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Balancing the Grid: Understanding Tradeoffs Between Resilience and Affordability in Utility Distribution System Planning

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Heightened attention on energy affordability has increased scrutiny of retail electricity rates across the United States. While severe weather events and other increasing hazards require investments in grid resilience, they must be balanced with affordability, grid modernization, meeting load growth and achieving other energy goals. Drawing on semi-structured interviews, this technical brief explores how utilities, regulators, and utility consumer offices understand, negotiate and evaluate tradeoffs between different distribution planning goals. We find that the three core groups perceive resilience as a driver of affordability challenges, struggle to distinguish between resilience and reliability investments, and lack widely accepted metrics to effectively evaluate resilience investments. Interviewees offer perspectives on key challenges for resilience planning, integration between resilience and other electricity planning processes, and potential future directions. By improving understanding of the drivers of utility and regulatory decision-making and utility consumer positions, this research contributes to a growing body of work seeking to understand the opportunities to balance competing grid objectives.

1. Introduction

Increasing severe weather events, as well as seismic events and cyber and physical attacks, pose unprecedented challenges to grid resilience in the United States (Schellenberg & Schwartz, 2024; NOAA, 2024). At the same time, retail electricity rates have risen sharply in many parts of the country, elevating affordability to a prominent concern (Deese & Meyer, 2026; Chen, 2025). Recent research identifies resilience investments, alongside aging infrastructure, natural gas price volatility, and distribution system modernization, as contributors to these rate increases with impacts that vary substantially (Donohoo-Vallett et al., 2026; Wiser et al., 2025; Wiser et al., 2026a).

Utilities and regulators must navigate overlapping and sometimes conflicting priorities. Prior research illuminated this tension with respect to resilience: Efforts to contain rate increases can deter necessary infrastructure upgrades and constrain pathways to resilience (Gervich, 2022), while retail rate design intended to improve economic efficiency and support a more resilient grid may heighten affordability burdens, particularly for lower-income households (Singh et al., 2025). Yet despite this tradeoff, relatively little is known about how key institutional actors involved in electricity system planning — utilities, state public utility commissions (PUCs), and utility consumer offices — understand, frame, and navigate it in practice. This technical brief seeks to bridge that gap.

Drawing on 22 semi-structured interviews with representatives of all types of utilities — investor-owned, municipal, and rural electric cooperatives, as well as PUCs and utility consumer offices across

geographically diverse states, the brief addresses the question, How are these organizations balancing tradeoffs between resilience and affordability for distribution system planning? We selected a purposive sample[1] designed to capture variation in hazard exposure, regulatory structure, and maturity of resilience planning requirements across states to answer this question.

We find that interviewees perceive resilience as a contributor to affordability challenges but struggle to distinguish spending on resilience from reliability costs, complicating efforts to isolate retail rate impacts. Interviewees acknowledge that resilience planning is still relatively nascent and report that existing frameworks are inconsistently applied, lack widely accepted standardized metrics, and rely primarily on retrospective prudence review rather than accountability strategies determined upfront. Importantly, interviewees define affordability in fundamentally different ways, ranging from using threshold-based energy burden metrics to broader characterizations of household security and livability. Despite disagreement about whether resilience planning should occur through dedicated proceedings or be integrated into existing planning processes, interviewees agree that the general rate case is the primary venue to negotiate resilience and affordability tradeoffs.

By surfacing the approaches, frameworks, and institutional and stakeholder perspectives that shape decision-making, this study contributes to an understanding of opportunities and barriers to balance competing grid objectives for distribution system planning, investments and affordability. The work complements existing efforts to characterize the state of utility resilience planning across the United States, offering a qualitative counterpart to quantitative assessments on these topics.

2. Background and Literature Review

As of June 2026, 16 states and one city require regulated utilities to file resilience plans, with wide variation in hazards covered (Collins et al., 2026). Ma et al. (2025) find that 45 states contain counties with high vulnerability levels — wildfire exposure in the Western U.S., hurricane risk along the Gulf and Atlantic coasts, and winter storms on the Great Lakes and Plains states. The plans also have widely varying analytical approaches and use inconsistent methods to assess cost, benefit, and distributional impact (Homer et al., 2017; De Martini et al., 2022; Schellenberg & Schwartz, 2024; Collins et al., 2025; Collins et al., 2026). This heterogeneity reflects differences in operational conditions that shape how utilities implement and prioritize resilience relative to other planning conditions.

Isolating the impact of resilience investments on retail electricity rates and affordability is challenging (Wiser et al., 2025; Wiser et al., 2026a; Wiser et al., 2026b; CPUC, 2020). Disasters and weather events vary significantly from state to state and are infrequent and hard to predict. Differences in resilience definitions and evaluation, how resilience expenditures overlap with reliability and grid modernization investments, and how investments flow into retail rates make it challenging to understand the relationship between resilience investments and affordability.

[1] A widely used non-probability sampling approach in qualitative, quantitative, and mixed-methods research, purposive sampling deliberately selects participants based on characteristics, experiences, or knowledge relevant to the research question, "prioritizing information-rich cases that provide depth of understanding rather than statistical generalizability." Zrineh, A., "Purposive sampling in research: Types, justifications, applications, and limitations," Journal of Medicine, Surgery, and Public Health, Vol. 10 (2026), https://doi.org/10.1016/j.glmedi.2026.100249.

Further, many of the benefits associated with resilience investments result in avoided customer outages costs as well as direct financial benefits to the utility. De Martini et al. (2025) distinguish between direct utility savings, which are financial benefits that accrue directly to the utility, and indirect savings, which are financial benefits that accrue to customers or society. Resilience investments may generate both direct and indirect savings, but the benefits of resilience investments remain invisible until resilience events occur. Further, assessing the effectiveness of resilience investments requires understanding the costs for counterfactual scenarios.

This section reviews relevant literature, beginning with definitional debates and then turning to frameworks for understanding the costs and benefits associated with resilience investments, affordability concerns, and the state of resilience planning requirements across the country.

