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SABIN CENTER FOR CLIMATE CHANGE LAW

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April 15, 2021

Federal Energy Regulatory Commission
Office of the Secretary
888 First Street NE
Washington, DC 20426

Via the FERC eFiling Portal

Re: FERC's Request for Comments Related to the Technical Conference on Climate Change, Extreme Weather, and Electric System Reliability (Docket No. AD21-13-000)

To Whom It May Concern:

Environmental Defense Fund ("EDF") and the Sabin Center for Climate Change Law ("Sabin Center") submit these comments in response to the Supplemental Notice of Technical Conference issued by the Federal Energy Regulatory Commission ("FERC" or "Commission") on March 15, 2021. The Supplemental Notice invited interested parties to respond to several questions regarding the impact of climate change on electric system reliability. In this letter, EDF and the Sabin Center respond to Questions 1 through 3 and 6 through 8.

EDF and the Sabin Center strongly support the Commission's work to better understand how the impacts of climate change will affect electric system reliability. We note, however, that effectively mitigating and managing the risks posed by climate change will require action by all participants in the energy industry. As further elaborated below, industry participants should engage in a two-step process of climate resilience planning, whereby each develops and regularly updates:

1. a climate vulnerability assessment, which identifies where and under what conditions assets and systems are at risk from the impacts of climate change; and

2. a climate resilience plan, which evaluates measures to reduce the risk to vulnerable assets and systems.

As distinguished from energy resilience planning, climate resilience planning requires attunement to the root cause of changing weather patterns that implicate the electric sector, rather than reaction to symptomatic impacts. Climate resilience planning requires entities to avoid perverse, maladaptive outcomes by recognizing the causal link between climate change mitigation and risk reduction and to account for synergistic risks across sectors. Related, and as considered in more detail below, well-designed and -implemented climate resilience planning conveys additional important benefits, including ensuring that costs for resilience measures are well-justified.

Although this letter draws from a variety of sources to illustrate best practices with respect to climate resilience planning, we highlight in particular a set of recommendations and conclusions from research published in a 2020 joint report, *Climate Risk in the Electricity Sector: Legal Obligations to Advance Climate Resilience Planning by Utilities*.[1] The recommendations were written with state public utility commissions and utilities as the principal audience, but many also apply here—to FERC and its regulated entities. As set forth in the report, with recent advances in climate modelling and downscaling techniques, utilities and others in the energy sector now have access to highly granular and localized climate projections. Despite that, however, many industry participants have neglected to consider knowable risks posed by climate change. Of course, failure to consider climate risks does not mean those risks do not exist, nor that they are not addressable. Without effective planning, the impacts of climate change will lead to increasing electric service disruptions, and other reliability issues. This has clear implications for FERC's statutory authority to ensure reliable electric service at just and reasonable rates.

As discussed further below, we recommend that FERC consider requiring regulated entities to engage in climate resilience planning. A central entity such as an interagency working group or task force could facilitate such planning and support efforts across agencies by, for example, developing downscaled climate projections and/or standard climate scenarios. We emphasize, however, that the importance of working towards more comprehensive and coordinated planning does not mean FERC and regulated entities should delay taking action on climate resilience. Industry standards can evolve and update quickly and should do so here.

Question 1: What are the most significant near-, medium-, and long-term challenges posed to electric system reliability due to climate change and extreme weather events?

Numerous government and independent studies have detailed various ways in which the impacts of climate change—both weather-related (e.g., higher temperatures and more frequent storms) and environmental (e.g., sea level rise)—could impair electric system reliability.[2] The electric

[1] ROMANY M. WEBB ET AL., CLIMATE RISK IN THE ELECTRICITY SECTOR: LEGAL OBLIGATIONS TO ADVANCE CLIMATE RESILIENCE PLANNING BY UTILITIES (2020), https://perma.cc/V25A-KBNP.

[2] *See e.g.,* U.S. GOV'T ACCOUNTABILITY OFFICE, ELECTRIC GRID RESILIENCE: CLIMATE CHANGE IS EXPECTED TO HAVE FAR-REACHING EFFECTS AND DOE AND FERC SHOULD TAKE ACTION 15-18 (2021) [hereinafter "GAO Climate Report"], https://perma.cc/Z9WA-FRLC; Craig D. Zamuda et al., *Energy Supply, Delivery, and Demand, in* IMPACTS, RISKS AND ADAPTATION IN THE UNITED STATES: FOURTH NATIONAL CLIMATE ASSESSMENT, Volume II 174-89 (D.R. Reidmiller et al. eds., 2018), https://perma.cc/P9QM-YJHF; JUSTIN GUNDLACH & ROMANY WEBB, CLIMATE CHANGE IMPACTS ON THE BULK POWER SYSTEM: ASSESSING VULNERABILITIES AND PLANNING FOR RESILIENCE 4-13 (2018), http://perma.cc/G9H8-Y2FW; U.S. DEP'T OF ENERGY, QUADRENNIAL ENERGY REVIEW: TRANSFORMING THE NATION'S ELECTRICITY SYSTEM: THE SECOND INSTALLMENT OF THE QER 4-28 – 4-32 (2017), https://perma.cc/DZJ5-7PHC; Ariel Miara et al., *Climate and Water Resource Change Impacts and Adaptation Potential for US Power Supply*, 7 NATURE CLIMATE CHANGE 793 (2017), https://perma.cc/AA5T-TUEL; MOLLY HELLMUTH ET AL., ADDRESSING CLIMATE VULNERABILITY FOR POWER SYSTEM RESILIENCE AND ENERGY SECURITY: A FOCUS ON HYDROPOWER RESOURCES (2017), https://perma.cc/9AJU-VEDC; U.S. DEP'T OF ENERGY, CLIMATE CHANGE AND THE U.S. ENERGY SECTOR: REGIONAL VULNERABILITIES AND RESILIENCE SOLUTIONS (2015), https://perma.cc/K9FZ-V7J5 [hereinafter "2015 DOE Report"]; U.S. DEP'T OF ENERGY. U.S. ENERGY SECTOR VULNERABILITIES TO CLIMATE CHANGE AND EXTREME WEATHER (2013), https://perma.cc/FMB6-RSRK [hereinafter "2013 DOE Report"]; Michelle T. H. van Vliet et al., *Vulnerability of US and European Electricity Supply to Climate Change*, 2 NATURE CLIMATE CHANGE 676 (2012), https://perma.cc/K2VZ-DJDJ; PETER CAMPBELL JOHNSTON ET AL., CLIMATE RISK AND ADAPTATION IN THE ELECTRIC POWER SECTOR (2012),

system is comprised of massive, place-based infrastructure (e.g., generating plants and transmission and distribution lines) which is highly sensitive to weather and environmental conditions. Current infrastructure is designed to operate reliably given the baseline conditions that existed in the past but, as climate change alters those conditions, the electric system is exposed to new risk profiles.[3]

The nature and extent of climate risks will vary geographically due to regional differences in both climate impacts and electric system design.[4] The risks will, however, be significant and widespread.[5] In the short-term, electric systems will primarily be affected by extreme weather events, which will increase in frequency and severity due to climate change, and could damage or destroy electricity infrastructure and force the shutdown of facilities. Key extreme weather events of concern include:

- **Heat waves**: More frequent and severe heat waves are expected to occur nationwide, but will be especially common in the southeast and southwest,[6] and could impair the operation of electricity generation, transmission, and distribution infrastructure.[7] High temperatures, particularly when accompanied by high humidity, reduce the operating efficiency (and thus output) of thermoelectric generating plants[8] and increase transmission line resistance which lowers the lines' carrying capacity and increases electricity losses during transmission.[9] High temperatures also increase demand for electricity which, in turn, increases the potential for supply shortfalls.[10] An example of this occurred in California in August 2020, when a heatwave triggered high demand for electricity, while also reducing output from natural gas generating plants, leading to a grid operator forced blackout.[11]

- **Storms, hurricanes, and flooding**: Heavy rainfall events are expected to increase in frequency and severity throughout the contiguous U.S.[12] The eastern U.S. is also projected to

https://perma.cc/XC2Q-YVHK; JAYANT SATHAYE ET AL., ESTIMATING RISK TO CALIFORNIA ENERGY INFRASTRUCTURE FROM PROJECTED CLIMATE CHANGE 9-50 (2011), https://perma.cc/M9BQ-NMRF.

[3] A growing body of literature, within the emerging field of "climate change attribution science," demonstrates a causal connection between climate change and various weather and environmental changes. *See generally* Michael Burger et al., *The Law and Science of Climate Change Attribution*, 45 COLUM. J. ENVTL. L. 57 (2020).

[4] GUNDLACH & WEBB, *supra* note 2, at 5.

[5] *Id*.

[6] R.S. Vose et al., *Temperature Changes in the United States, in* CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT, Volume I 185 (D.J. Wuebbles et al. eds., 2017), https://perma.cc/6WRF-XKT6.

[7] GUNDLACH & WEBB, *supra* note 2, at 7-8, 11.

[8] SATHAYE ET AL., *supra* note 2, at 16.

[9] *Id*. at 27.

[10] *Id*. at 35, 38.

[11] CAL. INDEP. SYS. OPERATOR, CAL. PUB. UTILS. COMM'N, & CAL. ENERGY COMM'N, PRELIMINARY ROOT CAUSE ANALYSIS: MID-AUGUST 2020 HEAT STORM (2020), https://perma.cc/KAF2-SQWQ.

[12] D.R. Easterling et al., *Precipitation Change in the United States*, *in* CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT, Volume I 207 (D.J. Wuebbles et al. eds., 2017), https://perma.cc/BQ3S-2SVZ.

experience more frequent and severe winter storms,[13] while more frequent and severe hurricanes and coastal flooding are expected in the south and east.[14] All of these events have the potential to damage or destroy electricity generation, transmission, and distribution infrastructure, leading to service outages.[15] Particularly where damage is widespread and other systems and infrastructure (e.g., roads) are affected, repairs can be complex and dangerous, making prompt restoration of service difficult. Even if they are not damaged, generating facilities may be forced to temporarily shut down or curtail output during or after heavy rainfall events and other storms, for example if their fuel stockpiles are saturated and thus rendered unusable. This occurred in Texas in 2017, when heavy rainfall associated with Hurricane Harvey saturated coal piles, preventing their use for electricity generation.[16]

- **Droughts**: More frequent and severe droughts are expected to occur in parts of the west and southwest[17] and could impair the operation, or force the temporary shutdown, of thermoelectric generating facilities that require water for cooling.[18] Hydroelectric generating facilities could also be affected due to reduced stream flows.[19] This occurred in California in 2014 when, due to a multi-year drought, hydroelectric generating capacity fell to just fifty-eight percent of the ten-year average.[20]

- **Wildfires**: More frequent and severe wildfires are expected to occur throughout the west, particularly in California,[21] and could damage, destroy, or force the shutdown of transmission and distribution lines.[22] Historically, these impacts have been managed by building redundancy into the system, but this will become increasingly difficult in the future as more frequent, severe, and longer wildfires impact more transmission and distribution lines.[23] Impacts to those lines could force the shutdown of the generating plants they serve. This occurred in Washington state in 2015, when a wildfire forced the shutdown of a transmission line, which in turn necessitated the curtailment of output from a hydroelectric power plant.[24] Similar issues have also arisen repeatedly in California in recent years.[25] Additionally, in parts

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[13] J.P. Kossin et al., *Extreme Storms, in* CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT, Volume I 257, 264-65 (D.J. Wuebbles et al. eds., 2017), https://perma.cc/TKM3-K6N9.
[14] *Id*. at 258-63.
[15] *See generally* 2013 DOE Report, *supra* note 2, at 3, 34-35; GAO Climate Report, *supra* note 2, at 15-17.
[16] Mark Watson, *Harvey's rain caused coal-to-gas switching: NRG Energy*, S&P GLOBAL PLATTS (Sept. 27, 2017), https://perma.cc/TMA6-7BUL.
[17] M.F. Wehner et al., *Droughts, Floods, and Wildfires, in* CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT, Volume I 231 (D.J. Wuebbles et al. eds., 2017), https://perma.cc/QD9P-XY26.
[18] ARGONNE NATIONAL LABORATORY, IMPACTS OF LONG-TERM DROUGHT ON POWER SYSTEMS IN THE U.S. SOUTHWEST 10, 37 (2012), https://perma.cc/7EKU-2Z3C.
[19] *Id*.; *see also* 2013 DOE Report, *supra* note 2, at 26.
[20] BENJAMIN L. PRESTON ET AL., RESILIENCE OF THE U.S. ELECTRICITY SYSTEM: A MULTI-HAZARD PERSPECTIVE 13 (2016), https://perma.cc/9G93-P824.
[21] Wehner et al., *supra* note 17.
[22] SATHAYE ET AL., *supra* note 2, at 40-45.
[23] *Id*.
[24] CRYSTAL RAYMOND, SEATTLE CITY LIGHT CLIMATE CHANGE VULNERABILITY ASSESSMENT AND ADAPTATION PLAN 17 (2015), https://perma.cc/LYQ6-ZT3L.
[25] *See, e.g.*, GAO Climate Report, *supra* note 2, at 5; DOE Report, *supra* note 2, at 3-9 – 3-10.

of California, outages have also occurred due to the pre-emptive shutdown of transmission and distribution lines at times of high wildfire risk.[26]

In the medium- to longer-term, non-event-based climate impacts will become more pronounced, and pose an increasing threat to electric systems and infrastructure. For example, as explained further in response to Question 3 below, increasing average temperatures could reduce the useful life of some transmission and distribution infrastructure.[27] Moreover, sea level rise caused by higher temperatures could lead to the inundation of coastal facilities, particularly during storms. A 2015 study by researchers at the U.S. Department of Energy ("DOE") and Oak Ridge National Laboratory found that, within the next forty years, sea level rise could increase the number of electric substations exposed to inundation during a weak (category 1) hurricane by forty-four percent from 711 to 1,025.[28] Another DOE study found that, by 2100, up to twenty-three percent of energy assets in Miami and twelve percent in New Yok City could be inundated by sunny day or "nuisance" flooding caused solely by sea level rise.[29]

It is important to note that, while electric system operators have always had to deal with weather- and environment-related risks, climate change presents fundamentally different challenges to those encountered in the past. The impacts of climate change are likely to affect the electric system in multiple, compounding, and synergistic, ways—both because individual climate impacts may affect multiple parts of the system and because multiple impacts may occur simultaneously.[30] Other interdependent sectors, such as upstream energy production, water supply, and telecommunications, will also be affected by climate impacts which could further exacerbate effects on the electric system.[31] As DOE warned in 2013, "disruptions of services in [the electric sector] may result in disruptions in one or more other sectors," and vice versa, "potentially leading to cascading system failures."[32] The tragic events in Texas in February 2021, following Winter Storm Uri, provide a real world example. Initial reports indicate that the extreme cold temperatures associated with the storm not only impaired the operation of electric generating facilities, but also natural gas and other infrastructure on which those facilities rely, leading to extremely widespread and long-lasting electricity outages affecting approximately four million households.[33]

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[26] *PG&E shutdown: 800,000 people to lose power to prevent California wildfires*, THE GUARDIAN (Oct. 9, 2019), https://perma.cc/2BTB-MJLV.
[27] U.S. DEP'T OF ENERGY, CLIMATE CHANGE AND THE ELECTRICITY SECTOR: GUIDE FOR CLIMATE CHANGE RESILIENCE PLANNING 10 (2016), https://perma.cc/GK9T-DUY4.
[28] JAMES BRADBURY ET AL., CLIMATE CHANGE AND ENERGY INFRASTRUCTURE EXPOSURE TO STORM SURGE AND SEA-LEVEL RISE 11 (2015), https://perma.cc/3WKY-CVY9.
[29] U.S. DEP'T OF ENERGY, EFFECT OF SEA LEVEL RISE ON ENERGY INFRASTRUCTURE IN FOUR MAJOR METROPOLITAN AREAS 13 (2014), https://perma.cc/D23E-768D.
[30] *See generally* 2013 DOE Report, *supra* note 2, at 5-6.
[31] *Id.*
[32] *Id*. at 5.
[33] Letter from Woody Rickerson, Vice President, Grid Planning and Operations, Elec. Reliability Council of Tex., Inc. to Arthur C. D'Andrea, Chairman, Pub. Util. Comm'n of Tex. (Apr. 6, 2021), https://perma.cc/322H-ARDH.

Furthermore, the electricity outages impacted some natural gas and oil extraction and pipelines that had no backup power available at compressor stations, worsening the fuel shortages.[34]

There is broad consensus among experts that, unless changes are made to the way electric and other systems are designed, operated, and regulated, the impacts of climate change will lead to increased service disruptions, with broad social and economic consequences. Electric service disruptions pose a threat to public health and safety, as witnessed in New York during Superstorm Sandy in 2012, when electricity outages forced the evacuation of 215 patients from New York University Langone Medical Center at the peak of the storm.[35] More recently the outages in Texas during Winter Storm Uri inflicted numerous impacts on human health and life, leading to boil water advisories for over a week, forcing the closure of COVID-19 vaccination clinics, and contributing to dozens of deaths from freezing temperatures and carbon monoxide poisoning due to running cars or propane heaters in closed spaces.[36] Disadvantaged communities are at especially high risk from outages. As the Government Accountability Office has noted:

> [P]ower outages can disproportionately affect vulnerable populations that rely on continued electricity service to address certain health conditions. In addition, low-income groups are more vulnerable to events . . . given their limited ability to meet higher energy costs and invest in measures to minimize the impact of outages, such as backup generators.[37]

Electricity outages also have significant economic implications. A recent study commissioned by DOE found that electricity outages cost American businesses approximately $150 billion annually.[38] That figure will increase in the future if, as expected, the impacts of climate change cause more frequent and longer-lasting electricity outages.

System operators in some areas have recently sought to mitigate electricity outages and other reliability issues by increasing fossil fuel generation. For example, during Winter Storm Uri in February 2021, the Electric Reliability Council of Texas requested and was granted emergency authorization from DOE to direct natural gas, coal, and distillate fuel oil generating units to operate at their maximum output levels.[39] In issuing the authorization, DOE noted that operating the plants at their maximum levels "may result in exceedance of emissions of sulfur dioxide, nitrogen oxide,

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[34] Rachel Adams-Heard et al., *A Giant Flaw in Texas Blackouts: It Cut Power to Gas Supplies*, BLOOMBERG (Feb. 19, 2021), https://perma.cc/Z4UR-MW9Q.
[35] Alexandra Sifferlin, *Lessons from Superstorm Sandy: When Hospital Generators Fail*, TIME (Oct. 30, 2012), https://perma.cc/4VDC-SVZ4.
[36] N.Y. Pub. Serv. Comm'n, Petition for Performance of Statewide Utility Climate Change Vulnerability Studies, Case 21-M-0199, 7-8 (Mar. 19, 2021), https://perma.cc/8F59-NUWV; *see also* Tex. Dep't of State Health Servs., News Updates, *Winter Storm-Related Deaths – April 6, 2021* (Apr. 6, 2021), https://perma.cc/NEF4-ZXNM.
[37] GAO Climate Report, *supra* note 1, at 20.
[38] LITOS STRATEGIC COMMUNICATION, THE SMART GRID: AN INTRODUCTION 5 (Undated), https://perma.cc/74VV-XN7E.
[39] U.S. Dep't of Energy, Order No. 202-21-1 (Feb. 14, 2021), https://perma.cc/9B7A-76HK. The California Independent System Operator was also granted emergency authorization to direct fossil fuel generators to operate at their maximum output level, "notwithstanding air quality or other permit limitations," during a period of extreme heat in September 2020. *See* U.S. Dep't of Energy, Order No. 202-20-2 (Sept. 6, 2020), https://perma.cc/VK3N-FGBR.

mercury, and carbon monoxide emissions, as well as wastewater release limits."[40] It would also result in significant greenhouse gas emissions, which contribute to climate change, and thus exacerbate the underlying cause of many reliability issues. Compounding this problem, declining reliability is also likely to result in greater use of back-up generating systems by customers, at least those with the means to invest in them.[41] Again, because back-up generators are typically powered by natural gas or diesel and thus emit greenhouse gases, this could increase the climate risks facing the electric sector.

Given the above, DOE has warned that "[i]n the absence of concerted action to improve [climate] resilience, energy system vulnerabilities pose a threat to America's national security, energy security, economic well-being, and quality of life."[42]

Question 2: With respect to extreme weather events, have these issues impacted the electric system, either directly or indirectly, more frequently or seriously than in the past, and if so, how? Will extreme weather events require changes to the way generation, transmission, substation, or other facilities are designed, built, sited, and operated?

As a capital-intensive and place-based industry, the electric sector has long been impacted by extreme weather events. Extreme weather events are already the leading cause of electricity outages in the U.S. and the number of weather-related outages is increasing.[43] That increase is at least partly attributable to increased severity of extreme weather events fueled by climate change—a problem that will only worsen in the future.[44] Extreme weather-related electricity outages, and measures to prevent and restore service after such outages, impose costs on electricity providers and customers.[45] Again, climate change is expected to magnify those impacts, with one recent government report finding that climate change could result in a twenty-five percent annual increase for transmission and distribution infrastructure costs alone.[46] Infrastructure owners that fail to effectively prepare for and manage climate risk are also likely to face higher borrowing and insurance costs in the future.[47]

[40] U.S. Dep't of Energy, Order No. 202-21-1 (Feb. 14, 2021), https://perma.cc/9B7A-76HK.
[41] Catherine Wolfram, *Electricity Outages Lead to Substantial Backup Generator Purchases*, ENERGY INST. BLOG (May 26, 2020), https://perma.cc/R6SD-NQ49.
[42] 2015 DOE Report, *supra* note 2, at i.
[43] U.S. DEP'T OF ENERGY, QUADRENNIAL ENERGY REVIEW: TRANSFORMING THE NATION'S ELECTRICITY SYSTEM: THE SECOND INSTALLMENT OF THE QER S-12 (2017), https://perma.cc/DZJ5-7PHC.
[44] *Id.*; *see also* U.S. GOV'T ACCOUNTABILITY OFFICE, OPPORTUNITIES EXIST FOR DOE TO BETTER SUPPORT UTILITIES IN IMPROVING RESILIENCE TO HURRICANES 1 (2021), https://perma.cc/TVD3-EYUS ("[T]he growing severity of extreme weather events in recent years has been a principal contributor to an increase in the frequency and duration of U.S. power outages. According to the Congressional Budget Office, extreme weather events are projected to worsen in the future due to climate change.").
[45] See response to Question 1 *supra*, discussing the costs of electricity outages.
[46] GAO Climate Report, *supra* note 2, at 6.
[47] *See generally* Juhyun Jong et al., *Carbon Risk, Carbon Risk Awareness, and the Cost of Debt Financing,* 150 J. BUS. ETHICS 1151 (2018), https://perma.cc/JC83-KXTU (finding an "economic[ally] meaningful" "positive association between cost of debt and carbon risk").

Put simply, as climate change intensifies, and the frequency, severity, and intensity of extreme weather events increases, the electric sector will face mounting risks.[48] That has clear implications for FERC's statutory obligation to ensure electric service reliability at just and reasonable rates.

Responding to the impacts of climate change on the electric sector will require changes in planning, siting, operation, expenditure, and regulation. As noted in our 2020 report—*Climate Risk in the Electricity Sector: Legal Obligations to Advance Climate Resilience Planning by Utilities*—steps may need to be taken both "to prevent or minimize damage to vulnerable assets (e.g., investments in asset hardening or relocation) and to manage the consequences of such damage when it occurs (e.g., investments in system recoverability)."[49] Critically, however, improving climate resilience will not always require expending capital. With appropriate planning to integrate future climate impacts into current system design and operation, the need for investments in asset hardening and costly retrofits can be minimized. This is essential to ensure just and reasonable rates.

Effective planning is also necessary to prevent maladaptive outcomes. Maladaptation occurs where measures taken "address the symptom of a particular risk while also exacerbating its underlying cause."[50] Take, for example, the known need for generation increases to meet higher demand caused by climate change amplified temperature shifts. Utilizing carbon-intensive generation to meet that added demand would be an illustration of maladaptation and only further the cycle of risk, symptom, and response. Maladaptation should be avoided, as it can "constrain the options or ability of other decision makers now or in the future to manage the impacts of climate change, thereby resulting in an increase in exposure and/or vulnerability to climate change."[51] Focus only upon climate risk without consideration of climate action likewise ignores the causal linkage between the two concerns, namely that urgent mitigation efforts are fundamental to reducing climate risk. That is, "reducing greenhouse gas emissions continues to be the best approach to preventing future damage."[52]

Additionally, any resilience-related capital expenditures must be considered in the context of cost to the end-use customer. Because both the costs associated with grid outages and the costs of recovery are typically borne by the customer, there is often good reason to invest in climate resilience that reduces outages. However, regulators must protect against investments to effectuate outcomes that could be met through less costly alternatives (e.g., by elevating a new substation at risk from future sea level rise during its initial construction, rather than when the risk materializes).

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[48] Craig D. Zamuda et al., *Energy Supply, Delivery, and Demand, in* IMPACTS, RISKS AND ADAPTATION IN THE UNITED STATES: FOURTH NATIONAL CLIMATE ASSESSMENT, Volume II 175 (D.R. Reidmiller et al. eds., 2018), https://perma.cc/P9QM-YJHF ("The [U.S.] energy system is already affected by extreme weather events, and due to climate change, it is projected to be increasingly threatened by more frequent and longer-lasting power outages affecting critical energy infrastructure and creating fuel availability and demand imbalances.").
[49] WEBB ET AL., *supra* note 1, at 4.
[50] *Id.*
[51] *Id.*
[52] *Id.* at 4, note 30.

Well-designed and -implemented climate resilience planning can address these concerns. Climate resilience planning is a two-stage process: first, climate vulnerabilities are assessed, and second, climate resilience plans are implemented. Generally, "climate vulnerability assessments identify where and under what conditions electric utility assets are at risk from the impacts of climate change, how those risks will manifest, and what the consequences will be for system operation."[53] Often, vulnerabilities can be identified with specificity, in some instances particular to a single mile.[54] This information can be immensely valuable and immediately useful and should feed into the next stage of the process, where entities "develop climate resilience plans, outlining measures to reduce the risk to vulnerable assets."[55]

Any capital expenditure should be premised upon careful study and consideration conducted when climate vulnerability is assessed. Alternatives to address those vulnerabilities should then be considered. Often, those actions can be accomplished through non-capital intensive actions, such as operational changes, planning updates, and/or design modifications. And to guard against maladaptation, climate resilience planning should "be evaluated and implemented in a manner consistent with emission reduction strategies."[56] Well-designed climate resilience planning that reflects this key component might consider, for example, avenues to catalyze distributed energy resources rather than harden fossil infrastructure. Critically, any resilience strategy should consider and score its own recommendations in the context of associated emissions. The strategy should be avoided if that exercise demonstrates that it is carbon-intensive, and alternatives should be preferred.

Careful attention to opportunities for customer-focused resiliency measures can also enhance the benefits of resilience planning and prevent maladaptation.[57] Enabling measures like customer-sited distributed generation, demand response resources, distributed storage, and energy efficiency measures including weatherization can reduce the harm to individuals and communities during extreme weather events, reduce demand on the grid, and offer services to the grid. The development of such measures can be supported both directly as part of resilience planning and through ensuring that distributed energy resources are able to participate in markets and otherwise receive compensation for the value they create.

The above should not be read to suggest that hardening measures are never appropriate. Rather, such measures would be appropriate on the basis of thoughtfully conducted climate resilience planning, where benefits are shown to outweigh costs.

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[53] *Id.* at 4.
[54] *Id.* at 5.
[55] *Id.* at 4.
[56] *Id.*
[57] *See generally* ALISON SILVERSTEIN ET AL., A CUSTOMER-FOCUSED FRAMEWORK FOR ELECTRIC SYSTEM RESILIENCE (2018), https://perma.cc/ZL7W-QZ9H.

Question 3: Will [non-event based climate] impacts require changes to the way generation, transmission, substation, or other facilities are designed, built, sited, and operated?

Non-event based climate impacts will also require changes in the way the grid is operated, built, and regulated. Many of the points made in response to Question 2 are applicable here, and the response above should be considered relevant to this question as well.

In addition to statements, evidence, and analysis offered above, non-event based climate impacts are relevant in particular to the daily operation and longer-term forecasting of the grid. Baseline shifts in weather patterns will profoundly affect the electric sector, which is designed to operate within specific temperature and weather bandwidths. Testimony provided in a 2013 rate case before the New York Public Service Commission ("NYPSC") revealed, for example, that Consolidated Edison ("ConEd") "had specified design parameters for its equipment that would be incompatible with the summer temperatures expected to occur during the useful life of that equipment."[58] Later study by ConEd additionally found that the performance and useful life of substations, and in particular transformers, were vulnerable if designed to an inaccurate reference temperature. The utility's vulnerability study found that this was indeed the case, and that the employed reference temperature was out of date—and equipment thus impaired—by not reflecting the climate change increases in baseline temperature.[59]

These concerns exist across entities, actors, and regions. Often, the effects of unaccounted for changes in baseline temperature can impede just and reasonable rates. Note, for example, that natural gas generating facilities are generally designed to operate at 59 degrees Fahrenheit.[60] Efficiency is reduced by up to 1 percent for every 1.8 degree Fahrenheit increase in temperature above that level.[61] The cumulative effect can be significant. One recent study of gas-fired generation in California found that that electricity losses on hot days could reach 10.3 gigawatts by 2100, equivalent to nearly one-quarter of total current gas-fired capacity.[62] The effect is that customers end up paying for capacity that is not available when needed most.

ISO-NE's 2017 Regional System Plan serves as another example. The plan incorporated climate change effects, at least at some level, when projecting summer temperatures, assuming that temperatures would increase as they have in past years and that this would lead to increased electricity demand. Yet ISO-NE did not consider the implications of that same summer heat for other parts of the system, such as transmission facility efficiency or asset life. Thus, as the Department of Homeland Security noted in 2016, ISO-NE did not address "climate change in its planning activities to determine the grid enhancement requirements necessary to meet future demand given projected temperature increases."[63] This is not unique to ISO-NE; grid operators all too often rely upon past data despite historic weather trends increasingly serving as a poor proxy for future conditions.

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[58] GUNDLACH & WEBB, *supra* note 2, at 16.
[59] CONSOLIDATED EDISON, CLIMATE CHANGE VULNERABILITY STUDY 40 (2019), https://perma.cc/GR37-6UJT.
[60] SATHAYE ET AL., *supra* note 2, at 11-12.
[61] *Id.*
[62] *Id*. at 18.
[63] GUNDLACH & WEBB, *supra* note 2, at 15.

As suggested at the outset of our comments and in response to Question 2, well-designed and -implemented climate resilience planning should form the core of any solution strategy for these growing climate risks. Climate resilience planning is essential to detect subtle shifts in baseline conditions that create significant vulnerabilities and is the framework by which appropriate remedial measures can be identified and evaluated.[64]

Question 6: How are relevant regulatory authorities, individual utilities, and regional planning authorities evaluating and addressing challenges posed to electric system reliability due to climate change and extreme weather events and what potential future actions are they considering? What additional steps should be considered to ensure electric system reliability?

Multiple government and independent bodies have recommended that participants in the electric industry engage in climate resilience planning, and developed tools and best practices to guide such planning.[65] Nevertheless, relatively few industry participants have prepared high quality, comprehensive climate resilience plans.

To the extent climate resilience planning has occurred in the electric industry, it has primarily been undertaken by utilities following particularly severe extreme weather events, which highlighted vulnerabilities in their systems. For example, Entergy Corporation commenced a study of climate risks in 2005 following Hurricanes Katrina and Rita, which caused widespread damage to its transmission and distribution systems.[66] ConEd was prompted to do the same by its experience with Superstorm Sandy in 2012. Both studies led to the publication of vulnerability assessments and resilience plans which are intended to inform future investment and other decisions. The ConEd study in particular is widely regarded as the best example to date of effective climate resilience planning. It is, however, important to note that one-off studies like that conducted by ConEd are not sufficient by themselves. Climate resilience planning is an ongoing process, involving regular re-evaluation of climate vulnerabilities and resilience measures, based on changing conditions and new information.

Building on the ConEd study, the New York Independent System Operator ("NYISO") recently completed its own climate vulnerability assessment.[67] The assessment evaluated how "more

[64] We note that additional issues related to infrastructure siting, construction, and maintenance could arise where sea level rise and/or other climate impacts force the relocation of communities away from certain areas. In areas where relocation is anticipated or planned, consideration will need to be given to the appropriateness of investing in new facilities and/or maintaining existing facilities, which may be forced out of service before the end of their full useful life.

[65] *See, e.g.*, WEBB ET AL., *supra* note 1, at 4-9; McKinsey & Co., *Confronting Climate Risk*, MCKINSEY QUARTERLY (May 15, 2020), https://perma.cc/T5AR-M2AW; U.S. DEP'T OF ENERGY, *supra* note 27, at 1-2; KRISTIN RALFF-DOUGLAS, CAL. PUB. UTILS. COMM'N, CLIMATE ADAPTATION IN THE ELECTRIC SECTOR: VULNERABILITY ASSESSMENTS & RESILIENCE PLANS 5 (2016), https://perma.cc/R6NW-F6GV.

[66] Gloria Gonzalez, *Entergy Seeks to Lead on Climate Risk Mitigation*, GREENBIZ (Aug. 14, 2013), https://perma.cc/9E9N-RP4D. Entergy Corporation documented the findings of its study in a series of reports. *See* ENTERGY CORP. ET AL., EFFECTIVELY ADDRESSING CLIMATE RISK THROUGH ADAPTATION FOR THE ENERGY GULF COAST (2010), https://perma.cc/QS6S-WC9W; ENTERGY CORP. ET AL., BUILDING A RESILIENT ENERGY GULF COAST: EXECUTIVE REPORT (Undated), https://perma.cc/9J47-FVFG.

[67] N.Y. INDEP. SYS. OPERATOR, THE VISION FOR A GREENER GRID: POWER TRENDS 2020 (2020), https://perma.cc/XY8R-CCBM; *see also* ITRON, INC., NEW YORK ISO CLIMATE CHANGE IMPACT STUDY –

frequent and severe storms, extended extreme temperature . . . and other meteorological events (e.g., wind lulls, droughts, and ice storms)" associated with climate change could impact "system load and resource availability" in New York.[68] The findings were used to incorporate climate change projections into NYISO's annual Load and Capacity Data Report and other core planning documents.[69]

The ConEd and NYISO studies together comprise the fullest analysis of climate risks facing a regional electric system in the U.S. To our knowledge, other Independent System Operators, Regional Transmission Organizations, and planning authorities have not engaged in similarly comprehensive climate resilience planning. Those entities typically leave climate resilience planning to the states in which they operate or the owners of facilities they oversee.[70] However, with limited exceptions (discussed below), states and facility owners have also failed to plan effectively.

Seeking to encourage more and better climate resilience planning, in 2015, DOE established the Partnership for Energy Sector Climate Resilience to provide a forum for electric utilities to exchange information and compare best practices on climate resilience planning.[71] As part of the program, seventeen electric utilities conducted climate vulnerability assessments, and fifteen developed resilience plans. As detailed in our 2020 report—*Climate Risk in the Electricity Sector: Legal Obligations to Advance Climate Resilience Planning by Utilities*—many utilities' planning processes had "major shortcomings."[72] For example, in developing their plans, most utilities considered only one or a subset of the climate impacts expected to occur within their service territories.[73] Several based their plans on historic weather data that did not incorporate forward-looking climate projections and thus, in DOE's view, were "at risk of underestimating [their] vulnerability to future climate change impacts."[74]

The need for improved climate resilience planning has also received attention, albeit often limited, from a handful of state regulators.[75] For example, in 2014 when approving plans for the ConEd climate resilience study, the NYPSC stated:

PHASE I: LONG-TERM LOAD IMPACT (2019), https://perma.cc/5HGX-2KPE; PAUL J. HIBBARD ET AL., ANALYSIS GROUP, CLIMATE CHANGE IMPACT AND RESILIENCE STUDY – PHASE II: AN ASSESSMENT OF CLIMATE CHANGE IMPACTS ON POWER SYSTEM RELIABILITY IN NEW YORK STATE (2020), https://perma.cc/72RK-V3BY.

[68] HIBBARD ET AL., *supra* note 67, at 6.

[69] N.Y. INDEP. SYS. OPERATOR, 2020 LOAD & CAPACITY DATA: GOLD BOOK (2020), https://perma.cc/ZY9E-QH6Y.

[70] GUNDLACH & WEBB, *supra* note 2, at 16.

[71] *Partnership Description*, U.S. DEP'T OF ENERGY: OFFICE OF POLICY, https://perma.cc/7Z57-RLHH (last visited July 17, 2020).

[72] WEBB ET AL., *supra* note 1, at 11.

[73] *Id*.

[74] U.S. DEP'T OF ENERGY, A REVIEW OF CLIMATE CHANGE VULNERABILITY ASSESSMENTS: CURRENT PRACTICES AND LESSONS LEARNED FROM DOE'S PARTNERSHIP FOR ENERGY SECTOR CLIMATE RESILIENCE 12 (2016), https://perma.cc/5EKK-T9GA.

[75] As discussed below, the state utility commissions in New York and California have led on the issue of climate resilience planning, though some others, including the Massachusetts Department of Public Utilities, have also taken limited action. *See* Mass. Dep't of Pub. Utils., Order Establishing Eversource's Revenue Requirement, Docket No. D.P.U. 17-05, at 411 (Nov. 30, 2017), https://perma.cc/3THR-ZKU7.

> The State's utilities should familiarize themselves with scientists' projections for local climate change impacts on each service territory. . . . We expect the utilities to consult the most current data to evaluate the climate impacts anticipated in their regions over the next years and decades, and to integrate these considerations into their system planning and construction forecasts and budgets.[76]

Despite this, however, ConEd is the only New York-based electric utility to have engaged in comprehensive climate resilience planning to date.[77] A petition, requesting that the NYPSC direct other utilities in the state to prepare climate resilience plans, was filed by the City of New York, EDF, Natural Resources Defense Council, and Sabin Center in March 2021.[78]

The California Public Utilities Commission ("CPUC") recently directed that state's investor-owned energy utilities to prepare and regularly update "climate vulnerability assessments" evaluating risks to their assets, operations, and services from changing temperatures, sea level rise, variations in precipitation, wildfire, and "cascading impacts / compounding incidents."[79] FERC should consider effort to similar effect, and could determine whether and how RTO activities might best weave in climate resilience planning. Additional efforts could align, inform, or be coordinated with such action, for example, through an interagency working group or task force as described in more detail below in response to Question 8.

Question 7: Are relevant regulatory authorities, individual utilities, or regional planning authorities considering changes to current modeling and planning assumptions used for transmission and resource adequacy planning? For example, is it still reasonable to base planning models on historic weather data and consumption trends?

The electric system has always required safe, adequate electric service, and affirmative obligations to identify and reduce risk have long been central to discharging this duty. Asserting that regulators must act is not based on a reinterpretation of these responsibilities; what is "new" is the magnitude of the risk posed by climate change.

Existing planning processes, based on historic data, do not adequately consider the consequences of climate change. Basing resource adequacy and other planning on historic weather data increases the potential for supply shortages and associated electricity outages.

