Reliance and Reliability

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As we move toward full electrification for household uses, we will need to change the perspective of how we look at reliability and the reliance we have on our utilities. Current measures of reliability are utility-centric, focus on averages and may exclude large-scale events which cause widespread and long-duration outages. Averages are not good enough now (if they ever were). Excluding large events from reliability metrics drives specific utility behavior: restoring densely populated areas quickly to keep averages down, even if some customers in other areas or customers in pockets of more densely populated areas are left without service for days or weeks; discounting compounding harms from long-duration outages; and claiming that reliability is improving when the customer experience clearly is not.

To adequately measure customer impact as we electrify everything, the perspective that we measure reliability from should not be that of the utility or of the regulator—but rather the individual, the household, the business who is increasingly reliant on that utility service. We need to view it from the perspective of the person who has no power, especially given the energy justice issues that arise with long-duration outages.

After discussing current measures of reliability and how they do not adequately capture customer experience and impact (including, in some cases, death), this Article will discuss how states and utility responses to increasingly poor reliability have been inadequate. Instead, regulators must center the customer when addressing reliability in three ways: first, by making more informed decisions; second, by expanding their idea of what can contribute to reliability, especially with regard to distributed resources and storage; and third, by allowing customers pathways to recover damages from their utility. This Article also suggests pitfalls for regulators to avoid as they transition to customer-centric reliability.

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INTRODUCTION

It is a truth universally acknowledged that a customer in possession of a utility connection must want reliable electricity.[1] Electric utilities,[2] however, have demonstrated themselves unable to keep up with climate impacts[3] and therefore

1. While some argue that the impact of storms is extraordinary and therefore outside of reliability and rather should be thought of as resilience, I adopt the view of the National Association of Regulatory Utility Commissioners that "resilience fits within the existing structure of reliability" and —as noted later—these weather events are predictable and becoming less and less extraordinary. *See* Miles Keogh & Christina Cody, *Resilience in Regulated Utilities*, NATIONAL ASSOCIATION OF REGULATORY UTILITY COMMISSIONERS 1 (Nov. 2013), https://pubs.naruc.org/pub/536F07E4-2354-D714-5153-7A80198A436D [perma.cc/N5SH-AP6V].

2. For the purposes of this Article, I am limiting the discussion to investor-owned utilities. While regulators may want to apply some of the suggestions outlined to municipal utilities and electric cooperatives, due to the different incentives and governance structures that exist between IOUs and these entities, I focus the discussion here on IOUs and their regulation.

3. In 2020, there were twenty-two billion-dollar disasters, the highest number yet. UNEARTH, THE COST OF EXTREME WEATHER: NAVIGATING STATE REGULATION AND SAFEGUARDING THE GRID IN TEXAS, NEW YORK, AND CALIFORNIA 1 (2021). *See also* @KHayhoe, X (Jan. 10, 2022, 1:14 PM), https://x.com/KHayhoe/status/1480603932091113481 [perma.cc/HB6B-X368] ("In the 1980s, there was one billion-dollar event every four months, on average. Now, there's one every ~3 weeks. Why? Three reasons: increasing exposure, increasing vulnerability, and the big one, increasing severity and/or frequency of weather extremes fueled by a warming world."); Rachel Ramirez, *'Off the*

provide that electricity reliably.[4] "Utilities face the highest combined physical risk from climate hazards like water stress, storms, and wildfires among different industries."[5] Floods,[6] hurricanes,[7] droughts,[8] extreme heat,[9] wildfires,[10] and freezing

Charts': Weather Disasters Have Cost the US $750 Billion Over Past 5 Years, CNN (Jan. 10, 2022, 11:00 AM EST), https://www.cnn.com/2022/01/10/weather/2021-us-billion-dollar-disasters-climate-noaa/index.html [perma.cc/J2N6-6E9W] ("In 2021, the US saw 20 weather and climate disasters that cost at least $1 billion EACH, all together carrying an economic toll of $145 billion. At least 688 people died in these events last year, . . . which was more than double the death toll of 2020.").

4. Brad Plumer & Ivan Penn, *Climate Crisis Catches Power Companies Unprepared*, N.Y. TIMES (updated Aug. 6, 2021), https://www.nytimes.com/2021/07/29/climate/electric-utilities-climate-change.html [perma.cc/3999-4G3H] (noting that the situation around wildfires and drought had become so dire that some homeowners are preemptively asking for their local utility to cut off their power before storms blow through). *See* Douglas MacMillan & Will Englund, *Longer, More Frequent Outages Afflict the U.S. Power Grid as States Fail to Prepare for Climate Change*, WASH. POST (Oct. 24, 2021, 11:04 AM), https://www.washingtonpost.com/business/2021/10/24/climate-change-power-outages/ [perma.cc/Y6UK-X4Y4] ("A major impediment is the failure by state regulators and the utility industry to consider the consequences of a more volatile climate—and to come up with better tools to prepare for it."); Christopher Bonasia, *Storms Trigger 80% of U.S. Power Outages Over 20 Years, Study Finds*, ENERGYMIX (May 3, 2024), https://www.theenergymix.com/storms-trigger-80-of-u-s-power-outages-over-20-years-study-finds/ [perma.cc/7GBT-TWE6] (describing how severity of storms plus stress on grid is causing reliability issues). *See also* Ryan P. Martin & Jan Maceczek, *With Huge Grid Infrastructure Investment Looming, NextEra, PG&E Offer Lessons on the Key Role of ESG*, UTIL. DIVE (Sept. 24, 2021), https://www.utilitydive.com/news/with-huge-grid-infrastructure-investment-looming-nextera-pge-offer-lesso/607135/ [perma.cc/D64D-H757] ("Utility companies and their oversight bodies have acknowledged a general lack of readiness for such adverse weather events . . . .").

5. Yannic Rack, *Utilities Face Greatest Threat as Climate Risks Intensify*, S&P GLOB. MKT. INTEL. (Sept. 20, 2021), https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/utilities-face-greatest-threat-as-climate-risks-intensify-66613890 [perma.cc/TF3J-ELJ4]. "The analysis . . . shows utilities' vulnerability to physical climate risks generally tops other climate-intensive sectors like industrial manufacturing, oil and gas and real estate." *Id.*

6. Jason Plautz, *Southeast Utilities Confront Extreme Weather, New Peak Demand Patterns to Avoid Texas-Style Blackouts*, UTIL. DIVE (Nov. 8, 2021), https://www.utilitydive.com/news/southeast-utilities-guard-against-texas-blackouts/608933/ [perma.cc/6RTK-JNMM] ("A report filed with the New Orleans City Council showed that over the first six months of 2021, New Orleans saw tens of thousands of outages more than any year since 2018, due to 'adverse weather conditions' and 'much higher-than-normal rainfall totals.' . . . Duke Energy, for example, has been building barriers around substations that had been flooded in previous storms . . . .").

7. Max Blau, Annie Waldman & Tegan Wendland, *Entergy Resisted Upgrading New Orleans' Power Grid. When Ida Hit, Residents Paid the Price.*, PROPUBLICA (Sept. 22, 2021, 6:00 AM), https://www.propublica.org/article/entergy-resisted-upgrading-new-orleans-power-grid-when-ida-hit-residents-paid-the-price [perma.cc/8NH4-VBN9]. *See also* Plautz, *supra* note 6.

8. Kavya Balaraman, *'Imagine the Unimaginable': How the Pacific Northwest is Trying to Build a Reliable Grid in a Changing Climate*, UTIL. DIVE (Nov. 8, 2021), https://www.utilitydive.com/news/pacific-northwest-reliable-grid-changing-climate/608959/ [perma.cc/K9QC-AVAP] ("[R]eliability is always a function of a particular year's precipitation and snowpack. With warmer winters, it's possible that the area will see more water in the system in the winter, meaning there will be less water left in the summer.").

9. *Id.* ("Thousands of customers faced blackouts during the heat wave weekend, caused not because of resource adequacy issues, but because some equipment couldn't handle the heat."). Some grid assets literally melted. Mario Azar, *Black & Veatch 2021-2022 Electric Report*, BLACK & VEATCH 1, 21, https://webassets.bv.com/2021-11/21_SDR_Electric_Report.pdf [perma.cc/326X-EMFQ].

10. MacMillan & Englund, *supra* note 4 ("Pacific Gas & Electric wants to bury 10,000 miles of power lines, both to make the grid more resilient and to reduce the risk of sparking wildfires. Its power equipment has contributed to multiple deadly wildfires in the past decade, including the 2018 Camp Fire that killed at least 85 people."). *See also* UNEARTH, *supra* note 3, at 6 ("Californian utilities must also grapple with a unique problem – [sic] their power lines can spark wildfires. 2020 was the fifth-warmest year and worst wildfire season on record in the U.S. These wildfires were some of the largest, most destructive, and deadliest in the state's history.").

conditions[11] have all plagued our grid with devastating consequences.[12]

The average U.S. utility customer loses power for longer annually than customers in other industrialized nations—and it has not improved despite increased utility spending.[13] Over the last twenty years, our energy infrastructure "has suffered $1 trillion in climate damages" with "more than $20 billion in damages to the nation's electric grid over the past five years" from large storms.[14] Despite billions of ratepayer funds spent on grid hardening and modernization designed to strengthen the grid to be able to withstand climate impacts like these,[15] reliability trends indicate the system is becoming less and less reliable.[16] After Hurricane

11. Catherine Morehouse, *ERCOT Narrowly Avoided 'Much More Devastating' Impacts as Nearly Half of Generation Went Offline: CEO*, UTIL. DIVE (Feb. 25, 2021), https://www.utilitydive.com/news/ercot-narrowly-avoided-much-more-devastating-impacts-as-nearly-half -of-ge/595701/ [perma.cc/9GW7-YXE3]. *See also* Denise Couture, *Winter Storm Wallops Parts of Southeastern U.S.*, NPR (Dec. 10, 2018, 3:13 PM), https://www.npr.org/2018/12/10/675256574/winter-storm-wallops-parts-of-southeastern-u-s [perma.cc/T4A6-63C6].

12. Physical incidents—for example, domestic terrorists shooting up a substation—are on the rise as well, leading to devastating customer outcomes, including lack of cell phone coverage in an emergency situation, inability for well water pumps to operate, local pharmacies losing critical medicines that need refrigeration, among other impacts. Andrew Wilkins (@A_Wilkins_), X (Dec. 10, 2022, 10:44 AM), https://x.com/a_wilkins_/status/1599429343670771712?s=43&t=8gwt2T_Id-xST73Ruq1jvw [perma.cc/U62N-33F4]; Derrick Bryson Taylor & April Rubin, *What to Know About the North Carolina Power Outages*, N.Y. TIMES (updated Dec. 8, 2022), https://www.nytimes.com/2022/12/05/us/north-carolina-power-outage-moore-county.html [perma.cc/9JPZ-GTRG].

13. Paul Mauldin, *U.S. Power Reliability: Are We Kidding Ourselves?*, T&D WORLD (Jan. 14, 2015), https://www.tdworld.com/grid-innovations/article/20966117/us-power-reliability-are-we-kidding-ourselves [perma.cc/76ZN-C6GL]. Some will argue the United States is not a perfect comparison to other industrialized countries because of our geographic scope or other operational considerations, but it is still a poor showing indeed. Additionally, some international grids with a much higher percentage of renewables—like Germany—have actually improved reliability with a higher penetration of wind and solar on their grids. Jan Rosenow (@janrosenow), X (June 20, 2024, 2:04 AM), https://x.com/janrosenow/status/.1803715578227491245?utm_source=substack&utm_medium=email [perma.cc/6RVB-J5B4].

14. Miranda Willson, *Cost of Climate Change to the Grid? $4B*, ENERGYWIRE (Jan. 12, 2022), https://subscriber.politicopro.com/article/eenews/2022/01/12/cost-of-climate-change-to-the-grid-4b-284879 [perma.cc/PL33-GY5F].

15. Catherine Morehouse & Kelsey Tamborrino, *Racing to Restore Louisiana Power, Entergy Faces New Questions About Grid*, POLITICO (Sept. 8, 2021, 5:10 PM), https://www.politico.com/news/2021/09/08/louisiana-entergy-grid-510583 [perma.cc/S3LS-2X8U]. *See also* Kathiann M. Kowalski, *Despite millions spent on service upgrades, Ohio utilities still miss reliability marks*, ENERGY NEWS NETWORK (June 13, 2024), https://energynews.us/2024/06/13/despite-millions-spent-on-service-upgrades-ohio-utilities-still-miss-reliability-marks/ [perma.cc/GN9X-GFMY] (stating "[l]ast year was the eighth in a row that at least one of Ohio's regulated electric utilities failed to meet one or both company-specific reliability standards set by the Public Utilities Commission of Ohio[,]" even while the utilities have been spending millions).

16. Robert Walton, *While Bulk Power System Remains Reliable, Key Metric Suggests Worrying Trend, NERC Finds*, UTIL. DIVE (Aug 18, 2021), https://www.utilitydive.com/news/while-bulk-power-system-remains-reliable-key-metric-suggests-worrying-tren/605135/ [perma.cc/M557-8H9V] ("Electric grid operators were forced to shed firm load for 22.4 hours in 2020 across the bulk power system (BPS), a significant increase over recent years and a potentially worrying trend as extreme weather events continue to impact the grid, according to an annual assessment issued Tuesday by the North American Electric Reliability Corp. (NERC). Operator-initiated firm load shedding 'is one of the metrics that, to me, matters the most,' John Moura, NERC's director of reliability assessment and performance analysis, said in a media briefing. 'At the end of the day, it's really an indication that the system ran out of options.'"). *See also* Anodyne Lindstrom & Sara Hoff, *U.S. Electricity Customers Experienced Eight Hours of Power Interruptions in 2020*, U.S. ENERGY INFO. ADMIN.: TODAY IN ENERGY (Nov. 10, 2021), https://www.eia.gov/todayinenergy/detail.php?id=50316 [perma.cc/W6D3-B8KT]*; see also* MacMillan & Englund, *supra* note 4.

Maria, the power outage affected almost the entire island of Puerto Rico and lasted more than ten months for some customers.[17] "US electricity customers in 2020 faced the greatest total duration of service disruptions since 2013, when the Energy Information Administration began collecting reliability data."[18] On average in 2020, "US customers experienced more than eight hours of disruptions," mostly caused by extreme weather.[19] Those in Louisiana fared far worse, dealing with sixty hours of disruption, with those in Alabama suffering for twenty-nine hours without electricity.[20] Given the impacts from Uri, Henri, and Ida, 2021 was even worse, adding to a long trend: Severe weather has doubled power outages over the last two decades.[21] And it is likely only going to get worse.[22]

One of the main challenges with reliability—as it is currently defined—is that regulators view reliability from the point of view of a utility. As we move to electrify everything to address climate change, we need to renovate the idea of reliability —to move from thinking about reliability from a utility perspective and think about it from the perspective of a customer. As with house renovations, it will be harder

17. Alexis Kwasinski, Fabio Andrade, Marcel J. Castro-Sitiriche & Efrain O'Neill-Carrillo, *Hurricane Maria Effects on Puerto Rico Electric Power Infrastructure*, 6 IEEE POWER AND ENERGY TECH. SYS. J. 85 (Mar. 2019).

18. Ellie Potter, *2020 Marked Worst Year for Electricity Service Disruptions Ever Recorded: EIA*, S&P GLOB. COMMODITY INSIGHTS (Nov. 11, 2021 20:58 UTC), https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/111121-2020-marked-worst-year-for-electricity-service-disruptions-ever-recorded-eia? [perma.cc/4TNM-82ZE].

19. *Id.* "Customers in Louisiana, Alabama, Iowa, Connecticut [sic] and Oklahoma saw the longest period of power disruptions for the year, the EIA reported. Louisianans faced 60 hours of interruptions compared to nearly 29 hours in Alabama." *Id.* Residents of Maine, however, "saw the highest average number of power interruptions." Jennifer Runyon, *EIA: US Electricity Customer Outage Minutes Trending Up*, POWERGRID INT'L (Nov. 11, 2021), https://www.renewableenergyworld.com/power-grid/outage-management/eia-us-electricity-customer-outage-minutes-trending-up/ [perma.cc/57N8-XXRK].

20. Potter, *supra* note 18.

21. Matthew Brown, Camille Fassett, Patrick Whittle, Janet McConnaughey & Jasen Lo, *Storms Batter Aging Power Grid as Climate Disasters Spread*, FACTOR THIS (Apr. 6, 2022), https://www.renewableenergyworld.com/energy-storage/battery/storms-batter-aging-power-grid-as-climate-disasters-spread/ [perma.cc/54E7-W9PL]. While official figures are not yet available, 2022 started with one million meters without service from a winter storm. Robert Walton, *US East Coast Begins 2022 With Winter Storm, Almost 1M Outages*, UTIL. DIVE (Jan. 4, 2022), https://www.utilitydive.com/news/us-east-coast-begins-2022-with-winter-storm-almost-1m-outages/616 608/ [perma.cc/6WED-DYYE]. A cold snap on Christmas Eve ended the year—with large numbers without power for Christmas, rolling blackouts, and weather-related deaths. *Thousands Without Power as Deadly Winter Storm's Deep Freeze Stretches Through Christmas Day*, CBS NEWS (updated Dec. 26, 2022, 12:00 AM), https://www.cbsnews.com/news/winter-storm-power-outages-freezing-temper atures-christmas-weather-forecast/[perma.cc/Q5QG-RUUV]. This is not to indicate that extreme weather is the only thing that could impact the reliability of our electric grid. As Russia's war in Ukraine has reminded citizens of both Ukraine and Germany, intentional actions or geopolitical aggression can also impact a nation's energy supply. Thomas Popik, *Ukraine's Coming Electricity Crisis How to Protect the Grid from Russian Attacks*, FOREIGN AFF. (Feb. 3, 2023), https://www.foreignaffairs.com/ukraine/ukraine-coming-electricity-crisis-protect-grid-from-russian-attacks [perma.cc/ENF6-W2WN]; Sören Amelang, Kerstine Appunn, Carolina Kyllmann, Benjamin Wehrmann & Julian Wettengel, *War in Ukraine: Tracking the Impacts on German Energy and Climate Policy*, CLEAN ENERGY WIRE (Feb. 24, 2023), https://www.cleanenergywire.org/news/ukraine-war-tracking-impacts-german-energy-and-climate-policy [perma.cc/Q8AT-L7PH].

22. Austyn Gaffney, *How Future Hurricanes Could Stress Power Grids of U.S. Cities*, N.Y. TIMES (July 8, 2024), https://www.nytimes.com/2024/07/05/climate/hurricanes-power-outages.html. [perma.cc/7VET-BR3L]. *See also Weather-related Power Outages Rising*, CLIMATE CENTRAL, https://www.climatecentral.org/climate-matters/weather-related-power-outages-rising [perma.cc/A9WT-WRUL].

to renovate our ideas around reliability than starting from scratch. The existing paradigm has worked, but just like burning fuel oil for heat is no longer a good option, our traditional measures of reliability have outlived their usefulness. We need to determine some metrics that are the reliability equivalent of an efficient heat pump. This will become ever more important as we decarbonize—adding electric cooking, heating, hot water and transportation could triple our reliance on the grid to provide the power that we need both cleanly and constantly.[23]

This task goes to state public utility commissions (PUCs) because they regulate utilities. To determine what measures PUCs should adopt, this Article will start by acknowledging that reliability needs to improve. The current reliability metrics commonly used by regulators to determine whether utilities are providing reliable service continue to allow harm and are especially concerning for energy justice reasons. Even as customers become more and more reliant on their utility connections, especially electricity, utilities claim they are not liable to their customers for any loss of service. This Article will address that claim, and how utilities are telling PUCs and customers that they are solving the problem with additional hardening—replacement of infrastructure plus additional operational systems. In fact, they are making the problem worse to protect their profits. I will then argue that simply increasing capital spending is not the answer. Instead, regulators must center the customer when addressing reliability in three ways: first, by making more informed decisions; second, by expanding their idea of what can contribute to reliability, especially with regard to distributed resources and storage; and third, by allowing customers pathways to recover damages from their utility. This Article also suggests pitfalls for regulators to avoid as they transition to customer-centric reliability.

I. WHAT "RELIABILITY" IS AND HOW WE MEASURE IT NEEDS TO IMPROVE

Customer harms from the loss of electricity are increasing, and yet our measures for assessing utility performance from a regulatory perspective have not changed. This section provides an overview of the current metrics used by regulators, the harms blackouts are causing customers, how those harms are borne disproportionately by poor and marginalized communities, and how some states have attempted to respond to poor reliability.

A. Measures

Current measures of reliability used by most regulatory regimes go by the acronyms SAIDI, SAIFI and CAIDI.[24] System Average Interruption Duration Index (SAIDI) "indicates the total sustained interruption duration for the average customer during a predefined period of time. It is commonly measured in minutes

23. Robert Walton, *Biden Decarbonization Goals Could Triple Reliance on Electric Grid: EPRI*, UTIL. DIVE (Jan. 14, 2022), https://www.utilitydive.com/news/biden-decarbonization-goals-could-triple-reliance-on-electricity-grid-epri/617188/ [perma.cc/JCY3-BAM8].

24. Momentary Average Interruption Frequency Index (MAIFI) and Average System Availability Index (ASAI) are also used but not as consistently. *See, e.g.*, *Evaluation of Data Submitted in APPA's 2018 Distribution System Reliability & Operations Survey*, AM. PUB. POWER ASS'N 1, 6 (July 2019), https://www.publicpower.org/system/files/documents/2018%20DSRO%20Report_0.pdf [perma.cc/494E-V747].

or hours of interruption."[25] Basically, this looks for the average minutes a customer was without power. However, this is an average and could be due to either many short-length interruptions or one longer interruption (assuming the regulator requires large events to be included in these metrics).

