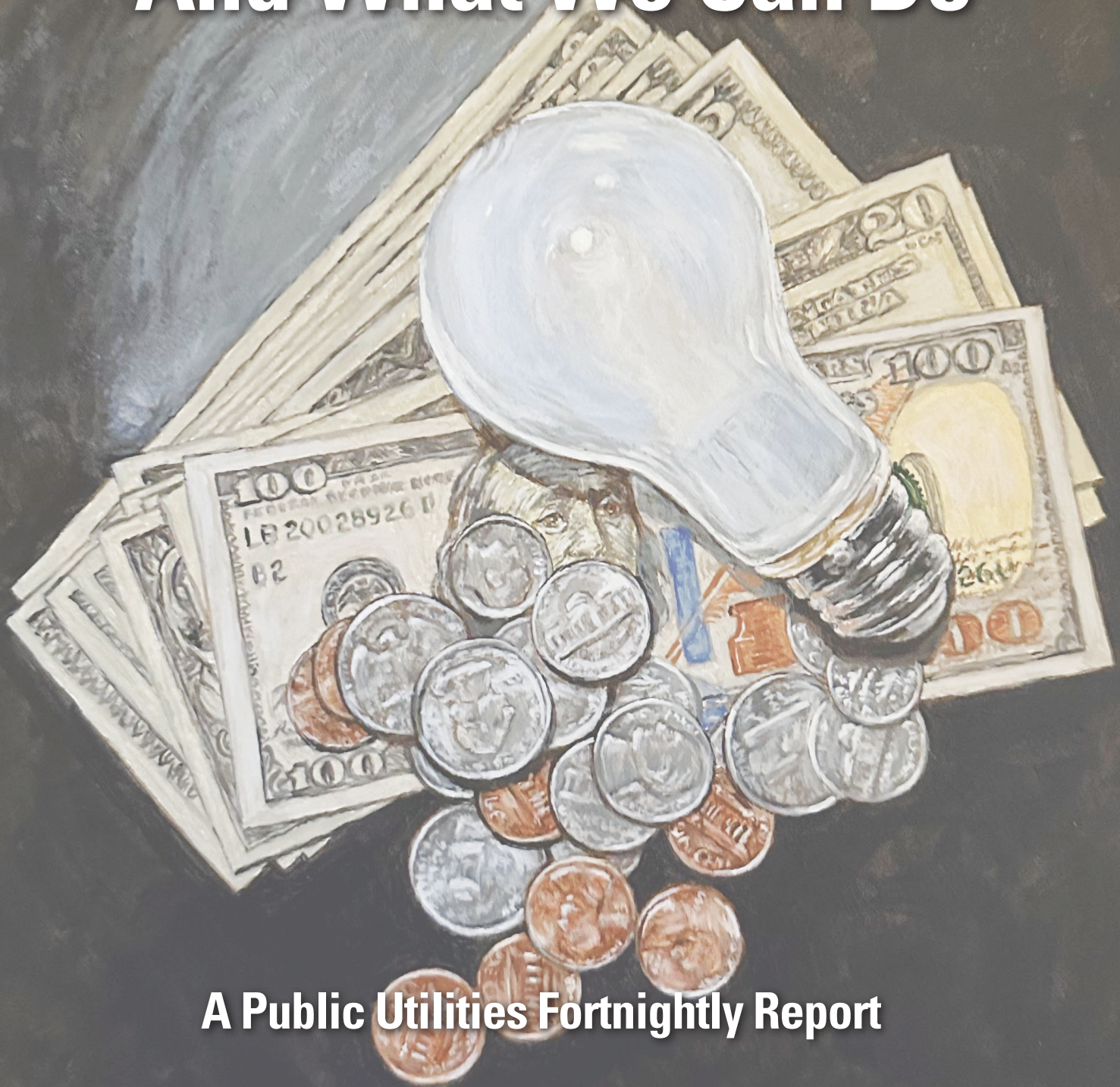
Energy Affordability and Equity

And What We Can Do



A Public Utilities Fortnightly Report

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Foreword

We at Public Utilities Fortnightly have written about this important topic of energy affordability this year. In January 2024 we published the "The Electric Affordability Handbook." In February 2024, the theme of that month's Public Utilities Fortnightly was on the cover: Electric Affordability Today and Tomorrow. Within the issue were excerpts from The Electric Affordability Handbook and an extensive article by us entitled "Modeling Affordability of the Energy Transformation." And the From the Editor essay was entitled "Electric Affordability Today and Tomorrow: Meanings, Myths, and Measures."

Ever since 2013, when one of the authors of this report published his book, "Lines Down: How We Pay, Use, Value Grid Electricity Amid the Storm," he has been tracking and writing about quantitative measures of the value and cost of electric utility service for utilities' residential customers particularly. So, when the topic of energy affordability rose even higher among the priorities of utilities and utility regulation, it was a natural next step for us to write about this more definitively.

It is our goal and hope that the report will shed more light on this subject that is more discussed than understood, and especially that it will illuminate a path or two that utilities and utility regulation can take to materially help those households with affordability challenges.

Steve Mitnick
Paul Kjellander

Important note: Eleven Commissioners agreed to be interviewed and answer our questions about affordability. Their answers are within this report in their entirety and unedited by us, appearing as Appendix A. But the responsibility for the views expressed in the remainder of this report is completely ours. The Commissioners did not review the report prior to its publication.

Introduction

We're Different

Central to our conversations about the energy affordability challenges of many American households, we're remarkably different in how we use energy: electricity, natural gas, motor gasoline, fuel oil, propane, even wood. And how much we use of each. And how much we use overall. And how much we spend on each. And how much we spend overall.

Our energy consumption, whether in quantities or dollars, differs annually, a lot. And it surely differs, a whole lot, seasonally and monthly. In the peak energy usage months especially. Think January, or July. That's when the differences widen still.

But our differences abound. And in more ways that are relevant to the conversations about affordability. We're remarkably different in our income. Whether from any one source or in total.

In our buying power, the variation is extraordinary and ordinary at the same time. Not just in what is normally considered "income." Households' buying power comes from a veritable rainbow of sources – wages and salaries, Social Security, private retirement plans, unemployment insurance, government and charitable assistance, unreported monies from tips to gigs to yard sales, gifts, child support payments, withdrawals from savings, etc. – reflecting the enormous diversity of life in America today.

Not only do we have differences. We literally have differences upon differences. Just take our energy differences and layer onto them our income differences.

The energy that one household uses can cost a narrow slice of its income. Alternatively, the energy a second household uses can cost a thick slice of its income. And, instead of these extremes of the distribution (thinking of this statistically), the energy a third household uses can cost it somewhere in between narrow and thick.

Of course, there are plenty of households nationally and in any region or community that are at, or near enough, the average in how much of a bite, of their home budget, energy takes. Though there are plenty of households where energy takes a far smaller bite or a far bigger bite of their buying power.

In statistics jargon, the right and left tails of the distribution are distant from the mean. And each tail represents rather large proportions of the overall population.

And Not Typical

In utility regulation, the term "typical bill" is often invoked. Yet only a percentage of utility customers pays amounts at or near the typical bill. Substantial percentages of customers pay far less or far more. But worse than that, given broad differences in income, substantial percentages of customers pay far less or far more in terms of the share of their income and buying power.

Back to our big differences that matter so much in our affordability conversations. Like, we're also remarkably different in how we spend our money, on energy and otherwise, on the myriads of non-energy goods and services that Americans put their money down for.

Additionally, we're remarkably different with respect to our assets and liabilities. Again, in total and more specifically, the monies we can call upon when needed, on that proverbial "rainy day." Also, regarding the monies that must be paid when due,

with serious consequences if we don't make payment on time and in full.

Our vast differences can frustrate those looking for one-size-fits-all descriptions of energy affordability challenges. Our differences are murky waters when searching for solutions that have a real potential to materially help households with unaffordability challenges.

Yes, averages such as typical bills and typical bill increases are easy to calculate. They can bring some comfort that we have a handle on what's going on. And on what can ease affordability challenges. But they only mask the difficulties of many households, because of our differences. As well as mask the lack of difficulties of many more.

This Report

More than anything else, this report drills down below the average-based descriptions of affordability challenges and solutions. It recognizes first and foremost that in order to materially help those households that indeed need help, we must understand what kinds of households have these challenges. And why they do. With the variety of their situations – energy, income, expenditures, and assets/liabilities – top of mind.

The same goes when we assess the probable impact of possible solutions on those households battling unaffordability. To factor in that a utility's residential customers, let alone those with affordability challenges, are anything but a homogeneous group with uniform circumstances.

Executive Summary

What is Energy Affordability?

What do we mean by affordability? And unaffordability? Whether in general, that is, for any household expenditure. Or any class of expenditures. Or all a household's expenditures in combination. Or specifically, for energy expenditures, our focus herein.

This report considers an expenditure or a price increase to be unaffordable when it significantly disrupts a household's ability to make other expenditures for all the goods and services they need and want, and regularly purchase. An expenditure or a price increase is thereby affordable, the converse of unaffordable, when it doesn't significantly disrupt this ability.

A core theme of this report is, we're different. Households vary quite substantially across the nation, a region, or a utility service area, in several respects that are essential for understanding unaffordability. And for answering the question posed by this report's subtitle, what can we do?

The multi-dimensional heterogeneity of households applies to unaffordability across the board. From housing to healthcare to childcare to energy. And it leads us to solutions that are most likely to materially address energy affordability, that are in the toolbox of utilities and utility regulation. It sheds light too about those actions that are less likely to have a material positive effect.

The many and consequential variations in households – their buying power and the mix of sources of buying power (wages and salaries and otherwise), their expenditures and the mix of products and services, their resources in reserve to get through the tough times – make broad averages of hundreds of thousands or millions of households in a utility service territory only representative in part. Including in utility regulation. The "typical bill" and "typical bill increase" in particular.

Who is Most Vulnerable to Energy Costs?

Now for the second core theme of this report. Notwithstanding utility regulation's admirable performance for the average residential customer, a sizable minority of households struggle to make ends meet, for all the goods and services they need and want, and regularly purchase.

These affordability-challenged households are quite naturally a serious concern. And of course, we in the utilities industry and utility regulation want to know, what we can do?

Especially for those in the lowest income quintile. That is, the one-fifth of households with the lowest income. It is the sole quintile of the five income quintiles that averages electric bills above 3.9 percent of income. That is, their average energy burden for the households grouped within that quintile.

The average energy burden of the households in the other four quintiles – with the second lowest income, the middle income, the second highest income, and the highest income – are 3.9 percent, 2.4 percent, 1.6 percent, and 0.9 percent. See Figure A, which will appear again in Chapter II of this report.

The common measures of energy affordability are all correlated with income. Energy burden. Energy share of wallet/buying power. Inability to pay energy bills. Each can help us point the way to the households most vulnerable to energy unaffordability,

Particularly vulnerable are households with both lower income and higher energy usage (and so, higher

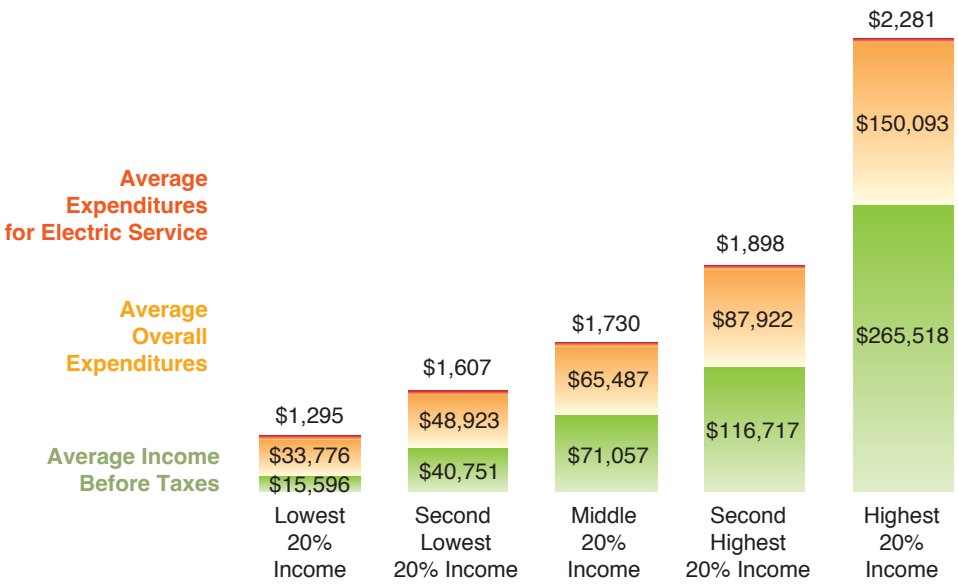
energy bills). This combination is most characteristic of low- and moderate-income households living in larger single-family detached houses with substantial interior spaces to cool and heat. This is most commonly found in rural and suburban communities with usually hotter temperatures in summer and usually colder temperatures in the winter, compared with the rest of the country.

Though low-income high-energy-usage households can be found anywhere nationally including in urban communities. Especially where there are larger single-family detached houses within cities such as, for example, in the outer boroughs of New York City.

These households, regardless of where they are located, are particularly vulnerable in those peak usage months when energy usage spikes (like July, August, January, February). And not only do they often have relatively lower income. They often have few funds for the proverbial "rainy day," and tenuous income sources.

So, coping with significant month-to-month variations in expenditures, including for energy, can be challenging. While the variation in monthly utility bills from, say May to July, may be bearable for more affluent households, a big spike can really challenge a household with lesser means. Especially if it comes at a time when other buying power and expenditure challenges present themselves.

Figure A. Electric Bills by Before Taxes Income Quintile, All U.S. Households, 2023



	Lowest 20% Income	Second Lowest 20% Income	Middle 20% Income	Second Highest 20% Income	Highest 20% Income
Energy Burden:	8.3%	3.9%	2.4%	1.6%	0.9%
Share of Wallet/ Buying Power	3.8%	3.3%	2.6%	2.2%	1.5%

Source: U.S. Bureau of Labor Statistics, Consumer Expenditures Survey, 2023

For the households of each quintile:
Energy Burden = Average Expenditures for Electric Service / Average Income Before Taxes
Share of Wallet / Buying Power = Average Expenditures for Electric Service / Average Overall Expenditures

How Might the Energy System Transformation Affect the Vulnerable?

A third core theme of this report is that the one hundred seventeen-year-old utility regulation model has been extraordinary in thinly spreading the bill impact of a utility's infrastructure investment. Across hundreds of thousands or millions of households. Across tens of thousands or hundreds of thousands of commercial and industrial customers. Across hundreds of each of their monthly bills over the decades of depreciating investment, further diluting the impact.

A quantitative analysis in the Appendix shows this effect, with representative assumptions. In the example presented there, if net rate base is increased by a billion dollars, average residential customer electric bills are increased by $49.40 per year. Or $4.12 monthly.

The billion-dollar investment by the utility boils down to a 0.08 percent increase in the average residential customer's share of wallet/buying power taken up by electric bills. Electricity's share of wallet increases from 2.2 percent to 2.28 percent. The share of wallet for all other goods and services the customer purchases, decreases from 97.8 percent to 97.72 percent. Which is not a large change.

This diluting of utility investment costs has been the track record of the utility regulation model. We can reasonably expect that the power of this model, with its remarkable dollar-for-dollar efficiency on behalf of utility customers, will keep delivering.

Now, and in the coming years, to drive the energy system transformation. Doing so affordably for most customers. Albeit as this report reiterates throughout, it's not all positive for all customers.

For two reasons. First, for the average household, the energy transformation can be expected to increase electricity's share of wallet, even when inflation-adjusted. For most customers, the increase will likely be manageable. Though for affordability-challenged households, it may not be.

Second, once the transformation scales up electrification, in future years, household energy expenditures overall may level off and perhaps fall in real terms, on average, because of less dependence on fossil fuel commodity prices, in particular. Though affordability-challenged households will likely be less able to take advantage of this trend, for example by switching to electric vehicles and electric heating in the home and installing rooftop solar. That is, unless utilities and utility regulation intervene through policies and programs to make adoption of these technologies more equitable.

In general, we can expect utility regulation's model will keep delivering through the transformation. Whether it operates as it has operated historically. Or whether it is modified, as it has been in some states, such as with performance-based ratemaking.

What Can We Do to Materially Assist the Vulnerable?

Fortunately, in the toolbox of utilities and utility regulation, there are practical policies and programs that have the potential to materially help households with energy affordability challenges. These are actions available for us to take, that really could significantly lessen the disruption to their ability to pay month-to-month expenditures. And while doing so, allow us to proceed as needed with the energy transformation on behalf of all utility customers, affordability-challenged households included.

Particularly critical is lessening the disruption to their ability to pay for their regular expenditures in the same months as peak usage month energy bills. Especially with increases in peak usage month energy bills that will accompany the energy transformation (from the required step-up in infrastructure investment).

We posit in this report a threshold test for whether a policy or program has the potential to materially make a difference for these households, at times when they are most financially stressed. It's about being impactful:

Threshold Test

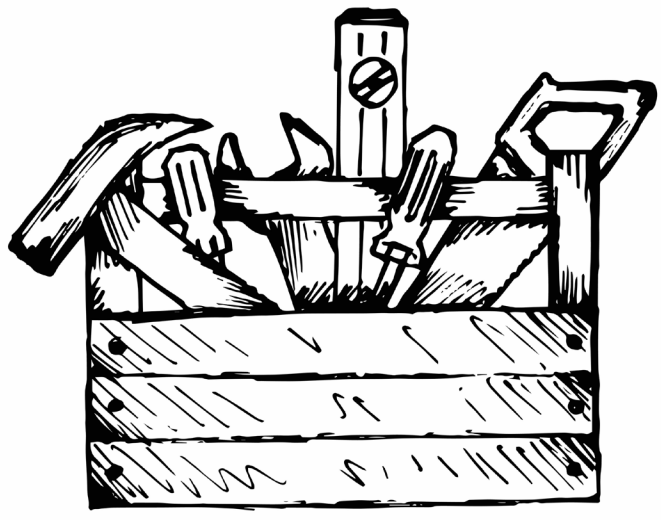
Would a policy or program
cut an affordability-challenged household's
energy expenditures by an **impactful** amount,
particularly in months when energy bills peak,
enabling them to continue buying other goods and services
they need, want, and regularly purchase?

Some programs and policies can pass this test. Such as low income-qualifying bill discounts, caps, credits, etc., for which many low- and moderate-income or LMI households throughout a utility service territory are eligible. Such as targeted community solar and energy efficiency which, practically speaking, tend to affect a smaller number of LMI households in a service territory. But they can also drive down, significantly, sometimes by several percentage points, participating customers' energy burden and share of wallet/buying power.

See Figure B, which will appear again in Chapter IV of this report.

Some programs and policies cannot pass that threshold test. Their impact on energy burden and share of wallet/buying power may be more on the order of tenths of percentage points.

Figure B. In Toolbox of Utilities and Utility Regulation That Can Materially Help Affordability-Challenged Households



Targeted Energy Efficiency
Targeted Community Solar
Income-Eligible Bill Programs

Notably, base rate case decisions concerning a utility's rate base and return tend to be limited to this range of potential impact on LMI households. This can be shown mathematically, as this report does in Appendix C.

Consumers in all financial circumstances, including those with middle and upper incomes, can feel resentment and pressure from rising prices. Price increases generally and utility rate increases specifically can be scorned by anyone.

Utilities and utility regulation however are responsible for ensuring the provision of safe, reliable, resilient, and environmentally-sound utility service to everyone. The necessary costs for doing all that they do, including addressing affordability, are shared and socialized by everyone through utility rates.

So, the only practical course to do something meaningful about affordability? It's about focus, which is the fourth theme of this report:

To **focus** our attention
on those LMI households
where our assistance can make the greatest difference
in their economic lives.

This report shows that targeting LMI suburban and rural communities with a predominance of high-energy-usage houses that are larger single family detached structures (sometimes found in urban communities too), can make a great difference. By restraining their monthly electric and gas bills. By restraining their bill increases. But especially by restraining their seasonal bill volatility.

Fortunately, as the data shows, such communities account for a relatively limited slice of their utilities' total revenue requirements, depending upon how the targets are defined. This provides more flexibility to utilities and utility regulation to target those households with the greatest needs with policies and programs.

That these households account for such a minor slice of a utility's overall revenue requirements is critical. It means that measured relief in the bills of some of the affordability-challenged – through low income-qualifying bill discounts, caps, credits, etc., or targeted community solar and energy efficiency, for example – would have, mathematically, quite a limited impact on the bills of all other customers. That is, on the bills of other households in the residential customer class, and on the bills of customers in the commercial and industrial classes.

Indeed, to the extent there would be some shifting, there would likely be some savings shifting in the other direction. Such as a reduction in arrearage and associated utility costs. Resulting in slight changes, net, spread across the bills of ninety-five, ninety-six, ninety-seven or more percent of a utility's customers in terms of total revenue requirements.

Then, there are the benefits for all customers of a utility, from targeted community solar and energy efficiency programs. While such programs can especially benefit customers that are affordability-challenged, they could also enhance system-wide resilience in so doing.

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I. What is Energy Affordability?

What is It Exactly?

The term is often spoken or written. But when affordability is brought up, the speaker or writer may mean one thing and the listener or reader may have something quite different in mind. The culprit is the term's definition, or more precisely, the term's lack of precision amid competing definitions.

Does the speaker or writer mean that a particular good or service is a reasonable or acceptable value for the money the seller is asking? Or do they mean that the full range of necessities can be purchased over time without undue hardship? Or, that particular necessities and other common goods and services can be purchased over time without undue hardship?

And then there's, when evoking affordability, who are we referring to? Elon Musk and Jeff Bezos likely find affordable most things they need and want. A family only a short step away from being evicted from their apartment likely doesn't.

Is affordability a sliding scale in which a good or service goes from affordable to unaffordable as its price is raised? Or is it either/or? Either something is affordable, or it isn't, after it crosses a red line demarcating affordability from unaffordability.

There're more complications in the way of a single accepted definition. Such as perceptions. An affluent homeowner in the suburbs can certainly feel that an increase in the prices at the pump, on the supermarket shelves, or to stow a bag on the plane, is not affordable. But he or she will pay the charges even if grumbling about it.

This kind of reaction to prices and price increases is indeed an intrinsic part of capitalism. I may crave that expensive suit or Caribbean cruise, but remorsefully take a pass because their prices strikes me as too high. But then, that's not the problem of affordability and energy affordability we're interested in and we're addressing in this report.

The term affordability comes up so frequently and with good reason since the problem for many households goes well beyond perceptions about reasonable or acceptable value. Any utility customer can feel resentment about their utility bill and increases to their bill. But only a minority of utility customers, albeit a significant minority, can feel negative impacts from increases that force difficult decisions about what necessities they must cut back and what bills they must pay only partially or put off entirely.

For them, making ends meet is an issue month-to-month, week-to-week, day-to-day. For them, some price increases and some unexpected expenses literally threaten their well-being. For them, their savings are little, their debts are hanging over them, and the idea of calling upon rainy day funds is a fantasy.

A Definition That Fits the Need

To define affordability, we start with unaffordability. That is, affordability is the converse of unaffordability. What's unaffordability? It is when a household's ability to buy the goods and services they need and want is significantly disrupted by an increase in some costs.

That leads us to a definition of affordability that fits the need. That we can use to better understand the households that face affordability challenges, why they do, and how might utilities and utility regulation materially help them. See Figure 1 for a definition of affordability that leads us toward real solutions for real households.

A number of the Commissioners that we inter-

viewed offered similar definitions along the lines that the level of utility rates and bills should not prevent households from being able to pay for necessities. That it should not, as one Commissioner said, cause utility customers to make sacrifices for essentials like groceries, medical care, and housing.

Another Commissioner said energy affordability means that utility customers pay no more than absolutely necessary for services. But that it does not mean "inexpensive."

See Appendix A of this report for more on what was said in the interviews.

What Causes an Affordability Challenge for a Household?

Whether a price increase makes an expenditure affordable or unaffordable for a household depends on the answers to these seven questions:

How necessary is the expenditure?

How often is the expenditure made?

How large is the percentage increase?

How large was the price prior to the increase (relative to the household's total expenditures)?