2.1 *Defining Resilience and Its Relationship to Reliability*

States and utilities use different definitions, frameworks, and sets of metrics for grid resilience (Kaloti & Chowdhury, 2023). This variation contributes to uncertainty about which utility expenditures qualify as resilience investments.

In particular, resilience overlaps with reliability, which is "the ability to maintain the delivery of electric power to customers in the face of routine uncertainty in operating conditions" (Eto et al., 2020). Recognizing that resilience and reliability are a continuum, in this paper we define resilience as "the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions" (Eto et al., 2020). As defined by Collins et al. (2026), resilience events are "events that are larger, statistically speaking, than the vast majority of routine, day-to-day reliability events a utility experiences in any given year."

However, distinguishing between resilience and reliability events does not necessarily make it easier to distinguish between resilience and reliability investments. Reliability investments that reduce the frequency and duration of outages under normal conditions may also improve system performance under severe conditions and vice versa. The resilience-reliability continuum can blur the boundary between these concepts, with different utilities characterizing the same type of infrastructure investment as a reliability upgrade, a resilience measure, or both. Distinguishing between resilience and other investments is a key challenge to developing a comprehensive understanding of the growth of resilience investments by U.S. electric utilities and their associated retail rate impacts.

Metrics compound this challenge. Reliability is typically measured using established indices such as System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI). These metrics are well institutionalized. Utilities regularly report them and regulators use them to set performance benchmarks and assess utility practice. In contrast, resilience lacks widely accepted benchmarks against which utility performance or investment adequacy can be assessed (Collins et al., 2025). While researchers and the electricity industry have developed and begun to deploy resilience metrics, utility and state uptake has been relatively recent, and in many cases are not as robust or standardized compared to reliability metrics (NARUC, 2025).

2.2 Types and Drivers of Grid Resilience Investments

Grid resilience investments can be broadly categorized along several dimensions. Kandaperumal and Srivastava (2020) distinguish between active and passive resilience, where active resilience refers to

actions taken with the explicit goal of increasing resilience while passive resilience denotes increases in resilience that occur as a result of pursuing reliability or other system performance goals. Active strategies are deployed during or after an event and are oriented toward maintaining supply to critical loads and minimizing restoration time. Passive investments are more capital-intensive and involve physically modifying system components to reduce their susceptibility to damage. This includes undergrounding overhead conductors, elevating substation structures, and selective hardening of vulnerable assets (Kandaperumal & Srivastava, 2020).

Resilience investments also vary significantly by hazard type, reflecting the geographic heterogeneity of weather risk across the United States. Keen et al. (2024a, 2024b, 2024c) document the range of investments utilities are making in response to wildfires, hurricanes, severe storms, and winter storm risks, each reflecting distinct vulnerability profiles, asset exposure characteristics, and regulatory contexts. Wildfire-prone utilities in the Western United States have pursued aggressive vegetation management programs, enhanced situational awareness systems, and public safety power shutoffs as near-term risk management tools, alongside longer-term infrastructure hardening. Gulf and Atlantic Coast utilities have generally focused on transmission and distribution hardening to withstand high wind and storm surge, while utilities in the Great Lakes and Plains states have increasingly invested in winterization and cold weather protection for generation and distribution assets.

Another category encompasses financial and risk mitigation investments, including liability management, insurance instruments, and post-disaster responsive expenditures. For wildfire, for example, this may include self-insurance reserves, commercial insurance, catastrophe bonds, risk pooling arrangements, and recovery bonds (Arab et al., 2021). Notably, commercial insurance has become increasingly expensive for utilities in wildfire-prone areas as hazard exposure has grown, pushing utilities toward legislative solutions such as recovery bond authorization (Arab et al., 2021). The cost of these instruments is ultimately borne by ratepayers, either through rate cases or through dedicated recovery mechanisms such as ratepayer-funded wildfire insurance pools and securitized bonds[2] (van Emmerick, 2026).

Across all of these categories, resilience investments have tended to be reactive rather than prospective, occurring in response to major outage or hazard events rather than through systematic integration into utility planning processes (Kazimierczuk et al., 2023). This has affordability implications and can introduce cost volatility that can be difficult for ratepayers to absorb.

2.3 *Frameworks and Tools for Evaluating Resilience Investments*

Broderick et al. (2021) identified a significant gap in the availability of evaluation frameworks capable of addressing the full range of resilience measures utilities consider, and call for both methodological development and qualitative research to better understand the factors that shape utility decision-making. Researchers and the electricity industry have made significant progress in this area in recent years.

For example, Lawrence Berkeley National Laboratory's Power Outage Economics Tool (POET) develops estimates of the economic impact of widespread, long duration power interruptions that utilities can use to prioritize and justify significant investments in power system resilience. FRONTIER is a web-based energy system resilience investment decision tool for islanded communities.

[2] Ratepayer-backed bonds for investor-owned utilities typically have a lower interest rate than the utility's average cost of capital.

De Martini et al. (2025) identify two primary approaches to evaluate resilience investments: *lowest reasonable cost*, which determines the lowest reasonable cost solution to meet a defined safety, reliability, or resilience requirement, and *benefit-cost analysis* (BCA), which monetizes both the costs and benefits of infrastructure investments and determines whether a specific or interrelated group of grid expenditures enhance welfare for all or a subset of customers. The appropriate method depends on the expenditure driver and the regulatory context in which the investment is being evaluated. Lowest reasonable cost analysis is most applicable when a resilience requirement has already been established, while BCA is the relevant standard when the investment's prudence is itself in question.

In practice, applying a standard BCA to resilience investments can be challenging because of the difficulty of assessing and quantifying dollar values for resilience benefits. Further, distinguishing between utility and non-utility benefits is essential to understanding how resilience investments are treated by utilities, regulators and consumers. For example, reduced customer outage costs represent a significant societal benefit but may not lower retail electricity rates.

Multi-objective decision-making frameworks can complement or serve as an alternative to standard BCA, particularly where monetization is difficult or contested. These approaches allow resilience investments to be evaluated across multiple dimensions simultaneously, without requiring that all values be collapsed into a single monetary metric (Homer et al., 2017; De Martini et al., 2022; De Martini et al., 2025).

