."[29] Furthermore, staff finds that mobile broadband services are not a viable substitute for fixed broadband services due to cost, access, and capacity limitations of wireless technology.[30] For example, schoolwork, job applications, and government services are functions that are

[26] "Making Conservation A Way of Life," 2019.
[27] Feinstein 2018, p. 30.
[28] FH Healthcare Indicators and FH Medical Price Index 2019, p. 25.
[29] "2016 Broadband Progress Report."
[30] Achilles 2019.

difficult, if not impossible, to accomplish on mobile. In addition, mobile services provide lower speeds, lower data caps, higher latency and higher prices compared to wireline broadband.[31]

Staff also finds that voice service, regardless of technology type, is an integral part of day to day life, especially during emergencies. The public needs voice services to be able to reach 911 and, in turn, first responders rely on voice services to receive and handle information during emergencies.[32] According to Scott Howland, Chief Information Officer of the California Highway Patrol's Information Management Division, there were about 27 million 911 calls made in 2018, of which 12% or 3.2 million were made through landline.[33]

1) Service Provider Data Request

In May 2019, staff issued a Data Request to six telecommunications service providers.[34] The objective of the data request was to gather the carriers' analysis in the determination of 1) essential data transmission bandwidth and capacity for specified tasks performed over a broadband network, and 2) factors to establish the components of residential broadband service offerings.

All the service providers pointed us to Federal Communications Commission (FCC) reports.[35,36] Additionally, Frontier and Verizon provided staff with the results of their own insight and expertise. Using the results from the data request, staff computes the average minimum download speed for two devices to be 20 Mbps.[37] This estimation falls into FCC's determination of medium service.[38]

2) Federal Lifeline Minimum Service Standards

To establish Federal Lifeline minimum service standards,[39] the FCC has determined that "the minimum service standards for fixed broadband speed should be based on the service to which a "substantial majority" of consumers subscribe, and "that 70 percent of consumers constitutes a 'substantial majority' in the context of fixed broadband speeds."[40]

The Federal Lifeline minimum standards (effective December 1, 2019) are as follows:[41]

- Fixed broadband speed: 20 Mbps downstream / 3 Mbps upstream (4 Mbps downstream / 1 Mbps upstream if no residential fixed broadband packages meet the minimum service level)

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[31] "The Inclusive Internet Index 2019."
[32] While text-to-911 is available in some areas, voice-based 911 service is the most reliable, recommended, and preferred method of contact by emergency call centers.
[33] "2019 Communications Division En Banc," 2019.
[34] The six service providers are AT&T, Frontier, Comcast, Cox, Sprint, and Verizon.
[35] "Broadband Speed Guide," 2018.
[36] "Household Broadband Guide," 2018.
[37] For concurrent use of two devices, we assumed only one device will perform a video function while another performs other basic functions such as email, browsing, audio, and file transfers.
[38] Medium service is required for 2 moderate use devices at a time. Moderate use incorporates basic functions plus one high-demand application, including telecommuting and multiparty video conferencing. Light use incorporates only basic functions such as email, browsing, basic video, VoIP, internet radio on one or two devices.
[39] 47 CFR §54.408 defines minimum service standards as "The level of service which an eligible telecommunications carrier must provide to an end user in order to receive the Lifeline support amount."
[40] Lifeline and Link Up Reform and Modernization et al., 2016, paras. 78-90.
[41] *Wireline Competition Bureau Announces Updated Lifeline Minimum Service Standards and Indexed Budget Amount*, 2018.

- Fixed broadband capacity: 1024 GB per month
- Mobile broadband speed: 3G
- Mobile broadband capacity: 8.75 GB per month
- Mobile voice telephony: 1000 minutes per month

Fixed voice telephony has no minimum service standards since most plans already include unlimited minutes.[42] New standards are published in a Public Notice issued by the Wireline Competition Bureau on or before July 31 of each year, which will give the new minimum standard for the upcoming year.

3) California Benchmark

Staff performed an iteration of FCC's Federal Lifeline methodology by gathering subscribership data from CPUC's Geographic Information System (GIS) team to determine what level of service the substantial majority of Californians subscribe to. The data that staff used are provided annually by California service providers directly to the GIS team and include download and upload speeds of each subscriber in a given tract.

Staff found that the substantial majority of Californians subscribe to a minimum of 70 Mbps down and a minimum of 5 Mbps up. This could possibly be traced to the state's early broadband adoption. California's broadband infrastructure has continued to develop with the rest of the country. This could also be an indication that the broadband market in California offers services beyond what consumers need and, in turn, consumers tend to oversubscribe.

By looking at the California-level iteration of FCC's Federal Lifeline methodology to establish minimum service, staff reasons that it may be reasonable to, going forward, raise essential service standards to 70 Mbps down and 5 Mbps up.

4) Results

For fixed broadband essential service, staff's recommendation of minimum connection speed of 20 megabits per second (Mbps) downstream / 3 Mbps upstream is derived from results from Service Provider Data Request, whereas the capacity of 1024 gigabyte (GB) per month mirrors the Federal Lifeline Minimum Standards.

For voice service, CPUC's Universal Service Decision[43] has long established unlimited local calling as a basic service for fixed voice telephony. Absent fixed voice telephony, staff finds mobile voice telephony with 1000 minutes per month (per Federal Lifeline Minimum Standards) to be a viable substitute.

Staff recommends continuing assessment in establishing essential telecommunications service over time on an annual basis.

[42] Lifeline and Link Up Reform and Modernization et al., 2016, para 62
[43] D.96-10-066

4. Affordability Metrics

In **Section 1**, staff proposed a conceptual definition of utility affordability as the degree to which a household can regularly pay for *essential service* of each public utility type on a full and timely basis without substantial hardship. In order to quantitatively describe affordability, we propose three metrics that provide complementary descriptions of a household's ability to pay for essential utility service.

The **Affordability Ratio** describes the impact a utility bill has on household budgets, that is, the percent of income (after housing) that is spent on essential utility service.

Hours at Minimum Wage describes utility essential service bills in terms of worked hours required to pay them. It provides a clearer illustration of the impact on daily lives of low-income ratepayers than the dollar amount alone.

The **Ability to Pay Index** describes the relative economic conditions of communities in terms of household income and the cost of housing (inclusive of utility expenses).

An affordability analysis, in essence, relates two numbers: (1) the cost of utility service and (2) the economic standing of the households paying for utility service. Establishing either of these quantities alone requires careful assumptions and acceptance of data limitations when working beyond the scale of single households and with limited access to reliable data. As such, we propose three metrics that depict the components of affordability independently and in relation to one another. The three metrics also address distinct yet related questions about the ability for households to afford utility service, and the economic vulnerability of communities and households to increased utility expenses.