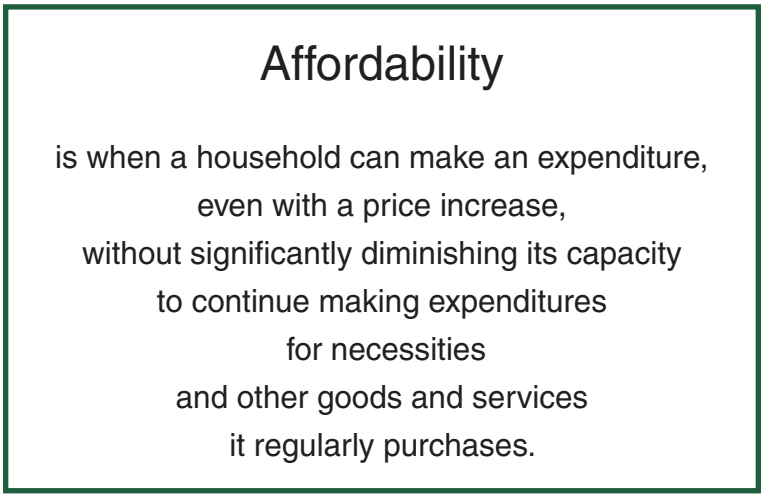
How large are the price increases of other of its expenditures at roughly the same time?

How tenuous is the continued flow of income and other sources of buying power?

How limited are its accessible rainy-day funds?

If a household's expenditure is necessary, is made often, has had a large price increase, had a large price prior to the increase (relative to total expenditures), is coming at a time when there are other price increases, and when buying power is tenuous and rainy-day funds are limited. Then it is likely unaffordable.

Figure 1. Definition of Affordability
That Leads Us Toward Real Solutions for Real Households



If on the other hand, a household's expenditure is not necessary, is not made often, had a moderate price increase, had a moderate price prior to the increase (relative to total expenditures), is coming at a time when there are few or no other major price increases, and when buying power is fairly secure and rainy-day funds are somewhat available. Then it is likely affordable.

When Buying Power is Tenuous

Quoting from the Board of Governors of the Federal Reserve System's annual report, "Economic Well-Being of U.S. Households in 2023," published in May 2024:

> "The total level of yearly income may mask changes in income from month to month, and mismatches between the timing of income and expenses can lead to financial challenges."

The Fed's 2023 survey found that 28 percent of households nationally experienced monthly variations in income (that is, their income was not roughly the same each month). For example, 47 percent of those employed in construction and 44 percent employed in leisure and hospitality said their income varied at least occasionally month to month.

By race and ethnicity, 30 percent of African Americans and 35 percent of Hispanics said they experience varying income. And 11 percent of African Americans and 16 percent of Hispanics said their varying income causes hardship.

The Scope of Affordability

The term affordability is sometimes said or written to critique the cost to consumers of a particular good or service or a category of goods or services. As in, the cost of buying a home is unaffordable for many. Or sometimes to critique an increase in the cost after the price has been raised. As in, this latest rate hike has made home insurance unaffordable for many.

And sometimes the term affordability is said or written to critique the overall cost to consumers of all the goods and services in combination that they need and want. As in, the cost of living in Silicon Valley

is unaffordable for many. Or sometimes to critique increases in the costs of all the goods and services in combination after prices for many of them have been raised. As in, inflation has made reaching and remaining in the middle class unaffordable for many.

And Energy Affordability?

Put aside for a moment those energy costs necessary to operate a household's vehicle or vehicles. The remaining costs to heat and cool the home, and to power electrical appliances and devices are generally no more than a few percent of a household's total expenditures on all goods and services. So, it takes a relatively large increase in those heating, cooling, and powering costs to significantly disrupt its ability to buy the goods and services it wants and needs.

But such increases can take place. Such as when natural gas prices spike, affecting natural gas costs directly and electric utility service costs indirectly. This impact is naturally more serious when a household has relatively low income and limited assets to fall back upon. Such households are exactly the ones vulnerable to energy affordability challenges. They are the households for which mitigating programs and policies should aim to help.

The Where and When of Energy Affordability

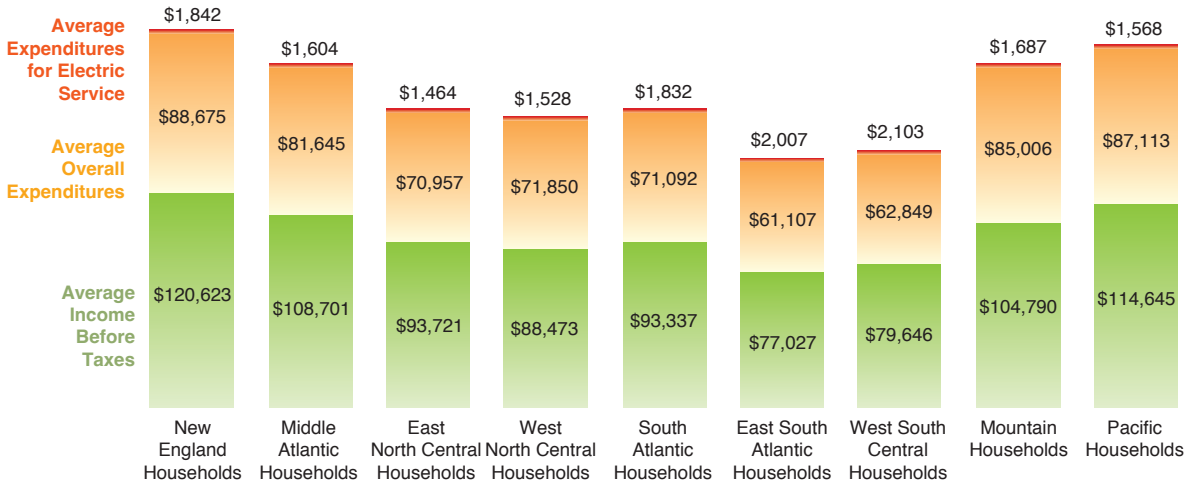
The data shows that average electric bills are larger (in absolute terms and relative to household expenditures in total), both annually and during summer peak usage season, in the southern States where air conditioning usually runs more. And the data shows that average electric bills are larger in rural or suburban areas where homes are disproportionately single-family detached structures with greater interior volumes to air condition.

Of the nine Census Divisions, expenditures for electric service average the highest in the West South Central. That is, in Texas, Oklahoma, Arkansas, and Louisiana. A close second place in electric service expenditures is the East South Atlantic, encompassing Kentucky, Tennessee, Mississippi, and Alabama. Yet these two Census Divisions have the lowest averages in both before taxes income and expenditures overall for all goods and services.

As a result, per the U.S. Bureau of Labor Statistics' 2023 Consumer Expenditure Survey, electric service expenditures averaged 3.4 percent of overall expenditures and 2.6 percent of before taxes income in the West South Central, and 3.3 percent of overall expenditures and 2.6 percent of before taxes income in the East South Central. In contrast, electric service expenditures averaged 1.8 percent of overall expenditures and 1.4 percent of before taxes income in the Pacific, that is, California, Washington, Oregon, Hawaii, and Alaska, and 2.0 percent of overall expenditures and 1.5 percent of before taxes income in the Middle Atlantic, that is, New York, New Jersey, and Pennsylvania.

See Figure 2.

Figure 2. Income, Overall Expenditures, Electric Expenditures by Census Division, 2023



	New England Households	Middle Atlantic Households	East North Central Households	West North Central Households	South Atlantic Households	East South Atlantic Households	West South Central Households	Mountain Households	Pacific Households
Energy Burden:	1.5%	1.5%	1.6%	1.7%	2.0%	2.6%	2.6%	1.6%	1.4%
Share of Wallet/ Buying Power	2.1%	2.0%	2.1%	2.1%	2.6%	3.3%	3.4%	2.0%	1.8%

Source: U.S. Bureau of Labor Statistics, Consumer Expenditures Survey, 2023

For the households of each quintile:

Energy Burden = Average Expenditures for Electric Service / Average Income Before Taxes

Share of Wallet / Buying Power = Average Expenditures for Electric Service / Average Overall Expenditures

The data also shows that average natural gas bills are larger (in absolute terms and relative to household expenditures in total), both annually and during winter peak usage season, in the northern States where heating furnaces usually run more. And the data shows that average natural gas bills are again larger in rural or suburban areas where homes are disproportionately single-family detached structures with greater interior volumes to air condition.

Energy Burden

The term that is quite often used to describe the degree of energy affordability is "energy burden." There are alternatives for quantifying energy affordability, as we shall discuss below. Particularly, "share of wallet/buying power." Though energy burden is clearly the more common metric.

Energy burden was popularized over twenty years ago, in 2003, by Roger Colton. He has since regularly published calculations of what he calls "the home affordability gap."

His analysis is based in part on the step in his model that states that the 'affordable burden' for home energy bills is set at 6 percent of gross household income.

This is discussed at the website of the American Council for an Energy-Efficient Economy, commonly referred to as ACEEE:

"The 6% [energy] affordability threshold is based on Fisher, Sheehan and Colton's Home Energy Affordability Gap Analysis. This affordability percentage is based on the assumption that an affordable housing burden is less than 30% of income spent on energy, and 20% of housing costs should be allocated to energy bills. This leads to 6% of an affordable housing burden spent on energy costs, or a 6% energy burden."

See Appendix B of this report for more on Colton's model, assumptions, and results.

Leaving aside those details about Colton's work for the Appendix, energy burden has the advantage of being easy to calculate. Though for the sake of clarity, one must appreciate a few subtle complexities.

We start with a household's annual energy expenditures. In the calculation of energy burden, that's the numerator.

But before proceeding further, something must be said about this first complexity. Sometimes, commentators invoking the term energy burden include motor gasoline for a household's vehicles. Along with expenditures for electric utility service, natural gas service, and for fuels to heat the home like heating oil and propane. And sometimes they don't, which makes a big difference.

In either of these formulations, in order to calculate energy burden, you must divide a household's annual energy expenditures by its annual income. But which of these components of energy expenditures are we including, and which are we excluding?

Let's keep things straight. We will call it "total energy burden" when everything in included in the numerator. That is, electric utility service, natural gas service, fuels to heat the home, and motor gasoline.

And we will call it "home energy burden" when only electric service, natural gas service, and fuels to heat the home are included. Home energy burden casts aside the motor gasoline component.

And then we will call it "utility energy burden" when only electric service and natural gas service are included. Utility energy burden casts aside both fuels to heat the home and motor gasoline.

And finally, we will call it "electric energy burden" when only electric service is included. Those other components of energy expenditures are not in the equation.

In this report, we will generally mean this variation. That is, we will mean "electric energy burden" even when we simply say, "energy burden."

Utilities are Different Too

The motor gasoline component of the total energy burden is projected to drop by a significant amount as the energy system transformation proceeds. This will be due to vehicle electrification. And the natural gas component of the energy burden is projected to drop by a significant amount as well. This will be due to home electrification. So, the energy transformation will, in these ways, offset at least some utility customers' costs from the investment that will be required by utilities, making those costs more manageable, generally.

Though it is important to recognize that utilities are different too. How the energy transformation will affect affordability will differ accordingly.

For example, the motor gasoline component of the total energy burden for the residential customers of that utility tends to be greater than the gasoline component for, say, the residential customers of the utility serving New York City. Southern Californians generally drive more. And gasoline there is considerably pricier.

Another example highlights the differences between utilities as to the pace of their energy transformation and the capital required given that path. Where the pace of the energy transformation is faster, and where the capital additions required are greater (relative to utility revenue requirements at present), utilities and utility regulation need to be even more on the lookout for policies and programs to attenuate utility bill impacts on those residential customers who are affordability challenged.

Income versus Buying Power

With these caveats, we now turn back to the calculation of energy burden. In all its formulations, whether talking about the total energy burden, home energy burden, utility energy burden, or electric energy burden.

The dividend in that calculation is income. But here's another thing to keep in mind. Reported annual income before or after taxes is just one source of buying power for many of the lowest-income households.

In 2023, for example, there were 11.5 million households nationally with annual income before taxes less than $15,000, according to the U.S. Bureau of Labor Statistics, Consumer Expenditure Survey. This category includes 8.5 percent of all American households, roughly one in every twelve.

Their annual income before taxes averaged $7,265. Since their annual expenditures for electric utility service averaged $1,191, their electric energy burden (when only their expenditures for electric service are included) was therefore 16.4 percent. Their average energy burden would be even higher, considerably so, if other energy expenditures were included, as in the total energy burden, home energy burden, and utility energy burden.

Notably, their annual income after taxes averaged $7,880. That was composed of average annual wages and salaries of $2,146 (only 27.2 percent of after-tax income), Social Security, private and government retirement of $2,733, public assistance, Supplemental Security Income, and Supplemental Nutrition Assistance Program of $1,704, unemployment and workers' compensation, veterans' benefits, and regular contributions for support of $192, other income of $431, and personal taxes of minus $615. A quarter of the people in these households were earners and a quarter were adults aged 65 and over.

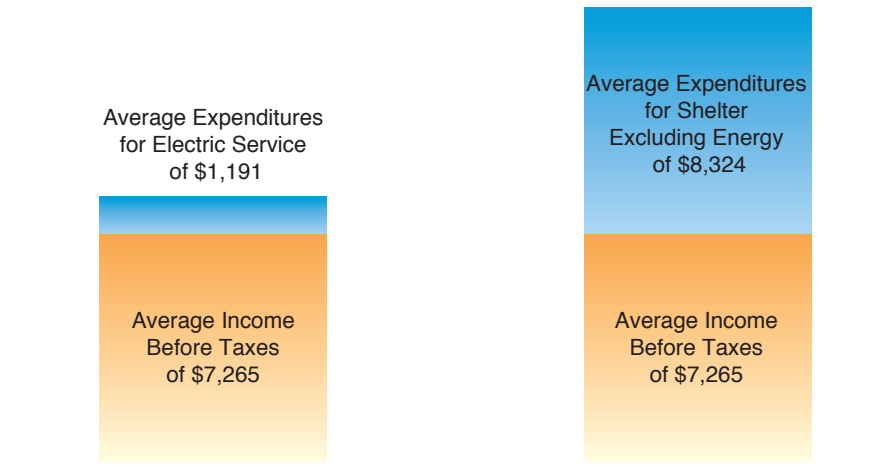
Their annual expenditures for shelter in owned and rented dwellings, excluding utilities and fuels, averaged $8,324. This means the average "shelter burden" for these low-income households, that is, annual expenditures on shelter divided by annual income, was as high as 114.6 percent.

How could a grouping of households spend more on average on shelter than their average income? As in the case of the grouping of the 11.5 million households with annual income before taxes of less than $15,000 in 2023? It is simply because this grouping includes many retired persons living off financial assets, many students financially supported by family, and many others that receive monies not reported as income before taxes.

See Figure 3. And Figure 4 on two categories of low-income households in one of the four Census Regions, the Northeast, as an example of income and regional differences.

Notwithstanding these anomalies, low income is a strong statistical predictor of low buying power and low net savings. And therefore, low income is a strong predictor of households with affordability challenges.

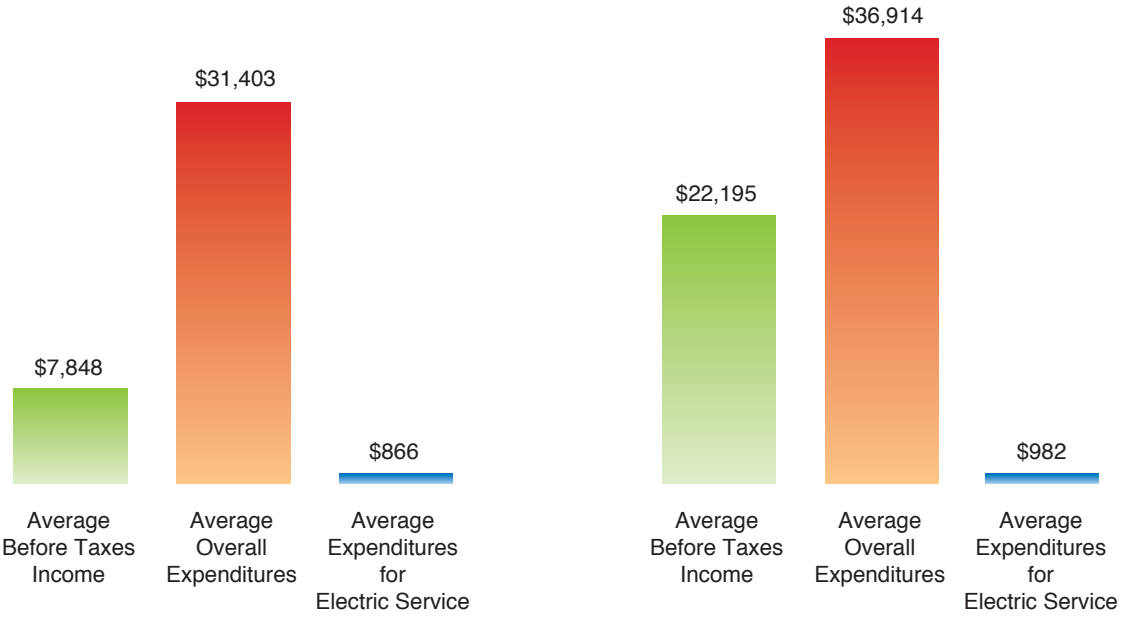
Figure 3: 8.5% of All U.S. Households Nationally in 2023 With Before Taxes Income Less Than $15,000



Source: U.S. Bureau of Labor Statistics, Consumer Expenditures Survey, 2023

For the households of each quintile:
Energy Burden = Average Expenditures for Electric Service / Average Income Before Taxes
Share of Wallet / Buying Power = Average Expenditures for Electric Service / Average Overall Expenditures

Figure 4. Income, Overall Expenditures, Electric Expenditures, Northeast Low-Income Households, 2022-2023



	Average Income Before Taxes, Less than $15,000	Average Income Before Taxes, $15,000-$29,999
Energy Burden:	11.0%	4.4%
Share of Wallet/ Buying Power	2.8%	2.7%

Source: U.S. Bureau of Labor Statistics, Consumer Expenditures Survey, 2023

Exceptions are most significant in households headed by the youngest and the oldest. The income of many of those households are even more substantially supplemented by other sources of buying power like financial assets and support from family. Their expenditures may far outpace their income before taxes biasing the expenditures-to-income relationship for LMI groupings like those with income less than $15,000.

Why Not Shelter Burden, Food Burden, Phone Burden?

Quoting a September 2020 report by the American Council for an Energy-Efficient Economy, "How High are Household Energy Burdens?":

> "High energy burdens are often defined as greater than 6% of income, while severe energy burdens are those greater than 10% of income."

The report's footnote for this statement reads as follows:

> "Researchers estimate that housing costs should be no more than 30% of household income, and household energy costs should be no more than 20% of housing costs. This means that affordable household energy costs should be no more than 6% of total household income."

Much of the research that has led to this contemporary definition of energy burden has been focused on "energy insecurity" and on increasing the penetration of energy efficiency upgrades for the homes of low-income households and those of African Americans, Hispanics, older adults, and renters. Most of the drivers of energy burden pertain to the energy efficiency of a home, appliances, and devices and willingness of households to participate in upgrade programs.

As said earlier in this report, average household income for the lowest-income households accounts for only a fraction of household expenditures because there are other sources of buying power. Since income is the denominator of any energy burden calculation, this can make the result of the calculation large and unrepresentative for heterogenous categories of households like all those residing in a particular large city.

One might ask why energy burden is so frequently invoked to portray the affordability challenges of households and not "shelter burden," "food burden," or "phone burden?" For example, as found by the U.S. Bureau of Labor Statistics, 2023 American Community Survey, the shelter burden of 18.1 million of the 42.5 million renter households nationally exceeded 35 percent. And another 3.9 million of renter households had a shelter burden of 30 to 34.9 percent.

Each of these categories of expenditures like shelter usually take a bigger bite of the buying power of low-income households, than energy does. Each is a necessity as much as is energy.

The answer is utilities and utility regulation can affect expenditures on energy in ways that policy cannot affect expenditures on shelter, food, or phones. At least for what households spend on electric and natural gas utility services, these are litigated in transparent regulatory proceedings; aside from uncontrollable amounts like fuel and purchased power costs.

Share of Wallet/Buying Power

The term "share of wallet" is another easily calculated metric of affordability. As before, in the calculation of energy burden, take a household's annual energy expenditures. Again, sometimes motor gasoline for the household's vehicles is included, and sometimes it isn't included. In either formulation, then divide the household's annual energy expenditures by its annual total expenditures on all goods and services.

As opposed to energy burden, share of wallet looks at energy expenditures (specifically, in this report, electric energy expenditures) relative to total buying power. Rather than just that portion of buying power that comes from reported income before or after taxes.

Which wouldn't make much of a difference for most American households. For most, a very large portion of their buying power comes from reported income. But this is not the case for many low-income households.

The lowest-income households' average annual total expenditures were $32,081 in 2023, for those with below $15,000 before taxes income. Their electric energy share of wallet was therefore 3.7 percent. Their shelter share of wallet was 26 percent. Both metrics are more representative of the circumstances of these households than the electric energy burden and shelter burden metrics of 16.4 percent and 114.6 percent.

It is not just the very lowest-income households. Let us look at the next category, which includes the 17.1 million households with income before taxes of $15,000 to $29,999. It is a large category with 12.7 percent of all American households, roughly one in every eight.

Their annual income before taxes averaged $22,684. Since their annual expenditures for electric utility service averaged $1,386, their electric energy burden (when only their expenditure for electric service is included) was therefore 6.1 percent. Their average energy burden would be even higher, considerably so, if other energy expenditures were included.

Notably, their annual income after taxes averaged $23,211. That was composed of average annual wages and salaries of $7,167 (only one-third or so of after-tax income), Social Security, private and government retirement of $12,926 (more than half of after-tax income), interest, dividends, rental income, and other property income of $310, public assistance, Supplemental Security Income, and Supplemental Nutrition Assistance Program of $1,134, unemployment and workers' compensation, veterans' benefits, and regular contributions for support of $227, and personal taxes of minus $520. Nearly a third of the people in these households were earners and nearly half were adults aged 65 and over.

Their annual expenditures for shelter in owned and rented dwellings, excluding utilities and fuels, averaged $9,079. This means the average "shelter burden" for this second category of low-income households, that is, annual expenditures on shelter divided by annual income, was 40 percent.

Since this second category of low-income households' average annual total expenditures were $35,587, the energy share of wallet was 3.9 percent. And the shelter share of wallet was 25.5 percent. Both metrics are a little more representative of the circumstances of these households than the energy and shelter burden metrics of 6.1 and 40 percent.

An Average of Zero and a Large Number

The reader will recall the extensive discussion above regarding the many and large differences among American households in energy usage and cost, income, savings, etc. The same broad variation applies as well to each category of households.

For instance, let's dig deeper into the category of households with income before taxes of $15,000 to $29,999. These 17.1 million households are quite a large segment of all the households in the U.S., as we said, roughly one in eight.

Again, nearly half of the people in these low-income households were adults aged 65 and over. Which means of course that more than half of the people in these households were younger than 65.

Nearly half of the people in these households that were aged 65 and over were likely to be collecting Social Security. The more than half of the people in these households that were younger than 65 were unlikely to be collecting Social Security. Unlikely though not zero since eligibility for Social Security can start as early as age 62.

As said above, for all 17.1 million households in this category, the average income from Social Security, private and government pensions was $12,926 annually. But very few of these households must receive $12,926. Instead, the distribution was almost certainly zero Social Security, government and private pensions for more than half of the 17.1 million households and amounts well in excess of $12,926 for nearly half of the 17.1 million households such that the average comes out to be $12,926.

Similarly, for the households in this category, the average annual expenditure for natural gas utility service was $343 in 2023. This average is also unrepresentative since a large number of these households did not have natural gas service or if they did, it was only for cooking and perhaps for heating water. The remainder of these households who used natural gas ser-

vice for heating their homes must have had far higher expenditures for gas service. So, the distribution was almost certainly zero for a substantial number of households (who didn't have gas service), considerably less than $343 for another substantial number of these households (who used gas for cooking and perhaps for heating water), and then considerably more for the final substantial number of them (who used it for heating their homes).

Role of Energy in Affordability

But the mission of this report for the utilities industry and utility regulation is to understand affordability. And how to address the challenges facing the American public with respect to a narrow slice of their economic life.

After all, just 2.3 percent of all U.S. consumer expenditures in 2023 was for electric utility service, 0.7 percent for natural gas service, 0.2 percent for fuel oil and other petroleum products for the home, and 3.2 percent for motor gasoline. This according to the U.S. Bureau of Labor Statistics, Consumer Expenditure Survey.