[76] N.Y. Pub. Serv. Comm'n, Order Approving Electric, Gas, and Steam Rate Plans in Accord with Joint Proposal, Case 13-E-0030 et al., 71-72 (Feb. 21, 2014), https://perma.cc/Y78W-GY8H.
[77] WEBB ET AL., *supra* note 1, at 14.
[78] N.Y. Pub. Serv. Comm'n, Petition for Performance of Statewide Utility Climate Change Vulnerability Studies, Case 21-M-0199 (Mar. 19, 2021), https://perma.cc/8F59-NUWV. The petition noted that climate vulnerability studies can be considered in conjunction with opportunities for decarbonization and the managed contraction of the gas system to allow for well-informed decision-making on the most cost-effective approach to addressing the identified vulnerabilities and ensuring the remaining system is resilient to climate change. *Id.* at 18.
[79] Cal. Pub. Utils. Comm'n, Decision on Energy Utility Climate Change Vulnerability Assessments and Climate Adaptation in Disadvantaged Communities (Phase 1, Topics 4 and 5), Rulemaking 18-04-019 (Aug. 27, 2020), https://perma.cc/2GKK-VCNP.

California experienced outages for this reason in August 2020.[80] A Sabin Center review of the outages found:

> In determining the amount of resources needed [to meet electricity demand], the CPUC relies on demand forecasts set by the [California Energy Commission ("CEC")] based on average historic peak demand, reflecting one-in-two year conditions. The CEC adds a fifteen percent "planning reserve margin" to, among other things, "account for plant outages and higher than average peak demand." Even that was not sufficient to account for the impact of the August [2020] heatwaves, however. On August 14, with California experiencing a one-in-thirty-five year heatwave event resulting in temperatures ten to twenty degrees above normal, peak demand was over five percent higher than forecast. While demand was under-estimated, it appears that supply may have over-estimated, including because the planning process failed to account for the impact of high heat on generating facilities.[81]

In addition to acute events like outages, reliance on historic data and practices can also result in decreased performance and useful life of equipment, for example by failing to adjust for increases to baseline temperature in designing equipment (see response to Question 3 above).[82] It might also result in facilities being designed in ways, or installed in places, that make them susceptible to climate change-amplified weather and environmental shifts. For example, decisions regarding the elevation of coastal facilities are typically based on Federal Emergency Management Agency ("FEMA") flood maps, which reflect historic flooding patterns and do not account for future sea level rise due to climate change.[83]

Resource adequacy and other planning processes can avoid these missteps by incorporating downscaled climate projections, which reflect anticipated future conditions in the planning area.[84] The availability of such projections has increased significantly in recent years, with various publicly available tools and reports developed by government and academic bodies, as well as private entities.[85] One example is the web-based Cal-Adapt tool which was developed by

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[80] The first climate resilience plans required by the CPUC, discussed in response to Question 6 above, are due beginning in 2021. *See* Cal. Pub. Utils. Comm'n, *Climate Change Adaptation*, https://perma.cc/NF22-7V5X (last visited Apr. 14, 2021).

[81] Romany Webb, *California Blackouts Highlight Need to Better Plan for Climate Impacts*, CLIMATE L. BLOG (Oct. 12, 2020), https://perma.cc/7H98-3UX4.]

[82] *See, e.g.*, GUNDLACH & WEBB, *supra* note 2, at 16 ; CONSOLIDATED EDISON, CLIMATE CHANGE VULNERABILITY STUDY 40 (2019), https://perma.cc/GR37-6UJT.

[83] *See generally* Michael B. Gerrard & Edward McTiernan, *The Perils of Relying on FEMA Flood Maps in Real Estate Transactions*, N.Y.L. J. (Sept. 9, 2020), https://perma.cc/U5KV-9EFR.

[84] WEBB ET AL., *supra* note 1, at 5.

[85] *See, e.g.*, U.S. Climate Resilience Toolkit, *Energy Data Gallery*, https://toolkit.climate.gov/topics/energy/energy-data-gallery (last updated Sept. 24, 2019); Nat'l Aeronautics & Space Admin., *NASA Earth Exchange (NEX) Downscaled Climate Projections (NEX-DCP30)*, https://www.nccs.nasa.gov/services/data-collections/land-based-products/nex-dcp30 (last visited Apr. 14, 2021); U.S. Geological Survey, *Regional Climate Change Viewer*, http://regclim.coas.oregonstate.edu/visualization/rccv/index.html (last visited Apr. 14, 2021); Bureau of Reclamation et al., *Downscaled CMIP3 and CMIP5 Climate and Hydrology Projections*, https://gdo-dcp.ucllnl.org/downscaled_cmip_projections/#Welcome (last visited Apr. 14, 2021); Conservation Biology

researchers at the University of California, Berkeley with funding from the California Energy Commission and California Strategic Growth Council.[86] The tool includes projections for key climate variables, such as temperature and precipitation, at 3.5 square mile increments.[87] Other sources include even more granular data, with spatial scales below 2.5 miles, and even as fine as 0.6 miles.[88]

It should, however, be noted that merely integrating forward-looking projections into existing planning processes is insufficient by itself. Utilities and system operators must also engage in comprehensive climate resilience planning in a manner consistent with emission reduction strategies.

Question 8: Are relevant regulatory authorities, individual utilities, or regulated planning authorities considering measures to harden facilities against extreme weather events?

Utilities have taken a range of steps to harden their infrastructure against extreme weather events. A recent Government Accountability Office report found that, to protect against storms, including hurricanes, utilities have implemented "physical changes to grid infrastructure such as constructing flood walls, installing network protectors, elevating facilities, undergrounding electrical equipment, and utility pole management."[89] Utilities have also undertaken hardening measures to address other extreme weather events, such as exceptionally hot or cold temperatures, as explained further in response to Question 2 above. In a small number of cases, state regulators have directed utilities to integrate consideration of climate impacts, including extreme weather events, into their construction, budgeting, and other plans.[90]

However, most regulatory authorities and utilities are not doing enough, or to the extent that they are taking action, are not taking a comprehensive view on climate risk.[91] In order to invest

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Inst., *Adapt West–A Climate Adaptation Conservation Planning Database for North America*, https://adaptwest.databasin.org/ (last visited Apr. 14, 2021).

[86] Cal-Adapt, https://cal-adapt.org/ (last visited Apr. 14, 2021). For more information about Cal-Adapt, see Susan Wilhelm, Cal. Energy Comm'n, Presentation at IEPR Workshop on Adaptation and Resilience for the Energy System: Unveiling Cal-Adapt 2.0: Facilitating Energy Sector Resilience and Providing Foundational Scenarios for California's Fourth Climate Change Assessment (Aug. 29, 2017), https://perma.cc/27TJ-H2J7.

[87] Cal-Adapt, *Climate Tools*, https://cal-adapt.org/tools/ (last visited Apr. 14, 2021).

[88] Katharine Hayhoe et al., *Climate Models, Scenarios, and Projections*, *in* CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT, Volume I 133, 144 (D.J. Wuebbles et al. eds., 2017), https://perma.cc/HB9P-F8EL.

[89] U.S. GOV'T ACCOUNTABILITY OFFICE, OPPORTUNITIES EXIST FOR DOE TO BETTER SUPPORT UTILITIES IN IMPROVING RESILIENCE TO HURRICANES 7 (2021), https://perma.cc/TVD3-EYUS; *see also* CONSOLIDATED EDISON, CLIMATE CHANGE RESILIENCE AND ADAPTATION: SUMMARY OF 2020 ACTIVITIES 7 (2021), https://perma.cc/Z5BF-E7CH ("Con Edison has updated its flood design standard to require that infrastructure design account for the 100-year flood, two feet of freeboard, and sea level rise through the useful life of the site.").

[90] *See, e.g.*, N.Y. Pub. Serv. Comm'n, Order Approving Electric, Gas, and Steam Rate Plans in Accord with Joint Proposal, Case 13-E-0030 et al., 71-72 (Feb. 21, 2014), https://perma.cc/Y78W-GY8H; Cal. Pub. Utils. Comm'n, Decision on Energy Utility Climate Change Vulnerability Assessments and Climate Adaptation in Disadvantaged Communities (Phase 1, Topics 4 and 5), Rulemaking 18-04-019 (Aug. 27, 2020), https://perma.cc/2GKK-VCNP.

[91] WEBB ET AL., *supra* note 1, at 9-14.

effectively in resilience and avoid maladaptation, as discussed in response to Question 2 above, further investments in system and asset hardening should be informed by climate resilience planning.[92] A central entity such as an interagency working group or task force could facilitate climate resilience planning by regulatory authorities and utilities, for example by standardizing climate scenarios. However, the importance of working towards more comprehensive and coordinated planning does not mean utilities and regulators should delay taking action on climate resilience; industry standards can evolve and update quickly, and should do so here.[93]

* * * * *

Thank you for the opportunity to submit these comments. For your reference, we have attached two key reports, which further elaborate on the points made above. Please contact us if you have any questions.

Sincerely,

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Attachments (2):

(1) Romany M. Webb, Michael Panfil, and Sarah Ladin, *Climate Risk in the Electricity Sector: Legal Obligations to Advance Climate Resilience Planning by Utilities* (2020).

(2) Justin Gundlach and Romany Webb, *Climate Change Impacts on the Bulk Power System: Assessing Vulnerabilities and Planning for Resilience* (2018).

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[92] N.Y. Pub. Serv. Comm'n, Petition for Performance of Statewide Utility Climate Change Vulnerability Studies, Case 21-M-0199, 17-18 (Mar. 19, 2021), https://perma.cc/8F59-NUWV.
[93] *See, e.g.*, JUDSEN BRUZGUL ET AL., RISING SEAS AND ELECTRICITY INFRASTRUCTURE: POTENTIAL IMPACTS AND ADAPTATION OPTIONS FOR SAN DIEGO GAS AND ELECTRIC (SDG&E) 18 (2018), https://perma.cc/C5BV-P2ZB ("Low- and no-regrets adaptation actions can be implemented now, while further research is conducted to enable informed flexible pathways to be established for longer-term aims.").

CLIMATE RISK IN THE ELECTRICITY SECTOR:

Legal Obligations to Advance Climate Resilience Planning by Electric Utilities

Romany M. Webb, **Michael Panfil** and **Sarah Ladin**

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Finding the ways that work

Climate Risk in the Electricity Sector: Legal Obligations to Advance Climate Resilience Planning by Electric Utilities

ROMANY M. WEBB, MICHAEL PANFIL AND SARAH LADIN

Abstract:

Electricity generation, transmission and distribution, and load are all impacted by weather patterns. Electric system assets have been designed for historic weather conditions, with the goal of ensuring reliability and quick recovery following extreme events. However, climate change is causing major shifts in historic weather patterns and more frequent and severe extremes, which are creating new risk profiles for the electric system. Proactive climate resilience planning by electric utilities to identify, respond, and rationally allocate these climate risks is thus increasingly salient. This paper argues that it is also legally required.

Recently published industry studies demonstrate that accurate, specific, and actionable climate resilience planning is possible. Nevertheless, and despite the significant benefits of climate resilience planning, relatively few electric utilities have engaged in the process. This paper explores two legal doctrines, public utility law and tort law, which we argue obligate electric utilities to plan for the impacts of climate change on their assets and operations. Public utility law requires electric utilities to meet, among other things, prudent investment and reliability standards. Tort law establishes a duty of care that obligates electric utilities to, among other things, avoid foreseeable harm when performing acts that could injure others. We argue that, as climate science becomes more precise and predictive, these legal standards take on new meaning and require electric utilities to engage in climate resilience planning.

The Sabin Center for Climate Change Law develops legal techniques to fight climate change, trains law students and lawyers in their use, and provides the legal profession and the public with up-to-date resources on key topics in climate law and regulation. It works closely with the scientists at Columbia University's Earth Institute and with a wide range of governmental, non- governmental and academic organizations.

Environmental Defense Fund (EDF) is a non-partisan, non-governmental environmental organization representing over two million members and supporters nationwide. Since 1967, EDF has linked law, policy, science, and economics to create innovative and cost-effective solutions to today's most pressing environmental problems.

Disclaimer:

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PART 1:

Introduction

The electric system is significantly affected by weather conditions. High temperatures increase demand for electricity, while simultaneously reducing the operating efficiency of thermoelectric generating facilities and the carrying capacity of transmission and distribution lines.[1] Droughts can force the curtailment or shutdown of hydroelectric and other water-dependent generation, as can storms and flooding, which can also damage or destroy transmission and distribution infrastructure.[2] Seeking to reduce these and other risks, electric system operators have designed their infrastructure in the context of historic weather patterns, with the goal of ensuring reliability and quick recovery following extreme weather events. However, with climate change now causing major shifts in historic weather patterns and more frequent and severe extremes, electric system operators must fundamentally rethink their approach.

The Fourth National Climate Assessment, published in 2018, concluded that "[a]nnual average temperature over the contiguous United States has increased by 1.2ºF (0.7ºC) over the last few decades and by 1.8ºF (1ºC) relative to the beginning of the last century."[3] This temperature increase has led to more frequent and intense heat waves, droughts, storms, and other extremes, as well as environmental changes such as sea level rise, all of which are negatively affecting the electric system.

The number and severity of weather-related electricity outages have increased in recent years as system operators grapple with multiple compounding climate impacts.[4] One example occurred in Washington state in summer 2015, when higher than average temperatures led to a spike in demand at the same time as a wildfire forced the shutdown of a transmission line, which in turn necessitated the curtailment of output from a hydroelectric generating facility.[5] This led to a twenty-percent shortfall in electricity supply, which cost the local utility—Seattle City Light—approximately $100,000 per day to replace.[6] More recently, what may be the hottest terrestrial temperature ever reliably recorded in California, along with severe wildfires, contributed to a grid operator forced blackout in August 2020.[7]

As these experiences demonstrate, the consequences of climate change already present a significant physical risk to electricity infrastructure, with that risk expected to increase in coming years as climate change worsens.[8] The Chief Executive Officer of investment giant BlackRock, Larry Fink, recently observed that climate risk is "driving a profound reassessment of risk and asset values."[9] The U.S. Commodity Futures Trading Commission's report, Managing Climate Risk in the U.S. Financial System, similarly found that "awareness is growing across infrastructure sectors, including energy . . . that physi-

1 *See generally* Craig Zamuda et al., *Energy Supply, Delivery, and Demand*, in IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES: FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME II 174, 193 (D.R. Reidmiller et al. eds., 2018), https://perma.cc/P9QM-YJHF.

2 *Id.*; *see also* Michelle T. H. van Vliet et al., *Vulnerability of US and European Electricity Supply to Climate Change*, 2 NATURE CLIMATE CHANGE 676 (2012), https://perma.cc/K2VZ-DJDJ (finding that, due to climate change-induced drought and heat, the capacity of fossil fuel and nuclear power plants in the U.S. will decline by 4.4 to 15 percent between 2031 and 2060).

3 Katherine Hayhoe et al., *Our Changing Climate*, in IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES: FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME II 72, 74 (D.R. Reidmiller et al., eds., 2018), https://perma.cc/R8PT-9YB2 https://perma.cc/HB9P-F8EL.

4 ALYSON KENWARD & UROOJ RAJA, BLACKOUT: EXTREME WEATHER, CLIMATE CHANGE AND POWER OUTAGES 10-11 (2014), https://perma.cc/FPF2-55AK; Alex Gilbert & Morgan Bazilian, *California Power Outages Underscore Challenge of Maintaining Reliability During Climate Change, the Energy Transition*, UTIL. DIVE (Aug. 19, 2020), https://perma.cc/J7LB-8H2W.

5 CRYSTAL RAYMOND, SEATTLE CITY LIGHT CLIMATE CHANGE VULNERABILITY ASSESSMENT AND ADAPTATION PLAN 17 (2015), https://perma.cc/LYQ6-ZT3L [hereinafter SCL CLIMATE VULNERABILITY ASSESSMENT].

6 Written Testimony of Dr. Lynn Best, Chief Environmental Officer, Seattle City Light, to Field Hearing of the Senate Committee on Energy and Natural Resources Subcommittee on Energy on the Department of Energy's Functions and Capabilities to Respond to Emergencies (Aug. 15, 2016), https://perma.cc/6X57-7R9U.

7 Kavya Balaraman, *California Regulators Plan Post-Mortem to Examine Cause of Rolling Blackouts*, UTIL. DIVE (Aug. 21, 2020), https://perma.cc/L5RU-7FJP.

8 Zamuda et al., *supra* note 1, at 193; *see also* U.S. DEP'T OF ENERGY, CLIMATE CHANGE AND THE U.S. ENERGY SECTOR: REGIONAL VULNERABILITIES AND RESILIENCE SOLUTIONS 189 (2015), https://perma.cc/K9FZ-V7J5.

9 Larry Fink, *A Fundamental Reshaping of Finance*, BLACKROCK (Jan. 14, 2020), https://perma.cc/RCG7-EC73.

cal risks do not just impact particular sites and locations, but also shorten the lifecycle of infrastructure and degrade its operational reliability."[10]

A number of electric utilities have acknowledged climate risk in general terms in their corporate filings with the U.S. Securities and Exchange Commission and other documents.[11] Most electric utilities are, however, yet to integrate climate considerations into system planning, design, operation, and other decisions.[12] Indeed, only a handful of electric utilities have conducted a comprehensive assessment of where and under what conditions their systems are vulnerable to the impacts of climate change, and fewer still have identified and implemented measures to reduce those vulnerabilities. (Consistent with industry parlance, in this paper, we refer to the process of assessing vulnerabilities and developing remedial measures as "climate resilience planning").

This paper argues that electric utilities are legally obligated to plan for climate risks to protect already made investments and proactively improve future investment decisions. We identify two separate legal bases for such an obligation, though others almost certainly exist. The first is found in state public utility law, which requires electric utilities to provide customers with continuous, reliable service at just and reasonable rates—something that will not be possible unless electric utilities plan for future climate impacts. The second arises from tort law principles, under which electric utilities may be held liable for negligence if they breach an owed duty of care, which we argue here extends to failure to plan for reasonably foreseeable climate impacts.

This paper explores how public utility law and tort law can be used to drive climate resilience planning by electric utilities. We consider the feasibility of each approach and discuss relevant legal considerations, doctrines, and precedents. This paper should not be read, however, to endorse a particular litigation strategy or offer recommendations as to when, where, or how a particular approach should be pursued. The remainder of the paper is structured as follows: Part 2 defines climate resilience planning and details its use in the electric utility sector. Part 3 explores opportunities to advance climate resilience planning through state utility commission proceedings. It identifies key statutory and common law requirements imposed by public utility law that authorize, and in some cases even compel, state utility commissions to mandate climate resilience planning by electric utilities. Part 4 considers whether and when electric utilities that fail to engage in climate resilience planning can be held liable under tort law in state court. Part 5 considers the interplay between the two primary forums identified in Parts 3 and 4, analyzing legal considerations centered upon choice of forum, including doctrines of primary jurisdiction and exhaustion, and related evidentiary issues. Part 6 concludes.

10 U.S. COMMODITY FUTURES TRADING COMM'N CLIMATE-RELATED MARKET RISK SUBCOMM., MANAGING CLIMATE RISK IN THE U.S. FINANCIAL SYSTEM 14 (2020), https://perma.cc/UT9M-FG2Y [hereinafter CFTC REPORT].

11 *E.g.*, NextEra Energy, Inc. & Florida Power & Light Co., Annual Report (Form 10-K) 25 (Feb. 15, 2019) (indicating that "severe weather and natural disasters . . . can be disruptive and cause power outages and property damage . . . . [The company's] physical plants could be placed at greater risk of damage should changes in the global climate produce unusual variations in temperature and weather patterns, resulting in more intense, frequent and extreme weather events, abnormal levels of precipitation and . . . a change in sea level"); Consolidated Edison Company of New York, Inc., Annual Report (Form 10-K) 36 (Feb. 20, 2020) (noting that "[c]limate change could affect customer demand for the Companies' energy services. It might also cause physical damage to the Company's facilities and destruction of their operations due to more frequent and more extreme weather-related events").

12 *See infra* Part 2.3.

PART 2:

Climate Resilience Planning in the Electric Utility Sector

Electric utilities face differing climate risks, partly because of regional differences in the nature and extent of climate-induced weather and environmental changes, and also partly because of differences in electric utility systems and assets. All electric utilities will, however, be affected by climate change in some way.[13] Across all regions, electric utilities will be faced with higher average and extreme temperatures, changing precipitation patterns, and more intense storms that could force the curtailment or shutdown of generating facilities and lead to widespread transmission and distribution outages.[14]

The U.S. Department of Energy ("DOE") and various other government bodies and private-sector entities (e.g., Moody's) have recommended that electric utilities engage in climate resilience planning to identify vulnerabilities within their systems and develop management options.[15] This Part describes the basic steps involved in climate resilience planning and the data required. We also explain how climate resilience planning differs from traditional electric utility planning processes and the benefits it provides. Finally, we survey recent electric utility climate resilience planning efforts and assess their adequacy. Based on that analysis, we conclude that climate risks to electric utility infrastructure can be identified and incorporated into decision-making using well-established, proven planning processes. We observe instances where those processes have been effectively employed by electric utilities, but additionally find that the sector generally has often failed to engage in climate resilience planning despite its feasibility and usefulness. That failure has major implications for electric utility customers, who are more likely to experience climate-induced service disruptions due to the utility's failure to prepare and will ultimately bear the costs of recovery, which may be significantly higher than the costs of prevention.[16] Climate-induced electricity service disruptions can also have broader social consequences. For example, where electricity outages affect critical facilities, such as hospitals or water treatment plants, public health and safety may be threatened.[17] Similar threats may also arise due to environmental accidents or other problems triggered by outages. One example occurred during Hurricane Harvey in Texas in 2017, when an electricity outage at an industrial facility led to the release of toxic chemicals into the air.[18] More recently, the 2020 blackouts in California, triggered by extreme heat, caused pumps at a wastewater treatment plant to fail, resulting in raw sewage being discharged into nearby waters.[19]

13 Zamuda et al., *supra* note 1, at 178.

14 *Id.* at 179-83. Numerous other reports have explored how the impacts of climate change will affect different parts of the electric system in different areas. *See, e.g.*, JAYANT SATHAYE ET AL., ESTIMATING RISK TO CALIFORNIA ENERGY INFRASTRUCTURE FROM PROJECTED CLIMATE CHANGE 9-50 (2011), https://perma.cc/EX2M-8828; PETER CAMPBELL JOHNSTON ET AL., CLIMATE RISK AND ADAPTATION IN THE ELECTRIC POWER SECTOR (2012), https://perma.cc/XC2Q-YVHK; U.S. DEP'T OF ENERGY, *supra* note 8; Ariel Miara et al., *Climate and Water Resource Change Impacts and Adaptation Potential for US Power Supply*, 7 NATURE CLIMATE CHANGE 793 (2017), https://perma.cc/AA5T-TUEL; MOLLY HELLMUTH ET AL., ADDRESSING CLIMATE VULNERABILITY FOR POWER SYSTEM RESILIENCE AND ENERGY SECURITY: A FOCUS ON HYDROPOWER RESOURCES (2017), https://perma.cc/9AJU-VEDC; JUSTIN GUNDLACH & ROMANY WEBB, CLIMATE CHANGE IMPACTS ON THE BULK POWER SYSTEM: ASSESSING VULNERABILITIES AND PLANNING FOR RESILIENCE 4-13 (2018), https://perma.cc/353Y-RSGB; ANNA M. BROCKWAY & LAUREL N. DUNN, WEATHERING ADAPTATION: GRID INFRASTRUCTURE PLANNING IN A CHANGING CLIMATE 5-13 (2019), https://perma.cc/LH5J-DZME.

15 *See generally* U.S. DEP'T OF ENERGY, CLIMATE CHANGE AND THE ELECTRICITY SECTOR: GUIDE FOR CLIMATE CHANGE RESILIENCE PLANNING 1-2 (2016), https://perma.cc/6B6Q-EH7P [hereinafter 2016 DOE PLANNING GUIDE]; KRISTIN RALFF-DOUGLAS, CAL. PUB. UTILS. COMM'N, CLIMATE ADAPTATION IN THE ELECTRIC SECTOR: VULNERABILITY ASSESSMENTS & RESILIENCE PLANS 5 (2016), https://perma.cc/R6NW-F6GV [hereinafter 2016 CPUC REPORT]; McKinsey & Co., *Confronting Climate Risk*, MCKINSEY QUARTERLY (May 15, 2020), https://perma.cc/T5AR-M2AW; Research Announcement, Moody's Investors Service, Moody's U.S. Regulated Electric Utilities Face Varied Exposure to Climate Hazards (Jan. 16, 2020), https://www.moodys.com/research/Moodys-US-regulated-electric-utilities-face-varied-exposure-to-climate--PBC_1210434.

16 SCL CLIMATE VULNERABILITY ASSESSMENT, *supra* note 5, at 1 (noting that "[i]t will be easier and more cost-effective to consider the impacts of climate change in the planning and design of new infrastructure and power resources now than it will be to retrofit infrastructure or replace resources once the impacts of climate change intensity").

17 *See generally* Justin Gundlach, *Microgrids and Resilience to Climate-Driven Impacts on Public Health*, 18 HOUS. J. HEALTH L. & POL'Y 77 (2018), https://perma.cc/4DCT-4W3W.

18 Steven Mufson, *Harvey Causes Chemical Companies to Release 1 Million Pounds of Extra Air Pollutants*, THE TEXAS TRIBUNE (Sept. 4, 2017), https://perma.cc/MR7F-BBX4; Lisa Song et al., Independent Monitors Found Benzene Levels After Harvey Six Times Higher Than Guidelines, PROPUBLICA (Sept. 14, 2017), https://perma.cc/9YMF-2PVJ.

19 J.D. Morris, *50,000 Gallons of Sewage Spill into Oakland-Alameda Waters After Power Failure*, SAN FRANCISCO CHRON. (Aug. 16, 2020), https://perma.cc/SBE4-MK2C.

2.1 The Basics of Climate Resilience Planning

In the electric utility sector, climate resilience planning is generally conceived of as a two-stage process, involving the development of (1) climate vulnerability assessments and (2) climate resilience plans.[20] Broadly, climate vulnerability assessments identify where and under what conditions electric utility assets are at risk from the impacts of climate change, how those risks will manifest, and what the consequences will be for system operation.[21] Based on that information, electric utilities can then develop climate resilience plans, outlining measures to reduce the risk to vulnerable assets.[22] Such efforts can take a number of forms, but generally involve both measures to prevent or minimize damage to vulnerable assets (e.g., investments in asset hardening[23] or relocation) and to manage the consequences of such damage when it occurs (e.g., investments in system recoverability).[24] In developing climate resilience plans, electric utilities compare the costs and impacts of different measures and, based on that information and the risk profile of each asset, determine whether, when, and how to invest.[25]

Previous reports published by DOE and others have outlined recommended best practices for climate resilience planning in the electric utility sector.[26] Those reports generally recommend that electric utilities take a long-range, 50-plus year view and plan for the impacts of climate change over the anticipated useful life of existing assets and new assets under development.[27] Electric utilities should not necessarily limit

Box 1: Guarding Against Maladaptation in Resilience Planning

Maladaptive measures address the symptom of a particular risk while also exacerbating its underlying cause. As the World Bank has noted, in the climate context, maladaptation involves "actions . . . that (unintentionally) constrain the options or ability of other decision makers now or in the future to manage the impacts of climate change, thereby resulting in an increase in exposure and/or vulnerability to climate change."[28] Maladaptation also "describes the extent to which adaptation fails or has been conducted in an unsustainable manner."[29] Guarding against maladaptation requires climate resilience planning and investment processes to be designed in a manner that acknowledges the critical importance of reducing greenhouse gas emissions to reduce climate risk.[30]

In the context of electric utility climate resilience planning, measures to gird against coming climate consequences should be evaluated and implemented in a manner consistent with emission reduction strategies. Thus, for example, electric utilities should consider investments to support distributed renewable energy resource deployment instead of hardening fossil fuel infrastructure. While this paper focuses on the need to assess climate risk and implement climate resilience planning, electric utilities must also make the transition to clean energy a fundamental priority of their resilience efforts.

20 2016 DOE PLANNING GUIDE, *supra* note 15, at 1.

21 *Id.* at iii.

22 *Id.*

23 Hardening measures include adding barriers to protect equipment vulnerable to flooding, adding or improving cooling systems to protect equipment vulnerable to high heat, and reinforcing assets vulnerable to wind damage. *See generally* Zamuda et al., *supra* note 1, at 188-89.

24 While various steps can be taken to lessen the risks posed by climate change, it would be cost prohibitive, and is likely unnecessary to, design a system that is completely immune from climate impacts. *See* 2016 CPUC REPORT, *supra* note 15, at 22.

25 *See, e.g.*, 2016 DOE PLANNING GUIDE, *supra* note 15; U.S. DEP'T OF ENERGY, CLIMATE CHANGE AND THE ELECTRICITY SECTOR: GUIDE FOR ASSESSING VULNERABILITIES AND DEVELOPING RESILIENCE SOLUTIONS TO SEA LEVEL RISE (2016), https://perma.cc/AAA7-P448; ASIAN DEVELOPMENT BANK, GUIDELINES FOR CLIMATE PROOFING INVESTMENT IN THE ENERGY SECTOR (2013), https://perma.cc/ZRD2-M7EG; 2016 CPUC REPORT, *supra* note 15; MELISSA ALLEN ET AL., OAK RIDGE NAT'L LAB., ASSESSING THE COSTS AND BENEFITS OF RESILIENCE INVESTMENTS: TENNES*SEE* VALLEY AUTHORITY CASE STUDY (2017), https://perma.cc/N6S9-LGX7; GUNDLACH & WEBB, *supra* note 14.

26 2016 DOE PLANNING GUIDE, *supra* note 15, at 44, 80, 83.

27 *Id.* at 22-26.

28 JANE EBINGER & WALTER VERGARA, WORLD BANK, CLIMATE IMPACTS ON ENERGY SYSTEMS: KEY ISSUES FOR ENERGY SECTOR ADAPTATION 90 (2011), https://perma.cc/3WVZ-MPJC. Maladaptation could, for example, occur where electric utilities invest in elevating or hardening infrastructure against sea level rise in areas where "retreat" is more appropriate. *See generally* Beatriz Azevedo de Almeida & Ali Mostafavi, *Resilience of Infrastructure Systems to Sea-Level Rise in Coastal Areas: Impacts, Adaptation Measures, and Implementation Challenges*, 8 SUSTAINABILITY 1115 (2016), https://perma.cc/FNW3-7WBS (finding that "[e]levating vulnerable systems is the most effective adaptation measure to reduce the risk of failure of the electric system. Although being the most effective methods, elevation of energy equipment could not be the most cost-effective approach").

29 Orr Karassin, *Mind the Gap: Knowledge and Need in Regulating Adaptation to Climate Change*, 22 GEO. INT'L ENV'T L. REV. 383, 389 n.31 (2010).

30 EBINGER & VERGARA, *supra* note 26, at xxx. Notably reducing greenhouse gas emissions continues to be the best approach to preventing future damage. Alice Hill & Leonardo Martinez-Diaz, *Adapt or Perish: Preparing for the Inescapable Effects of Climate Change*, FOREIGN AFFS. (Jan./Feb. 2020), https://perma.cc/CG49-38DJ. For a discussion of how mitigation efforts should be informed by adaptation benefits, *see* Lesley K. McAllister, *Adaptive Mitigation in the Electric Power Sector*, 2011 B.Y.U. L. REV. 2115 (2011), https://perma.cc/Q6CZ-X6K6.

their review solely to assets they own or operate, particularly where their ability to deliver reliable electricity services depends on facilities owned or operated by third-parties. One critical groups of assets that may fall outside electric utilities' direct control but should nevertheless be considered is generation. In this regard, the California Public Utilities Commission ("CPUC") has noted that in states with deregulated electricity markets, "utilities no longer own all the generation assets and rely on independent power producers and merchant generators for a significant amount of power. These assets should be considered part of any evaluation of vulnerabilities in the same way the [utilities] assess their own assets."[31]

Electric utilities should consider the full range of climate impacts expected to occur within their respective service territories during the planning period. This necessarily requires the use of forward-looking projections because, in the age of climate change, historic data is no longer a good predictor of future conditions.[32] Since the impacts of climate change will vary regionally, electric utilities should use localized or downscaled projections, which reflect anticipated conditions in the planning area (see **Box 2**).[33] Based on those projections electric utilities can evaluate how different climate outcomes may affect their systems and identify key vulnerabilities that may need to be addressed.[34] Electric utilities will often benefit from engaging outside con-

Box 2: Projecting Climate Impacts

The extent of future climate change will depend largely on the amount of future greenhouse gas emissions.[35] Global climate models (GCMs), which mathematically simulate key aspects of the Earth's climate, are used to project likely outcomes based on different emissions scenarios.[36] While the spatial resolution of GCMs has increased over time, most still use grid cells that extend sixty miles or more on one side, resulting in coarse-resolution projections that are ill suited for use in climate resilience planning.[37] Downscaling techniques can, however, be used to process and refine GCM projections to estimate climate impacts at finer geographic scales that are more useful for climate resilience planning.[38]

The availability of downscaled data has increased significantly in recent years.[39] It can now be found in various publicly available tools and reports developed by government, academic, and other independent bodies.[40] One example is the web-based Cal-Adapt tool which was developed by researchers at the University of California, Berkeley with funding from the California Energy Commission and California Strategic Growth Council.[41] The tool includes projections for key climate variables, such as temperature and precipitation, at 3.5 square mile increments.[42] Other sources include even more granular data, with spatial scales below 2.5 miles, and even as fine as 0.6 miles.[43]

31 *Id.*

32 U.S. DEP'T OF ENERGY, A REVIEW OF CLIMATE CHANGE VULNERABILITY ASSESSMENTS: CURRENT PRACTICES AND LESSONS LEARNED FROM DOE'S PARTNERSHIP FOR ENERGY SECTOR CLIMATE RESILIENCE 12 (2016), https://perma.cc/5EKK-T9GA [hereinafter 2016 DOE PARTNERSHIP REPORT].

33 2016 DOE PLANNING GUIDE, *supra* note 15, at 17; 2016 CPUC REPORT, *supra* note 15, at 9.

34 The assessment of impacts builds on, but is distinct from, the assessment of future climate conditions. The latter focuses on how key climate variables (*e.g.*, temperature, precipitation, etc.) are likely to change in the future and the associated shifts in environmental conditions (*e.g.*, sea level rise). That involves a different analysis from the assessment of how future climate and environmental conditions will impact electric assets and systems.

35 Hayhoe et al., *Climate Models, Scenarios, and Projections*, in CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME I 133, 134 (D.J. Wuebbles et al., eds., 2017), https://perma.cc/HB9P-F8EL.

36 *Id.* at 141.

37 CONSOLIDATED EDISON, CLIMATE CHANGE VULNERABILITY STUDY (2019), https://perma.cc/GR37-6UJT. The spatial resolution of GCMs is improving. The latest, experimental models can project key climate parameters (*e.g.*, temperature and precipitation) in 15 to 30 mile increments. Even this may, however, be too coarse for use in climate resilience planning. *See* Hayhoe et al., *supra* note 35, at 141.

38 Hayhoe et al., *supra* note 35, at 141. For a discussion of downscaling techniques, *see id.* 144-46; SYLWIA TRZASKA & EMILIE SCHNARR, CENTER FOR INTERNATIONAL EARTH SCIENCE INFORMATION NETWORK, A REVIEW OF DOWNSCALING METHODS FOR CLIMATE CHANGE PROJECTIONS (2014), https://perma.cc/YC8V-46B2.

39 Joseph J. Barsugli et al., *The Practitioners Dilemma: How to Assess the Credibility of Downscaled Climate Projections*, 94 EOS 424, 424 (2013), https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1002/2013EO460005.

40 *See, e.g.*, U.S. Climate Resilience Toolkit, *Energy Data Gallery*, https://toolkit.climate.gov/topics/energy/energy-data-gallery (last updated Sept. 24, 2019); Nat'l Aeronautics & Space Admin., *NASA Earth Exchange (NEX) Downscaled Climate Projections (NEX-DCP30)*, https://www.nccs.nasa.gov/services/data-collections/land-based-products/nex-dcp30 (last visited July 10, 2020); U.S. Geological Survey, *Regional Climate Change Viewer*, http://regclim.coas.oregonstate.edu/visualization/rccv/index.html (last visited July 10, 2020); Bureau of Reclamation et al., *Downscaled CMIP3 and CMIP5 Climate and Hydrology Projections*, https://gdo-dcp.ucllnl.org/downscaled_cmip_projections/#Welcome (last visited July 10, 2020); Conservation Biology Inst., *Adapt West–A Climate Adaptation Conservation Planning Database for North America*, https://adaptwest.databasin.org/ (last visited July 10, 2020).

41 Cal-Adapt, https://cal-adapt.org/ (last visited July 10, 2020). For more information about Cal-Adapt, *see* Susan Wilhelm, Cal. Energy Comm'n, Presentation at IEPR Workshop on Adaptation and Resilience for the Energy System: Unveiling Cal-Adapt 2.0: Facilitating Energy Sector Resilience and Providing Foundational Scenarios for California's Fourth Climate Change Assessment (Aug. 29, 2017), https://perma.cc/27TJ-H2J7.

42 Cal-Adapt, *Climate Tools*, https://cal-adapt.org/tools/ (last visited July 10, 2020).

43 Hayhoe et al., *supra* note 35, at 144.

sultants or partnering with academic researchers who can assist in developing and/or interpreting downscaled climate projections and work with the utility's in-house engineering team to evaluate system impacts.

Given the uncertainty regarding future emission levels and associated climate impacts, it is often recommended that electric utilities adopt a "bounded parameters" approach, comparing asset vulnerabilities and resilience solutions under best- and worst-case scenarios.[44] That approach can, however, be difficult to implement because projected outcomes often differ widely between scenarios.[45] For example, a 2014 DOE study of climate risks to energy infrastructure found that, by the 2070s (i.e., within the useful life of some assets deployed this decade),[46] New York City could experience anywhere from one to four feet of sea level rise.[47] Planning for such a wide range of possible outcomes presents significant challenges for electric utilities, including because relatively low probability outcomes could have catastrophic impacts. Consider, for instance, how existing assets would be affected under the different sea level rise scenarios in the DOE study. With one foot of sea level rise, only one large existing electric system asset[48] would be inundated, whereas nine would be inundated at the high end.[49] Should electric utilities invest in measures to protect all nine potentially affected assets or only a subset? Should electric utilities design new assets to withstand a full four feet of sea level rise or only a smaller amount? Should electric utilities delay making these decisions until greater certainty exists?

Electric utilities' answers to these and similar questions will necessarily depend on their own risk tolerances—i.e., the level of risk they are willing to accept—and those of their customers, regulators, and other stakeholders. Where risk tolerances differ, conflicts could arise. It is important to recognize that, while the appropriate risk tolerance may be debated, all electric systems present some risk as service disruptions and outages can never be completely eliminated.[50]

One tool that may aid electric utilities and other stakeholders in evaluating risk is probabilistic modeling. Broadly, probabilistic climate projections incorporate probability distributions for each climate parameter, and thus provide an indication of the likelihood of different climate outcomes.[51] As such, probabilistic projections enable electric utilities to make a more informed assessment of where and how individual assets will be impacted, and the most appropriate resilience investments.[52] Recognizing these benefits, DOE has supported research to develop downscaled, probabilistic climate projections.[53] Such projections are now publicly available for key climate parameters (e.g., temperature and precipitation) in many areas,[54] but custom modeling may be required in some cases.[55] Recent advances in modeling techniques have made it easier for electric utilities and others to obtain customized projections, incorporating detail at spatial and temporal scales that align with those used in the planning process.