We argue that these metrics, taken together, provide a more holistic picture of affordability than any one in isolation. **Figure *1*** summarizes how the three metrics work together to show a full picture of affordability. The following text presents this framework's general approach to describing household economic conditions and translating essential service quantities into costs. We then discuss the formula, methods, and interpretation of each metric in turn.

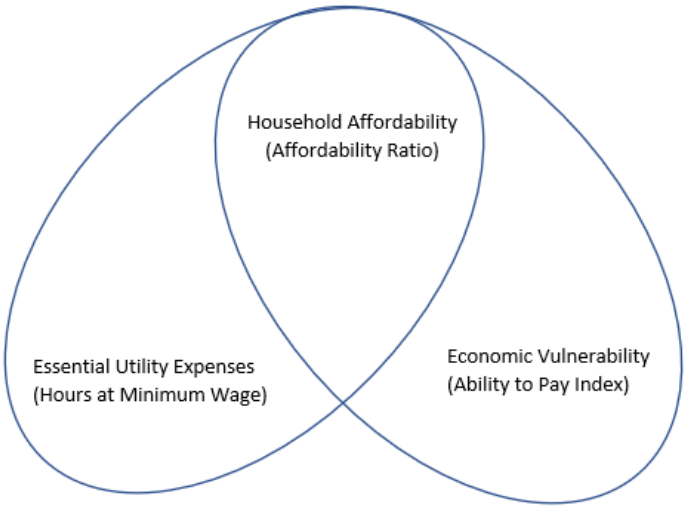

Figure 1: Complementary Metrics

a. Affordability Ratio (AR)

The affordability ratio is the percent of a household's income remaining after housing costs that is spent on essential utility expenses.

i. Metric

$$AR = \frac{W_{ES} + E_{ES} + T_{ES}}{I - H}$$

Where AR is the sum of the bills for essential water, energy, and telecommunications service ($W_{ES} + E_{ES} + T_{ES}$), divided by the household's income (I) less housing costs (H), i.e. mortgage, rent, or property tax. The denominator of AR is hereafter referenced as "Income After Housing Costs."

ii. Rationale and Interpretation

Affordability Ratio describes the impact a utility bill has on a particular household budget, that is, the percent of income (after housing) that is spent on essential utility service. Community-wide measures of affordability that take the average utility bill as a percentage of median household income, obscure the differential burdens faced by households with lower or higher incomes. They also do not provide an accurate picture of affordability sensitive to geographic variations in the cost of living that can significantly impact the amount of income available to cover utility expenses. Affordability Ratio addresses both of these shortcomings.

Since Affordability Ratio is fundamentally calculated by household, it can separately describe affordability for low, middle- and high-income ratepayers. Affordability Ratio also adjusts income by the cost of housing, which accounts for the majority of geographic variation in cost of living within the same utility service territory.

Affordability Ratio does not vary linearly with utility costs. Changes in Affordability Ratio are dependent on income less housing, so Affordability Ratio will increase more for a low-income household than a high-income household bearing the same housing costs and experiencing the same utility rate increase.

iii. Data and Methods

1) Household Income and Housing Costs

For household data, we use the Public Use Microdata Samples (PUMS) dataset from the Census Bureau.[44] California PUMS data include approximately 776,000 households statewide, sampled from U.S. census responses. The PUMS associated with a single Public Use Microdata Area (PUMA) are statistically representative of the population in the geographic PUMA region. While PUMAs are larger than census tracts or block groups, PUMS data provide census responses from individual households.

[44] "American Community Survey: About PUMS."

At the census tract scale, we can only publicly access *statistical aggregates* of household census responses, for example, the median cost of housing and median income by census tract. At the PUMA scale, we can work from *individual household* census responses. Computing the AR denominator, or Income After Housing Costs (IAHC) value based on PUMS household variables, rather than census tract aggregates, retains important variation in income levels and cost of housing, and more faithfully depicts economic conditions based on actual sampled households.

About the PUMA

There are 265 PUMAs in California, each containing roughly 3000 PUMS households on average (minimum household count: 1308, max: 7944). Each PUMA has a population of at least 100,000 and is composed of groups of census tracts. Depending on population density, a single PUMA may contain several less-populous counties, or cover just a portion of a more populous county. PUMA are delineated by metropolitan areas and other "meaningful geographies," yielding areas with similar socioeconomic profiles.[1] While data on income and essential expenses (bill for essential utility service and other essential expenses – see **Section 4.b.ii.a**) are readily available at the county level, a county-level analysis obscures socioeconomic variation within a county, which can be significant in counties such as Los Angeles and San Bernardino. Using PUMAs allows that intra-county variation to be considered in areas where it is prominent, while grouping together demographically similar areas in less-populated rural regions. **Figure *2*** shows the boundaries of each of the 265 PUMAs in California.

Staff also prefers PUMS to census tract aggregates because housing costs reported at the tract scale include utilities.[45] Thus, to use tract-scale housing expenses to evaluate essential service affordability would effectively double-count utility expenses. In the PUMS data, rent, property tax, and mortgage expenses for each household are reported separately. Going forward, staff recommends that the Commission obtain ACS custom cross-tabulations that provide each utility expense and housing costs by income level at the tract scale, so that a robust AR that does not double-count utilities can be calculated for more geographically granular areas than PUMAs.[46]

2) Describing Household Economic Conditions: Income After Housing Costs (IAHC)

Adjusted income constructs such as *discretionary income*[47] or *disposable income*[48] are defined as household income less all essential expenses.[49]

Adjusted household income accounts for variance in the price of housing and other basic goods and services by removing these costs Conceptually, the ideal adjusted income value would fully account for geographic variance in the cost of housing and basic goods and services, alongside variance in household

[45] Specifically, ACS housing costs include the sum of payments for mortgages, rent, real estate taxes; fire, hazard, and flood insurance on the property; utilities; and fuels.
[46] "American Community Survey: Custom Tables," 2018.
[47] Feinstein 2018, p.iii.
[48] Teodoro 2018, p.15.
[49] There are other variations of adjusted income; Kessides uses "residual income" to indicate income less a fixed basket of goods, which are not necessarily essential, for a similar analysis of utility affordability.

composition, such as single-parent, two-working parent, single adult, etc. Given practical limitations to data availability, staff propose using an adjusted income value of **income after housing costs (IAHC)**.

In arriving at this decision, staff reviewed detailed family budget profiles, such as the Economic Policy Institute's Family Budget Calculator,[50] United Ways of California's Real Cost Measure,[51] and the California Budget and Policy Center's *Making Ends Meet*,[52] which presents household budgets by household type (single adult; single working parent, two parent, one working; two parent, two working) and county.