To give regulators a better idea of which of these occurred—many short (but sustained) outages or a few longer ones—utilities are often also required to report System Average Interruption Frequency Index (SAIFI). SAIFI "is defined as the average number of times that a customer is interrupted during a specified time period. It is determined by dividing the total number of customers interrupted in a time period by the average number of customers served."[26] Measured in "interruptions per customer," SAIFI basically gives the average number of times a customer has had power interrupted for more than a momentary blip. Recognizing that SAIDI and SAIFI both had challenges, regulators also started calculating Customer Average Interruption Duration Index (CAIDI). CAIDI is SAIDI divided by SAIFI,[27] and is designed to "enable utilities to report the average duration of a customer outage for those customers affected."[28]

All three of these measures focus on averages and may exclude large-scale events which cause widespread and long duration outages. Regulators have chosen to allow utilities to exclude the impact of these events across the country, including in places where extreme weather events have had significant effects like California[29] and Louisiana.[30] The inclusion of major weather events will only become more important as these weather events become more common. With major storms included, SAIDI, SAIFI, and CAIDI have all trended up since 2013.[31]

Based on how the metrics are calculated, it encourages the utilities to convince their regulators that certain "punctuating" events, like outages from large storms that utilities claim are unforeseeable and cannot be planned for, should be excluded from the calculations.[32] This is problematic for two reasons: (1) high-intensity, long-

25. *System Average Interruption Duration Index (SAIDI)*, HAWAIIAN ELECTRIC (last visited July 27, 2023), https://www.hawaiianelectric.com/documents/about_us/key_performance_metrics/formula/formula_saidi.htm [perma.cc/UK3R-9EZH].

26. AM. PUB. POWER ASS'N, *supra* note 24, at 42.

27. *Id.* at 14.

28. *Id.* at 42.

29. *See, e.g.*, Pacific Gas & Electric Company, *2018 Annual Electric Reliability Report 1*, 6, CAL. PUB. UTIL. COMM'N (July 15, 2019). ("PG&E is focusing on metrics that include planned outages but exclude major event days .... PG&E believes these metrics best reflect the typical customer's experience and are common benchmark metrics across the electric utility industry.").

30. Letter from Courtney R. Nicholson, Entergy Vice President of Regul. and Pub. Affs., to Lora W. Johnson, Clerk of Council (Sept. 29, 2021) (on file with author) ("For the purposes of these metrics, interruptions caused by momentary outages and major events are excluded. Such exclusions are consistent with standard industry reliability indices used by most electric utilities to assess the reliability of their electrical system, which exclude major outage events that cause interruptions to a significant portion of the utility's customer base, momentary outages lasting no longer than five (5) minutes….").

31. *Table 11.1 Reliability Metrics of U.S. Distribution System*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/electricity/annual/html/epa_11_01.html [perma.cc/B6AC-N5VU] (last visited July 27, 2023). 2013 is when EIA started collecting this data.

32. For example, FirstEnergy's Ohio customers were without power for an average of 395 minutes, but much of that was due to major weather events which are excluded from the performance standard regulators look at—leading to an average outage for performance standard purposes of only 135 minutes. Kathiann M. Kowalski, *Ohio County Looks to Microgrids to Attract and Retain Business by Boosting Resilience*, FACTOR THIS (Sept. 19, 2022), https://www.renewableenergyworld.com/power-grid/microgrid/ohio-county-looks-to-microgrids-to-attract-and-retain-business-by-boosting

duration events are the outages that most impact customers, and (2) with climate change, these events will become more common. We will not fix (or plan for) what we do not measure. So, for example, while ConEd was fined for not meeting reliability targets, that did not include any penalty for the millions who lost power due to Isaias starting on August 4, 2020, and who did not have power fully restored until ten days later.[33] Regulators also excluded the impacts from Ida, even though that extreme weather event happened barely more than a year later.

Excluding major events also allows utilities to claim improvements in reliability when, in fact, customers are suffering from decreased reliability. For example, PG&E reported to regulators that, excluding major events, PG&E had reduced the number of minutes of sustained outages that customers experienced in 2018 by 20% compared with a decade earlier.[34] However, with major events included in that SAIDI calculation, reliability had actually decreased substantially over the decade—with the average customer out of power for seventy more minutes in 2018 versus 2009, a 30% increase.[35] This illustrates how excluding major events allows for manipulation and for utilities to push a false narrative about improved reliability when the reality is the opposite.

Averages are not good enough now (if they ever were). As Texas experienced with Winter Storm Uri, and both Louisiana/Mississippi and the Northeast have experienced again with Ida, what matters to a specific utility customer is not the average length of time that all of a utility's customers will not have power; what matters is how long that specific customer will be without power. And that duration is highly variable, as is amply being demonstrated.

The restoration work, however, is not as haphazard as it may seem. The adoption of these particular measures by regulators drives specific utility behavior.[36] First of all, the utility will be focused on meters—not necessarily the number of individuals impacted. While the metrics say "customer," it is really calculated on a meter basis. The utility does not attempt to determine how many individuals might be dependent on that one meter, and treats all meters the same. Therefore, if there are areas that have a higher number of people per living unit, the utility will not take this into account, but rather assume each meter is serving the same number of individuals.

Given the focus on averages, utilities will aim to restore more densely populated areas quickly to keep averages down, even if some customers in other areas or customers in pockets of more densely populated areas are left without

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-resilience/ [perma.cc/2KSC-AY3E]. *See also* Grant McEachran, *Improving Grid Reliability and Resilience– Where Automation and Undergrounding Can Help*, POWERGRID INT'L (June 6, 2023), https://www.power-grid.com/td/improving-grid-reliability-and-resilience-where-automation-and-undergrounding-can-help/.

33. Press Release, New York Public Service Commission, PSC Receives Reports on Electric Reliability, Customer Service, Gas and Electric Safety of the State's Large Public Utilities (June 17, 2021), https://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterSeq=64435&MNO=21-M-0046/ [perma.cc/Y9ST-D86B] (click "Press Release - PSC Receives Reports on Electric Reliability, Customer Service, Gas and Electric Safety of the State").

34. CAL. PUB. UTIL. COMM'N, *supra* note 29.

35. *Id.* at 171.

36. *See, e.g.*, Butte County District Attorney, The Camp Fire Public Report, 1, 53 (June 16, 2020) (according to a PG&E manager, "reliability is 'more about the customer impacts. So number of customers, the duration of outages, large cities, metropolitan areas'").

service for days or weeks. It makes more sense for the utility, based on these metrics, to send crews to the location that could restore more meters, even if that is less efficient overall. So, meters that have power restored all around them, even in densely populated areas, may wait for power to be restored days or weeks after their neighbors. There is no metric for ensuring an entire circuit or all neighbors in a neighborhood have their power restored.

While it may seem at first to be a good thing to focus on populated areas—providing the fastest restoration for the highest number seems to be a fine utilitarian balancing—the issue is that population density is a blunt instrument that misses individual or community vulnerabilities and does not take those appropriately into account. As in any triage situation, it is most important to know the seriousness of the condition, not just the quantity.

The measures that exist are utility-centric rather than customer-centric. This focus on reliability from the utilities' perspective is clear; in Florida, for example, "[s]tate law requires that storm hardening investments and measures be cost -effective, and that utility plans include estimates of their costs and benefits *to the utility*."[37] The decisions around hardening focus on the utility, not on the customer.

The focus on reliability metrics—as currently defined—can also lead to poor utility behavior. Utilities will not make the best decisions on their own. Measures that could have avoided events like the Camp Fire, the deadly and destructive 2018 wildfire in northern California, were deemed unnecessary "because although the likelihood of failed structures happening is high, the affected customers are likely in the order of >1K."[38] A former PG&E transmission employee admitted—and documents and other employees corroborated—that transmission lines are maintained differently based on who those lines serve, with fewer inspections and less maintenance work in remote, rural areas.[39] Other transmission lines were chosen to be run to failure, with those "which contribute the most to SAIFI" receiving maintenance and improvements.[40] The Butte County District Attorney's report found parallels between the San Bruno gas pipeline explosion and the Camp Fire:

> The San Bruno investigation also established that PG&E was making inspection policy decisions based on budget. Testimony and documents presented during the Federal jury trial clearly established in the years prior to the San Bruno explosion, PG&E used the least expensive inspection method to inspect older gas transmission lines, including the San Bruno line that ruptured and exploded. The chosen inspection method was less expensive in two ways: 1) It was less expensive to execute; and 2) it was not designed to actually detect pipe integrity flaws that would require immediate and costly repair or replacement. Prior to the Camp

37. Alan H. Sanstad, Qianru Zhu, Benjamin Leibowicz, Peter H. Larsen & Joseph H. Eto, *Case Studies of the Economic Impacts of Power Interruptions and Damage to Electricity System Infrastructure from Extreme Events*, LAWRENCE BERKELEY NAT'L LAB'Y 1, 8 [hereinafter *Case Studies of the Economic Impacts Slideshow*], https://eta-publications.lbl.gov/sites/default/files/case_studies_of_power_interruptions_slides _30nov 2020.pdf [perma.cc/FF5M-E3TE] (last visited July 27, 2023).

38. Butte County District Attorney, *supra* note 36, at 54.

39. *Id.* at 58–62.

40. *Id.* at 63.

> Fire, for the Caribou-Palermo line PG&E utilized the least expensive inspection method (air patrols) in a manner guaranteed not to detect any problems that would require immediate and costly repairs. Because troublemen [PG&E employees specifically trained to do equipment inspections] were not finding safety problems requiring repairs, PG&E was able to devote capital budget funds to projects focused on improving reliability metrics.[41]

The report also found that "[i]n large population areas PG&E was staffed by experts, trained and qualified engineers and specialists having decades of experience. In less populated areas, Transmission Line Management was almost completely dependent upon less qualified Troublemen, Linemen and Towermen, and other personnel."[42] Because PG&E manipulated data to achieve desired results and did not take other needed actions, "18,804 structures, including almost 14,000 residential structures were destroyed—and 84 Butte County citizens needlessly lost their lives."[43] While this could be dismissed as a cautionary tale about PG&E, this prioritization is common across the industry.[44]

Indeed, it is telling that when a city and its utility worked together on a project to underground lines based, at least in part, on which distribution feeders had had the higher number and longest duration of outages and customer interruption over a decade, the industry press noted that the process "features novel performance metrics intended to measure benefits to the electric system that go beyond traditional measures of reliability."[45] But these actions should not be unique: Utilities know the parts of the grid which fail most frequently and, therefore, that "the customers served by those grids that experience markedly below-average levels of power reliability."[46] Other utilities have started tracking other metrics, such as CEMI-3, customers experiencing more than three sustained interruptions in a year.[47] Unfortunately, utilities are not suddenly recognizing that they need to do better to be customer centric, but rather for a self-serving reason: to justify additional capital spending, and therefore more profit. And some utilities are even attempting to make the minimal targets that they are subject to around duration and frequency of outages more lenient rather than improving their performance.[48]

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41. *Id.* at 66–67.

42. *Id.* at 84.

43. *Id.* at 86.

44. STUDIO ID, UTILITY CAPITAL INVESTMENT PLANNING: REACH BEYOND RELIABILITY TO CLIMATE RESILIENCE 4, https://go.copperleaf.com/rs/727-PJA-841/images/Copperleaf_UtilityDive_Playbook_Utility_Capital_Investment_Planning_1224_EN.pdf [perma.cc/899C-MWY6] ("Utilities tend to prioritize these projects according to the potential consequences of failure: A substation serving a hospital or heavily populated area would likely be flood-proofed before feeders and transformers serving rural residential or agricultural customers would be upgraded or fire-proofed.").

45. *The ScottMadden Energy Industry Update: Take it to the Limit*, SCOTTMADDEN, INC. 1, 22 (last visited July 27, 2023), https://www.scottmadden.com/content/uploads/2020/05/Scott Madden_Energy_Industry_Update_V20_I1_2020.pdf [perma.cc/6G74-6ZZT] (citing as the metric "Customers Experiencing Long Interruption Duration").

46. Grant McEachran, *Improving Grid Reliability: Focus on 'Worst-Performing Feeders'*, FACTOR THIS (May 31, 2023), https://www.renewableenergyworld.com/power-grid/outage-management/improving-grid-reliability-focus-on-worst-performing-feeders/ [perma.cc/CU8C- G38G].

47. *See, e.g.*, McEachran, *supra* note 32.

48. Mike Tony, *PSC Staff Slams APCo Power Outage Performance, Ready to Investigate AEP Companies*, CHARLESTON GAZETTE-MAIL (Oct. 2, 2024), https://www.wvgazettemail.com/news

B. People Are Suffering

As noted above, since longer-duration outages are typically excluded from utility reliability metrics, little research has been done to quantify the impact on customers, especially residential customers, from these outages. As a Berkeley Lab report found, "[u]tilities often report statistics, including the counts, locations, and durations of customers without power, but generally did not monetize these customer impacts."[49] Importantly, "[n]o utility or regulator used regional economic modeling to estimate either direct or indirect costs of power interruptions."[50] One of the few studies that has been done found that "a residential customer incurs a cost of $4.08 on average for a one-hour service interruption on a summer weekday and $11.20 per hour for outages with eight-hour durations during the same period."[51] The longer the outage, the more costly for the customer on a per hour basis—because the harms compound.

A recent study on the economic impact of long duration, widespread power interruptions found that while regulators collected and acted on economic information related to cost recovery for the utility, little of the same economic information related to customer and regional impacts was collected or analyzed.[52] As one paper described it:

> "[A] Berkeley Lab study last year of outages caused by major weather events in six states found that neither state officials nor utility executives attempted to calculate the social and economic costs of longer and more frequent outages, such as food spoilage, business closures, supply chain disruptions and medical problems."[53]

Remote workers might also lose out completely on wages for the entire duration of an outage.[54] While difficult to quantify,[55] these are more than mere inconveniences. As noted in reporting around a prolonged outage in Detroit: "It's more than just an inconvenience to customers. The Reyes family concluded their ordeal by emptying spoiled food from a fridge and spending hundreds of dollars to

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/energy_and_environment/psc-staff-slams-apco-power-outage-performance-ready-to-investigate-aep-companies/article_5cf516c8-8021-11ef-9a77-0f807a160f52.html [perma.cc/QQ9G-FN6W].

49. Sanstad et al., supra note 37, at 22. The exception was Maryland, but the estimate was calculated by a state task force rather than the utility or the regulator. ALAN H. SANSTAD, QIANRU ZHU, BENJAMIN LEIBOWICZ, PETER H. LARSEN & JOSEPH H. ETO, CASE STUDIES OF THE ECONOMIC IMPACTS OF POWER INTERRUPTIONS AND DAMAGE TO ELECTRICITY SYSTEM INFRASTRUCTURE FROM EXTREME EVENTS 102 (Nov. 2020) [hereinafter SANSTAD ET AL., CASE STUDIES OF THE ECONOMIC IMPACTS REPORT], https://eta-publications.lbl.gov/sites/default/files/impacts_case_ studies_final_30nov2020.pdf [perma.cc/ZM7A-NHY8].

50. Sanstad et al., *supra* note 37, at 22.

51. SANSTAD ET AL., CASE STUDIES OF THE ECONOMIC IMPACTS REPORT, *supra* note 49, at 93.

52. Sanstad et al., *supra* note 37, at 20–21.

53. MacMillan & Englund, *supra* note 4.

54. Dillon Collier & Joshua Saunders, *Anger and Confusion Continued Months After CPS Energy Issued Winter Storm Bill Credits*, KSAT.COM (Feb. 15, 2022 10:22 PM), https://www.ksat.com/news/local/2022/02/16/anger-and-confusion-continued-months-after-cps-energy-issued-winter-storm-bill-credits/ [perma.cc/9HJD-UMD2] (noting a customer who could not work for three days due to electricity outages and therefore lost wages for three days).

55. Mishal Thadani, *The Elusive 'Value of Resilience': Why Every Utility Is Asking for It and Why It's So Hard to Pin Down*, UTIL. DIVE (Sept. 7, 2023), https://www.utilitydive.com/news/value-of-resilience-power-outages-extreme-weather/692680/[perma.cc/W2RM-H6FF].

restock it. Across the region, tens of thousands of residents faced similar expenses as they went without power for over a week."[56]

It is also important to note that long duration outages cause more harm than just economic loss.[57] As one utility customer without power during a recent outage noted, "I get it that y'all prioritize orange boxes [indicating a larger number of customers out] over green dots [a smaller number without power] because your metrics are based on % of customers restored. But for people on wells, no power often means no water."[58] While this area is undertheorized in the literature, recent studies suggested the need to think more broadly about physical and mental health, safety impacts, and vulnerability to crime.[59] Age, income, health status, routine, caregiving or work responsibilities, expectations around internet availability, and outage duration all were found to impact likely resilience.[60] In the case of a longer duration electricity service interruption, there can be little question that customers are directly harmed by the utility's failure to adequately provide service.[61]

Lack of reliability is also a health concern. For example, a recent study found that less than 40% of community health centers in Florida have backup power systems, but 83% of community health centers have temperature-regulated vaccines on site.[62] For the 43% that have temperature-sensitive vaccines but no backup power system, a lack of reliability may cause those vaccines to be wasted. For these

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56. Tom Perkins, *How Decades of Neglect Left Detroit's Grid Vulnerable to Powerful Storms*, FACTOR THIS (Sept. 16, 2021), https://www.renewableenergyworld.com/power-grid/outage-management/how-decades-of-neglect-left-detroits-grid-vulnerable-to-powerful-storms/ [perma.cc/UY3X-XXEP]. Mr. Reyes posted a question to X that others must have been wondering as well: "So what condiments stay good when the power goes out for 4.5 days? Do I gotta throw away hot sauce? Mustard? Pickles? Every damn thing?" *Id.*

57. *See, e.g.*, Andrew Wilkins (@A_Wilkins_), X (Dec. 10, 2022, 10:44 AM), https://x.com/a_wilkins_/status/1599429343670771712?s=43&t=8gwt2T_Id-xST73Ruq1jvw [perma.cc/N5AQ-RMZT]. Economic losses also look different to different groups. *See* Simon Mahan (@SimonMahan), X (May 24, 2023, 8:49 AM), https://x.com/simonmahan/status/1661353668799594498?s=43&t=LNPLnREHmYkQUYDJtENVxw [perma.cc/C6T5-29WS].

58. Dan Carleton (@arniembluford), X (July 1, 2023 6:38 PM), https://x.com/arniembluford/status/1675272615915667456?s=43&t=LNPLnREHmYkQUYDJtENVxw [perma.cc//VGU6-WBVK].

59. Emily Cox, *"I Hope They Shouldn't Happen": Social Vulnerability and Resilience to Urban Energy Disruptions in a Digital Society in Scotland*, 95 ENERGY RSCH. & SOC. SCI. 1, 4 (Dec. 1, 2022). *See also* Madeline Macmillan, Kyle Wilson, Sunhee Baik, Juan Pablo Carvallo, Anamika Dubey & Christine A. Holland, *Shedding Light on the Economic Costs of Long-Duration Power Outages: A Review Of Resilience Assessment Methods and Strategies*, 99 ENERGY RSCH. & SOC. SCI. 103055 (May 2023). ("For residential customers, there are significant costs imposed from non-monetary and intangible sources such as fear, inconvenience, lack of comfort, lost leisure, and inability to heat or cool homes.").

60. Cox, *supra* note 59, at 4–6.

61. Chris Watts, *Moving Beyond Average Reliability Metrics*, S&C ELECTRIC COMPANY (July 21, 2020), https://www.sandc.com/en/gridtalk/2020/july/21/moving-beyond-average-reliability-metrics/[perma.cc/C2DB-UZQC] ("As more people are sheltering, working from home, and doing at-home schooling, any interruption in power can stretch beyond just affecting homeowners' needs; it can also affect business and educational performance as well."). The effects of this are even more pronounced as working from home due to increasing natural disasters becomes more and more likely. Brit Morse, *More Natural Disasters Will Make Hybrid Work Even More Essential*, INC. (Nov. 15, 2023), https://www.inc.com/brit-morse/more-natural-disasters-will-make-hybrid-work-even-more-essential.html [perma.cc/T8L9-XCVZ].

62. FLA. ASS'N. OF CMTY. HEALTH CTRS, INC. & CLEAN ENERGY GRP., *Supporting Access to Health Care: Resilient Emergency Power for Florida Community Health Centers* 1 (May 2023), https://www.cleanegroup.org/wp-content/uploads/Resilient-Emergency-Power-for-Florida-Community-Health-Centers.pdf [perma.cc/S2Q8-8V52].

same community health centers, it is also a revenue issue; the study found that power outages cost community health centers in Florida "an average of $41,000 per day in lost revenue."[63] A recent study also found that in Phoenix, a multiday loss of electricity combined with a heatwave "could send an estimated 789,600 people to the emergency room for heat-related illnesses. That's nearly half the population. The city has only 3,000 emergency room beds."[64]

What few occasions we have estimates from around long duration widespread power interruptions, the costs are high. Estimates from Winter Storm Uri in Texas are that the Value of Lost Load (VoLL), "a monetary indicator expressing the costs associated with an interruption of electricity supply,"[65] are somewhere between $100 billion and $300 billion.[66] Based on climate change, it is easy to recognize that longer-duration outages will become more and more costly. Given the heart-wrenching stories that came out of previous storms and the aftermath of prolonged outages,[67] we must do better.

C. Energy Justice Considerations

The impacts of poor reliability are not evenly distributed. One report found that DTE, the utility provider for Detroit, "generally disinvested in low-income and minority neighborhoods, and spends more resources on improving service in whiter, wealthier areas" leading to starkly different reliability outcomes.[68] One resident estimated that the recurring outages had cost at least $10,000 in damages, but the sole response from the utility was a one-time $25 bill credit.[69] And, amazingly, the Michigan PSC seems to agree that the payment is sufficient: They adopted rules requiring an automatic $25 bill credit for "customers who experience a power outage lasting longer than 120 hours during a state of emergency, an outage lasting longer than 16 hours under normal conditions, or more than seven service interruptions in a 12-month period."[70] DTE is requesting an exemption from even being required to track outages sufficiently to provide that paltry sum.[71]

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63. *Id.*

64. Somini Sengupta, *How Extreme Heat Causes Cascading Crises*, N.Y. TIMES (May 26, 2023), https://www.nytimes.com/2023/05/26/climate/extreme-heat-hospitals.html [perma.cc/GWS3-SNCM].