After securing the necessary data, electric utilities can evaluate the risk to their assets by comparing anticipated future climate and environmental conditions to existing asset characteristics (e.g., location) and design and operating parameters.[56] Electric utilities should assign a risk profile to each asset, based on the likelihood and consequences of it being impacted, and use that to prioritize vulnerabilities and resilience measures.[57]

44 *See, e.g.*, 2016 DOE PLANNING GUIDE, *supra* note 15, at 19.

45 2016 CPUC REPORT, *supra* note 15, at 8-9.

46 Many electric system assets have useful lives of 50 years or more. *See* Zamuda et al., *supra* note 1, at 192.

47 U.S. DEP'T OF ENERGY, EFFECT OF SEA LEVEL RISE ON ENERGY INFRASTRUCTURE IN FOUR MAJOR METROPOLITAN AREAS 15 (2014), https://perma.cc/D66N-633K.

48 The DOE study defined large assets to mean power plants of 100 megawatt capacity or greater and substations of 230 kilovolts or greater. *See id.* at 16.

49 *Id.* at 17-18.

50 *See generally* Romany Webb, *Ensuring Electricity System Resilience in the Face of Climate Change: Report of a Workshop Co-Hosted by the Sabin Center for Climate Change Law*, CLIMATE L. BLOG (Apr. 17, 2019), https://perma.cc/J7HF-9FCU.

51 2016 DOE PLANNING GUIDE, *supra* note 15, at 19; *see also* A. Barrie Pittock et al., *Probabilities Will Help Us Plan for Climate Change*, 413 NATURE 249 (2001), https://perma.cc/8TBG-PCQ7 (arguing that "probability estimates are needed" for effective planning and that, without them, "planners will be left needing to . . . hedge their bets, delay their decisions, or else gamble on whether humanity will go down high or low emissions development pathways as they adapt design standards and zoning to climate change").

52 2016 DOE PLANNING GUIDE, *supra* note 15, at 19.

53 *Id.* DOE has partnered with the National Aeronautics and Space Administration and the National Oceanic and Atmospheric Administration to make available climate data specifically tailored for use in electric resilience planning. *See generally* U.S. Climate Resilience Toolkit, *Energy Data Gallery*, https://toolkit.climate.gov/topics/energy/energy-data-gallery (last updated Sept. 24, 2019).

54 *See, e.g.*, Liang Ning et al., *Probabilistic Projections of Climate Change for the Mid-Atlantic Region of the United States: Validation of Precipitation Downscaling during the Historical Era*, 25 J. CLIMATE 509 (2012), https://perma.cc/SGL8-9L9B; David W. Pierce et al., *Probabilistic Estimates of Future Changes in California Temperature and Precipitation Using Statistical and Dynamical Downscaling*, 40 CLIMATE DYNAMICS 839 (2013), https://link.springer.com/content/pdf/10.1007/s00382-012-1337-9.pdf.

55 2016 DOE PLANNING GUIDE, *supra* note 15, at 19.

56 *See id.* at 31-35.

57 *Id.* at 54-59.

A range of measures, with varying risk mitigation potential, may be available for each vulnerability.[58] In developing their resilience plans, electric utilities must compare the available measures to determine whether and when to invest.[59] In other contexts, electric utilities typically base their investment decisions on cost-benefit analysis ("CBA"), but this can be difficult to apply to resilience projects, including because key benefits are unknown or difficult to quantify.[60] Additional evaluation tools may, therefore, be needed (see **Box 3**).

It is often recommended that, after evaluating possible resilience measures, electric utilities develop "flexible resilience pathways" to guide their implementation. The flexible pathways approach is intended to assist electric utilities to manage the uncertainties inherent in climate change.[61] Under this approach, electric utilities are encouraged to implement no- and low-regrets resilience measures immediately, and establish thresholds or "trigger points" for the taking of other actions.[62] The thresholds are based on pre-determined risk levels that, if left

Box 3: Tools for Evaluating Resilience Measures

CBA is widely used, both within and outside the electric utility sector, to assess the financial viability of projects that have large upfront costs but deliver benefits over many years. The process is conceptually simple—a project's benefits and costs are expressed in monetary terms, discounted to present value, and then compared. Few issues arise when costs and benefits are known and easily quantifiable. However, that is often not the case for climate resilience measures, the benefits of which will depend (at least in part) on future climate outcomes, which are uncertain. Any assumptions made will invariably affect the results of the CBA. Thus, when using CBA, electric utilities should conduct sensitivity analysis to assess how changing the assumptions would affect the results.[63]

CBA also inevitably involves difficult decisions about which costs and benefits should be counted.[64] In the electric utility sector, the primary focus is typically on costs and benefits that accrue to the electric utility company and its customers, with little or no attention paid to broader societal impacts.[65] This can create difficulties when applying CBA to investments in climate resilience because, while the costs of such measures are imposed on electric utility companies and their customers today, the benefits are often more widely dispersed (both geographically and temporally).[66]

Given the above, electric utilities and the state utility commissions that regulate them should look at using other tools to evaluate resilience measures. One option is breakeven analysis, which begins by estimating the value to customers of avoiding electricity outages,[67] and then calculates how many outages would need to be mitigated by a resilience measure in order for customers to realize sufficient value to justify investing in that measure.[68] This can then be compared to the probability of future climate-related outages to assess the expected benefits of investment.

Resilience measures can also be evaluated under the so-called "robust decision making" or "RDM" framework. Under this approach, measures are assessed under a wide range of possible, future outcomes to determine which will perform best in a range of circumstances.[69]

58 For a discussion of potential resilience measures, *see id.* at 61-64.

59 *Id.* at 77.

60 *Id.* at 77-80; *see also* Craig Zamuda et al., *Monetization Methods for Evaluating Investments in Electricity System Resilience to Extreme Weather and Climate Change*, 32 ELEC. J. 106641 (2019), https://perma.cc/V2QR-YUJ7.

61 *See* JUDSEN BRUZGUL ET AL., RISING SEAS AND ELECTRICITY INFRASTRUCTURE: POTENTIAL IMPACTS AND ADAPTATION OPTIONS FOR SAN DIEGO GAS AND ELECTRIC (SDG&E) 18 (2018), https://perma.cc/C5BV-P2ZB.

62 *Id.* No regrets measures are ones that can be taken now, despite uncertainty about future climate change, and will deliver benefits regardless of future conditions.

63 Sensitive analysis shows the relative importance of different inputs into the CBA and thus can be used to determine how varying each input would alter the result. *See* 2016 DOE PLANNING GUIDE, *supra* note 15, at 80.

64 *See* Zamuda et al., *supra* note 60, at 106641.

65 *Id.* at 106641, 106645.

66 *Id.* at 106642-44.

67 This is often referred to as the value of lost load ("VOLL"). Previous studies have estimated the VOLL for different classes of electric utility customers. *See, e.g.*, MICHAEL J. SULLIVAN, ESTIMATED VALUE OF SERVICE RELIABILITY FOR ELECTRIC UTILITY CUSTOMERS IN THE UNITED STATES (2009), https://perma.cc/9HWV-JVV4; MICHAEL J. SULLIVAN, UPDATED VALUE OF SERVICE RELIABILITY ESTIMATES FOR ELECTRIC UTILITY CUSTOMERS IN THE UNITED STATES (2015), https://perma.cc/7TMD-CS6S.

68 *See generally* William P. Zarakas et al., Utility Investments in Resiliency: Balancing Benefits with Costs in an Uncertain Environment, ELEC. J., June 2014, at 31, https://perma.cc/3HGJ-6ARJ.

69 *See generally* Robert J. Lempert, Embedding (Some) Benefit-Cost Concepts into Decision Support Processes with Deep Uncertainty, 5 J. BENEFIT-COST ANALYSIS 487 (2014).

unaddressed, would result in severe impacts and potentially irreversible consequences.[70] In assessing risk, electric utilities should consider not only the vulnerability of individual assets to climate impacts, but also the asset's importance to system operation and reliability. Electric utilities may be justified in incurring larger costs to enhance the resilience of critical assets, the loss of which could result in widespread or prolonged outages, or pose serious risks to public health or the environment.

2.2 The Importance of Climate Resilience Planning

Climate resilience planning differs from, but complements, other planning processes commonly employed by electric utilities. Consider, for example, the integrated resource plans ("IRPs") that many utilities develop to evaluate supply- and demand-side options for meeting future electricity needs.[71] While IRPs vary, most employ a twenty-year planning horizon,[72] which is shorter than that recommended for climate resilience planning.[73] Moreover, whereas climate resilience planning relies on forward-looking projections,[74] IRPs are frequently based on historic data.[75] The load forecasts used in IRPs typically assume a continuation of historic weather patterns and thus do not accurately account for anticipated future temperature increases and other climate impacts that could affect electricity demand.[76] In evaluating options to meet demand, electric utilities generally do not consider their relative vulnerability to climate impacts, or possible resilience enhancements.[77] Climate resilience planning addresses these vulnerabilities, providing additional information that can be used to update load forecasts and compare resource options, thus enabling electric utilities to make more informed investment decisions.

Climate resilience planning is also important to supplement the disaster or emergency response planning currently undertaken by electric utilities. Broadly, disaster or emergency response planning focuses on electric utilities' preparedness for one-off weather-related or other events (e.g., cyber-attacks), which could lead to service interruptions or safety issues.[78] Such planning is typically based on historic data, reflecting the incidence and severity of past events, and focuses on short-term measures to prepare and respond.[79] While that is certainly important, it is not sufficient to address the risks posed by climate change, which requires a broader future-focused approach.[80]

Integrating climate considerations into current planning and investment decisions should benefit both electric utilities and their customers. Identifying and reducing climate-related threats to existing assets may require material investments in hardening and relocation—projects that typically have long-lead times and must therefore be planned now to avoid future reliability issues.[81] Advance planning can also improve investment decision-making, ensuring that electric utilities act prudently and that their capital expenditures benefit ratepayers. Electric utilities must also plan for the impacts of climate change on new assets, many of which will remain in operation for several decades, during which time climate impacts will become increasingly severe.[82] Considering those impacts now enables electric utilities to build-in resilience, thereby lessening the need for costly retrofits in the future, as well as the potential for future outages.[83] Thus, while climate resilience planning may require up-front investments, it should result in lifetime savings for electric utilities and their customers, including in the form of avoided storm damage and recovery costs.

70 *Id.*

71 As of May 2020, 36 states required electric utilities to file IRPs, or equivalent documents. *See* Coley Girouard, Understanding IRPs: How Utilities Plan for the Future, ADVANCED ENERGY PERSPECTIVES (Aug. 11, 2015), https://perma.cc/V6DQ-MPG7.

72 *Id.*

73 As discussed in Part 2.1, *supra*, it is recommended that climate resilience planning take a longer-term view, and consider climate impacts over the expected useful life of electric system assets, which can be fifty years or more.

74 *See* Part 2.1, *supra*.

75 *See* BROCKWAY & DUNN, *supra* note 14, at 21.

76 There are some exceptions. For example, the California Energy Commission publishes load forecasts which are developed based on historic weather data, but then adjusted to account for anticipated future temperature increases. Other climate impacts are not, however, accounted for. *See id.*

77 Again, there are some exceptions. For example, Tennessee Valley Authority has previously considered resilience measures in its IRPs. *See* ALLEN ET AL., *supra* note 29, at ix.

78 *See generally* AM. PUB. POWER ASS'N, ALL-HAZARDS GUIDEBOOK (2018), https://perma.cc/5RMX-ZTGZ.

79 *Id.* at 15-17.

80 The same is also likely true of cyber-attacks. Technological and other advances mean that past experience with cyber-attacks may not be a good predictor of future events.

81 Webb, *supra* note 50.

82 SCL CLIMATE VULNERABILITY ASSESSMENT, *supra* note 5, at 1 (recognizing that "[d]ecisions are being made today that will shape the resources and infrastructure of the utility for decades into the future when the impacts of climate change will intensify").

83 *Id.* (concluding that "[i]t will be easier and more cost-effective to consider the impacts of climate change in the planning and design of new infrastructure and power resources now than it will be to retrofit infrastructure or replace resources once the impacts of climate change intensify").

Box 4: The Consequences of Failing to Plan for Climate Impacts

Recent electricity outages in California provide a preview of what might become the "new normal" if climate considerations are not integrated into electric system planning. On August 14 and 15, 2020, the California Independent System Operator ("CAISO")—the entity that manages much of California's electric grid—ordered electric utilities in the state to initiate temporary rolling service cuts, due to a shortage of electricity supplies.[84] As a result, over 800,000 customers lost electricity, some for up to two hours.[85]

A preliminary analysis of the incident, conducted by the CAISO, the CPUC, and the California Energy Commission, concluded that a "[c]limate change-induced extreme heat storm across the western United States resulted in demand for electricity exceeding the existing electricity resource planning targets."[86] The analysis further found that existing resource planning processes do not adequately account for extreme heat and other climate-induced changes.[87] For example, the electricity demand forecasts used to develop resource adequacy requirements are based on average historic peak demand, reflecting one-in-two-year conditions.[88] A fifteen percent "planning resource margin" is added to that amount to, among other things, account for demand spikes.[89] However, even that was not sufficient to account for the impact of the August 2020 heatwaves, which reflected what was considered to be a one-in-thirty-five-year event. As climate change accelerates, such events will occur more frequently, and thus must be factored into planning processes so as to minimize the risk of supply shortages and associated outages.

Failing to plan for the impacts of climate change could also increase electric utilities' costs in other ways. For example, electric utilities that fail to design new infrastructure with climate impacts in mind may face higher borrowing and insurance costs as concern grows within the financial community about the impacts of climate change on electric utility infrastructure and business models.[90]

2.3 Extent of Climate Resilience Planning in the Electric Utility Sector

Despite the benefits of climate resilience planning, relatively few electric utilities have engaged in the process, with many citing the uncertainties inherent in climate change and the challenges associated with studying it as reasons not to act (see **Box 5**). Where climate resilience planning has occurred, electric utilities have often been forced into action by particularly severe extreme weather events, which have highlighted vulnerabilities within their systems. For example, after Hurricanes Katrina and Rita caused widespread damage to its transmission and distribution systems in 2005, Entergy Corporation instituted a program to study climate risks and develop resilience measures.[91] Consolidated Edison Company of New York, Inc. ("Con Ed") did the same following Superstorm Sandy in 2013. As discussed further below, Con Ed's "Climate Change Vulnerability Study" ("Con Ed Climate Study") was particularly comprehensive, using custom downscaled projections to analyze five climate variables over seven time periods from 2020 through 2080.[92] In accordance with recommended best practice, Con Ed took a probabilistic approach, under which it analyzed the likelihood and consequences of a range of plausible climate outcomes.[93] This enabled Con Ed to identify key vulnerabilities within its system and design flexible resilience pathways to manage those vulnerabilities.[94]

84 CAL. INDEP. SYS. OPERATOR, CAL. PUB. UTILS. COMM'N & CAL. ENERGY COMM'N, PRELIMINARY ROOT CAUSE ANALYSIS: MID-AUGUST 2020 HEAT STORM 2-3 (2020), https://perma.cc/2KV2-K76D.

85 *Id.* at 42.

86 *Id.* at 43.

87 *Id.* at 43-44.

88 *Id.* at 18.

89 *Id.*

90 *See generally* Juhyun Jong et al., CARBON RISK, CARBON RISK AWARENESS, AND THE COST OF DEBT FINANCING, 150 J. BUS. ETHICS 1151 (2018) (finding an "economic[ally] meaningful" "positive association between cost of debt and carbon risk"). As discussed further below, electric utilities that fail to plan for climate impacts also risk being denied cost recovery for their capital investments under the prudence standard. *See infra* Part 3.1.1.

91 Gloria Gonzalez, *Entergy Seeks to Lead on Climate Risk Mitigation*, GREENBIZ (Aug. 14, 2013), https://perma.cc/9E9N-RP4D. Entergy Corporation documented the findings of its study in a series of reports. *See* ENTERGY CORPORATION ET AL., EFFECTIVELY ADDRESSING CLIMATE RISK THROUGH ADAPTATION FOR THE ENERGY GULF COAST (2010), https://perma.cc/QS6S-WC9W; ENTERGY CORPORATION ET AL., BUILDING A RESILIENT ENERGY GULF COAST: EXECUTIVE REPORT (Undated), https://perma.cc/9J47-FVFG.

92 *See* CONSOLIDATED EDISON, *supra* note 37.

93 *Id.* at 12-15.

94 *Id.* at 32-49, 57-61.

Box 5: Why Have So Few Electric Utilities Engaged in Climate Resilience Planning?

Various explanations have been offered for electric utilities' reluctance to engage in climate resilience planning. The Fourth National Climate Assessment identified "[t]he inability to predict future climate parameters with complete accuracy" as a key factor discouraging climate resilience planning.[95] While electric utilities regularly deal with uncertainty in other contexts (e.g., when planning for projected changes in electricity load), climate change is often perceived as involving greater unknowns. Many electric utilities appear to view climate resilience planning as akin to an exercise in conjecture. For example, in May 2016, NextEra Energy—the parent company of Florida Power and Light—opposed a shareholder proposal to require the electric utility to report annually on its vulnerability to sea level rise by saying: "a proposal that asks the company to speculate on a single aspect of global climate change nearly a century into the future would be a waste of time and money."[96]

Other electric utilities have cited limited data availability as a hindrance to climate resilience planning. For example, some utilities participating in DOE's Resilience Partnership complained of a "disconnect between the granularity of the outputs of climate modeling and the types of temperature [and other] projections utility planners need."[97] Recent improvements in climate modeling and downscaling techniques have helped to mitigate this problem (see Box 2). Still, however, electric utilities often have to engage consultants or other researchers to develop localized climate data that meets their needs which can be costly.[98] Even larger costs are associated with measures to harden or otherwise enhance the resilience of electric utility assets.

This raises another set of questions for electric utilities considering engaging in climate resilience planning—will they be permitted to recover the potentially significant costs incurred in the planning process? And, even more important, will they be permitted to recover the much larger costs associated with implementing resilience measures that planning demonstrates are advisable? Due to electric utilities' status as monopoly service providers, and the essential nature of the service they provide, their rates are strictly regulated by state utility commissions.[99] While regulation varies between states, the basic goal of all commissions is to ensure "just and reasonable" rates, which enable electric utilities to recover no more than their prudently incurred costs, plus a reasonable return on prudent investments.[100] Many state utility commissions are yet to rule on whether, and if so when, electric utilities will be permitted to recover the costs associated with climate resilience planning and investment. The resulting uncertainty may have discouraged some electric utilities from engaging in the planning process.[101] Seemingly confirming this, the Con Ed Climate Study was delayed for several years, in part due to uncertainty regarding whether the New York Public Service Commission ("NYPSC") would allow Con Ed to recover the associated costs. This may be even more of a concern for electric utilities operating in states where the utility commission has not historically acted on climate-related issues or there is political resistance to addressing or even discussing the issue.

The Con Ed Climate Study is widely regarded as the gold standard for climate resilience planning in the electric utility sector.[102] The studies conducted by other electric utilities have generally been more limited: often focusing solely or primarily on event-based climate impacts (e.g., storms or wildfires) and ignoring more gradual changes (e.g., temperature and sea level rise); considering climate impacts on only a subset of their

95 Zamuda et al., *supra* note 1, at 192.

96 Mary Ellen Klas, *Shareholders of FPL's Parent Company Reject Climate Change Report*, MIAMI HERALD (May 19, 2016), https://www.miamiherald.com/news/business/ceo-compensation/article78721212.html.

97 2016 DOE PARTNERSHIP REPORT, *supra* note 32, at 2; *see also id.* at 27 (noting that utilities participating in the Resilience Partnership "identified multiple data that are necessary for effective resilience planning but currently unavailable," such as "downscaled climate model data for projected changed in future climate," and that "[i]n general, Partners found the spatial and temporal resolution of current climate models lacking"); *see generally* CRAIG ZAMUDA ET AL., ELECTRIC SECTOR RESILIENCE STRATEGIES: CURRENT PRACTICES AND LESSONS LEARNED FOR EXTREME WEATHER 6, 24 (2019) (on file with authors).

98 *Id.* at 25.

99 *See generally* REGUL. ASSISTANCE PROJECT, ELECTRICITY REGULATION IN THE US: A GUIDE 3 (2011), https://perma.cc/V82A-7S2F.

100 *Id.* at 38.

101 *See generally* Heather N. Jarvis, *Keeping the Lights on at All Costs? Imploring Consistent Prudence Review and a Prudence Standard that Includes Demand Response and Responsible Portfolio Management*, 29 VT. L. REV. 1037, 1040-41 (2005), https://perma.cc/U6MU-UFJF (concluding that electric utilities are often reluctant to "take risks for fear of not being able to recapture expenditures" and citing, as an example, utilities' avoiding investment in new generation assets because of "regulatory uncertainty" arising from a "perceived . . . breakdown in the regulatory compact under which utilities had come to believe they were entitled to recover full all of their utility investments" (internal citations omitted)).

102 Direct Testimony of James Van Nostrand and Tyler Fitch on Behalf of Vote Solar, In the Matter of Application of Duke Energy Carolinas, LLC for Adjustment of Rates and Charges Applicable to Electric Service in North Carolina, N.C.U.C. Docket No. E-7, Sub 1214, at 54-55 (Feb. 18, 2020), https://perma.cc/RLM6-Z4DA [hereinafter Vote Solar DEC Testimony].

assets, rather than the system as a whole; or assessing asset vulnerabilities based only on historic weather data or very limited climate projections (e.g., a single "worst case" outcome).

These and other flaws were identified in several of the climate vulnerability assessments prepared by electric utilities as part of DOE's Partnership for Energy Sector Climate Resilience ("Resilience Partnership"). Established in April 2015 in response to industry requests for additional guidance on climate resilience planning, the Resilience Partnership was intended to provide a forum for electric utilities to exchange information and compare best practices.[103] As part of the Resilience Partnership, seventeen electric utilities, serving approximately twenty-five percent of electricity customers in the U.S., conducted climate vulnerability assessments.[104] Most also developed resilience plans.[105]

DOE provided participating electric utilities with general guidance on planning, but "encouraged each [utility] to determine the approach, level of detail, and specificity that was appropriate for their organization."[106] As a result, the quality of electric utilities' planning processes varied considerably, with some having major shortcomings.[107] For example:

- Three of the participating electric utilities based their climate vulnerability assessments solely on historic weather data and did not use forward-looking climate projections.[108] As DOE recognized, "relying solely on historical data puts a utility at risk of underestimating its vulnerability to future climate change impacts."[109]

- Rather than consider the full range of climate impacts expected to occur within their respective service territories, most participating electric utilities focused on one or a subset of impacts.[110] Notably, nine utilities did not consider changes in average and/or extreme temperatures that are projected to occur in all regions, and at least four coastal utilities did not consider sea level rise.[111] Some vulnerabilities were, therefore, almost certainly overlooked in the utilities' assessments.

- Less than half of participating electric utilities assessed climate vulnerabilities across all of their "assets and operations."[112] Several utilities considered only a sub-set of assets, with many focusing on a single asset type (e.g., substations).[113] Again, this likely resulted in the utilities overlooking some vulnerabilities.

- While some participating electric utilities conducted quantitative exposure assessments to identify specific assets at risk from the studied climate impact(s), several undertook only a qualitative assessment, looking generally at possible risks to the types of assets they own, but not conducting an asset-by-asset review.[114] This qualitative approach is unlikely to provide sufficient detail to enable the development of resilience plans.[115]

A small number of state utility commissions have recently taken steps to promote more robust climate resilience planning by electric utilities. Examples are provided below.[116]

103 U.S. Dep't of Energy, *Partnership Description*, OFFICE OF POLICY, https://perma.cc/7Z57-RLHH (last visited July 17, 2020).

104 The participating companies were: (1) Con Ed, (2) Dominion Virginia Power, (3) Entergy Corporation, (4) Exelon Corporation, (5) Great River Energy, (6) Hoosier Energy, (7) Iberdola USA, (8) National Grid, (9) New York Power Authority, (10) Pacific Gas and Electric Company, (11) Public Service Enterprise Group, (12) Sacramento Municipal Utility District, (13) San Diego Gas and Electric Company, (14) Seattle City Light, (15) Southern California Edison, (16) Tennes*see* Valley Authority, and (17) Xcel Energy, Inc. 2016 DOE PARTNERSHIP REPORT, *supra* note 32, at 5-7.

105 At least fifteen companies developed resilience plans. *See generally* ZAMUDA ET AL., *supra* note 97, at 6.

106 2016 DOE PARTNERSHIP REPORT, *supra* note 32, at 4.

107 *See generally id.* (discussing the adequacy of electric utilities' climate vulnerability assessments); ZAMUDA ET AL., *supra* note 97 (discussing the adequacy of electric utilities' resilience plans). The shortcomings in some electric utilities' past climate vulnerability assessments and resilience plans highlight the need for careful scrutiny thereof by state utility commissions.

108 2016 DOE PARTNERSHIP REPORT, *supra* note 32, at 12.

109 *Id.*

110 Three companies considered only one type of climate impact (i.e., either "flooding & precipitation changes" or "winter storms"), while two others considered three or less. *See id.* at 5-7.

111 *See id.* at 5-7, 20.

112 Eight companies considered "all assets and operations," four considered "assets" only, and five considered a "subset of assets." *Id.* at 5-7.

113 *Id.* at 8.

114 *Id.* at 15.

115 Qualitative assessments do not, for example, enable utilities to determine the precise number of at-risk assets. *See id.*

116 Like the state utility commissions in California and New York, the Massachusetts Department of Public Utilities has also taken some steps to support climate resilience planning, but its efforts to date have been more limited. *See* Mass. Dep't of Pub. Utils., Order Establishing Eversource's Revenue Requirement, Docket No. D.P.U. 17-05, at 411 (Nov. 30, 2017), https://perma.cc/3THR-ZKU7.

2.3.1 California

In April 2015, then California Governor Jerry Brown signed an executive order requiring, among other things, an assessment of climate change vulnerabilities by economic sector.[117] In response, in July 2015, the CPUC and California Energy Commission established a working group to assist electric utilities to conduct climate vulnerability assessments and develop resilience plans.[118] While California's three largest electric utilities—Pacific Gas and Electric Company ("PG&E"), San Diego Gas and Electric Company ("SDG&E"), and Southern California Edison ("SCE")—had already committed to doing so through DOE's Resilience Partnership, the CPUC and California Energy Commission working group encouraged them and other utilities to go beyond the requirements of that program.[119]

In a January 2016 report, the CPUC indicated that electric utilities "should create an iterative process" for climate resilience planning, such that updated information is available "at least in advance of every general rate case to inform the investment process."[120] PG&E, SDG&E, and SCE have since integrated climate change considerations into the Risk Assessment Mitigation Phase ("RAMP") process they are required to complete prior to each rate case.[121] While that is an important first step, the analysis in the utilities' RAMP reports is far from comprehensive.

The RAMP process was not designed specifically for climate resilience planning, but rather as a more general tool, which electric and gas utilities can use to assess a wide range of safety-related risks to their operations. In their first RAMP reports, PG&E, SDG&E, and SCE all identified climate change as one of several key sources of safety-related risk.[122] The three utilities' reports discussed, in general terms, how various climate impacts could affect their operations. PG&E's report examined six climate impacts in two different time periods—i.e., 2022 and 2050—using two model scenarios for each.[123] This approach enabled PG&E to identify a range of plausible future climate outcomes in both the near- and long-term.[124] Based on those outcomes PG&E estimated safety risks to its workforce and the general public from climate change in terms of additional injuries and deaths.[125] PG&E concluded that, in 2022, it could "experience safety consequences for PG&E workforce and the public of an additional 25–129 injuries and 1-3 fatalities per year due to climate change impacts, and in 2050, an additional 66–173 injuries and 2–5 fatalities."[126] Both the 2022 and 2050 figures are significantly lower than the actual number of deaths caused by recent wildfires sparked by PG&E equipment and worsened by climate change. For example, in 2020, PG&E pleaded guilty to eighty-four counts of involuntary manslaughter in connection with deaths arising from the 2018 Camp Fire which ignited when a PG&E owned and operated transmission line came into contact with dry vegetation.[127]

The RAMP reports prepared by SDG&E and SCE were more limited than that of PG&E, focusing on a smaller number of near-term, event-based climate impacts.[128] All three utilities concluded that further analysis is required to determine the full extent of their climate vulnerabilities, and develop resilience solutions. None of the utilities had published such analysis at the time of writing.

117 Cal. Exec. Order B-30-15 (Apr. 29, 2015), https://perma.cc/PH7Y-97MK.

118 CAL. NAT. RES. AGENCY, SAFEGUARDING CALIFORNIA: IMPLEMENTATION ACTION PLANS 88 (2016), https://perma.cc/LQE3-U4KU.

119 For example, the CPUC encouraged electric utilities to expand their vulnerability assessments to include a broader range of assets, among other things. *See* 2016 CPUC REPORT, *supra* note 15, at 16-14.

120 *Id.* at 21.

121 Established in December 2014 in response to the enactment of state legislation declaring "safety" to be "the top priority" of the CPUC, the RAMP process is intended to provide greater transparency on how electric and gas utilities assess and mitigate safety-related risks. To that end, prior to their three-yearly rate case, each utility must file with the CPUC a RAMP report that identifies the key risks it faces and options for mitigating those risks. *See* Cal. Pub. Utils. Comm'n, Decision 14-12-025: Incorporating a Risk-Based Decision-Making Framework into the Rate Case Plan and Modifying Appendix A of Decision 07-07-004 (Dec. 9, 2014), https://perma.cc/3JQ5-4FB3.

122 *See* RISK ASSESSMENT AND MITIGATION PHASE REPORT OF SAN DIEGO GAS & ELECTRIC COMPANY AND SOUTHERN CALIFORNIA GAS COMPANY (Oct. 27, 2016), https://perma.cc/7LPQ-9TPZ [hereinafter SDG&E RAMP]; SOUTHERN CALIFORNIA EDISON COMPANY'S 2018 RISK ASSESSMENT AND MITIGATION PHASE REPORT (Nov. 15, 2018), https://perma.cc/Z6G6-FXQQ [hereinafter SCE RAMP]; ARTHUR O'DONNELL ET AL., CAL. PUB. UTILS. COMM'N, RISK AND SAFETY ASPECTS OF RISK ASSESSMENT AND MITIGATION PHASE REPORT OF PACIFIC GAS AND ELECTRIC (Mar. 30, 2017), https://perma.cc/TTD4-5KLE [hereinafter CPUC Review of PG&E RAMP].

123 PG&E analyzed risks associated with major storm events, sea level rise, subsidence, heat waves, wildfires, and drought in 2022 and 2050. *See* CPUC Review of PG&E RAMP, *supra* note 122, at 144.

124 *Id.*

125 *Id.* at 145.

126 *Id.*

127 Ivan Penn & Peter Eavis, *PG&E Pleads Guilty to 84 Counts of Manslaughter in Camp Fire* Case, N.Y. TIMES (June 16, 2020), https://perma.cc/M9U4-8YY8.

128 SDG&E focused on increased temperatures and heat waves, increased wildfires, precipitation changes, and sea level rise and analyzed risks associated with a potential "worst case scenario" involving "[e]xtreme winds in SDG&E's Fire Threat Zone during a time of drought and elevated temperatures [that] cause a wire down event leading to a wildfire." *See* SDG&E RAMP, *supra* note 122, at 14-4 to 14-6. SCE examined risks associated with "99th percentile extreme heat events, extreme rain events, and extreme wildfires in the near term (2018-2023)." *See* SCE RAMP, *supra* note 122, at 12-2.

Seeking to advance climate resilience planning, in May 2018, the CPUC instituted proceedings to develop guidance for electric, gas, and other utilities "on how to incorporate [climate] adaptation into their planning and operations" (among other things).[129] In August 2020, the CPUC issued a decision requiring investor-owned energy utilities to submit climate vulnerability assessments every four years as part of their rate case filings.[130] The assessments must identify risks to the utilities' assets, operations, and services from changing temperatures, sea level rise, variations in precipitation, wildfire, and "cascading impacts / compounding incidents" over the next fifty years and options for dealing with those risks.[131] Each utility will be required to file its assessment with the CPUC prior to its general rate case. SCE will submit its first assessment in 2022, followed by PG&E in 2024, and SDG&E in 2025.[132]

2.3.2 New York

In June 2013, as part of rate case proceedings for Con Ed, the New York Public Service Commission ("NYPSC") convened a "Resiliency Collaborative" to explore issues related to storm hardening and climate resilience.[133] Those issues received special attention in the rate case, largely because of New York's experience with Superstorm Sandy, which occurred less than three months before Con Ed filed its rate case. In its filing, Con Ed had requested approximately $1 billion for "storm hardening structural improvements . . . that are intended to reduce the size and scope of service outages from major storms, as well as to improve responsiveness and expedite the recovery process."[134] Con Ed's focus solely on storm hardening prompted criticism from several environmental and other groups, who pushed for a broader approach that would account for the full range of climate impacts.[135]

The Resiliency Collaborative provided a forum for NYPSC staff, Con Ed, federal, state, and local government agencies, and a range of non-governmental organizations to work together on climate issues.[136] The participating groups reached a settlement requiring, among other things, Con Ed to complete a climate vulnerability assessment in 2014.[137] While Con Ed missed that deadline,[138] the completed assessment was published in the Con Ed Climate Study in December 2019, and is the most robust climate resilience planning effort undertaken by any electric utility to date.[139]

The Con Ed Climate Study analyzed projected change in temperature, humidity, precipitation, sea level, and extreme weather in Con Ed's service territory over seven time periods spanning from 2020 through 2080.[140] Con Ed engaged scientists at Columbia University's Lamont-Doherty Earth Observatory and consultants at ICF International, Inc., to develop downscaled climate projections for three sub-areas within its territory based thirty-two GCMs.[141] To account for uncertainty, the study team used multiple projections assuming different future greenhouse gas concentrations, as well as "extreme event narratives" representing plausible worst-

129 *See* Cal. Pub. Utils. Comm'n, Rulemaking 18-04-019: Order Instituting Rulemaking to Consider Strategies and Guidance for Climate Change Adaptation (May 7, 2018), https://perma.cc/BL9Q-Y9AX.

130 Cal. Pub. Utils. Comm'n, Rulemaking 18-04-019: Decision on Energy Utility Climate Change Vulnerability Assessments and Climate Adaptation in Disadvantaged Communities (Phase 1, Topics 4 and 5) (Aug. 27, 2020), https://perma.cc/2GKK-VCNP.

131 *Id.* at 4.

132 The filing dates are staggered to align with the utilities' general rate cases. *See* Cal. Pub. Utils. Comm'n, *Climate Change Adaptation*, ENERGY, https://perma.cc/79FF-LJV6 (last visited Oct. 15, 2020).

133 N.Y. Pub. Serv. Comm'n, Notice of Collaborative Meeting Concerning Storm Hardening and Resiliency Issues, Case 13-E-0030, et al. (July 1, 2013), https://perma.cc/92Y3-6HJG.

134 Letter from Craig Ivey, President, Consolidated Edison Co. of N.Y., Inc., to Hon. Jeffrey C. Cohen, Acting Sec'y, N.Y. Pub. Serv. Comm'n, 1 (Jan. 25, 2013) (on file with authors).

135 *See generally* N.Y. Pub. Serv. Comm'n, Order Approving Electric, Gas and Steam Rate Plans in Accord with Joint Proposal, Case 13-E-0030 et al., at 62 (Feb. 21, 2014), https://perma.cc/Y78W-GY8H [hereinafter NYPSC Rate Order]. Prior to the rate case proceedings, several environmental groups, led by the then Columbia Center for Climate Change Law (now the Sabin Center for Climate Change Law), had filed a petition with the NYPSC, requesting that it require all utility companies under its jurisdiction to engage in climate resilience planning. *See* Letter from Anne R. Siders, Assoc. Dir., Ctr. for Climate Change L., et al., to Hon. Jaclyn A. Brilling, Sec'y, N.Y. Pub. Serv. Comm'n (Dec. 12, 2012), https://perma.cc/V43Z-9MX8.

136 Participants in the Resiliency Collaborative were: (1) NYDPS Staff, (2) Con Ed, (3) City of New York, (4) County of Westchester, (5) New York State Office of Attorney General, (6) New York Department of Environmental Conservation, (7) Utility Intervention Unit, Division of Consumer Protection, Department of State, (8) New York University School of Law Guarini Center on Environmental and Land Use Law, (9) Institute for Policy Integrity, (10) Public Utility Law Project of New York, Inc., (11) New York Energy Consumers Council, Inc., (12) Consumer Power Advocates, (13) Utility Workers Union of America, AFL-CIO, Local 1-2, (14) Energy Initiative Group LLC, (15) Columbia University Center for Climate Change Law, (16) Environmental Defense Fund, (17) Pace Energy and Climate Center, and (18) Natural Resources Defense Council. *See* NYPSC Rate Order, *supra* note 135, at 63. For a discussion of the collaborative process, *see* Eleanor Stein, *Judging and Mediating for the "Long Emergency": Superstorm Sandy, New York State's Regulatory Response to the Climate Change Crisis, and Reforming the Energy Vision*, *in* CRISIS LAWYERING: EFFECTIVE LEGAL ADVOCACY IN EMERGENCY SITUATIONS 259 (Raymond Brescia & Eric Stern, eds.) (forthcoming 2020).

137 NYPSC Rate Order, *supra* note 135, at 71.

138 Gwynne Hogan, 'They Dragged Their Feet': Con Ed's Plan for Heat Waves Is Years Behind Schedule, GOTHAMIST (July 24, 2019), https://perma.cc/KQG9-QFAE. Commencement of the Con Ed Climate Study was delayed for several years in part because of uncertainty over whether the company would be permitted to recover its costs from ratepayers.

139 CONSOLIDATED EDISON, *supra* note 37.

140 *Id.* at 18-19.

141 *Id.* at 17.

case scenarios.[142] The study team compared anticipated climate conditions against existing asset design and operating parameters to identify vulnerabilities within Con Ed's system and evaluated measures to address those vulnerabilities (see **Box 6**).[143] Based on that work, and an assessment of broader electricity market trends, Con Ed will develop a Climate Change Implementation Plan identifying priority actions to be taken over the next five, ten, and twenty years to improve the resilience of its system to climate impacts.[144] That plan is expected to be published by the end of 2020.[145]

In approving the settlement that led to the Con Ed Climate Study, the NYPSC encouraged other electric utilities in New York to also engage in climate resilience planning, stating:

> The State's utilities should familiarize themselves with scientists' projections for local climate change impacts on each service territory. . . . We expect the utilities to consult the most current data to evaluate the climate impacts anticipated in their regions over the next years and decades, and to integrate these considerations into their system planning and construction forecasts and budgets.[146]

Following the decision in Con Ed's rate case, the Sabin Center for Climate Change Law intervened in rate case proceedings involving two other New York-based utilities—Central Hudson Gas & Electric Corporation and Orange and Rockland Utilities, Inc. In both proceedings, a settlement was reached, under which each utility agreed to review the Con Ed Climate Study upon its completion and evaluate whether the results of the study and/or other information "suggest a need for an adjustment associated with [the utility's] capital expenditure planning or investment or operational procedures and whether further study may be required."[147] However, because the Con Ed Climate Study was not completed during the term of the settlement agreements, neither utility conducted the agreed upon review. To the authors' knowledge, at the time of writing, no other New York-based electric utility had completed a climate risk assessment similar to that done by Con Ed.