Staff finds that that income after housing costs is an adequate adjusted income value based on an analysis of Making Ends Meet budgets. First, we found that for every household type and geography, housing expenses consume the greatest portion of a household budget. Next, we compared the geographic variance of housing costs vs. other household costs. In California, housing costs vary more by county than other essential expenses. Housing costs also vary more by geography than by household type.

Staff recognizes that households bear other essential expenses such as food, healthcare, childcare, etc. Childcare was the budget item that varied most by household type. But to accurately incorporate the cost of childcare would require identifying whether a given household had children and used childcare services. To incorporate other sources of data to represent these essential expenses would introduce potential errors stemming from assumptions about household composition, parent working status, and mismatches in data geographic and temporal scale.

Thus, staff find it appropriate to adjust income by housing costs alone, as an empirically consistent and practical construct.

3) Essential Utility Service Expenses

Essential utility service expenses can be straightforwardly determined based on current and proposed rates. A central challenge of computing AR is appropriately matching these rates with household income and housing cost data. We approach this by identifying all PUMA that intersect with a utility service territory and calculating household AR for all PUMS households that could fall within that service territory that have complete household size, household income, and housing expense data.[53]

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[50] Gould, Elise, Zane Mokhiber, and Kathleen Bryant. *The Economic Policy Institute's Family Budget Calculator: Technical Documentation.* Washington, DC: Economic Policy Institute, March 5, 2018. https://www.epi.org/publication/family-budget-calculator-documentation/

[51] Block, Betsy Baum, Henry Gascon, and Peter Manzo. *Struggling to Stay Afloat: The Real Cost Measure in California 2019.* South Pasadena, California: United Ways of California, 2019. https://www.unitedwaysca.org/realcost/

[52] Kimberlin, Sara, and Amy Rose. "Making Ends Meet: How Much Does It Cost to Support a Family in California?" Sacramento, California: California Budget & Policy Center, December 2017. https://calbudgetcenter.org/resources/making-ends-meet-much-cost-support-family-california/

[53] The essential utility service expense for the utility whose service territory is being assessed is the assumed utility service expense assigned for all households used when calculating numerator of household AR. PUMS fields used in household AR denominator calculation: household size (NP), income (HINCP), and housing costs (RNTP, MRGP, TAXP). Annual housing costs were computed based on monthly rent payments (RNTPx12), or monthly mortgage plus property tax payments (MRGPx12 + TAXP). Households that do not carry a monthly mortgage payment were

Since we cannot determine the precise location of a PUMS household beyond its PUMA assignment, at least two problems may arise from any lack of correspondence between utility service territory boundaries and PUMA boundaries. First, that of *household allocation*: for a known service territory smaller than a PUMA, we cannot determine which subset of PUMS households within that PUMA are representative of subscribers to a given utility. Second, that of *utility assignment*: for a PUMA containing more than one utility service provider, we cannot determine the specific service provider for a given household based on its PUMA identifier alone.

Staff accepts the *household allocation* problem as a source of potential error. We assume that the households represented by the PUMS data for a given PUMA also adequately represent households in any smaller geography served by a utility that falls within that PUMA.

The *utility assignment* problem arises only with respect to industries not being directly evaluated in an affordability analysis. Rates that are not under evaluation, but are required to define the cost of total utility service, must be assigned based on potentially limited information about ratepayers within a utility service territory.

In the implementation example provided in Section 5, staff address the utility assignment problem by creating proxy essential service bills for the PUMA, designed to be generally representative of rates in that PUMA. Proxy bills are given in dollars per year, to reflect any seasonal variation in monthly essential service expenses (as with energy).

Staff acknowledge that other more robust approaches to assigning utility service rates to PUMS households may exist. However, bearing in mind that for some affordability analyses, detailed estimates of all industry bills may not be required, we propose a method that is practical to implement.

included in the analysis. Staff use California PUMS housing unit records data based on ACS 2013-2017 5-year estimates. Data available for download at: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_pums_csv_2013_2017&prodType=document

Figure 2: Public Use Microdata Areas (PUMAs) in California

4) Affordability Ratio Presentation: Aggregation Approach

Household ARs must be sampled or aggregated for presentation. Staff propose four summary affordability ratios based on household size and income level: household sizes of 2 and 4, and household incomes around the 20th and 50th percentile of incomes in a PUMA.

An AR at the 20th percentile of the income distribution illustrates affordability for economically vulnerable populations. As Teodoro states, "welfare economics… typically identify the 20th percentile as the lower boundary of the middle class. At this income level, 'working poor' households have very limited financial resources, but may not qualify for income assistance programs."[54] An AR at the 50th percentile, or median, is taken to be representative of a typical ratepayer.

A household size of 2 is taken to be illustrative of smaller households, and a size of 4 illustrative of family households. We must specify a household size for reported AR because the water essential service quantity (and thus the bill for water service) varies by household size.

Staff propose computing AR_{20} and AR_{50} for each household size by averaging affordability ratios for households falling between the 15th and 25th percentile of the income distribution for each household

[54] Teodoro 2018, p.15

size (for AR_{20}) or the 45th and 55th percentile of the income distribution (for AR_{50}). We take the mean for +/- five percentile points for the target income level in order to smooth variance in housing costs.

AR may be sampled or summarized for different household attributes of interest and/or at geographic scales larger than a PUMA, for example, such as a climate zone or county.[55]

b. Hours at Minimum Wage (HM)

Hours at Minimum Wage measures the hours of work necessary for an individual earning minimum wage to pay for essential utility bills:[56]

i. Metric

$$HM = \frac{W_{ES} + E_{ES} + T_{ES}}{M}$$

where W_{ES} represents a household's monthly bill for essential water service, E_{ES} represents a household's monthly bill for essential energy (electricity and gas) service, T_{ES} represents a household's monthly bill for essential telecommunications service, and M is the minimum wage for the municipality in which that household resides.

ii. Rationale and Interpretation

HR reflects the lived experience of ratepayers earning minimum wage, who are likely to be more economically vulnerable than higher income earners. It is intuitive to interpret: If utility bills increase and minimum wages do not, a minimum wage-earning ratepayer must work more hours to afford the same quantity of essential service.

HM only provides a sense of the gross impact of utility expenses, and not of the economic tradeoffs an economically vulnerable household may make. HM is thus partnered with metrics that are sensitive to household income and housing expenses.

iii. Data Sources and Methods

HM should be calculated at least for the California statewide minimum wage (currently $12.00/hr). There are a number of municipalities with higher minimum wages, so HM could also be provided for any municipal minimum wage within the utility service territory under analysis.