65. Thomas Schröder & Wilhelm Kuchshinrichs, *Value of Lost Load: An Efficient Economic Indicator for Power Supply Security? A Literature Review*, 3 FRONT. ENERGY RES. 55 (2015), https://www.frontiersin.org/articles/10.3389/fenrg.2015.00055/full [perma.cc/2Tm6-6HNB].

66. James McGinniss, *AOE Part II: The God of Efficiency is Dead, and Electrification Has Killed It*, JAMES'S NEWSL. (July 7, 2022), https://jamesmcginniss.substack.com/p/aoe-part-ii-the-god-of-efficiency?sd=pf&utm_source=substack&utm_medium=email [perma.cc/3THK-PADQ].

67. *See, e.g.*, MacMillan & Englund, *supra* note 4 (regarding Hurricane Florence and North Carolina: "More than 1 million residents were left disconnected from refrigerators, air conditioners, ventilators and other essential machines, some for up to two weeks. Elderly residents dependent on oxygen were evacuated from nursing homes. Relief teams flew medical supplies to hospitals cut off by flooded roads. Desperate people facing closed stores and rotting food looted a Wilmington Family Dollar.").

68. Tom Perkins, *'Utility Redlining': Detroit Power Outages Disproportionally Hit Minority and Low-Income Areas*, THE GUARDIAN (Oct. 6, 2022, 6:00 AM), https://www.theguardian.com/inequality/2022/oct/06/detroit-power-outages-impact-minority-low-income-neighborhoods?CMP=share_btn_tw [perma.cc/WZR4-QRP3].

69. *Id.*

70. John Engel, *Michigan AG Intervenes as DTE Seeks Exemption to Power Outage Refund Rule*, FACTOR THIS (June 20, 2024), https://www.renewableenergyworld.com/power-grid/outage-management/michigan-ag-intervenes-as-dte-seeks-exemption-to-power-outage-refund-rule [perma.cc/585 9-EDAJ].

71. *Id.*

In perhaps the most stark contrast of the effects of losing power, the CEO of Entergy took his family on a vacation to Vail, Colorado, during and after Hurricane Ida.[72] 87,000 Entergy customers remained without power fifteen days after the storm,[73] with some not having service restored for six weeks or longer.[74] At least one complained of receiving an electric bill from Entergy, despite her home being completely destroyed in the storm.[75] While not often acknowledged, losing power can be "deadly for the elderly, disabled and other vulnerable communities."[76] In Louisiana after Ida, with the power out and therefore no air conditioning available, "heat killed or contributed to the deaths of at least 21 people . . . . Most who died were elderly and African American."[77] During Winter Storm Uri in Texas, "Black households were nearly two times more likely to experience an outage for at least 24 consecutive hours compared to white households."[78]

Unfortunately, those suffering from reliability challenges also being poor is borne out in the data, and current reliability metrics tell regulators little about their lived experience.[79] A county-level study of electric reliability found "that Americans already bearing the brunt of climate change and health inequities . . . clustered in four regions—Louisiana, Arkansas, central Alabama and northern Michigan"—are

72. The Center Square, *Louisiana Could Require Utilities to Pay More for Storm Repairs*, NEW ORLEANS CITY BUSINESS (May 26, 2022), https://neworleanscitybusiness.com/blog/2022/05/26/louisiana-could-require-utilities-to-pay-more-for-storm-repairs [perma.cc/HBC8-MFKY].

73. Press Release, Entergy, Power Restored to More than 90% of Louisiana Customers Affected by Hurricane Ida (Sept. 14, 2021), https://www.entergynewsroom.com/news/power-restored-more-than-90-louisiana-customers-affected-by-hurricane-ida/[perma.cc/KM2J-E6R8].

74. Kezia Setyawan, *No Power, High Bills: Entergy Customers Express Frustration After Hurricane Ida*, HUOMATODAY (Dec. 13, 2021, 8:00 PM), https://www.houmatoday.com/story/news/2021/12/14/entergy-customers-express-frustrations-over-prices-after-hurricane-ida/6454176001 [perma.cc/938A-FNZ8].

75. *Id.* ("Pointe-aux-Chenes resident Brenda Billiot said the only thing left standing on her property is the front porch. Billiot said she's received two bills from Entergy totaling to around $600 since August. She's already paid one of them.").

76. Brown et al., *supra* note 21. As one elderly resident noted: "Two people on oxygen had nowhere to go. They just stayed in the apartment and hoped like hell that the power would come back on." *Id.* In California, a review "found nearly 160,000 instances of power shutoffs to customers with medical needs from 2017 to 2021. PG&E was responsible for more than 80%." *Id. See also* Julianne Skarha, Lily Gordon, Nazmus Sakib, Joseph June, Dylan Jester, Lindsay Peterson, Ross Andel & David Dosa, *Association of Power Outage With Mortality and Hospitalizations Among Florida Nursing Home Residents After Hurricane Irma*, JAMA Health Forum (Nov. 24, 2021), https://jamanetwork.com/journals/jama-health-forum/fullarticle/2786665 [perma.cc/LJB3-T3L8] ("Power loss was associated with an increased adjusted odds of mortality among all residents within 7 days . . . and 30 days . . . poststorm . . . .").

77. Brown et al., *supra* note 21; *see also* Nicholas Bogel-Burroughs & Katy Reckdahl, *The Greatest Killer in New Orleans Wasn't the Hurricane. It Was the Heat.*, N.Y. TIMES (Sept. 15, 2021), https://www.nytimes.com/2021/09/15/us/new-orleans-hurricane-ida-heat.html [perma.cc/2QHX-RGRZ].

78. Adam Mahoney, *Why Upgrading the Nation's Electric Grid Is a Racial Issue*, CAPITAL B (Nov. 15, 2023), https://capitalbnews.org/winter-blackout-forecast/[perma.cc/5JNB-3FPH].

79. Laura Patrick, *Worst-Performing Circuits Underscore the Importance of Equity*, ENERGYCENTRAL (July 24, 2024), https://energycentral.com/c/gr/worst-performing-circuits-underscore-importance-equity [perma.cc/32XM-8932].

most at risk for an extended (8+ hour) blackout.[80] These communities are especially threatened during a long power outage based on high social vulnerability.[81]

Even where cities and regulators have attempted to work with utilities to make improvements, utilities can scrap the programs. Three community centers in Minneapolis that serve predominantly low income communities of color were supposed to receive microgrids and other improvements which would have enabled them to support those communities during extended outages.[82] The projects were scheduled to be installed for $9 million but were cancelled when the Public Utilities Commission limited the utility's rate increases.[83] The utility—Xcel Energy—had an annual gross profit of more than $1.7 billion in 2022, an increase of almost 10% from 2021.[84] More than a third of those earnings came from the regulated service territory where the projects were cancelled.[85] Energy developers are now asking the PUC to allow them to build these projects for the community since Xcel has declined to do so,[86] although Xcel may be reconsidering.[87]

The energy burden for the most vulnerable is increasing. "Rising electric bills because of extreme weather have outsized impact on low income households and communities of color."[88] New studies have shown that "energy insecurity is not just determined by income but also by other social and health factors" such as medical needs or disabilities.[89] Energy insecurity and inequality is even more pronounced during extreme events, with greater negative impacts on low income households.[90] Energy efficiency and other programs can help but are not sufficiently targeted for low-income customers and do not have sufficient funding.[91] And new research

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80. Alden Woods, *Prolonged Power Outages, Often Caused by Weather Events, Hit Some Parts of the U.S. Harder Than Others*, UNIV. OF WASH. NEWS (May 1, 2023), https://www.washington.edu/news/2023/05/01/prolonged-power-outages-often-caused-by-weather-events-hit-some-parts-of-the-u-s-harder-than-others/[perma.cc/B6WX-7PNJ].

81. *Id.*

82. Andrew Hazzard, *Xcel Energy Cuts Funding for Resiliency Stations at Minneapolis Sites Serving Diverse Neighborhoods*, SAHANJOURNAL (June 13, 2023), https://sahanjournal.com/climate-environment/xcel-cuts-resilient-minneapolis-funding-minneapolis-community-centers [perma.cc/5YTV8ZJ2].

83. The utility claims the PUC action had nothing to do with the sudden cancellation of community programs occurring immediately after the PUC decision. *Id.*

84. Xcel Energy, 2022 Year End Earnings Report 1, 3 (Jan. 26, 2023), https://s25.q4cdn.com/680186029/files/doc_downloads/2023/Xcel-Energy-Earnings-Release-2022-Q4-Final.pdf [perma.cc/Z8WN-WNKW].

85. *Id.* at 5.

86. Rao Konidena, *If Xcel Won't Fund Resilience Hubs, Minnesota Has Other Options*, FACTOR THIS (June 20, 2023), https://www.renewableenergyworld.com/solar/if-xcel-wont-fund-resilience-hubs-minnesota-has-other-options/ [perma.cc/27DJ-CASB].

87. Xcel Energy in Minnesota filed a revised version of its Resilient Minneapolis Project.

88. Brown et al., *supra* note 21.

89. Chien-fei Chen, Jamie Greig, Hannah Nelson & Fangxing Li, *When Disadvantage Collides: The Concentrated Effects of Energy Insecurity and Internet Burdens in the United States*, 91 ENERGY RSCH. & SOC. SCI. 102713 (2022).

90. Chien-fei Chen, Thomas Dietz, Nina Fefferman, Jamie Greig, Kristen Cetin, Caitlin Robinson, Laura Arpan, Marcel Schweiker, Bing Dong, Wenbo Wu, Yue Li, Hongyu Zhou, Jianzhong Wu, Jin Wen, Joshua Fu, Tianzhen Hong, Da Yan, Hannah Nelson, Yimin Zhu, Xueping Li & Rachel Fu, *Extreme Events, Energy Security and Equality Through Micro- and Macro-Levels: Concepts, Challenges and Methods*, 85 ENERGY RSCH. & SOC. SCI. 102401 (Mar. 2022), https://www.sciencedirect.com/science/article/pii/S2214629621004886 [perma.cc/NQ5E-LPCG].

91. Robert Walton, *Utilities are Spending More on Low-Income Efficiency Programs, but Disparities Remain: ACEEE*, UTIL. DIVE (Nov. 18, 2022), https://www.utilitydive.com/news

shows that few states and utilities have programs or policies to address the rising energy insecurity.[92]

It could be argued that averages actually serve somewhat of an equity function, incenting utilities not to focus, for example, on the wealthiest parts of their service area first. But alone, especially with extreme events removed from the calculations, they continue to obscure too much.

D. States Are Not Fixing the Problem

States have started attempting to hold utilities responsible for poor reliability metrics, especially around storm response. However, the penalties have been minimal and, as of yet, ineffective at driving change. After Isaias, Connecticut regulators ordered the utilities to focus on "increasing the number of line workers and other responders who restore power and clear blocked roads, and improving communications with customers."[93] They also assessed Eversource a $30 million fine,[94] the maximum fine that they could under statute.[95] To resolve other lingering state challenges over their response, Eversource further agreed to "return $103.4 million to consumers" through bill credits and targeted customer assistance.[96] Given that Eversource's 2020 earnings were $1.205 billion,[97] it is unlikely that a $30 million

/utilities-are-spending-more-on-low-income-efficiency-programs-but-disparit/636918/ [perma.cc/MQ6P-CGM3]; Press Release, American Council for an Energy-Efficient Economy, Report: Most States Don't Ensure Utility Energy Efficiency Programs Benefit Underserved Households (May 16, 2023), https://www.aceee.org/press-release/2023/05/report-most-states-dont-ensure-energy-efficiency-programs-benefit-underserved [perma.cc/JCM7-BFFY]; Heather Payne, *Electrifying Efficiency*, 40 STAN. ENVTL. L.J. 57 (2021).

92. Amanda Dewey, *Proactive Steps Needed to Reduce Burdens or Households Experiencing Energy Insecurity*, ACEEE (Oct. 6, 2023), https://www.aceee.org/blog-post/2023/10/proactive-steps-needed-reduce-burdens-households-experiencing-energy-insecurity [perma.cc/M78Q-HWBD].

93. Dave Collins, *Connecticut Officials Mull Utility Fines Over Storm Response*, POWERGRID INT'L (Apr. 29, 2021), https://www.power-grid.com/td/connecticut-officials-mull-utility-fines-over-storm-response/ [https://web.archive.org/web/20210919150353/]. A new law, HB 7006, also authorized the Public Utilities Regulatory Authority "to establish a system of utility review focused on safety, reliability, storm response, affordability, communication with municipalities, and other factors." Robert Walton, *Gov. Cuomo Proposes Bill to 'Dramatically Increase Penalties' for NY Utility Storm Response Failures*, UTIL. DIVE (Oct. 30, 2020), https://www.utilitydive.com/news/gov-cuomo-propos es-to-dramatically-increase-penalties-for-new-york-utilit/588099/ [perma.cc/AVA7-N6UK]; H.R. No. 7006, Gen. Assemb., Spec. Sess. 2020 (Conn. 2020).

94. *See, e.g.*, Dave Collins, *Connecticut Utilities Face Steep Fines for Storm Failures*, POWERGRID INT'L (May 7, 2021), https://web.archive.org/web/20210513140139/https://www.power-grid.com/customer-service/connecticut-utilities-face-steep-fines-for-storm-failures/ [perma.cc/7DHZ-9JXY].

95. This is likely because $30 million is the maximum fine that PURA can assess. Stephen Singer, *Connecticut Regulators Propose a Maximum Penalty of $30 Million Against Eversource for Tropical Storm Isaias Failures*, HARTFORD COURANT (May 6, 2021, 5:55 PM), https://www.courant.com/business/hc-biz-pura-utilities-fines-20210506-pnoo2kq7p5b6botz3ffizndev4-story.html [perma.cc/T8NJ-5GQX].

96. Pat Eaton-Robb, *Connecticut, Eversource Reach Deal Over Isaias Response*, POWERGRID INT'L (Oct. 4, 2021), https://web.archive.org/web/20211005203537/https://www.power-grid.com/td/connecticut-eversource-reach-deal-over-isaias-response/[perma.cc/UJ6Y-ASEJ].

97. *Eversource Energy Reports Full Year 2020 Results*, BUSINESS WIRE (Feb. 16, 2021, 4:14 PM), https://www.businesswire.com/news/home/20210216005963/en/Eversource-Energy-Reports-Full-Year-2020-Results [perma.cc/9YYF-VWRH].

fine or $103 million as a credit to customers for poor storm response will drive much behavior change.[98]

Likewise, Louisiana is looking at the potential to have shareholders pay up to 20% of storm repairs—leaving ratepayers to pay 80% of the bill. Even that 20% will likely actually never fall on shareholders, given that the utility had refinanced bonds at a lower interest rate—which they were not required to return to ratepayers, but likely would have paid out in dividends to shareholders—saving more with the interest rate decrease than what the storm repair bill would come to.[99]

Two of New York's utilities—ConEd and NYSEG—were fined for reliability performance in 2020 even excluding major storms.[100] But "[i]ncluding major storms, 2020 had the worst performance for frequency, duration, and customer hours of interruption over the past five years."[101] And ConEd's performance is getting worse:

> Prior to 2011, no storm had ever caused 200,000 outages on the utility's grid. Then came Hurricane Irene in August of 2011, which caused 204,000 outages on ConEd's system. Then a year later, Hurricane Sandy caused 1.1 million outages. In March 2018, the utility experienced winter storms Riley and Quinn, which caused a combined 210,000 outages. And in August 2020, Tropical Storm Isaias caused 330,000 outages.[102]

Based on utility poor performance around Isaias, New York fined utilities more than $86 million[103] and has proposed increasing fines utilities would be subject

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98. With Henri a year later, thousands of outages (and therefore decreased demand) were expected to continue for days after the storm came through Connecticut and Rhode Island. Mark Watson, *Northeast Power Prices Climb as Storm-Related Restoration Efforts Advance*, S & P GLOB. COMMODITY INSIGHTS (Aug. 23, 2021, 9:36 PM), https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/electric-power/082321-northeast-power-prices-climb-as-storm-related-restoration-efforts-advance [perma.cc/ZY3M-ZZ9B]. Connecticut is now looking at implementing new performance-based rulemaking to spur the utility into better performance. Stephen Singer, *Connecticut Drafts a Performance-Based Regulation System Following Utilities' Storm Response*, UTIL. DIVE (Feb. 6, 2023), https://www.utilitydive.com/news/connecticut-performance-based-regulation-eversource-avangrid-pura/642000/ [perma.cc/6GN8-6LUA].

99. The Center Square, *supra* note 72. The Louisiana PSC came to this position after looking at increasing IOU profits, increasing dividends to shareholders, Entergy CEO's pay raise, and "his family vacation to Vail, Colorado during Hurricane Ida as customers struggled without power." *Id.*

100. Robert Walton, *New York Scrutiny: National Grid Faces Bribery Investigation; Revenues Docked for Con Edison, NYSEG, RG&E*, UTIL. DIVE (June 22, 2021), https://www.utilitydive.com/news/new-york-scrutiny-national-grid-faces-bribery-investigation-revenues-dock/602192 [perma.cc/S8D5-P8UA] ("The PSC hit Con Edison with a negative revenue adjustment of $5 million for exceeding its network outage frequency target, which excludes outages related to major storms. NYSEG will see a negative revenue adjustment of $7 million, also for exceeding its outage frequency target excluding major storms."). ConEd blamed the non-storm metric on "'a single event, which was a 33-minute outage in parts of northern Manhattan early on the morning of Aug. 7.'" *Id.* Rochester Gas & Electric was also fined, but for failure to meet meter-reading metrics. *Id.*

101. New York Public Service Commission, *supra* note 33.

102. Robert Walton, *Northeast Utilities are Spending Billions on Resilience, and the Investments are Paying Off*, UTIL. DIVE (Nov. 10, 2021), https://www.utilitydive.com/news/northeast-utilities-are-spending-billions-on-resilience-and-the-investment/608378/ [perma.cc/34NJ-CFZF].

103. *New York State Reaches Over $86 Million Settlement with Utilities for Failures During Emergencies*, CBS N.Y. (July 15, 2021, 8:17 PM), https://newyork.cbslocal.com/2021/07/15/new-york-state-utilities-settlement-tropical-storm-isaias-emergency-response/ [perma.cc/2UWQ-5VBL].

to for poor storm response,[104] among other measures.[105] ConEd and the other utilities have indicated that they would want cost recovery for credits provided to customers outlined in a staff proposal, including "$25 credits for each 24 hours of service outages during prolonged interruptions, reimbursement for prescription medications and up to $540 for spoiled food."[106] These payments would only be necessary if the outage affected more than 20,000 accounts for at least 72 hours.[107] The threat of being fined additional amounts has not changed behavior: In 2023, NYSEG was fined another $7 million for not meeting reliability targets in 2022.[108]

Arkansas opened a docket based on Winter Storm Uri to assess utilities' preparation, response, operational performance and communication.[109] The Michigan PSC has ordered each investor-owned utility to address its response to the storms in August 2021 that led to widespread outages.[110] Some Michigan lawmakers want to go further, requiring hourly bill credits for outages and preventing recovery of those credits in rates, but have been unable to implement those changes, with the utilities claiming they are already doing enough.[111] With continued outages, the PSC in Michigan seems to agree more with legislators than the utilities, as they are looking at a proposal which would include fines of up to $10 million per year for utilities "whose customers have common and long-running power outages."[112] Maine is likewise looking to potentially increase transparency

104. Walton, *supra* note 91.

105. One bill, S1544A, "requires public utilities in the state to disclose executive compensation" and was signed by the governor. Senate Bill S1544A, 2021-2022 Reg. Sess. (N.Y. 2021). Also signed by the governor was bill S1311A, which requires LIPA to provide a "detailed description of all expenses of the Authority which are related to advertising and lobbying." Senate Bill S1311A, 2021-2022 Reg. Sess. (N.Y. 2021).

106. Robert Walton, *New York Utilities Fear 'Potentially Unlimited' Obligation Under Proposed Refund Rules for Prolonged Outages*, UTIL. DIVE (May 24, 2022), https://www.utilitydive.com/news/new-york-utilities-coned-psc-outage-reimbursement/624258/ [perma.cc/3FDN-ZKFH].

107. *Id.*

108. Gio Battaglia & Carl Aldinger, *NYSEG, RG&E fined over $20M for bad customer service, electric reliability*, MYTWINTIERS (June 23, 2023), https://www.mytwintiers.com/news-header/new-york-news/nyseg-rge-fined-over-20m-for-bad-customer-service-electric-reliability/ [perma.cc/54GG-FB2W].

109. In the Matter of an Investigation into the Operations, Procedures, and Performances of the Regulated Utilities During the Winter Weather Event February 2021, INSIGHT ENGINE (updated Jan. 13, 2023), https://powersuite.aee.net/dockets/ar-21-036-u [perma.cc/DK97-36XR] (click "Source - Original Docket").

110. In the Matter, on the Commission's Own Motion, to Open a Docket for Certain Regulated Electric Utilities to File Their Distribution Investment and Maintenance Plans and for Other Related, Uncontested Matters, INSIGHT ENGINE (updated Nov. 15, 2022), https://powersuite.aee.net/dockets/mi-u-20147 [perma.cc/3JGQ-Z5YH] (click "Source—Original Document"). DTE's plan is to reduce power outages by 30% by 2029, which would be an improvement given that "45% of its customers had outages greater than 8 hours" in 2023. Beth LeBlanc, *Audit: DTE, Consumers Electricity Outage Durations 'Worse Than Average' Among Utilities*, DETROIT NEWS (Sept. 23, 2024), https://www.detroitnews.com/story/business/2024/09/23/audit-dte-consumers-energy-electricity-outage-durations-worse-than-average-among-utilities-michigan/75352945007/ [perma.cc/H986-HEJU]. Of course, a 30% reduction would still mean that 30% of their customers would have outages greater than eight hours annually.