While these are percentages across all one hundred thirty-five million households nationally, with broad variations by region, income, type of home and locality, family size, age, etc., they do show that there are limits to how much utilities and utility regulation can help households they serve, to make ends meet.

To illustrate that these percentages are for all hundred thirty-five million households, masking broad variations, the average income before taxes was $101,805. Clearly, very many of those households have incomes below that level and even well below that level.

And the average monthly electric bill was $146.91. Though the average in the South Census Region where air conditioners run more was $163.50.

To illustrate how these percentages compare with how much American households spend on other goods and services, 2.3 percent of all their expenditures was for vehicle insurance. On a monthly basis, it comes out to $147.90, a dollar more than for electric utility service.

It should be noted that 11 percent of households did not own or lease a vehicle in 2023. So, for the remaining 89 percent of households who did, their insurance averaged significantly more than $147.90, likely more than the $146.91 for electricity.

The Importance of Focus

To further home in on what we shall attempt to discuss in this report, it's certainly common for consumers in all financial circumstances, including those with middle and upper incomes, to feel resentment and pressure from unaffordable prices they see too. Price increases generally and utility rate increases specifically can be scorned by anyone.

But utilities and utility regulation are responsible for ensuring the provision of safe, reliable, resilient, and environmentally-sound utility service to the entirety of their communities. The necessary costs for doing so are shared and socialized by everyone through utility prices (rates). So, the only practical course to do something about affordability is to focus our attention on those LMI households where we can make the greatest difference in their economic lives.

To illustrate this, the thirteen million households with income before taxes of $200,000 and more, averaged monthly electric bills of $195. But that was only 1.4 percent of their expenditures. The thirteen million households with income before taxes of less than $15,000, averaged monthly electric bills of $96. But that was 3.7 percent of their expenditures. Doing something to help the latter households with their electric bills would of course be more impactful on their ability to make ends meet.

Affordability Trends

It is worthwhile to acknowledge that many goods and services and categories of them are broadly affordable. Food is the classic case. Notwithstanding temporary increases in the prices of eggs, milk, meat, etc., the long-term trend is one of decreasing food costs throughout the supermarket shelves, inflation adjusted.

More evidence for this is in the detailed data that the U.S. Bureau of Economic Analysis uses to calculate the Gross Domestic Product. In 2023, 7.8 percent of Americans' consumption expenditures went to pay for

food and non-alcoholic beverages purchased for home use, while in 1959, the first year of the historical data, 19.4 percent went to pay for food and non-alcoholic beverages purchased for home use. The slice of our buying power that goes for food consumed at home has been cut by more than half.

Clearly, Americans are not eating less food in quantity or quality in 2023 as compared to 1959. Though some would criticize the healthfulness of what we eat nowadays.

You might wonder if these numbers are representative considering how often we now eat away from home. But the numbers on that are consistent with our conclusion that food has become considerably more affordable in the last sixty-five years. In 2023, 5.1 percent of Americans' consumption expenditures went to pay for meals at eating places. While in 1959, 3.9 percent went to pay for meals at eating places. Not that much difference there notwithstanding the huge increase in our patronage of restaurants, fast-food joints, coffee cafes, etc.

What about electricity? How has the cost of electric utility service changed from 1959 to 2023?

In 2023, 1.3 percent of Americans' consumption expenditures went to pay for electricity. While in 1959, 1.5 percent went to pay for electricity.

Indeed, this percentage peaked in 1982 and 1983, at 2.3 percent. And the current 1.3 percent is a historical low. Furthermore, the percentage has been a constant 1.3 percent in all but one of the years since 2017 (that exception being 2018.)

Of course, Americans used much more electricity in their homes in 2023 than in 1959. While spending a smaller slice of their budgets for the power. Arguably this makes electric utility service affordable, since we are receiving more for the money we're paying. Though one can say with confidence that well less than a majority of the public consider this to be the case.

Not only are we using more electricity in our homes than sixty-five years ago, but we are also realizing considerably more value from its usage. There are many ways to illustrate this point.

Among them, households are certainly more disrupted today than in the late nineteen fifties if there's an interruption in electric utility service because of a storm outage for instance. Today, a prolonged outage would risk the ease with which we communicate with our phones, travel with an electric car, and work in home offices. In many households, it would risk the necessary operation of medical devices. In many households, a lengthy outage without air conditioning, in high-temperature conditions particularly, carries a health risk as well.

Electricity is Generally Affordable, on Average

Published in late July 2024 by the Bureau of Economic Analysis of the U.S. Department of Commerce, the Gross Domestic Product report for this year's second quarter was encouraging. It showed the economy continues to grow at a healthy pace. This was largely due to the 5.2 percent increase in total consumer spending from last year's second quarter to this year's second quarter.

In the report's details, the data on what American households paid for electric utility service was also encouraging. Though in this most recent quarter, they spent $258 billion dollars for electricity, on an annualized basis, this amounted to one and one-third percent of their expenditures for all goods and services, or 1.33 percent. That's one and one-third of a penny on every dollar of their total expenditures.

If one looks at what American households paid for electric service in the second quarter of each of the last twenty years, the percent of expenditures for all goods and services was lower in the second quarters of 2023 and 2021, at 1.25 percent and 1.24 percent. This was clearly because of the surge in total consumer spending, the denominator in this calculation, in those pandemic years.

But electricity's percentage of expenditures for all goods and services was higher in the second quarters of all the other years over the last twenty, going back to 2005. And electricity's percentage was considerably higher in the second quarters of all dozen years from 2005 through 2016, always equal to or greater than 1.40 percent.

Indeed, in the great recession years of 2009, 2010, and 2011, second quarter electric bills were as much as 1.57 percent, 1.61 percent, and 1.58 percent of expenditures for all goods and services.

From the second quarter of 2005 to the second quarter of 2024, total consumer spending rose from 8.7 trillion dollars to 19.4 trillion dollars, annualized. That's an increase of 123 percent. Consumer spending on electricity rose as well, though by 109 percent, from $123 billion to $258 billion dollars.

In comparison, consumer spending on natural gas rose by just 2 percent, from $60 billion in the second quarter of 2005 to $61 billion in the second quarter of 2024. And in the second quarter of 2024, consumer spending on natural gas was less than a fourth of consumer spending on electricity.

II. Who is Most Vulnerable to Energy Costs?

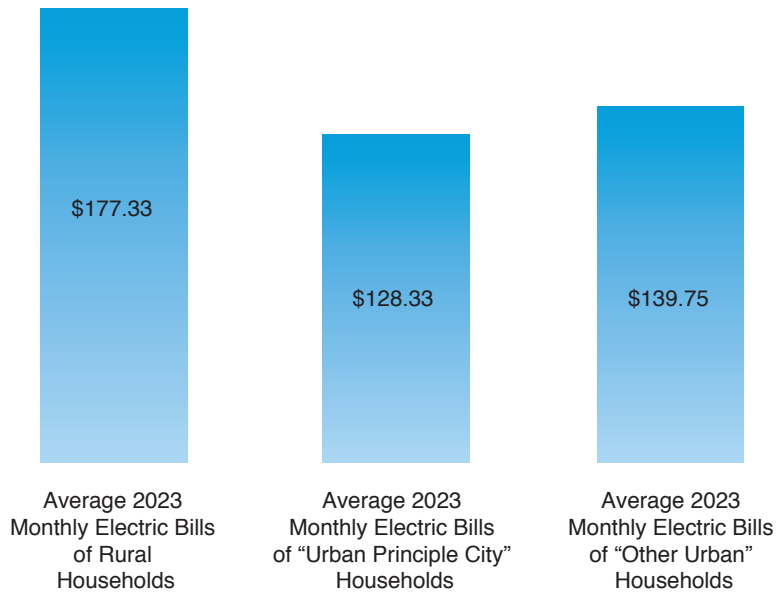
Rural Households Generally Spend Much More on Energy

In 2023, according to the U.S. Bureau of Labor Statistics, Consumer Expenditures Survey, the twenty-six million households nationally that lived outside urban areas averaged monthly electric utility service bills of $177.33. In contrast, the hundred nine million households nationally that lived in urban areas, averaged monthly electric bills of $128.33 for the forty-six million households in the "principal city" and $139.75 for the sixty-two million households in nearby surrounding communities.

In other words, rural electric bills were on average 38.2 percent higher than those in principal cities.

See Figure 5.

Figure 5. Average Monthly Electric Bills of Rural Versus Urban Households



Source: U.S. Bureau of Labor Statistics, Consumer Expenditures Survey, 2023

This difference is not surprising when one considers that in rural America, only 18 percent of households rent, while 82 percent are homeowners. In principal cities, 50 percent of households rent, and 50 percent are homeowners.

Very many renters live in multi-family housing. And if they do not, their single-family home is often smaller than those that are owner-occupied. Multi-family and small single-family homes generally use less energy to heat and cool and so usually use less electricity.

Indeed, in 2021-2022, monthly electric bills averaged $123.08 for the seventeen million households in urban areas with population from one million to two-and-a-half million, $125.67 for the seventeen million households in urban areas with population from two-and-a-half million to five million, and $126.92 for the twenty-one million households in urban areas with population above five million.

All these averages for urban households are well below the averages for rural households.

The households outside urban areas, as a group, spent less on natural gas than did those in urban areas. But those outside urban areas spent far more on fuel oil and other fuels like propane.

Rural households also spend more on motor gasoline, of course, further driving up their energy burden and share of wallet/buying power. These households average 2.5 vehicles per household, greater than the average of 1.5 vehicles for households in principal cities.

The households outside urban areas averaged monthly gasoline expenditures of $271.25 in 2023. In contrast, households that lived in principal cities averaged monthly gasoline expenditures of $185.33. In other words, rural gasoline expenditures were on average 46.4 percent higher.

African American and Hispanic Households

Notably, just 7 percent of rural households' "reference person" were African American and just 6 percent were Hispanic. The proportions of African Americans and Hispanics as reference persons of households in principal cities, in comparison, were 19 percent and 22 percent respectively.

Since energy costs for households in cities and suburban communities were considerably lower than for households in rural America, all other things being equal, energy costs of African Americans as a group and Hispanics too tend to be moderate as compared with other households in the U.S. In absolute terms, that is, in dollars.

In 2023, monthly electric bills for all one hundred thirty-five million households nationally averaged $146.92. For the eighteen million African American households (that is, the reference person in the Consumer Expenditure Survey is African American), monthly electric bills averaged $147.75. For the twenty-one million Hispanic households, monthly electric bills averaged $144.25.

It is important to note that 51 percent of those African American households are renters and with just 49 percent owning their home. Similarly, for Hispanics, 54 percent are renters and just 46 percent homeowners. While for all American households, only 35 percent are renters and 65 percent are homeowners.

The average monthly electric bill nationally for renters was $107.08 in 2023 and for homeowners it was far greater, at $168.25. African American and Hispanic households disproportionately live in rented apartments with lower electric bills. Though they disproportionately live in the South Census Region with higher electric bills.

See Figure 6.

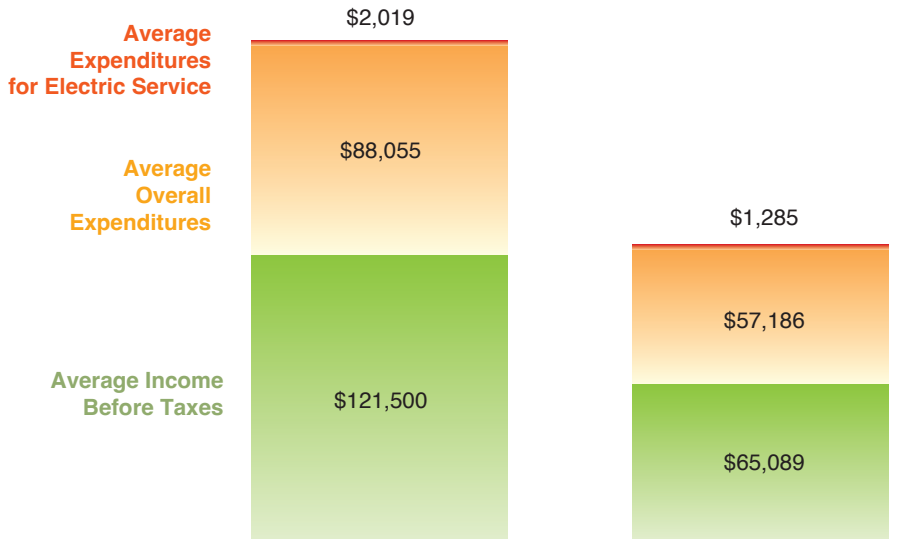
However, African American households averaged income before taxes in 2023 of $73,095 and total expenditures of $58,057. Hispanic households averaged income before taxes of $83,253 and total expenditures of $66,630. In contrast, average income before taxes for all households nationally was $101,805 and average total expenditures was $77,280.

The average electric energy burden, for electric utility service only, was 2.4 percent for African American households, 2.1 percent for Hispanic households, and 1.7 percent for all households nationally. And the average share of wallet/buying power, for electric util-

ity service only, was 3.1 percent for African American households, 2.6 percent for Hispanic households, and 2.3 percent for all households nationally.

African American and Hispanic households do pay relatively moderate electric bills on average. But they tend as a group to have less income and less total expenditures, driving up their energy burden and share of wallet/buying power.

Figure 6. Renters versus Homeowner Electric Bills, All U.S. Households, 2023



	All U.S. Homeowner Households	All U.S. Renter Households
Energy Burden:	1.7%	2.0%
Share of Wallet/ Buying Power	2.3%	2.3%

Source: U.S. Bureau of Labor Statistics, Consumer Expenditures Survey, 2023

For the households of each quintile:
Energy Burden = Average Expenditures for Electric Service / Average Income Before Taxes
Share of Wallet / Buying Power = Average Expenditures for Electric Service / Average Overall Expenditures

And Renters are Generally Low Income

According to the latest Survey of Household Economics and Decisionmaking fielded October 20 through November 5, 2023, by the Board of Governors of the Federal Reserve System, summarized in its May 2024 report, "Economic Well-Being of U.S. Households in 2023," for those surveyed with family income less than $25,000, just 26 percent are homeowners. This percentage jumps to 48 percent for those with family income of $25,000 to $49,999, 69 percent for those with family income of $50,000 to $99,999, and up to 87 percent for those with family income of $100,000 or more. These numbers further support the connection between households who are renters, their lower energy expenditures in general, and their lower household income in general.

See Figure 7.

The U.S. Census Bureau, 2023 American Community Survey also provides data on the income of owner-occupied households versus renter-occupied. For example, 9.9 percent of owner-occupied households had income below $25,000 in the past twelve months. That's about one in every ten such households. While 25 percent of renter-occupied households, that is, one in every four such households, had income below $25,000 in the last twelve months.

Income, Expenditures, Buying Power

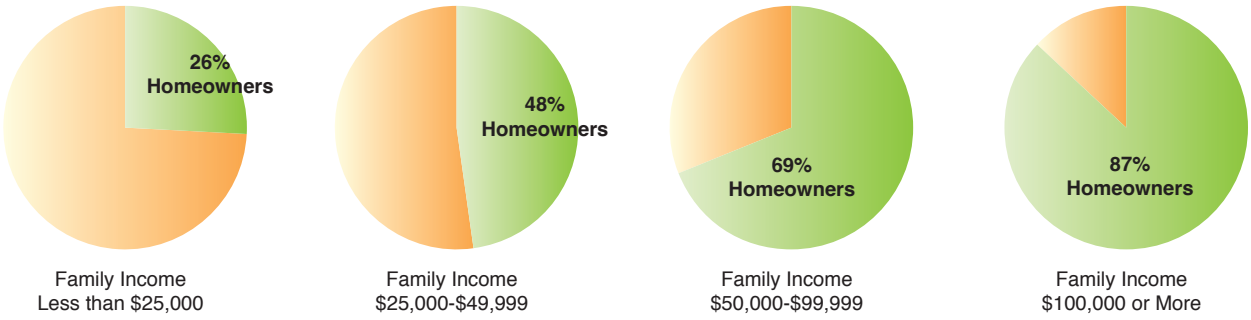
A household's total expenditures, as well as its accessible rainy-day funds, are more likely to be small, relative to American households generally, if its income is relatively small. In particular, LMI households consistently average substantially lower expenditures across virtually all categories of goods and services than medium- and high-income households, including electric and natural gas utility bills.

There are many LMI households with total expenditures well in excess of their reported income before and after taxes, as we have said earlier in this report. Such as those made up of retired persons living off financial assets, and those made up of students financially supported by family.

Nonetheless, for American households overall, total expenditures and income are highly correlated. The numbers show that the lowest-income households average a basic level of expenditures on all goods and services. And that as household income increases from those with the lowest-income, household total expenditures consistently increase too.

To demonstrate the correlation between household total expenditures and income, we again refer to the U.S. Bureau of Labor Statistics, Consumer Expenditure Survey. In 2023, the following are the averages for income before taxes and total expenditures for nine income levels of American households:

Figure 7. Lower Income Level Households are Mostly Renters and Not Homeowners



Source: Board of Governors of the Federal Reserve System, Survey of Household Economics and Decisionmaking, October 20 through November 5, 2023

Average Income Before Taxes	Average Total Expenditures	Number of Households
Less than $15,000	$32,081	11,492,000
$15,000 to $29,999	$35,587	17,114,000
$30,000 to $39,999	$47,027	11,137,000
$40,000 to $49,999	$50,204	9,814,000
$50,000 to $69,999	$59,461	17,068,000
$70,000 to $99,999	$71,899	18,939,000
$100,000 to $149,000	$90,677	22,396,000
$150,000 to $199,999	$117,818	11,237,000
$200,000 and more	$174,993	15,359,000

Notably, the two categories of highest-income households, those with income before taxes of $150,000 to $199,000, and those with $200,000 and more, have an average before taxes income of $171,339 and $335,248 respectively. Those averages are as much as twenty-four times and forty-six times the average income of the lowest-income households, $7,265. Yet the average total expenditures of those two categories of highest-income households are just four times and five times the average total expenditures of the lowest-income households.

This dynamic reflects the far greater consumption to savings ratio of the lowest-income households. And, as economists might term it, how much dearer every dollar of expenditures is to those with the least income.

Those households with the least income, with the greatest consumption to savings ratio, have little or no room for error. When that rainy day arrives, with higher-than-normal costs coming in left and right, there's rarely sufficient funds to take them through the cash crunch. If this happens in the same month as when utility bills peak, the crunch can become a crisis.

Lowest Income Quintile

There is strong logic for focusing on the lowest income quintile of households when there is a desire to understand the toughest affordability challenges, track the trends over time, and most importantly address them meaningfully. If only because, according to the U.S. Census Bureau, Household Pulse Survey, between fifteen and twenty percent of households across most demographic cuts have problems paying their energy bills consistently.

And if only because according to the U.S. Bureau of Labor Statistics, in 2023, those twenty percent of households had average monthly income before taxes of $1,299.67, average monthly total expenditures of $2,814.67, and average monthly electric bills of $107.92. Their average electric energy burden (electric utility service only) was therefore 8.3 percent, and their average share of wallet/buying power was 3.8 percent.

See Figure 8.

So, for LMI households, monthly electric and natural gas utility bills (on average), seasonal peak usage bills, and bill increases tend to be a higher percentage of household total expenditures, than for medium- and high-income households. Making the increases more likely to significantly diminish their capacity to continue making expenditures for necessities and other goods and services they regularly purchase.

And the inevitable month-to-month and seasonal volatility of electric and natural gas bills are more likely to significantly diminish their capacity to continue making expenditures for necessities and other goods and services they regularly purchase. These trends are exacerbated when LMI households live in large single-family detached homes with large interior volumes to cool and heat.

Inability to Pay Energy Bills

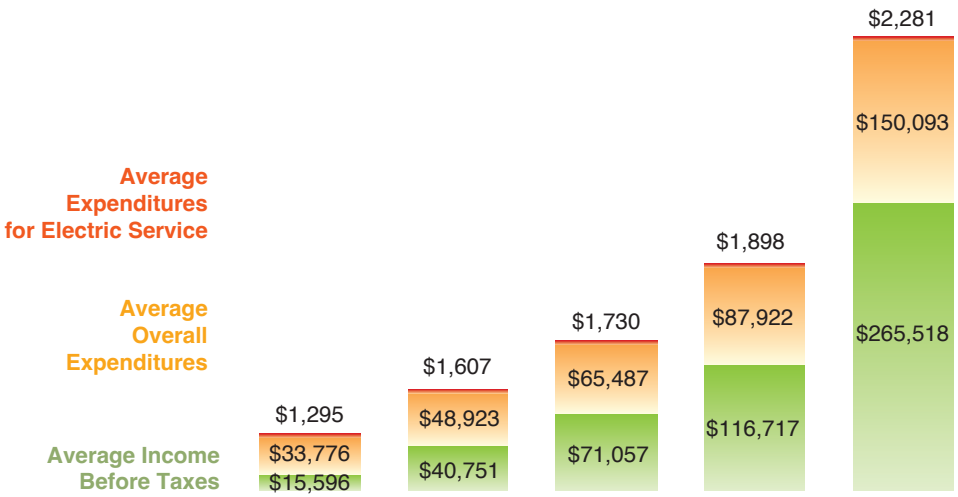
The U.S. Census Bureau sent its Household Pulse Survey to a million households for the period of June 25 through July 22, 2024 and received more than seventy thousand responses. It found that 5.4 percent of the adults are in households that were unable almost every month to pay an energy bill or its full amount.

9.1 percent of the adults are in households that were unable for some months to pay an energy bill or its full amount. And 8.6 percent of the adults are in households that were unable for one or two months to pay an energy bill or its full amount.

The Household Pulse Survey further found that 9.8 percent of the adults in Black households were unable almost every month to pay an energy bill or its full amount. 16.5 percent of the adults in these households were unable for some months to pay an energy bill or its full amount. And 12.3 percent of the adults in these households were unable for one or two months to pay an energy bill or its full amount. Just 61.4 percent haven't experienced this problem.

And the Household Pulse Survey found that 12.3 percent of the adults in households with less than $25,000 in household income were unable almost every month to pay an energy bill or its full amount. 17 percent of the adults in these households were unable for some months to pay an energy bill or its full amount. And 12.1 percent of the adults in these households were unable for one or two months to pay an energy bill or its full amount. Just 58.5 percent haven't experienced this problem.

Figure 8. Electric Bills by Before Taxes Income Quintile, All U.S. Households, 2023



Source: U.S. Bureau of Labor Statistics, Consumer Expenditures Survey, 2023

For the households of each quintile:

Energy Burden = Average Expenditures for Electric Service / Average Income Before Taxes

Share of Wallet / Buying Power = Average Expenditures for Electric Service / Average Overall Expenditures

Inability to Pay Bills Generally

That Census Bureau Household Pulse Survey for the more recent period of August 20 through September 16, 2024 asked whether there was difficulty paying usual household expenses in the last seven days. Of those adults who answered this question, across the U.S., 17.3 percent said it was very difficult. 19.8 percent said it was somewhat difficult. 28.9 percent said it was a little difficult. And 34.0 percent said it was not at all difficult.

It should not be a surprise that these percentages varied with household income. For instance, of those adults who answered the question, again across the U.S., 13.3 percent had household income less than $25,000. For them, as much as 34.8 percent said it was very difficult to pay usual household expenses in the last seven days. 24.9 percent said it was somewhat difficult. 25.3 percent said it was a little difficult. And just 15.0 percent said it was not at all difficult.

In contrast, we can look at how the 10.3 percent of adults with household income of $200,000 and above answered this question. Only 2.9 percent of them said it was very difficult to pay usual household expenses in the last seven days. Only 6.7 percent said it was somewhat difficult. Only 20.0 percent said it was a little difficult. And the overwhelming majority, 73.2 percent, said it was not at all difficult.

See Figure 9.

The state-by-state variations for this question in the Household Pulse Survey were quite telling, especially for those states with the greatest income inequality. For example, in a recent Household Pulse Survey, in New York, for those adults who had household income less than $25,000, 35.7 percent said it was very difficult to pay usual household expenses in the last seven days. In Texas, 34.6 percent of those lowest-income adults answered this way. In California, 28.1 percent did. In Massachusetts, 30.7 percent did. In Illinois, 25.3 percent did. In the District of Columbia, 36.1 percent did.