Seeking to promote greater transparency of the climate risks facing electric utilities, in October 2020, the NYPSC initiated a new proceeding to address "matters related to the financial reporting of climate issues."[148] It appears that the proceeding will focus on whether and how electric utilities should be required to make climate-related risk disclosures in their annual financial statements.[149] The order initiating the proceeding noted that the parent companies of several New York-based electric utilities already disclose climate risks in their financial statements, but that the disclosures reflect "data aggregated at the holding-company level and [are] not utility specific." The order indicated that the NYPSC "believes" climate-related risk disclosures should be made at the utility level and solicited comments on the form of such disclosures.[150] Depending on the outcome of the proceedings, it could result in electric utilities being forced to engage in climate resilience planning (i.e., to identify climate-related risks that must be disclosed).

142 *Id.* at 17-19.

143 *Id.* at 32-37, 38-49.

144 *Id.* at 10.

145 *Id.* at 1.

146 NYPSC Rate Order, *supra* note 135, at 71-72.

147 *See* N.Y. Pub. Serv. Comm'n, Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Central Hudson Gas & Electric Corporation for Electric Service, Joint Proposal, Case 14-E-0319, at 51 (Feb. 6, 2015); N.Y. Pub. Serv. Comm'n, Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Orange and Rockland Utilities, Inc. for Electric Service, Case 14-E-0493, at 52 (June 5, 2015).

148 N.Y. Pub. Serv. Comm'n, Order Instituting Proceedings in the Matter Regarding the Need for Reporting Risks Related to Climate Change, Case 20-M-0499 (Oct. 15, 2020), https://perma.cc/459N-PTJY. While we focus here on electric utilities, the proceedings apply to New York gas utilities as well.

149 *Id.* at 3.

150 *Id.* at 8.

Box 6: Key Findings from the Con Ed Climate Study

The Con Ed Climate Study revealed highly relevant, specific, and actionable information regarding the impacts of climate change on electric utility assets and operations. Downscaled climate projections developed for the study detail a number of significant changes in weather conditions in Con Ed's service territory, including a fourteen-fold increase in the number of days with temperatures above 86ºF (30ºC), a twenty-percent decrease in cold weather days, and a twenty-five-time increase in heat wave events by 2050.[151] Precipitation in Con Ed's service territory is likewise expected to increase, with 500-year floods occurring every ten years by 2100, and the flood height associated with a 100-year flood increasing by up to fifty percent.[152] The study identified a number of ways in which these and other climate impacts could put Con Ed's infrastructure at risk. For example, increased temperatures were shown to result in transmission line sag, which presents a safety risk.[153] Other infrastructure—particularly substations—was found to be at risk from climate change-amplified storm surge and flooding.[154] Predicted peak load was also revised to reflect increased demand and reduced operational efficiency on hotter days.[155]

151 CONSOLIDATED EDISON, *supra* note 37, at 11, 17.
152 *Id.* at 22-24.
153 *Id.* at 41.
154 *Id.* at 40.
155 *Id.* at 42.

PART 3:

Advancing Climate Resilience Planning Through Electric Utility Regulatory Proceedings

As discussed in Part 2.3, state utility commissions have played an important role in advancing climate resilience planning in the electric utility sector, at least in some areas. Recent proceedings before the CPUC and NYPSC, in particular, serve as case studies for how broad principles of utility regulation can be used to further climate resilience planning. In this Part, we discuss two possible avenues for engagement on climate resilience planning before state utility commissions, namely:

1. intervening in rate case proceedings for a specific electric utility to challenge its past or proposed future expenditures on the basis that it has not adequately considered climate risks and/or to obtain commission approval for the recovery of costs associated with climate resilience planning and investment; and

2. petitioning a state utility commission for a regulation or administrative order mandating climate resilience planning by all electric utilities under its jurisdiction.

For each avenue, we identify specific legal theories that require climate resilience planning, focusing in particular on electric utilities' core obligation to ensure reliable services at just and reasonable rates.

3.1 Advocating for Climate Resilience Planning Through Rate Case Proceedings

Climate resilience planning may be advocated in rate case proceedings, wherein the state utility commission reviews and approves or rejects an electric utility's rates and other terms of service. Rate regulation is a core responsibility of all state utility commissions, which are charged with ensuring that electric utilities do not misuse their monopoly power in a way that harms customers, for example by engaging in price gouging.[156] The regulatory framework varies between states, but all require electricity rates to be "just and reasonable,"[157] which has been interpreted to mean that rates must be "neither less than compensatory nor excessive."[158] To achieve that balance, state utility commissions set rates using a cost of service approach, under which electric utilities are permitted to earn a reasonable return on investments and recover reasonably incurred expenses.[159]

In some states, rate case proceedings are held on a fixed schedule (e.g., every three years), while in others they are conducted on an ad hoc basis.[160] Rate case proceedings involve judicial-type processes, with parties filing briefs and written evidence and the state utility commission holding hearings in which witnesses appear and can be cross-examined.[161] Most state utility commissions also provide an opportunity for non-parties to make statements during the hearing or at other times.[162] That is one avenue for raising issues relating

156 *See generally* REGUL. ASSISTANCE PROJECT, *supra* note 99, at 5-6. Even in states where the electricity sector has been deregulated, utility commissions continue to regulate rates for monopoly services, such as distribution.

157 James M. Van Nostrand, *Keeping the Lights on During Superstorm Sandy: Climate Change Adaptation and the Resiliency Benefits of Distributed Generation*, N.Y.U. ENV'T L. J. 92, 145 (2015), https://perma.cc/93JL-GGN4 ("Ratemaking statutes uniformly require utility rates to be 'just and reasonable' or 'fair, just, reasonable, and sufficient.'" (internal citations omitted)).

158 Farmer's Union Cent. Exch., Inc. v. Fed. Energy Reg. Comm'n, 734 F.2d 1486, 1502 (D.C. Cir. 1984).

159 REGUL. ASSISTANCE PROJECT, *supra* note 99, at 5.

160 *Id.* at 40.

161 *Id.* at 41-45.

162 *Id.* at 44.

Box 7: State Utility Commissions' Authority to Consider Environmental Issues

State utility commissions are often thought of as economic regulators, responsible solely for ensuring that electric utilities deliver reliable service at low cost.[163] As such, environmental issues are often thought to fall outside the purview of state utility commissions, and instead be the exclusive responsibility of environmental protection agencies.[164] In fact, however, state utility commissions often can and do act on environmental issues. A 2006 study found that "[f]ifteen state commissions have statutes explicitly setting out a general authority or obligation to consider environmental matters" and others have "implicit authority" to do so "through their general charge that regulation of public utilities furthers the public interest."[165]

Environmental issues are most commonly dealt with by state utility commissions in the context of facility siting decisions.[166] Those decisions may provide another avenue for identifying and assessing climate risks to electric utility infrastructure.

State statutes often expressly require state utility commissions to consider the environmental impacts of proposed infrastructure in their siting decisions.[167] In several states, the requirement is expressed in broadly-applicable environmental review statutes, which emulate the National Environmental Policy Act ("NEPA").[168] Briefly, NEPA requires federal agencies to evaluate the environmental impacts of major projects they conduct, fund, or authorize.[169] Agencies must consider environmental impacts against baseline conditions in the project area and account for climate change when defining the baseline.[170] Multiple federal courts have held that agencies must consider how a proposed project will be affected by increasing temperatures, sea level rise, and other climate-induced phenomena.[171]

Consistent with the federal precedent, in states with their own "little NEPA" statutes, agencies are often required or encouraged to consider the impacts of climate change on projects as part of their environmental reviews. In Massachusetts, for example, state agencies are required to consider "predicted sea level rise" and other "reasonably foreseeable climate change impacts" when approving new projects.[172] The Massachusetts Executive Office of Energy and Environmental Affairs has proposed that, for each project, agencies prepare a so-called "climate impact assessment" that evaluates the potential effects on the project of sea level rise, changes in precipitation, and changes in average and extreme temperatures, and the appropriateness of measures designed to reduce or avoid those impacts.[173] These issues could be considered by the Massachusetts Department of Public Utilities, for example, when reviewing proposals for new transmission infrastructure.[174] In Massachusetts and other states, third-parties can comment on proposals and intervene in review proceedings, which provides an opportunity to push for consideration of climate impacts[175]

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163 *See generally* Michael Dworkin et al., *Revisiting the Environmental Duties of Public Utility Commissions*, 7 VT. J. ENVT'L L. 1 (2006), https://perma.cc/48DZ-SLDC.

164 *Id.*

165 *Id.* at 1-2.

166 Decisions regarding facility siting are the responsibility of the utility commissions in some (but not all) states.

167 Dworkin et al., *supra* note 156, at 3 ("In thirty states, certification and siting review includes consideration of environmental protection.").

168 Sixteen states and the District of Columbia have environmental review laws similar to NEPA. *See* Daniel P. Selmi, *Themes in the Evolution of the State Environmental Policy Acts*, 38 URB. LAW. 949 (2006), https://perma.cc/L9GY-4FLL; Patrick Marchman, *"Little NEPAs": State Equivalents to the National Environmental Policy Act in Indiana, Minnesota and Wisconsin* (Oct. 8, 2012), https://perma.cc/VG98-NJBV (unpublished capstone paper). Some states exempt the utility commission from compliance with the environmental review statute. *See, e.g.*, MONT. CODE ANN. § 75-1-201(3) ("The department of public service regulation, in exercise of its regulatory authority over rates and charges of railroads, motor carriers, and public utilities, is exempt from" compliance with the state environmental review statute).

169 42 U.S.C. § 4332(2)(C) (requiring preparation of an environmental impact statement for any "major federal action" that "significantly affect[s] the quality of the human environment").

170 *See generally* Council on Environmental Quality, Considering Cumulative Effects under the National Environmental Policy Act 41 (1997), https://perma.cc/W5FY-9ZQC. In July 2020, the Council on Environmental Quality finalized revisions to its NEPA implementing regulations, which eliminate the former requirement to consider "cumulative effects" in environmental reviews. This will have the effect of limiting consideration of climate change in environmental reviews. However, the revised regulations continue to require agencies to consider climate impacts when defining the baseline, at least in some circumstances. *See* Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act, 85 Fed. Reg. 43,304, 43,331 (July 15, 2020) ("[A]gencies will consider predictable environmental trends in the area in the baseline analysis of the affected environment," including "[t]rends determined to be a consequence of climate change.").

171 *See, e.g.*, AquAlliance v. U.S. Bureau of Reclamation, 287 F. Supp. 3d 969 (E.D. Cal. 2018) ("NEPA requires an evaluation of the impact of climate change on a project."); Kunaknana v. U.S. Army Corps of Eng'rs, 23 F. Supp. 3d 1063, 1092-98 (D. Alaska 2014) (determining that the Amy Corps of Engineers should have considered new information about climate change when determining whether to prepare a supplemental EIS).

172 MASS. GEN. LAWS. ch. 30, § 61.

173 MASS. EXEC. OFF. OF ENERGY & ENV'T AFFAIRS, DRAFT MEPA CLIMATE CHANGE ADAPTATION AND RESILIENCY POLICY 4-8 (2015), https://perma.cc/VV2J-MJRU.

174 The Massachusetts Department of Public Utilities' Siting Division is responsible for reviewing proposals to construct and operate transmission lines in the state. *See generally* Mass.gov, *DPU Siting Division*, https://perma.cc/X2XZ-RB9L (last visited Sept. 11, 2020). State agencies can make use of various publicly-available tools and datasets to evaluate climate impacts on new infrastructure. *See generally* JESSICA WENTZ, ASSESSING THE IMPACTS OF CLIMATE CHANGE ON THE BUILT ENVIRONMENT UNDER NEPA AND STATE EIA LAWS: A SURVEY OF CURRENT PRACTICES AND RECOMMENDATIONS FOR MODEL PROTOCOLS 15-26 (2015), https://perma.cc/M6MQ-S2UB.

175 *See generally Mass.gov, EFSB and DPU Siting Process*, https://perma.cc/Y529-V5FQ (last visited Sept. 11, 2020).

to climate resilience planning in rate case proceedings, which requires only minimal investments of time and other resources by the raising entity. It should, however, be noted that state utility commissions generally attach less weight to statements made by non-parties.[176] For that reason, interested persons may choose to formally intervene in, and become parties to, the rate case proceeding.

Intervention refers to the process by which interested persons obtain approval from the state utility commission to participate in rate case or other proceedings. Each commission has its own rules regarding participation, with most requiring third parties to file a petition to intervene, which explains their interest in the case and reasons for intervening.[177] Some state utility commissions require would-be intervenors to demonstrate that their legal rights or duties will be substantially affected by the outcome of the proceeding and/or that their interests are not sufficiently represented by other parties.[178] Although some state utility commissions restrict intervention,[179] many are highly permissive of it and merely require a showing that it is "in the public interest."[180] However, there may be other, practical challenges associated with intervening in rate case proceedings. Such proceedings can last for several months and are highly complex, dealing with a broad range of technical issues, most of which have little or no relevance to climate resilience planning. Nevertheless, even if an intervenor is focused solely on that one issue, he/she/it may need to be represented in hearings concerning other matters.[181] Intervenors may need to engage outside legal counsel to represent them and/or expert witnesses to appear on their behalf which can be highly costly.[182]

The remainder of this subpart discusses three key ratemaking principles that could be relied on to advance climate resilience planning in rate case proceedings: (1) the prudence standard, (2) the used and useful test, and (3) the least cost principle.

3.1.1 The Prudence Standard

Prudence is a central tenet of electric utility rate regulation.[183] Electric utilities are typically only permitted to recover prudent and necessary operating expenses and earn a return on prudent used and useful capital investments.[184] State utility commissions assess prudence by considering what a reasonable, professional utility manager would have done given the information that was known or knowable at the time.[185] The prudence standard has thus been described as similar to the reasonable person standard applied in tort law.[186]

176 *Id.* at 44-45.

177 *See, e.g.*, MO. CODE REGS. ANN. tit. 4, § 240-2.075 (requiring petitions to intervene to be filed within 30 days after the commission gives notice of the case and include information about the petitioner, including a statement of his/her/its "interest in the case and reasons for *see*king intervention"); OR. ADMIN. R. 860-001-0300 (requiring petitions to intervene to contain basic information about the petitioner, "[t]he nature and extent of the petitioner's interest in the proceedings," and "[t]he issues petitioner intends to raise at the proceedings").

178 *See, e.g.*, KAN. ADMIN. REGS. § 82-1-225 (providing that a petition for intervention may only be granted if it "states facts demonstrating that the petitioner's legal rights, duties, privileges, immunities, or other legal interests may be substantially affected by the proceeding"); OHIO ADMIN. CODE 4901-1-11 (allowing intervention by any person who "has a real and substantial interest in the proceeding" and who "is so situated that the disposition of the proceeding may . . . impair or impede his or her ability to protect that interest, unless the person's interest is adequately represented by existing parties").

179 *See, e.g.*, N.J. Bd. of Pub. Utils., In the Matter of the Petition of Public Service Electric and Gas Company for Approval of the Energy Storage Program, Docket Nos. EO13020155 & GO13020156 (Sept. 30, 2013), https://perma.cc/3AFG-P28T (denying Environmental Defense Fund intervenor status). *But see* N.J. Bd. of Pub. Utils., In the Matter of the Petition of Atlantic City Electric Company for Approval of Amendments to its Tariff to provide for an Increase in Rates and Charges for Electric Service Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 48:2-21.1, for Approval of a Grid Resiliency Initiative and Cost Recovery Related Thereto, and for Other Appropriate Relief (2016), Docket No. ER16030252 (Oct. 5, 2016), https://perma.cc/HDG9-M7KW (granting Environmental Defense Fund intervenor status).

180 *See, e.g.*, 52 PA. CODE § 5.72 (allowing intervention where the petitioner has an "interest of such nature that participation by the petitioner may be in the public interest"); WASH. ADMIN. CODE § 480-07-355 (allowing intervention "if the petitioner's participation is in the public interest").

181 The requirements regarding participation in hearings vary between states. In some states, intervenors must be represented at all or most of the hearing, even those portions that do not relate directly to climate resilience planning. In other states, intervenors have more flexibility, and can choose to only be represented at parts of the hearing.

182 In some states, electric utilities provide limited funding to intervenors, but that funding is often only available to those representing consumer groups. *See generally* Or. Pub. Util. Comm'n, *Intervenor Funding*, https://perma.cc/2AJR-TV6E (last visited Oct. 21, 2020).

183 Long Is. Lighting Co. v. Pub. Serv. Comm'n of State of N.Y., 523 N.Y.S.2d 615, 620 (N.Y. App. Div. 1987) (describing prudence as "an essential constituent of utility regulation"); *see also* Appeal of Conservation L. Found., 507 A.2d 652, 673 (N.H. 1986) (describing the prudence standard as a key principle governing ratemaking); Gulf States Utils. Co. v. La. Pub. Serv. Comm'n, 578 So. 2d 71, 85 (La. 1991) (stating that "one of the principles used by ratemaking bodies and courts to [determine how much of a utility's investment in a particular plant should be included within its rate base] is the prudent investment standard"); Entergy Gulf States, Inc. v. La. Pub. Serv. Comm'n, 726 So. 2d 870, 873 (La. 1999) (noting that the prudence standard is applied to "counterbalance the monopolistic effects on the ratepayers who do not have a choice about which company provides their utility service"); Town of Hingham v. Dep't of Telecomms. & Energy, 740 N.E.2d 984, 989 (Mass. 2001) (indicating that "[t]he prudence test determines whether cost recovery is allowed at all").

184 *See generally* REGUL. ASSISTANCE PROJECT, *supra* note 99, at 47, 51-52, 57-58. Some states do not require electric utilities to establish that their capital investments resulted in assets that are "used and useful." *See infra* Part 3.1.2.

185 Jarvis, *supra* note 101, at 1042.

186 *See, e.g.*, *Appeal of Conservation L. Found.*, 507 A.2d at 673 (holding that the prudence standard "essentially applies an analogue of the common law negligence standard for determining whether to exclude value from rate base").

In rate case proceedings, the burden of demonstrating prudence falls on the electric utility, which must prove that it acted reasonably in the circumstances.[187] This requires a showing that the electric utility engaged in a sound decision-making process in which it took appropriate steps to obtain relevant information and evaluated that information in reaching its conclusion. As the Louisiana supreme court observed in *Gulf States Utilities Co. v. Louisiana Public Service Commission*, "the utility must demonstrate that it went through a reasonable . . . process to arrive at a course of action and, given the facts as they were or should have been known at the time, responded in a reasonable manner."[188] The Louisiana supreme court held that, to satisfy the prudence standard, the utility's decision-making process must have been "logical" and based on "information and planning techniques known or knowable at the time" the decision was made.[189] However, in the case of long-running investment projects, the electric utility is not merely expected to act prudently at the outset, but throughout.[190] Thus, according to the Louisiana supreme court, electric utilities must "respond prudently to changing circumstances or new challenges that arise as the project progresses."[191] Courts and public utility commissions in other states have applied the prudence standard similarly.[192]

Applying the above principles, the prudence standard requires electric utilities to employ established techniques to evaluate and manage climate risks when making investment and other operational decisions that impact rates. The physical risks to electric system operation from increasing temperatures, more severe storms and wildfires, and other climate impacts have been well-documented in numerous government and independent reports.[193] Electric utilities, therefore, can no longer feign ignorance. To use the parlance of the Louisiana supreme court, electric utilities now know, or should know, that the impacts of climate change pose material risks to their operations and assets. Indeed, many have admitted as much in their filings with the SEC and other documents.[194]

In this context, for electric utilities' decisions to be considered "logical" and "reasonable," they must integrate climate risk into their decision-making processes. Indeed, since many utility investment decisions involve assets that are intended to remain in operation for forty years or more, it is impossible to make rational choices without accounting for long-term climate impacts. Such climate-focused decision-making has been advocated by corporate analysts and advisors, including McKinsey and Company, which recently stated:

> Climate change needs to become a major feature in corporate and public-sector decision making. . . . For companies, this will mean taking climate considerations into account when looking at capital allocation, development of products or services, and supply chain management, for example. Large capital projects would be evaluated in a way that reflects the increased probability of climate hazards at their location: How will that probability change over time? What are the possible changes in cost of capital for exposed assets? How will climate risk affect the broader market context and other implicit assumptions in the investment case?[195]

Climate resilience planning enables electric utilities to answer these and other questions, thereby ensuring that their investment decisions are prudent in light of climate change. The techniques for climate resilience planning

187 Long Is. Lighting Co., 523 N.Y.S.2d at 620 (holding that the "burden of proof is upon the utility whose rates . . . are being considered to justify its conduct"). Electric utilities generally benefit from a presumption of prudence absent evidence to the contrary. If there is any evidence suggesting imprudence, the burden shifts to the utility to demonstrate the appropriateness of its conduct. *See, e.g.*, Off. of Pub. Couns. v. Mo. Pub. Serv. Comm'n, 523 S.W.3d 14, 19 (Mo. Ct. App. 2017) (holding that "the presumption of prudence sets out an evidentiary presumption which provides that the utility's expenditures are presumed to be prudent until adequate contrary evidence is produced, at which point the presumption disappears from the case . . . . The presumption affects who has the burden of proceeding, but it does not change the burden of proof, which [is] on the utility" (internal citations omitted)).

188 *Gulf States Utils.*, 578 So. 2d at 85, *aff'd,* Gulf States Utils. Co. v. La. Pub. Serv. Comm'n, 689 So. 2d 1337, 1346 (La. 1997); *Entergy Gulf States*, 726 So. 2d at 874; Gordon v. Council of New Orleans, 977 So. 2d 212, 292 (La. Ct. App. 2008).

189 Gulf States Utils., 578 So. 2d at 85.

190 *Id.*

191 *Id.*

192 *See, e.g.*, *Long Is. Lighting Co.*, 523 N.Y.S.2d at 620 (holding that "[p]rudence is determined by judging whether the utility acted reasonably, under the circumstances at the time"); Citizens Action Coal. of Ind., Inc. v. N. Ind. Pub. Serv. Co., 472 N.E.2d 938, 958 (Ind. Ct. App. 1984) (holding that "[t]he measure of the prudence of utility expenditures is gauged by what one would consider good management decisions and practices" and that, where a utility undertakes a long-term project, it must respond prudently to changing circumstances); Gulf States Utils. Co. v. Pub. Util. Comm'n, 841 S.W.2d 459, 475 (Tex. App. 1992) (noting that the state utility commission defines prudence as "[t]he exercise of that judgement . . . which a reasonable utility manager would exercise . . . in the same or similar circumstances given the information" that was known or knowable); Green Mountain Power Corp., 184 Pub. Util. Rep. 4th 1, 217 (Vt. Pub. Serv. Bd. 1998) (stating that, to satisfy the prudence standard, the electric utility must "mak[e] all reasonable efforts to gather relevant information and . . . respond accordingly"); Fitchburg Gas & Elec. Light Co. v. Dep't of Pub. Utils., 956 N.E.2d 213, 216 (Mass. 2011) (indicating that "[w]hen conducting a prudence review, the [D]epartment [of Public Utilities] determines whether a utility's actions, based on all that it knew or should have known at the time, were reasonable and prudent in light of the circumstances").

193 *See supra* note 14.

194 *See supra* note 11.

195 McKinsey & Co., *supra* note 15.

are well-established and have already been put into practice by some electric utilities. The Con Ed Climate Study, discussed in Part 2.3, demonstrates that the necessary tools and data are available to evaluate the impacts of climate change over long periods and develop flexible resilience pathways to manage those impacts. In short, no electric utility or state utility commission can deny that the reasons for, and process of, climate resilience planning are now "known or knowable."

Given the above, in order to meet the prudence standard, electric utilities must engage in climate resilience planning and consider the findings thereof when making investment decisions. State utility commissions could mandate climate resilience planning by electric utilities on that basis. Moreover, regardless of whether state utility commissions impose such a mandate, electric utilities that fail to engage in climate resilience planning could have their investment decisions challenged in rate case proceedings. Such challenges could be used as leverage to secure a commitment from the relevant electric utility to engage in climate resilience planning.[196] It could also result in disallowance of the electric utility's costs on the basis that they are imprudent, which would send a strong signal as to the importance of climate resilience planning and encourage other utilities to engage in the process.

At the time of writing, at least two electric utilities—Duke Energy Carolinas, LLC ("DEC") and Duke Energy Progress, LLC ("DEP")—had seen their expenditures challenged under the prudence standard on the basis that they failed to adequately consider climate risk. In February 2020, Vote Solar submitted testimony[197] in rate case proceedings for DEC before the North Carolina Utilities Commission, challenging its request to recover "[c]osts incurred to maintain and modernize the company's electric system, generate cleaner power, improve reliability, [and] efficiently restore service to customers after major storm damage" (among other things).[198] Subsequently, in April 2020, Vote Solar challenged DEP's request to recover costs associated with grid maintenance and modernization in its rate case proceedings before the North Carolina Utilities Commission.[199]

Both challenges raised the same broad argument. Vote Solar noted that, in developing their plans to maintain and modernize the electric system, DEC/DEP did not conduct a climate vulnerability assessment or any similar study of climate impacts, purportedly because they were "unable to say with certainty what the future impacts of climate change may or may not be."[200] Vote Solar argued that, due to DEC/DEP's failure to consider climate change, there was insufficient evidence "to determine if the Compan[ies] made the most prudent prioritization and investments in light of [their] actual, projected climate risk."[201] Before the North Carolina Utilities Commission could rule on this issue, the parties reached a settlement under which DEC/DEP agreed to convene Climate Risk and Resilience Working Groups, which will look at ways to assess the impacts of climate change on the DEC/DEP system and integrate consideration of those impacts into DEC/DEP planning.[202]

3.1.2 The Used and Useful Test

Electric utilities that fail to adequately prepare for the impacts of climate change also risk being denied cost recovery for their capital investments under the "used and useful" test.[203] Where that test applies, electric utilities are only permitted to include in their rate base, and claim depreciation and other expenses on, capital investments that are physically used and useful in providing services to customers.[204] The distinction between used and useful is somewhat blurry. Generally,

196 Disputes regarding the prudence of electric utility investments are, in practice, often resolved through settlement. *See generally* Eleanor Stein, *The Long Island City Power Outage Settlement: A Case Study in Alternative Dispute Resolution*, 27 PACE ENV'T L. REV. 357 (2009), https://perma.cc/5WUU-U55V.

197 Vote Solar DEC Testimony, *supra* note 102.

198 Duke Energy Carolinas, LLC Application to Adjust Retail Rates, N.C.U.C. Docket No. E-7, SUB 1214 (Sept. 30, 2019), https://perma.cc/95DV-WZDA.

199 Direct Testimony of James Van Nostrand and Tyler Fitch on Behalf of Vote Solar, In the Matter of Application of Duke Energy Progress, LLC for Adjustment of Rates and Charges Applicable to Electric Service in North Carolina, N.C.U.C. Docket No. E-2, Sub 1219 (Feb. 18, 2020), https://perma.cc/C5FD-E9QY [hereinafter Vote Solar DEP Testimony].

200 Vote Solar DEC Testimony, *supra* note 102, at 19 (discussing DEC's response to discovery on how it manages climate-related risks); Vote Solar DEP Testimony, *supra* note 199, at 20 (discussing DEP's response to discovery on how it manages climate-related risks).

201 Vote Solar DEC Testimony, *supra* note 102, at 94; Vote Solar DEP Testimony, *supra* note 199, at 98.

202 Agreement and Stipulation of Settlement, In the Matter of Application Duke Energy Carolinas, LLC for Adjustment of Rates and Charges Applicable to Electric Service in North Carolina, N.C.U.C. Docket No. E-7, SUB 1214 (July 8, 2020) [hereinafter DEC Settlement Agreement]; Agreement and Stipulation of Settlement, In the Matter of Application of Duke Energy Progress, LLC for Adjustment of Rates and Charges Applicable to Electric Service in North Carolina, N.C.U.C. Docket No. E-2, Sub 1219 (July 9, 2020) [hereinafter DEP Settlement Agreement]. DEC and DEP agreed to undertake climate-resilience planning to "study the impacts of climate change on" their Grid Improvement Plans and "existing grid, including operations, planning and physical assets on its transmission and distribution systems" utilizing "[b]est practices climate modeling and scenario analysis." DEC Settlement Agreement at 4; DEP Settlement Agreement at 4.

203 A number of state utility commissions apply both the used and useful test and the prudence standard, though some commissions only employ one of the two standards. *See generally* Richard J. Pierce, Jr., *The Regulatory Treatment of Mistakes in Retrospect: Canceled Plants and Excess Capacity*, 132 U. PA. L. REV. 497, 512-13 (1984), https://perma.cc/KE2Z-DZAZ.

204 Denver Union Stock Yard Co. v. United States, 304 U.S. 470, 475 (1983).

however, state utility commissions look at whether an investment resulted in an asset that is physically providing services (and is thus "used") and whether that asset is actually needed to provide those services (and thus "useful").[205]

The used and useful test is most commonly employed to prevent electric utilities including in their rate base investments in assets that are still under construction.[206] Once an asset is completed and placed into service, the electric utility's investment is typically added to its rate base. In each subsequent rate case proceeding, the state utility commission verifies that the asset is still used and useful, and will remain so for the period during which the rates will be in effect.[207] An asset must be removed from rate based if it ceases to be used and useful, for example, because of chronic operational problems that take it out of service for extended periods.[208] In this regard, the Pennsylvania Public Utility Commission has held that "[t]he length of time [an] asset may be out of service and not removed from rate base depends upon the nature of the plant, the degree to which the outages can be expected to occur during normal operation of the plant, and the certainty with which resumption of service can be predicted."[209] Prolonged outages (e.g., of a year or more) that are not expected with normal operation of assets may result in the assets being found to be not used and useful and thus removed from rate base.[210]

Without adequate planning and investment in resilience, climate impacts could render electric system assets inoperable, either permanently or for extended periods. Sea level rise is perhaps the most obvious example. A 2014 DOE study found that in Houston, Los Angeles, Miami, and New York City alone up to forty-five energy facilities could be inundated due to sea level rise by 2050.[211] Other climate impacts could also lead to premature facility retirement or service interruptions. Indeed, just this year, Xcel Energy accelerated its plans to close a coal plant in New Mexico due to water scarcity issues.[212] As climate impacts worsen, more assets will be affected. For instance, the Con Ed Climate Study found that increasing temperatures would accelerate the aging of substation transformers, for which the design reference temperature is lower than the temperature projected to occur in the future due to climate change.[213]

Climate-affected facilities that retire prematurely will cease to be used and useful and thus effectively become stranded assets, the costs of which cannot be recovered by electric utilities in rates. The used and useful test would also prevent electric utilities from recovering the costs of assets that experience regular and/or extended outages due to the impacts of climate change. As noted above, in the past, facilities experiencing non-routine outages, which are not "expected to occur during normal operations" (e.g., maintenance), have been treated as not used and useful and therefore excluded from the electric utility's rate base.[214]

3.1.3 The Least Cost Principle

By applying the prudence standard and/or used and useful test, state utility commissions ensure that electric utilities are only reimbursed for expenses that were reasonably incurred, and deliver benefits to customers. This is consistent with the overarching goal of electric utility regulation—i.e., to ensure "just and reasonable" rates that appropriately balance utilities'

205 *See generally* Jonathan A. Lesser, *The Used and Useful Test: Implications for a Restructured Electric Industry*, 23 ENERGY L. J. 349, 352 (2002), https://perma.cc/Z4AZ-68VN.

206 The used and useful test has also been employed to exclude from rate base assets that are surplus to the utility's requirements. For example, where an electric utility has a 1000 megawatt short-fall in generating capacity and adds a new 2000 megawatt plant, the excess 1000 megawatts of supply may be temporarily excluded from rate base until demand increases. *See generally* Van Nostrand, *supra* note 170, at 139-42.

207 Pa. Pub. Util. Comm'n v. Metro. Edison Co., 53 Pa. PUC 329, 333 (Pa. Pub. Util. Comm'n June 15, 1979) (holding that the commission must consider whether an "investment is or will be useful during [the] period in which the rates are to be in effect").

208 *Id.*; *see also* Pa. Power Co. v. Pa. Pub. Util. Comm'n, 56 A.2d 43, 47-48 (Pa. Commw. Ct. 1989) (holding that "[t]he touchstone for determining whether or not a prudently constructed unit *should be included in a utility's rate base* is whether or not, *during the test year involved*, the unit will be used and useful in rendering service to the public" (second emphasis added) (quoting Philadelphia Elec. Co. v. Pa. Pub. Util. Comm'n, 433 A.2d 620, 623 (Pa. Commw. Ct. 1981)).

209 *Metro. Edison Co.*, 53 Pa. PUC at 333.

210 *Id.* (holding that a generating facility expected to be offline for two to four years must be removed from rate base because such facilities "by their nature are not expected to experience" such prolonged outages).

211 U.S. DEP'T OF ENERGY, EFFECT OF SEA LEVEL RISE ON ENERGY INFRASTRUCTURE IN FOUR MAJOR METROPOLITAN AREAS 13 (2014), https://perma.cc/D66N-633K.

212 Kavya Balaraman, *Water Scarcity Accelerates Plans to Close Xcel's Tolk Coal Plant by a Decade*, UTIL. DIVE (Jan. 15, 2020), https://perma.cc/TXM9-JJ9Y. This decision came as Moody's raised concern over the effect of climate change induced heat and water stress on Xcel's and other electric utility's operations. Mike Hughlett, *Moody's Gives Xcel 'Red Flag' for Water Stress Because of Climate Change in Southwest States*, STAR TRIB. (Jan. 22, 2020), https://perma.cc/J84K-D4ZR.

213 CONSOLIDATED EDISON, *supra* note 37, at 40. The transformers have a design reference temperature of 86oF. In the future, however, New York City is projected to experience up to 26 days per year above 86oF, and 23 days above 95oF. *See id.* at 19.

214 Metro. Edison Co., 53 Pa. PUC at 333 (holding that "[t]he length of time which utility plant may be out of service and not removed from rate base depends upon the nature of the plant, the degree to which the outage can be expected to occur during normal operation of the plant, and the certainty with which resumption of service can be predicted").

need to earn sufficient revenue to maintain their systems and make new investments against customers' interest in keeping prices low.[215] The interest in keeping customer prices low has a particularly significant influence on state utility commissions' regulatory decisions.[216]

Legislation in several states expressly identifies cost minimization as a goal of electric utility regulation. In Vermont, for example, legislation calls for "meeting the public's need for energy services . . . at the lowest present value life cycle cost."[217] Legislation in South Carolina similarly declares a policy in favor of "minimiz[ing] the cost of energy throughout the state."[218] Even absent this type of express statutory direction, state utility commissions have generally applied the principle of "least cost" when setting rates.[219] In rate case and other proceedings, state utility commissions have required electric utilities to take various steps to reduce electricity costs, while maintaining service reliability. For example, as discussed in Part 2.2 above, electric utilities in thirty-six states are now required to engage in a process of integrated resource planning that is intended to identify the optimal resource mix that will ensure long-term service reliability at least cost.[220]

Requiring electric utilities to engage in climate resilience planning furthers the goal of reducing electricity costs while maintaining utilities' ability to provide reliable service. As discussed in Part 2 above, such planning enables electric utilities to design new assets and systems that are "resilient from the start," thereby avoiding the need for costly retrofits in the future. It also facilitates action to improve electric utilities ability to avoid or quickly recover from outages which further reduces costs. The reductions are likely to more than offset any costs incurred by electric utilities to enhance their climate resilience.

A 2019 study by McKinsey and Company found that, if left unaddressed, climate change would cause the storm damage and outage costs incurred by a typical electric utility to increase by at least twenty-three percent or $300 million to $1.7 billion by 2050.[221] In comparison, according to the study:

> [I]t would take $700 million to $1 billion for a typical Southeastern US utility to prepare for impacts related to climate change. That is . . . much less than the projected future storm costs of $1.7 billion. While each utility's cost-benefit calculation will differ based on its unique risk exposure profile and infrastructure costs, our conclusion is that it pays to prepare for extreme weather . . . . There are also likely to be ancillary benefits, such as improved reliability and enhanced diversity of supply.[222]

Confirming McKinsey and Company's conclusion, a 2020 study found that due to the impacts of climate change, spending on transmission and distribution infrastructure could increase by up twenty-five percent or $24 billion per year by 2090.[223] The study further found that designing new infrastructure based on projected climate conditions over its useful life "roughly halves the expected costs of climate change experienced in 2090" compared to a scenario in which no adjustments are made to infrastructure design.[224] Requiring electric utilities to take steps to enhance their resilience to climate change is, therefore, fully consistent with the least cost principle employed by state utility commissions when setting electricity rates.[225]

215 Farmer's Union Cent. Exch., Inc. v. Fed. Energy Reg. Comm'n, 734 F.2d 1486, 1502 (D.C. Cir. 1984) (holding that, in setting rates, state utility commissions must balance the interests of electricity suppliers and their customers to determine a level that is "neither less than compensatory nor excessive").

216 *See generally* Jeremy Knee, *Rational Electricity Regulation: Environmental Impacts and the "Public Interest"*, 113 W. VA. L. REV. 739 (2011) (concluding that state utility commissions have generally exercised their ratemaking authority so as to "minimize[e] costs to consumers").

217 VT. CODE ANN. tit. 30, § 218c(a)(1).

218 S.C. CODE ANN. § 48-52-210.

219 *See, e.g.*, Re Ky. Power Co., 2010 WL 2640998 (Ky. Pub. Serv. Comm'n June 28, 2010) (recognizing "that 'least cost' is one of the fundamental principles utilized when setting rates that are fair, just, and reasonable").

220 Girouard, *supra* note 71; *see also* Energy Policy Act of 1992, Pub. L. No. 102-486, § 111(d) (amending section 3 of the Public Utility Regulatory Policy Act to insert a new definition of "integrated resource planning" as follows: "The term 'integrated resource planning' means, in the case of an electric utility, a planning and selection process for new resources that evaluates the full range of alternatives . . . in order to provide adequate and reliable service to its electric customers at the *lowest system cost*" (emphasis added)).

221 Sarah Brody et al., *Why, and How, Utilities Should Start to Manage Climate-Change Risk*, MCKINSEY & CO. INSIGHTS (Apr. 24, 2019), https://perma.cc/R84Q-YKMY. This is a conservative estimate because it only accounts for "regional increases in extreme weather or storm damage due to sea-level" and no other climate impacts. *See id.*

222 *Id.*

223 Charles Fant et al., *Climate Change Impacts and Costs to U.S. Electricity Transmission and Distribution Infrastructure*, 195 ENERGY 7 (2020), https://perma.cc/QN2J-D4VQ.

224 *Id.*

225 It should be noted that the least cost principle could be relied upon to challenge cost recovery for climate resilience planning and investment. Those activities often involve significant upfront costs, which may necessitate consumer rate increases, at least in the short term. In the longer term, however, climate resilience planning and investments should generate cost savings that can be passed onto ratepayers, as discussed above.

Box 8: Cost Recovery for Climate Resilience Planning and Investments

While it delivers many benefits, climate resilience planning also involves costs. Electric utilities must generally engage consultants or other researchers to develop localized climate projections and analyze the impact of projected conditions on assets (see **Box 2** and **Box 3**). Where vulnerable assets are identified, electric utilities may need to make material investments to enhanced their resilience, for example through hardening or relocation. Electric utilities may be discouraged from investing by uncertainty as to whether, when, and how they will be permitted to recover their costs.[226]

In the case of capital investments, cost recovery typically does not occur until after the electric utility has invested and the relevant state utility commission has determined that the investment was "prudent" and/or resulted in an asset that is "used and useful" (among other requirements).[227] This approach ensures that customers are not burdened with inappropriately incurred costs, but can discourage innovation by electric utilities concerned about the potential for disallowance of investments with novel or unquantified benefits. This is likely to be a particular issue with resilience investments, the benefits of which are often uncertain or difficult to quantify.[228] Compounding this problem, even where benefits are known and quantifiable, they may not be taken into account by state utility commissions. A 2017 study by the Lawrence Berkeley National Laboratory found that several state utility commissions consider only a "[l]imited number of benefit categories" when evaluating resilience investments.[229] For example, the Florida Public Service Commission focuses solely on the value of avoiding physical damage to electric utility infrastructure and does not account for the value to customers of avoiding service interruptions,[230] despite the many tools available to estimate customer interruption costs.[231] State utility commissions should employ those and other tools to assess the full range of benefits of resilience investments. They should also look at using alternatives to cost-benefit analysis, such as breakeven analysis or RDM, to evaluate resilience investments (see **Box 3**).