California has a higher minimum wage rate than the Federal minimum wage. The statewide minimum wage is $12.00 per hour and on January 1, 2020, the minimum wage rate will increase to $13/hr. The minimum wage will increase by one dollar each year until 2022, when the minimum wage will be $15. Starting in 2023, the minimum wage will be increased relative to the Consumer Price Index for all Urban Consumers (CPI-U) as calculated by the Bureau of Labor Statistics.[57] Both the Economic Policy Institute[58]

[55] In cases where a PUMA is comprised of multiple counties, the PUMA is the most granular unit of geography available.
[56] Teodoro, 2018.
[57] "Minimum Wage Tracker," 2019.
[58] Ibid.

and the UC Berkeley Labor Center[59] provide up-to-date inventories of municipalities in which the local minimum wage exceeds the state value.

c. Ability-to-Pay Index

i. Metric

The Ability-to-Pay Index describes economic vulnerability at the census tract scale. It is based on the composition of households in each tract, by income and percent of income spent on housing and other large non-discretionary expenses.[60] Households with the lowest incomes and highest percent income spent on housing are assumed to have the lowest ability-to-pay, and households with the highest incomes and lowest percent income spent on housing are assumed to have the highest ability-to-pay. The tract-level Ability-to-Pay Index (API) is a weighted average of the scores for household types within the tract.

ii. Rationale and Interpretation

API provides an index of relative economic vulnerability at the census tract scale. Where more geographic precision is demanded, tract-scale API can help the commission contextualize AR. This index is scaled from 0-1000, where 1000 represents the highest economic vulnerability (lowest ability to pay) and 0 the lowest economic vulnerability (highest ability to pay).

Because API is derived from tract-scale housing data, the cost of housing is inclusive of utilities. API includes what consumers actually pay for utility service in each census tract as part of the census-collected housing expense data—rather than bill data at actual rates for an essential service quantity, as used in HM and AR. As a result, API cannot be calculated to evaluate the effect of varying the bills for essential service on this affordability metric as can be done for HM and AR.

While API cannot serve as a direct measure of the affordability of essential utility service, it is a valuable third metric as it accounts for observed housing expenses, inclusive of utilities, and is resolved at the tract scale. Thus, it can provide relative historical and spatial context for affordability alongside the other two metrics.

iii. Data Sources and Methods

Each household type is assigned an economic vulnerability score (global priority ranking) from 0 to 1000 based on a hierarchical weighting process, ranking first based on income and then by percent of income spent on housing (See **Table 2**). Tract API are a weighted average of scores for household types in the tract. The API is created using American Community Survey (ACS) census tract cross-tabulations, so while a global priority ranking (vulnerability score) could be assigned to a given household, API is inherently a census-tract level metric. **Figure 3** shows API values for each census tract in California.

The income classifications are defined in terms of income thresholds based on either the federal poverty line (FPL), from the U.S. Department of Health and Human Services; and or the area median income (AMI), based on the U.S. Department of Housing and Urban Development's Fair Market Rent statistics (see **Table *2***).

[59] "Inventory of US City and County Minimum Wage Ordinances," 2019.

[60] Lin, Jessica. "Affordability and access in focus: Metrics and tools of relative energy vulnerability." Elsevier Inc.: *The Electricity Journal* 31:6. September 2018. https://doi.org/10.1016/j.tej.2018.06.005/

Staff recommends using the API values based on Area Median Income rather than Federal Poverty Line. API (FPL) values share the same definition of "low-income" statewide, while AMI based income thresholds are set relative to the county. AMI values are thus more compatible for interpretation alongside metrics defined at the PUMA scale.

Computed API values are publicly available from the National Renewable Energy Laboratory (NREL).[61] As it is unknown if NREL will be publishing updated API values on a recurring basis, staff plans to replicate these methods in-house to ensure that APIs are reliably available and up to date.

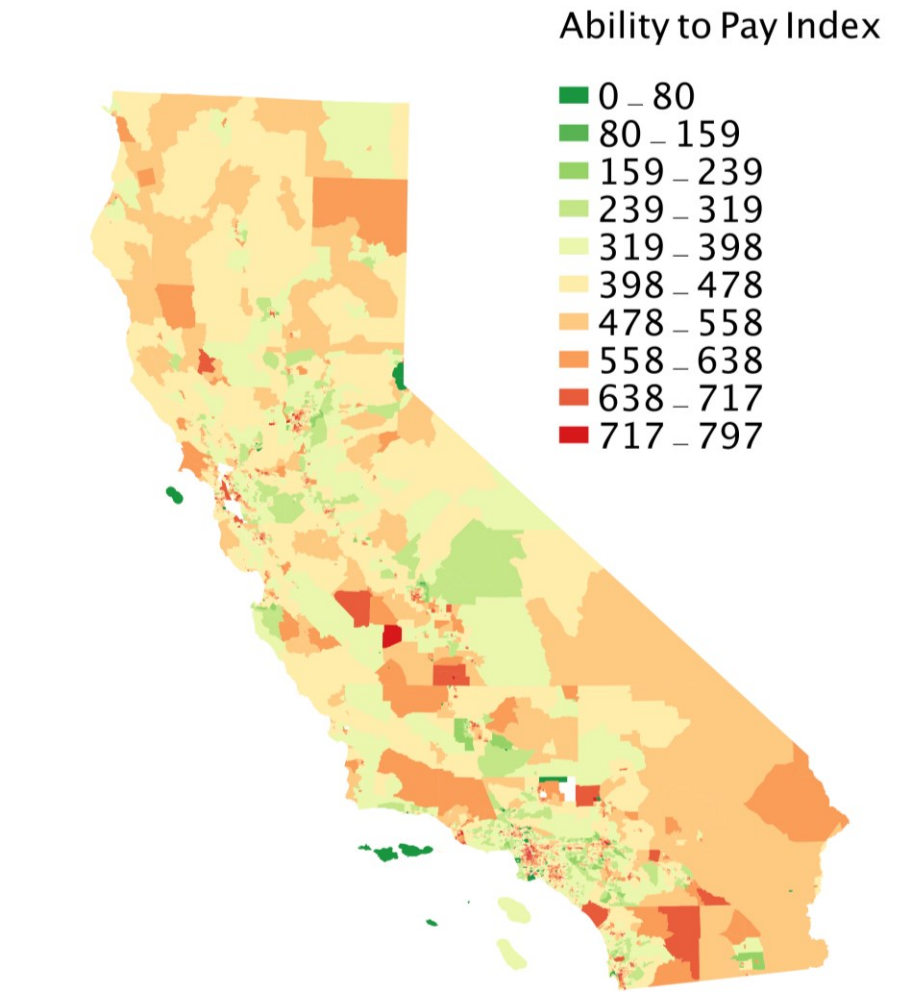

Figure 3: API Values for California Census Tracts[62]

[61] US Department of Energy (DOE)/NREL/ALLIANCE, "Solar for All." Ability to Pay Index values are presented and available for download at https://maps.nrel.gov/solar-for-all, under the "Customer Cost Burden" section.
[62] The tract-level API is a weighted average of vulnerability scores for the household types in that tract. Household types and related vulnerability scores are presented in Table 4.