111. Beth LeBlanc, *Michigan Democratic Lawmakers: Pay Utility Customers by the Hour for Outages*, DETROIT NEWS (updated Apr. 13, 2022, 4:00 p.m. ET), https://www.detroitnews.com/story/news/local/michigan/2022/04/13/michigan-democratic-lawmakers-pay-utility-customers-hour-outages/7304087001/ [perma.cc/S2KD-W7ZE].

112. Sheri McWhirter, *Outage-prone Michigan utilities could face $10M in annual fines*, MLIVE (June 7, 2024), https://www.mlive.com/public-interest/2024/06/outage-prone-michigan-utilities-could-face-10m-in-annual-fines.html. A recent report found that the two investor-owned utilities in

around outages—requiring reporting of specific service interruption and reliability data.[113] The state is also requiring additional integrated planning and passed a new law where utilities "could face penalties for failing to meet service standards" but limits any penalty at $1 million.[114]

None of these measures is having a substantial impact on reliability and how customers recover from an extended blackout. States are looking to penalize utilities, but those penalties do not help customers. These actions continue to look at outages from a utility perspective rather than a customer one. And this is not due to a lack of opportunity. In states that perform integrated resource plans (IRPs), regulators have the ability during those proceedings to ask the utility how they are going to meet customers' needs. While the majority of that inquiry could—and rightly so—focus on the mix of resources (solar, wind, nuclear, geothermal, fossil gas, etc.) that would provide electricity for customers during normal operating conditions, regulators could also require utilities to perform an analysis of the economic impacts of outages on customers. Therefore, even in states and in proceedings where utilities should be analyzing lost load—the conditions under which the utility would be unable to deliver electricity and the economic impact of outages—they are not. Nor are regulators requiring them to. For example, while the IRPs for Louisiana utilities admittedly should contemplate reliability (given the poor reliability statistics in the state), when addressing Cleco's latest IRP, regulators responded to intervenors requesting that outage data be modeled that the utility "should not be required to include an analysis of loss of load expectation ('LOLE') for each portfolio/combination."[115] As LOLE is an estimation of when the utility

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Michigan "are each 'worse than average' when it comes to power outage restoration times" with CAIDI for both utilities "in the 4th quartile compared with other utilities, both when including and excluding major weather events." Robert Walton, *DTE, Consumers Energy Outage Restoration Times, Reliability Measures Lagging: Audit*, UTIL. DIVE (Sept. 25, 2024), https://www.utilitydive.com/news/dte-consumers-audit-power-outages-michigan-PSC-Liberty/727890/ [perma.cc/6VUK-4SEK].

113. *Maine Regulators Propose Tougher Performance Standards for Power Utilities*, CENTRAL MAINE (updated Mar. 24, 2022), https://www.centralmaine.com/2022/03/24/maine-regulators-propose-tougher-performance-standards-for-power-utilities/ [perma.cc/VHU2-SCSJ].

114. Robert Walton, *New Maine Utility Law Requires Integrated Planning to Support State Goals, Sets Penalties for Reliability Failures*, UTIL. DIVE (May 11, 2022), https://www.utilitydive.com/news/maine-utility-law-grid-planning-state-climate-cmp/623543/ [perma.cc/JTR3-RYHA].

115. *In re: 2021 Request to Initiate Integrated Resource Planning Process Pursuant to the General Order (Corrected) in Docket No. R-30021 Dated April 20, 2012*, LA. PUB. SERVICE COMM'N (Feb. 28, 2023), https://lpscpubvalence.lpsc.louisiana.gov/portal/PSC/DocumentDetails?documentId=164149 [perma.cc/3YVQ-44CM] (Click "Staff Report issued by W. Noah Hoggatt, LPSC Staff Attorney.pdf"). A 0.1 LOLE equates to a customer having a blackout only once every decade. Robert Walton, *Outage Duration, Frequency and Magnitude: Texas PUC Staff Backs ERCOT's Reliability Framework*, UTIL. DIVE (Apr. 25, 2023), https://www.utilitydive.com/news/duration-frequency-magnitude-puct-staff-ERCOT-reliability-metric/648505/ [perma.cc/DNP9-ZX5P]. Interestingly, it seems that "the foundational resource adequacy standard governing the bulk US power system is an arbitrary figure from a 1947 paper by an obscure NYU professor, the basis of which nobody appears to know even 75 years later." Tyler Norris (@tylerhnorris), X (July 3, 2023 12:50 PM), https://x.com/tylerhnorris/status/1675909785177272334?s=43&t=LNPLnREHmYkQUYDJtENVxw [perma.cc/US9R-HK2H]. *See* Kevin Carden, Nick Wintermantel & Johannes Pfeifenberger, *The Economics of Resource Adequacy Planning: Why Reserve Margins Are Not Just About Keeping the Lights On*, NATIONAL REGULATORY RESEARCH INSTITUTE (Apr. 2011), https://pubs.naruc.org/pub/FA865D94-FA0B-F4BA-67B3-436C4216F135 [perma.cc/WVU4-CRCR] ("In the literature we surveyed, no justification was given for the reasonableness of the standard other than that is approximately the level that customers were accustomed to.").

would be unable to deliver electricity to customers,[116] something certainly that regulators should want to know, utilities should be able to accurately forecast to understand the impact of poor reliability on customers.

Additionally, researchers at the Department of Energy are attempting to help regulators and others model the value of interruption.[117] But even this only uses the same three metrics—SAIFI, SAIDI, and CAIDI.[118] The values produced based on the type of customer and the length of interruption is based on "a series of econometrically estimated equations" derived from "a pool of all available past utility-sponsored customer surveys on the value of lost load."[119] Given the increasing poor reliability and the lack of regulatory action, customers may well need additional ways to take action.

II. UTILITY RESPONSES ARE INADEQUATE

Is reliability actually improving? To hear utilities tell it, they are fervently trying to make it better. This Part provides an overview of two distinct types of strategies utilities follow that they say are moving toward achieving improved reliability. The first is spending on programs designed to provide resilience and the second is telling customers to take additional actions themselves if they want more reliability. Neither of these is a panacea, and in fact, both are making things worse because utility interests do not match the interests of their customers.[120]

Up until this point, utilities have prioritized actions which increase their profits, not actual reliability, when determining how to respond to reliability challenges. Investor-owned utilities (IOUs) make money by earning a regulated return on the capital deployed by investors—basically, a profit approved by regulators on what is invested in long-term assets.[121] IOUs do not receive this profit from operation and maintenance expenses. Therefore, there is a significant difference between what IOUs are incented to do—spend capital and grid hardening—versus what customers want: better reliability. Their spending patterns are misguided, because the poor reliability and higher bills customers have been dealing with demonstrate that simply spending more is not working. As for telling customers to protect themselves, that is inappropriate because customers do not know how—that is the utility's job, not theirs. This part concludes that there is little hope that reliability will improve under the status quo: Utilities will continue their underwhelming approaches until and unless regulators make them change course.

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116. Energy Resource Modeling Team Energy Division, *Loss of Load Expectation, Effective Load Carrying Capability, and Planning Reserve Margin Studies for 2024*, CPUC (Mar. 3, 2022), https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/resource-adequacy-homepage/finalra_lole_elcc_2024_workshop03032022.pdf [perma.cc/U3HK-ZG6G].

117. *Interruption Cost Estimate (ICE) Calculator*, LAWRENCE BERKELEY NATIONAL LAB'Y (July 27, 2023), https://icecalculator.com/home [perma.cc/XC5H-ULSX].

118. *Grid Modernization: Metrics Analysis (GMLC1.1)—Reliability*, GRID MODERNIZATION LAB'Y CONSORTIUM i, iv (Apr. 2020).

119. *Id.*

120. A third option might be allowing utilities to profit from disaster relief. However, "[a]uthorizing utilities to earn a return on disaster relief programs also leads to moral hazard, since utilities may be disinclined to make preventive investments that would reduce the likelihood and costs of disasters if they know that they will earn a profit paying responding to the disaster after it occurs." Aneil Kovvali & Joshua C. Macey, *Hidden Value Transfers in Public Utilities*, PENN. L. REV. (forthcoming 2023), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4493284 [perma.cc/E2VD-ZJBE].

121. Heather Payne, *Private (Utility) Regulators*, 50 ENV'T L. 999, 1013 (2021).

A. More Spending, Higher Customer Bills

Utility infrastructure spending is already unsustainable, and is continuing to increase.[122] Industry press notes that "transmission and distribution spending is the cornerstone of many utilities' investment programs as companies look to harden critical infrastructure," and this spending is "expected to be the basis for solid profit expansion."[123] Another notes: "Infrastructure hardening is a common way to address climate resilience" for utilities.[124]

Utilities are delivering that investment for shareholder profit. In response to failures around Isaias, for example, NYSEG said that "they are spending millions of dollars over the next three years to address outages."[125] In addition to increased vegetation management (which is not a capital expenditure), the utility "will spend $550 million on an 'asset condition replacement program' to modernize the system and replace aging infrastructure. Across that same period, the utility will be spending $107 million on resiliency and hardening against storms, with a goal to reduce the frequency and duration of outages."[126] All that capital will enter rate base, and which will be paid for by ratepayers with profit (currently averaging 10% in recent rate cases).[127]

Duke Energy has put forward a "$13 billion, 10-year resilience proposal."[128] Georgia Power—also talking about reliability[129]—has said it "is investing $13 billion in capital improvements for transmission and delivery, including self-healing grids."[130] According to the utility, "ConEd spends about $3 billion annually to keep its entire system safe and reliable."[131] National Grid "spends almost $1 billion annually on resilience."[132] PSE&G "plans to spend $900 million from 2021-2025 to

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122. *Id.* at 1014–28; *Electric Power Industry Outlook*, EDISON ELECTRIC INST. (Feb. 10, 2021), https://www.eei.org/issuesandpolicy/finance/wsb/Documents/2021_Wall_Street_Final_Slides_Web.pdf; Lisa Fontanella et at., *The Big Picture: 2022 Electric, Natural Gas and Water Utilities Outlook*, S&P GLOB. MKT. INTEL. (Oct. 2021), https://pages.marketintelligence.spglobal.com/rs/565-BDO-100/images/The-Big-Picture-Energy-2021.pdf [perma.cc/ZYW3-R8Z7] (noting that "US [sic] utility capex to remain on upswing, driven by infrastructure needs" and that "U.S. electric companies are looking to harden critical infrastructure" with "[e]lectric transmission and distribution investments for the U.S. electric and multiutility holding companies covered by Regulatory Research Associates appear to be on the upswing, approximating $61 billion in 2021 and rising to more than $63 billion in 2022 and 2023").

123. Fontanella, *supra* note 122, at 3–4.

124. STUDIO ID, *supra* note 44, at 4.

125. Walton, *supra* note 100. The other issue with vegetation management such as NYSEG is pondering, however, is that trees remove carbon and provide cooling. Removing trees outside the utility right of way could have a significant environmental justice impact, depending on where that trimming occurs and whether the locations are already lower in tree cover. I have also not found any legal authority for removing trees outside the utility right-of-way.

126. *Id.*

127. Edison Electric Institute, *supra* note 122; Fontanella, *supra* note 122 (showing current authorized ROE is around 10% and noting that "[w]hile authorized ROEs generally move directionally with Treasury bond yields, over the past several years, state commissions have approved ROEs that contain a higher premium over Treasury bond yields than have historically prevailed").

128. Plautz, *supra* note 6.

129. Iulia Gheorghiu, *Southern CEO: Georgia Power to Consider Resilience in IRP for First Time*, UTIL. DIVE (Jan. 18, 2019), https://www.utilitydive.com/news/southern-ceo-georgia-power-to-consider-resilience-in-irp-for-first-time/546407/ [perma.cc/N5PM-LDKC].

130. Plautz, *supra* note 6.

131. Walton, *supra* note 100.

132. *Id.*

boost reliability," increasing the amount of planned capital spend which ratepayers will be liable for "to the $14 billion to $16 billion range."[133] "Entergy is in the middle of a nearly $7 billion program to upgrade its transmission lines after another hurricane already wiped out part of its network in 2020."[134] ConEd invested $2.3 billion on reliability.[135] And PG&E plans to spend more than $20 billion to underground wires;[136] all that spending in a "supportive cost recovery" environment and regulatory approval of above average rates of return has led to a higher credit rating for the utility, and higher bills for customers.[137] As one commentator put it, "utilities in many states 'are waving their hands and saying hurricanes' to justify spending that would do little to improve climate resilience."[138]

While regulators are funding some of these measures, they are not approving them all. "Of $15.7 billion in grid improvements under consideration last year, regulators approved only $3.4 billion."[139] And this is at least partly because of what the concept of resilience has meant to utilities: As described by one government report, "'resilience investments' were typically related to traditional storm hardening . . . but at greater scale and cost."[140] Given the focus of utilities on increasing capital spend, "[r]egulators need to assure utility customers that they will benefit from improved resilience by at least the cost incurred by the utility to make this improvement."[141] However, given the lack of focus on how much outages cost customers and the fact that the only improvements being considered are going into utility rate base, this is a difficult task.[142] As utilities continue to focus solely on the things that drive infrastructure investment, and therefore profit, "major weather

133. *Id.*

134. Rack, *supra* note 5.

135. Yusef Latief, *New York's Con Edison Invests $2.3bn into Grid Resilience*, FACTOR THIS (May 28, 2024), https://www.renewableenergyworld.com/power-grid/outage-management/new-yorks-con-edison-invests-2-3bn-into-grid-resilience/ [perma.cc/C4PR-VZJB].

136. *Id.* This would both decrease wildfire risk and increase resiliency by negating the need for Public Safety Power Shutoffs, when the utility turns off power to reduce the risk of electrical equipment sparking wildfires. UNEARTH, *supra* note 3, at 7 (discussing PSPS).

137. Ethan Howland, *PG&E Corp., Utility Subsidiary Credit Outlook Improves to 'Positive' on Wildfire Mitigation Efforts: Moody's*, UTIL. DIVE (Feb. 10, 2023), https://www.utilitydive.com/news/pge-corp-credit-outlook-positive-wildfire-moody/642504/ [perma.cc/7TMN-49ZJ].

138. MacMillan & Englund, *supra* note 4.

139. *Id.* Another recent study found that 78% of requested investments have been approved by regulators, which equates to $62.8 billion over six years. Kathy (Huishan) Hu, *With 78% of Requested Investments Approved, US Regulators are Backing Grid Modernization*, UTIL. DIVE (May 13, 2024), https://www.utilitydive.com/news/us-regulators-backing-power-distribution-grid-modernization-investment-reliability-safety/715706/ [perma.cc/X258-N438].

140. Sanstad et al., *supra* note 37, at 23.

141. SANSTAD ET AL., CASE STUDIES OF THE ECONOMIC IMPACTS REPORT, *supra* note 49, at 6.

142. *Id.* at 7 (noting that the benefits of reliability and resilience investments are difficult to monetize and the "need for improved information on the costs that power interruptions impose on utility customers"); Herman K. Trabish, *Duke, SCE, Other Grid Modernization Proposals Faced Big Cost Questions, More Regulator Scrutiny in 2021*, UTIL. DIVE (Jan. 4, 2022), https://www.utilitydive.com/news/duke-sce-other-grid-mod-proposals-confronted-big-cost-questions-in-2021-a/610977/ [perma.cc/9DW6-Z6P9] (noting that there is no evidence that grid modernization has paid off, as "utility spending on grid modernization has not lowered rates or significantly increased demand-side flexibility").

disturbances, cyber events, and other low-frequency, high-impact events threaten the electric grid," none of which utilities are prepared for.[143]

Advanced Metering Infrastructure (AMI), colloquially known as "smart meters," is a great example of a technology that utilities have convinced regulators is necessary to improve reliability, but which has not lived up to the expected consumer benefits.[144] The idea was simple: Utilities would know exactly which customers were out of power, and therefore, which areas to focus on in terms of restoration. Despite rate-basing hundreds of millions of dollars,[145] utilities have failed "to realize promised dispatch efficiencies and cost savings."[146] Additionally, while cloud solutions might solve some of the issues plaguing the rollout of smart meters,[147] it is unlikely that utilities will take advantage of these solutions because they cannot rate base cloud solutions.[148] Their profit motive, again, keeps utilities from implementing solutions that would be both better and cheaper for the customers they serve.[149]

There are actions that would improve reliability without significant capital investment. The National Renewable Energy Laboratory is working to use smart meter data, which customers have already paid to install and operate, to automate power restoration.[150] Also using smart meters, new tools for situational awareness to reduce the impact of power outages are being developed.[151] Virtual power plants, which primarily use customer assets and demand response, have been shown to provide necessary reliability at significantly less cost that natural gas generation units

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143. SCOTT MADDEN, *supra* note 45, at 19 ("NERC has noted for less probable, severe events, 'bulk electric system owners and operators may not be able to apply economically justifiable or practical measures to prevent or mitigate an adverse reliability impact on the bulk electric system even if these events can result in cascading, uncontrolled separation, or voltage collapse.'").

144. Copper Labs, *Falling Out of Love With AMI: Why We Need a New Approach to Smart Metering*, UTIL. DIVE (Feb. 13, 2023), https://www.utilitydive.com/spons/falling-out-of-love-with-ami-why-we-need-a-new-approach-to-smart-metering/642212/ [perma.cc/26TV-DR3R] ("However, results from a range of studies suggest that many of the promised benefits of AMI have yet to be delivered even after a decade of implementation. For instance, a 2022 analysis from the Mission:data Coalition found that 97% of smart meters fail to provide promised customer benefits . . . .").

145. *Id.*

146. Trabish, *supra* note 142.

147. Copper Labs, *supra* note 144.

148. *See* John Funk, *Illinois Regulators Reject Proposal to Allow Utilities Cost Recovery for Cloud-Based Computing*, UTIL. DIVE (July 24, 2020), https://www.utilitydive.com/news/illinois-regulators-reject-proposal-to-allow-utilities-cost-recovery-for-cl/582249/ [perma.cc/9PTZ-LL26]; Illinois Com. Comm'n, Order Initiating Proposed Rulemaking Relating to the Regulatory Accounting Treatment of Cloud-Based Solutions (July 25, 2020).

149. Municipal utilities and cooperatives tend to have a different perspective on cloud computing solutions given that they do not have the same ratebase profit focus. As capital or O&M is not determinative, they are more willing to implement the best solution. For AMI, this is often a cloud-based system, as utilities are not technology providers. Leaving technology, customer interface, and interoperability to entities which do these things all the time provides a better customer experience, as does the fact that the cloud-based systems are updated regularly, which utility customer interfaces are not. (Customer systems are refreshed in the IOU universe approximately every twenty years.)

150. Emma Penrod, *NREL to Test Real-Time Utility Meter Data as Resilience Solution Amid Rising Renewable Energy Adoption*, UTIL. DIVE (Mar. 9, 2023), https://www.utilitydive.com/news/nrel-test-real-time-utility-meter-data-resilience-solution-renewable-energy-adoption/644540/ [perma.cc/W2RP-Y25F].

151. T.J. Triolo, *Streamlining Situational Awareness for Electric Utilities Using Smart Meters*, FACTOR THIS (May 5, 2023), https://www.power-grid.com/smart-grid/streamlining-situational-awareness-for-electric-utilities-using-smart-meters/ [perma.cc/K3LV-3T9A].

or large batteries while also having lower carbon emissions.[152] Vegetation management—important because falling trees are the cause of the majority of power outages—tends to get less funding (and be of a lower priority) precisely because it is not a capital investment.[153] However, utilities have not historically focused on these ways to improve reliability and there are no incentives to do so in the future.

B. Customers Acting in Self-Protection

Utilities have also made the argument that customers should "self-protect" to minimize the cost of a service interruption on them. This is fallible for two reasons: 1) If a monopoly is providing a public service, customers should not have to spend additional money besides paying their bill, and this leaves the subset of the population least able to spend additional funds to "self-protect" most open to the losses of an extended outage; and 2) this is victim blaming—just like Exxon and other oil companies saying that the issues with climate change were due to personal choice, rather than systemic disinformation.

Saying that utilities should not be responsible for any damages due to service interruptions and the real problem is customers not each getting generators is like saying that the carbon impact of flying for one family vacation a year is the reason climate change is happening rather than the political lobbying and a massive disinformation campaign. Put candidly, "[a]t this point, the utility companies' insistence that they are truly blindsided by these weather events is sounding about as credible as Tim Robinson's man in a hot dog costume insisting he wasn't the guy who crashed that hot dog-shaped car."[154]

However, customers are already taking the fact that their utility fails to deliver power reliably into account: by adding distributed solar to enable them to generate their own electricity, and by equipping their homes with storage. Other customers are looking to use the storage in their electric vehicles (EVs) to withstand outages—either directly by plugging their home into their vehicle,[155] or by using their vehicle as a temperature-controlled location when their home loses power.[156]

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152. Patrick Cooley, *VPPs Provide Same Resource Adequacy as Gas Peakers, Large Batteries, at Up to 60% Less Cost: Study*, UTIL. DIVE (May 5, 2023), https://www.utilitydive.com/news/vpps-provide-same-resource-adequacy-as-gas-peakers-large-batteries-at-up-t/649570/ [perma.cc/XKC7-NAWD]. *See also* Joel B. Eisen, Felix Mormann & Heather Payne, Virtual Energy, 2024 U. ILL. L. REV. 107 (2024).