Even if electric utilities are permitted to recover resilience investments, the regulatory lag—i.e., the gap between when the investments are made and when cost recovery occurs—could undermine their financial viability.[232] This is likely to be less of an issue in states where rate case proceedings are held on an ad hoc basis because, in those states, the electric utility can request adjustment of its rates to reflect new investments when they are made. This is not, however, possible in states where rate case proceedings are held on a fixed schedule (e.g., every three years). In those states, cost recovery may be delayed, which could affect the electric utility's credit rating and thus its ability to obtain financing on reasonable terms. It could also lead to declining profits because the utility is required to cover financing costs internally for long periods of time.

Given the above, electric utilities may want to obtain pre-approval of resilience investments, and/or recover their costs as they are incurred. This could be achieved through cost tracking which, in simple terms, allows a utility to recover the costs associated with a specific activity on a periodic basis outside of its rate case.[233] Historically, cost tracking was only permitted for substantial, variable, and uncontrollable costs that could threaten the utility's financial viability if not recovered outside its rate case (e.g., fuel costs).[234] More recently, however, cost tracking has been permitted in a broader range of circumstances. For example, some state utility commissions have allowed cost tracking for investments in grid modernization technologies (e.g., advanced metering), reasoning that utilities may otherwise be reluctant to invest therein due to their high costs and unquantified benefits.[235] The same will often be true of resilience investments. The appropriateness of allowing cost tracking for resilience investments must be assessed on a case-by-case basis and appropriate customer safeguards put in place. In the grid modernization context, some state utility commissions have capped the total amount utilities can recover through cost tracking and dealt with variations through risk sharing mechanisms, under which cost overruns are borne primarily by the utility and cost under-runs allocated primarily to customers.[236] A similar approach could be used for resilience investments.

226 *See supra* Box 5.

227 As discussed above, some state utility commissions only apply one of the two standards. *See supra* note 203.

228 *See supra* Part 2.1.

229 KRISTINA LACOMMARE ET AL., LAWRENCE BERKELEY NAT'L LAB., EVALUATING PROPOSED INVESTMENTS IN POWER SYSTEM RELIABILITY AND RESILIENCE: PRELIMINARY RESULTS FROM INTERVIEWS WITH PUBLIC UTILITY COMMISSION STAFF 3 (2017), https://perma.cc/FXS9-DSLQ.

230 *Id.* at 25.

3.2 Petitioning the State Utility Commission to Require Climate Resilience Planning

As well as addressing climate risk through rate case proceedings for specific electric utilities, state utility commissions could also deal with the issue in general rulemaking proceedings, involving all electric utilities under their jurisdiction. Through such proceedings a state utility commission could adopt an administrative order or regulation directing electric utilities to engage in climate resilience planning. The CPUC recently did just that, issuing a decision in August 2020 that requires investor-owned electric and gas utilities in California to periodically evaluate risks to their assets, operations, and services from the impacts of climate change.[237] The CPUC decision could serve as a model for other state utility commissions.

The CPUC's work on climate resilience was prompted, in part, by an executive order issued by then-California Governor Jerry Brown in April 2015.[238] The executive order noted that the impacts of climate change "pose tremendous risks to [California's] people, agriculture, economy, infrastructure and the environment" and that accounting for those risks "in planning and decision making will help the state make more informed decisions and avoid high costs in the future."[239] To that end, the executive order directed the California Natural Resources Agency to develop and maintain a statewide climate adaptation strategy, which identifies "vulnerabilities to climate change by sector" and "priority actions" to reduce those vulnerabilities.[240] The California Natural Resources Agency appointed the CPUC, California Energy Commission, and California Department of General Services to lead adaptation efforts in the energy sector.[241] The CPUC subsequently commenced a rulemaking proceeding on its own motion "to consider how to address climate change adaptation for the investor-owned electric and gas utilities" it regulates.[242]

Several other states also have policies regarding climate change adaptation, which could serve as the foundation for state utility commission action on the issue. For example, in October 2019, New Jersey Governor Philip Murphy signed an executive order mandating the development of a Statewide Climate Change Resiliency Strategy outlining measures the state should take to adapt to the impacts of climate change.[243] In justifying the need for such a strategy, Governor Murphy noted that "the severity of future impacts of climate change on our state will directly depend on the willingness and ability of communities, businesses, industries, and government entities to integrate climate change considerations into planning and decision-making."[244] The Governor declared a state-wide policy requiring agencies to "take proactive and coordinated efforts" to plan for, and protect against, climate impacts.[245] That policy could be relied upon by the New Jersey Board of Public Utilities to justify commencing proceedings on electric utility climate resilience.

Where state utility commissions fail to act on climate resilience planning of their own initiative, third parties could petition them to do so. An example of this occurred in December 2012, when a coalition of environmental and public interest organizations filed a petition with the NYPSC, requesting that it direct all electric and other utilities under its jurisdiction to evaluate and plan for climate impacts.[246] The NYPSC did not take any formal action in response to the petition

231 One such tool is the Interruption Cost Estimate ("ICE") Calculator, which was developed by Lawrence Berkeley National Laboratory and Nexant, Inc. The ICE Calculator can be used to estimate the cost of electricity outages per interruption event, per average kilowatt, or per unserved kilowatt hour. *See* U.S. Dep't of Energy, Lawrence Berkeley Nat'l Lab., & Nexant, Inc., *ICE Calculator*, https://www.icecalculator.com/home. The Florida Public Service Commission reportedly does not use the ICE Calculator or similar tools due to concerns about their accuracy. *See* LACOMMARE ET AL., *supra* note 229, at 3, 25.

232 KEN COSTELLO, NAT'L REGUL. RSCH. INST., THE TWO SIDES OF COST TRACKERS: WHY REGULATORS MUST CONSIDER BOTH 4, 14 (2009), http://perma.cc/255P-MJEA.

233 *Id.* at 1-2.

234 *Id.* at 7-8.

235 For a discussion of the use of cost tracking mechanisms in this context, *see* ROMANY M. WEBB, DEPLOYING ADVANCED METERING INFRASTRUCTURE ON THE NATURAL GAS SYSTEM: REGULATORY CHALLENGES AND OPPORTUNITIES (2018), https://perma.cc/SY7A-XTRJ.

236 *See id.* at 22-23.

237 Cal. Pub. Utils. Comm'n, *supra* note 130.

238 Cal. Exec. Order. B-30-15, *supra* note 117.

239 *Id.* at pmbl.

240 *Id.* at art. 4.

241 CAL. NAT. RES. AGENCY, *supra* note 118, at 6.

242 Cal. Pub. Utils. Comm'n, *supra* note 129.

243 N.J. Exec. Order No. 89 (Oct. 29, 2019), https://perma.cc/LQ5G-XGZP.

244 *Id.* at pmbl.

245 *Id.*

246 *See* Letter from Anne R. Siders, Assoc. Dir., Ctr. for Climate Change L., et al. to the Hon. Jaclyn A Brilling, Sec'y, N.Y. Pub. Serv. Comm'n (Dec. 12, 2012) (on file with authors) [hereinafter "NYPSC Petition"].

but, in a letter to the petitioners, then acting secretary of the Commission Jeffrey Cohen noted that New York Governor Andrew Cuomo had called for climate resilience planning and indicated that staff were working to identify planning approaches that were in the "best interests of ratepayers."[247] The issues raised in the petition were ultimately dealt with in the Resiliency Collaborative convened by the NYPSC as part of Con Ed's 2013 rate case.[248]

Like the NYPSC, other state utility commissions also allow third parties to file petitions seeking declaratory orders or the adoption or amendment of regulations. While the filing rules vary between states, there are often no or few restrictions on who can petition the commission, with many states allowing any person to do so, even if they do not have a demonstrated legal interest in the matter at issue.[249] Thus, unlike intervenors in rate case proceedings (discussed above), petitioners are often not required to show that their legal rights or duties will be affected by the outcome of the petition.[250]

State utility commissions typically require petitions seeking the adoption or amendment of regulations to include suggested regulatory language.[251] Petitions must also explain why regulatory or other action is being sought, the anticipated effects of such action, and the commission's legal authority to take it.[252] The latter is particularly important because, as most are statutory creations, state utility commissions can only act on petitions to the extent permitted under their authorizing statutes and related judicial decisions.[253]

Petitions regarding climate resilience planning could point to a number of legal principles that authorize, and in some cases even require, state utility commissions to act. Perhaps most notably, state utility commissions are responsible for ensuring that electric utilities fulfil their statutory "duty to serve," including by providing reliable services to customers. Climate resilience planning by electric utilities is necessary to assure long-term service reliability and thus fulfil the duty to serve.

Originally developed through the common law, and now codified in state statutes, the duty to serve has been described as requiring electric utilities "to provide extraordinary levels of service to customers."[254] The duty encompasses, among other things, an obligation to provide "adequate service."[255] While each state has its own formulation, service adequacy is often defined in terms of reliability, with electric utilities expected to take appropriate steps to prevent outages and restore service promptly when they occur.[256] As the California supreme court succinctly explained more than half a century ago in *Langley v. Pacific Gas & Electric Co.*, electric utilities must "exercise reasonable care in operating [their] system[s] so as to avoid unreasonable risks of harm" to their customers as a result of outages.[257] This principle was recently reiterated by a California court of appeal in *Mobil Oil Corp. v. Southern California Edison Co.*[258] In that case, the court held that while electric utilities are not expected to (and cannot) prevent all outages, they must take steps to minimize the effect thereof on customers, including by engaging in appropriate planning.[259]

247 Letter from Jeffrey C. Cohen, Acting Sec'y, N.Y. Pub. Serv. Comm'n, in Response to the Petition of the Center for Climate Change Law at Columbia University Regarding Natural Hazard Planning, Matter No. 12-02755 (Jan. 16, 2013) (on file with authors).

248 *See supra* Part 2.3.3.

249 *See, e.g.*, OR. ADMIN. R. 860-001-0250 (providing that any "person may petition the Commission to promulgate, amend, or repeal a rule"); *see also id.* 860-001-0010; OR. REV. STAT. § 765.010(5) (defining "person" to include "individuals, joint ventures, partnerships corporations, and associations or their officers, employees, agents, lessees, assignees, trustees or receivers").

250 *See supra* Part 3.1.

251 *See, e.g.*, CAL. CODE REGS. tit. 20, § 6.3(b) (stating that, where a petition seeks "adoption or amendment of a regulation," it "must include specific proposed wording for that regulation").

252 *See, e.g.*, OR. ADMIN. R. 137-001-0070 (requiring petitions to include "[f]acts or arguments in sufficient detail to show the reasons for and effects of adoption, amendment, or repeal of the rule" and "[a]ll propositions of law to be asserted by the petitioner").

253 Some state utility commissions are established in the relevant state constitution. *See, e.g.*, CAL. CONST., art. XII.

254 Jim Rossi, *The Common Law "Duty to Serve" and Protection of Consumers in an Age of Competitive Retail Public Utility Restructuring*, 51 VAND. L. REV. 1233, 1242 (1998), https://perma.cc/W5CV-853C; Jim Rossi, *Universal Service in Competitive Retail Electric Power Markets: Whither the Duty to Serve?* 21 ENERGY L. J. 27, 29 (2000), https://perma.cc/EZA6-2NAE.

255 *See, e.g.*, CAL. PUB. UTIL. CODE § 451 ("Every public utility shall maintain such adequate, efficient, just, and reasonable service, instrumentalities, equipment, and facilities . . . as are necesary [sic] to promote the safety, health, comfort, and convenience of its patrons, employees, and the public."); N.J. STAT. ANN. § 48:2-23 ("The board may . . . require any public utility to furnish safe, adequate and proper service."); 66 PA. CONS. STAT § 1501 ("Every public utility shall furnish and maintain adequate, efficient, safe, and reasonable service and facilities.").

256 *See generally* Note, *The Duty of a Public Utility to Render Adequate Service: Its Scope and Enforcement*, 62 COLUM. L. REV. 312, 312-13 (1962) (noting that, while "[t]he standard of adequacy is incapable of precise definition," state statutes generally require utilities to "provide safe, continuous, comfortable, and efficient service," and "to take precautions against [service interruptions] and to restore service as quickly as possible" (internal citations omitted)).

257 Langley v. Pacific Gas & Elec. Co., 262 P.2d 846, 853 (Cal. 1953).

258 No. B145834, 2003 Cal. App. Unpub. LEXIS 595 (Cal. Ct. App. Jan 21, 2003).

259 *Id.* at *23-24.

Unless electric utilities plan for climate change, the more frequent and severe storms and other extreme weather events it brings will lead to additional and longer-lasting electricity outages, with potentially severe consequences for customers. Electric utilities can, however, minimize the risk of outages and their effect on customers by engaging in climate resilience planning. As discussed in Part 2.1, climate resilience planning enables electric utilities to identify where and when their systems are vulnerable to the impacts of climate change and develop solutions to mitigate those vulnerabilities, such that they can continue to provide reliable electricity services to customers despite climate change.

Requiring electric utilities to take steps to avoid future reliability issues falls squarely within state utility commissions' regulatory mandate. There is no doubt that climate resilience planning is necessary for electric utilities to operate their systems with "reasonable care" so as to "avoid unreasonable risks of harm" to their customers. Indeed, with the impacts of climate change and their effects on electric systems now well documented in numerous government and other reports,[260] it is not reasonable for electric utilities to continue operating their systems based on past climate conditions. Doing so exposes customers to an unreasonable risk of harm from increasingly frequent and severe outages, which could be avoided or mitigated by employing proven climate resilience planning techniques.

Relatedly, where state law imposes requirements on electric utilities with respect to storm or other extreme event preparedness that provides another legal justification for requiring climate resilience planning. For example, the December 2012 petition filed with the NYPSC cited section 66 of the New York Public Service Law, which requires electric utilities to develop "emergency response plans" that outline measures to prepare for, and ensure prompt restoration of service after, storms and similar events.[261] The petition noted that electric utilities' emergency response plans focus solely "on anticipation and response to disasters in the short-term" and argued that "[a]dequately planning for storms, as required under the Public Service Law, requires long-term assessment of risks," based on "future climate predictions."[262] This enables electric utilities to make a more informed assessment of how frequently storms will occur, their likely severity, and what system changes are needed to prevent and manage associated outages.[263]

260 *See supra* note 14.

261 NYPSC Petition, *supra* note 246, at 5; *see also* N.Y. PUB. SERV. LAW § 66. Similar planning obligations are imposed on electric utilities in many other states. *See, e.g.*, FLA. STAT. § 366.96; MASS. GEN. LAWS. Ch. 164, § 85B; 25 TEX. ADMIN. CODE § 25.53.

262 NYPSC Petition, *supra* note 246, at 5-6.

263 *Id.* at 6.

PART 4:

Advancing Climate Resilience Through Tort Law Claims in State Court

Part 3 considered whether and when state public utility law requires electric utilities to address the consequences of climate change through climate resilience planning. In this Part we consider the use of tort law to advance climate resilience planning in the electric utility sector.

Although factual considerations often remain similar in the context of public utility and tort law, and the evidence identified in Part 2 will be relevant in both areas, the two bodies of law diverge in material ways. Most significantly, whereas claims grounded in public utility law will often center primarily on anticipated impacts of climate change, tort law claims will generally be based upon some prior impact. For the purpose of this paper, we term the contemplated tort law claim a 'climate resilience claim,' and define it as a claim arising from an electric utility's failure to adequately prepare for reasonably foreseeable event- and non-event-based climate impacts to owned assets and/or operations where that failure results in cognizable harm. Cognizable harm could include injury to persons and/or property damage resulting from electricity service outages, for example where a heat wave causes a transmission line to sag, triggering an outage that results in a blackout at the premises of a customer who uses electricity to power a medical device. Climate resilience claims could also arise in situations where the harm (e.g., personal injury or property damage) is not directly connected to, or the result of, a service outage. One example might be where transmission line sag caused by a heat wave sparks a wildfire which damages property.[264]

This Part explores whether and when a climate resilience claim could be brought against an electric utility in connection with its failure to engage in climate resilience planning The Part proceeds in primarily four subparts, modeled upon common law tort claims. First, the Part explores the bounds of an electric utility's duty of care, and argues that it encompasses a duty to prepare for the impacts of climate change. Second, the Part describes how such a duty might be breached by failing to engage in climate resilience planning. Four approaches to identifying breach are discussed in particular: risk-utility analysis, the multi-factor balancing test, industry custom, and public policy considerations. Third, causation is considered, with particular emphasis upon proximate cause and foreseeability. Fourth, harm is explored, with the underlying retroactive basis for tort claims noted above distinguished from the fundamentally proactive focus which undergirds state utility commission proceedings. Before turning to those subparts, however, we first address questions of precedent.

4.1 Climate Resilience Claims and Precedent

In examining climate resilience claims, this work draws primarily from three sources of precedent: (1) extreme weather tort claims, (2) statutory failure to adapt claims, and (3) tort claims premised on defendant's direct greenhouse gas emissions or sale of fossil fuels. Climate resilience claims, however, are premised upon a different theory and basis than these sources of examined precedent, and are therefore compared and distinguished in this subpart.

In borrowing from precedent, we rely most heavily upon negligence suits brought against electric utilities in the context of extreme weather events, which we term 'extreme weather tort claims.' Such claims typically arise from an electric utility's failure to adequately prepare for, or respond to, a particular extreme weather event that impacts its owned assets or operations. Take, for example, *Rich Mountain Electric Cooperative, Inc. v. Revels*.[265] There, a severe storm took down a tree, which in turn pulled down one of the utility's distribu-

264 Importantly, we do not foreclose the possibility of some tort law climate resilience claim based on the showing of event not yet occurred. We do not, however, consider such issues here.

265 841 S.W.2d 151 (Ark. 1992).

tion lines, causing power outages.[266] As a result, the plaintiff—a chicken farmer—was unable to operate cooling equipment in his sheds, which resulted in the death of several thousand chickens when temperatures skyrocketed to over 100 degrees Fahrenheit the following day.[267] Plaintiff argued that the utility should have "more diligently pursued the cause of the outage."[268] The court agreed, holding that the utility "is required to use active diligence to discover defects in its system," but "had not been actively diligent in pursuing the outage."[269]

Extreme weather tort claims and climate resilience claims share similarities. The form of the injury can overlap[270] and questions of foreseeability are often central to analysis.[271] Yet the claims diverge in important ways. Temporally, an extreme weather tort claim generally focuses on the electric utility's immediate actions in response to an impending or recently occurred event, and questions of negligence center upon the reasonableness of that activity within a relatively short timeframe. The focus of Rich Mountain Electric, for example, was upon utility action in the hours before and after the storm.[272] A climate resilience claim, however, is focused on the sufficiency of longer-term utility planning for climate change. The focus is on whether the utility has adequately incorporated climate considerations into its operating procedures, practices, and decisions regarding capital investments and expenditures. These distinctions have important implications for utility obligation. While an extreme weather tort claim may focus inquiry on whether, for example, the utility's emergency response or customer notification was reasonable, a climate resilience claim would center analysis on the extent to which the utility's long-term planning reasonably considered the impacts of climate change on assets and operations.

Looking forward, extreme weather tort claims and climate resilience claims may be complementary and brought together. Because both claims can be premised upon similar events and harms, but are different legal theories, future actions may present both to the court to capture a wider range of utility policies and practices.

A second body of relevant precedent is found in statutory "failure to adapt" lawsuits.[273] These cases, like the Conservation Law Foundation's ("CLF") lawsuits against ExxonMobil and Shell, are premised on each defendant's failure to consider climate change impacts in complying with their statutory and permitting obligations. In both cases, CLF alleges that the companies failed to consider known climate change-induced effects in designing and implementing protective measures for their facilities as required by federal law.[274] These claims provide helpful comparison, as they, like climate resilience claims, premise argument upon an actor's failure to plan for reasonably foreseeable impacts of climate change to assets and operation. These claims should be distinguished, however, as they have a statutory basis, whereas climate resilience claims are premised upon common law obligations.[275]

Third and finally, we also consider tort law claims premised on an entity's contribution to climate change, either direct or indirect. Some cases, like *American Electric Power Co. v. Connecticut*, brought under federal common law, sought to hold defendants liable for their direct emission of climate-damaging greenhouse gases.[276] Other cases have been brought against fossil fuel companies in respect of the climate damage caused by the production and use of their products. Two recent examples are *City of Baltimore v. BP* and *County of San Mateo v. Chevron*. There,

266 *Id.* at 152.

267 *Id.*

268 *Id.* at 153.

269 *Id.* (quoting Stacks v. Ark. Power & Light Co., 771 S.W.2d 754 (Ark. 1989)).

270 For example, in both extreme weather tort claims and climate resilience claims, the "harm" could involve personal injury or property damage resulting from electricity service outages. *See* Part 4.5 infra.

271 *See* Parts 4.2 and 4.4 infra.

272 841 S.W.2d at 153-54.

273 CONSERVATION L. FOUND., CLIMATE ADAPTATION AND LIABILITY: A LEGAL PRIMER AND WORKSHOP SUMMARY REPORT (2018), https://perma.cc/8B4C-NBDS; Dena P. Adler, *Turning the Tide in Coastal and Riverine Energy Infrastructure Adaptation*, 4 OIL & GAS, NAT. RES. & ENERGY J. 519, 520 (2018), https://perma.cc/5UNG-ZK7N.

274 *See infra* notes 311-312 and accompanying text.

275 Complaint for Declaratory and Injunctive Relief and Civil Penalties, Conservation L. Found. v. ExxonMobil Corp., No. 1:16-cv-11950 (D. Mass. Sept. 29, 2016), https://perma.cc/MD99-LKYW [hereinafter CLF ExxonMobil Complaint]; Complaint for Declaratory and Injunctive Relief and Civil Penalties, Conservation L. Found. v. Shell Oil Products US, No. 1:17-cv-00396 (D.R.I. Aug. 28, 2017), https://perma.cc/8XKG-5MKM [hereinafter CLF Shell Complaint]. Another example, while not actively referencing or relying on climate change, is the wave of lawsuit brought after Arkema's Crosby Facility in Houston exploded in the wake of Hurricane Harvey. Those suits allege Arkema failed to adapt to the increased chance of greater flooding by not implementing procedures for handling dangerous chemicals in such a situation. *See* Harris County's Original Petition and Application for Permanent Injunction at 8, Harris County, Texas v. Arkema, Inc., No. 2017-7691 (Tex. Dist. Ct. Nov. 16, 2017), https://perma.cc/C8JT-KJLM; Plaintiffs' Original Petition and Application for Temporary Restraining Order and Temporary Injunction and Request for Disclosure, Graves v. Arkema, Inc. (Tex. Dist. Ct. Sept. 7, 2017), https://perma.cc/L79L-P8SB.

276 Am. Elec. Power Co. v. Connecticut, 564 U.S. 410 (2011).

Box 9: Wildfires and Climate Resilience Claims

Recent wildfires in the western U.S. serve as an increasingly alarming and visible example of climate change-amplified extreme weather. Entities charged with operation of the electric grid increasingly acknowledge the intersections among extreme weather, electricity service, and consequences of climate change. The CAISO concluded, for example, that "climate change-induced extreme heat storm across the western U.S." contributed to recent supply shortfalls and electricity outages[277] (see **Box 4**). The CPUC has likewise made clear that utilities "need to ensure a comprehensive approach to climate change risk is developed across all of the [utilities'] various departments to ensure a comprehensive approach to the [utilities'] climate change adaptation efforts."[278]

Wildfires in the western U.S. have also been the focus of significant litigation, with the 2018 Camp Fire a primary example. The Camp Fire, sparked by a faulty electric transmission line owned by PG&E and worsened by climate change-induced drought and high temperatures, resulted in the deadliest and most destructive wildfire in California's history at the time, with over 153,000 acres burned, 18,000 structures destroyed, and 85 fatalities.[279] PG&E faced a variety of subsequent claims and claimants, ultimately resulting in criminal charges, bankruptcy, and a CPUC approved settlement (among other things).

The CPUC's Safety and Enforcement Division found a number of failures on the part of PG&E in the context of the Camp Fire, including failure to maintain, reinforce, and regularly inspect its transmission lines and other equipment. The CPUC itself found that the utility had a "demonstrated record of failing to comply with Commission directives, including those related to vegetation management."[280]

Failure to properly maintain equipment serves as a basis for many extreme weather tort claims. In *Arkansas Valley Electric Cooperative Corp. v. Davis*, for example, the plaintiff was injured after coming into contact with a fallen electric power line.[281] The plaintiff argued that the injury was due to the defendant utility's negligence in failing to "replace the pole which they knew to be deteriorated" and failing to "maintain the pole and power line."[282] The Arkansas supreme court found that the lower court's inference of negligence was reasonable and based on substantial evidence, including findings that "the pole was at twenty-five percent strength," and insufficiently buried.[283] The defendant contended in response that the injury was an act of God, meaning a "violent disturbance of the elements such as a storm, a tempest, or a flood."[284] The court, in finding against defendant, carefully distinguished the negligent conduct at issue from a liability due to damages caused "solely by an act of God."[285] The court held that "[i]f an act of God concurs with the negligence or fault of man to proximately cause damages, the negligence or fault is not excused by the act of God."[286]

Failure to properly maintain equipment might also serve as a basis for a climate resilience claim. As noted above, climate-amplified wildfires are increasingly foreseeable, and an electric utility's failure to adequately prepare for such a reasonably foreseeable event may establish a basis for liability. That is, electric utility planning standards, equipment deployments, investment decisions, and operational decisions must keep pace with the impacts of climate change. Not doing so raises claims of negligence and implicates the electric utility's duty of care. Why then, has negligence not been the focus of ongoing and multiple PG&E wildfires?[287]

California is unique among states in applying the doctrine of inverse condemnation to its electric utilities. Under this doctrine, electric utilities are "held strictly liable for any wildfire caused by utility equipment regardless of standard of care or negligence."[288] Negligence has not been the standard, and thus not the aim, of litigation.[289] Other jurisdictions do not similarly apply inverse condemnation to electric utilities. Some other standard, and most often negligence, will thus be relevant to considering a utility's liability under a similar fact pattern.

277 Press Release, CAISO, CPUC, and CEC Issue Preliminary Report on Causes of August Rotating Outages (Oct. 6, 2020), https://perma.cc/3GX9-9ELJ.

278 Cal. Pub. Utils. Comm'n, *supra* note 130, at 107.

279 Cal. Pub. Utils. Comm'n, Investigation 19-06-015: Decision Approving Proposed Settlement Agreement with Modifications, at 3 (May 7, 2020), https://perma.cc/FF3M-98JH.

280 *Id.* at 73.

281 800 S.W.2d 420 (Ark. 1990).

282 *Id.* at 421.

283 *Id.* at 422.

284 *Id.* at 423.

285 *Id.*

286 *Id.*

plaintiff local governments have sought to impose liability for adaptation measures in response to rising sea levels and other climate impacts on the companies that have profited from the production and sale of fossil fuels.[290] The cases center upon the production and promotion of fossil fuels by defendants and the alleged disinformation campaign mounted by them to obscure the inevitable climate effects of defendants' activities.[291] A climate resilience claim is premised upon a different theory and basis. Specifically, a climate resilience claim, as considered here, focuses on the defendant's failure to adequately prepare for the impacts of climate change on its own assets and operations.

Given the untested nature of climate resilience claims, likely obstacles and challenges are particularly important to consider. Some, such as interaction between civil and public utility commission forums, and potential regulatory barriers such as limitation of liability provisions in utility tariffs are explored in greater detail in Part 5, *infra*. Others, such as the highly complex and technical nature of the evidence required to establish a climate resilience claim, and variation in tort and utility law across states are not exhaustively addressed in this paper and deserve careful consideration and further attention.

4.2 Duty of Care

In tort law, whether an electric utility has an obligation to consider the consequences of climate change turns first upon the presence of a duty. This duty is most often—but not always, see Box 10—a duty of care. *The Restatement (Second) of Torts*, describes the duty of care to "denote the fact that the actor is required to conduct himself in a particular manner at the risk that if he does not do so he becomes subject to liability to another to whom the duty is owed for any injury sustained by such other, of which that actor's conduct is a legal cause."[292] That is, the law imposes "a duty of reasonable care to avoid foreseeable harm when performing acts that could injure others."[293] In considering whether a duty of care is present, two inquiries are relevant: "(1) to whom is the duty owed and (2) what does the duty entail."[294]

4.2.1 To Whom Is the Duty of Care Owed?

The test to be used to identify to whom the duty of care is owed remains a topic of debate, largely centered upon the extent to which inquiry must be relational. Dueling opinions in *Palsgraf v. Long Island Railroad*, provide two analytic poles. Judge Cardozo's majority opinion conceived of duty as relational and turning on whether the aggrieved party is within the zone of foreseeable risk.[295] An "act is only negligent with respect to specific parties and specific harms."[296] In contrast, in his dissenting opinion, Judge Andrews described the duty of care as being "imposed on each one of us to protect society from unnecessary danger, not to protect A, B, or C alone."[297] Relational inquiry is thus not central, nor instructive, to Judge Andrews' enunciation. Analysis of these dueling theories of the duty of care is beyond the scope of this particular

287 We do not suggest here that negligence has never been alleged in the context of the 2018 Camp Fire. Rather, we seek to explicate California's unique liability structure for electric utilities and suggest that a climate resilience claim, rather than application of inverse condemnation doctrine, is more likely relevant to other jurisdictions.

288 COMM'N ON CATASTROPHIC WILDFIRE COST & RECOVERY, FINAL REPORT OF THE COMMISSION ON CATASTROPHIC WILDFIRE COST AND RECOVERY 4 (June 17, 2019), https://perma.cc/5QUC-SB6D.

289 We do not suggest here that PG&E was not negligent. Others have opined at length on the utility's actions and activities. We focus here only of the lack of its relevancy to establishing liability.

290 Plaintiff's Complaint, Mayor & City Council of Baltimore v. BP P.L.C., No. 24-C-18-004219 (Md. Cir. Ct. July 18, 2019), https://perma.cc/DQ33-WY57 [hereinafter Baltimore Complaint]; Complaint, County of San Mateo v. Chevron, No. 17 Civ. 03222 (Cal. Super. Ct. July 17, 2019), https://perma.cc/U7Z9-D83C [hereinafter San Mateo Complaint]. Suits against fossil fuel companies have also been brought by private parties. *See* Comer v. Murphy Oil USA, Inc., 585 F.3d 855 (5th Cir. 2009) (holding plaintiffs had standing and that none of the claims presented non-justiciable political questions), *reversed and remanded*, 607 F.3d 1049 (5th Cir. 2010) (Fifth Circuit local rules require that decisions be vacated when rehearing en banc is granted. In this case, the Fifth Circuit granted rehearing and then lost quorum due to the recusal of a judge. It therefore dismissed the appeal and the let the district court's dismissal of the case stand because it had already vacated its previous decision.), *dismissed on remand*, 839 F. Supp. 2d 849 (S.D. Miss. 2012) (holding that the plaintiffs' claims were barred by the doctrines of res judicata and collateral estoppel or, alternatively, that the plaintiffs did not have standing to assert their claims), *affirmed*, 718 F.3d 460 (5th Cir. 2013) (upholding the district court's dismissal of the case on the basis of res judicata).

291 *See, e.g.*, San Mateo Complaint, *supra* note 277, at ¶¶ 252, 254 (arguing that "[g]iven the grave dangers presented" a "reasonable" fossil fuel producer "would have warned of those known, inevitable climate effects"); Baltimore Complaint, *supra* note 277, at ¶ 10 ("Defendants' production, promotion, marketing of fossil fuel products, simultaneous concealment of the known hazards of those products, and their championing of anti-science campaigns, actually and proximately caused Plaintiff's injuries.").

292 RESTATEMENT (SECOND) OF TORTS § 4 (1965).

293 Alice C. Hill, Jump-Starting the Fight Against Climate Change: The Courts, BULLETIN OF THE ATOMIC SCI. (Sept. 25, 2019), https://perma.cc/36JB-2SEJ.

294 David Hunter & James Salzman, Negligence in the Air: The Duty of Care in Climate Change Litigation, 155 U. PENN. L. REV. 1741, 1746 (2007), https://perma.cc/LS5Z-9QNB.

295 "Negligence in the air, so to speak, will not do." Palsgraf v. Long Is. R. Co., 162 N.E. 99, 99 (N.Y. 1928).

296 Hunter & Salzman, *supra* note 281, at 1747.

297 *Id.*

paper.[298] It is, however, notable that both theories require an assessment of the foreseeability of injury which provides flexibility and malleability in analysis on the basis of evidence. Duty owed does not depend upon nor is it necessarily constrained by "contract, privity of interest or the proximity of relationship."[299] Rather, facts and evidence, such as that described in Part 2, are relevant to informing potential plaintiff class.

Climate resilience claims are based upon an electric utility's failure to respond to the consequences of climate change. A defined set of individuals—i.e., those who experience electricity service disruptions or other adverse effects as a result of the utility's operation in the context of a climate-induced extreme weather event or change in baseline weather conditions—are at risk of harm from the utility's failure to identify and plan for the impacts of climate change. Even so, however, questions remain as to precisely to whom the electric utility owes a duty of care. Should, for example, the duty be extended to all of the electric utility's customers? Any individual within the electric utility's particular service territory? Is service territory even an instructive framework, or should a different delineation be employed? Here, we turn to extreme weather tort cases to inform our analysis. As explained in greater detail in Part 4.1, we view this area of case law to be most adjacent and thus most useful to analysis throughout this Part.

Case law involving extreme weather torts is relatively consistent in holding that a duty of care is owed, at a minimum, to electric utility ratepayers.[300] Whether and to what extent such a duty of care is additionally owed to non-ratepayers is less straightforward. *Strauss v. Belle Realty Co.* is an oft-cited case in this context. The case arose out of a 1977 city-wide blackout in New York City.[301] Plaintiff Strauss injured himself falling down stairs during the blackout, and argued his injury resulted from Con Ed's negligent failure to maintain power.[302] The court rejected the plaintiff's argument, finding that Con Ed owed no duty of care to Strauss—the plaintiff was injured in the common area of his building where electricity was provided under a contract with the building owner not Strauss.[303] The court premised its holding on public policy grounds: "We conclude that in the case of a blackout of a metropolis of several million residents and visitors, each in some manner necessarily affected by a 25-hour power failure, liability for injuries in a building's common areas should, as a matter of public policy, be limited by the contractual relationship."[304]

The holding in *Strauss* creates specific limitations regarding who is owed a duty. Read narrowly, *Strauss* suggests that ratepayers alone are foreseeable. But the case may be better interpreted as a floor, rather than a ceiling, in determining who is owed a duty in the context of climate risk. The opinion itself leaves open the possibility, holding that "[a]s this court has long recognized, an obligation rooted in contract may engender a duty owed to those not in privity."[305] Limiting duty by contractual relationship is thus not premised in some legal basis, but instead was a choice based in moral values and social policies,[306] used to "limit the legal consequences of wrongs to a controllable degree."[307] That is, contractual relationship was adopted by the court primarily to limit liability "which could obviously be 'enormous,'" not due to some intrinsic value in privity between parties.[308]

4.2.2 What Does the Duty of Care Entail?

The duty of care is generally understood to require an entity to not create unreasonable risk, but precise language varies depending upon the specific tort and jurisdiction. The duty in negligence cases is "to act reasonably or not to act in such a way that creates an

298 "Volumes have been written about these two opinions and volumes more no doubt will follow." Douglas A. Kysar, *What Climate Change Can Do About Tort Law*, 41 ENV'T L. 1 (2011), https://perma.cc/FJ3J-M9FJ.

299 *Id.* at 10; *see also* John C.P. Goldberg & Benjamin C. Zipursky, *The Restatement (Third) and the Place of Duty in Negligence Law*, 54 VAND. L. REV. 657, 707 (2001), https://perma.cc/V3AD-37L8 ("[T]he fact that duty is relational and relationship-sensitive *does not* entail the further claim that the existence of a prior relationship between defendant and plaintiff is a prerequisite to the existence of an obligation of care running from the defendant to the plaintiff.").

300 *See, e.g.*, Praetorian Ins. Co. v. Long Is. Power Auth., No. 704580/2014, 2019 N.Y. Misc. LEXIS 2952 (N.Y. Sup. Ct. Apr. 10, 2019) (discussing precedent in which customers were owed a duty); Schulze v. La. Power & Light Co., 551 So. 2d 22 (La. Ct. App. 1989) (noting utilities have a duty to protect customers from sudden discontinuance of service); Nat'l Food Stores, Inc. v. Union Elec. Co., 494 S.W.2d 379 (Mo. App. 1973) (finding utility has duty to protect customers from foreseeable damage from failure of electrical service); *cf.* Rehab. Ctr. at Hollywood Hills, LLC v. Fla. Power & Light Co., No. 4D19-1786, 2020 Fla. App. LEXIS 6981 (Fla. App. Ct. 2020) (prohibiting non-ratepayer plaintiffs on the basis that doing so would unreasonably extend utility's "zone of risk").

301 Strauss v. Belle Realty Co., 482 N.E.2d 34, 35 (N.Y. 1985).

302 *Id.*

303 *Id.* at 38.

304 *Id.* at 35.

305 *Id.* at 36.

306 David G. Owen, *Duty Rules*, 54 VAND. L. REV. 767, 778 (2001), https://perma.cc/KT2R-YB9F.

307 *Strauss*, 482 N.E.2d at 36 (quoting Tobin v. Grossman, 249 N.E.2d 419, 424 (N.Y. 1969)).

308 *Id.* (citation omitted).

unreasonable risk of harm."[309] This aspect of the duty inquiry thus centers upon "whether certain sorts of risks . . . are properly within the ambit of [the defendant's] responsibility."[310]

Ongoing "failure to adapt" cases, premised upon statutory violation, provide one analogue when considering what the duty of care requires in the climate resilience context. Like climate resilience claims, these cases are oriented to an entity's failure to plan for reasonably foreseeable climate change impacts, but the statutory text, rather than tort law, informs content and obligation. *Conservation Law Foundation v. ExxonMobil* and *Conservation Law Foundation v. Shell Oil Products US* serve as the primary examples. In both cases, plaintiff CLF initiated still-extant citizen suits against ExxonMobil and Shell Oil Products US ("Shell"), respectively, alleging the companies had violated the Resource Conservation and Recovery Act ("RCRA") and the Clean Water Act ("CWA") by failing to incorporate known climate change-induced risks into their required permitting application under the statutes.[311] Specifically, the suits allege that ExxonMobil and Shell failed to account for climate change-induced effects—such as sea level rise, increased precipitation, increased magnitude and frequency of storm events and storm surges, and lack of preventative infrastructure—in their statutorily required stormwater pollution prevention plans, spill prevention, control and countermeasure plans, and facility response programs for their terminals in Massachusetts and Rhode Island (respectively). Of particular import, the statutorily required plans must be made in accordance with "good engineering practices," but CLF contends the ExxonMobil and Shell plans were not based on information regarding climate change-induced impacts known to reasonably prudent engineers.[312] The complaints assert that ExxonMobil and Shell knew of these impacts, but failed to design and implement protective measures to fortify their terminals as required by federal law.