Reliability investments can be validated through ongoing reporting on systematic performance. But the value of resilience investments may not be fully tested until a major event occurs, which could be years or even decades after the investment is made. For example Florida implemented stringent infrastructure hardening following the 2004 and 2005 hurricane seasons. No major storms made landfalls for eleven years, so the Commission had no opportunity to gather performance data to evaluate those investments until the 2016 and 2017 storm seasons (Florida Public Service Commission, 2018). Data from those storms indicated sizable improvements in resilience, including far quicker restoration times and reduced need for pole replacements for the distribution system and reduced failures for transmission structures.

2.4 Energy Affordability Concerns

While the recent national rise in retail electricity prices has tracked general inflation, state-level trends vary widely with certain jurisdictions experiencing price increases significantly higher than the national average (Donohoo-Vallett et al., 2026; Wiser et al., 2025). Between 2019 and 2024, states on the West Coast and in the Northeast were most affected by rising prices. California emerged as a significant outlier, with average retail prices increasing by 6.2 cents/kWh in real 2024 dollars — more than twice the increase of any other state. This was driven primarily by wildfire mitigation and related liability insurance costs. States in the Northeast also faced price surges. For example, residential customers in Connecticut and New Hampshire saw nominal increases of approximately 42.4% and 38.8% respectively between 2021 and 2023, largely due to high exposure to natural gas price volatility and the onset of the 2022 energy crisis. Furthermore, the compounding effects of disaster recovery from major storms in the East and wildfires in the West have solidified these regions as the primary sites of resilience-driven price increases (Wiser et al., 2025).

Cost recovery for investments made in the aftermath of resilience events can introduce rate and bill volatility, which poses challenges for household budgeting. This burden falls disproportionately on low-income households, which have limited ability to save money and face greater energy insecurity when there are spikes in bills (Adams et al., 2024).

Households with the highest electricity rates do not necessarily have the highest bills, as household affordability is also shaped by consumption, which can be impacted by factors such as climate, housing stock, and energy efficiency levels (Wiser et al., 2026b). Despite the centrality of affordability to utility regulation, there is no uniform definition of what constitutes an affordable electricity bill across U.S. jurisdictions. The most widely used metric is energy burden, which is the proportion of a household's income that goes towards their energy expenditures. A 6% energy burden is generally considered high and 10% severe (Baker et al., 2023).

While energy burden is a standardized metric, it fails to capture the complexity of household trade-offs and may ignore the needs of households who may under-consume energy to save money and endure more severe household temperatures (Cong et al., 2022). U.S. Energy Information Administration data reveals a significant spike in energy insecurity, where households change their energy consumption in response to financial stress, with the number of U.S. households experiencing energy insecurity rising from 27% in 2020 to 33% in 2024 (EIA, 2026). In 2024, 25% of households reported reducing or foregoing food or medicine to pay their energy bills (National Consumer Law Center, 2026).

A small but growing number of states have moved toward more explicit regulatory treatment of affordability. California's Public Utilities Commission launched a formal Affordability Rulemaking in 2018, establishing an affordability framework, adopting energy burden metrics, and requiring the issuance of annual affordability reports (CPUC, 2020). Rate design alongside other customer protections and programs can help address energy insecurity (Shumway et al., 2024). However, these frameworks primarily address affordability as a standalone concern rather than in explicit relation to resilience investment. As resilience costs increasingly flow into rates, the question of how regulators and utilities navigate the tradeoff between necessary infrastructure investment and household affordability remains understudied.

3. Methodology

3.1 Study Design

While planning documents and rate data reveal what resilience investments electric utilities are considering and what they cost, they do not reveal how utilities, regulators, and consumer representatives think about resilience or how they consider tradeoffs between affordability and resilience concerns. Researchers used semi-structured interviews to uncover the underlying reasoning and institutional logics that underpin resilience investments, with the goal of understanding how they interact with affordability issues. Semi-structured interviews also accommodated significant differences between states, regions, and hazard types, allowing questions based on relevant utility cases. Because there is no agreed-upon definition of resilience in the electric utility industry, and because tradeoffs between resilience and affordability may be addressed through regulatory processes that involve contested interpretations, a qualitative approach was best suited for this study.

Researchers used a geographically diverse national sample to reflect disparate regulatory structures, planning requirements, resilience vulnerabilities, building stocks and other factors. Capturing such

variations allows consideration of how the same fundamental tradeoff manifests differently depending on context.

Regulatory structure and cost recovery

For investor-owned utilities, which serve the majority of U.S. electricity customers, state PUCs determine resilience planning requirements and cost recovery. Public power utilities and rural electric cooperatives operate under different governance structures and, except for coops in about 10 states, they are generally not subject to PUC jurisdiction. However, they may still be shaped by state planning requirements and face similar resilience-affordability tradeoffs in practice (Elliot et al., 2019; Lazenby et al., 2025).

3.2 Interview Protocol

Researchers developed three linked interview protocols for use with groups that have a distinct position in the decision-making process and face different incentives when evaluating resilience investments:

- PUCs
- Utility consumer offices
- Electric utilities — primarily investor-owned utilities, with additional perspectives from public power utilities and rural electric cooperatives.

Participants were recruited through direct outreach and snowball sampling.[3] The sample was constructed to capture variation in resilience risk profiles, regulatory structures, and policy environments across states, rather than statistical representativeness. The sample was designed to illuminate the range of institutional perspectives at work in states where the resilience-affordability tradeoff is actively being negotiated.

We contacted at least one interviewee in each core group for all states that have any form of mandated resilience planning as identified in Schellenberg & Schwartz (2024). We compared this list with the top 15 states with the highest SAIDI between 2019 and 2024. We also used newspaper articles and regulatory docket review to surface utility resilience cases that were particularly relevant to the intersection of resilience and affordability.