153. Scott Chambers, *Trees Cause Most Power Outages. Why Does Vegetation Management Get the Axe?*, FACTOR THIS (Mar. 26, 2024), https://www.renewableenergyworld.com/power-grid/outage-management/trees-cause-most-power-outages-why-does-vegetation-management-get-the-axe/ [perma.cc/4SQU-QFC7].

154. Lee DeVito, *DTE and Consumers Energy Keep Blaming the Weather for Michigan's Power Outages*, DETROIT METRO TIMES (Feb. 27, 2023, 12:13 PM), https://www.metrotimes.com/news/dte-and-consumers-energy-keep-blaming-the-weather-for-michigans-power-outages-from-winter-ice-or-summer-wind-32483952 [perma.cc/B6FD-299S].

155. *See* Scott Evans, *How the Ford F-150 Lightning Can Power Your Whole House*, MOTORTREND (May 18, 2022), https://www.motortrend.com/features/2022-ford-f-150-lightning-home-power/; ClickOnDetroit, *F-150 Truck Saves Wedding Reception During Power Outage in Farmington Hills*, YOUTUBE (Aug. 18, 2021), https://www.youtube.com/watch?v=74gBdyfj-bw&ab_channel=ClickOnDetroit%7CLocal4%7CWDIV [perma.cc/H5QP-547M].

156. Eva Fox, *Tesla Car Saves Family with a Newborn from Freezing in Texas*, TESMANIAN (Feb 17, 2021), https://www.tesmanian.com/blogs/tesmanian-blog/tesla-car-saves-a-family-with-a-newborn-from-freezing-in-texas [perma.cc/P4EH-L7HM].

The challenge with this approach is twofold: (1) It may be less efficient for every customer to self-insure individually;[157] and (2) not every customer has the ability to self-insure, leading to equity issues.[158]

Even with customers spending their money to gain access to electricity when their utility fails to provide it, utilities claim that—at least in part—their reliability challenges are due to the increase in generation they do not control. As one grid executive said, "as distributed resources start to increase in penetration, that planning process for reliability gets challenging."[159] The challenge comes from utilities' lack of control. Therefore, utilities are and will continue to use increasing levels of renewable and distributed resources as a scapegoat for poor reliability, even when that is not the cause. Blaming grid problems on what would conform with the utility or a political worldview is not unique to this situation; we also saw renewables blamed for the grid problems during Winter Storm Uri in Texas, even though all other generation resources had many more issues.

Utilities will continue to blame renewables for reliability issues because utilities prefer to stifle competition and therefore disparaging renewables and distributed sources of electricity continues to enshrine their monopoly power[160] and enables them to convince regulators to let them build more fossil-fueled generation.[161] This is true even though "[i]n case after case, fossil fuel plants fail much more often than grid planners expect."[162] Natural gas had the most issues during Winter Storm

157. McGinniss, *supra* note 66.

158. Ivan Penn & Peter Eavis, *Backup Power: A Growing Need, if You Can Afford It*, N.Y. TIMES (May 6, 2023), https://www.nytimes.com/2023/05/06/business/energy-environment/backup-power-generators-climate-change.html [perma.cc/5XG8-LUJV].

159. Walton, *supra* note 102. *See also* Jason Plautz, *PSEG CEO Izzo Backs Democrats' Clean Electricity Performance Program, Bucking AEP, Others*, UTIL. DIVE (Sept. 23, 2021), https://www.utilitydive.com/news/pseg-ceo-izzo-backs-democrats-clean-electricity-performance-program-bucki/607049/ [perma.cc/LUB6-XPHW] (discussing how AEP—which operates coal plants—said that the Clean Electricity Performance Program (CEPP), which would incent utilities to adopt clean energy and penalize those that did not, would "adversely impact the reliability and resilience of the electric grid"); Walton, *supra* note 102 (arguing reliability planning becomes more difficult with distributed generation). In fact, large portions of our grid routinely run on more than 70% renewable resources for hours at a time. Michelle Solomon, *It's time to rethink grid reliability*, UTIL. DIVE (July 20, 2023), https://www .utilitydive.com/news/grid-reliability-energy-transition-energy-innovation/688423 [perma.cc/9XAU-RZ48].

160. Jeff St. John, *Why Are Blackouts Looming? Blame Extreme Weather, Not Wind and Solar*, CANARY MEDIA (May 27, 2022), https://www.canarymedia.com/articles/utilities/why-are-blackouts-looming-blame-extreme-weather-not-wind-and-solar [perma.cc/3QQF-N3G9]; Daniel Tait (@taitdl), X (Mar. 7, 2023, 10:59 AM), https://x.com/mission_data/status/1633135397684539392?s=43&t=LNPLnREHmYkQUYDJtENVxw [perma.cc/6M5A-FTY8]. *See also* Iulia Gheorghiu, *Arizona Legislature Advances Bill Restricting Retail Competition in Effort to Promote Reliability*, UTIL. DIVE (Apr. 21, 2022), https://www.utilitydive.com/news/arizona-legislature-advances-bill-restricting-retail-competition-in-effort/622409/ [perma.cc/6FRS-ULGY].

161. *See, e.g.*, Diana DiGangi, *Dominion Energy Projects Adding Up to 9 GW of Gas-fired Capacity in Virginia to Bolster Reliability*, UTIL. DIVE (May 4, 2023) https://www.utilitydive.com/news/dominion-virginia-resource-plan-reliability-natural-gas-coal-renewables-youngkin/649377/ [perma.cc/A8LC-PTW5].

162. Christy Walsh, *Power Grid Failures Reveal the Myth of Fossil Fuel Reliability*, BLOOMBERG LAW (Feb. 2, 2023, 4:00 AM), https://news.bloomberglaw.com/us-law-week/power-grid-failures-reveal-the-myth-of-fossil-fuel-reliability [perma.cc/5CKU-XNF9].

Elliott[163] but coal plants failed as well.[164] These failures occur even when those facilities are provided capacity payments to be ready to run.[165] Instead of generating electricity,

> outages at fossil fuel plants began stacking up. Some couldn't get fuel. Some just stopped working. And others failed to start. By Dec. 24, an astonishing 46 gigawatts of power plants (enough to power California) were out of service. PJM reported failures across the gas system, including low pressure, frozen compressors, and a lack of commercially available fuel. Plant shutdowns, it said, were "unacceptably high."[166]

The grid operator barely kept the lights on for the sixty-five million people in its service territory.[167] In fact, the entire Eastern Interconnect had the potential for the entire grid to fail during the storm;[168] more than 13% of generating capacity went offline, with more than 60% of that capacity being natural gas.[169] And unfortunately, our grid is becoming ever more dependent on natural gas generators,[170] and some that were supposed to be replaced with carbon-free sources are being retained rather than replaced.[171] Amazingly, wind was even

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163. Clarion Energy Content Directors, *FERC-NERC Final Report: Natural Gas Struggled the Most during Winter Storm Elliott*, POWER ENG'G FACTOR THIS (Nov. 8, 2023), https://www.power-eng.com/policy-regulation/ferc-nerc-final-report-natural-gas-struggled-the-most-during-winter-storm-elliott/ [perma.cc/22VP-E46E].

164. Ryan Van Velzer, *Fossil Fuels Failed Kentucky Utility Customers During Winter Blackouts*, LOUISVILLE PUBLIC MEDIA (Aug. 31, 2023, 5:03 PM), https://www.lpm.org/news/2023-08-31/fossil-fuels-failed-kentucky-utility-customers-during-winter-blackouts [perma.cc/RV9T-4NQZ].

165. *Id.* Some of those same generators are now arguing that they should not be fined for their non-performance, even though they failed to operate when called upon for reliability purposes. Ethan Howland, *PJM, PSEG, Others Urge FERC to Reject Generator Pleas to Drop Winter Storm Elliott Non-Performance Penalties*, UTIL. DIVE (May 31, 2023), https://www.utilitydive.com/news/pjm-ferc-winter-storm-elliott-penalty-complaints/651620/ [perma.cc/T7ER-5PN6]. FERC is mediating settlement talks about the fines. Ethan Howland, *FERC to Oversee Settlement Talks to Resolve PJM Winter Storm Elliott Complaints Amid $1.8B in Charges*, UTIL. DIVE (June 7, 2023), https://www.utilitydive.com/news/ferc-pjm-winter-storm-elliott-settlement-complaints-calpine-vistra/652282/ [perma.cc/4KHJ-VUD9]. It is also well documented that "capacity markets everywhere habitually over-procure capacity and under-procure capabilities for grids confronting new and mounting reliability challenges." David Littell & Michael Hogan, *FERC Points PJM Toward a 21st-Century Reliability Approach*, UTIL. DIVE (June 15, 2021), https://www.utilitydive.com/news/ferc-points-pjm-toward-a-21st-century-reliability-approach/601805/ [perma.cc/AJ3N-P2TR].

166. Walsh, *supra* note 162.

167. Casey Roberts, *How PJM, America's Biggest Grid Operator, Got Its Reliability Report Wrong*, UTIL. DIVE (May 12, 2023), https://www.utilitydive.com/news/pjm-grid-operator-reliability-capacity-market-coal-gas-wind-solar/649152/ [perma.cc/36CX-6VW3].

168. Simon Mahan (@SimonMahan), X (Nov. 7, 2023, 4:23 PM), https://x.com/simonmahan/status/1722001838734463077?s=43&t=LNPLnREHmYkQUYDJtENVxw [perma.cc/M9NS-N7WZ].

169. Ethan Howland, *Record 13% of Eastern Interconnect Capacity Failed in Winter Storm Elliott: FERC, NERC*, UTILITY DIVE (Sept. 22. 2023), https://www.utilitydive.com/news/winter-storm-elliott-ferc-nerc-report-power-plant-outages/694451/ [perma.cc/2P25-3EDS].

170. Robert Walton, *NARUC Launches Initiative to Enhance Gas-electric Sector Coordination, Boost Grid Reliability*, UTILITY DIVE (Nov. 28, 2023), https://www.utilitydive.com/news/NARUC-GEAR-gas-electric-coordination/700800/ [perma.cc/HV6U-KXZ6].

171. *See, e.g.*, Sammy Roth, *Despite Climate Goals, California Will Let Three Gas Plants Keep Running*, L.A. TIMES (Aug. 15, 2023, 8:09 PM), https://www.latimes.com/environment/newsletter/2023-08-15/despite-climate-goals-california-will-let-three-gas-plants-keep-running-boiling-point?utm

curtailed—told not to produce—in neighboring areas that could have supplied power even as there were rolling blackouts in the Southeast.[172]

While there were not rolling blackouts from major winter storms in January 2024, the grid did come perilously close to that again, with fossil gas plants again having the most problems.[173] More seriously, "black-start" units—those designed (and paid) to be able to start up without external electrical power, and that are therefore critical in the event of a large grid blackout[174]—had unplanned outages, due to both fuel supply issues and equipment failures.

C. Utilities Behaving Badly (A Non-Exhaustive List)

While it might have been true at one point in time that service interruptions were not a large inconvenience—there were other methods to heat our spaces and water, to cook, we did not have the internet and our digitally connected lives—that is increasingly not the case. Our electric service is becoming more critical and should be treated as such, with electric utilities actually held accountable for their service or lack thereof. A common refrain from utilities is that "unregulated companies infrequently reimburse customers for service interruptions."[175] But this is not a valid argument—the very reason that these companies have been given monopoly status (at least in part) is because they are providing a critical public function.

Another common plea is that utilities should not be held accountable for weather related interruptions or other outages beyond their control.[176] This is incorrect from a policy perspective for three reasons: (1) This assumes utilities have done everything they can to prepare for the likely outcomes from weather, which they have not, given that the reliability impacts from weather-related disruptions are excluded from current reliability metrics and they are actively resisting other policy innovations, like distributed solar and other distributed energy resources, that would lessen the impacts of weather related outages, plus recent history around outages;[177] (2) this ignores that carbon from utilities' electricity production has fueled climate change and that therefore they are in part responsible for the extreme weather

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_id=107965&sfmc_id=2600589&skey_id=3493ff18e1b09badd6f0d272c2016ec89c91b9546b4d663d06ad52bf5250ec37 [perma.cc/CM48-UYFH].

172. Nick Guidi & Chris Carmody, *The Southeast Energy Exchange Market Launched a Year Ago. It Still isn't Delivering on its Promises.*, UTIL. DIVE (Nov. 22, 2023), https://www.utilitydive.com/news/southeast-energy-exchange-market-clean-power-ferc-spp-miso/700502/ [perma.cc/2PVQ-68FC]. *See also* Van Velzer, *supra* note 164 (noting that parts of Kentucky in PJM did not have rolling blackouts while the rest of Kentucky—which is still vertically integrated and did not join PJM—did).

173. Paul Arbaje, *FERC and NERC Review of Winter Storm Gas Failures Lacks Transparency, Key Details*, UTIL. DIVE (May 3, 2024), https://www.utilitydive.com/news/ferc-nerc-winter-storm-review-gas-power-outage-ucs/715106/ [perma.cc/EAA8-JLLU].

174. Nat'l Renewable Energy Lab'y, *Black Start*, GRID MODERNIZATION, (last visited Mar. 3, 2025). https://www.nrel.gov/grid/black-start.html [perma.cc/H3CM-S5KN].

175. Ken Costello, *Should Public Utilities Compensate Customers for Service Interruptions?*, NAT'L REGUL. RSCH. INST. i, iv (July 2012) https://pubs.naruc.org/pub/FA86AD59-0662-E1F4-1213-3698BF336139 [perma.cc/W95M-M87H].

176. *Id.*

177. Distribute energy resources are typically defined as "small, modular, energy generation and storage technologies" including "wind turbines, photovoltaics (PV), fuel cells, microturbines, reciprocating engines, combustion turbines, cogeneration, and energy storage systems" that can "be either connected to the local electric power grid or isolated from the grid in stand-alone applications." NAT'L RENEWABLE ENERGY LAB'Y, USING DISTRIBUTED ENERGY RESOURCES (May 2002), https://www.nrel.gov/docs/fy02osti/31570.pdf [perma.cc/V4YU-6JYV].

related events being borne by their customers;[178] and (3) that utilities continue not to plan for extreme weather.[179] Claiming that utilities should only be liable in cases of "willful or gross neglect or other extreme conditions, which commissions seem to determine rarely,"[180] is no longer making utilities sufficiently liable as we become more dependent on electricity and work to electrify everything.[181]

Allowing utilities to claim that any weather-related interruption is "beyond their control" has absolved the utilities of far, far too many poor decisions over the last 120+ years. That lack of reliability and action is estimated to "cost utility customers $2–3 billion in any given year."[182] Other research puts the number higher, finding that "severe-weather-related power interruptions cost the U.S. economy $20–55 billion each year."[183] Another study finds the impacts to be up to $75 billion annually.[184] However, these are for short-term events. As the Berkeley Lawrence National Lab noted, "[t]here is significantly less literature on the economic impacts of large-scale, long-duration interruptions than on short-term outages."[185]

One example should be sufficient to demonstrate the culpability of utilities in the impact that ratepayers are currently feeling. When Hurricane Ida (Ida) hit New Orleans, "nearly 1.2 million customers lost power . . . due to damaged transmission and distribution infrastructure."[186] "Ida knocked out nearly one-eighth of the utility's transmission network in a single blow—including every transmission line serving New Orleans."[187] And this was not particularly new: "When Hurricane Gustav struck the Gulf Coast in 2008, leaving more than 100,000 Louisiana customers without power for over a week, Entergy's grid was in shambles. Only one of the transmission lines serving New Orleans survived the storm."[188] After Ida, some of those residents of Louisiana and Mississippi were left without power for weeks. Rather than focus on system reliability—which would have built more large-scale transmission lines—Entergy "instead opted to focus on smaller transmission projects that aren't open to competition."[189] Larger transmission

178. Maria Gallucci, *EPA Rules May Push Power Plants to Capture Carbon. Is The Tech Ready?*, CANARY MEDIA (Apr. 28, 2023), https://www.canarymedia.com/articles/carbon-capture/epa-rules-may-push-power-plants-to-capture-carbon-is-the-tech-ready [perma.cc/88QX-NDZ3] (noting fossil fuel plants "spew[] billions of tons of planet-warming gases in the process" of providing electricity).

179. Blau et al., *supra* note 7.

180. Costello, *supra* note 175, at iv.

181. Winter Storm Uri might be an exception—insurance companies are suing both ERCOT and thirty-seven generators for "losses and property damage sustained during" the storm, alleging gross negligence for failure to plan and prepare for the storm. Avery Travis, *More Than 100 Insurance Companies Sue ERCOT, Power Generators over Winter Storm Losses*, KXAN (Jan. 4, 2022, 10:42 PM), https://www.kxan.com/news/texas/more-than-100-insurance-companies-sue-ercot-power-generators-over-winter-storm-losses/[perma.cc/N6FA-AZ8L]. The gross negligence claim is based on prior warnings that equipment needed to be weatherized, especially after previous storms. *Id.*

182. SANSTAD ET AL., *supra* note 49, at 10.

183. *Id.*

184. *Id.*

185. *Id.* at 12.

186. Andy Kowalczyk, *Utility Entergy Stymied Transmission Projects That Might Have Prevented Some New Orleans Blackouts*, CANARY MEDIA (Sept. 30, 2021), https://www.canarymedia.com/articles/utilities/utility-entergy-stymied-transmission-projects-that-might-have-prevented-some-new-orleans-blackouts [perma.cc/9SH6-YZ2L].

187. *Id.*

188. Blau et al., *supra* note 7.

189. Kowalczyk, *supra* note 186 ("[R]egional transmission projects in MISO that are 345 kilovolts and up—the size category of projects that are required to be open to competitive bidding

projects, which would have had to have been competitively bid and might not have been constructed by Entergy, would have been much better for reliability and would have been able to survive impacts from the storm. As is becoming clear, however, Entergy put its profit motive—and the ability to obtain a regulated rate of return from captive ratepayers for capital investments—above the need for a reliable system. By claiming that those small transmission projects which it was the monopoly provider for were enough to meet any transmission need, Entergy negated any reason for regulators to require the construction of larger transmission lines, leading to a system that was unable to meet basic needs for far too many.[190]

Entergy's focus on making sure it captured all capital investment for itself did not end at transmission lines. Indeed, one recent capital investment—a new natural gas plant "that could quickly restore power following an outage"—"did not quickly supply power to any portion of the city."[191] Rather than build a new transmission line that would have increased reliability in the New Orleans area, the utility built a 980 MW gas plant—adding $870 million to its rate base in the process, even though the transmission line would have cost only $108 million.[192] But again, the transmission line would have had to have been competitively bid; the gas plant was not. Continuing to demonstrate its focus on fossil fuels and maximizing profits, the utility also "implied it would sue" the New Orleans City Council if the council

—would have a greater ability to transfer power and would be engineered to withstand winds up to 150 mph. The lines feeding New Orleans, by contrast, were a jumble of new and old 230-kilovolt lines, some of which were approaching the end of their expected lifespans. A large part of Entergy's system was built to comply with an earlier generation of engineering standards that were not as stringent as current standards. Entergy's website states that all new projects are built to withstand 140 to 150 mph winds, but it doesn't disclose the age of the infrastructure in its system. Given that transmission assets have a 50-year average lifespan, the utility's focus on smaller projects designed to prop up these aging assets threatens overall reliability.").

190. Blau et al., *supra* note 7 ("But an investigation by ProPublica and NPR found that the utility, along with its parent company, Entergy, failed to take the necessary steps to protect its customers against outages, despite opportunities after several big hurricanes to build more resilient systems. Entergy has aggressively resisted efforts by regulators, residents and advocates to improve its infrastructure. The company's restoration of its equipment after major storms didn't prioritize the grid modernization that industry experts say could limit the scope and duration of power outages . . . . Five independent energy and environment experts who reviewed the findings of NPR and ProPublica's investigation said that ENO and its parent corporation, a Fortune 500 company that made a record profit of $1.4 billion in 2020, had failed in recent years to reduce the scope of harm that a storm like Ida could cause. They expressed concerns over the utility's insufficient grid investments, spending cuts for routine maintenance and overstatement of equipment's capabilities to supply reliable power after storms. As a result, local officials were left to reckon with a stark reality: The most vulnerable New Orleans residents were left powerless by the city's most powerful company."). *See also* Kowalczyk, *supra* note 184 ("Entergy has a very strong incentive to maximize smaller, local projects, which are shielded from MISO review and approval while simultaneously restricting the ability to expand transmission which may lead to more electric power competition.").

191. Blau et al., *supra* note 7 ("After the storm, Entergy has shared a variety of explanations as to why the company didn't use the black-start technology. First, May, the Entergy Louisiana president and CEO, said the natural gas plant required power from a downed transmission line. Then, he explained the plant could start up by itself, but the company chose a different way to 'rapidly restore power' to more customers. At a press conference, ENO CEO and President Deanna Rodriguez claimed the plant 'worked as it was designed to work' and served as a 'big part of the solution.'").

192. Kowalczyk, *supra* note 186. ("Ironically, this gas plant sat idle in the aftermath of Hurricane Ida, unable to generate power to feed a blacked-out grid.").

adopted an ordinance that would have required a shift to renewable resources and allowed for more distributed energy.[193]

Unfortunately, although probably not surprisingly, even the costs that utilities pass on to ratepayers to reestablish power after a storm have been found problematic. In one recent instance, Maine regulators agreed with public advocates that a large investor-owned utility in the state billed customers for storm response costs, even though it was determined that those costs were not prudently incurred, including based on the fact that there was not evidence to support spending the utility wanted customers to pay for.[194] Thankfully, in that case, ratepayers will have a reduction in what they are expected to pay. Other customers are less likely to be afforded that relief—it is expected that Texas electricity bills will go up 2% for a fifteen-year period to pay for the effects of Hurricane Beryl.[195] This is on top of the $800 million that was rate based for large generators by Houston area utility CenterPoint, which proved useless during the storm and subsequent recovery—even though the utility is expected to make $30 million in profits (paid for by ratepayers) on the capital investment in that equipment.[196]

It is obvious that the system as a whole—and utilities in particular—need to rethink infrastructure risk.[197] It is well accepted, for example, that more large, regional transmission would improve reliability, but grid operators are not even using the capacity that exists now.[198] Unfortunately, there is little evidence that utilities are rethinking risk. As one analysis recently found:

> Utilities may also be underestimating their risks from rare-but-catastrophic 'black swan' events, such as the destructive and deadly February 2021 Texas deep freeze, or the extraordinary Pacific Northwest heatwave in June 2021. In our survey, utility participants ranked such risks quite low: Only 8% are significantly concerned about potential liability for damage or loss of life caused by utility infrastructure (or by damage to utility infrastructure).[199]

193. Blau et al., *supra* note 7.

194. Evan Popp, *Regulators Approve Deal to Reduce CMP Storm Charges to Ratepayers by $850,000*, FACTOR THIS (June 12, 2024), https://www.renewableenergyworld.com/energy-business/policy-and-regulation/regulators-approve-deal-to-reduce-cmp-storm-charges-to-ratepayers-by-850000/ [perma.cc/F3EU-T6A3].