The interplay between climate risk and possible statutory claims is beyond the scope of this paper, and remains an important area in need of further research. Relevant here, however, is how such claims might provide a model for the duty of care in a climate resilience claim. In both CLF lawsuits, the courts must consider whether the defendants violated the requirements of their permits by failing to consider the known risk of foreseeable climate change impacts. Climate resilience claims would turn on a similar question: whether electric utilities must consider, as part of their duty of care, the known risk of foreseeable climate change impacts on their assets and operations. An electric utility's duty of care requires one "to act reasonably or not to act in such a way that creates an unreasonable risk of harm."[313] As demonstrated in Part 2, climate change impacts on electric utilities' assets and operations are increasingly knowable, as are the consequent risks of harm to utility customers. A reasonable and logical—a prudent—electric utility would integrate climate risk into decision-making.[314] Addressing climate risk through resilience planning may thus be within the ambit of an electric utility's responsibility.

Elucidating with a high-degree of precision and uniformity what the duty of care entails may prove challenging, however, in a climate resilience claim. Two tort cases brought against electric utilities in connection with extreme weather events highlight different ways that courts have approached a similar inquiry. First, in *Praetorian Insurance Co. v. Long Island Power Authority*, a New York court was asked to consider relatively novel questions of duty in the aftermath of Superstorm Sandy.[315] Plaintiffs in the case, still ongoing at the time of writing, alleged that the storm had resulted in the loss and destruction of their properties through a confluence of flooding and energized wiring and that the electric utility had a duty to de-energize lines before a storm. The court held that electric utilities are "under a duty to exercise reasonable care

309 Hunter & Salzman, *supra* note 281, at 1746. The inquiry into the content of the duty of care provides a basis to consider whether failing to take certain actions is unreasonable, issues taken up when determining breach, discussed infra. *See* Goldberg & Zipursky, *supra* note 299, at 703-04 ("It is, of course, always *possible* to describe these cases as 'breach' rather than 'duty' cases. . . . The line between duty and breach issues is sometimes blurry. . . .").

310 *Id.* at 705. Courts often conflate duty and breach by deciding questions of breach under the guise of duty. *See id.* at 713 (discussing the use of duty in the sense of "Breach-as-a-Matter-of-Law").

311 CLF ExxonMobil Complaint, *supra* note 275; CLF Shell Complaint, *supra* note 275. The case against ExxonMobil remains undecided, and is currently subject to a federal primary jurisdiction doctrine dispute, whether EPA should have an opportunity to review the permit through the ongoing permit renewal process. In March 2020, the district court granted ExxonMobil's request for a stay until EPA makes a determination on the renewal. Conservation L. Found. v. ExxonMobil Corp., 448 F. Supp. 3d 7 (D. Mass. 2020). The stay is now on appeal before the First Circuit. *See* Notice of Appeal, Conservation L. Found. v. ExxonMobil Corp., No. 1:16-cv-11950-MLW (D. Mass. Apr. 17, 2020), https://perma.cc/GW7W-RH8T. This inquiry is closely related to questions of forum discussed in detail in Part 5.1, below. The case against Shell survived a motion to dismiss and has advanced to the discovery phase, with the court rejecting primary jurisdiction and abstention arguments. Conservation L. Found. v. Shell Oil Products US, No. 17-396 WES, 2020 WL 577874, at *4 (D.R.I. Sept. 28, 2020).

312 CLF ExxonMobil Complaint, *supra* note 275, at 59; CLF Shell Complaint, *supra* note 275, at 62.

313 Hunter & Salzman, *supra* note 281, at 1746.

314 *See supra* Part 3.1.1.

315 Praetorian Ins. Co. v. Long Is. Power Auth., No. 704580/2014, 2019 N.Y. Misc. LEXIS 2952 (N.Y. Sup. Ct. Apr. 10, 2019).

in the supply of electric service."[316] Electric utilities must exercise that duty in a way "commensurate with the inherent danger hidden in its high voltage equipment."[317] The court avoided answering "whether defendants, having been able to de-energize [its power lines ahead of Superstorm Sandy], 'acted with the degree of care which was commensurate with the risk to which it had exposed' the Plaintiffs."[318] The court viewed that as a question of breach to be answered by the jury.[319] Similarly, in considering a climate resilience claim, a court might conclude that the duty is to take reasonable action commensurate to the risk to the plaintiff (of outages, for example) and then allow a jury to determine whether the utility, having failed to undertake feasible climate resilience planning, acted with the appropriate degree of care.

A New Jersey court approached this inquiry in a similar case with different result. In *Roudi v. Jersey Central Power & Light*, the same conduct and harm was alleged as in *Praetorian*: the electric utility had failed to de-energize its lines ahead of Superstorm Sandy causing fires that damaged plaintiffs' homes.[320] Here, however, the court did not see preemptive de-energizing as a matter of breach of the duty of reasonable care; instead it assessed whether it should recognize and impose a wholly new duty to preemptively de-energize.[321] The court concluded there could be no such "far-reaching" duty, emphasizing various policy considerations relied upon by the lower court, including the "crushing burden" the duty would place on the utility.[322] This case illustrates a different approach to defining what the duty of care entails in a climate resilience claim.[323] If a court views climate resilience planning as a duty in and of itself, it might examine how far-reaching that duty would be and the burden it would place on the utility. Notably, should a court adopt this approach, it does not necessarily follow that the outcome of such a case would replicate *Roudi*. Rather, it suggests that scope of the court's review would similarly focus inquiry under analysis of duty.

Box 10: Potentially Available Claims and Duties

This Part centers analysis of duty and breach upon theories of negligence and duty of care. However, additional claims and duties may be relevant, including:

Product liability claims, where the duty of care is defined as obligation "to avoid selling a defective product or one that is unaccompanied by an adequate warning."[324]

Private nuisance claims, which prohibit defendants from "interfere[ing] unreasonably or knowingly with the use and enjoyment of another's property."[325]

Public nuisance claims, where the duty of care requires a defendant to, "not to contribute unreasonably or knowingly to an interference with the public's resources."[326]

Statutory claims, where duty is defined in law.[327] One example might be the electric utilities' statutory duty to serve, which, unlike the duty of care, is based upon the grant of monopoly franchise and requires an electric utility to extend and maintain adequate service.[328]

316 *Id.* at *20.

317 *Id.* at *21. This potentially "heightened" duty that electric utilities are under is a common theme throughout negligence claims against utilities. Case law in many states recognizes a heightened duty of care commensurate with proper operation and maintenance of electric systems. *See, e.g.*, Ala. Power Co. v. Jackson, 166 So. 692, 693 (Ala. 1936); Citerella v. United Illuminating Co., 266 A.2d 382, 386 (Conn. 1969); Miss. Power & Light Co. v. Shepard, 285 So. 2d 725, 729 (Miss. 1973).

318 *Praetorian*, 2019 N.Y. Misc. LEXIS 2952, at *21.

319 *Id.*

320 Roudi v. Jersey Cent. Power & Light, No. A-1505-18T1, 2020 WL 1650710, at *1 (N.J. Super. Ct. App. Div. Apr. 3, 2020).

321 *Id.* at *4.

322 *Id.* at *5, *7.

323 The court's approach in *Praetorian* appears to more closely aligns with the Restatement's primary sense of duty, which asks "whether the defendant was obligated to act with due regard" toward the plaintiff. *See* Goldberg & Zipursky, *supra* note 299, at 699-70, 714 (citing RESTATEMENT (SECOND) OF TORTS § 4).

324 Hunter & Salzman, *supra* note 281, at 1746.

325 *Id.* at 1749.

326 *Id.*

327 *E.g.*, CLF ExxonMobil Complaint, *supra* note 275; CLF Shell Complaint, *supra* note 275.

328 *See generally* Rossi, *The Common Law "Duty to Serve"*, *supra* note 254 (discussing the contours of the utility's duty to serve).

4.3 Breach of Duty

Courts most often employ four key approaches to determine whether a duty of care, once established, has been breached: risk-utility analysis, the multi-factor balancing test, industry custom, and public policy considerations. Each is explored in turn, below. We find that breach, in a climate resilience claim, is cognizable through each approach identified.

4.3.1 Risk-Utility Analysis

Risk-utility analysis considers whether "the burden of preventing injury is less than the product of the magnitude of the injury and its likelihood."[329] *The Restatement (Second) of Torts* describes this analysis as "where an act is one which a reasonable man would recognize as involving a risk of harm to another, the risk is unreasonable and the act is negligent if the risk is of such magnitude as to outweigh what the law regards as the utility of the act or of the particular manner in which it is done."[330]

In a climate resilience claim, the product of the magnitude of injury (i.e., to life and property from climate-induced outages and other harms) and likelihood of harm (variable by location, but nowhere in the U.S. is immune) would be weighed against the burden of preventing injury (i.e., by conducting climate resilience planning and making resilience investments).[331] Climate change impacts are significant and foreseeable and costs continue to grow as climate change increasingly results in more frequent, severe, and intense extreme weather events and marked changes in non-event weather patterns (e.g., higher average temperatures).[332] A court, in employing risk-utility analysis, thus has significant evidence to draw from to support a finding of breach. Scales will tip only further as the consequences of climate change increase in severity and the magnitude of harm becomes greater.[333] Planning may reveal methods to reduce injury through operational changes rather than new, significant, and additional expenditures. Such methods would reduce the burden on the defendant of preventing injury. There is mounting evidence that the cost of implementing resilience measures today will be less than the cost of injury from outages that will occur in the future, for example, in terms of value of lost load due to climate change impacts (see **Box 3**).[334] The risk-utility analysis thus increasingly favors engaging in climate resilience planning and making resilience investments now, and that a failure to do so breaches an electric utility's duty of care.

4.3.2 Multi-Factor Balancing Test

A second approach the courts employ in assessing breach is the multi-factor balancing test. Here, a court would consider additional elements beyond simply balancing the burden of avoidance against the likely damage, including (1) the foreseeability and degree of certainty of harm, (2) the goal of using tort law as a deterrent for future harm, (3) the burden on the defendant, and (4) the consequences to the community of imposing a duty.[335]

The multi-factor balancing test's additional considerations generally favor a finding that failure to adequately prepare for the impacts of climate change may constitute a breach of a utility's duty of care. For example:

1. Foreseeability and degree of certainty of harm are both increasingly supported by ever-sharpening climate science and granular, down-scaled data analysis.

2. Imposing liability for failure to prepare for climate change may well deter future harm by spurring proactive resilience planning.

3. The burden to electric utilities of engaging in climate resilience planning is likely to be modest as any costs associated could be structured similarly to how risks are traditionally allocated. Although consideration of climate change is not within the traditional role of an electric utility, risk assessment is a foundational aspect of electric utility planning

329 Hunter & Salzman, *supra* note 281, at 1756.

330 RESTATEMENT (SECOND) OF TORTS § 291 (1965).

331 ProPublica, *New Climate Maps Show a Transformed United States* (Sept. 15, 2020), https://perma.cc/EB9W-E2Q3; *see generally* David W. Fahey et al., *Physical Drivers of Climate Change*, *in* CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME I 73, 76, 81, 94-98 (D.J. Wuebbles et al., eds., 2017), https://perma.cc/HB9P-F8EL.

332 Fahey et al., *supra* note 331, at 76, 81, 94-98.

333 *See generally id.*

334 *See supra* Parts 2 and 3.1.3.

335 Hunter & Salzman, *supra* note 281, at 1768-69 (providing list of factors considered by a federal court in California, Vu v. Singer Co., 538 F. Supp. 26, 29 (N.D. Cal. 1981)). The Third Restatement also touches upon several of these concepts. *See* RESTATEMENT (THIRD) OF TORTS § 3 (2010).

and thus whatever additional effort climate resilience planning may require may be supported through existing processes.

4. Ratepayers, at the very least, and likely any individual within a given service area, would benefit, insofar as improved climate resilience planning results in reduced harm to person and property through at least the entirety of a utility's franchise area. Predicted benefits would, however, be evaluated in the context of expected rate impacts.

4.3.3 Industry Custom

Industry custom may aid in establishing breach, with the courts considering the practices of the relevant industry to assess the scope of the duty and comparing that to the defendant's own conduct.[336] However, as made clear in *T.J. Hooper v. Northern Barge Corp.*, industry custom is not controlling, and only girds against breach to the extent that custom itself is reasonable.[337] In *Hooper*, the plaintiffs' barges, towed by the defendant's tugboats, were lost at sea during a storm. Plaintiffs alleged that the defendant was negligent in failing to provide the tugboats with radios which would have provided advanced warning of the oncoming storm. The defendant argued that no industry custom nor legal requirement existed to obligate it to ensure radios were installed. The court, in finding for the plaintiffs, held that industry custom was not a shield against liability in the case at hand because "there are precautions so imperative that even their universal disregard will not excuse their omission."[338]

Nor is industry custom static; it necessarily changes as technology and science improves. There may be situations where "a whole calling may have unduly lagged in the adoption of new and available devices."[339] In such a case, the whole industry would have failed to adopt reasonable measures for preventing risk, and thus a showing of industry custom would provide no defense to a defendant's breach.

As explored in more detail in Part 2.3 above, electric utilities have until recently not robustly engaged in climate resilience planning. Indeed, this paper is a reflection of the need to advance industry efforts to keep pace with best available science, evidence, and practical experience. There are, however, signs that industry custom is changing. In recent years, a number of electric utilities have engaged in climate resilience planning, and others have acknowledged the need to do so.[340] Several state utility commissions have also recognized the relevance of climate change to the sector it regulates.[341] Con Ed's Climate Study has demonstrated that climate resilience planning is feasible and provides vital information about how climate change will impact assets and operations. It is already being held up as industry standard in other rate cases and at least two other electric utilities have already agreed to undertake similar assessments. Electric utilities that fail to follow suit could be considered "laggards" in breach of a growing industry custom.[343] Additionally, climate resilience planning has been widely supported and recommended by government and industry bodies, suggesting that it is a practice "so imperative that even [its] universal disregard will not excuse [its] omission."[344]

4.3.4 Public Policy Considerations

Breach may additionally be informed by public policy considerations, which are relevant also to identifying duty in certain instances, as illustrated in *Strauss* and *Roudi*. Here, just as overriding policy concerns might persuade a court not to impose a duty, it might also prompt a judge to forego a finding of breach "out of concern that the scale of liability will be so large as to run counter to public policy."[345] In particular, courts may find reason to limit breach out of concern that not doing so would create limitless liability for the defendant. That concern would, however, be less persuasive where plaintiffs are limited to electric utility ratepayers.

336 *Id.* at 1776-77.
337 The T.J. Hooper v. N. Barge Corp., 60 F.2d 737 (2d Cir. 1932).
338 *Id.* at 740.
339 *Id.*
340 Electric utilities in California, for example, have recognized the need to further study the impacts of climate change on their assets and operations. *See supra* Part 2.3.1.
341 *E.g.*, CONSOLIDATED EDISON, *supra* note 37; N.J. Exec. Order No. 89, *supra* note 243; Cal. Pub. Utils. Comm'n, *supra* note 130; N.Y. Pub. Serv. Comm'n, Order Instituting Proceeding, Case No. 20-M00499 (Oct. 15, 2020), https://perma.cc/7P5A-6FG4; CFTC REPORT, *supra* note 10, at 14-15, 18, 32, 76.
342 Vote Solar DEC Testimony, *supra* note 102, at 53; Vote Solar DEP Testimony, *supra* note 199, at 56; DEC Settlement Agreement, *supra* note 202, at 4; DEP Settlement Agreement, *supra* note 202, at 4.
343 Hunter & Salzman, *supra* note 281, at 1794.
344 *T.J. Hooper*, 60 F.2d at 740.
345 Hunter & Salzman, *supra* note 281, at 1781.

Box 11: Breach and Specific Conduct

Precision is necessary in defining what constitutes breach. That is, the specific conduct and particularity of breach alleged matters. In *Praetorian*, discussed above, the court rejected public policy reasons why no duty should be imposed and, if there is a duty, why no breach found.[346] The court concluded it was up to the trier of fact to determine whether failing to de-energize lines, even though it had the ability to do so, amounted to a breach of the electric utility's duty to exercise reasonable care—whether the electric utility had "acted with the degree of care which was commensurate with the risk to which it had exposed."[347]

A similar degree of specificity would be necessary in informing what constitutes breach in a climate resilience claim. In theory, various electric utility actions (or failures to act) could support a finding of breach, such as:

- failure to build or raise assets at a level outside the zone of flooding likely to occur given the foreseeable increased storm surge due to climate change; and
- failure to account for climate change-amplified temperature rise when purchasing infrastructure built to operate at certain temperatures.

Reasonably foreseeable planning practices that can be implemented when the utility conducts a risk assessment provide accurate projections of what its service territory will look like in a changed climate and the physical impacts that climate change will have on owned infrastructure. The failure to engage in such practices could thus serve as a specific conduct that would inform whether the duty of care was breached.

4.4 Causation

Tort law requires that the plaintiff's harm is linked through some cause and effect relationship to the defendant's negligent conduct. This causation requirement includes two analytic prongs: (1) cause-in-fact and (2) proximate, or legal, cause.[348]

4.4.1 Cause-in-Fact

Cause-in-fact is most often determined through the "but for" test. This test is met only on the finding that "the harm would have not occurred *but for* the defendant's negligence."[349] The defendant's negligent conduct must be a necessary cause of the harm; it must be "at least partially to blame."[350]

Climate change claims premised upon a defendant's production and sale of fossil fuels have relied upon careful collection and reflection of scientific evidence and study.[351] This is particularly true with respect to the causation element, which first required establishing the existence of the anthropogenic greenhouse gas effect. Given that "it is fair to say that global warming may be the most carefully and fully studied scientific topic in human history," this causal connection has been well-established.[352] This same basis is also necessary to climate resilience claims, which likewise must premise any causal chain first upon evidence of increasing climate change. Although such causal linkage in a climate resilience claim may require specific and particularized climate impacts to that utility's service territory, downscaled climate projections, as described in Part 2, make such information attainable.

From here, however, paths diverge. Tort litigation premised on an entity's contribution to climate change generally next considers questions of scale and attribution, linking the defendant's conduct (e.g., the production and sale of fossil fuels) to a specific set of harms.[353] These inquiries are relevant to the cause-in-fact analysis. Climate resilience claims, however, focus causality

346 Praetorian Ins. Co. v. Long Is. Power Auth., No. 704580/2014, 2019 N.Y. Misc. LEXIS 2952, *15-20 (N.Y. Sup. Ct. Apr. 10, 2019).

347 *Id.* at *20-21 (citations omitted).

348 David G. Owen, *The Five Elements of Negligence*, 35 HOFSTRA L. REV. 1671, 1673-74 (2007), https://perma.cc/XZ33-L247.

349 *Id.* at 1680. In some instances, cause-in-fact is established using the substantial factor test, although this is generally reserved "for situations where multiple events combine to cause an injury that would have occurred even if one of them were removed." *Id.* at 1681.

350 *Id.* at 1680.

351 Hunter & Salzman, *supra* note 281, at 1763-64.

352 Kysar, *supra* note 298, at 30.

353 *Id.* at 31; *see also* Michael Burger, Jessica Wentz & Radley Horton, *The Law and Science of Climate Change Attribution*, 45 COLUM. J. ENV'T L. 57 (2020), https://perma.cc/M8FH-8EKS.

on a different chain: the linkage between a defendant's failure to reasonably plan for the increasingly severe and frequent consequences of climate change to owned infrastructure and harms that result. Take, as an example, outages after Superstorm Sandy in New York City—Con Ed's service territory. Assume the outages occurred because a piece of equipment was in the flood zone and was rendered inoperable by storm surge. Before the storm, Con Ed built its assets based on an assumed 12.5-foot storm surge, which was derived from the historical record.[354] This assumed storm surge was incorrect, as historic data did not account for the impacts of climate change. Had Con Ed engaged in climate resilience planning, it would presumably have identified a different set of assumptions that were more accurate.

This fact pattern could potentially give rise to an extreme weather tort claim. A plaintiff might allege, for example, that the electric utility's emergency preparations immediately prior to the storm were insufficient. The fact pattern might additionally give rise to a climate resilience claim. Here, a climate resilience claim might focus on the sufficiency of the electric utility's actions in incorporating foreseeable climate change impacts to its longer-term planning, processes, and risk assessments. It might assert, for example, that but for Con Ed's decision not to conduct a climate risk assessment and identify reasonably foreseeable consequences of climate change, like higher storm surges, assets would not have been placed in flood prone areas. That is, the utility's failure to engage in climate resilience planning—is at least partially to blame for the assets being rendered inoperable by flooding and the consequent outages, and thus a "but for" or "necessary" cause of the harm.

4.4.2 Proximate Cause

Proximate cause "addresses . . . the question of whether in logic, fairness, policy, and practicality, the defendant ought to be held legally accountable for the plaintiff's harm that in some manner is 'remote' from the defendant's breach."[355] Defined as the "reasonably close connection between a defendant's wrong and the plaintiff's injury," proximate cause provides limitation to defendant liability.[356] The concept of foreseeability is central to determining proximate cause, premised on the theory that "responsibility for consequences should be based on the quality of an actor's choices that led to the consequences. The moral fiber of such choices is gauged by the consequences the actor should have contemplated as plausible eventualities at the time the choice was made."[357] Proximate cause will not be found when the "defendant's negligence appear[s] simply too attenuated" or "tenuous or 'remote.'"[358]

Extreme weather tort cases again are instructive in considering causation. Similar questions of foreseeability emerge, as the remoteness of the causal chain is often central to court inquiry. Extreme weather tort cases are, however, surprisingly sparse and outcomes are uneven. As a general rule, precedent often collapses both prongs of the causality analysis or centers only on proximate cause. Analysis generally turns upon the foreseeability of the plaintiff's harm in connection to the defendant's breach of duty. Praetorian serves as one example. In dismissing defendant's motion for summary judgment, the court held that "the foreseeability of harm to the plaintiffs was clear. There were ample weather reports of the approach of Superstorm Sandy and about the great surges that would occur. The dangers of flood waters coming into contact with live electric power were well known in the utility industry."[359]

A similar analysis is embedded in *National Food Stores, Inc. v. Union Electric Co.*[360] There, plaintiff National Food Stores alleged that electric utility defendant was liable for the loss of foodstuffs, caused by an electricity outage during a summer heat wave. Although the case was premised on a duty to serve and defendant's failure to provide notice of an impending outage, rather than duty of care, the causation analysis proceeded similarly, with the court oriented again to the foreseeability of the harm. Whether the utility should have been aware of looming outage was central. In ruling in favor of the plaintiff, the court contrasted precedent where an outage was "caused by external forces outside the control of the power company, which were not reasonably foreseeable," with the case at hand, where the utility "was well aware of the unprecedented demand upon its facil-

354 Van Nostrand, *supra* note 170, at 101.
355 Owen, *supra* note 348, at 1681.
356 *Id.* at 1681-82.
357 *Id.* at 1671.
358 *Id.* at 1684.
359 Praetorian Ins. Co. v. Long Is. Power Auth., No. 704580/2014, 2019 N.Y. Misc. LEXIS 2952, at *18 (N.Y. Sup. Ct. Apr. 10, 2019). The Praetorian case was ongoing at the time of writing.
360 494 S.W.2d 379 (Mo. Ct. App. 1973).

ities."[361] In the latter situation, the utility's negligence is a legal cause that is not excused because of the presence of external forces at play.

Applying this precedent to a climate resilience claim, establishing proximate cause will require a showing that it was reasonably foreseeable that particular climate impacts would occur in particular areas and that, unless the electric utility implemented appropriate resilience measures, those impacts would lead to outages. As discussed in Part 2, downscaled climate projections can be used to identify local climate impacts, and their likely consequences for electric utility operations assessed through the climate resilience planning process.[362] Indeed, as the Con Ed Climate Study demonstrates, electric utilities have the ability to uncover climate vulnerabilities within their systems and take appropriate remedial action. To the extent other electric utilities fail to undertake and periodically update similar studies, any outages resulting from climate-induced phenomena are arguably not only caused by climate change—an external event—but also by the utility's failure to appropriately prepare for it. The electric utility's negligence in failing to conduct climate resilience planning is a proximate cause for which it can be held liable in tort.

4.5 Harm

As stated at the outset of this Part, a climate resilience claim arises from an electric utility's failure to adequately prepare for reasonably foreseeable event- and non-event-based climate impacts to owned assets and/or operations where that failure results in cognizable harm. While state utility commissions will often consider climate resilience in the context of future climate impacts, climate resilience claims before a court, like the majority of tort law claims, will generally center upon past events.[363]

Cognizable harm could include a variety of injuries. Borrowing from extreme weather case law, harm to person and property both appear to be cognizable harms. In *Praetorian* and *National Food*, plaintiffs brought suit on the basis of property loss.[364] Other cases have been based on physical harm to individuals, for example, from downed power lines.[365] Harm may thus include injury to persons and/or property damage resulting from electricity service outages, for example where a heat wave forces curtailment of output from a thermoelectric generating plant, triggering an outage that results in a blackout at a frozen foods warehouse, leading to spoilage. Climate resilience claims might also, however, arise in situations where the harm (e.g., personal injury or property damage) is not directly connected to, or the result of, a service outage. Like in *Arkansas Valley Electric*, where litigation resulted from contact and injury with a downed power line, harm resulting from the electric utility's equipment, operation, or asset directly (i.e., rather than a subsequent forced outage) is a potential additional basis for a climate resilience claim. One example might be where transmission line sag results in a wildfire, which leads to loss of life and property damage.

361 *Id.*

362 *See* CONSOLIDATED EDISON, *supra* note 37 (employing downscaled modeling).

363 Note, however, that this should not be read to foreclose potential cases brought on different theories of harm or injury.

364 *Praetorian*, No. 704580/2014, 2019 N.Y. Misc. LEXIS 2952; Nat'l Food Stores, Inc. v. Union Elec. Co., 494 S.W.2d 379 (Mo. Ct. App. 1973).

365 *See, e.g.*, Ark. Valley Elec. Coop. Corp. v. Davis, 800 S.W.2d 420 (Ark. 1990) (negligence action against utility for failing to replace a deteriorated pole which had been downed in a tornado).

PART 5:

Interplay between State Utility Commissions and Courts

Parts 3 and 4 above detail two pathways for advancing climate resilience planning by electric utilities—one before state utility commissions and the other in state court. Although these two approaches generally raise different temporal issues—that is, prospective compared to retrospective action—interplay and overlap necessarily exists. This Part considers the interaction between the pathways, with a focus upon how state utility commission and state court proceedings may intersect. Specifically, this Part considers how a climate resilience claim brought against an electric utility implicates the jurisdiction of both state utility commissions and civil courts, and the law governing each body's role in reviewing such a claim.

This Part proceeds in three subparts. First, it addresses issues of primary jurisdiction and exhaustion to provide an understanding of where climate resilience claims likely will be heard in the first instance. Second, it describes the relevance of state utility commission findings in "collateral" civil litigation where claims related to commission proceedings are raised. Third, it identifies instances where limitation of liability provisions in electric utility tariffs may apply. In each of these areas, there is variability among states, since each has its own body of law and judicial doctrines. Original research was conducted to elucidate these state differences. This Part's analysis relies upon that work to identify and analyze variability between states.

5.1 Proper Forum: Primary Jurisdiction and Exhaustion

Climate resilience claims involve factual and legal issues that may be relevant to both state utility commission and state court proceedings. Questions of proper forum necessarily emerge, as it is not immediately clear in all instances whether the state court or state utility commission should consider climate resilience claims in the first instance.[366] As a general rule, civil courts most often serve as the forum for tort law claims against electric utilities, particularly where only questions of law exist.[367] Conversely, claims relating to the rates charged and services provided by electric utilities generally fall within the jurisdiction of the state utility commission.[368] Issues raised in climate resilience claims, where there is some alleged failure on the part of the electric utility to fulfil a planning obligation, fall somewhere between these two, creating thorny question of proper forum. Such a claim might "sound in" tort, as described in Part 4, but might also implicate issues of rates and services, like those discussed in Part 3.

Two doctrines are particularly relevant to the proper forum inquiry: primary jurisdiction and exhaustion of administrative remedies. While distinct doctrines, courts often muddle the two or even use them interchangeably.[369] Primary jurisdiction doctrine is a prudential doctrine that courts may invoke where a claim is originally cognizable by both a trial court and an administrative agency.[370] When the doctrine is invoked, a court may abstain from hearing the claim and refer it to the relevant agency for determination

366 Notably, this question may not be present in other contexts. Electric utilities are closely regulated, resulting in extensive agency jurisdiction, and thus important considerations of forum exist. This may not be true for other professions and industries, and thus questions of forum will be less relevant in those contexts.

367 *E.g.*, Hamilton v. United Tel. Co. of Kan., Inc., 636 P.2d 202, 204 (Kan. Ct. App. 1981) (cases lacking factual issues, essentially private disputes and those raising questions that are "inherently judicial, i.e., was there breach of contract? Was there negligence?" belong within the jurisdiction of the courts not the commission); Schuster v. Nw. Energy Co., 314 P.3d 650, 652 (Mont. 2013) (finding courts have jurisdiction in cases involving the "legal rights and responsibilities" of parties); *see also* infra notes 395-398 and accompanying text.

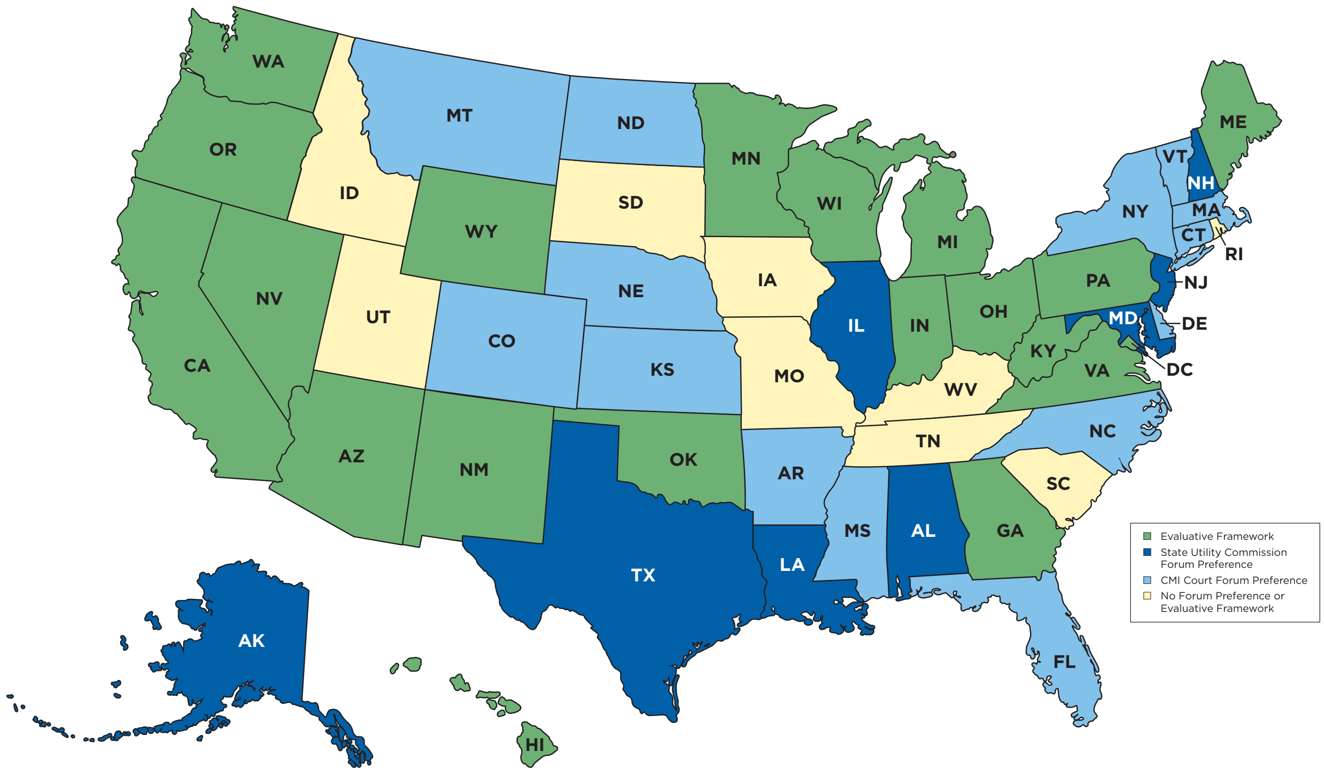
368 *E.g.*, Daily Advertiser v. Trans-La, Div. of Atmos Energy Corp., 612 So. 2d 7, 17 (La. 1993); Sheffler v. Commonwealth Edison Co., 399 Ill. App. 3d 51, 70 (Ill. App. Ct. 2010); Nev. Power Co. v. Eighth Judicial Dist. Ct. of Nev., 102 P.3d 578, 584 (Nev. 2004); *see also* infra note 384.

369 Paula Knippa, *Primary Jurisdiction Doctrine and the Circumforaneous Litigant*, 85 TEX. L. REV. 1289, 1291-92 (2007).

370 *Id.* at 1290 ("The development of the primary jurisdiction doctrine is a function of the judiciary's recognition that the adjudicatory authority of regulatory agencies will inevitably overlap with the jurisdiction of traditional judicial courts."); *see, e.g.*, Pacific Lightnet, Inc. v. Time Warner Telecomms., Inc., 318 P.3d 97, 109 (Haw. 2013) ("[P]rimary jurisdiction presumes that the claim at issue is originally cognizable by both the court and the agency.").

in the first instance.[371] Exhaustion doctrine, on the other hand, is a non-discretionary rule requiring a party to initiate its claims before an administrative agency.[372] The claim can only be heard by the judiciary through appellate review after the agency has made a determination.[373] Exhaustion is generally required where an agency is said to have "exclusive" jurisdiction over the claim.[374]

Graphic 1: U.S. Map with States Color Coded by Category



Box 12: Fifty State Survey – Description and Methodology

This Part is informed by original research that identified relevant state-level precedent on primary jurisdiction and exhaustion. The research examined cases involving common law claims against electric and other public utilities. Specific emphasis was placed on cases involving tort claims brought against electric utilities. In some instances, we also examined cases involving other common law claims, primarily contract claims, to fill in research gaps where courts discussed forum for common law claims more generally. Likewise, claims against other types of utilities, particularly telecommunications and water utilities, were encompassed in the research.

Cases where a tort claim was brought against a utility and premised upon an extreme weather event were of particular note. Again, we believe these cases to be the best analogue for the climate resilience planning considerations that animate this paper. As such, this Part identifies and summarizes, when available, the analysis and holdings in those cases in particular.

371 Knippa, *supra* note 369, at 1291-92.

372 United States v. W. Pac. R.R. Co., 532 U.S. 59, 63 (1963) ("'Exhaustion' applies where a claim is cognizable in the first instance by an administrative agency alone . . . .").

373 Louis L. Jaffe, *Primary Jurisdiction*, 77 HARV. L. REV. 1037, 1037 (1964) ("Exhaustion emerges as a defense to judicial review of an administrative action not as yet deemed complete."); *Western Pacific R.R.*, 352 U.S. at 63 (when exhaustion applies, "judicial interference is withheld until the administrative process has run its course").

374 *See, e.g.*, *Pacific Lightnet*, 318 P.3d at 97 ("[T]he court must first determine whether the agency has exclusive original jurisdiction, in which case, the doctrine of exhaustion would apply.").

Application of these doctrines varies significantly among state jurisdictions. Drawing from a fifty state survey conducted to inform this paper (see Box 12) we categorize states based on whether there is/are: (1) precedent providing direction on forum availability, (2) precedent providing guidance as to process and evaluation of forum availability, or (3) no rules that emerge from precedent.

Importantly, the research demonstrates that categorization is fluid, and there is often space for courts to distinguish a claim to avoid precedent or apply an exception. This is likely to be particularly true with respect to climate resilience planning, which is a generally novel concern for courts and utility commissions. Thus, while this subpart categorizes states, the research should be viewed as illuminating the myriad ways in which questions regarding forum have been resolved in the past and could play out in future climate resilience claims.

5.1.1 Direction on Forum Availability

Twenty-two states have precedent that provides some consistency in whether tort law claims against an electric utility first proceed to a state court or the state utility commission.

(A) Civil Court

In fourteen states, precedent illustrates a pattern of allowing tort claims against an electric utility to be heard in a civil court in the first instance.[375] This is evidenced by either explicit statements that such claims fall within the province of the courts as a common law tort,[376] or from a pattern of precedent in which courts heard such claims.[377]

One example is *Florida Power & Light v. Velez*, wherein a Florida appellate court was asked to address electricity customer allegations of gross negligence by Florida Power and Light ("FPL") in the context of a severe weather event.[378] Plaintiffs asserted that FPL had failed to comply with storm-hardening standards imposed by the state utility commission.[379] The court concluded the claims could be heard by the trial court, holding that "the mere fact that such claims may involve questions of whether FPL failed to meet certain standards established by the [state utility commission] does not divest the trial court of its jurisdiction, or vest exclusive jurisdiction in the [state utility commission], to resolve such issues."[380] The court relied on an earlier Florida supreme court decision that the court had jurisdiction over a claim against a telephone company for negligently failing to provide efficient telephone service as required by state utility commission standards.[381] That decision is widely cited by Florida courts for the proposition that jurisdiction over tort claims properly lies with the judiciary even when the case concerns technical matters related to a utility's regulatory compliance.[382]

375 These states include Arkansas, Colorado, Connecticut, Delaware, Florida, Kansas, Massachusetts, Mississippi, Montana, Nebraska, New York, North Carolina, North Dakota and Vermont.

376 *See, e.g.*, Paine, Webber, Jackson & Curtis, Inc. v. Adams, 718 P.2d 508, 513 (Colo. 1986); Hamilton v. United Tel. Co., 636 P.2d 202, 204 (Kan. Ct. App. 1981) ("[N]o administrative remedy exists for a party where the dispute is essentially private. Where there is no administrative remedy, the litigant may proceed directly to district court."); Fernandes v. Attleboro Housing Auth., 20 N.E.3d 229 (Mass. 2014) (court is not ousted of jurisdiction where case presents at least one matter for judicial determination); State ex rel. Pub. Serv. Comm'n v. Dist. Court of First Judicial Dist. in and for Lewis and Clark County, 84 P.2d 335, 335 (Mont. 1938) (concluding the state utility commission was not enacted for the purpose of arbitrating "controversies between utilities and private persons"); Green Mountain. Power Corp. v. Sprint Commc'ns, 779 A.2d 687 (Vt. 2001).