Income Level (AMI definition)	**% of Income Spent on Housing**	Vulnerability Score **(Global Priority Ranking)**
Extremely Low (<30% of Area Median Income)	> 50%	1,001.10
	40 - 49%	970.7
	35 - 39%	951.8
	30 - 34%	931.4
	25 - 29%	901.9
	20 - 24%	881.9
	0 - 20%	862
Very Low (30 - 50% of Area Median Income)	> 50%	861.4
	40 - 49%	831.6
	35 - 39%	811.5
	30 - 34%	791.7
	25 - 29%	761.1
	20 - 24%	740
	0 - 20%	720.2
Low (50 - 80% of Area Median Income)	> 50%	720
	40 - 49%	689.4
	35 - 39%	669.7
	30 - 34%	649.4
	25 - 29%	619.2
	20 - 24%	599.6
	0 - 20%	579.6
Moderate (80 - 120% of Area Median Income)	> 50%	550.5
	40 - 49%	509.3
	35 - 39%	469
	30 - 34%	429.1
	25 - 29%	389.9
	20 - 24%	349.4
	0 - 20%	309.9
Non-LMI (>120% of Area Median Income)	> 50%	199
	40 - 49%	149.4
	35 - 39%	100.4
	30 - 34%	58.7
	25 - 29%	50.8
	20 - 24%	43.4
	0 - 20%	33.1

Table 2: API Master Ranking Table[63]

[63] Adapted from table in Supplemental Materials: https://doi.org/10.1016/j.tej.2018.06.005
We present the income thresholds established by Area Median Income, and recommended in this report. Alternative Federal Poverty Line income thresholds are set as: Extremely Low (< 100% FPL), Very Low (100-150% FPL), Low (150-200% FPL), Moderate (200-300% FPL), Non-LMI (>300% FPL).

5. Implementation

This affordability framework 1) establishes essential service quantities for energy, water, and telecommunications services, and 2) proposes complementary metrics for measuring the affordability of essential services. This framework can be used in Commission proceedings and beyond, including but not limited to case-by-case affordability assessments such as: utility applications including general rate cases; rate increases via advice letter; resolutions, and grant requests.

While long-term data management planning to ensure cost-efficient implementation is still underway, staff envisions a database and affordability calculator designed such that the Commission can readily compute the proposed metrics using current and/or proposed residential rates as inputs. In addition to case-by-case affordability calculations, these metrics could also be used to provide backward-looking trend analyses of actual expenses to ratepayers. Such analyses could indicate long-term and systemic unaffordability or provide monitoring for areas in which utility service is approaching unaffordability.

The data used for ongoing affordability analyses could include, but not be limited to: Public Use Microdata Sample 5-year estimates, updated with each ACS release, tract-scale Ability to Pay indices obtained from the National Renewable Energy Lab or developed separately, statewide municipal minimum wage rates, utility service territory boundaries, number of residential customers served by each utility, and essential service quantities.

Section 5.a uses an example of prior commission grants, advice letters, and general rate cases to demonstrate the application of the affordability framework, i.e. the calculation of each metric.

a. Example: Del Norte, Lassen, Modoc, Plumas and Siskiyou Counties

To illustrate the metrics, the following sections provide examples for each industry, based on households sampled from the Del Norte, Lassen, Modoc, Plumas, and Siskiyou Counties PUMA (0601500). This PUMA combines several rural and less populous counties (while PUMA in more populous areas will cover only portions of counties). For households sampled in this PUMA, median household income ranks 239 out of 265 PUMA statewide, median housing costs rank 264 out of 265 statewide, and median income after housing costs rank 220 out of 265 PUMA statewide (where 1 is the highest income, housing costs, or IAHC).

For household-level data used in this analysis, we use the 2013-2017 ACS 5-year Public Use Microdata Sample Housing Unit Records from the US Census Bureau, accessed via the American Fact Finder website.[64] PUMA 0601500 contains 6,637 housing unit records, 3,713 (or about 56%) of which have complete income (HINCP) and housing cost (RNTP or MRGP + TAXP) fields. We applied the weighting factors provided (ADJHSG, ADJINC) to normalize dollar amounts for household income and housing costs to 2017 dollars. Other PUMS household weighting factors, required for computing accurate summary statistics and reporting margins of error, were not used in this analysis, which is intended for illustrative purposes only. Affordability metrics computed to aid in commission decisions should use all appropriate weighting factors and report standard errors.

[64] The PUMS data used for this analysis is available for download at this link: https://www2.census.gov/programs-surveys/acs/data/pums/2017/5-Year/csv_hca.zip