195. Robert Walton, *Texas Weighs Clawing Back $800M CenterPoint Spent on Unused Generation*, UTIL. DIVE (July 31, 2024), https://www.utilitydive.com/news/texas-lawmakers-consider-clawing-back-800m-centerpoint-following-beryl-recovery/722865/ [perma.cc/H8JC-DKKS].

196. *Id.* Additionally, the "generators can take days to move and assemble and require special permits" to run. *Id.*

197. *Rise in Climate Disasters Forces Utilities to Rethink Infrastructure Risk*, THE ENERGY MIX (Jan. 11, 2024), https://www.theenergymix.com/rise-in-climate-disasters-forces-utilities-to-rethink-infrastructure-risk/ [perma.cc/B2ZE-YSVT].

198. Ethan Howland, *Grid Operators Fail to Effectively Use Interregional Ties, Increasing Costs, Hurting Reliability: NREL*, UTIL. DIVE (June 7, 2024), https://www.utilitydive.com/news/nrel-interregional-transmission-barriers-report-doe/718306/ [perma.cc/3SG5-R8EB].

199. STUDIO ID, *supra* note 44, at 3.

Recent events hopefully will have brought the risk more into focus, given that utilities will have continued liability for utility caused wildfires[200] and courts have indicated that utilities will not be shielded from gross negligence or intentional misconduct.[201]

Given the ever-increasing impacts of climate change, those extreme events are forecast to become even more frequent. Customers deserve better, and centering them in regulatory decisions provides a viable path forward.

III. CENTERING THE CUSTOMER

Utilities are failing their customers. The reliability focused on by utilities does not take into account the importance of electricity to the consumer.[202] Regulators must do better centering the customer experience when designing reliability metrics and implementing actions that supposedly will increase the reliability of our electricity system. This section provides ways to do that, suggesting regulators focus on ways to make more informed decisions and a discussion of other ways to improve reliability, including administratively set payments to customers. While some contours of the potential liability schemes would need to be worked out, considerations in each of these will be addressed. The section ends with a discussion of traps that regulators should avoid.

A. More Informed Decisions

To make more informed decisions around reliability, regulators should take long-duration outages into account for all reliability metric calculations. Additionally, they should adopt new reliability metrics that do not focus on averages. As we cannot harden everything to address our increasingly severe climate challenges, this section ends with some thoughts on prioritization and how to address that our grid will fail—and we need to also prepare for that.

1. Take Long-Duration Outages into Account

Measures for reliability must center the customer rather than the utility. So, what would that look like? First of all, regulators must start measuring and taking longer-duration outages into account—and holding utilities responsible for them. These "'dark-sky' events, interruptions that affect large areas and last from several days to a few weeks . . . are historically the most common type of major electric power disruption."[203] And yet, even with that prevalence, these are exactly the events that utilities are allowed to exclude from their reliability metrics. While "the costs incurred from long-duration outages are not well documented, particularly

200. Courtney Sherwood, *Oregon Can't Limit PacifiCorp's 2020 Wildfire Payouts, State Utility Regulators Determine*, OPB (May 30, 2024, 4:27 PM), https://www.opb.org/article/2024/05/30/oregon-cannot-cap-pacificorp-wildfire-payouts-utility-regulators-decide/ [perma.cc/5P6Q-MULG].

201. Lauren Irwin, *Texas Appeals Court Says Winter Storm Lawsuits Against Transmission and Distribution Utilities Can Move Forward*, THE HILL (Apr. 4, 2024, 5:22 PM), https://thehill.com/regulation/court-battles/4573473-texas-appeals-court-says-winter-storm-lawsuits-against-transmission-and-distribution-utilities-can-move-forward/ [perma.cc/E895-XM66].

202. McGinniss, *supra* note 66.

203. SANSTAD ET AL., *supra* note 49, at 2.

how cost varies by location, duration and scale,"[204] the impacts to customers from these events are much greater than from shorter-duration outages.[205]

One way to have more attention paid to these longer-duration outages—and, therefore, the impacts from them—is to include them in the current reliability targets that utilities are responsible for. This is the bare minimum that should occur.[206] Utilities themselves recognize that including all outage events in reliability metrics "puts more accountability for restoration after major events on the utility manager."[207]

2. New Metrics of Reliability

Regulators should also look at developing new reliability metrics. There are already a number of specified metrics that regulators could choose from; industry has already done some of the work for regulators, developing new metrics that identify individual customers experiencing multiple interruptions (CEMI), multiple momentary interruptions (CEMM), or long interruption duration (CELID).[208] One recommendation would even be for regulators to measure CEMSMI—Customers Experiencing Multiple Sustained and Momentary Interruptions.[209] These are also not new per se; the issue is that few utilities measure or report them.[210] While these would help and should be tracked, they still will not give regulators the full picture. Analytics platforms also exist that could help.[211]

Texas, the most recent state to review reliability metrics, has proposed adopting metrics based on duration, frequency, and magnitude.[212] The frequency metric uses a traditional loss of load expectation (LOLE) metric, where a 0.1 LOLE equates to a customer having a blackout only once every decade.[213] However, LOLE does not help regulators understand how long outages are, but simply how frequently they are happening.[214] Other metrics include loss of load hours (LOLH),

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204. Macmillan et al., *supra* note 59.

205. Blau et al., *supra* note 7.

206. Keogh & Cody, *supra* note 1, at 9 (showing that CAIDI and SAIDI should include major events if regulators are interested in resilience). About half of regulators currently track these metrics excluding major events. *Id.* at 7.

207. AM. PUB. POWER ASS'N, *supra* note 24, at 6.

208. Watts, *supra* note 61.

209. *Id.*

210. GRID MODERNIZATION LAB'Y CONSORTIUM, *supra* note 118, at i, app. A.

211. *See, e.g.*, NLINE, https://nline.io/platform (last visited July 27, 2023).

212. Robert Walton, *Texas Regulators Should Consider a Combination of Metrics to Establish Reliability Standard, Stakeholders Urge*, UTIL. DIVE (Apr. 2, 2023), https://www.utilitydive.com/news/texas-puc-ercot-reliability-standard/646734/ [perma.cc/C3FZ-DCRE]. These metrics were adopted in September 2024. Tom Kleckner, *Texas PUC Sets Reliability Standard for ERCOT*, RTO INSIDER (Sept. 3, 2024), https://www.rtoinsider.com/86619-texas-puc-sets-reliability-standard-ercot [perma .cc/R39M-ES6G].

213. *Id.*

214. Because of this limitation, "MISO is questioning whether its current loss of load standard remains the best method for establishing resource adequacy" and recognizes that "many industry experts recommend change" to "a more comprehensive" measurement scheme. Amanda Durish Cook, *MISO Dips Toes into Potential New Resource Adequacy Standard; States Demand Key Role*, RTO INSIDER (Sept. 26, 2024), https://www.rtoinsider.com/88193-miso-potential-new-resource-adequacy-standard [perma.cc/H5SFHQ LE].

which would measure the duration of outages.[215] This would be helpful for regulators to understand whether outages are relatively short in duration—and therefore not very impactful for most customers—or whether more customers are suffering from long-duration outages, even if it might only happen infrequently. In terms of magnitude, regulators are looking at expected unserved energy (EUE) as a metric.[216] This provides a measure of how much energy would have been consumed had the outage not occurred. The higher the EUE, the greater the magnitude of the outage. Additionally, regulators are working with consultants to understand the value of lost load (VOLL).[217] VOLL provides an estimate of the economic impact of the outages. Even in Texas, however, critics have recommended against the adoption of even minimum reliability metrics, arguing that it would imply too high of a VOLL and effectively set up a capacity market.[218] Illinois regulators have also adopted additional metrics as required by the Climate and Equitable Jobs Act.[219]

New metrics are also critical to address energy justice concerns. First, rather than just averages, it is important for regulators to understand both the mean and the variance—averages can be gamed too easily. Requiring variance reporting would lessen that ability. Second, regulators could add additional outage metrics calculated for 90%, 95%, and 99% of customers restored after a storm. This would demonstrate how long the distribution tail was for a particular utility—in other words, how the last remaining customers without power in their service territory are faring. Third, regulators could use additional measures of social vulnerability to craft reliability metrics. These are commonly available by census track and would give regulators a better idea of how many customers who are least able to withstand the impacts of long-duration power failures are being subjected to them.[220] While it is recognized that all communities should have reliable energy,[221] we are far from

215. Patricio Rocha Garrido, *Education: Other Resource Adequacy Reliability Metrics*, PJM (Jan. 10, 2022), https://www.pjm.com/-/media/committees-groups/task-forces/rastf/2022/20220110/20220110-item-03-reliability-metrics-education.ashx [perma.cc/RXQ9-SZKY].

216. Walton, *supra* note 212.

217. *Id.*

218. *Id.* Texas regulators, however, are going ahead and surveying customers about the cost of power outages to inform how they should be thinking about VOLL. Robert Walton, *ERCOT to Survey Customers About Cost of Power Outages*, UTIL. DIVE (Mar. 27, 2024), https://www.utilitydive.com/news/texas-PUCT-survey-customers-cost-of-power-outages-VOLL-ERCOT/711456/ [perma.cc/VM3J-MFBN]. To better account for impacts, one RTO operator, MISO, proposed to increase its VOLL to $10,000/MWh. However, under pressure, it has said it will now limit that amount to only shorter-duration outages and will use a much lower value for any long-duration outages. Amanda Durish Cook, *MISO to Limit Use of $10K VOLL During Long-duration Outages*, RTO INSIDER (July 14, 2024), https://www.rtoinsider.com/83081-miso-limit-use-10k-voll-during-long-duration-outages [perma.cc/8F4W-2V4D].

219. S.B. 2408, 102nd Gen. Assemb. (Ill. 2021). *See also Case Details for 22-0067*, ILL. COM. COMM'N (filed Jan. 20, 2022), https://icc.illinois.gov/docket/P2022-0067 [perma.cc/4DLQ-RW55]; *Commw. Edison Co.*, ILL. COM. COMM'N (filed Sept. 27, 2022), https://icc.illinois.gov/docket/P2022-0067/documents/328509/files/571872.pdf [perma.cc/J8U3-ZTHM] (final order) (adopting SAIDI, SAIFI, CEMI4, and CELID for reliability).

220. At least one utility, Xcel, is providing at least some of this data for part of its service territory. *See Xcel Energy MN Electric Service Quality Interactive Map*, XCEL ENERGY, https://xeago.maps.arcgis.com/apps/webappviewer/index.html?id=6b87f4d407864b939bcea05aad05bdd1 [perma.cc/8MU5-XQ45] (last visited July 27, 2023).

221. Ethan Howland, *FERC Expands Environmental Justice, Equity Considerations in Agency Decision-Making, EJ Counsel Says*, UTIL. DIVE (June 3, 2022), https://www.utilitydive.com/news/ferc-environmental-justice-energy-equity-EJ-cole/624852/ [perma.cc/MHQ3-7KPY].

realizing that goal. However, including major events, not relying on averages, and looking at reliability from the customer perspective should help all customers.

It is also important to recognize seasonality. It will be far less impactful on customers if an extended outage occurs during mild spring or fall weather rather than during extreme heat or cold. No metrics currently take prevailing conditions into account at the time the outage occurs, but rather consider an outage to have the same effect whenever it happens. Based on all our lived experience, that simply is not the case. Our metrics need to recognize the additional hardship that comes when outages occur during extreme heat or cold and the additional risks and costs that come with those outages.

These updated and new metrics provide the additional benefit of information forcing. The information asymmetry that exists within monopoly utility regulation is well documented.[222] By requiring additional reporting from utilities, regulators also address the lack of transparency that exists around utility operations and decision making. This additional knowledge can help customers and advocates in future regulatory proceedings.

3. We Cannot Harden Everything. . .

It is true that we cannot harden everything; however, in making those decisions, we should be taking utility conflicts of interest into account. At least in some circles in the energy ecosystem, there is acknowledgement that more alignment needs to occur "to deploy the right grid resilience investments . . . and the appropriate level of investment."[223] As has been noted, "simply armouring infrastructure everywhere in anticipation of more extremes may ineffectively deploy scarce resources away from the highest risk assets."[224] While reliability matters, "[r]isk tolerance, investment priorities, and policy objectives may not naturally align among the long list of stakeholders."[225] We can no longer let reliability be something "addressed by event and outage planning within the utility"[226]—again, as they are failing to meet customer needs.

Self-interest and the desire to protect their profits also lead utilities to spurn the development of interregional transmission and other grid changes.[227] According to Federal Energy Regulatory Commission (FERC) Chairman Phillips, increased transmission is "the best path to bolstering grid reliability."[228] It could also have saved billions during Winter Storm Uri and provided power to homes. More

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222. *See, e.g.*, Payne, *supra* note 121.

223. SCOTTMADDEN, *supra* note 45, at 4.

224. Mikhail V. Chester, B. Shane Underwood & Constantine Samaras, *Keeping Infrastructure Reliable Under Climate Uncertainty*, 10 NATURE CLIMATE CHANGE 488, 488 (June 2020).

225. SCOTTMADDEN, *supra* note 45, at 17.

226. *Id.*

227. Joel B. Eisen & Heather Payne, *Rebuilding Grid Governance*, 48 BYU L. REV. 1057 (2023); Juhohn Lee, *Utilities: Why the U.S. is Struggling to Modernize the Electric Grid*, CNBC (Aug. 12, 2022 7:45 AM), https://www.cnbc.com/2022/08/12/why-the-us-is-struggling-to-modernize-its-power grid.html [perma.cc/N3BK-Y8ML].

228. Ethan Howland, *FERC Close to Final Interconnection Rule, Interregional Transfer Proposal: Chairman Phillips*, UTIL. DIVE (Apr. 28, 2023), https://www.utilitydive.com/news/ferc-intercon nection-reform-interregional-transfer-capacity-phillips/648850/ [perma.cc/4XGD-JLKC].

generally, more interregional transmission would provide significant cost savings for consumers in addition to providing reliability benefits.[229]

It is economically infeasible to provide service that is 100% reliable, and increasingly extreme weather will continue to make that true. For that reason, I have argued that there may be places where central-station grid service will not be the best answer and that, for those locations, microgrids or off-grid solutions may be a better answer.[230] Given that these locations are also likely often the last ones restored after a storm, alternate solutions may also provide faster recovery from extreme weather events. But more could be done in the initial design of the project and in determining where strategic investments occur that could aid the problem.[231] We cannot assume that past conditions are sufficient to predict future climatic conditions.[232] Instead, we must design for uncertainty, but also recognize and acknowledge that our infrastructure will fail[233]—and we need adequate processes and regulatory frameworks for when that happens.[234] As one industry report put it, "planning and designing for graceful degradation and rapid recovery may be appropriate instead of hardening against all risk."[235]

Of course, that rapid recovery does require plants that have been paid to be available to start without external power—so called "black-start" units—to be able to do precisely that: start up and provide power to the grid when none is being fed from the grid to them. However, as one grid operator has recently admitted, nearly half of the units paid to provide this service in the case of a grid emergency lack firm fuel supplies and therefore might not be able to perform.[236]

But to understand which grid investments would make the most sense, planning needs to change. A recent industry survey found "only 43% of utility participants said their organization always or usually accounts for climate change impacts when making capital investment decisions."[237] This should be at 100%— and it should be looking at future climate states, not historical climate variation.[238] Planning also needs to focus on the worse performing parts of our utility system. Some of the industry is already thinking about this, as are other jurisdictions.[239] Developing new metrics that focus on the customer experience and also require specific targeted actions by utilities would be far better than our current

229. *More Interregional Transmission Could Have Saved Nearly $1 Billion, Preserved Power for 200,000 Homes During Texas Freeze*, AM. COUNCIL ON RENEWABLE ENERGY (July 22, 2021), https://acore.org/news/more-interregional-transmission-could-have-saved-nearly-1-billion-preserved-power-for-200000-homes-during-texas-freeze/ [perma.cc/J4ZJ-A8DT].

230. Heather Payne, *Unservice: Reconceptualizing the Utility Duty to Serve in Light of Climate Change*, 56 U. RICH. L. REV. 603 (2022).

231. Chester, Underwood & Samaras, *supra* note 224.

232. *Id.*

233. *Id.*

234. McGinniss, *supra* note 66.

235. SCOTTMADDEN, *supra* note 45, at 19.

236. Ethan Howland, *PJM Proposes Incentives for 'Black Start' Units with Assured Fuel Supplies to Speed Outage Recovery Times*, UTIL. DIVE (May 15, 2023), https://www.utilitydive.com/news/pjm-black-start-units-assured-fuel-supply/650245/ [perma.cc/92QU-M3P2].

237. STUDIO ID, *supra* note 44, at 2.

238. Kavya Balaraman, *The Power Grid Faced Heat Waves, Record Demand and Tight Conditions in 2022. What Happens Next?*, UTIL. DIVE (Nov. 22, 2022), https://www.utilitydive.com/news/electric-reliability-power-outage-extreme-weather-california-texas-pacific-northwest-ercot-caiso/637065/ [perma.cc/R9WV-86PA].

239. *See, e.g.*, McEachran, *supra* note 46.

system. Many of these actions might be microgrids (where distributed energy resources plus storage can provide small areas of the grid with the ability to isolate and continue operation when the larger grid goes down) or utilization of customer assets rather than large amounts of additional rate base.[240] Additional rate base would require ratepayers to pay more profit to the utility; investment by customers in assets they own does not incur that cost.

Software also exists that could aid regulators in determining the intersection of climate risk that could impact the electricity grid and community vulnerability, including energy burden.[241] However, few utilities are making decisions based on this data, but rather still focus on static measures like age of equipment to drive investment decisions.[242]

Risk assessments also need to be modified—taking climate change into account flexibly and dynamically as conditions change and climate change impacts accelerate.[243] Of the six case studies performed by Berkeley Lawrence National Lab, only one—ConEd in New York—used a detailed framework to evaluate the impact that resilience projects would have.[244]

> The inputs to the risk calculation are (1) the number of customers affected by a power interruption, (2) the type of infrastructure or equipment affected, and (3) the duration of the interruption. Estimates are made for substations, underground facilities, and overhead facilities. Within each of these groups, certain types of infrastructure are assigned "population equivalents" using formulae that weight the infrastructure in order to reflect the societal effects of power interruptions that would affect it. The types of infrastructure that are weighted are residential high-rise buildings, hospitals and public health facilities, public safety facilities, and other critical facilities.[245]

But even this detailed methodology focused on the "value of reliability or lost load estimates,"[246] which will put more emphasis on locations that would typically use more electricity—wealthy suburban homes, for example, rather than lower income areas. The analysis explicitly "estimated the GDP loss for the specific area fed by a substation" to obtain likely loss if a particular substation went down.[247] This specifically ignores the fact that where GDP is highest—in wealthy areas—the residents and businesses are most likely to have sufficient financial and other safety nets to better weather an extended outage, as they will have available resources to

240. When customers install distributed energy resources like solar or storage, they are using their own capital. Since this capital is not utility invested capital, it does not require other ratepayers to pay a return on equity (a profit) to have it invested in the reliability of the system.

241. Jeff St. John, *This Software Factors Climate Risk and Energy Equity Into Grid Planning*, CANARY MEDIA (Feb. 23, 2023), https://www.canarymedia.com/articles/utilities/this-software-factors-climate-risk-and-energy-equity-into-grid-planning [perma.cc/5V7L-EUVW].

242. *Id.*

243. STUDIO ID, *supra* note 44, at 4.

244. SANSTAD ET AL., *supra* note 49, at 36.

245. *Id.* Additionally, as the report notes, ConEd was not clear in how data was extrapolated for longer-duration outages or how population equivalents were determined, which drove which critical facilities needed to be the highest priority. *Id.* at 37–38.

246. *Id.* at 37.

247. *Id.* at 39.

either leave or procure what is necessary. As amply demonstrated by Ida (and Hurricanes Florence, Katrina, and numerous other extreme weather events in the past), that is not the case in lower-income areas, which should be prioritized for resilience investment.

While acknowledging that "there is no agreed upon or widely accepted cost-avoidance model" that could be quickly adopted,[248] regulators could do a much better job at assessing the impacts of longer-duration outages.[249] Maryland, for example, recognized that residential customers incur a variety of costs as a result of power outages. The most direct costs include expenses for restaurant meals and hotel stays. For residential customers who depend on electric pumps for well water, direct costs are incurred to pay for alternative water sources. Moreover, the inconvenience caused by a power outage can be substantial because of impacts such as interruptions in internet access and telephone service. The cost of power outages exacerbating health-related conditions can be very high.[250]

But regulators did not attempt to quantify all these costs for longer-duration events, much less in a way that could indicate which areas should be prioritized for reliability activities given a lack of generators or other resources that would make a long-term outage a more substantial hardship. Utilities will continue to use the lack of data around customer impacts to claim that those events should be excluded and should not factor into metrics used to determine the acceptability of utility performance.[251] Regulators should know which models best address the outcomes they are looking to achieve and independently identify the assumptions and parameters to use, not accept whatever the utility proposes, models, or uses.[252]

B. Other Ways to Improve Reliability—and Help Customers When It Cannot Be

Metrics, while they can be improved, are a lacking proxy for the impact that outages have on customers; even if we improve what we measure, that still has limitations. Regulators should work to improve reliability in other ways besides massive infrastructure and new operational system investment, aka grid hardening—by implementing distributed resources and microgrids, reforming markets, and increasing transmission to name a few. They could also make our society more resilient by putting the cost of poor reliability where it rightfully belongs: on utility shareholders rather than customers. This section suggests two ways to do that: by utilizing direct payment to customers and authorizing reliance damages.