377 *See, e.g.*, Entergy Miss., Inc. v. Acey, 153 So. 3d 670 (Miss. 2014) (emotional distress claim after suffering burns from touching sagging power line); Williams v. Entergy Miss., Inc., 19 So. 3d 757 (Miss. 2008) (negligence claim by pedestrian who tripped on guy wire); Redhead v. Entergy Miss., Inc., 828 So. 2d 801 (Miss. 2001) (negligence claim alleging company responsible for fire and damage to tree farm); Mitsubishi Elec. & Elecs. USA, Inc. v. Duke Power Co., 573 S.E.2d 742 (N.C. Ct. App. 2002) (appellate court approvingly discusses trial court's decision to try the torts claims in the first instance on the merits); Willis v. Duke Power Co., 229 S.E.2d 191 (N.C. 1976) (wrongful death claim alleging negligence in maintenance of wires); Kirton v. Williams Elec. Coop., 265 N.W.2d 702 (N.D. 1978) (wrongful death based in negligence and nuisance); Dehn v. Otter Tail Power Co., 251 N.W.2d 404 (N.D. 1977) (claim for personal injuries sustained from contact with transmission line); Froemke v. Otter Tail Power Co., 276 N.W. 146 (N.D. 1937) (negligence resulting in fire); Del. Elec. Coop. v. Duphily, 703 A.2d 1202, 1204 (Del. 1997) (negligence claim for electrocution); Delmarva Power & Light Co. v. Burrows, 435 A.2d 716, 717 (Del. 1981) (same); Scanlon v. Conn. Light & Power Co., 782 A.2d 87 (Conn. 2001) (negligent maintenance and installation of equipment causing harm to dairy herd); Travelers Indem. Co. of Am. v. Conn. Light & Power Co., 2008 WL 2447351 (Conn. Sup. Ct. June 4, 2008) (tort claims, including negligence and products liability, for home fire).

378 Fla. Power & Light Co. v. Velez, 257 So. 3d 1176, 1177 (Fla. Dist. Ct. App. 2018). This class action law suit is ongoing and currently in the pre-trial discovery stage. *See* Miami-Dade County Clerk of the Courts, *Civil, Family and Probate Courts Online System*, Local Case No. 2017-022854-CA-01, https://www2.miami-dadeclerk.com/ocs/Search.aspx (last visited Oct. 12, 2020).

379 *Id.*

380 *Id.*

381 S. Bell Tel. & Tel. Co. v. Mobile Am. Corp., 291 So. 2d 199, 201 (Fla. 1974).

382 *See* Ramos v. Fla. Power & Light Co., 21 So. 3d 91 (Fla. Dist. Ct. App. 2009) (exhaustion not required in suit against utility for gross negligence related to meter tampering and service cut off); Trawick v. Fla. Power & Light Co., 700 So. 2d 770 (Fla. Dist. Ct. App. 1997) (action for injunction and declaratory relief against utility for improper tree trimming not within PUC's jurisdiction); Fla. Power & Light Co. v. Glazer, 671 So. 2d 211 (Fla. Dist. Ct. App. 1996) (courts may hear tort claims where statutory and regulatory compliance is raised as a defense).

New York courts have also allowed tort claims against utilities to proceed in civil court, including a claim in the context of an extreme weather event. *See* Praetorian Ins. Co. v. Long Is. Power Auth., No. 704580/2014, 2019 N.Y. Misc. LEXIS 2952 (N.Y. Sup. Ct. Apr. 10, 2019) (claim against utility for failing to de-energize power lines ahead of Superstorm Sandy proceeds, with court deciding a motion to dismiss, but without reference to forum questions).

(B) State Utility Commission

Courts in eight states have precedent that indicates tort law claims are generally heard by the state utility commission in the first instance.[383] In several of these states, the courts have reached this conclusion on the basis that the cases inevitably involve "services" or "rates" that are subject to state utility commission oversight, making it the primary adjudicator.[384] Others have concluded that adjudication of these claims requires the commission's expertise in resolving questions of fact.[385] Notably, these courts have reached this conclusion even in light of state case law holding that typical common law claims, like tort and contract claims, can be heard by the trial court initially.[386] Often, tort claims against utilities in these states will be bifurcated, such that all issues within the jurisdiction of the state utility commission will be decided in that forum first and then questions of negligence will be decided by the judiciary, *see infra* section 5.2.[387]

Illinois is particularly illustrative. The Illinois Commerce Commission has exclusive jurisdiction over claims stemming from services and rates of public utilities under its jurisdiction.[388] The Illinois supreme court most recently considered this authority in *Sheffler v. Commonwealth Edison Co.* and interpreted it broadly. Plaintiff customers had lost power during a winter storm, and alleged that electric utility Commonwealth Edison had negligently failed to provide adequate, efficient, and reliable electrical service in violation of its statutory duties.[389] The supreme court affirmed the lower court's holding that such claims went to the service provided for the rates charged and should be heard by the commission, not the court.[390] The high court found the nature of the relief sought "was predicated on allegations that Commonwealth Edison was not providing adequate service," which "goes directly to [Commonwealth Edison's] service and infrastructure, which is within the Commission's original jurisdiction."[391] It also explained it was "essential" that the agency handle matters related to service and rates that involved technical data and expert opinions.[392] Illinois is therefore an example of a jurisdiction that has concluded that claims against a utility, even those that sound in tort, must be heard first by the state utility commission.

5.1.2 Evaluative Framework for Assessing Forum Availability

Courts in nineteen states and the District of Columbia have adopted evaluative frameworks to determine proper forum for particular tort law claims brought against an electric utility.[393] Courts in these states have identified relevant considerations that judges should weigh in assessing primary jurisdiction. While not all states use each, five common considerations are: (1) the relative expertise of each potential adjudicator; (2) the desire for regulatory uniformity; (3) the potential for adjudication to interfere with the agency's role; (4) whether the claim is of public concern; and (5) the possible futility of agency adjudication.[394] These considerations are not specific to cases involving electric utilities. However, given the expansive jurisdiction of state utility commissions over electric utilities, the con-

383 These states include Alabama, Alaska, Illinois, Louisiana, Maryland, New Jersey, New Hampshire, and Texas.

384 *E.g.*, Richards v. Baton Rouge Water Co., 142 So. 3d 1027 (La. Ct. App. 2014); Oncor Electric Delivery Co. v. Chapparall Energy, 546 S.W.3d 133 (Tex. 2018).

385 *E.g.*, Alaska Pub. Utils. Comm'n v. Chugach Elec. Ass'n, 580 P.2d 687 (Alaska 1978) (overruled on other grounds); Bell Atl. of Md., Inc. v. Intercom Sys. Corp., 782 A.2d 791 (Md. 2001).

386 *E.g.*, Nelson v. Pub. Serv. Co., 402 A.2d 623, 625 (N.H. 1979); City of Graysville v. Glenn, 46 So. 3d 925, 929 (Ala. 2010).

387 *See, e.g.*, Minutella v. Jersey Cent. Power & Light, No. OCN-L-2955-14 (N.J. Sup. Ct. Mar. 30, 2015. Defendants argued the negligence claim raised issues regarding the "safe, adequate and proper provision" of service, which were issues "within the exclusive authority and expertise of the BPU." *Id.* at 17-18. The court agreed. While the question of negligence was within the "conventional experience and jurisdiction of the courts," the "issues of safe delivery" of electricity service fell within the jurisdiction of the BPU, which should be allowed to decide "factual issues as to whether it was appropriate or necessary to suspend the delivery of electrical service" in the first instance. *Id.* at 32-33.

388 *See, e.g.*, Adams v. N. Ill. Gas Co., 809 N.E.2d 1248 (Ill. 2004); Vill. of Roselle v. Commonwealth Edison Co., 859 N.E.2d 1 (Ill. App. Ct. 2006); City of Chicago ex rel. Thrasher v. Commonwealth Edison Co., 513 N.E.2d 460 (Ill. App. Ct. 1987). *But cf.* Sutherland v. Ill. Bell, 627 N.E.2d 145 (Ill. App. Ct. 1993) (claims that the services and equipment of phone company were unordered, inadequate or ambiguously billed constituted typical claims for damages and within the province of the courts).

389 Sheffler v. Commonwealth Edison Co., 923 N.E.2d 1259, 1262, 1262 (Ill. App. Ct. 2010), aff'd, Sheffler v. Commonwealth Edison Co., 955 N.E.2d 1110, 1122 (Ill. 2011).

390 *Sheffler*, 923 N.E.2d at 1273-77; *Sheffler*, 955 N.E.2d at 1122. The lower court found that the plaintiffs claim was for "reparations," as opposed to civil damages, because "the essence of the claim is that a utility has charged too much for a service." *Sheffler*, 923 N.E.2d at 1275. The complaint pertained to rates because it "concerns claims that ComEd provided inadequate or unreliable electric services." *Id.*

391 *Sheffler*, 955 N.E.2d at 1125.

392 *Id.* at 1122.

393 These states include Arizona, California, Georgia, Hawaii, Indiana, Maine, Michigan, Minnesota, Nevada, New Mexico, Ohio, Oklahoma, Oregon, Pennsylvania, Virginia, Washington, West Virginia, Wisconsin, and Wyoming. Notably, Oklahoma, Virginia and Wyoming do not use a multifactor test, but instead the answer seems to hinge primarily on whether the case involves public or private rights. *See infra* note 415.

394 As discussed above, CLF's statutory failure to adapt lawsuit against ExxonMobil has been stayed under federal primary jurisdiction doctrine. *See supra* note 311. The district court there considered some similar factors in assessing whether to stay its proceedings to allow EPA an opportunity to review the permit at issue first. Conservation L. Found. v. ExxonMobil Corp., 448 F. Supp. 3d 7 (D. Mass. 2020). The court relied on the *Blackstone* factors: "(a) 'the agency determination l[ies] at the heart of the task assigned the agency by Congress'; (b) 'agency expertise [i]s required to unravel intricate, technical facts'; (c) 'the agency determination would materially aid the court'; and (d) deference to the agency would 'serve the interest of national uniformity in regulation.'" *Id.* (quoting Massachusetts v. Blackstone Valley Elec. Co., 67 F.3d 981, 992 (1st Cir. 1995)).

siderations are particularly useful in applying primary jurisdiction doctrine in such cases.

First, courts often consider the relative expertise of each potential adjudicator. Where tort law issues "predominate"[395] or only issues of statutory interpretation or legal construction are raised,[396] claims are viewed as falling within the "conventional jurisdiction"[397] of the judiciary. Courts may presume they have at least as much expertise in handling these claims, if not more.[398] However, state utility commissions may be better qualified to examine technical questions that arise in claims against electric utilities and to make conclusions about compliance with the statutory and regulatory scheme.[399]State utility commission are viewed as having "special competence"[400] and expertise in these areas.[401]

Second, courts also consider regulatory uniformity. Where court adjudication could create inconsistency through ad hoc judicial decisions applying regulations and resolving similar issues, courts may decide that claims are best heard in the first instance by the state utility commission. Likewise, a court might consider whether judicial adjudication could lead to conflicting decisions not just between judges, but also between the courts and the state utility commission.

Third, and relatedly, courts also consider whether adjudication would interfere with the legislative purpose in creating regulatory agencies. Courts are often reticent to interfere in areas that have been delegated to agencies and seek to respect the role that the legislatures intended for agencies to fill.[404] The courts, therefore, will often refer claims where there are relevant regulatory standards in place,[405] where interpretation of technical terms or tariff provisions is needed,[406] or where a claim involves a "general supervisory or regulatory policy."[407]

Fourth, courts consider whether the claim is a matter of public concern or of a private nature. Where tort claims against electric utilities implicate "broad public doctrines"[408] or "widespread acts,"[409] and involve disputes affecting the public[410] that are not unique to one party,[411] such claims are best heard by the agency. However, where claims are purely private disputes[412] or relate to personal injury or property damage not covered by tariffs,[413] the court might choose to retain the case because regulatory schemes are not designed to address such individual harm. Courts also refer to this consideration as a division between "individual rights and public rights."[414] Some courts most heavily rely on this consideration to the exclusion of others, although the dividing line between public and private rights claims remains hazy.[415]

395 *E.g.*, Campbell v. Mountain States Tel. & Tel. Co., 586 P.2d 987, 993 (Ariz. 1978) (cited by Qwest Corp. v. Kelly, 59 P.3d 789, 797 (Ariz. 2002)); Nev. Power Co. v. Eighth Judicial Dist. Ct., 102 P.3d 578, 587 (Nev. 2004) (cited by Jafbros, Inc. v. Am. Family Mut. Ins. Co., No. 57058, 2012 Nev. Unpub. LEXIS 457, at *6 (Nev. Apr. 2, 2012)). Indiana has ruled that if even one issue falls within the court's subject matter jurisdiction, the whole case falls within its jurisdiction. Austin Lakes Joint Venture v. Avon Utils., 648 N.E.2d 641, 646 (1995).

396 *E.g.*, MDC Rests., LLC, v. Eighth Judicial Dist. Ct., 419 P.3d 148, 153 (Nev. 2018) (refusing to refer a question of constitutional interpretation to the agency); State ex rel. Norvell v. Ariz. Pub. Serv. Co., 510 P.2d 98, 104 (N.M. 1973) (issues of law or statutory interpretation significant).

397 *E.g.*, *Campbell*, 586 P.2d at 991; State ex rel. Bell Atlantic-West Virginia v. Ranson, 497 S.E.2d 755, 764 (W. Va. 1997). Some states refer to these types of case as "inherently judicial." *E.g.*, City of Rochester v. People's Coop. Power Ass'n, 483 N.W.2d 477, 480 (Minn. 1992).

398 *E.g.*, *Campbell*, 586 P.2d at 993; District of Columbia v. D.C. Pub. Serv. Comm'n, 963 A.2d 1144, 1153 (D.C. 2009); Am. Ass'n of Cruise Passengers v. Cunard Line, 31 F.3d 1184 (D.C. 1994); Benton Falls Assocs. v. Cent. Me. Power Co., 828 A.2d 759, 764 (Me. 2003).

399 *E.g.*, Elkin v. Bell Tel. Co., 420 A.2d 371, 376 (Pa. 1980); *MDC Restaurants*, 419 P.3d at 153; *Norvell.*, 510 P.2d at 104; State ex rel. Chesapeake & Potomac Tel. Co. v. Ashworth, 438 S.E.2d 890, 894 (W. Va. 1993); Brookfield v. Milwaukee Metro. Sewerage Dist., 491 N.W.2d 484, 492 (Wis. 1992).

400 *E.g.*, *District of Columbia*, 963 A.2d at 1153; *Austin Lakes*, 648 N.E.2d at 647.

401 *E.g.*, Durcon Co. v. Detroit Edison Co., 655 N.W.2d 304, 310 (Mich. Ct. App. 2002); *District of Columbia*, 963 A.2d 1144.

402 *E.g.*, *Elkin*, 420 A.2d at 376; City of Taylor v. Detroit Edison Co., 715 N.W.2d 28, 35 (Mich. 2006); *Bell Atlantic-West Virginia*, 497 S.E.2d 755.

403 *E.g.*, Dreyer v. Portland Gen. Elec. Co., 142 P.3d 1010, 1022 (Or. 2006); *Bell Atlantic-West Virginia*, 497 S.E.2d 755.

404 *E.g.*, Farmers Ins. Exchange v. Superior Ct., 826 P.2d 730, 741 (Cal. 1992); Kona Old Hawaiian Trails Grp. v. Lyman, 734 P.2d 161 (Haw. 1987); Matthews v. District of Columbia, 875 A.2d 650 (D.C. 2005); *City of Taylor*, 715 N.W.2d 28 (Mich. 2006) (asking whether "court would upset the regulatory scheme of the agency").

405 Corrigan v. Illuminating Co., 910 N.E.2d 1009, 1011-14 (Ohio 2009); San Diego Gas & Elec. Co. v. Superior Ct. ("Covalt"), 920 P.2d 669, 742 (Cal. 1996) (asking whether the CPUC is actually exercising authority to regulate the matter at issue in assessing a claim belongs before the CPUC); *see also* Ind. Mich. Power Co. v. Runge, 717 N.E.2d 216, 225 (Ind. Ct. App. 1999).

406 *E.g.*, *Bell Atlantic-West Virginia*, 497 S.E.2d at 764; Levesque v. Cent. Me. Power Co., 2019 Me. Bus. & Consumer LEXIS 9, *10 (Me. Bus. & Cons. Ct. 2019).

407 Wilson v. S. Cal. Edison, 184 Cal. Rptr. 3d 26 (Cal. Ct. App. 2015).

408 Campbell v. Mountain States Tel. & Tel. Co., 586 P.2d 987, 991 (Ariz. 1978).

409 D.J. Hopkins, Inc. v. GTE Northwest, Inc., 947 P.2d 1220, 1225 (Wash. Ct. App. 1997) ("Courts often defer to agency jurisdiction when the allegations involve widespread acts" rather than "an isolated action or transaction").

410 Sw. Pub. Serv. Co. v. Artesia Alfalfa Growers' Ass'n, 353 P.2d 62, 68-69 (N.M. 1960); *accord* OS Farms, Inc. v. New Mexico Am. Water Co., 218 P.3d 1269 (N.M. Ct. App. 2009) ("[W]hen there is a clear demarcation between acts concerning rights of private litigants and acts affecting the public interest" the courts have jurisdiction over the former and the PUC over the latter) (quiet title suit against utility and commission).

411 *E.g.*, *D.J. Hopkins*, 947 P.2d at 1225 (citing Moore v. Pac. Nw. Bell, 662 P.2d 398, 402 (Wash. Ct. App. 1983), approving of a "distinction between tortious injury unique to one and unreasonable practices suffered by all").

412 *E.g.*, *Campbell*, 586 P.2d at 991; *Artesia Alfalfa Growers'*, 353 P.2d at 68-69; *D.J. Hopkins*, 947 P.2d at 1225.

413 *E.g.*, Rinaldo's Const. Corp. v. Mich. Bell Tel. Co., 559 N.W.2d 647, 654 (Mich. 1997).

414 *Artesia Alfalfa Growers'*, 353 P.2d at 68 (noting prior case finding the right to not be discriminated against is an individual right, while the public has a right to be protected against exorbitant rates and explaining that the former is a "legal right" while the latter is a "political right").

415 For example, Oklahoma courts have emphasized that the state utility commission has jurisdiction over public rights claims, described as those that "arise between the government and others," Tenneco Oil Co. v. El Paso Nat. Gas Co., 687 P.2d 1049 (Okla. 1984), and Wyoming courts have concluded the state utility commission's jurisdiction extends to matters "affected with a public interest," which are services geared "to or for the public." *In re* Investigation, 745 P.2d 563 (Wyo. 1987).

Fifth, courts consider the futility or inadequacy of agency processes due to a lack of remedy. Often, this becomes particularly important where a state utility commission is unable to award monetary damages that the plaintiff seeks.[416] Courts will also emphasize adjudicatory efficiency and acknowledge the burden that an exhaustion requirement would place on a plaintiff in assessing whether futility favors court adjudication.[417]

5.1.3 No Rules Emerge from Precedent

In the remaining nine states, precedent is limited and uneven on forum availability and evaluative framework.[418] In some states, there is insufficient case law addressing proper forum or involving tort claims against utilities. In other states, courts have not clearly distinguished a tort law claim from an adequacy of service claim. In Missouri, there is conflicting case law on the issue—early decisions provided guidance, but those cases appear to have been contradicted in later decisions without explanation.[419]

5.2 State Utility Commission Findings in "Collateral" Case

Where the state utility commission makes findings and conclusions in the first instance, plaintiffs might choose to bring (or reinitiate) "collateral" civil litigation against an electric utility before the state trial court. This may occur where the state utility commission was unable to provide the requested remedy or where the state court bifurcated the proceeding between regulatory compliance and/or highly technical issues on the one hand and tort law questions on the other. A few state courts have provided direction on the effect of state utility commission proceedings on subsequent civil litigation against electric utilities. In most cases, the courts have held that statutory and regulatory compliance findings of the state utility commission will not be binding on questions of law, but the court will take the commission's factual findings and apply them in making legal conclusions.[420] Some courts have been clear that compliance findings are subject to collateral estoppel,[421] while others have allowed for some review.[422]

This subpart is intended to demonstrate how related state utility commission and state court proceedings may interact. As discussed above, there are instances where some aspects of a case should be decided by the expert agency, while other matters must be determined by the competent legal court. We highlight cases from four states—Florida, Texas, Pennsylvania, and Massachusetts—that illustrate different ways courts have considered the effect of state utility commission determinations and findings on collateral civil litigation.

5.2.1 Florida

In Florida, the state utility commission's findings, like those regarding statutory or regulatory compliance, are not binding on questions of tort liability in collateral civil litigation. For example, in *Southern Bell Telephone & Telephone Co. v. Mobile America Corp.*, the plaintiff alleged its telephone utility failed to comply with its statutory duty to provide efficient phone service and sought monetary damages.[423] The Florida supreme court concluded that where a trial court seeks the expertise of the state utility commission regarding statutory compliance, its findings "are not conclusive but should be considered together with any other evidence before the court on the issue of liability, and on the issue of damages if applicable to that issue."[424] Decisions should be made by considering the "total evidence"; state utility commission findings are "much like that of the report of a referee or special master which the court, or jury, could act upon as all of the evidence might indicate."[425]

416 *E.g.*, *Moore*, 662 P.2d 398; Siewart v. N. States Power Co., 793 N.W.2d 272 (Minn. 2011).

417 *E.g.*, Elkin v. Bell Tel. Co., 420 A.2d 371, 371 (Pa. 1980); Pacific Lightnet, Inc. v. Time Warner Telecomms., 318 P.3d 97, 109-10 (Haw. 2013).

418 These states include Idaho, Iowa, Kentucky, Missouri, Rhode Island, South Carolina, South Dakota, Tennessee, and Utah.

419 While a more recent case established a three-factor test for primary jurisdiction, *see* Killian v. J & J Installers, Inc., 802 S.W.2d 158 (Mo. 1991) (en banc), a much older case continues to be cited as the seminal primary jurisdiction decision and that three-factor test has been ignored. State ex rel. and to Use of Kan. City Power & Light Co. v. Buzard, 168 S.W.2d 1044 (Mo. 1943) (en banc), *cited by*, *e.g.*, Inter-City Beverage Co., Inc. v. Kan. City Power & Light Co., 889 S.W.2d 875 (Mo. Ct. App. 1994). What's more, a variety of tort suits against utilities have simply proceeded in court without discussion of either case. *E.g.*, Gladden v. Mo. Pub. Serv. Co., 277 S.W.2d 510 (Mo. 1955) (negligence case proceeding without discussion); Sparks v. Platte-Clay Elec. Coop., 861 S.W.2d 604 (Mo. Ct. App. 1993) (electrical fire negligence proceeds without discussion). And, some cases have simply said that the PSC cannot abrogate tort law claims for negligence. *E.g.*, Pub. Serv. Comm'n v. Mo. Gas Energy, 388 S.W.3d 221 (Mo. Ct. App. 2012).

420 *E.g.*, S. Bell Tel. & Tel. Co. v. Mobile Am. Corp., 291 So. 2d 199 (Fla. 1974).

421 *E.g.*, *Elkin*, 420 A.2d at 376-77. The doctrine of collateral estoppel applies to "preclude[] relitigation of issues actually litigated and necessary to the outcome of the first action" in a second action where a judgment has been rendered in a prior case. Parkland Hosiery Co. v. Shore, 439 U.S. 322, 326 n.5 (1979). Offensive collateral estoppel "occurs when the plaintiff seeks to foreclose the defendant from litigating an issue the defendant has previously litigated unsuccessfully." *Id.* at 326 n.4. Defensive collateral estoppel "occurs when a defendant seeks to prevent a plaintiff from asserting a claim that the plaintiff has previously litigated." *Id.*

422 Oncor Elec. Delivery Co. v. Chapparall Energy, 546 S.W.3d 133 (Tex. 2018).

423 291 So. 2d at 200.

424 *Id.* at 201-02.

425 *Id.* at 202.

5.2.2 Texas

The Texas supreme court recently held that factual findings made by the state utility commission should be reviewed under the "substantial evidence" standard—that is, "such relevant evidence as a reasonable mind might accept as adequate to support a conclusion." [426] In *Oncor Electric Delivery Co. v. Chapparall Energy*, the plaintiff brought a breach of contract claim against the electric utility for failing to adhere to the service agreement.[427] The electric utility contended that the state utility commission had jurisdiction and should hear the claim first; the court agreed.[428] The Texas supreme court explained that there was a two-step hybrid process for resolution of common law claims against utilities for monetary damages.[429] First, because a relevant statutory scheme required an agency with exclusive jurisdiction to make certain findings before a trial court could adjudicate a claim, the agency needed to first resolve all issues that fell within its exclusive jurisdiction.[430] Second, those findings could then be used in a later filed suit before a trial court to obtain any relief that the agency was unable to provide.[431] Commission findings relied upon in the later filed suit would be "subject to substantial evidence review."[432]

5.2.3 Pennsylvania

The Pennsylvania supreme court, in *Elkin v. Bell Telephone Co. of Pennsylvania*, stated that state utility commission determinations regarding statutory and regulatory compliance are "binding upon the court and the parties" and are "not subject to collateral attack in the pending court proceeding."[433] There, among other claims, the plaintiff alleged that the telephone company had negligently failed to provide reasonable service.[434] The company contended the state utility commission had jurisdiction over the issues, and the trial court agreed and stayed the case until the commission made determinations on standards of service.[435] In affirming the lower court's decision, the Pennsylvania supreme court explained that where a matter is referred by the trial court to the state utility commission, it cannot allow the commission's determinations to be challenged in the collateral trial court case—they are subject to appellate review, but not collateral attack.[436] The collateral case, "will not, of course, be used to relitigate the question of adequacy of service, but only to litigate such questions as were not resolved through administrative channels."[437] The civil litigation will be "guided in scope and direction by the nature and outcome of the agency determination."[438]

5.2.4 Massachusetts

The Massachusetts supreme court has opined on whether a trial court may apply offensive collateral estoppel to state utility commission factual findings. In Bellermann v. Fitchburg Gas & Electric Light Co., the state utility commission sua sponte opened an investigation into a utility's preparation and response to a major winter storm to determine whether it had satisfied its public service obligation to provide safe and reliable service.[439] After an investigation and adjudicatory proceedings, the state utility commission concluded that the electric utility had violated its obligations.[440] Electric utility customers subsequently filed a class action lawsuit alleging gross negligence and statutory violations and requested the court grant the commission's findings issue preclusive effect.[441] Unlike the Pennsylvania supreme court in *Elkin*, which made a blanket statement on the application of collateral estoppel to state utility commission factual findings, the Massachusetts supreme court in *Bellermann* explained that the trial court has broad discretion in

426 Richardson v. Perales, 402 U.S. 389 (1971).
427 546 S.W.3d at 137.
428 *Id.* at 138-41.
429 *Id.* at 142.
430 *Id.*
431 *Id.*
432 *Id.*
433 420 A.2d 371, 376-77 (Pa. 1980).
434 *Id.* at 373.
435 *Id.* Pennsylvania, like Texas, employs a bifurcated jurisdictional procedure in which trial courts may, under the doctrine of primary jurisdiction, refer aspects of a claim to the commission where adjudication of the matter involves statutory or regulatory compliance or standards of service that fall within the state utility commission's jurisdiction and technical expertise. *Id.* at 374-75.
436 *Id.* at 376-77.
437 Feingold v. Bell of Pa., 383 A.2d 791, 801 n.4 (Pa. 1977) (Pomeroy, J., dissenting), quoted with approval by *Elkin*, 420 A.2d at 376 n.7.
438 *Elkin*, 420 A.2d at 377.
439 18 N.E.3d 1050, 1057 (Mass. 2014).
440 *Id.* at 1057-58.
441 *Id.* at 1054. While the plaintiffs sought to apply issue preclusion, the court uses the term collateral estoppel instead, explaining they are the same concept. *Id.* at 1065.

determining whether offensive collateral estoppel should apply.[442] The court emphasized that the central inquiry is whether the defendant had a full and fair opportunity to litigate in the first action.[443] In concluding that the lower court had not abused its discretion in finding that the state utility commission's findings had preclusive effect, the court highlighted the robust procedural nature of the commission proceeding at issue: "The [commission] conducted a five-day adjudicatory hearing at which [Fitchburg Gas & Electric ("FG & E")] was represented by competent counsel, and FG & E had a right to proffer evidence, subpoena witnesses, cross-examine witnesses under oath, present oral and written arguments, and appeal an adverse decision."[444]

5.3 Limitations on Liability

State utility commission-approved tariffs often limit the liability of electric utilities in a variety of ways.[445] Tariff provisions vary significantly in language and scope, not just by state, but also between utilities operating within the same jurisdiction.[446] These limitations can bind the hands of judges in providing relief to parties injured by electric utilities' actions (or failure to act). Limitations on liability have generally been justified as in the public interest on the basis that, when their liability is defined and limited, electric utilities are better able to provide service at reasonable rates.[447] Such limitations will be binding on state courts: tariffs have the force and effect of law.[448] Limitation provisions are generally enforced under the filed rate doctrine, which prevents courts from hearing collateral challenges to approved tariff provisions.[449] However, the courts in a few states have concluded that certain liability provisions are unenforceable as contrary to public policy. Further, while these liability provisions could severely limit judges' ability to provide relief, courts have retained flexibility through their ability to interpret and apply tariff language. In some states, courts have narrowly construed tariff provisions to limit their application.[450]

While there are some differences between states, only a few courts have refused completely to enforce tariff limitations on liability.[451] In a majority of states, courts have held that tariff provisions may limit an electric utility's liability for ordinary negligence that causes economic harm, but may not limit liability for gross negligence or willful or wanton misconduct causing economic harm.[452] A few have extended this rule to allow utilities to limit their liability for ordinary negligence that causes personal injury or property damage.[453] There are also states that have allowed electric utilities to limit liability for gross negligence causing economic harm.[454]

442 *Id.* at 1065, 1066, 1068, 1069.

443 *Id.* at 1065.

444 *Id.* at 1069.

445 In some states, statutes and regulations also may limit liability. *See, e.g.*, UTAH CODE ANN. § 54-22-203 (electric utility cannot be held liable for damage to cattle from stray voltage); S.D. CODIFIED LAWS § 49-47-7 (stray voltage damages limited to those incurred in the year prior to notice to utility). In other states, statutes or regulations may prevent limitations on liability. *See, e.g.*, VA. CODE ANN. § 56-260.1 (prohibiting utility from including provisions limiting liability for personal injury or property damage related to power lines); N.Y. COMP. CODES R. & REGS. tit. 16, § 218.1 (1973) (prohibiting inclusion of certain limitations of liability in utility tariffs).

446 Re Liability of Elec. Power Cos. for Injury or Damages Resulting from Problems in Delivery of Elec. Power, 82 Md. P.S.C. 92 (Md. Pub. Serv. Comm'n Apr. 5, 1991) (noting lack of uniformity in liability provisions among utilities operating in the state and rejecting proposal to standardize the liability provision).

447 *E.g.*, W. Union Tel. Co. v. Esteve Bros. & Co., 256 U.S. 566, 569 (1921); Comput. Tool & Eng'g, Inc. v. N. States Power Co., 453 N.W.2d 569, 572 (Minn. Ct. App. 1990); U.S. Airways, Inc. v. Qwest Corp., 361 P.3d 942, 946 (Ariz. Ct. App. 2015), *aff'd in relevant part*, U.S. Airways, Inc. v. Qwest Corp., 385 P.3d 412 (Ariz. 2016).

448 *E.g.*, Pacific Lightnet, Inc. v. Time Warner Telecomm., 318 P.3d 97, 110 (Haw. 2013); State Farm Fire & Cas. Co. v. PECO, 54 A.3d 921, 926 (Pa. Super. Ct. 2012); Adams v. N. Ill. Gas. Co., 809 N.E.2d 1248, 1263 (Ill. 2004).

449 *E.g.*, Teleconnect Co. v. U.S. W. Commc'ns, 508 N.W.2d 644, 648 (Iowa 1993).

450 *See infra* notes 470-475 and accompanying text.

451 Mobile Elec. Serv., Inc. v. FirsTel, Inc., 649 N.W.2d 603, 606 (S.D. 2002) (inclusion of limitations on liability creates contracts of adhesion because customers have no choice but to accept the tariff terms); Discount Fabric of Racine, Inc. v. Wis. Tel. Co, 345 N.W.2d 417 (Wis. 1984). Michigan courts have conflicting case law, although *Allen v. Michigan Bell Telephone Co.* is often relied upon by other jurisdictions as a decision concluding tariff limitations should not be enforced. 171 N.W.2d 689 (Mich. Ct. App. 1969). *But see* Durcon Co. v. Detroit Edison Co., 655 N.W.2d 304 (Mich. Ct. App. 2002) (applying Rinaldo's Construction Corp. v. Mich. Bell Tel. Co., 559 N.W.2d 647, 654 (Mich. 1997), concluding that tariff limitations on liability are presumptively valid until challenged before the commission). *Adams v. Northern Illinois Gas Co.*, is another case often relied upon for the same premise, 809 N.E.2d 1248 (Ill. 2004), however later Illinois case law is clear that tariff limitations on liability that speak to the issue are controlling. *See, e.g.*, Sheffler v. Commonwealth Edison, 955 N.E.2d 1110 (Ill. 2011).

Most recently, a Connecticut trial court generally questioned whether the state utility commission had any authority to approve limitations on liability provisions, and specifically questioned the validity of its broad exculpatory clause that could be read to "immunize CL&P from any liability whatsoever." O'Neill v. Conn. Light & Power Co., No. HHDCV186089044S, 2020 WL 1889124, at *7 (Conn. Super. Ct. Feb. 21, 2020); *but see* Zurich Am. Ins. Co. v. S. Conn. Gas. Co., No. 19-cv-00534, 2020 WL 869862 (D. Conn. Feb. 21, 2020) (enforcing gas company's limitation on liability for negligence provision).

452 *E.g.*, Danisco Ingredients USA, Inc. v. Kan. City Power & Lighting Co., 986 P.2d 377, 384-85 (Kan. 1999) (noting that Kansas has followed the "majority rule"); Bulbman, Inc. v. Nev. Bell, 825 P.2d 588 (Nev. 1992) (affirming lower court's endorsement of the "majority view").

453 *E.g.*, Sw. Elec. Power Co. v. Grant, 73 S.W.3d 211 (Tex. 2002) (allowing limitation on liability for personal injury where it is narrowly drawn); Los Angeles Cellular Tel. Co. v. Superior Ct. of Los Angeles Cnty., 76 Cal. Rptr. 2d 894 (Cal. Ct. App. 1998) (same); Landrum v. Fla. Power & Light Co., 505 So. 2d 552 (Fla. Dist. Ct. App. 1987) (same). *But see, e.g.*, Pub. Serv. Comm'n of Mo. v. Mo. Gas Energy, 388 S.W.3d 221, 230-31 (Mo Ct. App. 2012) ("We find no statute . . . that grants the Commission the authority to limit a public utility's negligence liability involving personal injury or property damage.").

454 Brown v. United Water Del. Inc., No. 291,2009, 2010 WL 2052373, at *5-7 (Del. Super. Ct. May 20, 2010); Md. Cas. Co. v. NSTAR Elec. Co., 30 N.E.3d 105, 110-15 (Mass. 2015) (allowing limitation on liability owed for economic harm (i.e., special, indirect, or consequential damages) even in face of gross negligence after concluding in dicta that there were no statutory or public policy bars to a tariff limiting liability for gross negligence); Prof'l Answering Serv., Inc. v. Chesapeake & Potomac Tel. Co., 565 A.2d 55, 65 (D.C. 1989).

Beyond broad limitations on ordinary negligence, electric utilities' tariffs often limit claims in more specific ways. For example, rather than excluding liability for negligence entirely, some will place specific caps on the amount of damages that may be recovered.[455] Others will limit the types of damages that may be sought (i.e., direct vs. consequential).[456] Sometimes these provisions will distinguish between types of customers (i.e., residential versus non-residential).[457] These caveats have been considered by some courts in assessing the reasonableness of tariff provisions because the caveats demonstrate that the electric utility is not seeking to immunize itself from liability entirely, but instead only in certain reasonable and narrowly prescribed circumstances.[458] Notably, some courts have also held that tariff provisions are

Box 13: Tariff Language

The following tariff provisions are illustrative of the examples above. It is notable, however, that these types of provisions exist in utility tariffs in every state. As the provisions are often given the force and effect of law once they are approved by the state utility commission, judges will be bound by their limitations in adjudicating tort claims against utilities, although there is some room for interpretation.

Cap on Damages: PECO Energy Company (Pennsylvania)

12.1 Limitation on Liability for Service Interruptions and Variations: In all other circumstances, the liability of the Company to customers or other persons for damages, direct or consequential, including damage to computers and other electronic equipment and appliances, loss of business, or loss of production caused by any interruption, reversal, spike, surge or variation in supply or voltage, transient voltage, or any other failure in the supply of electricity shall in no event, unless caused by the willful and/or wanton misconduct of the Company, **exceed an amount in liquidated damages equivalent to the greater of $1000 or two times the charge to the customer for the service affected** during the period in which such interruption, reversal, spike, surge or variation in supply or voltage, transient voltage, or any other failure in the supply of electricity occurs.[459]

Limitation on Type of Damages: Northern States Power Co. (Minnesota)

1.4 Continuity of Service: The Company will endeavor to provide continuous service but does not guarantee an uninterrupted or undisturbed supply of electric service. The Company shall not be responsible for any loss or damage resulting from the interruption or disturbance of service for any cause other than gross negligence of the Company. **The Company shall not be liable for any loss of profits or other consequential damages resulting from the use of service or any interruption or disturbance of service.**[460]

Distinguishing Between Customers: NSTAR Electric Co. (Massachusetts)

3. Limitation of Liability: In any event, **for non-residential Customers** served under general service rates, the Company shall not be liable in contract, in tort (including negligence and M.G.L.c.93A), strict liability or otherwise for any special, indirect, or consequential damages whatsoever including, but not limited to, loss of profits or revenue, loss of use of equipment, cost of capital, cost of temporary equipment, overtime, business interruption, spoilage of goods, claims of Customers of the Customer or other economic harm.[461]

455 *E.g.*, *O'Neill*, 2020 WL 1889124, at *7 (noting previous cases had approved tariffs where liability was reasonably capped); Woodburn v. Nw. Bell Tel. Co., 275 N.W.2d 403, 404-05 (Iowa 1979) (approving tariff capping amount recoverable); State Farm Fire & Cas. Co. v. PECO, 54 A.3d 921, 929-30 (Pa. Super. Ct. 2012) ("The second paragraph establishes two scenarios which serve solely to limit the amount of recovery."); Providence Forge Oil Co. v. Chesapeake & Potomac Tel., 1966 WL 88488, at *3 (Va. Cir. Ct. 1966) (upholding limitation in tariff for errors in directory to a certain amount).

456 *E.g.*, Re Liability of Electric Power Cos. for Injury or Damages Resulting from Problems in Delivery of Elec. Power, 82 Md. P.S.C. 92 (Md. Pub. Serv. Comm'n Apr. 5, 1991) (commission noting and approving of tariffs limiting the type of damages that could be recovered for interruptions in services); *Maryland Cas. Co.*, 30 N.E.3d at 109-10 (limiting liability for gross negligence, but only for special, indirect, or consequential damages); Busalacchi v. San Diego Gas & Elec. Co., No. 12-CV-298-H-KSC, 2013 WL 12100702, at *4 (S.D. Cal. Sept. 26, 2013) (tariff provision barring special or consequential damages against utility enforced); ZumBerge v. N. States Power Co., 481 N.W.2d 103, 106 (Minn. Ct. App. 1992) (assessing limitation on consequential damages from use of service provision).

457 *E.g.*, *Maryland Casualty*, 30 N.E.3d at 115-16 (limiting liability where claim brought by nonresidential customer).

458 *E.g.*, *id.*; *State Farm Fire*, 54 A.3d 921, 929.

459 PECO Energy Co., *Electric Service Tariff* (effective Sept. 1, 2020), https://perma.cc/J7FP-RCL6.

460 Northern States Power Co., *Minnesota Electric Rate Book: General Rules and Regulations* (effective Apr. 1, 2010), https://perma.cc/8HQB-KAJG.