More Evidence from the Fed

The latest survey by the Board of Governors of the Federal Reserve System, summarized in its May 2024 report, "Economic Well-Being of U.S. Households in 2023," provides further insight on the inability to pay bills. It found, for instance, that 17 percent of all those surveyed said they did not pay all bills in full in the prior month. Notably, for credit cards, this means they paid less than the minimum payment.

Though the percentage across all those surveyed was 17 percent, the breakdown by race and ethnicity is of interest. It was 31 percent for African Americans and 27 percent for Hispanics, who said they did not pay all bills in full in the prior month.

And the breakdown by types of bills not paid in full in the prior month is also of interest. Among homeowners, 3 percent said they did not pay their water, gas, and electric bills in full. But among renters, 11 percent said they did not pay their water, gas, and electric bills in full.

Figure 9. Difficulty Paying Usual Household Expenses in Last Seven Days, by Income

Household Income	Not at All Difficult	A Little Difficult	Somewhat Difficult	Very Difficult
Less than $25,000	15.0%	25.3%	24.9%	34.8%
$25,000 - $34,999	20.2%	28.5%	26.0%	25.4%
$35,000 - $49,999	24.1%	28.9%	24.0%	23.0%
$50,000 - $74,999	26.7%	33.6%	21.9%	17.8%
$75,000 - $99,999	35.4%	29.9%	18.8%	15.9%
$100,000 - $149,999	43.3%	31.0%	16.0%	9.7%
$150,000 - $199,999	55.9%	28.9%	10.4%	4.9%
$200,000 and Above	73.2%	20.0%	6.7%	2.9%

And among both homeowners and renters, the most prevalent type of bill not paid was indeed their water, gas, and electric bills. Ahead of phone, internet, and cable bills; rent or mortgage; car payments; and credit card minimum payments.

The Fed's survey asked as well whether changes in prices compared with last year made the financial situation worse of those surveyed. Of those with family income less than $25,000, 29 percent said price changes made their financial situation much worse, and 67 percent said at least somewhat worse. In contrast, of those with family income of $100,000 or more, 11 percent said price changes made their financial situation much worse, and 58 percent said at least somewhat worse.

The report by the Fed stated this about the lack of rainy-day funds of many households:

> "Relatively small, unexpected expenses, such as a car repair or a modest medical bill, can be a hardship for many families, especially those without a financial cushion."

When asked whether they could cover a four-hundred-dollar emergency expense completely using cash or its equivalent, 37 percent of those surveyed said they could not do so. Asked another way, 18 percent of those surveyed said the largest emergency expense they could handle using only savings was less than $100.

Another 14 percent said the largest emergency expense they could handle using only savings was $100 to $499. And asked for ways they would cover a four-hundred-dollar emergency expense, the most common answers were, would put it on a credit card and pay it off over time, would just not pay it right now, would borrow from a friend or family member, and would sell something.

Affordability and Equity

We have defined affordability but have not defined the term "equity." So, what do we mean by equity and in particular, "energy equity?"

Quoting from the website of the Pacific Northwest National Laboratory:

> "Energy equity recognizes that disadvantaged communities have been historically marginalized and overburdened by pollution, underinvestment in clean energy infrastructure, and lack of access to energy-efficient housing and transportation. An equitable energy system is one where the economic, health, and social benefits of participation extend to all levels of society, regardless of ability, race, or socioeconomic status. Achieving energy equity requires intentionally designing systems, technology, procedures, and policies that lead to the fair and just distribution of benefits in the energy system."

And quoting from a 2019 Utah Law Review article, "Clean Energy Equity," by Texas A&M University School of Law's Felix Mormann:

> "Policymakers and scholars have historically assessed the performance of clean energy policies through an efficacy-oriented lens and, more recently, through an efficiency-oriented lens. This Article has made the case for adding equity as another first-order consideration in the design, implementation, and assessment of policies to promote the transition to a clean and decarbonized energy economy. Properly defined as the commensurate distribution of costs and benefits, the concept of equity offers a more reliable metric than the competing, normatively charged notions of fairness that dominate the public discourse today. Doctrinally, equity is no stranger to energy law but, rather, deeply rooted in rate design and other staples of public utility law.

For a task as Herculean in scope as the clean energy transition, where timelines are measured in decades and capital requirements in trillions of dollars, it is important to consider not only the equity of the end goal of decarbonization. Rather, any inquiry should logically begin with the distribution of costs and benefits that policies create along the way. Accordingly, this

Article calls on policymakers and scholars to include both the equity of the desired outcome and the equity of the enabling policy landscape as they craft the next generation of clean energy policies."

What's the application to our analysis of energy affordability? An end goal is that disadvantaged communities, such as those with predominantly low-income African American and Hispanic households, should have roughly similar shares of their buying power taken up by energy expenditures as other households nationally, regionally, and in utility service areas.

And an intermediate goal is that the affordability-challenged households in those disadvantaged communities should be offered opportunities – such as targeted energy efficiency, targeted community solar, and income-eligible discount bill programs – as steps towards that end goal.

III. How Might the Energy System Transformation Affect the Vulnerable?

Affordability, Broadly, is Essential for the Energy System Transformation

The energy system transformation is reimagining how Americans make, move, and consume energy. But while the objective is to slash the emission of climate change gases, another is to do this affordably, and broadly so.

This secondary goal is increasingly well understood. For if the energy transformation is not affordable across demographic groupings, it would adversely affect the economic well-being of many millions of households nationally (and many commercial and industrial customers of utilities too). But if the transformation is not affordable, and broadly so, it would also erode public support to see the transformation all the way through.

The Magic is in the Math of Utility Regulation

There is, however, reason for optimism. Because it can be shown, rigorously, that electric utilities and utility regulation have the tools to pursue the objective of the energy transformation – slashing climate change gas emissions – affordably, and broadly so.

How is this balancing act possible? It is, due to the workings of utility regulation.

Utility regulation intrinsically enables regulated utilities to invest impressive quantities of capital, year in and year out, to keep up and then improve the infrastructure undergirding electric utility service. On a dollar-for-dollar basis, regulation does this extraordinarily efficiently on behalf of utility customers.

This was why utility regulation was adopted by the states in the first place, starting in the year 1907. It is what utility regulation has regularly accomplished in the hundred and seventeen years since. Though this estimable record has hardly been appreciated by all.

Tens of millions of dollars or hundreds of millions of dollars of utility investment can be authorized at the conclusion of a utility regulatory proceeding. The numbers can be that large. Indeed, the sheer magnitude of the numbers can be intimidating when read about in a press account.

Yet, after revenue requirements, class cost allocation, and rate design are litigated during the proceeding, and when the resulting increase in utility return and depreciation is spread thinly across hundreds of thousands or millions of customers, the individual household bill may be increased by a few dollars. Viewed through this lens, customers generally get a lot of value for a cost that is manageable.

Albeit for most though not for all.

Role of Economy-Wide Inflation

Importantly, that increase in the typical bill will then be further diminished. Not only by the workings of utility regulation that, as we said, spreads thinly customer costs of utility infrastructure investment.

Not only directly, in dollars and cents, in what economists call "absolute terms." But indirectly, in what those dollars and cents mean in a customer's buying power, in what economists call "real terms."

That increase in the typical bill in absolute terms will be eroded in the next year. And then eroded again in the subsequent year. And eroded again and again in every year thereafter.

Why? Because of economy-wide inflation.

See Figure 10.

Average expenditures nationally for electric service have increased from 2021 to 2022 and increased again from 2022 to 2023. This increase happens virtually every year. But so too does average expenditures on all goods and services overall, and so too does average before taxes income. In 2021, electric service expenditures were 2.3 percent of overall expenditures and 1.8 percent of income. In 2022, electric service expenditures were again 2.3 percent of overall expenditures and again 1.8 percent of income. And in 2023, electric service expenditures were again 2.3 percent of overall expenditures and had slightly fallen to 1.7 percent of income.

Let's illustrate this factor in household electric bills with an example. It is after all fairly abstract on paper. But quite real in real life.

Suppose for a moment that a utility's typical bill for its residential customers is increased by 5 percent. In dollars and cents. In absolute terms.

Now, let's consider the role of moderate inflation in the economy.

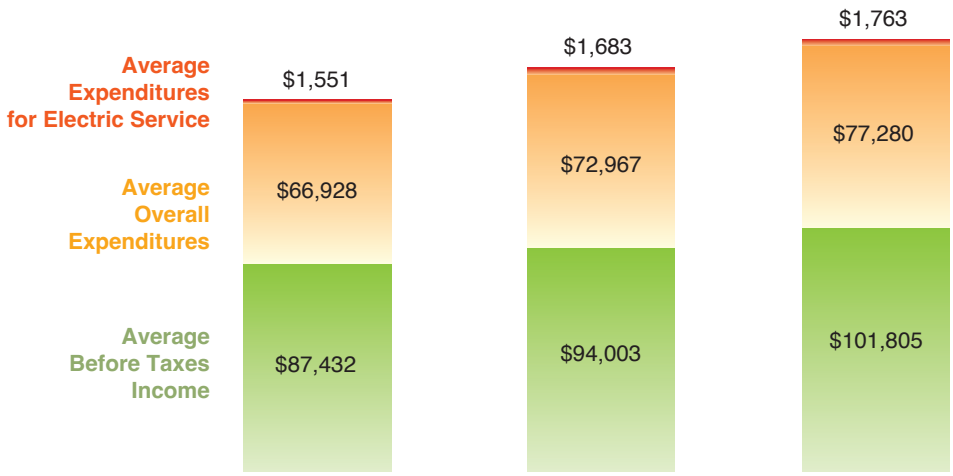
It is worth noting that moderate inflation is actually the norm. Notwithstanding what many in the public might assume. Moderate inflation is preferable for the country's economy to the alternatives, those being no inflation, deflation, or high inflation.

Moderate inflation does raise the prices consumers must pay for the goods and services they need and want. On average. But moderate inflation at the same time raises wages and salaries. And government program payments as well such as Social Security. Again, on average.

So, utility bill increases, if at a rate of increase roughly equal to the rate of inflation, have less effect on the buying power and well-being of households. Then if one only looked at the bill increase in absolute terms. That is, then if one ignored economy-wide inflation.

Back to our example. Suppose economy-wide inflation is 2.5 percent per year.

Figure 10. Income, Overall Expenditures, Electric Expenditures, 2021-2023



	2021	2022	2023
Energy Burden:	1.8%	1.8%	1.7%
Share of Wallet/ Buying Power	2.3%	2.3%	2.3%

Source: U.S. Bureau of Labor Statistics, Consumer Expenditures Survey, 2023

For the households of each quintile:

Energy Burden = Average Expenditures for Electric Service / Average Income Before Taxes

Share of Wallet / Buying Power = Average Expenditures for Electric Service / Average Overall Expenditures

A year after the utility's typical bill was increased by 5 percent, economy-wide inflation will have increased prices, wages and salaries, and government program payments on average by 2.5 percent. This means that in real terms, the typical bill increase is roughly halved. Two years after the typical bill was increased by 5 percent, in real terms, the typical bill increase is roughly zeroed out.

Consider how critical it is to factor in economy-wide inflation. For instance, the average selling price of a home in the year 1960 was $11,900. The average selling price in 2024 is $412,300. This comes out to be a thirty-five-times increase. But that very large scale of the increase is deceiving.

The increase in absolute terms should be adjusted to take into account the role of economy-wide inflation. Which has resulted in an eleven-times increase during the sixty-four-year period since 1960, per the Consumer Price Index. To express the increase in home prices appropriately, one adjusts the increase in absolute terms to the increase in real terms with the CPI.

For Most Though Not for All

Note that we have been using the term, "typical bill." But just because an increase in the typical bill for utility service across the entire residential customer class can have a relatively minimal effect on households on average does not mean that millions of LMI households aren't materially impacted.

Who are these households? How are they impacted? What tools are available to utilities and utility regulation to lessen the impact? Much more on this consequential nuance later in this report.

That said, this remarkable power of utility regulation to thinly spread the costs of infrastructure investment is why, though nearly every major regulated electric utility has invested many billions of dollars over the last decade, the percentage of household expenditures or of income that goes to pay electric bills has not been trending up. Rather, it generally has been holding steady.

And the percent of household expenditures that goes to pay electric bills is at the lowest levels since the data was first compiled by the U.S. Bureau of Economic Analysis and published in its Gross Domestic Product releases. That goes all the way back, nearly seven decades, to the year 1959.

Modeling the Energy Transformation

To evaluate the affordability of electric bills for residential customers, we must do a little math. The core idea here is to show the link between the investment necessary to advance the energy transformation and the effect on a household's electric bills. We do this here by understanding and then exercising the mechanisms of utility regulation with representative numbers.

See Appendix C.

The result of the analysis in the Appendix, with representative assumptions, is telling.

For every dollar of increase in net rate base, a very tiny fraction of a penny must be paid by the individual residential customers. Indeed, that amount is further spread across twelve monthly utility bills in a year.

So, if net rate base is increased by a billion dollars, average residential customer electric bills are increased by $49.40 per year. Or $4.12 monthly.

If net rate base is instead increased by a half billion dollars, the average residential customer electric bills are increased by $24.70 per year. Or $2.06 monthly.

The difference in the two scenarios is $2.06 monthly in the average electric bill. That is, the utility and notably the utility's customers get a billion dollars in infrastructure investment for an average bill impact of $4.12. They get half that, a half billion dollars in infrastructure investment, for an average bill impact of $2.06. Each customer saving, in this scenario, $2.06 monthly, on average. That is, for example, considerably less than an LMI household would save from income-eligible bill programs in place in many States.

The billion-dollar investment by the utility boils down to a 0.08 percent increase in the share of wallet/buying power taken up by electricity. In other words, inflation-adjusted, that's eight-hundredths of one percent. The share of wallet increases from 2.2 to 2.28 percent.

As a result, the percentage of household resources available for all other goods and services as a share of

household total expenditures decreases from 97.8 to 97.72 percent. It falls by that same eight-hundredths of one percent.

Insull's Ingenious Invention

The regulation of electric utilities is an ingenious institution. Its procedures make it practical for utilities to apply capital in extraordinary amounts, as needed, and as approved by regulators, to constantly improve electricity's infrastructure. Regulation delivers these improvements to utility customers with remarkable dollar-for-dollar efficiency.

The triad of revenue requirements, cost allocation, and rate design are litigated during a deliberative regulatory proceeding. Then, when an increase in utility return and depreciation is authorized by regulators, to support as much as billions of dollars of utility investment, the increase is thinly spread across millions of customers. In the end, the individual household bill increases a few dollars monthly.

A fortunate product of these procedures is the electric affordability paradox. Although every major regulated electric utility has invested many billions of dollars over the last decade, the percentage of household expenditures that goes to pay electric bills is generally trending down over the long term and is holding steady over the last few years.

Could the admirable track record of utility regulation continue throughout the energy transformation? There is good reason to think so, given the efficient mechanisms built into regulation.

A number of the Commissioners that we interviewed offered their perspectives on how the energy transformation will impact affordability, and equity. One Commissioner said it will cost more in the near term. But that, perhaps, there will be longer-term benefits that will inure to utility customers. He advises that we should be thoughtful and respectful of what all that entails.

Another Commissioner said that the energy transformation, depending upon how it is implemented, can help affordability and equity. Substituting wind, solar, peaking capacity, and transmission for fuel, and related operations and maintenance and other expenses can be highly cost-effective. Transportation electrification can also help lower customer rates.

See Appendix A of this report for more on what was said in the interviews.

Revenue Requirement Model's Dilutive Mechanisms

It is a remarkable result. Because of the dilutive mechanisms of utility regulation's revenue requirements model, the impact on utility customer bills is comparatively moderate until the rate of investment reaches a very high level.

The costs to support the utility's investment are spread thinly by the basic equation of utility regulation across myriad customers and multiple decades. In this way, the increases in customer rates and bills are tempered.

Indeed, for every dollar of revenue requirements allocated to the residential class, the utility invested approximately eight to nine dollars. This consistent result is simply because of the equation we derived in Appendix C, "The Math of Residential Bill Increases."

IV. What Can We Do to Materially Assist the Vulnerable?

Commissioners' Take

A number of the Commissioners that we interviewed offered their take on how to address energy affordability. One Commissioner talked about Percentage of Income Payment Plans, PIPP, allowing a utility to adjust a customer's bill based on their income so it is more likely to be paid, and arrearages avoided. Another brought up direct efforts like discounts for specific customer groups – seniors, veterans, disabled persons – and indirect efforts such as energy efficiency and weatherization assistance.

Another Commissioner said that the sea change in demand for electricity from data centers, electric vehicles, etc. presents an opportunity to spread fixed costs across that increased demand and, at the same time, stretch the dollars for assisting affordability-challenged households even further.

See Appendix A of this report for more on what was said in the interviews.

Targeting to Be Effective

Electric and natural gas bill affordability, as subsets of energy affordability, is best addressed by utilities and utility regulation by targeting LMI suburban and rural communities (and selected LMI urban communities with predominantly larger single-family detached houses). And by somehow restraining monthly electric and gas bills, bill increases, and bill volatility for them.

Fortunately, such communities account for a remarkably small slice of their utilities' revenue requirements. This provides more flexibility to utilities and utility regulation to target them with policies and programs.

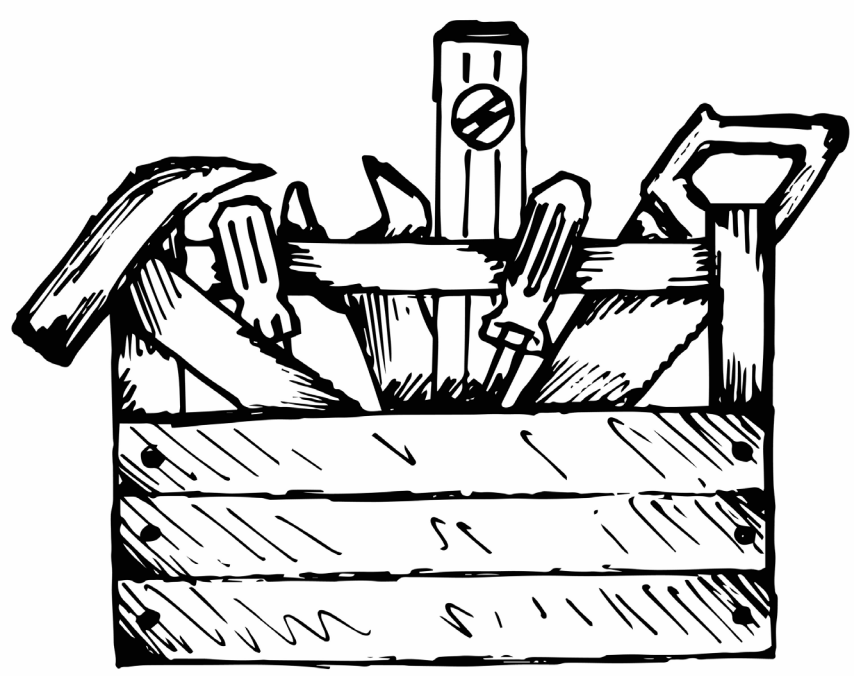
Such as broad-based bill discount tariffs that any low income or government assistance-qualifying customers can sign up for. Or such as stepped-up investment in energy efficiency and community solar focused on communities where these kinds of customers predominate.

See Figure 11.

To illustrate this key fact, that LMI customers are a small slice of all customers from a revenue perspective, we again refer to the U.S. Bureau of Labor Statistics, Consumer Expenditure Survey. In 2023, the lowest income quintile of American households, that is, the twenty-seven million households with the lowest income, paid electric utility bills amounting to just 14.6 percent of the amount paid by all households. Though they were 20 percent of all households.

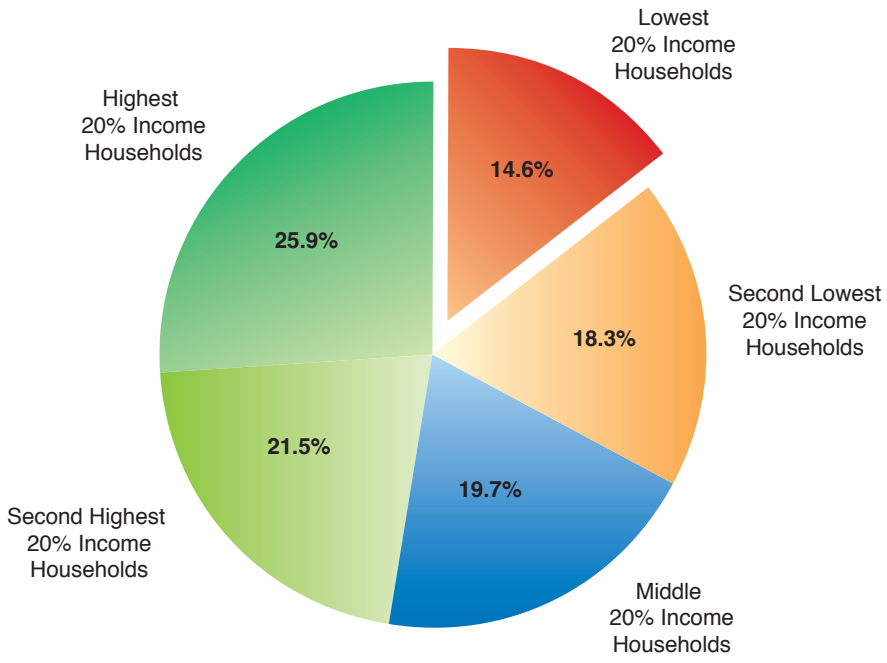
See Figure 12.

Figure 11. In Toolbox of Utilities and Utility Regulation That Can Materially Help Affordability-Challenged Households



Targeted Energy Efficiency
Targeted Community Solar
Income-Eligible Bill Programs

Figure 12. Small Share of Utility Revenue Requirements by Lowest Income Households Provides Flexibility



Source: U.S. Bureau of Labor Statistics, Consumer Expenditures Survey, 2023

And this lowest income quintile paid natural gas utility bills amounting to just 12 percent of the amount paid by all households. Though as in the case of electric bills, they were 20 percent of all households.

So, for a utility with a residential class cost allocation of 40 percent, if the lowest income quintile of the residential class was 14 percent, this means that only 5.6 percent of all the utility's revenue requirements across all rate classes is paid by lowest income quintile households. Somehow restraining that amount to some degree would thus have no more than a small effect on all other utility customers that have been covering 94.4 percent of the utility's revenue requirements.

In a litigated base rate proceeding, at least one party could be expected to argue that this is cost shifting or cross subsidization. Another party might argue that if the effect on all other customers is minimal and on the order of pennies per month for other residential customers, then consideration should be given to differences in customers' abilities to pay and how the broad public interest can be served by lessening somewhat energy's share of wallet for the most affordability-challenged households.

Let's run the arithmetic to illustrate this dynamic. Suppose the aggregate utility bills of this lowest income quintile of the residential class were somehow reduced, quite substantially, by 10 percent. This means that these households that were paying 5.6 percent of the utility's revenue requirements would start paying around 5 percent.

Which also means that the remaining residential customers and all the commercial and industrial customers would need to, among themselves, pick up that missing 0.6 percent of revenue requirements. This would have the effect of raising their utility bills by around 0.6 percent.

The bottom line? Reducing the bills of the lowest-income quintile of the residential customers by 10 percent would only necessitate raising the bills of all other utility customers by 0.6 percent. For a monthly residential bill of one hundred dollars, shifting costs in this way would translate into sixty cents more for those not eligible for the discount.

Targeted Community Solar

According to a February 2024 report by the National Renewable Energy Laboratory, entitled "Technical Potential and Meaningful Benefits of Community Solar in the United States," community solar could ultimately serve the 42 percent of households nationally that are unable to adopt behind-the-meter solar, including LMI households. A scenario in the report projects that as many as six hundred and thirty thousand LMI households could participate in community solar with electric bill savings for these households of at least 20 percent.

The Solar Energy Industries Association states at its website that at least nineteen states and the District of Columbia have policies and programs that encourage community solar.

A Commissioner we interviewed told us that all community solar subscribers in his State are guaranteed savings equal to a substantial percentage of their electric bills. And more than half of the subscribers are earmarked for LMI customers. See Appendix A for all the interviews.

Targeted Energy Efficiency

The U.S. Department of Energy has estimated that the average household is wasting 10 percent to 20 percent of its energy bills from drafts, air leaks around openings, and outdated heating and cooling systems. And that energy bills could be reduced by as much as 30 percent from a range of energy efficiency improvements.