1. Distributed Resources, Microgrids

It certainly might be a failure of imagination on the part of utilities about what could help with reliability:

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248. *Id.* at 68.

249. *Id.* at 104 ("The lack of avoided cost data for power interruptions lasting one day to several weeks is particularly salient. Put simply, there are currently no such data readily available for incorporation into regulatory and utility decision making.").

250. *Id.* at 92.

251. *Id.* at 104.

252. Macmillan et al., *supra* note 59, at 8 (showing regulator lack of understanding is an issue in reliability and resiliency efforts around grid investments).

> "Utilities are right to focus on reliability, but many seem unable to envision reliability as anything except 100% dispatchable generation" . . . Many utilities that are behind in setting or achieving emissions reductions "seem to see new technologies like DER as complications instead of tools to maintain reliability, lower customer costs, and clean up the grid."[253]

In the aftermath of storms, utility ratepayers who have lost power rush to install generators or solar (or solar plus storage) systems, hoping that they will not suffer the same fate again with the next storm.[254] Those who have recently experienced outages due to wildfires do the same.[255] While solar plus storage systems can meet the needs of individual customers,[256] the value that these systems provide to the larger grid are rarely factored into the contributions they might make when calculations are done by utilities or regulators.[257] In fact, utilities are currently using storage for financial arbitrage rather than reliability or resiliency.[258]

Utilities could use other tools to enhance reliability—microgrids, solar-plus-storage installations, energy efficiency.[259] And this would not be unheard of in the

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253. Herman K. Trabish, *As Utilities Risk Missing Carbon Reduction Targets, Analysts Stress Need for Organizational Change*, UTIL. DIVE (July 1, 2021), https://www.utilitydive.com/news/as-utilities-risk-missing-carbon-reduction-targets-analysts-stress-need-fo/601341/ [perma.cc/H7DK-L4HV]. We must dismiss the idea of baseload. Solomon, *supra* note 159. *See also* Amy L. Stein, *Distributed Reliability*, 87 U. COLO. L. REV. 887 (2016) (arguing distributed resources are key for reliability); Amy L. Stein, *Regulating Reliability*, 54 HOUS. L. REV. 1191 (2017) (arguing for more federal involvement in reliability).

254. Penn & Eavis, *supra* note 158. *See also* McGinniss, *supra* note 66 (noting that more customers are adopting distributed energy resources after each outage—and, since they are, it is unnecessary "to wait around for markets to adapt" to that reality); Emma Foehringer Merchant, *Frustrated by Outdated Grids, Consumers Are Lobbying for Control of Their Electricity*, INSIDE CLIMATE NEWS (May 5, 2023), https://insideclimatenews.org/news/05052023/electric-grid-customer-control [perma.cc/Y3C4-T8V9]; Maria Gallucci, *How to Make Sure Your Solar-Plus-Battery System Works in a Blackout*, CANARY MEDIA (Oct. 17, 2022), https://www.canarymedia.com/articles/solar/how-to-make-sure-your-solar-plus-battery-system-works-in-a-blackout [perma.cc/RXX9-VXN7].

255. Minhong Xu, *Wildfire, Power Shutoff, and Residential Energy Storage Adoption*, SSRN (July 1, 2023), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4509545 [perma.cc/T822-88K3].

256. Will Gorman, Galen Barbose, Juan Pablo Carvallo, Suhee Baik, Changler Miller, Philip White & Marlena Praprost, *County-Level Assessment of Behind-the-Meter Solar and Storage to Mitigate Long Duration Power Interruptions for Residential Customers*, 342 APPLIED ENERGY 121166 (July 15, 2023).

257. David Roberts, *Why Rooftop Solar and Home Batteries Make a Clean Grid Vastly More Affordable*, CANARY MEDIA (May 28, 2021), https://www.canarymedia.com/articles/rooftop-solar-and-home-batteries-make-a-clean-grid-vastly-more-affordable/ [perma.cc/EY6A-5HS9] (recognizing that "DERs will enable more utility-scale wind and solar" and that "[a]n economywide decarbonization scenario that makes use of DERs saves a trillion dollars relative to one that doesn't." Even so, "VCE's modeling only captures DERs' contribution to overall grid performance and cost. It does not capture many of the benefits that have long attracted customers to them: resilience against brownouts and blackouts, the capacity to go off-grid temporarily (or permanently), independence from the whims of utilities and state regulators, reduced personal greenhouse gas emissions, and most of all, lower electricity bills.").

258. Kassia Micek, *Arbitrage Is the Primary Use of Battery Storage Reported by US Utilities: EIA*, S&P GLOBAL (June 25, 2024), https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/electric-power/062524-arbitrage-is-the-primary-use-of-battery-storage-reported-by-us-utilities-eia [perma.cc/283V-XLQ2].

259. *See, e.g.*, MIKE SPECIAN & AIMEE BELL-PASHT, ENERGY EFFICIENCY IN A HIGH RENEWABLE ENERGY FUTURE (June 2023), https://www.aceee.org/sites/default/files/pdfs/U23

utility space: Vermont utility Green Mountain Power has proposed offering all customers storage in response to the increasingly extreme effects from storms.[260] Australia has also seen remarkably reduced impacts from transmission outages with solar plus storage installations.[261] More grid outages do not need to mean less resiliency.[262] Depending on how we organize local resources and distribution grids, communities can be just as resilient—but it will look different, and will likely be less remunerative for the utility. However, it could be both overall cheaper and end up being far less disruptive to customers. Distributed energy resources "can provide the system with flexibility, voltage control, congestion management, frequency control, energy, capacity, and net load flattening"[263]—all with resources that the utility does not obtain a profit on.

Microgrids and distributed generation could significantly improve reliability from a customer perspective[264] and could reduce the cost of reliability.[265] But utilities continue to fight against widespread implementation of these tools, arguing that microgrids should only be allowed when part of the utility system and, therefore, part of the utility's rate base.[266]

03.pdf [perma.cc/2VUG-9EKF] (finding energy efficiency critical for reducing costs and improving reliability as we transition to a carbon-free grid).

260. Diana DiGangi, *Green Mountain Power Proposes Energy Storage for All Vermonters*, UTILITY DIVE (Oct. 10, 2023), https://www.utilitydive.com/news/green-mountain-power-vermont-storage-grid-hardening/696180/ [perma.cc/B65P-EVWW]; Mitchell Beer, *Vermont 'Un-Utility' Offers Storage Batteries for All After Record Storms*, ENERGY MIX (Oct. 11, 2023), https://www.theenergymix.com/vermont-utility-offers-storage-batteries-for-all-in-response-to-record-storms/ [perma.cc/BS52-5XPD].

261. Jonathan Gifford, *Australia's Outages Make the Resiliency Case for Solar and Batteries*, LATITUDE MEDIA (Mar. 13, 2024), https://www.latitudemedia.com/news/australias-outages-make-the-resiliency-case-for-solar-and-batteries [perma.cc/VT8R-BK2N].

262. Some states are already starting to look at these possibilities. *See, e.g.*, *Resiliency and Microgrids*, CAL. PUB. UTIL. COMM'N (last visited July 27, 2023), https://www.cpuc.ca.gov/resiliencyandmicrogrids [perma.cc/2848-RD2F].

263. Herman K. Trabish, *High Electricity Rates Impede Crucial but Costly Technology Investments to Manage Rising DER Levels: Utilities*, UTIL. DIVE (Nov. 29, 2022), https://www.utilitydive.com/news/high-electricity-rates-impede-crucial-but-costly-technology-investments-to/637126 [perma.cc/ULZ8-TGZS].

264. *See, e.g.*, *Microgrid With Long-Duration Energy Storage to Help Power California Children's Hospital*, RENEWABLE ENERGY WORLD (Sept. 27, 2023), https://www.renewableenergyworld.com/storage/microgrid-with-long-duration-energy-storage-to-help-power-california-childrens-hospital [perma.cc/BGR2-NH2J]; Avery Palmer, *Energy Secretary Granholm Meets With IREC Puerto Rico Team to Discuss Energy Resilience*, IREC (Nov. 3, 2023), https://irecusa.org/blog/local-energy-climate-solutions/energy-secretary-granholm-meets-with-irec-puerto-rico-team-to-discuss-energy-resilience [perma.cc/CV4D-PAY3].

265. Sarah Shemkus, *Microgrid Model Spreads in Massachusetts as Cities Look to Lessen Costs, Outages*, ENERGY NEWS NETWORK (Nov. 21, 2023), https://energynews.us/2023/11/21/microgrid-model-spreads-in-massachusetts-as-cities-look-to-lessen-costs-outages/ [perma.cc/25P5-BVHW].

266. Sam Maslin, *Moving Beyond California's One-Sided View of Reliability*, UTIL. DIVE (Sept. 27, 2022), https://www.utilitydive.com/news/moving-beyond-californias-one-sided-view-of-reliability/632730 [perma.cc/X8QL-N7MB]; Ryan Kennedy, *California Utilities Commission Rejects Solar Microgrid Proposal*, PV MAGAZINE (Apr. 13, 2023), https://pv-magazine-usa.com/2023/04/13/california-utilities-commission-rejects-solar-microgrid-proposal [perma.cc/NF7E-PJZK]. *See also Decision Granting the Public Advocates Office of the California Public Utilities Commission Motion to Dismiss Sunnova Community Microgrids California, LLC's Application*, D.23-04-005, 2023 WL 3038804 (Cal. P.U.C. 2023).

Adopting different metrics, however, would also provide a greater incentive for microgrids and distributed generation.[267] The current system is focused on large-scale generators and the transmission system.[268] This ignores that distributed generation may be able to help with reliability, especially if those resources are paid sufficiently to aid in reliability. Where these are currently being added—in areas without the potential funding streams that increasing resilience might provide—they are being added for business interruption purposes due to the increased cost of providing that amount of reliability, not to meet humanitarian needs, and it is unclear whether the local investor-owned utilities (IOUs) will try to block even these efforts.[269] Especially with the additional incentives and tax benefits associated with storage in the Inflation Reduction Act,[270] regulators should be looking at how these assets can aid in reliability, especially given the acknowledgment that new regulatory regimes[271] and tools[272] could help with adoption and, therefore, reliability and resilience.

2. Other Government Actions

Other actions taken by federal, state, and municipal governments can also make a big impact on reliability.[273] For example, the adoption of more efficient building codes means each structure (and, ideally, renovated structure) uses less electricity.[274] This can put less strain on the electricity grid during extreme weather events, which enables reliability.

A discussion of the changes needed to bring about a full harmonization between the wholesale and retail markets is beyond the scope of this Article, as is a discussion of other topics, which potentially touch on reliability of our grid.[275] But

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267. *See, e.g.*, McGinniss, *supra* note 66 (making the argument that as we electrify everything the local grid will become more important, requiring the use of distributed energy resources).

268. Maslin, *supra* note 266.

269. Kowalski, *supra* note 32. Investor-owned utilities serve approximately 72% of the US population. Anodyne Lindstrom & Sara Hoff, *Investor-Owned Utilities Served 72% of U.S. Electricity Customers in 2017*, U.S. ENERGY INFO. ADMIN.: TODAY IN ENERGY (Aug. 15, 2019), https://www.eia.gov/todayinenergy/detail.php?id=40913 [perma.cc/3QXE-48CY].

270. 26 U.S.C. § 48(a)(3)(A)(ix).

271. Maeve Allsup, *Will a New Tariff Solve California's Microgrid Woes?*, LATITUDE MEDIA (Nov. 8, 2023), https://www.latitudemedia.com/news/microgrids-debate-california [perma.cc/52NE-JDHH]; Sara Baldwin, *Skepticism Persists Around Clean Energy and Grid Reliability. Here's How to Fix That*, UTIL. DIVE (Oct. 5, 2023), https://www.utilitydive.com/news/skepticism-persists-around-clean-energy-and-grid-reliability-heres-how-to/695393 [perma.cc/F8Y5-835S].

272. Sean Wolfe, *New DOE Tool Connects Multiple Microgrids for Resilience*, FACTOR THIS (Nov. 9, 2023), https://www.renewableenergyworld.com/power-grid/microgrid/new-doe-tool-connects-multiple-microgrids-for-resilience [perma.cc/P8KQ-5NXN].

273. While the actions of the North American Electric Reliability Corporation (NERC) are outside the scope of this paper, the enforcement of system reliability in the bulk power grid is performed by NERC and its regions. Keogh & Cody, *supra* note 1, at 3. *See also* Joshua Macey, Shelley Welton & Hannah Jacobs Wiseman, *Grid Reliability in the Electric Era*, 41 YALE J. REG. (forthcoming 2025), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4547667.papers.cfm?abstract_id=4547667&dgcid=ejournal_htmlemail_energy%3Alaw%3Apolicy%3Aejournal_abstractlink [perma.cc/SRE8-P5F2].

274. Robert Walton, *As Storm Season Begins, White House Building Code Initiative Aims to Cut Energy Waste, Build Resilient Homes*, UTIL. DIVE (June 6, 2022), https://www.utilitydive.com/news/as-storm-season-begins-white-house-building-code-initiative-aims-to-cut-en/624916 [perma.cc/8MNK-F8CJ].

275. *See, e.g.*, Energy Systems Integration Group, *Webinar: Ensuring Reliability with a Transforming Fleet: The Average vs. Marginal ELCC Debate*, YOUTUBE (June 17, 2022), https://www.youtube.com/watch?v=a6TSV3lnmyw [perma.cc/8CD4-M9Y4].

market design—especially compensating demand response—can add reliability.[276] It is important to recognize that regulators do have options to increase reliability at the generation, transmission, and distribution levels.[277] While most of the outages detailed in this Article come from issues in the distribution system,[278] additional transmission buildout[279] and adding more flexible resources like storage[280] and demand-side aggregation can only help.[281] Adopting metrics that distinguish between outages that occur due to insufficient generation, bulk transmission issues, or distribution system challenges could also help regulators be more informed about what, precisely, is impacting reliability in their jurisdiction.[282]

3. Payments to Customers for Outages

Better metrics and other ways to improve reliability can only go so far. If those improved reliability metrics are not met, then the utility may be fined, but that fine is unlikely to be passed directly onto customers.[283] If the metrics are met, then the overall customer experience will hopefully improve, but that still does not address the situation where certain customers suffer with worse reliability than most in the utility's territory. As noted above, utilities typically owe their customers nothing

276. Robert Walton, *Treating Power Demand Like Supply in Wholesale Markets Could Boost Grid Reliability, Lower Prices: ESIG*, UTIL. DIVE (May 31, 2023), https://www.utilitydive.com/news/two-sided-electricity-market-bitcoin-texas-grid-reliability-esgi/651619 [perma.cc/N77T-CVDX].

277. Especially in generation, "the electricity and natural gas industries' interdependencies have been identified as" a risk to the bulk electric power system and that entities should plan for "plausible and extreme natural gas disruptions." *NERC Report Highlights 'Importance and Urgency' of Addressing Multiple Grid Threats*, POWERGRID INT'L (July 20, 2022), https://www.power-grid.com/td/nerc-report-highlights-importance-and-urgency-of-addressing-multiple-grid-threats/ [perma.cc/6EYE-DK26].

278. Because of this, the reliability concerns are very similar for traditionally vertically integrated states and restructured states. Retail competition would not solve these issues because they are primarily located in part of our electricity system which is a monopoly everywhere.

279. *See, e.g.*, Ethan Howland, *MISO Finds Broad Benefits to Building $10.4B of Transmission Projects to Support 53 GW of Clean Energy*, UTIL. DIVE, (Apr. 7, 2022), https://www.utilitydive.com/news/miso-benefits-transmission-projects-renewable/621729/ [perma.cc/B6MD-WV9W].

280. *See, e.g.*, Patrick Meyer, *Battery Storage Boost to Texas Reliability Is an Example for the Whole Country*, UTIL. DIVE (Oct. 23, 2023), https://www.utilitydive.com/news/battery-storage-texas-reliability-grid-benefits/695982/ [perma.cc/7VME-5RLR].

281. Herman K. Trabish, *Reliability Concerns Drive Need for Energy Market Design Reforms, but Regions Diverge in FERC Proceeding*, UTIL. DIVE (Apr. 11, 2022), https://www.utilitydive.com/news/reliability-concerns-drive-need-for-energy-market-design-reforms-but-FERC/619895/ [perma.cc/6GWF-B9RS]. Storage in California alone could provide grid benefits of up to $1.6 billion per year, much of which is based on additional reliability. Kavya Balaraman, *California's Storage Portfolio Could Provide Grid Benefits of Up to $1.6B per Year By 2032, Report Finds*, UTIL. DIVE (June 20, 2023), https://www.utilitydive.com/news/california-puc-energy-storage-lumen-report-grid-reliability/653196/ [perma.cc/DB92-J5BP].

282. Grid Modernization Laboratory Consortium, *supra* note 118, at Reliability I, iii–iv. There is also wide acknowledgement that we will need large amounts of new carbon-free generation to remain reliability as carbon-emitting resources retire. *See, e.g.*, LONG TERM RESOURCE ADEQUACY, MISO (Sept. 12, 2023), https://cdn.misoenergy.org/20230912%20System%20Planning%20Committee%20of%20the%20BOD%20Item%2005%20Long%20Term%20Resource%20Adequacy630148.pdf [perma.cc/EN63-VK2C].

283. *See infra* Part I.D.

when they fail to provide electric service.[284] The only way to address the direct impact on customers is to pay them.[285]

Customers are acting in reasonable reliance on the promise utilities are making by way of their monopoly position in electricity distribution: to provide the pathway for electricity to reach a customer's premises and to deliver electricity. Customers should, therefore, be awarded for losses suffered when utilities fail to deliver that service. Customers are obviously harmed and damages would restore them to the position occupied before the utility failure. One option for regulators is to adopt a schedule of payments that must be made to customers—from shareholders, that cannot be collected from utility customers—when the power fails. This would be similar to what is being proposed for air travel—if your flight gets delayed or cancelled, you are paid a certain amount.[286]

Regulators should also recognize that payment by the utility to customers when the power goes out is not unheard of as a standard practice.[287] Utility customers in the U.K., for example, do not only receive payment when the utility feels like it or there is sufficient outage, but every time performance standards are not met.[288] We would do well to adopt such a practice.

Interestingly, even some reporters think that utilities already are responsible for replacing lost food, ruined medication, and hotel stays in the case of outages.[289] However, there must be better oversight of these efforts. When utilities do issue credits, they can get it wrong: CPS in San Antonio credited customers for lost power during Winter Storm Uri.[290] While most customers were given a bill credit of $8.75, customers who experienced the longest outages could receive up to $100. More than 3,000 people complained that the utility had gotten the duration of the outage affecting them—and therefore, the amount of credit they should have received—incorrect, and the utility found the customers were correct in 65% of the cases.[291]

Utilities will view the requirement that they pay their customers damages for a lack of delivery as "reparation" that "customers should receive . . . only if the utility did something wrong."[292] This logic is already in full view: In New York, where the PSC is looking at implementing even the most minimal of reimbursements, ConEd

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284. *See, e.g.*, Peter McGuire, *Power Plants Owed Nothing to Customers*, LAW360 (Dec. 14, 2023, 11:30 AM), https://www.law360.com/appellate/articles/1777332 [perma.cc/RR47-F3GE].

285. This Article does not address the regulatory challenges that exist when the utility has directly caused significant harm other than a lack of electric reliability, such as when homes are destroyed due to wildfires sparked by a downed electric line. Those situations, including loss of life, need a separate regime and will be discussed in a subsequent paper.

286. European airline law requires compensation for when flights are delayed by three hours or more, or cancelled with less than fourteen days' notice. *FAQs—Air Passenger Rights*, YOUR EUROPE (last visited July 30, 2023), https://europa.eu/youreurope/citizens/travel/passenger-rights/air/faq/index_en.htm [perma.cc/A6A4-XWLK].

287. McEachran, *supra* note 32.

288. Costello, *supra* note 175, at 35 n.105.

289. Madison Carter (@madisonlcarter), X (Dec. 20, 2022, 5:28 PM), https://x.com/madisonlcarter/status/1608953101935071233 [perma.cc/436Q-47AW].

290. Fares Sabawi, *CPS Energy to Apply One-Time Credit for Customers Out of Power During Winter Storm,* KSAT (Apr. 7, 2021), https://www.ksat.com/news/local/2021/04/07/cps-energy-to-apply-one-time-credit-for-customers-out-of-power-during-winter-storm/ [perma.cc/P5UH-PD6R].

291. Collier, *supra* note 54.

292. Costello, *supra* note 175, at 37.

has requested that they be allowed to recover the costs of reimbursing customers in rates.[293] They argue that doing anything else makes the state's utilities "insurers against major storms and the more frequent heat waves that may result from climate change,"[294] ignoring the role that they had in creating precisely the climate impacts they are now experiencing. Instead, the utilities only want to provide any reimbursement due to an issue with utility-owned equipment that affects more than 10% of a utility's total customers in a service territory.[295]

This ignores the very essence of the relationship between utility and customer. Customers have no other choice for their transmission and distribution (T&D) provider—the utility that provides the poles and wires—they are mandated to be in an exclusive contract with that monopoly provider. Therefore, the utility inherently does something wrong every time there is a service interruption. A customer who is out of power for weeks should not have to determine specifically how or what "the utility did . . . wrong" to be compensated for the loss of a critical service.[296] The argument is that customers are compensated for "product defects."[297] The lack of service is a product defect.