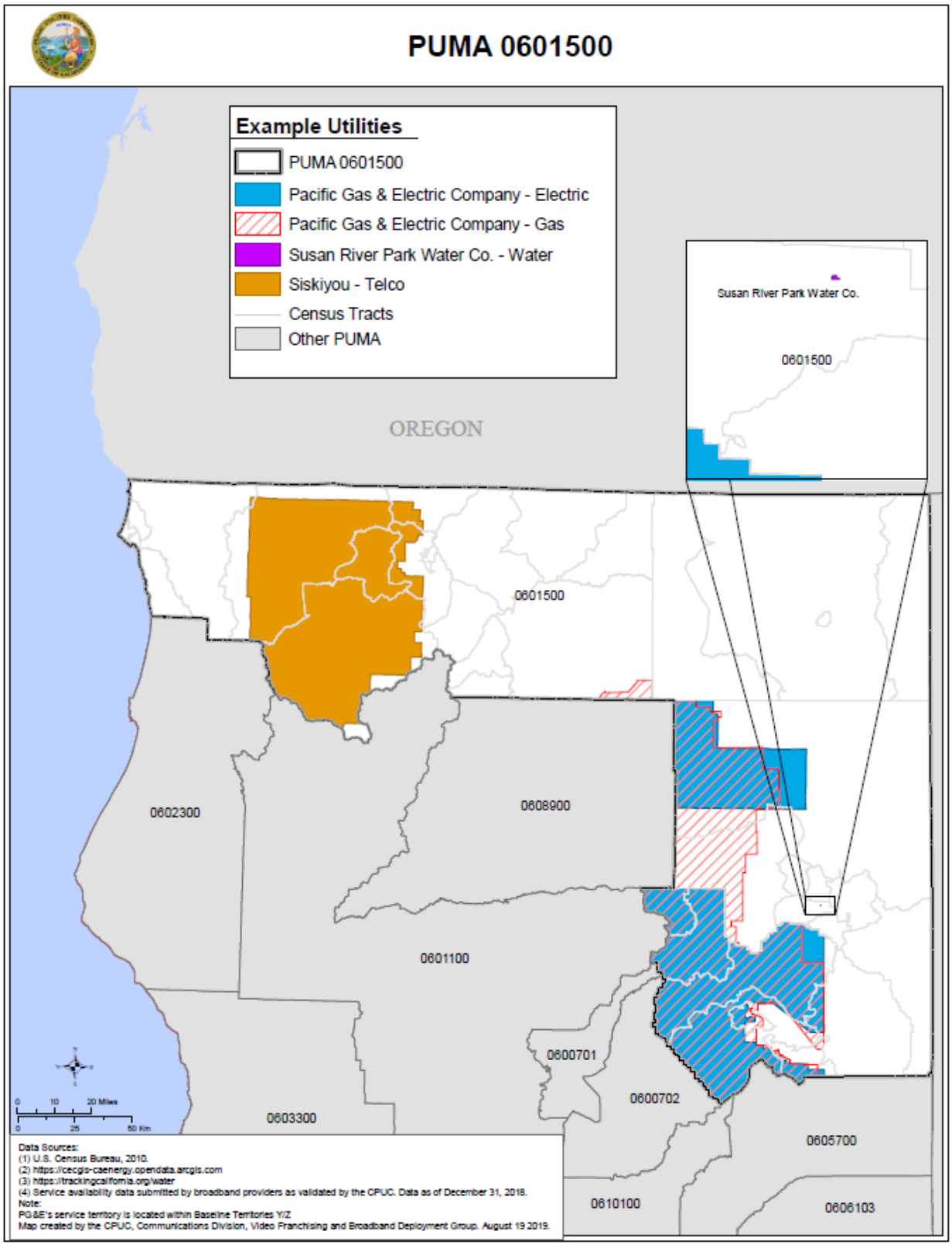

Figure 4: Utilities of Interest in PUMA 0601500

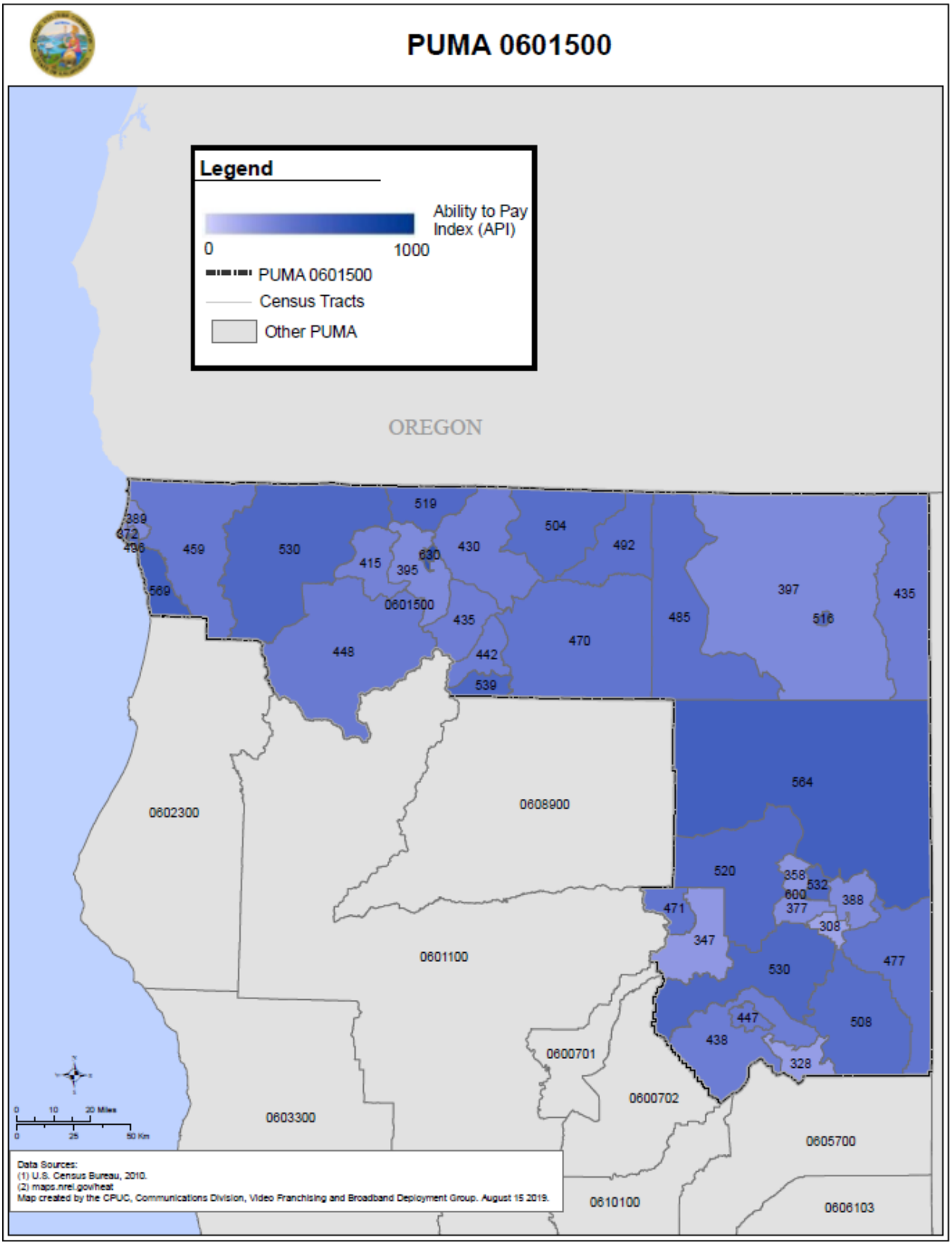

Figure 5: Ability-to-Pay Index for Tracts in PUMA 0601500

i. Proxy Bills

As noted in **Section 4.a.iii.3),** the metrics use proxy bills to hold expenses for two utilities constant while affordability for the third utility is being assessed. The following sections discuss the methodologies used in deriving the proxy bills in **Table *3***.

	2-Person Household	4-Person Household
Water	$49.47	$53.46
Energy[65]	$129.00	$129.00
Telecommunications	$173.95	$173.95

Table 3: Proxy Utility Bills in PUMA 0601500

1) Energy Bill Proxy

The monthly household bill is the bill charged by the CPUC-regulated provider[66] that has the most customers in the PUMA for the quantity of essential service. The climate zone with the most customers in the PUMA is selected as the representative climate zone.