The potential for savings varies, naturally, depending on the household's home and their energy usage prior to such improvements. For example, whether it is a detached single-family house or an apartment in multi-family building. Whether it has a large or small interior volume to cool and heat. Whether the household has four or five or more persons living there or just one or two.

That being said, if a household with less-than-average energy usage increases the efficiency of their home and the appliances within it, this may mean several tens of dollars of utility bill savings during a peak usage month. And if that household is LMI, sav-

ing this amount of money could indeed be a material positive difference.

Rate Design

Suppose a proceeding in utility regulation is considering a rate increase that would increase the monthly bills paid by each residential customer by an average of $5.00 per customer. If the utility has two million residential customers, the residential class revenue requirement that is being contemplated would be $10 million per month, equivalent to $120 million per year.

In the rate design phase of the case, a party might propose that this entire amount be collected from customers through their monthly customer charge. Another party might take the opposite position, proposing that this entire amount be collected from customers through their monthly per kilowatt-hour energy charge.

How do these two rate design proposals compare? In terms of their impact on those customers challenged by affordability generally. And in terms of their impact on them during peak usage months particularly.

The proposal that the entire amount be collected from customers through their monthly customer charge has a simpler impact. Every residential customer from the one with the lowest income to the one with the highest income will pay $5.00 more per month.

For the customer with the highest income, the additional $5.00 per month will be virtually insignificant. On a monthly basis that customer may have an income well north of a $100,000 and total expenditures on all goods and services well north of $25,000. So, their energy burden would rise by 0.00005 percent, or five-hundred-thousandths. And their share of wallet/buying power would rise by 0.0002 percent, or two-ten-thousandths.

For the customer with the lowest income, the additional $5.00 per month would instead be significant. On a monthly basis that customer may have an income of not much above zero (let's assume $500), and total expenditures on all goods and services of say, $1,000. So, their energy burden would rise by 0.01 percent, or one-hundredth. And their share of wallet/buying power would rise by 0.05 percent, or five-thousandths.

More tangibly, paying that extra $5.00 would mean spending $5.00 less on other goods and services that the customer needs and wants, and has been buying. Not much of a concern for that customer with the highest income. But likely a concern for that customer with the lowest income.

The proposal that the entire amount be collected from customers through their monthly per kilowatt-hour energy charge has a more complicated impact. Every residential customer has their own usage of kilowatt-hours and that varies of course through the months of the year, peaking in some months.

Suppose that the $5.00 per month per residential customer varies throughout the year such that during the three summer months kilowatt-hour usage is two and a third times the annual average, that during the three winter months kilowatt-hour usage is at the annual average, and that during the six spring and fall months kilowatt-hour usage is half the annual average. If you do the arithmetic, you will see that the numbers in this example do come out to the annual average.

So, for the average residential customer, the "typical bill increase" on a monthly basis would come out to $11.67 for the three summer months, $5.00 for the three winter months, and $2.50 for the six spring and fall months. And for that affordability-challenged residential customer, if their kilowatt-hour usage was average, they would see $11.67 more in their electric bill during those three summer months. An amount that would be 1.2 percent of their expenditures in those months, a now more impactful level that would need to be accommodated in what for them is a very tight budget.

This exercise demonstrates the limitations of the typical bill and typical bill increase formulation. Here, though the typical bill increase was $5.00 per month, this obscured the variation in the bill impact from the variation in kilowatt-hour usage by month for any residential customer, and it further obscured the variation in bill impact from the variation in the income, buying power, and financial circumstances generally; what the classic text "Principles of Public Utility Rates" by James Bonbright et al. called the ability to pay.

For Utility Service Territories Where Usage is Highly Correlated with Income

Now consider an extension of our example in which the affordability-challenged customer has lower than average kilowatt-hour usage annually, notwithstanding the monthly variations. Suppose, for instance, that a residential customer uses half the annual average. This is not uncommon for many low-income households that live in small apartments in urban multi-family housing.

Then, during the three summer months, kilowatt-hour usage is one and a sixth times the annual average, that during the three winter months, kilowatt-hour usage is half the annual average, and that during the six spring and fall months, kilowatt-hour usage is a quarter of the annual average. They would therefore see a monthly bill increase of $5.83 during the three summer months, $2.50 during the three winter months, and $1.25 during the six spring and fall months. For this customer, the bill impact was clearly less disruptive to their ability to buy necessities and other regularly purchased goods and services than if the proposal to recover all the residential revenue requirements through the fixed monthly customer charge was adopted.

Additionally, the annual total bill increase for that LMI customer, when the increase is entirely through the per-kilowatt-hour energy charge of the bill, comes to $32.50. While the annual total bill increase for that LMI customer, when the increase is entirely through the fixed customer charge of the bill, comes out to $60.00.

This suggests that, for the purpose of lessening a utility rate and bill impact on LMI customers, rate design should lean more heavily on the per-kilowatt-hour energy charge of the bill rather than the fixed customer charge of the bill. But, there is another critical consideration to take into account.

Service Territories Where Income and Energy Usage are Proportional and Inversely Proportional

In many utility service territories, kilowatt-hour usage is highly correlated with income. Since those with higher income are more likely to be homeowners rather than renters, and more likely to own single family detached homes with larger spaces to cool in the summer and warm in the winter. Households with lower income in those service territories are more likely to rent their homes in multi-family dwellings with smaller spaces to cool and heat.

However, there is a very important caveat to take into account. There are evidently a number of exceptions around the country to this tendency.

For example, some utility service territories include outer suburban and rural areas with more extreme weather. Such as the inland west coast. These areas could have lower incomes but higher energy usage. Income and energy usage for these service territories overall would then not be proportional, but inversely proportional.

This counter trend can also apply to utility service territories that are very heavily outer suburban and rural. Such as in sections of the northeast and midwest. These service territories too could have many communities with typically low incomes but high energy usage. Income and energy usage for these utilities would again not be proportional, but inversely proportional.

Does a given utility service territory have residential income and energy usage correlation or not? This is an important consideration when assessing whether rate design, specifically changing the mix of fixed and variable charges in residential tariffs, can play a productive role in addressing energy affordability.

Discounts and Income-Tiered Rates for Low-Income Households

California's electric utilities offer 30 percent to 35 percent discounts on the bills of low-income households under the California Alternate Rates for Energy program, or CARE. Another program, Family Electric Rate Assistance or FERA offers an 18 percent discount for households with income just above those eligible for CARE.

Additionally, utility regulation approved in May 2024 an income-graduated fixed charge for CARE and FERA qualifying households. And finally, the Per-

centage of Income Payment Plan or PIPP is available to CARE households in zip codes with the highest incidence of recurring disconnections or that have been disconnected at least twice over the prior year.

Beginning December 2023, Connecticut's electric utilities began offering a two-tier Low Income Discount Rate or LIDR of 10 percent and 50 percent discounts depending upon the household's level of low income and participation in public assistance.

In Illinois, one of its electric utilities proposed multi-tier low-income discount rates in the March 2024 utility regulation proceeding, still under consideration. Another utility plans to propose such a plan sometime this year.

Utility regulation in Massachusetts has approved low-income rates for two electric utilities. And, for a third utility, a five-tiered discount structure for households at different levels of income.

And in New York, electric utilities offer increased discounts in tiers generally based upon a household's eligibility for the Home Energy Assistance Program or HEAP.

There are also utility discount programs for low-income households in effect or shall be shortly, for Alabama, Arizona, Arkansas, Colorado, District of Columbia, Georgia, Kentucky, Louisiana, Maine, Michigan, Minnesota, Mississippi, Missouri, Montana, New Hampshire, New Mexico, North Carolina, Oklahoma, Oregon, Pennsylvania, Rhode Island, Texas, Utah, Vermont, Virginia, Washington State, and West Virginia. Households in those states are eligible if their income is at a particular level or below it, or if they receive government assistance.

Many of the programs offer discounts. Though in some cases, bills are capped.

See Appendix D for a summary of such programs in thirty-three states and the District of Columbia.

Arrearage for Utility Bills of Low-Income Households

Utilities in many states have arrearage programs in place to assist households with past due bills. The Arrearage Management Plan program or AMP in California for example offers a forgiveness amount up to $8,000 per customer for households enrolled in CARE or FERA, that owe at least $500 on their bill for electric and natural gas service (or at least $250 on their gas bill for gas-only customers) and are more than ninety days past due.

In Connecticut, the forgiveness amount is up to $20,000 per customer. To be eligible, the household's income must be at or below 60 percent of the state's median income or receive government assistance for energy and have a past due of $100 or more for sixty or more days.

Similar programs are in effect in Delaware, District of Columbia, Illinois, Maine, Massachusetts, Missouri, New Hampshire, Oregon, Pennsylvania, and Rhode Island.

Addressing Gas Price Volatility

The volatility of natural gas prices is arguably one of the most important factors in energy affordability. If only because an LMI household can encounter a making-ends-meet crisis that comes about when the price of a necessity, like a utility, spikes at a time of the year when in this case, kilowatt-hour or therm usage (and thus the utility bill) typically peaks.

When we think about the tools in the toolbox of utilities and utility regulation, to combat the affordability challenges of many utility customers, some address gas price volatility, explicitly or implicitly. Such as energy efficiency, which can shave the peaks of a household's energy usage, when the weather is extreme especially. And some actions of utilities and utility regulation do not. Such as decisions about a utility's rate base and return with effects on household bills that are fixed, regardless of gas price volatility.

To demonstrate the volatility of natural gas prices, we refer to U.S. Department of Energy, Energy Information Administration, Henry Hub natural gas spot price per million BTU. Though this price has generally remained under $3.00 since February of this past year, 2023, and has often been below $2.00, it was usually over $6.00 during the last two months of 2022 and was over $9.00 during much of the summer of that year. The period of over $3.00 gas prices lasted from June of 2021 through January of 2023.

Of course, households that use natural gas for space heating, as well as for cooking and heating water, must pay peak bills for natural gas utility service during the winter months. Less understood is that the energy costs of all households, whether they heat their homes with electricity, natural gas, fuel oil, propane, or wood, are similarly exposed to the ups and downs of natural gas prices.

That's because the prices for generated electricity from powerplants, certainly in the states that "deregulated" power generation during the 1996 – 2005 decade, but also in the states that did not, are highly correlated with prices for natural gas. The plants that run on that fuel are so often the marginal price-setting generator of electric power. When gas prices spike, the energy component of electric utility bills in those states will jump too.

See Figure 13.

Expenses Beyond the Control of Utility Regulation Model

Whether in the traditional utility regulatory model, setting customer rates for vertically integrated electric utilities, or in the modified version of the model in the restructured states, there are major components of a utility's costs beyond the control of the utility and utility regulation. When those costs spike, as natural gas prices did after Russia invaded Ukraine, or as some equipment prices did during the supply chain bottlenecks during the pandemic, utility costs and thus customer rates are inevitably driven up. So, utility regulation is significantly limited in how it can address energy affordability, aside from the three classes of tools we discussed here.

Figure 13. Year-over-Year Change in Overall CPI and Average Electric Rates, and Spot Natural Gas Prices, August 2012-August 2024

	Year-over-Year Change Overall CPI	Year-over-Year Change Average Electric Rate	Average Natural Gas Spot Price
August 2012	1.7%	-1.2%	$3.72
August 2013	1.5%	2.8%	$4.81
August 2014	1.7%	4.1%	$5.34
August 2015	0.2%	-0.6%	$3.57
August 2016	1.1%	-0.7%	$3.86
August 2017	1.9%	2.3%	$3.74
August 2018	2.7%	-0.5%	$3.72
August 2019	1.7%	-0.1%	$2.86
August 2020	1.3%	-0.1%	$2.79
August 2021	5.3%	5.2%	$4.98
August 2022	8.3%	15.8%	$9.49
August 2023	3.7%	2.1%	$2.62
August 2024	2.5%	3.9%	$1.93

Sources: U.S. Bureau of Labor Statistics, Consumer Price Index, Each August of 2012 through 2024 and Henry Hub Natural Gas Spot Price Averaged Each August of 2012 through 2024

Capital for O&M

One of the most effective ways to reduce a utility's revenue requirements for all customers, those with affordability challenges included, without risking the provision of safe, reliable, resilient, and clean utility service, is to invest capital to eliminate expenses. Utilities are increasingly finding, for instance, that investing in capital to develop artificial intelligence systems can eliminate major categories of expenses while at least maintaining and sometimes raising performance.

Referring to the math of utility regulation discussed earlier in this report, when a utility invests a dollar of capital, its revenue requirements are increased only through the return on capital and depreciation components of the basic equation of utility regulation. Both components together may add only twelve to thirteen cents to annual revenue requirements for every dollar of capital the utility invests.

So, if a utility invests $10 million of capital that has the effect of eliminating $10 million of expenses, then annual revenue requirements would fall by $8.8 to $8.9 million. And if the LMI customers of the utility are responsible for paying 5 percent to 6 percent of the annual revenue requirements in total, then those customers' share would fall by around half a million dollars.

What's So Typical About Typical?

Every utility base rate case proceeding litigates and ultimately decides upon a typical bill increase. But what does that really mean for the utility customer? And if the typical bill increase doesn't quite suffice to fully describe the impact on customers, including those customers facing affordability challenges month-to-month, week-to-week and day-to-day, what stat does?

The explanatory limitations of a typical bill increase for framing the decision and order that concludes base rate cases have been appreciated by few in utility regulation, admittedly. But the limitations are there, nevertheless, and can be more widely understood. Since this longstanding metric is but an average of averages.

The typical bill and typical bill increase are a tradition of utility regulation. They are indeed numbers that are easy to calculate. And easy to communicate to the layman and public.

And they are a standard. One can say, for instance, that this typical bill increase is $2.50 whereas the typical bill increase two years ago was $3.50.

Yet very few of those million residential customers will actually see a $2.31 increase in their monthly electric bill, for example, if that is the typical bill increase that is calculated and communicated. For a variety of reasons. Due to the wide variety of customers.

Which means that the terms "typical bill" and "typical bill increase" are useful for such comparisons. Yet they are not representative of the impact on residential customers writ large because customers vary so very much as does their usage of energy.

First, for virtually any residential customer, their electric bill as well as the increase in their electric bill varies monthly. And it varies quite considerably from season to season.

If they are a heavy user of air conditioning, their summer bill and bill increase will be significantly greater in the summertime as compared to their bill at other times of the year. If they are a heavy user of electric heating, their winter bill and bill increase will be significantly greater in the wintertime as compared to their bill at other times of the year. While in the spring and fall, their bill and bill increase will usually fall short of the typical bill and typical bill increase.

Second, residential customers vary substantially with respect to their usage of kilowatt-hours throughout the year in total. Many households living in large single-family houses use twice or three times the kilowatt-hours of households living in one- or two-bedroom apartments in multi-family dwellings; or even more than that.

What are the consequences of this year-in-total variation? LMI households that are more likely to face affordability challenges are more likely to live in smaller homes. This means they disproportionately use fewer kilowatt-hours than the residential customer class average, annually.

Fixed charges therefore make up a larger propor-

tion of their monthly electric bills, as a generalization, and their bill increase from an infrastructure investment increase would tend to be less than that of the typical bill across all residential customers.

Third, LMI households facing affordability problems of course tend to have lower income and lower buying power for expenditures on all the goods and services they need and want. So even though their bill increase from an infrastructure investment increase would tend to be less than that of the typical bill across all residential customers, as a percentage of income and buying power for expenditures on all the goods and services they need and want would offset some or all of their bills and bill increases being less than the typical bill and typical bill increases.

Conclusions

Utility Regulation's Power Unleashed Again

This report has told the inspiring story – supplemented with some math in Appendix C – of how, as the electric grid was built out in the twentieth century, the enormous investments to do so were translated into customer rates and bills moderate enough to encourage universal adoption of utility service. Much of the credit belongs to the utility regulation model. By thinly spreading across customers and decades, the costs that made those investments possible.

That same story is about to be repeated. This is how the electric grid will be transformed in the twenty-first century.

How the enormous investments necessary to transform the grid will be translated into increases in customer rates and bills moderate enough to be manageable by most households. By most households. But not by all.

Target, Target, Target

As this report has emphasized again and again, households vary so much in ways that are critical to the question at hand. We have made the case herein that it is essential to cast a bright light on these differences to see clearly the energy affordability problem. And to see clearly the practical policies and programs that have a realistic potential to materially help those households experiencing real challenges in making ends meet.

Yes, the value proposition of utility regulation is quite favorable for the average customer. And the value proposition is especially favorable for the households with substantial financial means, for whom paying for energy requires but a slight percentage of their overall buying power.

For those households already pressed to make ends meet, however, the bill increases that will come with the grid's transformation could add noticeably to the pressure on them. In peak energy usage months particularly.

Indeed, for an appreciable number of customers in any utility service territory, it doesn't take very much to lose their balance. Often it must feel they're walking on a tightrope, managing bills that must be paid, for everything from the monthly rent to unanticipated medical or car repair expenses.

It is for this reason that policy and program tools that are available to utilities and utility regulators must be considered. And for the most effective tools in their toolbox, fielded at scale.

If a policy or program more narrowly targets those very households already pressed to make ends meet, it can have a meaningful effect on their bills and a minimal effect on the bills of a utility's other customers. As when an electric utility carefully selects certain lines for hardening (those most vulnerable to severe weather events), significantly improving resilience for the customers in those areas while keeping down to a minimum the bill impact for its customers elsewhere.

Can It Materially Make a Difference?

This leads us to a simple threshold test for whether a policy or program has the potential to materially make a difference for these households, at times when they are most financially stressed.

See Figure 14.

Because for a low-income household with total expenditures per month of as little as $1,000, $10.00 represents 1 percent of their buying power.

True, that may not be a meaningful amount for more affluent households spending several thousands of dollars monthly on goods and services. $10.00?

Figure 14. Simple Threshold Test for the Potential to Materially Make a Difference for Energy Affordability-Challenged Households

Would a policy or program
cut an affordability-challenged household's energy expenditures
by an impactful amount,
particularly in months when energy bills peak,
enabling them to continue buying other goods and services
they need, want, and regularly purchase?

That would be only a tenth of a percent of the buying power of a household spending $10,000 monthly.

But $10.00 might just be meaningful at 1 percent of buying power. And it could really be meaningful if the amount came to 2 percent, 3 percent, 4 percent, or 5 percent of buying power. Which is what $20.00, $30.00, $40.00, or $50.00 per month translates into for that low-income household spending as little as $1,000 monthly. Base rate case decisions concerning a utility's rate base and return, while they are so consequential for other reasons, do not have the potential to materially make this much of a difference for these households. That is, in the range of $10.00 to $50.00 monthly.

If only because the impact on customer bills is diluted across all customers. And is not targeted at those in need, at affordability-challenged households.

The Flexibility to Act

Yet, there is good reason for optimism, as to what we can do at utilities and in utility regulation. Indeed, some states are leading the way.

That affordability-challenged households account for such a minor slice of a utility's overall revenue requirements is a critical factor for utilities and utility regulation to consider. Since targeted help for some number of these households can affect but a fraction of a fraction of overall revenue requirements, utilities and utility regulation have the flexibility to act.

It means that measured relief in the bills of some of the affordability challenged – through low income-qualifying bill discounts, caps, credits, etc., or targeted community solar and energy efficiency, for example – would have, mathematically, a limited impact on the bills of all other customers. That is, on the bills of other households in the residential customer class, and on the bills of customers in the commercial and industrial classes.

Indeed, to the extent there would be some shifting, there would likely be some savings shifting in the other direction. Such as a reduction in arrearage and associated utility costs. Resulting in even smaller changes, net, spread across the bills of 95 percent, 96 percent, 97 percent or more percent of a utility's customers in terms of total revenue requirements.

It may even be possible in some regulatory jurisdictions to further spread the costs of some affordability solutions over the years as we generally do with depreciation of utility investments, to minimize the effects on non-participating customer bills even more. For example, for energy efficiency enhancements for utility customers. These costs are, in fact, investments that arguably have the same long-life benefits as do enhancements in, say, distribution system assets.

Such policies and programs can be win-win for all customers. Targeted meaningful help for households that are pressed particularly in peak energy usage months. While delivering the benefits of the energy transformation with moderate bill impacts for utility customers generally.


Appendices

Appendix A: Commissioner Interviews

Commissioner Perspectives on the Definition of Affordability

We asked eleven Commissioners of state utility regulation about how they define energy affordability and if they think there is a consensus on the definition. The following is what they told us in full:

Chair Jehmal Hudson of the Virginia State Corporation Commission said this:

> "There is no single, universally accepted definition of energy affordability. Nonetheless, most agree this term generally refers to the ability of households to pay for essential energy services, such as electricity, without sacrificing other essentials like food, healthcare and housing. One measure of energy affordability is the percentage of income that a household spends on energy, known as the household's energy burden. Energy affordability programs often seek to reduce the needs of vulnerable or low-income populations, who may be disproportionately affected by high energy costs.
>
> Energy affordability can be influenced by regional differences, including climate, energy infrastructure, and local economic conditions including an area's typical household income levels and energy rates. For example, households in colder climates may spend a higher percentage of their income to pay heating bills in winter than households in temperate climates. What is affordable in one region may not be in another, complicating efforts to establish a uniform definition.
>
> Energy affordability is relevant to stakeholders with distinct priorities and perspectives, including policymakers, utility companies, consumer advocates, and households. Each group's definition of energy affordability is influenced by its viewpoint.
>
> These groups, and the states in which they reside and work, may adopt different policy frameworks to address energy affordability. For instance, some may prioritize direct financial assistance to low-income households, while others may focus on energy efficiency improvements to reduce overall energy consumption.
>
> Changes in the energy landscape, like the transition to renewable energy and technological advancements, as well as broader economic conditions, such as income inequity, unemployment rates, and inflation, also impact the definition of energy affordability. As these conditions change, so might the perception of what constitutes affordable energy as well as the options that energy affordability programs can offer.
>
> The lack of a universal definition allows for flexibility in addressing the unique challenges faced by different regions and populations, but it also creates challenges when attempting to compare or standardize approaches across different contexts and geographies. The ongoing dialogue among stakeholders continues to shape and refine how energy affordability is defined and addressed."

Chair Dave Danner of the Washington Utilities and Transportation Commission said this:

"To me, 'energy affordability' has two components. First, it means that utility customers are paying no more than absolutely necessary for services. Unfortunately, it does not mean "inexpensive."

While we scrub requests for rate increases to ensure that only prudent and necessary costs are passed on to ratepayers, we also have to make sure that companies have sufficient revenue to provide safe and reliable service, attract capital, and comply with applicable laws. Many things are driving costs up right now – a period of inflation, rising labor costs, high insurance premiums, replacement of aging or emitting resources, and capital expenditures necessary to meet load growth. Many of these costs are unavoidable; it's our duty to see that utilities keep these costs as low as possible.

Second, 'affordability' means we have to do what we can to help those who have trouble paying their energy bills. By law, Washington electric utilities must offer low-income tariffs.

All of the regulated energy utilities in Washington have low-income assistance programs and offer payment plans if customers need more time to pay. We have detailed processes that utilities must follow before disconnecting a customer to ensure that we do everything we can to keep that customer's lights on. And by law we don't allow disconnections during extreme weather events.

But there are limits to how much assistance we can provide, as those costs must be socialized among all ratepayers. We have to be mindful of how much we can ask of families that don't qualify for low-income assistance but who are living paycheck to paycheck.

I'm not sure there is a consensus on this. But if revenues do not cover costs, there are only three outcomes. We can push the costs down the road for the next generation to pick up, but that is hardly fair. We can push costs on to shareholders, but then they quit investing, the cost of borrowing goes up, and the costs to customers go up. Or we simply underfund the utilities, but that leads to risks to safety and reliability.

None of those outcomes is acceptable. Rates have to be sufficient to address prudently incurred costs."

Chair Angie Hatton of the Kentucky Public Service Commission said this:

"Energy affordability refers to the ability of consumers to meet their 'energy burden' or the ability to pay for their home energy needs without making sacrifices of other essentials like groceries, medical care, or housing, sometimes referenced in terms of a percentage of household income spent on energy bills. Different definitions may be used depending on what sector is defining affordability, whether it be from the utility industry, government, social reform groups or home energy assistance funds. I think awareness is growing that this is an important social and economic issue, especially in areas of high poverty like eastern Kentucky where I live."