A total of 22 interviews were conducted from 79 potential participants contacted, representing a 29% response rate. Of the 22 interviewees, 9 were consumer office representatives, 7 were PUC staff, and 6 were utilities, including 2 investor-owned utilities, 2 cooperatives and 2 publicly owned utilities. Table 1 provides a detailed breakdown of interviewee type. All interviews were held over Zoom or Google Meet between February and May 2026. All participants consented to being recorded and each interview lasted about 60 minutes.

[3] Snowball sampling is a recruitment technique that asks research participants to assist researchers in identifying other potential subjects. https://research.oregonstate.edu/ori/irb/policies-and-guidance-investigators/guidance/snowball-sampling

Table 1. Interviewee counts

State*	Utility Consumer Representative**	PUC	Utility	Total
State #1	1		2	3
State #2	1			1
State #3		1		1
State #4		1	1	2
State #5	1			1
State #6	1	1		2
State #7		1		1
State #8	1	1		2
State #9	1	1		2
State #10	1			1
State #11	1			1
State #12			1	1
State #13			1	1
State #14		1	1	2
State #15	1			1
Total	**9**	**7**	**6**	**22**

* State names are withheld to protect participants' confidentiality.
** Our interview sample includes organizations that perform a similar role to statutory consumer advocates in certain states.

The interview protocols[4] included questions regarding:

- Interviewee's perceptions of resilience and associated investments in contrast with reliability
- Interviewee's perception of whether resilience was a key driver of rate increases or other affordability concerns
- Metrics and tools used by interviewees and other stakeholders to evaluate resilience investments
- Relevant dockets or proceedings that highlight current challenges involved in making resilience investments
- Solutions and future directions.

Interview data and findings are presented in aggregate and without direct attribution to individuals or organizations to protect participant confidentiality, consistent with the study's Institutional Review Board protocol.

[4] This study was reviewed and determined to be exempt by Lawrence Berkeley National Laboratory's Human and Animal Regulatory Committees Protocol No. 440NR001. In accordance with the study's Institutional Review Board protocol, all participants provided verbal informed consent and received a participant information sheet at the time of recruitment.

3.3 Data Analysis

A detailed transcript and recorded audio were generated for each interview. Most interviews included two of the three co-authors taking notes in a shared document during the interviews to record high-level themes and takeaways. The interview audio and transcript were uploaded to the qualitative data analysis software Atlas.ti. An inductive coding process captured five main themes that emerged from the interviews. The lead author led the coding process to reduce intercoder discrepancies.

Because interviewees represented structurally distinct institutional positions — utility consumer representatives, PUCs and utilities — the analysis was attentive to variation in how each group framed and prioritized each of the themes. Perspectives that diverged meaningfully across institutional roles are noted in the findings.

4. Results

4.1 Interviewees understand resilience broadly but struggle to distinguish it from reliability

Five themes emerged from interviewee perspectives on characteristics and definitions of resilience vs. reliability. Each of these themes has distinct implications for evaluation and ratepayer impacts of resilience investments. Table 2 summarizes these findings.

Table 2. Interviewee characterization of resilience-reliability relationship and implications for affordability

Perspective	Characteristics	Affordability Implications
Resilience and reliability are overlapping but distinct concepts	Reliability governs normal operating conditions; resilience governs performance under high-impact events; concepts are related but not interchangeable	Definitional overlap makes it difficult to isolate resilience-related rate impacts from reliability, grid modernization, and other distribution system investments
Resilience is treated synonymously with grid hardening in practice	What utilities call resilience is often physical infrastructure investment in poles and wires rather than a more systematic approach	Viewing resilience solely as grid hardening directs utility spending toward capital-intensive build-out rather than lower-cost alternatives, increasing rates without necessarily solving underlying vulnerabilities
Reliability has clearer metrics and longer institutional history	Reliability evaluation is supported by established indices like SAIDI and SAIFI	Absence of widely accepted, standardized resilience metrics makes it difficult to evaluate whether investments are prudent or to hold utilities accountable for performance, increasing the risk that ratepayers bear costs for investments of uncertain value
Resilience requires a holistic, cross-system perspective	Resilience must account for demand-side conditions, aging infrastructure, and interdependencies with other systems	A narrow infrastructure-focused approach may miss lower-cost demand-side and cross-system solutions; jurisdictional constraints can prevent PUCs from considering the full value of resilience investments

Jurisdictional constraints limit holistic resilience evaluation	Commissions may be statutorily limited to evaluating direct utility costs and benefits, excluding broader societal value	Investments that would be cost-effective on a holistic basis may fail to clear regulatory review, limiting the ability to justify resilience spending that would reduce long-run utility costs

Resilience and reliability are overlapping but distinct concepts. Interviewees predominantly viewed resilience and reliability as related, but distinct, concepts. One interviewee defined these terms broadly by articulating reliability as "how we measure the grid as far as its function under normal circumstances" whereas resilience is "the ability to withstand and recover from major events." Similarly, a second interviewee articulated a clear difference between the two ideas, with reliability as "the lights don't go off" and resilience as "how quickly can you get the lights back on" while acknowledging that there is interplay between these two concepts. Another interviewee stated that attending to this overlap requires understanding that "all resilience is reliability, but all reliability isn't resilience." Interviewees' responses and articulation of resilience and reliability as different but overlapping concepts are in alignment with existing literature highlighting the relationship between resilience and reliability (Carvallo et al., 2022).

Resilience is treated synonymously with grid hardening in practice. Interviewees consistently described difficulty distinguishing between resilience and reliability spending, particularly during evaluation of specific utility expenditures. Several pushed this distinction further, stating that what is commonly considered resilience spending is more accurately characterized as grid hardening — the physical infrastructure investment in poles, wires, and transmission assets — rather than a more systematic approach associated with resilience. A PUC interviewee described how this can create challenges between stakeholders:

I think people use them interchangeably…. In two of the plans that we have identified, what the utilities have called resilience, I would call strictly grid hardening.