Bills shown here for illustrative purposes are derived from PG&E electric and gas essential service rates and basic essential service quantities for baseline territory Y.[67] While PacifiCorp also serves electric customers in this PUMA, at the time of writing staff did not have data sufficient to determine whether it is the electric service provider for the majority of customers in the PUMA, so PG&E rates are assumed to be adequate proxy rates for this example. PG&E gas rates are also assumed to be adequate proxy rates in this example.

2) Water Bill Proxy

The monthly household bill is derived from data from the Water Board's Department of Drinking Water. For each household size, it is an average of bills of all Community Water Systems in the PUMA weighted by number of service connections.[68] Since the example water company covers such a small part of the PUMA, as shown in **Figure 4**, its rates cannot be assumed to be representative of the whole PUMA. The water bill will generally differ between a 2-person and 4-person household as essential service for water is taken at the per capita level—thus, a household bill depends on the size of the household.

3) Telecommunications Bill Proxy

The monthly household bill is the bill charged for the essential service quantity by the Local Exchange Carrier (LEC) that has the most customers.[69] The bill is the same across all household sizes as essential telecommunications service is already taken at the household level.

[65] $129.00 is the sum of proxy electric bill $68.68 and proxy gas bill $60.32.
[66] Includes SMJUs (see discussion of SMJUs in Recommended Essential Service Quantities subsection).
[67] Essential service rates are baseline rates from rate schedules E-1 and G-1. Rates are averages for 2017 twelve-month period, weighted to take rate changes throughout the year into consideration.
[68] Systems with no rate and systems with erroneous data were excluded from the calculation.
[69] In future applications, if we cannot gather pricing information from the carrier with the most customers, the rate from the carrier with the next largest customer base will be used as a proxy.

i. Affordability Ratio Aggregation

In the following examples, affordability ratios are computed for households of size 2 and 4, and at the 20th and 50th percentile of income (Future analyses could provide essential service bills for every household size in the PUMA, so that all sampled households can be used for analysis). Following the method described in Section 4.a.iii.4), we identify the household incomes at the 20th and 50th percentile points. For example, to present an AR_{20} for household size 2, we subset the computed AR values for all 2-person households making between $23,157.67 and $31,079.64 per year, and take the mean of those households' AR.

This is just one potential approach for Affordability Ratio aggregation. AR may conceivably be aggregated and presented based on other income thresholds, household sizes, or any of the housing unit variables available in the PUMS data.

		Income (-/+ 5 percentile points)
2-Person Household	20th percentile	$27,010.47 ($23,157.67 to $31,079.64)
	50th percentile	$55,541.08 ($51,181.48 to $62,145.26)
4-Person Household	20th percentile	$29,787.25 ($23,557.74 to $33,314.96)
	50th percentile	$59,768.87 ($54,374.42 to $66,727.87)

Table 4: Income thresholds used for aggregating AR

ii. Energy – GRC Phase II

PG&E is an electricity and gas service provider in PUMA 0601500. An electric residential rate design settlement agreement in PG&E's 2017 General Rate Case Phase II was filed in January 2018,[70] and adopted in its entirety in Decision (D).18-08-013. The settlement agreement revised electric baseline quantities, based on moving from a six-month summer season to a four-month summer season. Illustrative proposed rates show a decrease in the standard Tier 1 baseline rate from $0.19979/kWh to $0.19735/kWh. With the revised electric baseline quantities and illustrative rates proposed in the settlement agreement, PG&E residential ratepayers receiving basic service on the standard rate in baseline territory Y within PUMA 0601500 would see their average monthly electricity bill reduced from $70.69 to $68.62 (a 3% reduction).[71]

When applying the Affordability Ratio and Hours at Minimum Wage metrics, the current monthly bill of $70.69 and the proposed monthly bill of $68.62 are used as the electricity essential service monthly bill values being evaluated in the proceeding. This affordability analysis uses the proxy bills for gas, water, and telecommunications essential service expenses, and the current and proposed rate structure as provided by PG&E in the proceeding for electric essential service expense.

[70] Motion of PG&E for Adoption of Residential Rate Design Supplemental Settlement Agreement in Application (A).16-06-013.

[71] The average monthly bill is based on annual bill impacts for both the summer and winter seasons.

	2-Person Household			4-Person Household		
	Current Rate @ $70.69	Proposed Rate @ $68.62	Difference	Current Rate @ $70.69	Proposed Rate @ $68.62	Difference
HM (hours)	29.54	29.36	-0.18	29.87	29.70	-0.17
AR_{20}	20.33%	20.21%	-0.12%	19.67%	19.55%	-0.11%
AR_{50}	7.79%	7.75%	-0.05%	7.17%	7.13%	-0.04%
API	461.47					

Table 5: Energy Affordability Analysis

Table *5* presents affordability metrics for of the full bundle of utility essential service. Hours at Minimum Wage shows that for a minimum wage earner, about 30 hours, or ¾ of a full-time workweek, are required to pay for a month's essential utility services. The average Ability to Pay Index for the 21 census intersecting with PG&E electric service territory within the PUMA is 461.47.[72] By comparing to the PUMA-wide average API of 468.92, we can surmise that ratepayers affected by this change are at a similar level of economic vulnerability as those households used to compute the PUMA-wide AR.

	2-Person Household			4-Person Household		
	Current Rate @ $70.69	Proposed Rate @ $68.62	Difference	Current Rate @ $70.69	Proposed Rate @ $68.62	Difference
HM_E (hours)	5.89	5.72	-0.17	5.89	5.72	-0.17
$AR_{20,E}$	4.1%	4.0%	-0.1%	3.9%	3.8%	-0.1%
$AR_{50,E}$	1.6%	1.5%	-0.1%	1.4%	1.4%	-0.0%
API	461.47					

Table 6: Electric in Isolation

Table *6* presents affordability metrics sensitive to essential service (Hours at Minimum Wage and Affordability Ratio) for current and proposed electric bills for energy essential service in the numerator. We can see that for households at the 20th percentile of income, electric bills alone account for about 4% of income after housing costs. We can see that the same rate decrease has a slightly larger impact on Affordability Ratio for 4-person households earning between the 15th and 25th percentile than between the 45th and 55th percentile of income.

iii. Water – Small Utility GRC

Susan River Park Water Company (SRPWC) is a CPUC-regulated utility located fully within census tract **06035040302**, which is inside PUMA 0601500. SPRWC filed for a rate increase in 2017 to recover increased operating expenses and utility plant investments.[73] The utility has a flat rate structure, so the bill is independent of the quantity of water used. The utility requested to increase the flat rate from $72 to $113.48, which is a substantial (57.6%) increase. **Table 7** provides a comparison of the rate increase

[72] Census tract to electric utility boundary mapping was obtained from the National Renewable Energy Laboratory. Data available for download at maps.nrel.gov/solar-for-all/, under the "Utilities" section.
[73] Resolution W-5134

using the three affordability metrics. This affordability analysis uses the proxy rates for energy and telecommunications, and the actual rate structure of SRPWC.