Chair Eric Blank of the Colorado Public Utilities Commission said this:

"For me, affordability is keeping, as best we can, longer-term electric rate growth in Colorado roughly at or below inflation and the national average in a way that is consistent with achieving our environmental, reliability, and safety objectives.

I don't think there is a common definition. In Colorado, something like a third of the custom-

ers (three hundred thousand to four hundred thousand) may be categorized as income qualified. When you add in customers in disproportionately impacted communities and 'income burdened' customers, the definitions include even more customers, such that I'm concerned that it includes so many customers that it may be beyond our resources to materially help.

Given these realities, I've been wondering if we should focus our affordability efforts more on the customers most at risk of disconnect, instead of just using opt-in clean energy approaches that may target support to the most sophisticated customers who may need it the least."

Commissioner Letha Tawney of the Oregon Public Utility Commission said this:

"Oregon PUC staff is delving into this question but there is clearly not consensus or necessarily all the data needed to understand the many dimensions of affordability. It is clear that some households experience the burden of energy costs much more acutely and are more impacted by rate designs and policies such as fees."

Commissioner Maida Coleman of the Missouri Public Service Commission said this:

"I think of affordability as the level at which customers can pay for their utility service without having to sacrifice other essentials, such as food, rent, mortgages or medication. Yes, customers may have to budget for utility costs – as they would any other cost, but they shouldn't face undue hardship simply to pay their light or water bill.

There are several classes of ratepayers, and while an industrial customer may have a different concept of affordability than a residential customer, I think most would agree that rates should be as low as possible while still allowing for service that is safe and adequate."

Commissioner Floyd McKissick of the North Carolina Utilities Commission said this:

"I would kind of define it the way I see it used frequently, which is if a person's paying more than six percent of their gross income on energy, that type of thing. I think that's kind of a generic percentage that's frequently referred to and used in determining whether a person is energy burdened.

At the same time, I've heard of one in seven families spending upwards of fourteen percent of their gross income for utilities.

I don't think there's a common recognized definition, but that's one that's frequently referred to. I think the thing that ought to be considered is not just the percent of income or gross income that's going toward utilities, but to also take in account the type of structure that one is living in, which is a more challenging and difficult thing to do.

Because if you're living in a rather small dwelling, but it leaks energy due to poor insulation, where there's a need for weatherization, or because it has a heating system that's not energy efficient or appliances that are not energy efficient, then you're going to disproportionately pay a percentage of your income toward utilities than you would if you were in an energy efficient dwelling that did not leak or hemorrhage energy. So in my mind, affordability and whether a consumer is energy burdened are inextricably linked."

Chair Steve DeFrank of the Pennsylvania Public Utility Commission said this:

"I believe energy affordability can be broken down into two components. First, it's about achieving an equitable balance. That means the balance to provide access to a vital energy utility

at reasonable rates while ensuring energy utility system upkeep is funded in a fair manner.

Second, it's about ensuring utility service is not a hinderance to accessing a reasonable quality of living. The rates charged to all customers should allow an opportunity for a comfortable quality of living without sacrificing basic necessities.

Having said that, I do not believe there is a consensus on how we define energy affordability. This lack of consensus on what it means makes it challenging for regulators to address these issues."

Chair Pat O'Connell of the New Mexico Public Regulation Commission said this:

"I don't know that there's consensus because it's objectively hard to measure. For me, the concept is your energy bill should allow you to do what you need to do without making tough choices.

So, if you're a residential customer, it's the heat versus eat choice. If your energy is affordable, you don't have to make that choice. If you're a business customer, energy should be low cost enough that you can create the value that you set out to create when you started your business.

So, it differs what it means for any type of customer that makes it hard to just set a number on it and say, above this, it's expensive, below, that's affordable. So that's why I don't think there's consensus other than that's something we're all working to achieve."

Commissioner Zenon Christodoulou of the New Jersey Board of Public Utilities said this:

"Affordability is an important way to frame the energy cost issue. We don't expect energy to be free or necessarily cheap. But it does need to be something that people can pay for without an undue burden or our entire economy would fall apart.

Energy is the building block of world economies; its true value is incalculable. With that significance in mind, it certainly would be helpful to have a universally accepted and understood definition of 'affordable,' but as of yet, a consensus definition does not exist. Regulators, utility executives, and the general public, each have vastly different concepts of affordability.

A definition of energy affordability that I try to stay mindful of is the ability of energy users to pay for their energy consumption without jeopardizing their consumption of other essential expenses like food, healthcare and education.

To achieve energy affordability, the entire industry must respond accurately and quickly to market signals so competitive forces can guarantee the long-term stability of the energy infrastructure at the lowest possible cost. If those dynamics are achieved, then the resulting pricing will reflect market efficiencies and the most affordable pricing that we can hope to achieve.

In the current market, there is a heightened level of urgency as we are experiencing an unusual spike in energy prices. These rapid changes have not given consumers enough time to modify their usage or energy providers enough clarity to react to market opportunities. This will continue to impact affordability in the short term, however one defines it, and will require some new ways of addressing the issue."

Chair Mary Throne of the Wyoming Public Service Commission said this:

"Broadly speaking, affordability means you can pay for your electricity and still pay for your other necessities and have something left over. And affordability means that your utilities have

to be reasonable and with rates that don't take a huge chunk out of the budget.

However, I don't think there's a consensus on the definition of affordability."

Commissioner Perspectives on Incorporating Affordability and Equity

We asked the eleven Commissioners of state utility regulation about how they incorporate affordability and equity into decisionmaking. The following is what they told us in full:

Chair Jehmal Hudson of the Virginia State Corporation Commission said this:

"Incorporating affordability and equity into decision-making processes, especially within the context of public utilities or regulatory bodies, requires a structured approach, and multiple organizations are taking on this important issue. Since 2023, NARUC has partnered with NASEO, NASUCA, and NGA to co-host regional workshops to consider this topic. The partnership's objectives are to identify equity-related challenges and opportunities, spotlight innovative work done by states, and develop actions to address energy equity issues.

Additionally, in July 2024, the Critical Consumer Issues Forum released a report exploring how rate design and other regulatory tools can help mitigate upward pressure on customer energy bills and maximize the value of grid assets. The report developed ten consensus principles in the following three areas: foundational issues of rate design, rate design considerations, and customer education. Acknowledging that rate design is complex, the report reminded decision makers that regional, state, and utility differences with respect to ratemaking must be considered.

Along with rate design, other structures that support energy equity include programs that (i) provide financial assistance or subsidies to low-income households, and/or (ii) invest in energy efficiency improvements for low-income and vulnerable households to reduce energy consumption.

Both types of programs can reduce the percentage of household income needed to pay energy bills. Education about available assistance programs, energy-saving practices, and utility customers' rights empowers consumers to take advantage of resources and activities designed to promote energy affordability.

Importantly, key stakeholders must ensure that energy affordability programs and investments are geographically equitable, providing resources and infrastructure improvements in underserved areas that may have higher energy costs or less reliable service."

Chair Dave Danner of the Washington Utilities and Transportation Commission said this:

"We are in the process of figuring that out. We issued an order two years ago (Cascade Natural Gas, Docket UG-21055 Order 09, August 23, 2022) that offered preliminary guidance to utilities in addressing equity in their operations. We adopted the four tenets of energy equity justice – recognition justice, procedural justice, distributional justice, and restorative justice – developed by the University of Michigan School for Environment and Sustainability and required utilities to convene equity advisory groups and begin to develop equity plans.

Last year, we commenced a rulemaking proceeding (Docket A-230217) with the goal of providing more comprehensive guidance using those four tenets. We also convened a public workshop last April that was well attended and provided us useful perspectives. We have a lot to

learn and I'm grateful that our investor-owned utilities are committed to working with us as we move forward."

Chair Angie Hatton of the Kentucky Public Service Commission said this:

"Although 'affordability' is not a specific factor to be considered in the Kentucky PSC's defined parameters, it underlies every decision in terms of finding 'just and reasonable' rates in areas of the state, both rural and urban, where poverty statistics can't be in good conscience ignored.

Equitable implications of ratemaking have not been recognized until recently, but it seems equity is a topic at most every training and professional meeting of regulatory commissioners I attend these days in an effort to understand the effects. The best way to incorporate equity in ratemaking may be to encourage and ensure that the perspectives of different racial and social groups are represented at public comment hearings and as intervenors in cases, where applicable."

Chair Eric Blank of the Colorado Public Utilities Commission said this:

"We try to incorporate these affordability, rate, and equity considerations into every decision we make."

Commissioner Letha Tawney of the Oregon Public Utility Commission said this:

"A public utility commission's central mandate to regulate for reliable and safe service delivered in a least cost manner is foundational to driving general affordability. Beyond that, the Oregon PUC is striving to understand how rates and policies impact households differently. Several stakeholders have raised specific ideas to address equity in our ongoing rate cases and there is a robust dialogue in Oregon on this issue."

Commissioner Maida Coleman of the Missouri Public Service Commission said this:

"Equity is the fair sharing or distribution of something, and I believe that is what the traditional ratemaking process is about. As a regulator, I am responsible for balancing the interests of the customer and the utility that serves them. Rate cases can be complex, but in the final sum, a just and reasonable outcome is the goal regulators must achieve."

Commissioner Floyd McKissick of the North Carolina Utilities Commission said this:

"I think you almost have to do, if you're making say a major capital investment, an assessment of how equity plays into that picture, how affordability plays into that picture, actually sound analysis to think that out and to see how those competing equities can be balanced. I think that's a critical part of the equation.

So, I think for decision makers, you have to sit there and do what I call an equity impact analysis to take those variables into account when you're making major capital investments.

Or likewise, even if you're involved in a rate case, to think if your rates are going up by a certain percentage, how can you minimize the impact of those who would be impacted substantially with maybe low income and maybe senior citizens and think about what the opportunities are.

Are there opportunities for say, bill assistance programs or customer assistance programs that can offset or mitigate the impact of you say a rate increase for example?

I think right now there are about thirty states that have some type of customer assistance

program or bill assistance program that can help mitigate the impacts upon those that might be disproportionately impacted."

Chair Steve DeFrank of the Pennsylvania Public Utility Commission said this:

"As an economic regulator, affordability and equity are aspects important in all decisions. We must remember that service rates that are affordable to one customer, may not be to another.

As such, regulators must design rates that provide an affordable option for income eligible customers. Such design must be made in an equitable manner that ensures that low-income customer assistance programs are adequately funded and available but still considers any burden rate assistance may have on those customers funding that assistance. Furthermore, we must ensure that those customers who fall behind in their payments, for whatever reason, are given a reasonable opportunity to get caught up through payment arrangements or other means.

Moving on, in general, as energy utility operations and business models evolve, regulators must maintain a keen focus on affordability and equity in all areas of oversight. Not just in rates, but also in quality of service and safety."

Chair Pat O'Connell of the New Mexico Public Regulation Commission said this:

"I know that just the fact of inflation, prices are going up, so try to listen as much as I can when people are having to make those trade-offs I just described, and then that also leads to equity.

We're trying to build new systems. We always want to build a better system tomorrow than we have today. That includes getting to the folks that are most affected by the new choices as soon as possible and listening.

So that is the goal. Harder to achieve than saying what it is that I'm trying to do, though, because when you're out there trying to reach people who have never been listened to before, sometimes it's even hard to identify that they're out there. So, it's more of a pursuit, I think, than a process."

Commissioner Zenon Christodoulou of the New Jersey Board of Public Utilities said this:

"Affordability and equity are bedrock principles at the Board of Public Utilities. Along with reliability and security, affordability and equity are essential to every decision I make as a commissioner.

As state regulators, we are the last line of defense for the ratepayers. In order to effectively protect them from asymmetric market forces, it's our duty to provide safe, reliable, affordable and equitable utility services.

One of the most equitable goals we can achieve is energy affordability for all ratepayers. We are fully aware that different households have different financial responsibilities, and we are committed to ensuring that excessive burdens are avoided to help stabilize communities and the economy as a whole. That is best described by what Governor Murphy has described as a stronger and fairer economy, which will generate significant benefits for New Jersey."

Chair Mary Throne of the Wyoming Public Service Commission said this:

"Our statute, I think, uses the word affordable once. I don't believe it ever mentions equity.

So, I wouldn't say that I, personally, specifically address equity. It's become a little bit of a buzzword. I do focus on affordability. But I think when it comes to equity, general utility principles incorporate a lot of equity components.

Traditional utility rates are based on cost causation and with no cross subsidies between classes of ratepayers. So, in general there is a lot that's baked into utility rate making that includes the concept of equity."

Commissioner Perspectives on How Energy System Transformation Will Impact Affordability and Equity

We asked the eleven Commissioners of state utility regulation how they think the energy transformation will impact affordability and equity. The following is what they told us in full:

Chair Jehmal Hudson of the Virginia State Corporation Commission said this:

"The shift to cleaner, renewable energy sources has significant implications for both energy affordability and equity. The transition's impact on populations and communities can vary widely, potentially creating both new opportunities and new challenges to existing inequities.

Transitioning to renewable energy requires substantial investments in new infrastructure, such as solar panels, wind turbines, and energy storage systems. The costs of such investments can be passed on to consumers through higher energy rates.

At least initially, costs associated with the energy transition could disproportionately affect low-income households, who already struggle to pay energy bills. Over time, however, as renewable energy technologies become more widespread and efficient, the costs of generating and distributing clean energy are expected to decrease. This could lead to lower energy prices in the long run, benefiting all consumers.

Vulnerable and low-income populations in particular may benefit from energy transition-related weatherization programs, the adoption of energy-efficient appliances, and the shift to electric vehicles, the latter of which might reduce consumers' transportation costs. Though the upfront cost of EVs currently is a barrier for low-income households, as EV prices decrease and charging infrastructure becomes more accessible, low-income customers may benefit from their use.

Ensuring that the benefits of the energy transition are distributed equitably and that all communities are supported during this period of change is essential for achieving a just and sustainable future. And regulators must be cognizant of multiple opportunities for inequities to arise.

For example, rural areas might face higher energy costs and slower access to renewable energy infrastructure given their lower population density and longer distances to grid connections, frustrating energy inequities between rural and urban populations. Additionally, states and regions heavily dependent on fossil fuel industries might experience economic challenges, including job losses and higher energy costs, as the switch to renewables progresses. These regions may require targeted support to ensure an equitable energy transition.

Of particular concern are historically marginalized communities, who often inhabit areas with higher pollution levels due to the proximity of fossil fuel facilities. While the energy transition might improve air quality and health outcomes for residents in these communities, such benefits may be accompanied by job losses as demands for certain fuels decline and fewer workers are needed in those industries.

Policy makers need to adopt plans that create new job opportunities in the renewable energy sector and retrain workers to fill them. The renewable energy sector has the potential to offer new jobs, particularly in sectors like solar

and wind energy installation, maintenance, and manufacturing. However, ensuring that these jobs are accessible to workers from all backgrounds and regions is crucial for promoting equity.

The energy transition has the potential to improve both affordability and equity, particularly in the long term, as renewable energy becomes more widespread and cost-effective. [But] without careful planning, the transition could also exacerbate existing inequities and create new affordability challenges, especially for vulnerable populations. Regulators should seek to understand and overcome these challenges."

Chair Dave Danner of the Washington Utilities and Transportation Commission said this:

"With regard to equity, the question really isn't how the energy transition will impact equity, but how equity will impact the energy transition.

Equity, to me, is about developing and strengthening fairness in our procedures and outcomes. It's about eliminating the barriers that have prevented the full participation of historically underrepresented groups. And it's about acknowledging the different circumstances in which people find themselves. We need to make sure that the energy transition doesn't have an undue negative impact on certain groups while favoring others.

With regard to affordability, there is no question that there will be some upward pressure on rates in the short term if we are to achieve our state's aggressive carbon reduction goals. But I think rates will stabilize in the long-term as technologies mature and day-ahead markets develop in the west.

Just as solar and wind costs came down, I expect costs of nuclear and other energy resources will also level off. And we will continue to find new opportunities for energy efficiency.

And remember that there is a cost to not pushing the energy transition. We are already seeing the impacts of wildfires on energy infrastructure and insurance costs, the change in snowpack needed for hydropower, and the extreme weather that demands more peak power. The steps we take now to mitigate those threats can help us avoid even higher costs as we navigate the future."

Chair Angie Hatton of the Kentucky Public Service Commission said this:

"If regulatory commissions aren't careful to include considerations of affordability and equity in their decision making, the energy transition will be particularly hard on those of us who can least afford it. Low-income homeowners have less ability to afford to install solar panels, for instance, and renters won't have that option at all in most cases.

Siting decisions, likewise, need to be made with these considerations in mind to avoid further burdening lower income neighborhoods with noise pollution and unsightly facilities that affect health and quality of life and further degrade property values."

Chair Eric Blank of the Colorado Public Utilities Commission said this:

"If it's done properly, I think it can help affordability and equity. Fundamentally, substituting new 'steel' (wind, solar, peaking capacity, and transmission) for the 'fuel' (fuel, variable O&M, fixed O&M, admin costs, and ongoing capital) associated with aging coal plants can potentially be highly cost-effective. Similarly, if transportation electrification is incented in an appropriate fashion, these investments can increase both

sales and revenues and ultimately help lower rates for all customers."

Commissioner Letha Tawney of the Oregon Public Utility Commission said this:

"Modeling consistently shows that the energy transition can reduce total household energy costs when all is said and done – but the benefits and costs are uneven during the transition.

For example, electric vehicles save a family the cost of gasoline even while electricity costs may be rising. If they cannot buy or use an EV, then they are both paying the higher electricity costs and the cost of gasoline.

We need to be aware of who is benefiting and who is bearing the burdens during the transition."

Commissioner Maida Coleman of the Missouri Public Service Commission said this:

"This is one of the biggest challenges facing regulators today. I'm not aware of any jurisdiction in which utility prices have been going down. Much of today's costs result from updating utility infrastructure. And increases in price have the biggest impact on those who are least able to pay more.

But in the same way that regulators must balance the interests of utilities and the customers they serve, they must also balance the costs and infrastructure upgrades against the benefits they will bring. I am hopeful that many of the upgrades, from smart meters to integrating renewables will pay off in the long run by lower – or at the least – avoided costs to both companies and their customers."

Commissioner Floyd McKissick of the North Carolina Utilities Commission said this:

"It's going to be challenging. I think in the near-term, decarbonizing the electric generating facilities means moving to renewables. It means perhaps putting in greater transmission capacity that otherwise might be required. It means thinking about what other things might be necessary.

Based upon what I'm seeing here in North Carolina, and what I'm hearing is occurring in other jurisdictions short-term; it's going to be more costly, more expensive to transition to a decarbonized way of generating electricity in particular. If you're closing down coal generating facilities, if you're re-evaluating the use of CTs or CC units, if you're looking at other options that are open to us, whether it's onshore wind or offshore wind, they all involve moving into areas where there may not always be experience in all jurisdictions.

Some jurisdictions may have that experience today. Others may not. But it will cost more in the near term. Perhaps they will be longer-term benefits that will inure to rate payers and inure to the utilities as well.

So, we need to be thoughtful about it. We need to be respectful about what that entails.

In some jurisdictions it maybe even [means] rethinking about the criteria that are used in terms of what do they call least-cost planning and whether the least costs should be re-evaluated in terms of greatest long-term benefit.

Because some projects can provide longer term benefit. But may not be cheaper in terms of least costs today.

So, I think utilities and commissioners need to be thoughtful and aware of those things and need to figure out how you balance those competing [qualities] as we move forward. It's not

going to be easy. But I think in the long term, moving to decarbonized electric generation facilities will be not only great for the environment. In the longer-term, it will provide more stable ways of generating."

Chair Steve DeFrank of the Pennsylvania Public Utility Commission said this:

"I believe the energy transition offers an opportunity to ensure the most vulnerable customers are not left behind. But rather, availed continued access to reasonably priced utility service.

There is a significant sea change in demand for electricity: primarily supported by electric vehicle proliferation, increased appliance electrification, and data center growth. This increased volume represents an opportunity to adjust rates for all customers by spreading fixed costs amongst more demand.

Naturally, this would also permit utilities to spread customer assistance program costs amongst more volume. Ideally, energy transformation will allow greater efficiencies in the cost of service to be achieved. Thereby presenting an opportunity to stretch assistance dollars even further."

Chair Pat O'Connell of the New Mexico Public Regulation Commission said this:

"That's a fascinating topic because part of energy transition is we have more choices than we've ever had. And then in some ways with things like the Inflation Reduction Act, we have more assistance to help you make those choices than we've ever had before.

So then affordability and equity, it's really taking something that most of us would prefer to not have to think about, that it's a bill we're willing to pay, and then it allows us to move on and then circling back and saying, gee, is there a choice I can make that will make it more affordable for me and equitable for all?

And then again, going back to equity, reaching out to people who've never been asked that question and helping them make informed choices is part of the energy transition."

Commissioner Zenon Christodoulou of the New Jersey Board of Public Utilities said this:

"We are just scratching the surface of the twenty-first century's energy transition and the positive implications it will generate for generations to come. As we have seen, and will see, investments in energy infrastructure have long-term horizons and even longer-term benefits.

These large scale, society-wide, business decisions will provide more efficient systems that will incorporate new technologies and accommodate new demand. As these realities take hold, the cost structure and reliability of our energy system will be improved for all customers.

As overburdened households typically spend a higher percentage of their disposable income on utilities, the energy transition couldn't come fast enough. It will help make clean energy more accessible and affordable for all communities, including disadvantaged ones, which is one of our core missions at the BPU.

Our Community Solar Program, for example, affords homeowners and renters, who might not be able to install private solar, a chance to enjoy clean energy savings. This is making a huge difference in people's bills and the air we breathe.

Not only are all subscribers guaranteed to save a substantial percentage of their monthly energy bills, but more than half of the program is

earmarked for low- and medium-income participants. This is just one of our programs that provide state-wide opportunities to participate in the green transition."

Chair Mary Throne of the Wyoming Public Service Commission said this:

"Maybe some policymakers have not been as direct as they could have been about the cost of energy transition. It's impossible in our world to invest in a lot of new transmission and generation without some upward pressure on rates.

In Wyoming, we still enjoy some of the lowest rates in the country and it is our hope we can keep our ranking in the changing electricity world."

Commissioner Perspectives on Addressing Affordability and Equity

We asked the eleven Commissioners of state utility regulation about what policy tools they think are most effective for addressing affordability and equity concerns. The following is what they told us in full:

Chair Jehmal Hudson of the Virginia State Corporation Commission said this:

"We learned from the COVID-19 pandemic that energy affordability and equity involve far more than just the ability to pay one's utility bill. Communications, customer protections, and consumer education are also factors that decision makers must consider.

Before the pandemic, utilities used multiple avenues to communicate with customers, particularly vulnerable customers, such as physical locations, which were shuttered at the outset of the pandemic. Accessible communication channels between target populations and state governments and utilities remain a challenge.

Moreover, strong consumer protection regulations are necessary to prevent unfair practices by utilities, such as unjustified disconnections or predatory billing practices, which disproportionately affect low-income households. Educating consumers about available energy affordability programs, energy-saving practices, and customers' rights can empower people to make informed decisions and take advantage of resources designed to help them use less energy and pay for the energy they do use.

Some states, either through legislative action or regulatory decision making at the PUCs, require utilities to offer Percentage of Income Payment Plans (PIPP) as another avenue to improve customer affordability. As the name suggests, under a PIPP, a utility adjusts a customer's energy bill based on the customer's income so that the amount due is more likely to be paid and arrearages avoided. Moreover, state, federal, and utility assistance programs and related tax incentives to improve energy efficiency allow low- and moderate-income customers to install energy efficient upgrades in their homes, lowering monthly energy bills.

A multi-faceted approach is essential for effectively addressing energy affordability and equity concerns. By combining several tools – ranging from rate design and subsidies to regulatory mechanisms and workforce development – policymakers can create a more inclusive and fair energy system that benefits all consumers, particularly those who are most vulnerable.

The key to success is ensuring that these tools are implemented in a coordinated and targeted manner, with a strong focus on community education and engagement and the needs of marginalized populations."

Chair Dave Danner of the Washington Utilities and Transportation Commission said this:

"Our commission doesn't have authority over the siting of energy infrastructure, but the impact of siting decisions on a community can be huge. Siting authorities need to make sure that siting decisions are based on factors that do not unduly impact historically disadvantaged neighborhoods.