The same interviewee articulated a distinction between resilience, which they characterized as maximizing the capacity that already exists on the grid through technologies like dynamic line rating and grid-enhancing technologies, and reliability spending, which they characterized as direct infrastructure spending on poles and wires. In their view, conflating the two risks results in directing investment toward additional physical build-out when more cost-effective interventions would better utilize existing assets. They further highlighted the challenge this can pose in incentivizing resilience investments:

The challenge I've faced, and others may face, is we already approved grid hardening in the traditional operation and maintenance budget…. I want to ensure that you're not moving traditional O&M now into a resiliency rider.

Reliability has clearer metrics and longer institutional history. Interviewees repeatedly articulated greater comfort with reliability investments because they are supported by clearly defined metrics and targets. Resilience, by contrast, is a more recent concept in the regulatory landscape, with less time to establish robust standards and practices. The earliest any interviewee could remember resilience meaningfully entering the conversation was in 2018. As one interviewee noted:

[Reliability] has been a longer-term thought process for us and it's a little bit easier…. We've kind of gotten a reliability metric of one day in 10 years and with resilience I don't think we have that metric.

These definitional ambiguities make it challenging to understand how resilience impacts affordability. Because interviewees could not systematically distinguish resilience investments from reliability, grid modernization, and other distribution system investments, resilience-related rate impacts are difficult to isolate.

Resilience requires a holistic, cross-system perspective. Several interviewees pushed back against frameworks that treat resilience as primarily an infrastructure question, favoring instead a more holistic conception that encompasses demand-side conditions, community-level resources, and interdependencies between the electric grid and other systems. One interviewee stated that a genuinely resilient system must attend to both reliability and resilience simultaneously, noting that infrastructure assets many decades past their extended lifetime are "already not reliable on blue sky days" and that a system unable to perform under ordinary conditions cannot be meaningfully hardened against extraordinary ones. Others extended this to encompass interdependencies between the electric grid and other infrastructure systems. One interviewee illustrated how resilience investments in one domain can create cascading vulnerabilities elsewhere: Widespread installation of home gas generators following a major storm created a surge in gas demand during a subsequent storm, overwhelming gas distribution systems and compromising the ability of a sewage treatment facility to operate. The interviewee concluded that resilience planning must account for these cross-system dependencies rather than treating the electric grid in isolation.

Jurisdictional constraints limit holistic resilience evaluation. A PUC interviewee noted tension between a holistic conception of resilience and the statutory authority of regulatory commissions to consider broader societal costs and benefits. They explained that resilience investments that do not appear cost-effective under a strict utility-system analysis may rank differently once broader economic impacts are incorporated, such as the value of restoring service to businesses or enabling employees to return to work. However, their commission's authority is limited to considering direct utility costs and benefits to customers. This jurisdictional constraint means that some resilience investments that would be justifiable on a holistic cost-benefit basis will fail to clear regulatory review under the narrower standards the commission is statutorily authorized to apply.

Several PUC and consumer representatives raised concerns about the use of resilience as a justification for infrastructure spending that primarily serves to grow utility rate base rather than address genuine system needs. One interviewee described resilience as having "become a buzzword for utilities to justify any number of programs," noting that in the aftermath of a major storm in their state, utilities rapidly developed a succession of resilience programs and then sought accelerated cost recovery mechanisms to fund further rounds of resilience spending. Another interviewee argued that formal resilience planning requirements, however well-intentioned, can exacerbate this dynamic by effectively inviting utilities to compile and submit lists of investments they would like to make:

> If you ask a utility to come forward with a resilience plan, you're basically asking them to bring you a document that says, "Here's how we're going to grow the rate base." And so to me you're inviting spending…Then the utility is like, "You asked us. This is everything that we need." And so then if you're going to be really, really critical of it and disallow stuff, then the utility is like, "Why did we go through the exercise?"

The interviewee suggested that resilience and reliability planning should instead be treated as inherent components of a utility's ordinary system planning obligations, rather than distinct proceedings that create their own spending momentum.

Several interviewees grounded this concern in the fundamental economics of regulation of investor-owned utilities, pointing to the incentive structure that makes capital expenditure growth attractive. As one utility consumer representative explained, utilities are motivated to increase capital spending because it grows the rate base on which they have the opportunity to earn their authorized return:

They're looking to do what a company does...increase their capital expenditures, because that's a great way of earning that 9.9% return and makes Wall Street happy.

The same interviewee noted that this dynamic is particularly visible when utilities perform poorly on reliability metrics while simultaneously seeking large rate increases and premium returns on equity, pointing to their state's two largest utilities having ranked in the bottom quartile nationally on reliability:

You guys are below average, sometimes in the bottom quartile, and these kinds of things, and yet you want the premium returns on equity and you want these rate increases to do all this stuff. But you don't perform like even the average company in the country.

A different interviewee offered a longer-term perspective noting that rates, once increased, are very unlikely to decline significantly and that a more holistic approach to affordability may be necessary. In their view, an increased focus on reducing bills can help alleviate affordability pressures even if rates increase as a result of resilience and other necessary spending. Specifically, the interviewee cited grid-enhancing technologies, distributed resources and demand-side management as essential to reducing usage, thereby reducing the affordability impacts of resilience investments.

4.2 Interviewees are divided on whether resilience planning should be a separate process, but converge on the general rate case as the primary venue to negotiate tradeoffs

Interviews included participants from states with and without explicit resilience planning requirements. States with such explicit requirements roughly correspond to jurisdictions with a high number of resilience events. For example, many states that experience frequent wildfires require utilities to file a wildfire mitigation plan (Schellenberg and Schwartz 2024). Interviewees reported a variety of utility planning processes through which resilience is addressed, including integrated grid planning, hazard-specific requirements, and through proactive planning processes within distribution system planning.

Interviewees were divided on whether resilience planning should occur though a dedicated process or be absorbed into existing planning processes. One interviewee argued against separate resilience planning processes, saying:

I think for the sanity of all involved, I would probably advocate against having a separate proceeding…. I don't think it's too much of a stretch for [resilience planning] to be part of existing processes. I mean, that's really what the multi-year grid plans are supposed to be about.