There will be arguments made that shareholders should not be responsible. However, it has been acknowledged that requiring utilities' shareholders to compensate customers "can strengthen a utility's incentive to avoid service interruptions with potentially high costs."[298] This is not to say that holding utilities responsible for their actions is without some risk; indeed, at least one utility that was held responsible for its actions was forced into bankruptcy,[299] and others might follow. This underscores the need to get the liability paradigm correct, but should not absolve utilities of the impacts of their actions—or inaction—on captive customers.

The other argument that will be made is similar to that of qualified immunity. Qualified immunity exists—at least in part—because other citizens would be directly liable for any damages awarded to a harmed citizen based on the actions of a municipal officer acting within the scope of their employment/duties. Similarly, if utility customers are harmed and paid any form of damages by the utility, it is possible (based upon regulatory acquiescence, of course) that those funds could be put into the revenue requirement and be paid by other ratepayers.[300] However, that

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293. Walton, *supra* note 106.

294. *Id.*

295. *Id.* (Instead, the utilities recommended a widespread outage be defined as one "that affects 10% or more of the customers in the utility's service territory or, in the case of companies with more than one division, more than 20% of an operating division due to utility-owned equipment being unable to provide power.").

296. Costello, supra note 175, at 37.

297. Costello, supra note 175, at 21.

298. Costello, *supra* note 175, at 24.

299. Ivan Penn, *PG&E, Troubled California Utility, Emerges from Bankruptcy*, N.Y. TIMES (July 28, 2020), https://www.nytimes.com/2020/07/01/business/energy-environment/pge-bankruptcy-ends.html [perma.cc/K9PD-CHHD].

300. At least one utility is considering this option—requesting ratepayers pay for the legal liability the utility incurred for its equipment starting wildfires, for which it was found reckless and grossly negligent, and therefore was ordered to pay punitive as well as compensatory damages. Ryan Haas, *Pacific Power Potentially Wants Its Customers to Pay $90M in Wildfire Liability*, OPB (June 16, 2023, 5:29 PM), https://www.opb.org/article/2023/06/16/pacific-power-pacificorp-lawsuit-wildfire-2020-public-utility-damages/ [perma.cc/S7XS-LVNP].

does not have to be the case; indeed, regulators could require damages to come from shareholders rather than ratepayers, and should be vigilant about requiring that.

C. Traps to Avoid

As they implement changes to center reliability on the customer, there are specific issues that regulators should avoid: assuming that this problem can be fixed with performance-based ratemaking, allowing reliability expenses as an additional rider on customer bills, and implementing Reliability-as-a-Service (RaaS).

1. Performance-Based Ratemaking

While some commissions may feel that performance-based ratemaking around reliability may be the answer,[301] at least one state appellate court has ruled that a state regulatory commission does not have the power to reduce utility profit based on poor customer service.[302] Performance-based ratemaking is not the answer for other reasons as well: Mainly, the penalties are insufficient to drive utility behavior. Even with the new Maine law that was sold as promoting accountability, the maximum penalty is only up to $1 million per year.[303] But the metrics used are still the same as ever: CAIDI, SAIFI, and SAIDI, with the benchmarks "based on the historic performance of each utility, or otherwise at levels that reflect reasonable service quality."[304] Additionally, the utilities are to report "with and without" major event days.[305] Adoption of these metrics, based on historical performance, with the ability to remove major weather events, is simply more of the same.

Utilities have plenty of incentive for profit; they do not need more. Unfortunately, utilities have demonstrated they have only a limited incentive to provide safe and reliable service. Rather than being a substitution for regulatory oversight, performance-based regulation "puts greater onus on comprehensive study, analysis and enforcement"[306]—all things which are missing from our current regulatory scheme around reliability from the customer's perspective. What utilities need are regulations which would minimize their profit if they do not provide basic services to their monopoly customers. Performance-based regulation also "can blur the line between discretion and obligation."[307]

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301. Singer, *supra* note 95.

302. Matthew Casey, *AZ Appeals Court: Regulators Did Not Have Power to Cut APS Profits over Bad Customer Service*, KJZZ (Mar. 8, 2023, 5:47pm), https://kjzz.org/content/1840851/az-appeals-court-regulators-did-not-have-power-cut-aps-profits-over-bad-customer [perma.cc/897P-8B L9].

303. Jennifer Runyon, *Maine PUC Sets Minimum Service Standards for Utilities*, FACTOR THIS (Aug. 2, 2022), https://www.renewableenergyworld.com/energy-business/policy-and-regulation//maine-puc-sets-minimum-service-standards-for-utilities/ [perma.cc/RUB5-FH45].

304. ME. PUB. UTILS. COMM'N, § 65-407 Ch. 320, ELECTRIC TRANSMISSION AND DISTRIBUTION UTILITY SERVICE STANDARDS 6.B (effective Jan. 14, 2025), https://www.maine.gov/mpuc/legislative/laws-rules [perma.cc/AW6C-V62J] (choose "part 3" from dropdown; then choose "Chapter 320 Electric Transmission and Distribution Utility Service Standards).

305. *Id.*

306. STEVE WEISSMAN, CTR. FOR SUSTAINABLE ENERGY, ENSURING BETTER REGULATORY OUTCOMES—THE NEED FOR CAREFUL CONSIDERATION OF PERFORMANCE-BASED RATEMAKING POLICIES 3 (2021).

307. *Id.*

"Utilities have an obligation to perform prudently that regulators can enforce directly, rather than offering a financial reward and hoping that it produces the desired results."[308] Where reliability is concerned, regulators do not need to add additional rewards on top of the more than generous return on equity that the industry already gets just for performing its job—and performing it badly at times.[309] In short, direct enforcement of reliability needs to occur; "any approach that offers a reward for better performance is destined to be ineffective."[310] Rather than rewards, regulators should set standards and expectations; utilities should meet those even in the absence of additional potential rewards.[311]

2. Reliability Expenses as a Rider

Another proposed utility innovation around reliability is to remove the activities associated with reliability—like undergrounding—from standard rate cases and instead recover these expenses as a rider on customer bills.[312] The challenge with this approach is that it reduces regulatory oversight—these funds can be collected without any regulatory review. Utilities have demonstrated a lack of honesty around such riders in the past, collecting far above what was actually spent.[313]

3. Reliability-as-a-Service (RaaS)

There are at least some suggestions that regulators allow customers to choose their level of service reliability.[314] Indeed, some utilities—with regulatory approval—are already offering this, allowing specific customers to get additional reliability by paying for "Resilience-as-a-Service (RaaS)."[315] In each instance, the utility owns the equipment, providing additional installed capital on which the utility may earn a profit.[316] One of the key utility drivers for implementing these programs is the ability to generate extra revenue.[317] The customer pays more for the basic, reliable service that the utility should be providing but currently does not.[318]

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308. *Id.*

309. As one student comment put it: "It would further seem superfluous for creating a rewards system for obeying the law." E. Nathan Cheung, Comment, *Considerations for Closing the Moral and Legal Gap in Public Utility Regulation*, 40 J. NAT'L ASS'N ADMIN. L. JUDICIARY 59, 74 (2020).

310. Weissman, *supra* note 306, at 6.

311. An analysis of performance-based ratemaking with the utility as child and regulator as parent demonstrates well the issues. *Id.* at 4–5.

312. Jeremey Klingel, *Resiliency: An Earning Opportunity for the Greater Good of Customers and Utilities*, UTIL. DIVE (Apr. 16, 2020), https://www.utilitydive.com/news/resiliency-an-earning-opportunity-for-the-greater-good-of-customers-and-ut/576127/ [perma.cc/3Q3M-8PH6].

313. *See* JOEL B. EISEN, EMILY HAMMOND, JIM ROSSI, DAVID B. SPENCE & HANNAH J. WISEMAN, ENERGY, ECONOMICS AND THE ENVIRONMENT, 523-25 (Saul Levmore et al., Daniel A. Farber, Heather K. Gerken, Samuel Isaacharoff, Harold Hongju Koh, Thomas W. Merrill, Robert L. Rabin & Hillary A. Sale eds., 5th ed. 2019).

314. *See, e.g.*, McGinniss, *supra* note 66 (arguing for service level agreements specifying an endpoint uptime between users and power providers or utilities).

315. Mac Keller & Carolyn Dougherty, *Weathering Future Storms with Utility-Led Service Offerings*, SMART ELEC. POWER ALL. (May 8, 2023), https://sepapower.org/knowledge/utility-programs-for-enhanced-resilience-bringing-together-microgrid-energy-storage-and-customer-programs-perspectives/ [perma.cc/29QS-CSSF].

316. *Id.*

317. *Id.*

318. *Id.*

While this may be tempting theoretically—allowing each customer to decide how much reliability means to them and pay for it accordingly—it would most certainly lead to energy justice issues, which have been identified in the literature.[319] Those least able to pay the additional cost for RaaS protection from long duration outages and already facing high energy burdens are exactly the communities least able to afford the impacts from those outages.

CONCLUSION

To maintain the most livable planet, we must electrify everything, especially our entire built environment, by 2035.[320] To do that, we need our electric supply to be reliable. Unfortunately, while Americans are more worried about losing power than ten years ago[321] and we are paying more for our electricity,[322] our electric reliability issue is not getting better. The average West Virginia customer experienced 452 minutes of power failures in 2021, despite rapidly increasing power bills and the focus of the West Virginia regulators to maintain plenty of coal generation online for reliability.[323] Minneapolis residents had to deal with their utility cutting the power for eight hours in freezing weather on purpose with little notice—to replace equipment and make the system more reliable.[324] The Tennessee Valley Authority cut around 20% of available power during the late December 2022 storm, leading to rolling blackouts.[325] Duke Energy did as well.[326]

A recent post noted that the amount of time a PG&E customer had had power during the first quarter of 2023 was 80%.[327] Thousands of Michigan residents

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319. *See, e.g.*, Macmillan et al., *supra* note 59, at 8 (describing how willingness to pay and ability to pay for reliability are different, as "customers who may want to pay more to avoid interruptions may not be able to do so given financial restrictions limiting what they can afford").

320. RENEWING AMERICA, BRINGING INFRASTRUCTURE HOME 1 (July 2021), https://lpdd.org/wp-content/uploads/2021/07/bringing-infrastructure-home-50-state-report-on-us-home-electrification.pdf [perma.cc/68XG-LGTN].

321. Clarion Energy Content Directors, *Survey: Many Americans More Concerned About Power Outages than 10 Year Ago*, FACTOR THIS (Dec. 6, 2023), https://www.renewableenergyworld.com/power-grid/outage-management/survey-many-americans-more-concerned-about-power-outages-than-10 years-ago/ [perma.cc/AH7W-XEQK].

322. *Average Retail Electricity Prices in the United States in Selected Years from 1990 to 2023*, STATISTA, https://www.statista.com/statistics/183700/us-average-retail-electricity-price-since-1990/ [perma.cc/A8H5-FCSD] (last visited Mar. 4, 2025).

323. Marianne Lavelle, *Soaring West Virginia Electricity Prices Trigger Standoff over the State's Devotion to Coal Power*, INSIDE CLIMATE NEWS (Nov. 20, 2022), https://insideclimatenews.org/news/20112022/soaring-west-virginia-electricity-prices-trigger-standoff-over-the-states-devotion-to-coal-power [perma.cc/T32P-SEZL].

324. Allen Henry, *Minneapolis Residents Left Fuming, and Freezing, After Xcel Energy Cut Power for Hours on Frigid Day*, CBS NEWS MINN. (Nov. 30, 2022, 4:24 PM), https://www.cbsnews.com/minnesota/news/some-minneapolis-residents-fuming-and-freezing-after-xcel-energy-cuts-power-for-hours-on-frigid-day/ [perma.cc/YMA2-RGMA].

325. Kevin Clark, *TVA Lost Around 20% of Available Power Production During December Storm*, POWER ENG'G FACTOR THIS (May 10, 2023), https://www.power-eng.com/news/tva-lost-approximately-20-of-power-production-during-december-storm/ [perma.cc/HL5M-84NY].

326. Robert Walton, *Duke Energy Apologizes for Winter Storm Outages as FERC, NERC Open Investigation into Grid Failures*, UTIL. DIVE (Jan. 4, 2023), https://www.utilitydive.com/news/duke-energy-apologizes-for-winter-storm-outages-as-ferc-nerc-open-investig/639583/ [perma.cc/C8VNZWCK].

327. Ryan Null (@BIGjuevos), X (Mar. 25, 2023, 2:33 AM), https://x.com/bigjuevos/status/1639515827656605697?s=43&t=LNPLnREHmYkQUYDJtENVxw [perma.cc/4JVD-N63U].

suffered without electricity—yet again—for days in February 2023, dealing with what the regulator termed "persistent reliability and safety challenges."[328] The Louisville, KY area also had a weather event in March 2023 that "impacted more than 300,000 customers, downed more than 2,500 power lines and broke more than 230 utility poles."[329] Two weeks later, a winter storm caused more than a quarter million people in New England to lose power—and damaged a high-voltage transmission tower.[330] An early summer storm caused hundreds of thousands to be out of power in East Texas during a heat wave.[331] A severe thunderstorm, that only lasted fifteen minutes, knocked out thousands in Baton Rouge.[332] Thousands suffered through a sweltering, long July 4th holiday weekend with no power around Indianapolis, more than four days after a summer storm came through the area.[333] A hurricane in August knocked power out for hundreds of thousands,[334] with storms in early 2024 doing the same for those living across the country.[335]

As this article is finalized, Houston and the surrounding area are still recovering from the impacts of Hurricane Beryl. More than 2.26 million CenterPoint meters lost power at some point during the storm.[336] A May storm in

328. *Ice Storm Keeps Michigan's Utilities in the Reliability Hot Seat*, POWERGRID INT'L (Mar. 1, 2023), https://www.power-grid.com/td/ice-storm-keeps-michigans-utilities-in-the-reliability-hot-seat/ [perma.cc/TS6X-8KK4].

329. Louisville Gas and Electric and Kentucky Utilities (@lgeku), X (Mar. 4, 2023, 8:05 PM), https://x.com/lgeku/status/1632185561384460290?s=43&t=LNPLnREHmYkQUYDJtENVxw [perma.cc/A44W-3VRB].

330. Jennifer Runyon, *New England Nor'easter Knocks Out Power to Thousands, Damages Transmission System*, POWERGRID INT'L (Mar. 3, 2023), https://www.power-grid.com/td/new-england-noreaster-knocks-out-power-to-thousands-damages-transmission-system/ [perma.cc/8MRK-3X2U].

331. Michael E. Webber (@MichaelEWebber), X (Jun. 19, 2023, 12:09 PM), https://x.com/michaelewebber/status/1670826265476038657?s=43&t=LNPLnREHmYkQUYDJtENVxw [perma.cc/3HWZ-4E47].

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the same area had "knocked out power to more than 1 million CenterPoint customers, some for as long as 17 days."[337] With Beryl doing most damage on July 8, some customers still did not have power ten days later, prompting calls to decrease CenterPoint's service territory and investigate their preparedness (including around vegetation management) and spending.[338] More than 1,600 customers were still waiting for power to be restored more than two weeks after the storm.[339] At least eleven deaths are attributed to slow restoration and effects from heat, while CenterPoint's CEO "filmed a message to Houstonians from an office setting during which he mentioned he had a generator at home, all while sitting next to a thermostat that read 70 degrees."[340] CenterPoint's outage map—which would indicate which parts of the utility's service area had power and which did not—had not worked since the May storm, so resourceful Houstonians used the Whataburger app (which updated regularly) to determine which areas had power. Whataburger locations that were closed indicated that part of the city was still not restored; open Whataburger locations meant that part of the city had electricity, and therefore, those without could go there to find open restaurants, stores, and gas stations.[341] All this despite the fact that CenterPoint has spent "nearly 1.5 billion in capital expenditures on resilience-based projects" over the last five years,[342] and proposed to spend an additional $2.3 billion on resiliency based on a 2023 state law which required additional planning.[343] The utility's main response has been that this damage is more significant than a typical Category 1 hurricane would produce.[344] Microgrids and solar plus storage installations provided islands of available electricity amid the destruction and darkness around them.[345]

And yet, with all of the impacts our failing reliability has on customers, it is only the eighth highest concern of the utility industry based on a recent utility executive survey, behind issues like an aging workforce and environmental regulations.[346] The Biden Administration had at least tried to shine more light on

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Nadia Lathan, *Hot, Weary Houstonians Face Weekend Without Power as Hurricane Recovery Lags*, THE ENERGYMIX (July 11, 2024), https://www.theenergymix.com/hot-weary-houstonians-face-weekend-without-power-as-hurricane-recovery-lags/ [perma.cc/42E4-Q3RP].

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339. Kleckner, *supra* note 337.

340. Kleckner, *supra* note 337.

341. Foxhall & Martinez, *supra* note 336.

342. Robert Walton, *Texas Restoration Efforts Underway After Hurricane Beryl Leaves 2.7M Customers Without Power*, UTIL. DIVE (July 9, 2024), https://www.utilitydive.com/news/texas-restoration-efforts-underway-beryl-almost-3-million-without-power/720816/ [perma.cc/R5AC-NG4A].

343. Kleckner, *supra* note 337.

344. Tom Kleckner, *Texas Utilities: Beryl's Damage Unlike that of Cat 1s*, RTO INSIDER (July 11, 2024), https://www.rtoinsider.com/83021-texas-puc-hears-beryl-update/ [perma.cc/Z6XK- GS5Q].

345. Jeff St. John, *Houston's Post-Beryl Outages Highlight Benefits of Distributed Energy*, CANARY MEDIA (July 18, 2024), https://www.canarymedia.com/articles/distributed-energy-resources/houstons-post-beryl-outages-highlight-benefits-of-distributed-energy [perma.cc/TD2U-SYH8].

346. Azar et al., *supra* note 9, at 6.

the issue,[347] recognizing the disparate impact outages have on overburdened and low-income communities[348] due to underinvestment by utilities, which instead were focused on places with "prosperity and growth."[349] The Department of Energy is also focused on funding projects in rural or remote communities, acknowledging that these "communities often face higher energy costs and reduced reliability."[350] But as noted for the summer of 2023, "if summer temperatures spike and become more widespread," then much of the United States "will face an elevated risk of blackouts".[351] The situation is unlikely to improve soon.

Customers should "have a 'right to expect the utilities to anticipate extreme weather events, to provide a hardened grid that can withstand extreme weather, and to be prepared to restore power expediently when the grid fails.'"[352] At this point in time, that is far from reality, despite the significant expenditures[353] and rising electric bills.[354] Utilities' perspectives on longer and longer outages are nicely summed up by the response of SoCal Edison: "The best we can do is help the customer prepare."[355] But, as one exasperated customer tweeted at his utility during one of these events:

> We understand it's a massive process & you're working hard on it. But you tell us to make plans without telling us if it will be 12 hrs or 12 days. What to plan for. If it's 6 days, I'll throw away everything in my freezer & stay at a hotel. If it's 16 hrs I can wait it out. ??[356]

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347. Jennifer Runyon, *US Government Needs Utilities to Help Standardize Power Outage Data*, POWERGRID INT'L (Dec. 8, 2022), https://www.power-grid.com/td/us-government-needs-utilities-to-help-standardize-power-outage-data/ [perma.cc/WW8Y-4K4K] (noting outage data is "fragmented and doesn't use a common standard").

348. John Hewitt Jones, *Biden Administration Seeks More Power Outage Data from Utility Companies*, FEDSCOOP (Nov. 22, 2022), https://fedscoop.com/biden-administration-power-outage-data-initative/ [perma.cc/4KQQ-QBBW].

349. St. John, *supra* note 241.

350. Diana DiGangi, *DOE Directs $26M to PG&E, ConEd and Other Projects Testing How Clean Energy Can Support a Resilient Grid*, UTIL. DIVE (May 11, 2023), https://www.utilitydive.com/news/clean-energy-rural-grid-resilience-millions-funding/650075/ [perma.cc/3YWM-DRG5].

351. Robert Walton, *Most of US Faces Elevated Risk of Blackouts in Extreme Heat This Summer, NERC Warns*, UTIL. DIVE (May 17, 2023), https://www.utilitydive.com/news/most-of-us-faces-elevated-risk-of-summer-blackouts-extreme-heat-nerc/650531/ [perma.cc/S6YC-3YEB]; Jennifer Runyon, *Two-thirds of the Grid is at Risk of Energy Shortfalls This Summer, NERC Says*, FACTOR THIS (May 17, 2023), https://www.renewableenergyworld.com/power-grid/two-thirds-of-the-grid-is at-risk-of-energy-shortfalls-this-summer-nerc-says/ [perma.cc/3GQU-333Y] (listing specific conditions impacting different parts of the country); *United States at Risk of Tight Electric Supplies This Summer -NERC*, REUTERS (May 11, 2023, 12:57 PM), https://www.reuters.com/business/energy/united-states-risk-tight-electric-supplies-this-summer-nerc-2023-05-11/ [perma.cc/M8B5-4E8H].

352. *Ice Storm Keeps Michigan's Utilities in the Reliability Hot Seat*, *supra* note 328.

353. *See, e.g.*, Robert Walton, *DOE Announces $125M in Grid Modernization, Power Resilience Grants*, UTIL. DIVE (Sept. 6, 2023), https://www.utilitydive.com/news/department-of-energy-grid-modernization-power-resilience-grants/692897/ [perma.cc/7JSZ-RUCP].

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355. Brown et al., *supra* note 21.

356. MrBill (@MrBill1807), X (Mar. 4, 2023, 8:44 PM), https://x.com/MrBill1807/status/1632195293675397122 [perma.cc/MR38-FVK3].