One of the most important things we can do is simply broaden the conversation. We directed utilities to convene equity advisory groups, so that they hear directly from those representing vulnerable populations and historically underrepresented communities.

We provide funding to intervenors to make sure we hear from groups that may lack the means to participate in our proceedings. We offer translation services for our proceedings. Utilities are doing their outreach in multiple languages.

We can't presume to know the concerns of others; we need to engage them and hear from them."

Chair Angie Hatton of the Kentucky Public Service Commission said this:

"Direct rate interventions could be utilized such as income-based rate structures with tiered rate plans for low-income customers, lifeline rates (providing minimal utility service at a reduced rate for low-income households), rate discounts for specific customer groups such as seniors, veterans, or disabled ratepayers, and temporary rate freezes or caps for vulnerable populations.

Indirect efforts might also be incorporated such as energy efficiency programs, low-income weatherization assistance, utility bill debt forgiveness programs, linking utility profits to performance metrics, such as energy efficiency or customer satisfaction, strengthening consumer advocate roles in the rate-setting process, and requiring utilities to justify rate increases through rigorous cost-benefit analysis."

Chair Eric Blank of the Colorado Public Utilities Commission said this:

"I think there are limits to our ability to protect income qualified customers in a rising rate environment and perhaps the best thing we can do is keep rates affordable for all customers.

That might involve proper generation, transmission, and distribution planning, with meaningful stakeholder participation; fair and robust resource acquisition processes that encourage competitive market tension and third-party ownership where possible; data driven decision making; aligned utility and customer incentives, so utilities win when customers win, and vice versa; and overall utility and regulatory transparency and accountability."

Commissioner Letha Tawney of the Oregon Public Utility Commission said this:

"Our traditional regulatory tools will likely continue to serve us well, disciplining costs and managing risks through the transition. However, we likely need new tools to address how already burdened households experience the transition.

In Oregon, for example, we've implemented income differentiated bill discount programs and are working to expand ratepayer funded energy efficiency improvements in energy burdened households."

Commissioner Maida Coleman of the Missouri Public Service Commission said this:

"In an increasingly complex regulatory environment, I think there is a smaller margin for error or waste among both regulators and utilities.

We have better computers, better modeling, better metering than ever before. I think if we can use these technologies to better predict demand for utility services, shorten approval time for upgrades, repairs and maintenance, and help ensure that utilities can recover costs in a more efficient and timely manner, [and] we can improve efficiency and lower costs for everyone."

Commissioner Floyd McKissick of the North Carolina Utilities Commission said this:

"In North Carolina, we established a low-income affordability collaborative that met for better part of a year and did a report that probably ranged about three hundred pages. There were twenty-six different stakeholders or so that were involved in that process and came back with concrete recommendations about what might be done.

And what that resulted in, in North Carolina, was the introduction of a customer assistance program, which provided a bill credit amount of forty-two dollars a month for those that were eligible for LIHEAP.

Did that report contain other recommendations? The answer is yes. Do we need to think about what they may be? The answer is absolutely.

As I recall, Michigan established a program. I think it was Expedited Pilot Review for Innovative Pilots, allowing stakeholders and utilities to work together, come up with innovative pilots, and do it on a basis that they would be taken into consideration on an expedited basis. Where you could look and think outside the box about approaches that might be taken to improve affordability, to improve different customer assistance programs, or to support getting more energy efficient programs out into the mainstream. So, I think there are opportunities to do things of that sort."

Chair Steve DeFrank of the Pennsylvania Public Utility Commission said this:

"I believe strong customer assistance programs are the foundation to ensure affordability and equity. These can come in many varieties, whether that be direct rate assistance, grants, or rebates.

Overall, none of these tools work well if customers are not aware of their existence. So, above all else, robust outreach is vital to ensure customers are cognizant of the assistance programs available to them.

In Pennsylvania, we solicited input from stakeholders and put into action initiatives to maximize customer involvement in assistance programs. Simple concepts such as data sharing and uniform applications can go a long way to increasing participation in these much-needed programs.

Additionally, accessibility to the Commission is a key tool. Regulators cannot truly address affordability and equity concerns unless they know the adversities facing customers. Customer involvement can be one of the most important assets for a utility commission."

Chair Pat O'Connell of the New Mexico Public Regulation Commission said this:

"I come from a planning background. And I really do believe that thinking ahead, planning with an end goal in mind, so that might be thinking further ahead than people are used to doing, also allows you then to pick paths that are important.

Either things you definitely want to pursue because they look attractive or things you want to avoid because they look like they're not going to be a long-term benefit. So, when you've defined

those paths, then it gets easier to pick things like the denominators you need so then you can have alignment, and once you have alignment, then you can optimize. So, it really starts with planning and people taking planning seriously and understanding that we don't have all the answers, so let's think about this as choices."

Commissioner Zenon Christodoulou of the New Jersey Board of Public Utilities said this:

"Of course, the oversight of utilities' prudent expenses and tax incentives are two of the most powerful tools that government can use to achieve affordability and equity. The diligent review of expenses that utilities outlay is an ongoing process that the BPU never takes lightly.

Moreover, new energy efficient technologies and utility scale renewable energy projects benefit from the incentives that help lower initial start-up costs and make investments more attractive. New Jersey and states around the country provide countless programs to spur efficiency improving investments and make energy more affordable and equitable for all consumers.

Beyond government incentives and assistance programs, education is the most effective tool that governments, community organizations, and utilities alike can use to improve affordability and guarantee equity. No one should be satisfied with exclusively addressing the rate side of the cost equation.

Usage is often overlooked and is often the only direct means to lower monthly costs for all consumers. Simply using less and being more energy conscious is the surest and most immediate way to lower bills.

I have always emphasized the need for better education and explain how each individual can promote for their own financial well-being by becoming an active participant in their own bill reduction.

Energy affordability and the equity that it brings are best achieved through constant education that can inform consumers about the best time to use their appliances, how to best insulate their homes and how to incorporate energy efficient appliances into their planned purchases. I firmly believe that reducing usage is the best and most immediate way to reduce ratepayer bills. And, if saving money wasn't enough of an incentive, let's not forget the other critical goal that using less energy achieves – reducing harmful emissions and moderating the effects of global climate change. A win-win, if you ask me."

Chair Mary Throne of the Wyoming Public Service Commission said this:

"I think that the most important tools are making sure that Commissioners all do our jobs as regulators to ask the tough questions and scrutinize proposed rates – perhaps not really a policy tool.

Public Service Commissioners cannot do the job alone. The Covid-19 pandemic highlighted not only the scale of the need for utility assistance, but also consideration of the type of assistance needed in a changing energy world. In Wyoming, we rely primarily on LIHEAP, the Low Income Energy Assistance Program, administered through a sister agency, and as in most states, it only applies to home heating. There is little, if any assistance, routinely available for summer electricity bills where even in Wyoming, many vulnerable residents depend on air conditioning. Commissions should also work with our sister agencies to ensure customers are taking full advantage of weatherization and other opportunities to mitigate their utility rates."

Appendix B: Colton's Affordability Model and Energy Burden

According to the website of the American Council for an Energy-Efficient Economy, commonly referred to as ACEEE:

> "The 6% [energy] affordability threshold is based on Fisher, Sheehan and Colton's Home Energy Affordability Gap Analysis. This affordability percentage is based on the assumption that an affordable housing burden is less than 30% of income spent on energy, and 20% of housing costs should be allocated to energy bills. This leads to 6% of an affordable housing burden spent on energy costs, or a 6% energy burden."

Fisher, Sheehan and Colton is a small economics consulting firm based in Belmont, Massachusetts, long led by Roger Colton who co-founded it in 1985. Since 2003, Colton has regularly published calculations of the "home energy affordability gap" for every county in the U.S. Colton's model consists of a series of algorithms based in part on that premise, that an energy burden less than 6 percent means that energy is affordable and that an energy burden equal to or greater than 6 percent means that energy in unaffordable. Energy burden thereby became a commonly used metric.

The 6 percent threshold suggests that if household energy bills in a county average $2,500 per household, then any household with income of $41,667 or less is considered to have unaffordable energy. Though this is a simplification of the model which entails a number of mathematical steps to estimate energy bills particularly. The model does not take advantage of the U.S. Bureau of Labor's Consumer Expenditures microdata that provides the actual energy bills of surveyed households.

The Fisher, Sheehan and Colton website further states that "The 'affordable burden' for home heating and cooling is set at 2% of gross household income." Many households nationally must exceed this percentage and therefore have an unaffordable burden as it is so defined.

Appendix C: The Math of Residential Bill Increases

To evaluate the affordability of electric bills for residential customers, we must do a little math. The core idea here is to show the link between the investment necessary to advance the energy system transformation and the effect on a household's electric bills. We will do this here by understanding and then exercising the mechanisms of utility regulation with representative numbers.

We start out with the tried-and-true revenue requirements formula. This most basic equation of utility regulation is well known by anyone who has participated in the regulatory process.

It is, essentially, as straightforward as this. A utility's revenue requirements are the sum of the utility's return, and the full range of utility expenses, all as determined by regulators.

See Figure 15.

Figure 15. Utility Regulation's Most Basic Equation

Utility's Revenue Requirements = Utility's Return + Utility's Expenses

Now, let us layer in a few complications that are necessary for our analysis. We will break down those two quantities on the right side of the equal sign – a utility's return, and a utility's expenses – into their components.

First, a utility's return, when broken down, is the utility's weighted average of cost of capital multiplied by the utility's net rate base.

Second, a utility's expenses, when broken down, are the sum of the utility's depreciation for the period and its other cost categories.

See Figure 16.

Figure 16. Breaking Down Regulation's Most Basic Equation

Step 1: We first write again the equation from Figure 15:
Utility's Revenue Requirements =
Utility's Return
+ Utility's Expenses

Step 2: We then break down the two terms on the right-side of the equal sign:
Utility's Return =
Net Rate Base
x Weighted Cost of Capital

Utility's Expenses =
Depreciation
+ O&M
+ Fuel/Purchased Power
+ Taxes

Step 3: Then we plug into the equation this greater detail:
Utility's Revenue Requirements =
Net Rate Base x Weighted Cost of Capital
+ Depreciation + O&M + Fuel/Purchased Power + Taxes

Next, let us layer in a few more complications that are necessary for our analysis. We will further break down two of the quantities on the right side of the equal sign into their components. That is, the utility's weighted cost of capital, and the utility's depreciation.

First, the weighted cost of capital, when broken down, is a weighted average of the cost of the utility's debt and the cost of the utility's equity, weighted according to the utility's capital ratio of debt and equity. The weighted cost of capital is expressed as a rate, in percentages.

Second, a utility's depreciation is a complicated calculation based on the useful life of all its assets and how much of each has already been depreciated. But for the purposes of showing how the most basic equation of utility regulation works to enable extensive infrastructure investment with a relatively moderate effect on utility customer bills, we will express depreciation here as a simple function of the utility's net rate base.

This simplification is a reasonable approximation. Since a utility's depreciation and net rate base are generally well correlated.

See Figure 17.

Figure 17. Breaking Down Further Regulation's Most Basic Equation:

Step 1: We first write again the equation from Figure 16:
Utility's Revenue Requirements =
Net Rate Base x Weighted Cost of Capital
+ Depreciation + O&M + Fuel/Purchased Power + Taxes

Step 2: We break down two key terms, Weighted Cost of Capital, and Depreciation:
Weighted Cost of Capital =
(Overall Cost of Debt) x (Debt Percent of Capital Structure)
+ (Overall Cost of Equity) x (Equity Percent of Capital Structure)
Depreciation =
(Percent of Net Rate Base Derived from Depreciation Life Schedules)
x (Net Rate Base)

Step 3: Then we plug into the equation this greater detail:
Utility's Revenue Requirements =
Net Rate Base x [(Overall Cost of Debt) x (Debt Percent of Capital Structure)
+ (Overall Cost of Equity) x (Equity Percent of Capital Structure)]
+ [(Percent of Net Rate Base Derived from Depreciation Life Schedules) x (Net Rate Base)]
+ O&M + Fuel/Purchased Power + Taxes

A Reasonable Assumption About Depreciation

One might ask, why did we make depreciation in Figure 17 a simple function of net rate base? After all, when utilities prepare their applications to regulators to invest capital and accordingly increase their rates, they determine depreciation in quite a complicated process.

Utilities exactingly account for the annual depreciation of the as-of-yet undepreciated original cost of each major asset, asset by asset. Or, in the case of minor assets with lesser original cost, they do this for narrowly defined homogeneous classes of assets, asset class by asset class.

Notwithstanding this exacting procedure for calculating annual depreciation, which is in practice at every regulated utility, year-in and year-out, the arithmetic relationship of depreciation and net rate base can be remarkably consistent. If in year one, depreciation amounted to around one-twentieth of net rate base, it could reasonably be expected that in year two, depreciation would again amount to around one-twentieth of net rate base.

So, we will presume this rough consistency between depreciation and net rate base. This allows us to further simplify the revenue requirements formula for our present purpose, to model the energy transformation's affordability in a clearly understood way.

Assuming Other Revenue Requirements Values

A utility's revenue requirements play a central role in utility regulation. It is this amount that is allocated to the utility's customer classes (residential, commercial, industrial, and tariff subsets of these). The resultant rates – including variable rates per kilowatt-hour used by electric utility customers over the course of a month, and fixed charges per month – are designed to enable the utility to collect all of its revenue requirements from all of its customers in the aggregate.

With the calculation of revenue requirements, class cost allocation, and rate design, and the payment of monthly bills by customers, the utility is able to cover all of its expenses. And earn a return on equity capital to maintain its financial standing with those institutions and individuals who provide the equity and debt capital that is essential for the utility to continue to invest in electricity infrastructure.

So now, we posit a hypothetical with numbers. We'll assume values for the utility's capital structure and its costs of debt and equity. And we'll assume values relating the utility's net rate base and depreciation.

See Figure 18.

Figure 18. Example with Representative Numbers:

Step 1: We make these assumptions using representative values:
Overall Cost of Debt = 6%
Debt Percent of Capital Structure = 55%
Overall Cost of Equity = 9%
Equity Percent of Capital Structure = 45%
Percent of Net Rate Base Derived from Depreciation Life Schedules = 5%

Step 2: Then we rewrite the equation from Figure 17:
Utility's Revenue Requirements =
Net Rate Base x [(Overall Cost of Debt) x (Debt Percent of Capital Structure)
+ (Overall Cost of Equity) x (Equity Percent of Capital Structure)]
+ [(Percent of Net Rate Base Derived from Depreciation Life Schedules) x (Net Rate Base)]
+ O&M + Fuel/Purchased Power + Taxes

Step 3: Plugging in the values from Step 1 into the equation in Step 2:
Utility's Revenue Requirements =
Net Rate Base x [(6% x 55%) + (9% x 45%)]
+ (5% x Net Rate Base)
+ O&M + Fuel/Purchased Power + Taxes

A particularly useful tool of algebra is reorganizing the terms of an equation. It enables one to rewrite and simplify an equation, so it has fewer and more comprehensible terms. Doing so can make it clearer how the dependent variable, in this case, Utility's Revenue Requirements, varies with changes in independent variables, in this case, Net Rate Base.

See Figure 19.

After reorganizing terms of the equation, Utility's Revenue Requirements is written as a simple linear function of Net Rate Base. With a constant defining the function's rate of change (that is, the function's slope if it was shown as a graph).

O&M, Fuel/Purchased Power, and Taxes are still on the right-side of the equation. But here, in this analysis, we will not make any changes to these three variables. Rather, we're focusing on changes to two other variables, Net Rate Base and Depreciation, both of them the consequences of the utility's investment.

Figure 19. Revenue Requirements a Direct Function of Rate Base

Step 1: We write again the equation from Figure 18:
Utility's Revenue Requirements =
Net Rate Base x [(6% x 55%) + (9% x 45%)]
+ (5% x Net Rate Base)
+ O&M + Fuel/Purchased Power + Taxes

Step 2: We next simplify by calculating the weighted cost of capital:
Utility's Revenue Requirements =
[Net Rate Base x 7.35%]
+ (5% x Net Rate Base)
+ O&M + Fuel/Purchased Power + Taxes

Step 3: And further simplify by combining the Net Rate Base terms:
Total Revenue Requirements =
(12.35% x Net Rate Base)
+ O&M + Fuel/Purchased Power + Taxes

Translating Revenue Requirements into Customer Bill Impacts

All of the increase in our hypothetical utility's revenue requirements would not be borne alone by residential customers. The residential class of customers is usually responsible for reimbursing a utility for a third to a half of a utility's revenue requirements. The commercial and industrial classes of customers pick up the remainder of a utility's revenue requirements.

In the example, we will assume the residential classes' allocation of the utility's revenue requirements is equal to 40 percent.

See Figure 20.

That the residential class shares with the other customer classes the responsibility for reimbursing the utility is just one way that a large investment is cut down to size, on the way to an individual household's electric bill. In our example, 40 percent is the responsibility of residential customers and so 60 percent is not.

Another way that a large investment is cut down to size, on the way to a household's bill, has to do with the fact that in the residential class are hundreds of thousands or even millions of households sharing in reimbursing the utility. Indeed, as the number of customers of any class – residential, commercial, industrial – and their energy demand grows, the responsibility for reimbursing the utility is even more thinly spread. This is why there is great interest in the opportunity presented by the robust growth in energy demand from data centers, manufacturing plants, etc. to help utilities and utility regulation further spread costs and thereby restrain customers' electric rates and bills.

In our example, we will assume the residential class consists of one million households. For simplicity, we will assume all of them have uniform electricity usage. Later in this report we will address the wide variation in household electricity usage and the implications of this variability.

Figure 20. Translating to Residential Revenue Requirements

Step 1: We write again the equation from Figure 19:
Total Revenue Requirements =
(12.35% x Net Rate Base)
+ O&M + Fuel/Purchased Power + Taxes

Step 2: Next we focus only on the utility's residential customer class:
Residential Class's Allocation of Revenue Requirements =
Total Revenue Requirements x Residential Class Cost Allocation
= Total Revenue Requirements x 40%

Step 3: And focus on what happens when revenue requirements increase:
Increase in Residential Class's Allocation of Revenue Requirements =
Increase in Total Revenue Requirements x 40%

We are now almost at the end of the analysis. Next, we take that equation in the final step of Figure 20, which looks to solve for the Increase in Residential Class's Allocation of Revenue Requirements, and plug into the right side of the equals sign, the Increase in Total Revenue Requirements in the first step of Figure 20.

Then, we simply divide the Increase in Residential Class's Allocation of Revenue Requirements by the number of residential customers. This will get us to the responsibility for reimbursing the utility to be borne by the individual household.

Since the example is focused on the effect on household bills of utility infrastructure investment, which leads to increases in Utility's Return and Depreciation, we assume for clarity that O&M, Fuel/Purchased Power, and Taxes are constants, and so they do not figure into increases. Acknowledging that a more complex model would incorporate changes in those expense variables too.

The result is telling. For every dollar of increase in Net Rate Base, a very tiny fraction of a penny must be paid by the individual residential customers. Indeed, that amount is further spread across twelve monthly utility bills in a year.

See Figure 21.

Figure 21. Translating to Residential Rate Increases

Step 1: And, plugging in the numbers and substituting in the reorganized algebra from Figure 18:
Increase in Residential Class's Allocation of Revenue Requirements =
40% x {(12.35% x Increase in Net Rate Base)
+ Increase in O&M + Increase in Fuel/Purchased Power + Increase in Taxes}

Step 2: And transitioning to the per customer impact for the one million customers:
Average Increase in Residential Customer's Electric Bills Annually =
[40% x {(12.35% x Increase in Net Rate Base)
+ Increase in O&M + Increase in Fuel/Purchased Power + Increase in Taxes}] / 1,000,000

Step 3: Holding O&M, Fuel/Purchased Power, Taxes constant in this example, simplifies the formula to:
Average Increase in Residential Customer's Electric Bills Annually =
[40% x {(12.35% x Increase in Net Rate Base)}] / 1,000,000
= (4.94% x Increase in Net Rate Base) / 1,000,000
= 0.0000000494 x Increase in Net Rate Base

So, if net rate base is increased by a billion dollars, average residential customer electric bills are increased by $49.40 per year. Or $4.12 monthly.

If net rate base is instead increased by a half billion dollars, the average residential customer electric bills are increased by $24.70 per year. Or $2.06 monthly.

The difference in the two scenarios is $2.06 monthly in the average electric bill. That is, the utility and notably the utility's customers get a billion dollars in infrastructure investment for an average bill impact of $4.12. They get half that, a half billion dollars in infrastructure investment, for an average bill impact of $2.06. Each customer saving, in this scenario, $2.06 monthly, on average.

Sensitivity to Cost of Equity

In the above, we assumed that the most litigated component of the revenue requirements equation, the cost of equity, equals 9 percent. One might ask, what is the sensitivity of the average electric bill impact to a change in the cost of equity assumption?

This sensitivity can be shown simply. Assume that the cost of equity was ten basis points lower, reducing our assumption from 9 percent to 8.9 percent. How would that lower the average bill impact?

This ten-basis points reduction in the cost of equity would drive down the overall rate of return from 7.35 percent to 7.31 percent. It would accordingly drive down that constant we derived in Figure 17, that is multiplied by the net rate base, from 12.35 percent to 12.31 percent. That in turn would drop the constant we derived in Figure 19, after factoring in the residential class cost allocation, from 4.94 percent to 4.924 percent.

Therefore, if net rate base is increased by a billion dollars, the average residential customer electric bill would increase by $49.24 per year, with the reduced cost of equity. Rather than $49.40 per year. Or $4.10 monthly, rather than $4.12 monthly.

The bottom line: a ten-basis point reduction in the cost of equity, on a billion-dollar utility investment, saves the average residential customer two cents monthly. Doesn't really move the needle for customers.

Share of Wallet

The next step is to express the electric bill increase in terms of the "share of wallet/buying power." That is, what does the bill impact mean as a percentage of a household's total expenditures on all goods and services? To do this, we'll first calculate the electric bill's share of wallet prior to an increase, again using representative assumptions. See Figure 22.

Figure 22. Residential Bill in Terms of Share of Wallet/Buying Power

Step 1: Assume further that:
Average Household Total Expenditures = $60,000
Average Residential Customer Electric Bills = $1,320
Average Annual Increase in Household Total Expenditures = 3.5%

Step 2: Since:
Average Percent of Electric Bills as Share of Household Total Expenditures =
(Average Residential Customer Electric Bills / Average Household Total Expenditures) x 100

Step 3: Plugging in the numbers from the assumptions yields:
Average Percent of Electric Bills as Share of Household Total Expenditures =
($1,320 / $60,000) x 100 = 2.2%

Finally, we'll calculate what this all means to the individual household. How it impacts the household's ability to pay for the other goods and services it needs and wants, after paying its electric bill.

The billion-dollar investment by the utility boils down to a 0.08 percent increase in the share of wallet taken up by electricity. In other words, inflation-adjusted, that's eight-hundredths of one percent.

See Figure 23.

We say, inflation-adjusted, because the trends across all demographic groups of households, are that total expenditures for all goods and services increase with inflation year after year. Utility investment may cause electric rates and bills to increase in year one, and then perhaps again in year four, and then perhaps again in year seven. But household total expenditures typically rise in years one, two, three, four, five, six, seven, eight, and nine.

The American household generally has the means to spend more every year and does so. This is even the case for LMI households.

The data tells the story. The following are the average annual total expenditures of lowest quintile households nationally for the last ten years. Their household total expenditures increased each and every year. And the number for the last year, 2022, was 45.6 percent greater than for the first year, 2013.

2013	$22,393
2014	$23,713
2015	$24,470
2016	$25,138
2017	$26,019
2018	$26,399
2019	$28,672
2020	$28,724
2021	$30,869
2022	$32,612

This is, again, on average. Of course, while very many lowest income quintile households are increasing their total expenditures year in and year out, many households are not able to do so and are struggling.

All this demonstrates that electric bills as a percentage of household total expenditures could rise in year one, because of an electric rates and bills increase in that year. But then fall a little in year two, in the absence of an electric increase that year. And then fall a little more in year three, in the absence again of an electric increase that year.

And rise in year four, because of a second electric increase in that year. But fall a little in year five, without an electric increase that year. And fall a little more in year six, again without an electric increase that year. And so on.