Similarly, another interviewee argued against formal resilience planning requirements, advocating instead for resilience planning to be absorbed into existing planning processes:

I would not view that favorably. We expect the utility to be planning for a reliable, cost effective, resilient system just inherent[ly] in their planning process. If you ask a utility to come forward with a resilience plan…, you're inviting the utility to spend money that they may not necessarily need to spend. Again, they should already be doing this as part of their normal system planning and operation.

The concern that formal resilience planning requirements would drive additional unnecessary investments was echoed by another interviewee who said:

In terms of resilience planning, we want to see it, but we don't want to see it be a driver of spending for spending's sake…. It feels like resilience is the new way for utilities to rate base increasing investments in something that they should have been maintaining all along.

Yet, other interviewees expressed frustration about utilities' lack of interest in piloting new technologies or investing in new and novel approaches to increase system resilience. Several other interviewees expressed a need for separate resilience planning, as distribution system or integrated system planning processes do not effectively translate to resilience investments. One interviewee stated that resilience planning needs new and different types of expertise than traditional IRP processes:

When we get into IRP [integrated resource planning] models, we've been doing that for 30 years, and we know the right questions to ask…. [For resilience], it's kind of hard to feel confident that we even understand what the models are showing us.

Another interviewee echoed the need for a separate resilience planning process, noting the different time scales for resilience and other grid planning processes:

Part of it is the cadence of things, like, everything is on a a different timeline…. But there's just limited time to address issues, and in [integrated systems planning], we have to get it done within a 5-year cycle, and I just don't know if there's enough time to address [resilience].

One interviewee raised the issue of internal coordination between siloed planning teams if there are separate resilience planning efforts. They offered an illustrative example, describing a utility team undergrounding lines for wildfire safety that might excavate a trench sized only for the existing conductor, without consulting the team tracking load growth in the same area. If load growth subsequently requires a larger conductor in that corridor, the utility must dispatch crews a second time to re-excavate, leading to redundancy that costs more than building to the appropriate scale from the outset. This coordination challenge represents a case where resilience investments and long-term grid planning are not fully integrated, with consequences borne by ratepayers.

Despite these differing views, interviewees converged on the view that the general rate case is the primary venue where resilience and affordability tradeoffs are most directly negotiated, regardless of where planning occurs. Across states with and without formal resilience planning requirements, the rate case emerged as the common denominator where affordability consequences are ultimately determined. As one interviewee put it:

At the end of the day, the rate case is always where…. It's sort of like a budget, right? That's where your priorities or your values get revealed because that's where you're pitting everything against each other.

One interviewee noted a practical consequence of this dynamic, describing how issues such as cost allocation and large load contracts are routinely deferred to the rate case from other proceedings, but by that point, commitments have already been made that constrain what can actually be decided: "Once you approve the special contract and you've signed on the dotted line…you can't change that." In their view, the aggregation of deferred issues across multiple proceedings makes it increasingly difficult to get a clear picture of overall costs and distribution across ratepayers. Another interviewee agreed that the general

rate case is the decisive venue, but noted that tying resilience investments together to that proceeding made it challenging to incentivize new technologies. Instead, they advocated for securitizing resilience investments as an alternative financing mechanism.

4.3 Interviewees characterize and operationalize affordability differently

Interviewees define, measure, and prioritize affordability differently. Responses reflect distinct regulatory paradigms and views of available tools to address affordability concerns. Five distinct framings emerged from the interviews, ranging from narrow, metric-driven characterizations to concepts that situate energy affordability within broader questions of cost of living and long-term planning. Table 3 summarizes these views.

Table 3. Interviewee Perspectives on Affordability

Framing	Characteristics	Key Metrics and Frameworks	Example Interviewee Perspectives
Affordability as a threshold	Energy burden metrics; eligibility triggers for assistance programs	Energy burden	"If you're using electricity just for traditional uses…it would be 4% of your household income…. If you're using it for heating as well, it's 6%…. If you're using it for transportation as well, it would be 10%."
Affordability as a cost of living concern	Rate of increase relative to inflation and wages; bill volatility	Rate of bill increase; rate of inflation	"It's not about the rate. People don't care about that decimal point. Affordability is about what they pay in that bill."
Affordability as a cost allocation and cost-effectiveness question	How regulatory process design and BCA methodology shape who bears costs	BCA; cost allocation decisions; rate case design; test year methodology	"The utilities on their cost-benefit test have frequently had more speculative benefits than we were comfortable with."
Affordability as household security and livability	Whether people can safely inhabit a place; near and longer term time scales	Energy insecurity; outage duration; home temperature maintenance	"We are thinking about urgency in two timelines. Can people pay their bill next month? And can we continue to live here for a decade?"
Affordability as appropriately sizing the grid	Grid utilization and planning as affordability tools	Grid utilization metrics; load forecasting accuracy	"It makes us nervous because we think that the utilities are planning out and building out the grid on the basis of lower-confidence load information."

Affordability as a threshold. Several interviewees characterized affordability as a threshold concept, defined by whether a household's energy burden — the portion of household income spent on energy costs — exceeds an established level. One interviewee referenced energy burden thresholds of 4% of income for traditional electricity use, and 6% if heating is included, to determine eligibility for customers to receive financial assistance for electricity bills. In states with high average residential bills, interviewees noted that

meeting the baseline 4% threshold is required for financial assistance, and that those programs are exclusively ratepayer-supported rather than drawing on taxpayer revenues. Another interviewee in a state with deregulated electricity markets noted that supply costs represent more than half of the average residential bill. State regulators cannot directly control wholesale market costs, and oversight of distribution costs alone has more limited impact. The application of energy burden metrics is further complicated by the difference between rates and bills. One interviewee noted that their state's per-kilowatt-hour rates are among the highest in the region, yet bills may be lower because customers consume less energy due to energy efficiency.