	2-Person Household			4-Person Household		
	Original Rate @ $72	Adjusted Rate @ $113.48	Difference	Original Rate @ $72	Adjusted Rate @ $113.48	Difference
HM (hours)	31.25	34.75	3.5	31.25	34.75	3.5
AR_{20}	21.47%	23.84%	2.38%	20.77%	23.07%	2.30%
AR_{50}	8.24.0%	9.15%	0.91%	7.58%	8.42%	0.84%
API	377					

Table 7: Water Affordability Analysis

	2-Person Household			4-Person Household		
	Original Rate @ $72	Adjusted Rate @ $113.48	Difference	Original Rate @ $72	Adjusted Rate @ $113.48	Difference
HM_W (hours)	6	9.46	3.5	6	9.46	3.5
$AR_{20, W}$	4.12%	6.50%	2.38%	3.99%	6.29%	2.30%
$AR_{50, W}$	1.58%	2.49%	0.91%	1.46%	2.29%	0.84%
API	377					

Table 8: Water in Isolation

As shown in the table, even in areas with fairly low APIs, utility burden can be large for economically vulnerable households. Households at the 20th percentile of the income distribution in this PUMA still spend over 20% of their income after housing expenses on utility bills. The affordability impacts on more economically vulnerable ratepayers are more pronounced than on ratepayers at the median household income. Note also that a 57.6% increase in rates *does not* imply an equivalent decrease in affordability—the affordability impacts are dependent on other utility bills, incomes, and housing bills for the area.

iv. Telecommunications – Grant Request

The California Advanced Services Fund (CASF) is a public purpose program that focuses on encouraging deployment of broadband infrastructure in unserved and underserved areas of California. Upon receiving a grant request for CASF funding from a telecommunications service provider, CPUC staff reviews and analyzes submitted data to determine the project's eligibility. While the comprehensive review process includes an assessment of the area's household counts and average income that the project intends to serve, it currently does not examine the customer's ability to pay for the broadband service.

By examining the impact of telecommunications service rates on affordability, CPUC staff can make a more informed determination on a CASF grant request. To illustrate, we apply the affordability framework on an approved CASF grant application for Siskiyou Telephone Company. [74] The grant was approved for census tract 06093000500, which lies within PUMA 0601500.

[74] Resolution T-17539

Tract 06093000500 has an API of 530 while PUMA 0601500, which covers Del Norte, Lassen, Modoc, Plumas, and Siskiyou counties, has an average API of 469[75]. This means that in comparison to the PUMA to which it belongs, census tract 06093000500 is more economically vulnerable.

The proposed retail pricing plan for broadband essential service of 20 Mbps is $149.95 per month. For fixed voice—essential service for local calling—the retail price as regulated by the CPUC's California High Cost Fund-A Program is set at $24.00.[76] **Table 9** assesses the affordability whether the rates associated with the proposed retail pricing. This analysis uses the actual rates in question for telecommunications, and the proxy rates for energy and water.

	2-Person Household	4-Person Household
HM (hours)	29.4	29.7
AR_{20}	20.22%	19.56%
AR_{50}	7.75%	7.13%
API[77]	530	

Table 9: Telecommunications Affordability Analysis

Table 10 provides an example of how the affordability framework can be applied to a single utility bill, rather than a bundle of all three. That is, this analysis does not consider energy or water bills and only looks at the affordability of the telecommunications bills. Both analyses can be used side-by-side to understand a specific bill as a portion of the household's overall utility budget.

	2-Person Household	4-Person Household
HM_T (hours)	14.5	14.5
$AR_{20,\,T}$	9.96%	9.64%
$AR_{50,\,T}$	3.82%	3.52%
API	530	

Table 10: Telecommunications in Isolation

The results in **Table 9** and **Table 10** show that even when receiving a CASF grant, the rates offered by this provider still make up a sizeable portion of the household's utility budget. While these bills are not necessarily onerous for customers in the middle of the income distribution, customers at the 20th percentile spend around 3 times as much of their income after housing costs on telecommunications service.

In addition, contrary to other affordability studies allocating a minimal amount of expenses for telecommunications services, this analysis illustrates that telecommunications services are the highest utility expense incurred by a household in this PUMA[78]. For example, *Making Ends Meet* allocated

[75] Of the 265 PUMAs in California, this score ranks 126th or 48th percentile.
[76] For Siskiyou Telephone Company's customers to be able to avail the given rate of $149.95 for broadband services, the customers must also subscribe to landline services provided by the same carrier. Hence, for this analysis, we determine fixed voice as essential over mobile voice.
[77] Note that the telecommunications example shows a different API than the water example because the examples examine different census tracts within the same PUMA, and API is calculated at the census tract level.
[78] Energy is a close second if one adjusts the electric in isolation example to include gas bill as well.

telecommunications a budget of only $20. The telecommunications prices used in this illustration are comparable within the state and gives a more representative indication of telecommunications prices in California.

6. Conclusion

Staff believes that the combination of definitions and metrics proposed here satisfies both the goals of the OIR and the guiding principles outlined in Section 1. From the definitions also proposed in Section 1, staff has established a common language with which to discuss essential service and affordability, and introduced data sources and metrics that can express these concepts quantitatively. For essential service, staff from each industry division has identified data sources to accurately and flexibly define essential service quantities on an ongoing basis. In the case of affordability, Hours at Minimum Wage intuitively tracks essential service costs, the Ability-to-Pay Index represents the economic vulnerability of communities, and Affordability Ratio combines both of these dimensions to examine affordability at the household scale.

While staff has created an example of how the framework could be used to analyze potential rate changes or grant requests, this staff proposal marks just the starting point in developing a Commission-wide framework for affordability. The Commission must develop a sustainable and cost-effective approach to maintaining the data sources and tools necessary to compute affordability metrics on an ongoing basis. In tandem, the Commission must also decide how these metrics should be incorporated in its decision-making.

Staff confidently recommends the definitions, essential service quantities, and affordability metrics that are outlined in this proposal. Staff believes that the recommended data sources are the best available for calculating the recommended metrics. Staff will continue to develop plans for the Commission to implement and utilize this affordability framework to best suit its needs and policy goals.

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