This is how the year-after-year increases in household total expenditures help to keep down the electric bills' percentage. Electric bills, much like the prices and charges for almost everything else, go up over any number of years. Nonetheless, the share of wallet/buying power for paying electric bills is generally going down.

Figure 23. Residential Bill Increase in Terms of Share of Wallet/Buying Power

Step 1: Similarly:
Increase in Average Percent of Electric Bills as Share of Household Total Expenditures =
Increase in Average Residential Customer Electric Bills Annually /
{Average Household Total Expenditures x
(Average Annual Increase in Household Total Expenditures + 1)}

Step 2: In our example:
Increase in Average Percent of Electric Bills as Share of Household Total Expenditures =
($49.40 / $60,000 x 1.035) = 0.08%

The percentage of electric bills as a share of household expenditures in our example increases from 2.2 percent to 2.28 percent. That is, by eight-hundredths of one percent.

As a result, the percentage of household resources available for all other goods and services as a share of household total expenditures decreases from 97.8 percent to 97.72 percent. It falls by that same eight-hundredths of one percent.

Appendix D: Electric Utilities' Income-Eligible Programs

The following table summarizes income-eligible bill discount, credit, and cap programs of investor-owned electric utilities in thirty-three states and the District of Columbia.

The oft-used acronym in the table, FPL, stands for Federal Poverty Level.

The source of this research and information is the Edison Electric Institute.

Electric Utilities' Income-Eligible Programs

State	Utility	Type	Program	Discount	Eligibility
Alabama	Alabama Power	Flat Monthly Discount	Low Income Assistance Programs	$14.50 per month.	Receiving SSI or Medicaid for Low Income Families.
Arizona	Arizona Public Service	Discount Rate	Energy Support Program	25% up to $95 or 60% up to $165 per month.	Household income up to 200% of FPL or receiving assistance from approved assistance program.
Arizona	Tucson Electric Power	Flat Monthly Discount	Lifeline Program	$20 per month.	Household income up to 200% FPL.
Arizona	Unisource Energy Services	Flat Monthly Discount	Customer Assistance Residential Energy Support (CARES) Program	$16 per month.	As above
Arkansas	Entergy Arkansas	Sales Tax Exemption	Sales Tax Exemption	Exempted from the sales tax on the first 500 kWh per month.	Annual household income less than $12,000.
Arkansas	Oklahoma Gas & Electric	Flat Monthly Discount	Low-Income Assistance Program (LIAP)	$13 per month.	Qualified for LIHEAP.
California	Pacific Gas & Electric	Discount Rate	California Alternate Rates for Energy (CARE)	Up to 20% per monthly gas bill; 30-35% per monthly electric bill.	Household income up to 200% FPL or someone from household participates in Medi-Cal/Medicaid, CalFresh/ SNAP, TANF/Tribal TANF, WIC, Medi-Cal for Families, LIHEAP, SSI, National School Lunch Program, Bureau of Indian Affairs General Assistance, Head Start Income Eligible/Tribal.
		Discount Rate	Family Electric Rate Assistance Program (FERA)	18% per monthly electric bill.	Household income up to 250% FPL. Household with three or more people.

		Percentage of Income Payment Plan (PIPP)	Percentage of Income Payment Plan (PIPP) pilot programs	If income fits within income guidelines, $32 for electric and $11 for gas, plus taxes and fees. If income is higher than income guidelines, $97 for electric and $32 for gas, plus taxes and fees.	Enrolled in CARE program and located in one of zip codes with highest rates of reoccurring disconnections or have experienced two or more disconnections during the 12 months prior to the disconnections moratorium. Pilots include households with income 0-100% FPL, and 101-200% FPL.
California	Pacific Power	Discount Rate	California Alternate Rates for Energy (CARE)	25% per monthly gas and electric bill.	Household income up to 200% FPL or someone from household participates in Medi-Cal/Medicaid, CalFresh/ SNAP, TANF/Tribal TANF, WIC, Medi-Cal for Families, LIHEAP, SSI, National School Lunch Program, Bureau of Indian Affairs General Assistance, Head Start Income Eligible/Tribal.
California	San Diego Gas & Electric	Discount Rate	California Alternate Rates for Energy (CARE)	Total 35% effective discount.	Household income up to 200% FPL or someone from household participates in Bureau of Indian Affairs General Assistance, CalFresh (Food Stamps) / SNAP, CalWORKs or Tribal TANF, Head Start Income Eligible/ Tribal, LIHEAP, Medicaid/Medi-Cal, National School Lunch Program, SSI, Women, Infants and Children
		Discount Rate	Family Electric Rate Assistance Program (FERA)	18% per monthly electric bill.	Household income 200% to 250% FPL. Household with three or more people.
		Percentage of Income Payment Plan (PIPP)	Percentage of Income Payment Plan (PIPP) pilot programs	$43 plus taxes, fees for electric and natural gas (0-100% FPL); $129 plus taxes, fees for electric and natural gas (100-200% FPL).	Enrolled in CARE program and located in one of zip codes with highest rates of reoccurring disconnections or have experienced two or more disconnections during the 12 months prior to the disconnections moratorium. Pilots include households with income 0-100% FPL, and 101-200% FPL.
California	Southern California Edison	Discount Rate	California Alternate Rates for Energy (CARE)	Up to 30% per monthly electric bill.	Household income up to 200% FPL or someone from household participates in Medi-Cal/Medicaid, CalFresh/ SNAP, TANF/Tribal TANF, WIC, Medi-Cal for Families, LIHEAP, SSI, National School Lunch Program, Bureau of Indian Affairs General Assistance, Head Start Income Eligible/Tribal.
		Discount Rate	Family Electric Rate Assistance Program (FERA)	18% discount per monthly energy bill.	As above. Must be household with three or more people.
		Percentage of Income Payment Plan (PIPP)	Percentage of Income Payment Plan (PIPP) pilot programs	Monthly bill for eligible participants fixed at either $32 or $97 depending on household income.	Enrolled in CARE program and located in one of zip codes with highest rates of reoccurring disconnections or have experienced two or more disconnections during the 12 months prior to the disconnections moratorium. Pilots include households with income 0-100% FPL, and 101-200% FPL.
Connecticut	Eversource Energy	Discount Rate	Connecticut Electric Discount Rate	10% to 50% discount per monthly electric bills.	Households earning less than 60% state median income, households earning up to 160% FPL. Or receiving aid from assistance programs like Connecticut Energy Assistance Program.
Connecticut	United Illuminating	Discount Rate	Low-Income Discount Rate	Up to 50% discount per monthly electric bills.	As above

Colorado	Black Hills Energy	Percentage of Income Payment Plan (PIPP)	Black Hills Energy Affordability Program	Caps bills at 6% of monthly income.	Household income up to 200% FPL. Participate in Colorado Low Income Home Energy Assistance Program regardless of heating fuel type; or applied to Colorado LEAP with eligible household income.
Colorado	Xcel Energy	Percentage of Income Payment Plan (PIPP)	Electric Affordability Program - Percentage of Income Payment Program (PIPP)	Caps bills at 6% of monthly income for electric-only customers. 5% for gas/electric customers using electric as primary heating. 3% for gas/electricity customers using gas as primary heating.	185% FPL or 60% state median income.
		Flat Monthly Discount	Electric Affordability Program - Step Bill Discount (SBD)	20% or 25% for standard residential bill	Household income up to 200% FLP or less than 80% of the area median income.
District of Columbia	Pepco	Flat Monthly Discount	Residential Aid Discount Program	Up to $475 per year on electric bills. About 25% on overall bills.	Household income must meet current income eligibility requirements per Dept. of Energy & Environment.
Georgia	Georgia Power	Flat Monthly Discount	Income-Qualified Discount	$33.50 per month discount for electric service and fuel cost recovery.	Household income below 200% FLP and at least one qualification: 65 years of age or older, receive Social Security Disability Insurance, SSI, participating in the federal Housing Choice Voucher Program (HUD Section 8)
Illinois	Ameren Illinois	Percentage of Income Payment Plan (PIPP)	Percentage of Income Payment Plan (PIPP)	Cap at 6% of monthly income.	Income up to 150% FPL.
Illinois	ComEd	Percentage of Income Payment Plan (PIPP)	Percentage of Income Payment Plan (PIPP)	As above	As above
Kentucky	Kentucky Power	Flat Monthly Discount	Home Energy Assistance in Reduced Temperatures (HEART)	$58 or $115 monthly from January to April.	Determined by local community action agency in accordance with guidelines approved by PSC and availability of funds.
		Flat Monthly Discount	Temporary Heating Assistance in Winter (THAW)	Up to $175 discount January to April.	As above. Customer participation limited to one program each calendar year.
Louisiana	Cleco Corporate Holdings	Discount Rate	Cleco Alternative Rate for Electricity (CARE) Program	25% on fuel portion of bills year-around.	Must meet income guidelines of LIHEAP and enroll through their local Community Action Agency. Customers who receive LIHEAP automatically enrolled.
Maine	Central Maine Power	Flat Monthly Discount	Electricity Lifeline Program (ELP)	Credit up to $1,200 annually.	Based on annual electricity usage, household income. Must reapply every year.

Massachusetts	Eversource Energy	Discount Rate	Discount Rate	42% monthly.	Income meets eligibility requirements and participate in LIHEAP, SNAP, SSI, Veterans Dependency & Indemnity Compensation Surviving Parent or Spouse, MassHealth, School Breakfast/Lunch Program, Emergency Assistance for the Elderly, Disabled & Children, Veterans Non-Service Disability Pension, Public or Subsidized Housing, Commonwealth Care Plan Types 1, 2 or 3A, Transitional Aid to Families with Dependent Children, Health Safety Net Plan, Head Start, Women Infants & Children, and Veterans' Service Benefits (Chapter 115).
Massachusetts	National Grid	Discount Rate	Discount Rate	32% monthly, changing to a 5-tiered discount ranging from 32-71% based on household income in mid-2025.	Household income up to 60% of State Median Income, including automatic enrollment for customers receiving LIHEAP and certain other state programs.
Michigan	Consumers Energy	Flat Monthly Discount	Income Assistance Service Provision (RIA)	Monthly credit of $8. If credit balance occurs, the credit can be applied to future charges.	Household income does not exceed 150% of FPL. Verified when customer has provided proof they received or currently participating in the past 12 months: 1. Home Heating Credit energy draft; 2. State Emergency Relief; 3. Assistance from a Michigan Energy Assistance Program; 4. Medicaid. Or low-income verification form will be provided for customer to complete.
Michigan	DTE Energy	Flat Monthly Discount	Residential Income Assistance Credit	$8.50 monthly.	Household income up to 150% FPL
		Discount Rate	Special Low-Income Pilot	Different rates and $40 monthly discount.	Annual evidence receiving Home Heating Credit energy draft or warrant or must provide confirmation by authorized State or Federal agency that customer's total household income does not exceed 150% of FPL, or customer receives: 1. assistance from a state emergency relief program; 2. food stamps; 3. Medicaid.
Michigan	Indiana Michigan Power	Flat Monthly Discount	Low-Income Customer Service Charge Waiver (LICUS)	$7.58 monthly residential service charge waived.	Household income below 150% FPL or receiving assistance from State Emergency Relief Program, food stamps, or Medicaid
Michigan	Xcel Energy	Flat Monthly Discount	Michigan Residential Low-Income Credit	$9 monthly.	Household income below 150% of FPL; households automatically enrolled if receive MI Dept of Human Services State Emergency relief utility grant, MI Energy Assistance Program, MI Home Heat Credit, Medicaid or Supplemental Nutrition.
Minnesota	Minnesota Power	Flat Monthly Discount & Discount Rate	Customer Affordability of Residential Electricity (CARE)	1. $20 discount when bill over $20 2. Affordability discount keeps energy bill under 3% of household income.	1. Customers who qualify for Minnesota Power's Residential Service Income- and Usage-Qualified Discount or Minnesota's Energy Assistance Program, who are also of senior age or living with a disability. 2. If they spend more than 3% of annual income on electric bills. Funds limited and first-come-first-served.
Minnesota	Otter Tail Power	Flat Monthly Discount	Uplift	$15, $25, or $40 monthly based on previous year usage.	Receives LIHEAP.

Minnesota	Xcel Energy		PowerOn and Gas Affordability	Affordable monthly payments as a percentage of household income and past-due bill forgiveness.	Receiving assistance from LIHEAP. Customers participate in Energy Assistance Program may be eligible. Energy CENTS Coalition reviews all applications for eligibility.
Mississippi	Mississippi Power	Flat Monthly Discount	Residential Base Charge Waiver	Base charge discount of 88¢ per day.	Receive assistance from SSI or TANF.
Missouri	Ameren Missouri	Flat Monthly Discount	Keeping Current	$60-90 monthly credit for electric heat participants; $35-40 monthly credit for non-electric heat.	Up to 200% of FPL
		Flat Monthly Discount	Keeping Cool	$50 cooling bill credit May to September	Elderly, disabled, chronic medical condition, one or more children 5 years or younger, or up to 250% of FPL.
Missouri	Evergy	Flat Monthly Discount	Economic Relief Pilot Program	$65 monthly for maximum of 12 months	Household income below 200% FPL.
Montana	Montana-Dakota Utilities	Discount Rate	Montana Assistance	30% monthly.	Receiving assistance from LIHEAP.
Montana	NorthWestern Energy	Discount Rate	Low Income Discount	15% to 25% per month.	Receiving assistance from LIHEAP.
New Hampshire	Eversource Energy	Discount Rate	Electric Assistance Program (EAP)	8% to 76% per month.	60% of state median income.
New Mexico	Xcel Energy	Flat Monthly Discount	PowerOn and Gas Affordability	Discount on portion of their monthly electric and gas bills.	Receiving assistance from LIHEAP.
New York	Central Hudson Gas & Electric	Flat Monthly Discount	Bill Discount Program	Based on service type and amount of HEAP benefit.	Receiving benefits from Regular or Emergency HEAP; Lifeline; SNAP; Medicaid; SSI; Federal Public Housing Assistance; Veteran Pension or Survivors Pension; certain programs for Native Americans.
New York	Con Edison	Flat Monthly Discount	Energy Affordability Program (EAP)	Tiered depending on qualifying program. Tier 1 discounts (the majority): $42.38 for electric non-heat and electric heat, $4.48 for gas non-heat, and $133.19 for gas heat. T2: $53.51 for electric non-heat, $66.32 for electric heat, $4.48 for gas non-heat, and $159.11 for gas heat; T3: $73.07 for electric non-heat and $105.44 for electric heat, $4.48 for gas non-heat, and $178.67 for gas heat.	Receiving benefits from Home Energy Assistance Program, Supplemental Nutrition Assistance Program, Supplemental Security Income, Direct Vendor or Utility Guarantee, Temporary Aid to Needy Families, Safety Net Assistance, Medicaid, Federal Public Housing Assistance, Veterans Pension and Survivors Benefit, Lifeline telephone service program.

New York	National Grid	Flat Monthly Discount	Energy Affordability Program (EAP)	From $6.54 to $37.45 per month.	Receiving benefits from Home Energy Assistance Program. Other qualifying programs: Lifeline Telephone Service Program, Supplemental Nutrition Assistance Program, Supplemental Security Income, Medicaid, Veterans Disability or Survivors Pension, Federal Public Housing Assistance, Child Health Plus, Utility Guarantee/Direct Vendor programs, Temporary Assistance for Needy Families, and Safety Net Assistance.
New York	New York State Electric & Gas	Flat Monthly Discount	Energy Affordability Program (EAP)	From $23.55 to $51.25 per month.	Receiving benefits from Home Energy Assistance Program. Or if they receive SSI, SNAP, Medicaid, Federal Public Housing Assistance, Veterans Pension and Survivor Benefits, Bureau of Indian Affairs General Assistance, TANF, Food Distribution Program on Indian Reservation, Tribal Lands Head Start, Lifeline Telephone Service Program, HEAP grant applied to fuel vendor other than NYSEG.
New York	Orange and Rockland Utilities	Flat Monthly Discount	Energy Affordability Program (EAP)	From $59.29 to $88.25 per month.	Receiving benefits from Home Energy Assistance Program and Direct Vendor or Utility Guarantee. Other assistance programs eligible: Lifeline Telephone Service Program, Supplemental Nutrition Assistance Program, Supplemental Security Income, Temporary Aid to Needy Families, Safety Net Assistance, Medicaid, Federal Public Housing Assistance, Veterans Disability/ Pension or Survivors Benefits, Bureau of Indian Affairs General Assistance, Head Start, Tribal TANF, Food Distribution Program on Indian Reservation
New York	Rochester Gas and Electric	Flat Monthly Discount	Energy Affordability Program (EAP)	From $23.55 to $51.25 per month.	Automatically if receive HEAP benefit. Other assistance programs eligible: Supplemental Security Income, Supplemental Nutrition Assistance Program, Medicaid, Federal Public Housing Assistance, Veterans Pension and Survivor Benefits, Bureau of Indian Affairs General Assistance, Tribal Temporary Assistance for Needy Families, Food Distribution Program on Indian Reservations, Tribal Lands Head Start, Lifeline Telephone Service Program, and HEAP grant applied to a fuel vendor other than RG&E.
North Carolina	Duke Energy	Flat Monthly Discount	Customer Assistance Program	Monthly credit of $42 but cannot reduce customer's bill below the Basic Customer Charge.	Approved for LIEAP or the Crisis Intervention Program by the North Carolina Department of Health and Human Services.
Ohio	AEP Ohio	Percentage of Income Payment Plan (PIPP)	Percentage of Income Payment Plan Plus (PIPP Plus)	Gas heat homes have monthly payment of 5% of household income for gas bills, 5% of household income for electric bills. Electric heat homes have monthly payment of 10% of household income. Minimum monthly payment of $10.	Household income up to 175% FPL.

Ohio	AES Ohio	Percentage of Income Payment Plan (PIPP)	Percentage of Income Payment Plan Plus (PIPP Plus)	As above.	Household income up to 175% FPL.
Ohio	Duke Energy	Percentage of Income Payment Plan (PIPP)	Percentage of Income Payment Plan Plus (PIPP Plus)	As above	As above
Ohio	The Illuminating Company	Percentage of Income Payment Plan (PIPP)	Percentage of Income Payment Plan Plus (PIPP Plus)	As above	As above
Ohio	Ohio Edison	Percentage of Income Payment Plan (PIPP)	Percentage of Income Payment Plan Plus (PIPP Plus)	As above	As above
Ohio	Toledo Edison	Percentage of Income Payment Plan (PIPP)	Percentage of Income Payment Plan Plus (PIPP Plus)	As above	As above
Oklahoma	Oklahoma Gas & Electric	Flat Monthly Discount	Low-Income Assistance Program (LIAP)	$13 per month.	Must be qualified for LIHEAP.
Oregon	Pacific Power	Discount Rate	Oregon Low-Income Discount Program	20% if household income between 21% and 60% of state median income. 40% if income between 0% and 20%.	Below 60% of the state median income level adjusted for household size.
Oregon	Portland General Electric	Discount Rate	Income-Qualified Bill Discount	15% to 60% per month.	Below 60% of the state median income.
Pennsylvania	Duquesne Light	Percentage of Income Payment Plan (PIPP)	Customer Assistance Program (CAP)	CAP energy burden at 6% for natural gas heat, 4% for electric non-heat, 10% for electric heat for FPIG tiers 51%-100% and 101%-150%. For FPIG tier 0%-50%, maximum energy burden 4% for natural gas heat, 2% for electric non-heating, 6% for electric heat.	Household income up to 150% FPL.
Pennsylvania	Metropolitan Edison	Percentage of Income Payment Plan (PIPP)	Pennsylvania Customer Assistance Program (PCAP)	As above.	As above.
Pennsylvania	PECO	Percentage of Income Payment Plan (PIPP)	Customer Assistance Program (CAP)	As above.	As above.

Pennsylvania	Penelec	Percentage of Income Payment Plan (PIPP)	Pennsylvania Customer Assistance Program (PCAP)	As above.	As above.
Pennsylvania	Pennsylvania Power	Percentage of Income Payment Plan (PIPP)	Pennsylvania Customer Assistance Program (PCAP)	As above.	As above.
Pennsylvania	PPL Electric Utilities	Flat Monthly Discount	OnTrack	Determined by primary heat source, household income. Maximum of $31.50 for electric heat, $19.50 for gas or oil.	As above.
Pennsylvania	UGI Utilities	Percentage of Income Payment Plan (PIPP)	Customer Assistance Program (CAP)	As for Duquesne Light above.	As above.
Pennsylvania	West Penn Power	Percentage of Income Payment Plan (PIPP)	Pennsylvania Customer Assistance Program (PCAP)	As above.	As above.
Rhode Island	Rhode Island Energy	Discount Rate	Discount Rates	25% for Tier 1 customers. 30% for Tier 2 customers.	Tier 1 eligible if enrolled in SNAP/food stamps, qualify for HEAP/Heating Assistance, receive Supplemental Security Income. Tier 2 if they receive Medicaid, RI Works Program, Public Assistance.
Texas	El Paso Electric	Flat Monthly Discount	Low Income Rider Program	Up to $99 per year on electric. Don't pay $8.25 customer charge per month.	Household income up to 125% FPL.
Utah	Rocky Mountain Power	Flat Monthly Discount	Home Electric Lifeline Program (HELP)	$13.95 per month.	Household income up to 150% FPL. Must be qualified for Utah Home Energy Assistance Program.
Virginia	Appalachian Power	Percentage of Income Payment Plan (PIPP)	Percentage of Income Payment Program	As proposed, cap bills at 10% of income for households with electric heat, 6% without electric heat.	Households with income up to 150% of FPL.
Virginia	Dominion Energy	Percentage of Income Payment Plan (PIPP)	Percentage of Income Payment Program	As above.	As above.
Vermont	Green Mountain Power	Discount Rate	Energy Assistance Program (EAP)	25% on customer charge, energy charge per month. One-time arrearage forgiveness.	Household income up to 185% FPL.
Washington	Avista Utilities	Discount Rate	My Energy Discount	15% to 94%. Based on household size, income, energy costs, housing type. Participants receive $200 when enrolled.	Up to 200% of FLP or 80% of area median income.

Washington	PacifiCorp	Discount Rate	Low-Income Bill Assistance (LIBA)	From 15% to 72%.	Tier 1: 0-75% FPL Tier 2: 76-100% FPL Tier 3: 101-200% FPL or 80% of area median income, whichever greater.
Washington	Puget Sound Energy	Discount Rate	Bill Discount Rate (BDR)	5% to 45% depending on household income, size.	Household income 80% or less of area median income.
West Virginia	Appalachian Power	Discount Rate	20% Winter Discount Program	20% discount gas and electric.	Recipients of SSI at least age 18, recipients of WV WORKS, or recipients of Supplemental Nutrition Assistance Program benefits at least age 60.
West Virginia	Mon Power	Discount Rate	20% Discount Program	As above.	As above.
West Virginia	Potomac Edison	Discount Rate	20% Discount Program	As above	As above.

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Steve Mitnick is executive editor of Public Utilities Fortnightly and president of its parent company Lines Up, Inc., based in Arlington, Virginia. He also authors the digital quick-read weekly PUF's Where's Energy.

In his career, he was on the leadership teams of energy consulting practices at McKinsey & Co., Marsh & McLennan/Oliver Wyman, Bates White Economic Consulting, and PHB/Hagler Bailly. He was also president of the transmission development company Conjunction LLC, and chief energy advisor to the Governor of New York.

His book, Lines Down: How We Pay, Use, Value Grid Electricity Amid the Storm, was published in June 2013. His book, Lewis Latimer, The First Hidden Figure, was published in November 2020. His book, Women Leading Utilities, the Pioneers and Path to Today and Tomorrow, was published in May 2021. His book, Front Lines to Power Lines, co-authored with Rachel Moore, was published in November 2021. His book, Heroes of the Storms, How Electricity's Value is Built and Maintained, again co-authored with Rachel Moore, was published in December 2022.

He has testified before utility regulatory commissions of six states, the District of Columbia, the Federal Energy Regulatory Commission, and in Canada. Early in his career, he was a member of the faculty of Georgetown University where he taught microeconomics, macroeconomics, and statistics. He has an M.B.A. from the Wharton School, University of Pennsylvania, and two B.S. degrees from Rensselaer Polytechnic Institute, in physics, and in history/political science. He received the 2021 Leadership Award from the Keystone Policy Center, and 2022 Champion Award from the Women's Council on Energy and the Environment.

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