Affordability as a cost of living concern. A second group of interviewees situated affordability in relative terms, specifically the pace at which electricity costs are rising compared to general inflation and wage growth. From this perspective, even households that do not meet energy burden thresholds may experience electricity as increasingly unaffordable, contributing to financial instability that is not fully captured by affordability metrics. This framing places particular weight on bill volatility as a distinct affordability concern. As one interviewee noted:

"It's not about the rate. People don't care about that decimal point. Affordability is what they pay in that bill. And that's where I think so much of the conversation gets lost, because we get tied down in a rate conversation and an ROE [return on equity] conversation and at the end of the day, people want to ensure that when they go to pay their bill, they're not taking away from their bread, their medicine, their child's extracurricular activities, or their health care."

Affordability as a cost allocation and cost-effectiveness question. A third perspective treats affordability as a matter of regulatory process — specifically, how the design of regulatory processes and BCA frameworks determines which costs reach ratepayers and at what scale. Interviewees described cases where cost allocation decisions made in regulatory proceedings had as much practical impact on residential customer bills as the underlying investment decisions. Several consumer and PUC representatives expressed concern about utilities constructing BCA frameworks in ways that incorporate speculative benefit categories to push resilience investments over the justification threshold. As one interviewee noted:

The utilities on their cost-benefit test have frequently had more speculative benefits than we were comfortable with…. We frequently thought that was used to get marginal or perhaps non-cost beneficial programs over the finish line.

One consumer advocate distinguished BCA and affordability as separate regulatory questions: Even a project that clears a benefit-cost test may be unaffordable if the cumulative rate increase exceeds what customers can bear.

Affordability as household security and livability. The fourth, most expansive framing encountered across interviews treats affordability as a question of whether people can continue to safely inhabit a place. This perspective, most fully developed by interviewees in states facing repeated and severe electricity disruptions, encompasses housing stock quality, access to distributed energy resources, and the capacity of homes to maintain safe temperatures during and in the aftermath of outages. From this view, affordability operates on two timescales simultaneously. As one interviewee described it:

We are thinking about urgency in two timelines. Can people pay their bill next month? And can we continue to live here for a decade?

This framing points toward a broader set of tools and strategies that may fall outside of traditional utility regulation, such as community resilience hubs.

Affordability as appropriately sizing the grid. A fifth perspective approached affordability from the perspective of making sure the distribution grid is appropriately sized for the customers it serves. The concern is that overbuilding the electricity system raises costs for all customers, due to load forecasts that may not materialize or resilience programs that expand the utility's rate base beyond what is needed. One interviewee described grid utilization metrics as a useful accountability tool for tracking over time whether utilities are building in the wrong locations or at the wrong scale. From this view, a well-utilized grid is inherently more affordable because fixed infrastructure costs are spread over more kilowatt-hours. Another interviewee cautioned that proactive planning, based on uncertain forecasts of loads or distributed energy projects, carries affordability risks by building infrastructure in the wrong locations or at the wrong scale. In this view, the affordability question depends on whether the utility's basis for planning is robust enough to justify the costs ratepayers will bear.

Resilience spending rate impacts

Cutting across all perspectives on characterizing and operationalizing affordability is how resilience expenditures flow into rates and how customers experience the rate impacts. Several interviewees spoke about this question in the context of storm recovery costs. One interviewee noted that three storms in two years resulted in significant increases in bills. In states with high wildfire risk, interviewees indicated that insurance and mitigation costs were a significant driver of increased bills. At the same time, they struggled to rank resilience versus other drivers of rate increases. One interviewee stated that resilience is “meaningful and variable because these costs hit you in these huge chunks.” Another pointed to storm costs, stating that while they are not always a leading driver, “if you look at the last few years, it’s been a significant component of price increase.”

The design of ratemaking processes themselves also impact rates. One interviewee described how the state's use of projected rather than historical test years dramatically inflated the scale of rate cases in their state. In addition, frequency of rate cases can create a pancaking effect where successive rate increases compound. They also highlighted how utility billing and collections practices can exacerbate affordability burdens independently of the rate level, pointing to arrearage collection processes, high reconnection fees, and the sale of consumer debt to third-party collectors. In their view, these administrative dimensions are just as important as containing rates themselves.

4.4 Evaluating resilience investments

Benefit-cost analysis as the primary tool to evaluate resilience investments. Many interviewees identified BCA as a key framework for evaluating resilience investments, though they also articulated challenges with accurately assessing resilience benefits and costs.

Multiple interviewees referenced LBNL's Interruption Cost Estimate (ICE) Calculator as a commonly used industry tool for quantifying reliability benefits of outage prevention and reduction, but there was also concern about utilities using the tool consistently. On the other hand, one interviewee noted that a utility seemed reluctant to use the tool, despite having all the necessary input data.

Several utility consumer and PUC representatives noted a lack of transparency into how utilities conduct BCA. These interviewees expressed frustration about their inability to challenge utility BCA due to the lack of information provided about how the utility constructs metrics and determines value. A consumer representative also emphasized an important distinction between BCA and affordability:

[T]here's an infinite number of projects out there, be they resilience, reliability or whatever, that the utility could put out and say this is cost-beneficial. You don't necessarily do it [the project] because there is a cap in terms of just how much you can put into rates and how much upward rate pressure customers can bear so the affordability question is separate from cost-benefit."

Several interviewees discussed supplementing or replacing quantitative metrics with qualitative assessments, particularly where monetization is difficult. One utility interviewee described using a hybrid approach with a monetary BCA as the primary framework and qualitative scoring to validate BCA results (e.g., high, medium, low).

Lack of widely accepted, standardized resilience metrics. Many interviewees cited the challenge of resilience having no widely accepted standards or benchmarks, such as SAIDI and SAIFI for reliability. Some interviewees across all groups described how utilities made investment decisions without robust thresholds for adequate resilience. One interviewee described the use of the risk-spend efficiency metric that measures how much risk reduction is achieved per dollar spent. In their view, however, it was only theoretically useful due to low maturity of the utility's risk model. The interviewee described what they would like to see:

"What we're looking for is for them to make their risk model more granular, and not just [at] the circuit level, but the circuit segment level."

Another interviewee described how actual spending for a hazard mitigation plan came in at double the forecasted amount, driven by new risk modeling technology that revealed more risk than previously known. The primary metric for evaluating whether that increase was justified was the absence of utility-caused wildfires that year.

Retrospective resilience evaluation. A few interviewees expressed concern with retrospective resilience evaluations. They discussed how this approach is "backwards": A utility makes resilience investments, and after the next storm hits, the commission reviews whether the infrastructure performed as intended. This potentially means years between investment approval and the storm event that tests its performance. Additionally, approved investment plans may not adequately consider all hazards, especially those that have historically been infrequent.

Pilot projects and performance incentive mechanisms to improve accountability. Interviewees identified two approaches to introducing more prospective accountability into utility regulation, though both face challenges in practice. First, a consumer representative expressed a preference for pilot projects with clearly defined metrics, goals, and evaluation criteria as a way to assess resilience investments before scaling up. Second, another consumer representative described a recently approved performance incentive mechanism in their state, structured around a defined bandwidth of financial incentives and penalties tied to reliability metrics: Utilities could earn a bonus for meeting targets or face a penalty for falling below them. However, the interviewee flagged the difficulty of calibrating such mechanisms correctly:

"If it's too easy to achieve, so that's great for them, then they make even more money on top of" their authorized return.

The interviewee noted that utilities had initially resisted the mechanism, conceding only after sustained public pressure following major outages. The mechanism had been approved but was not yet in effect at the time of the interview.

4.5 Future Directions

Interviewees across groups interviewed emphasized that resilience is a relatively new planning area. Several referenced planned processes to address current challenges . PUC interviewees emphasized the need for new technical capacities among staff, as well as greater consensus on how to evaluate resilience investments. Describing this challenge, one interviewee noted:

"We have all sorts of questions about that when we get into IRP modeling, but we've been doing that for 30 years, and we know the right questions to ask.... In wildfire modeling, it's kind of hard to feel really confident that we even understand what the models are showing us."

The interviewee highlighted the need for new staff trained in and tasked with developing technical methods for evaluating wildfire mitigation plans, noting that the PUC had hired staff expressly for this purpose despite constrained budgets in order to effectively oversee resilience plans and investments. An interviewee representing a smaller PUC noted the same issue but argued that they could not justify the resources required for dedicated staff, instead advocating for more peer exchange and consensus building between states and jurisdictions.

"[W]e don't have many resources or staff or as much technical expertise as other PUCs. So being able to understand how the risk model identifies and prioritizes mitigations based on the risk of a certain asset would really be helpful. I struggle a little bit with the technical aspects of the risk modeling specifically…. Having a lessons learned repository from other PUCs would be helpful."

Interviewees displayed interest in peer learning and collaboration with other states facing the same hazards as well as other states with similar resources, size and constraints. At the same time, interviewees noted challenges with knowledge sharing. One interviewee recounted receiving an Excel workbook of evaluative models but lacked the technical expertise to effectively use it.

Interviewees also expressed the need for collaboration in order to achieve standard resilience definitions and metrics that adequately account for the perspectives of different groups involved in the utility

decision-making process. One interviewee noted that collaboration was essential to ensuring that resilience planning processes have appropriate checks and balances, saying:

"I think it's important to bring folks together to ...talk about this stuff, right? It shouldn't just be the utility.... [T]he utility...defines resilience and then determines how they're going to combat and...make investments in a resilient system.... I think, collaborative environment, bringing people in, talking about this stuff is really important from setting the foundations with definitions and then also...having those checks in place."

Some interviewees expressed interest in "piloting" new technologies to test effectiveness instead of immediately jumping to large investments. This approach requires utilities and other stakeholders to buy into the idea of smaller projects. One interviewee noted that in their jurisdiction, this approach has had limited success so far:

"We've been a little frustrated. We did an RFI [Request for Information], sort of looking for ideas, and we didn't get much. So we're actually going to have a workshop in the near future, pulling in the utilities and stakeholders to kind of talk about what is…, what do they see as a limiting factor? Why are they not sort of more interested in pilots that could try some things out and get them immediate recovery. It's a bit of a mystery why we're not seeing more proposals, given that we've expressed our openness to it."

Different groups favor different approaches, emphasizing that consensus across groups is important for successful outcomes.

5. Conclusion

This technical brief explores how utilities, PUCs, and utility consumer offices understand and negotiate between affordability and grid resilience in practice. Drawing on semi-structured interviews with representatives across these three groups, spanning multiple states and utility types, we find that these tradeoffs are nuanced and lacking standardization. Electric utility resilience planning is nascent in most states. There is a lack of consensus among interviewees on what counts as a resilience investment, how to best evaluate its effectiveness, and where resilience planning should sit in the broad utility landscape.

Interviewees widely view resilience-related spending as a contributor to rising electricity rates. They also identified other drivers that are increasing rates including aging infrastructure replacement, supply-side price volatility and transmission cost increases. Interviewees also commonly expressed difficulty distinguishing between resilience and reliability investments, contributing to ambiguity about whether an investment is truly a resilience investment. This is further complicated by the lack of widely accepted, standard resilience metrics, which makes it difficult to adequately evaluate utility proposals or hold utilities accountable for resilience performance.

Interviewees described evaluation frameworks as inadequate due to their inconsistent application, opaque or poorly explained BCA approaches, and largely retrospective analyses. A primary accountability mechanism is a post-mortem prudence review triggered by a resilience event, with ratepayers bearing the cost of investments before their value is tested.

Interviewees vary on their views on the resilience planning process. In some cases, there is greater support for dedicated resilience planning processes, especially in regions with acute threats. Others expressed

concern that a separate resilience planning process would justify unnecessary spending and thus unnecessary costs for ratepayers. In both cases, interviewees converged on the view that the general rate case is ultimately where priorities are revealed and affordability consequences are negotiated.

The persistent gap between BCA and affordability assessments warrants additional consideration. Future work could examine approaches to more standardized and formal affordability assessments, separate from BCA. This study also suggests the need for adopting prospective evaluation frameworks rather than relying on post-resilience event reviews as the primary accountability tool.

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