461 NSTAR Electric Co., *Terms and Conditions – Distribution Service* (effective Mar. 1, 2018), https://perma.cc/4NSE-6GHK.

enforceable against both customers and non-customers,[462] while others have limited application solely to customers.[463]

While tariffs are generally binding and enforced by state courts, judges retain broad authority to interpret tariff provisions. The filed rate doctrine does not prevent courts from interpreting their scope and applicability.[464] Some courts, viewing tariffs as having the force and effect of law, will apply the rules of statutory construction in interpreting ambiguous limitation provisions,[465] while others use the rules of contract interpretation instead.[466] Many courts have adopted the rule that exculpatory clauses in tariffs should be strictly construed against the electric utility and in favor of the customer.[467] Ambiguous provisions in particular leave room for court interpretation,[468] and a common interpretation rule is that limitations of liability for negligence must clearly express that purpose.[469]

Examples of narrow interpretations abound. A Washington court interpreted a provision that barred liability for damages due to causes beyond the utility's reasonable control to only protect the electric utility where the outside cause (in this case, a windstorm) was the sole cause, but not where there was concurrent negligence on the utility's part.[470] New York courts have narrowly construed provisions limiting liability for interruption of service, finding that they do not limit liability for harms that result from the negligent supply of service.[471] The Wisconsin supreme court concluded that stray voltage does not fall under the regular supply of electricity and therefore liability for harm from stay voltage is not limited by continuity of service limitation provisions.[472] Relatedly, a Minnesota court narrowly interpreted a limitation on liability for consequential damages "resulting from the use of service," concluding that a customer's mere use of service could not be viewed as resulting in the presence of stray voltage on his farm, which caused his damages.[473] There is even a difference among courts about how to interpret a tariff provision that says the electric utility is not liable except in cases of "willful default or neglect." Some have interpreted this as "willful default or willful neglect" meaning that it limits liability for negligence;[474] others have interpreted it as precluding liability except for negligence or willful default, which limits liability in fewer instances.[475]

462 U.S. Airways, Inc. v. Qwest Corp., 361 P.3d 942, 946 (Ariz. Ct. App. 2015) (applying limit to non-customer).

463 Tyus v. Ind. Power & Light, 134 N.E.3d 389, 407 (Ind. Ct. App. 2019) (concluding commission lacked authority to shield utility from liability for injuries to noncustomers caused by utility's negligence); Thrifty-Tel Inc. v. Bezenek, 54 Cal. Rptr. 2d 468 (Cal. Ct. App. 1996) (noting that it was not clear that Constitutional provisions authorizing the commission to set rates for services empowered it to liquidate a utility's tort damages against third parties); Colich & Sons v. Pacific Bell, 244 Cal. Rptr. 714 (Cal. Ct. App. 1988) (finding limitation of liability provisions did not apply in cases involving personal injuries by third parties); Abel Holding Co. Inc., v. American Dist. Tel. Co. 371 A.2d 111, 113-15 (N.J. Super. Ct. App. Div. 1977) (rejecting argument that tariff limitation was binding on both customers and third parties).

464 *E.g.*, Pacific Lightnet, Inc. v. Time Warner Telecomms., Inc., 318 P.3d 97, 110 (Haw. 2013) ("It is well-established that 'the filed-rate doctrine . . . does not preclude courts from interpreting the provisions of a tariff . . . .'" (quoting Brown v. MCI WorldCom Network Servs. Inc., 277 F.3d 1166, 1171-72 (9th Cir. 2002))).

465 Adams v. N. Ill. Gas. Co., 809 N.E.2d 1248, 1268-73 (Ill. 2004).

466 Estate of Pearson ex rel. Latta v. Interstate Power & Light, 700 N.W.2d 333, 343 (Iowa 2005).

467 Uncle Joe's Inc. v. L.M. Berry & Co., 156 P.3d 1113 (Alaska 2007); *see also* Finagin v. Ark. Dev. Fin. Auth., 139 S.W.3d 797, 806 (Ark. 2003).

468 *See* Tesoro Refining & Mktg. Co. v. Pacific Gas & Elec. Co., 146 F. Supp. 3d 1170, 1182-87 (N.D. Cal. 2015) (noting that while exculpatory tariff provisions are clearly enforceable, because PG&E's provision was ambiguous, the court could conclude that it did not bar liability in the specific case).

469 *Id.*

470 Nat'l Union Ins. of Pittsburgh v. Puget Sound Power & Light, 972 P.2d 481 (Wash. Ct. App. 1999) (holding that utility's continuity of service provision did not "absolve it from liability for service interruptions that it could have controlled or mitigated but for its unreasonable or unexplained failure to utilize available backup equipment in order to reestablish service with a minimum of delay while storm damage to regular equipment is being repaired").

471 Allstate Ins. Co. v. Long Is. Power Auth., No. 14-CV-0444, 2015 WL 867064, at *3-4 (E.D.N.Y. Feb. 27, 2015); Ahmed v. Consolidated Edison, 59 Misc.3d 323, 326-28 (N.Y. Civ. Ct. 2018).

472 Schmidt v. N. States Power Co., 742 N.W.2d 294, 315 (Wis. 2007).

473 ZumBerge v. N. States Power Co., 481 N.W.2d 103, 107 (Minn. Ct. App. 1992).

474 Singer Co. v. Baltimore Gas & Elec., 558 A.2d 419 (Md. Ct. Spec. App. 1989).

475 Lupoli v. N. Utils. Nat. Gas, Inc., No. 991844, 2004 WL 1195308 (Mass. Super. Ct. 2004) (applying N.H. law) (tariff barring lability except for "willful default or neglect" does not preclude claims for negligence).

PART 6:

Conclusion

Climate resilience planning becomes increasingly salient as the consequences of climate change become ever-more pronounced and pervasive. Electric utilities are not immune to climate change impacts; on the contrary, as operators of immense place-based infrastructure, they are particularly vulnerable. Already completed industry efforts make clear that climate resilience planning, capable of elucidating highly specific analysis and recommendation, is possible. The emergence of such knowable information necessarily implicates long-standing obligations already imposed on electric utilities. This paper explores two legal doctrines, public utility law and tort law structures, which we argue require electric utilities to engage in climate resilience planning.

The public utility law and tort law structures examined in this paper impose various obligations on electric utilities. Public utility law obligates electric utilities to meet, among other things, prudent investment, safe and adequate service, and reliability standards. Tort law obligates electric utilities to, among other things, avoid foreseeable harm when performing acts that could injure others. Both public utility law and tort law obligations can only be met if electric utilities institute effective planning processes. That is, law requires electric utilities to expend reasonable effort to uncover and incorporate relevant information into planning processes.

Science and evidence make clear that the consequences of climate change to electric utility assets is relevant—even critical—information to planning processes. And climate change impacts on electric utility infrastructure can be uncovered and incorporated as relevant information into planning processes with reasonable effort. It is, therefore, reasonable to conclude that electric utilities are obligated to expend reasonable efforts to uncover and incorporate consequences of climate change into planning processes.

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CLIMATE CHANGE IMPACTS ON THE BULK POWER SYSTEM:

Assessing Vulnerabilities and Planning for Resilience

By Justin Gundlach and Romany Webb

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The Sabin Center for Climate Change Law develops legal techniques to fight climate change, trains law students and lawyers in their use, and provides the legal profession and the public with up-to-date resources on key topics in climate law and regulation. It works closely with the scientists at Columbia University's Earth Institute and with a wide range of governmental, non-governmental and academic organizations.

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EXECUTIVE SUMMARY

As the scale, speed, and implications of climate change come into focus, stakeholders in the electricity sector are finding it increasingly difficult to turn a blind eye. However, many have opted to attend to climate impacts in a piecemeal fashion, often merely responding to particular extreme events—or types of extreme events, such as coastal storms or floods—and failing to consider the larger phenomenon. This is true of the bulk power system (BPS) in regions overseen by Independent System Operators and Regional Transmission Organizations (collectively, ISO/RTOs), none of which have comprehensively assessed their systems' vulnerabilities to climate change. Lacking such assessments, ISO/RTOs cannot plan for the impacts of climate change, and thereby ensure the continued reliability and resilience of the BPS.

The higher temperatures, more intense storms, and other weather extremes associated with climate change pose numerous threats to the BPS. These threats are summarized in a table in the appendix to this paper. As shown there, the impacts of climate change could force generating facilities to curtail output or shutdown, and lead to widespread transmission outages. These disruptions will be accompanied by other climate-driven phenomenon, including increases in electricity load and the height of load peaks, which will further strain facilities.

While the nature and extent of generation and transmission impairments will vary across the U.S.—due to differences in the nature and extent of climatic changes seen—no region will go unscathed. It is, therefore, vital that all ISO/RTOs begin planning now for a future in which climate change will feature. Otherwise, in the future, the BPS may be unable to deliver reliable electricity services at just and reasonable rates as required by the Federal Power Act.

This paper offers ISO/RTOs advice on how to plan for climate change and identifies resources and processes they could employ in the planning process. The regional variation in climate change impacts, as well as differences in generation and transmission resources, prevent formulation of a "one-size fits-all" approach to planning across ISO/RTO regions. Nevertheless, there are a number of general principles which we recommend all ISO/RTOs follow, namely:

- A detailed climate change vulnerability assessment should be undertaken to determine how the components and operations of each ISO/RTO's system will be affected by increasing temperatures, changing precipitation patterns, more intense storms, droughts, and other climate-driven weather extremes.

  - Vulnerability assessments should be based on downscaled projections of future climate change in the ISO/RTOs' respective operating regions. Many projections are available in existing datasets, including those developed by NASA and the U.S. Geological Survey. Gaps in available datasets (if any) should be noted and, if possible, filled by sponsoring supplemental research.
  - Vulnerability assessments should consider multiple projections that reflect a range of possible climate change scenarios, including a "worst case" (i.e., assuming continued high greenhouse gas emissions lead to large temperature increases and rates of sea level rise).
  - The timeframe for each vulnerability assessment should reflect the anticipated useful life of existing facilities or facilities scheduled for construction in the relevant ISO/RTO's region.
  - Vulnerability assessments should be periodically reviewed and updated as new information becomes available.

- Building on the vulnerability assessment, a plan should be developed for how to adapt and thereby prevent or manage the system disruptions that could threaten BPS reliability and resilience.

CONTENTS

1. INTRODUCTION

The resilience of the bulk power system (BPS) to various types of disruption has been the subject of much discussion in recent months. It was a key focus of the "Grid Reliability and Resiliency Pricing" proceeding before the Federal Energy Regulatory Commission (FERC),[1] the agency responsible for overseeing six Independent System Operators and Regional Transmission Organizations (collectively, ISO/RTOs) that manage much of the BPS.[2] The proceeding, which FERC opened on October 2, 2017 in response to a request from the Secretary of Energy, considered the need for ISO/RTO-level reforms to support so-called "resilience resources" that have a ninety-day fuel supply on-site. Concluding that a legal basis for such reforms was missing, FERC terminated the proceeding on January 8, 2018. FERC noted, however, that resilience "warrants further attention" and therefore opened another proceeding "to explore resilience issues in the RTOs/ISOs" (resilience proceeding).[3]

For the purposes of the resilience proceeding, FERC proposes to define "resilience" as "[t]he ability to withstand and reduce the magnitude and/or duration of disruptive events, which includes the capability to anticipate, absorb, adapt to, and/or rapidly recover from such an event."[4] Notably, resilience is distinct from reliability. In the short term, reliability is defined as the frequency and duration of outages due to "high frequency, low impact" events experienced in a given service territory[5] and, in the long-term, as the adequacy of energy supply vis-à-vis load in

[1] *Grid Resiliency Pricing Rule*, 82 Fed. Reg. 46,940 (Oct. 10, 2017).

[2] FERC, *Regional Transmission Organizations (RTO)/Independent System Operators (ISO)*, https://perma.cc/EVQ6-TZFJ (updated Dec. 21, 2017). FERC does not regulate the Electric Reliability Council of Texas. See FERC, *ERCOT*, https://perma.cc/84GU-5W2P (updated Nov. 17, 2017).

[3] Order Terminating Rulemaking Proceeding, Initiating New Proceeding, and Establishing Additional Procedures, 162 FERC ¶ 61,012, P 10 (2018). It is possible, though not certain, that the current phase of the proceeding will result in FERC calling for a full technical conference to address one or more sources of risk to BPS resilience.

[4] *Id.* at P 13 (citing the National Infrastructure Advisory Council's 2009 Critical Infrastructure Resilience Final Report and Recommendations at 8).

[5] Examples of short-term reliability metrics include: System Average Interruption Frequency Index (SAIFI), which captures the ratio of sustained outages over a year to the number of customers served (including both affected and unaffected customers); System Average Interruption Duration Index (SAIDI), is similar, and is often expressed as "consumer minutes" or "hours" to convey the average annual outage duration per consumer in a given service territory; and Consumer Average Interruption Frequency Index (CAIFI), which

that territory.[6] Resilience, by contrast, is concerned with preparation for, responses to, and recovery from less predictable "high impact, low frequency events."[7]

The order convening the resilience proceeding noted that FERC has already examined and addressed several types of risks to BPS reliability, both directly and via the North American Electric Reliability Corporation (NERC)'s development of reliability standards.[8] According to FERC, "[w]hile none of the Commission's efforts . . . were specifically targeted at 'resilience' by name, they were directed at elements of resilience, in that they sought to ensure the uninterrupted supply of electricity in the face of fuel disruptions" or other risks.[9] Risks addressed in a systematic fashion include "fuel assurance," "fuel supply issues during periods of system stress" (including due to extreme weather events), and "cybersecurity and physical security threats, as well as geomagnetic disturbances."[10] Missing from this list are risks arising from the effects of climate

captures the ratio of sustained outages over a year to the number of customers affected by those outages. NATIONAL ACADEMY OF SCIENCES, ENHANCING THE RESILIENCE OF THE NATION'S ELECTRICITY SYSTEM 13 (Apr. 2017).

[6] NORTH AMERICAN ELECTRICITY RELIABILITY CORPORATION (NERC), 2016 LONG-TERM RELIABILITY ASSESSMENT (2016) ("NERC's primary objective with the [Long-Term Reliability Assessment] is to assess resource and transmission adequacy across the NERC footprint, and to assess emerging issues that have an impact on BPS reliability over the next ten years.").

[7] Mathaios Panteli & Pierluigi Mancarella, *The Grid: Stronger, Bigger, Smarter?*, IEEE POWER ENERGY MAG., May/June 2015, at 58 (describing key parameters of resilience in electricity systems).

[8] Section 215 of the Federal Power Act, which became law in 2005, invites FERC to certify as the Electricity Reliability Organization (ERO) an entity able "to develop and enforce . . . reliability standards that provide for an adequate level of reliability of the bulk-power system" in an objective and procedurally sound manner. *See* Federal Power Act § 215(c)(1), *codified at* 16 U.S.C. § 824o; Energy Policy Act of 2005, Pub. L. 109–58, § 1211(a), 119 Stat. 941 (Aug. 8, 2005). FERC certified the North American Electric Reliability Council (NERC) as the ERO in 2006 (since 2007, the "C" has stood for "Corporation"). *See* 116 FERC ¶ 61,062 (2006). NERC's standards have been legally enforceable since 2007. *See* Mandatory Reliability Standards for the Bulk Power System, Order No. 693, 72 Fed. Reg. 16,416 (April 4, 2007), FERC Stats. & Regs. ¶ 31,242 (2007), *order on reh'g*, Order No. 693-A, 120 FERC ¶ 61,053 (2007).

[9] *Id.* at 7.

[10] *Id.* at 5–7. The Order cites the following past orders to illustrate and support these points: Centralized Capacity Markets in Regional Transmission Organizations and Independent System Operators, 149 FERC ¶ 61,145 (2014) (order addressing technical conferences on, among other things, the 2014 Polar Vortex); ISO New England Inc. and New England Power Pool, 147 FERC ¶ 61,172 (2014), *reh'g denied*, 153 FERC ¶ 61,223 (2015), *appeal pending sub nom.*, New England Power Generators Ass'n v. FERC, No. 16-1023 (D.C. Cir. filed Jan. 19, 2016); PJM Interconnection, L.L.C., 151 FERC ¶ 61,208 (2015), *reh'g denied*, 155 FERC ¶ 61,157 (2016), *aff'd sub nom.*, Advanced Energy Mgmt. All. v. FERC, 860 F.3d 656 (D.C. Cir. 2017); Physical Security Reliability Standard, Order No. 802, 149 FERC ¶ 61,140 (2014); Revised Critical Infrastructure Protection Reliability Standards, Order No. 822, 154 FERC ¶ 61,037 (2016), *reh'g denied*, Order No. 822-A, 156 FERC ¶

change. To the extent that FERC, NERC, or individual ISO/RTOs have examined such risks, that examination has been piecemeal, and has at no point taken into account downscaled climate projections[11] for the coming years and decades.

This paper argues that such an approach is inadequate to ensure the long-term resilience of the BPS to climate change. That inadequacy is legal as well as practical. The Federal Power Act (FPA) requires FERC to ensure the BPS operates in a manner that yields reliable electricity services at rates that are just, reasonable, and not unduly discriminatory or preferential.[12] To meet that requirement, FERC relies on market mechanisms, reasoning that they "provide correct incentives for [participants] to . . . make efficient investments in facilities and equipment."[13] However, FERC has recognized that, for markets to provide "correct" investment incentives, they must account for differences in the risk profiles of BPS facilities.[14] At present, because neither FERC nor the ISO/RTOs have conducted a comprehensive assessment of climate risks to BPS facilities, it is unclear whether those risks are duly unaccounted for.

While various facility owners have identified climate change as a source of material physical risk to their operations,[15] no one has sought to map such risks systematically at the ISO/RTO level. This paper argues that such mapping is an essential first step toward ensuring that, as the climate changes, the BPS continues to deliver reliable electricity services at just and reasonable rates. The rest of the paper proceeds in three sections. Section 2 briefly describes key

61,052 (2016); Revised Critical Infrastructure Protection Reliability Standards, Order No. 829, 156 FERC ¶ 61,050 (2016); Cyber Systems in Control Centers, Notice of Inquiry, FERC Stats. & Regs. ¶ 35,557 (2016); Revised Critical Infrastructure Protection Reliability Standards CIP-003-7 – Cyber Security – Security Management Controls, Notice of Proposed Rulemaking, 161 FERC ¶ 61,047 (2017); Reliability Standard for Transmission System Planned Performance for Geomagnetic Disturbance Events, Order No. 830, 156 FERC ¶ 61,215 (2016).

[11] Downscaled projections identify likely future changes in climate-driven extreme weather and other phenomenon at local scales.

[12] 16 U.S.C. §§ 824d(a)-(b) & 824o.

[13] Price Formation in Energy and Ancillary Services Markets Operated by Regional Transmission Organizations and Independent System Operators; Notice Inviting Post-Technical Workshop Comments, 80 Fed. Reg. 3,580 (Jan. 23, 2015).

[14] *See generally* P.J.M Interconnection, L.L.C., 151 FERC ¶ 61,208 (2015), *order on reh'g*, 155 FERC ¶ 61,157 (2016).

[15] *See e.g.*, NextEra Energy, Inc., Florida Power & Light Co., Annual Report (Form 10-K) 26 (Feb. 23, 2017); Consolidated Edison Company of New York, Inc., Annual Report (Form 10-K) 32 (Dec. 31, 2016); American Electric Power Company, Inc., Annual Report (Form 10-K) 41–42 (Dec. 31, 2016).

risks climate change poses for the BPS. Section 3 identifies processes and resources that can be employed to assess the BPS's vulnerability to climate change and plan for climate resilience. Section 4 contains recommendations for conducting vulnerability assessments and developing resilience plans.

2. CLIMATE CHANGE AND THE BULK POWER SYSTEM

Since the start of the 19th century, annual average temperatures in the contiguous U.S. have increased by up to 1.8°F (1.0°C), with two-thirds of this increase occurring in the last two decades.[16] Those decades also saw a marked rise in the frequency and intensity of heat waves[17] and other extremes, including droughts, floods, and storms,[18] as well as climate-related environmental changes such as sea level rise.[19] Conditions are expected to worsen in coming years as temperatures continue to increase, leading to significant and widespread adverse impacts, including on the BPS and the systems, communities, and individuals that rely on it.

Numerous sources—including reports of national laboratories,[20] federal agencies,[21] state agencies,[22] privately-sponsored researchers,[23] and international organizations,[24] corporate filings

[16] R.S. Vose et al., *Temperature Changes in the United States*, *in* CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT 185, 186 (D.J. Wuebbles et al. eds., 2017), https://perma.cc/TD85-T3H8.
[17] *Id*. at 191-192.
[18] M.F. Wehner et al., *Droughts, Floods, and Wildfires, in* CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT 231, 231 (D.J. Wuebbles et al. eds., 2017), https://perma.cc/TD85-T3H8.
[19] W.V. Sweet et al., *Sea Level Rise*, *in* CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT 333, 333 (D.J. Wuebbles et al. eds., 2017), https://perma.cc/TD85-T3H8.
[20] *See e.g.*, BENJAMIN L. PRESTON ET AL., RESILIENCE OF THE U.S. ELECTRICITY SYSTEM: A MULTI-HAZARD PERSPECTIVE (2016), https://perma.cc/9G93-P824.
[21] *See e.g.*, U.S. DEPT. OF ENERGY, CLIMATE CHANGE & THE ELECTRICITY SECTOR: GUIDE FOR CLIMATE CHANGE RESILIENCE PLANNING (2016), https://perma.cc/4WHR-EDFJ [hereinafter 2016 DOE Report]; U.S. DEPT. OF ENERGY, U.S. ENERGY SECTOR VULNERABILITIES TO CLIMATE CHANGE & EXTREME WEATHER (2013), https://perma.cc/9N8H-VM6S [hereinafter 2013 DOE Report]; ELECTRIC POWER RESEARCH INSTITUTE, POTENTIAL IMPACT OF CLIMATE CHANGE ON NATURAL RESOURCES IN THE TENNESSEE VALLEY AUTHORITY REGION (Nov. 2009), https://perma.cc/6YXR-QPBG.
[22] *See e.g.*, JAYANT SATHAYE ET AL., ESTIMATING RISK TO CALIFORNIA ENERGY INFRASTRUCTURE FROM PROJECTED CLIMATE CHANGE (2012), https://perma.cc/2ANF-S8ZV.
[23] *See e.g.*, EDWARD VINE, PUBLIC POLICY INSTITUTE OF CALIFORNIA, ADAPTATION OF CALIFORNIA'S ELECTRICITY SECTOR TO CLIMATE CHANGE (2008), https://perma.cc/5N2N-667Q.
[24] *See e.g.*, INTERNATIONAL ENERGY AGENCY, MAKING THE ENERGY SECTOR MORE RESILIENT TO CLIMATE CHANGE (2015), https://perma.cc/5WSM-J45P.

with the U.S. Securities and Exchange Commission,[25] and utilities' climate change vulnerability assessments and adaptation plans,[26] have identified the effects of climate change as sources of material physical risk for the generation and transmission segments of the BPS. The nature and extent of risks to generation and transmission will vary across regions because, though the global climate is generally growing warmer and stormier, regional climates will experience these and other phenomenon to varying degrees,[27] and also because different regions rely on different types of generation and differently situated transmission facilities. However, according to a 2015 Department of Energy (DOE) report, which mapped climate impacts on different parts of the U.S. energy sector, no region will go unscathed (see Figure 1).[28] Thus, ISO/RTOs in all regions should be planning for the effects of higher temperatures, heat waves, and more intense storms, which will be felt nationwide, as well as for regional effects, such as sea level rise along the coasts, wildfires in the West, drought in the Southwest and California, and more frequent and intense precipitation in the Northeast.[29]

[25] *See e.g.*, the 10-Ks listed *supra*, in note 15.
[26] TENNESSEE VALLEY AUTHORITY, CLIMATE CHANGE ADAPTATION PLAN—2016 UPDATE (June 2016), https://perma.cc/AQ82-M736; CRYSTAL RAYMOND, SEATTLE CITY LIGHT CLIMATE CHANGE VULNERABILITY ASSESSMENT AND ADAPTATION PLAN (2015), https://perma.cc/GBT2-2UV8.
[27] *See generally* CLIMATE CHANGE IMPACTS IN THE UNITED STATES: THE THIRD NATIONAL CLIMATE ASSESSMENT 370–618 (J.M. Melillo et al., eds., U.S. Global Change Research Program 2014) [hereinafter 3rd NCA].
[28] U.S. DEP'T OF ENERGY, CLIMATE CHANGE AND THE U.S. ENERGY SECTOR: REGIONAL VULNERABILITIES AND RESILIENCE SOLUTIONS (2015), https://perma.cc/3WQC-5JYV.
[29] These effects are described thoroughly in chapters 16 to 25 of the 3rd NCA, *supra* note 27.

Figure 1: DOE Map of Climate Impacts on the U.S. Energy Sector [30]

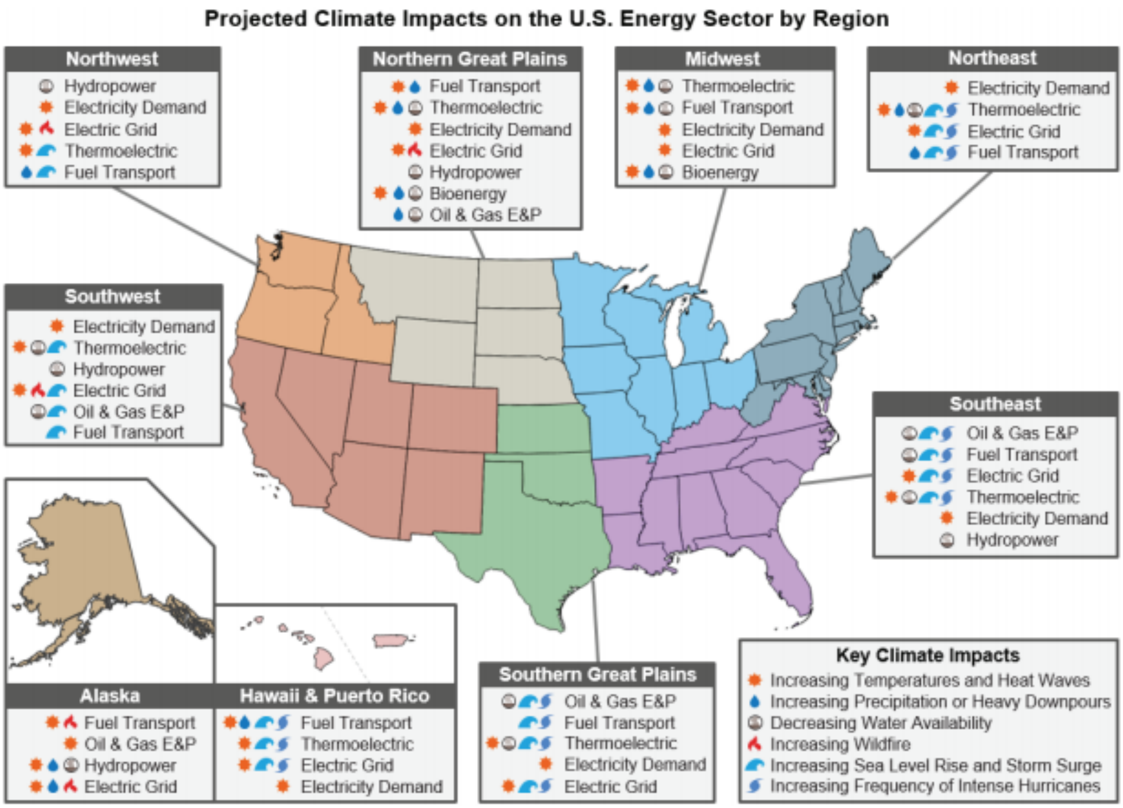

Figure ES-1. Potential climate change impacts on the U.S. energy infrastructure vary by region. Energy subsectors considered most vulnerable to projected climate impacts are listed first for each region.[1]

[1] "Thermoelectric" generally refers to power plants that use a steam turbine to generate electricity. Examples of thermoelectric power plant fuel sources include coal, natural gas, oil, nuclear, biomass, geothermal, and concentrated solar power. "Oil & Gas E&P" refers to upstream oil and gas operations, primarily exploration and production (E&P). "Fuel Transport" refers to movements of energy resources by rail, truck, marine vessel, and pipeline, and it includes associated facilities such as ports, pumping stations, terminals, and storage facilities. Hurricane impacts in Hawaii refer to a projected increase in the frequency of all hurricanes striking the islands, not just intense hurricanes; see Chapter 10 for specific projections. The order of subsector vulnerabilities shown in the figure is based on judgments by the report authors as well as experts from government agencies, national laboratories, and private sector energy companies.

A table summarizing the likely effects of various climatic changes on electricity generation and transmission facilities in each ISO/RTO region is included as Appendix A to this paper. Additional information regarding the effects is provided in this section. While the section discusses each climatic change separately, many will occur in parallel, and thus have compounding effects. Parts of the northeastern U.S., for instance, will simultaneously experience higher temperatures and sea level rise, both of which will adversely affect generation. Similarly, in the West, transmission will be simultaneously affected by higher temperatures and more extreme wildfires. In both areas, interdependencies between generation and transmission facilities and, more

[30] U.S. Dep't of Energy, *supra* note 28, at i.

generally, between the bulk and retail electricity systems may lead to further compounding of effects.[31]

2.1 Climate Change Impacts on Generating Facilities

Climate change will have profound impacts on electricity generation in the U.S., disrupting operations at many facilities, and forcing some to curtail output or entirely shutdown. The likely extent of these and other impacts, under various climate change scenarios, has been explored in a number of studies, the key findings of which are summarized below.

Increasing air temperatures: The Fourth National Climate Assessment, published in November 2017, forecasts that annual average temperatures in the contiguous U.S. will rise by at least 2.5°F (1.4°C) between 2021 and 2050.[32] Rising temperatures lower the efficiency of thermoelectric generating facilities, including nuclear and fossil fuel plants equipped with steam turbines, for at least three reasons. At higher temperatures:

1. the air mass of the turbine for a given volume intake is lower (i.e., as warmer air is less dense) ;
2. the pressure ratio within the turbine is lower, which reduces mass flow; and
3. the specific volume of air is higher, resulting in more power being consumed by the turbine during compression.[33]

The degree of efficiency reductions will depend on, among other things, the design of the generating facility and the fuel used. As an example, most natural gas facilities are designed to operate at 59°F (15°C), and may experience efficiency reductions of up to 1% for each 1.8°F (1°C) increase in temperatures above that level.[34] While this may sound small, when extended regionally, the impact on generator efficiency would be significant, particularly during heat waves. Research

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[31] *See supra* subpart 2.3.

[32] Vose et al., *supra* note 16, at 195.

[33] Sathaye et al., *supra* note 22, at 12.

[34] *Id*. at 13 (citing previous studies finding that, for each 1.0oC increase in temperatures above 15°C, the capacity of combined-cycle gas power plants may fall by 0.3-0.5% (if equipped with wet cooling) or up to 0.7% (if equipped with dry cooling) and indicating that, as "simple-cycle gas units . . . have been shown to be more sensitive to ambient temperature relative to combined-cycle units," the capacity of those units is assumed to "decrease by 1.0 percent per degree Celsius above 15°C"). *See also* 2013 DOE Report, *supra* note 21, at 10 (noting that "the power output of natural gas-fired combustion turbines . . . is estimated to decrease by approximately 0.6%-0.7% for a 1.8°F (1°C) increase in air temperature," while "[f]or combined cycle plants, output can decrease by approximately 0.3%-0.5%").

undertaken by the Lawrence Berkeley National Laboratory (LBNL), focusing on gas-fired generation in California, indicates that electricity losses on hot days could reach 10.3 gigawatts (GW) by 2100 or 23.4% of total current gas-fired capacity.[35] Electricity load on hot days is also projected to increase,[36] and with it the height of peak load, leading to an expected shortfall in peak generating capacity of over 35%.[37]

Increasing water temperatures: Generation shortfalls can also occur due to high water temperatures. Thermoelectric power plants generally require low-temperature water for cooling, using it to condense steam that has passed over the turbine, and thereby create a vacuum to draw more steam in.[38] Increased water temperatures reduce the effectiveness of this process, leading to turbine backpressure which lowers plant output.[39] Some nuclear plants, for example, could see declines in electricity output of 0.5% for each 1.8°F (1°C) increase in water temperatures.[40] In cases where water temperatures exceed technical specifications, plants may be forced to curtail output by larger amounts or entirely shutdown. This occurred in Connecticut in 2012, when the Millstone nuclear plant shut down after a heat wave caused cooling water temperatures to rise above the maximum allowed under its permit from the Nuclear Regulatory Commission.[41] Also in 2012, a heat wave in Illinois affected operations at several nuclear and coal plants, causing them to exceed

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[35] Sathaye et al., *supra* note 22, at 18. This represents a 6.2 percent increase in the maximum peak capacity loss compared to the period from 1961 to 1990. *Id*.

[36] *Id*. at 35 (indicating that, in California, "per-capita peak loads are projected to increase between 10 percent and 20 percent at the end of the century due to the effects of climate change on summer weekday afternoon temperatures").

[37] *Id*. at 38.

[38] Some thermoelectric generating plants are equipped with "dry cooling" systems which use ambient air to cool the steam and condense it back to water. *See* STEVE FLEISCHLI & BECKY HAYAT, POWER PLANT COOLING AND ASSOCIATED IMPACTS: THE NEED TO MODERNIZE U.S. POWER PLANTS & PROTECT OUR WATER RESOURCES & AQUATIC ECOSYSTEMS 3 (2014), https://perma.cc/DUF4-4H9Z.

[39] 2013 DOE Report, *supra* note 21, at 10 (indicating that "[i]ncreases in . . . cooling water temperatures will increase steam condensate temperatures and turbine backpressure, reducing power generation efficiency").

[40] Ahmet Durmayaz & Oguz Salim Sogut, *Influence of Cooling Water Temperature on the Efficiency of a Pressurized-Water Reactor Nuclear Power Plant*, 30 INTL. J. OF ENERGY RESEARCH 799 (2006).

[41] Matthew L. Wald, *Heat Shuts Down a Coastal Reactor*, N.Y. TIMES (Aug. 13, 2012), https://perma.cc/XE3C-8AH7 (reporting that the shutdown occurred after water temperatures in Long Island Sound reached 76.7°F. Under Millstone nuclear plant's operating permit, the cooling water it extracts can be no warmer than 75°F).

thermal limits[42] for cooling water discharges.[43]

Declining water availability: Many thermoelectric and other generating facilities, particularly in the West and South, will also be affected by droughts, which may become more frequent and severe due to climate change.[44] This will reduce the availability of cooling water for thermoelectric generating facilities, potentially forcing them to curtail or shut down operations. According to a recent DOE study, under extreme drought conditions on par with those experienced during the U.S. "dust bowl" of the 1930s, thermoelectric generation in the Southwest could decline by up to 20%.[45] The study also predicted declines of almost 60% in the region's hydroelectric generation under extreme drought conditions.[46] California has already experienced double-digit reductions in hydroelectric generating capacity, for example, in 2014, when persistent drought caused it to fall to just 58% of the ten-year average.[47]

Changing precipitation patterns: Hydroelectric and some thermal generating facilities will also be affected by other changes in precipitation, including shifts to more precipitation falling as rain rather than snow.[48] This will increase runoff during winter months, overloading hydroelectric reservoir capacity, and leading to the loss of energy normally available later in the year.[49] Similar losses may also occur as a result of earlier and more rapid thawing of the snowpack due to higher temperatures.[50] In both cases, stream flows throughout the year will be lower, reducing the

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[42] Thermal limits have been established for cooling water discharged back into the environment (i.e., following use) to protect aquatic ecosystems. *See* R. SKAGGS ET AL., CLIMATE AND ENERGY-WATER-LAND SYSTEM INTERACTIONS 2.14-2.15 (2012), https://perma.cc/969B-RAUS.
[43] Matthew L. Wald, *So, How Hot Was It?* N.Y. TIMES (Jul. 17. 2012), https://perma.cc/TNK3-CMAP.
[44] D.J. Wuebbles et al., *Executive Summary, in* CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT 10, 11 (D.J. Wuebbles et al. eds., 2017), https://perma.cc/TD85-T3H8.
[45] ARGONNE NATIONAL LABORATORY, IMPACTS OF LONG-TERM DROUGHT ON POWER SYSTEMS IN SOUTH WEST 10, 37 (2012), https://perma.cc/7EKU-2Z3C (defining the "southwest" region to encompass Arizona, California, Colorado, New Mexico, Nevada, Texas, and Utah).
[46] *Id*.
[47] Preston et al., *supra* note 20, at 13.
[48] Wuebbles et al., *supra* note 44, at 22 (projecting "shifts to more precipitation falling as rain than snow in the cold season in many parts of the central and eastern United States").
[49] Preston et al., *supra* note 20, at 13.
[50] *Id*. *See also* Wuebbles et al., *supra* note 44, at 21 (indicating that "[t]here has been a trend toward earlier snowmelt" and noting that this trend is expected to continue).

efficiency of hydroelectric generating facilities by reducing the pressure that drives their turbines.[51] Intense deluges, like the one that accompanied Hurricane Harvey in 2017, have also saturated coal piles, preventing their use as an energy source.[52]

Storms and flooding: All electricity generating facilities, regardless of type or location, will be impacted by future storms which are expected to become more intense due to climate change.[53] More intense rainstorms will contribute to inland flooding which can prevent the operation of generating facilities, as seen in Nebraska in mid-2011, when floodwaters surrounded the Fort Calhoun nuclear plant and prevented it returning to service after an earlier routine shutdown.[54] Similar issues have also occurred at coastal facilities due to hurricanes and associated storm surge—e.g., in New York during Hurricane Sandy[55]—with this situation expected to worsen in the future due to rising sea levels. Research by the National Laboratories suggests that, by 2050, sea level rise could increase the number of generating facilities exposed to inundation from storm surge during a weak (category 1) hurricane by 40%.[56] Many facilities could also be inundated by sunny-day or "nuisance" flooding caused solely by sea level rise—a recent DOE study of just four coastal cities (Houston, Los Angeles, New York, and Miami) identified up to 315 energy facilities that could be affected by 2100.[57]

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[51] 2013 DOE Report, *supra* note 21, at 26. *See also* U.S. Dept. of Energy & U.S. Dept. of Homeland Security, Dams & Energy Sectors Interdependency Study 24 (2011), https://perma.cc/9PB7-QFHR (indicating that "[f]or every foot of elevation lost in Lake Mead, Hoover Dam produces 5.7 MW less power").

[52] *Harvey's rain caused coal-to-gas switching: NRG Energy*, PLATTS, Sept. 27, 2017.

[53] *See e.g.*, Wuebbles et al., *supra* note 44, at 21 (noting that "[t]he frequency and intensity of heavy precipitation events in the United States are projected to continue to increase over the 21st century").

[54] The Fort Calhoun plant was shut-down prior to the flooding for refueling. The plant's return to service was delayed for several months due to persistent flood waters. *See* A.G. Sulzberger & Matthew L. Wald, *Flooding Brings Worries Over Two Nuclear Plants*, N.Y. TIMES, Jun. 20, 2011, http://www.nytimes.com/2011/06/21/us/21flood.html.

[55] Steven Mufson, *3 Nuclear Power Reactors Shut Down During Hurricane Sandy*, WASH. POST, Oct. 30, 2012, https://perma.cc/BTX9-FDLF (noting that "[t]hree nuclear power reactors were shut down because of electricity issues during Hurricane Sandy, while a fourth plant, Oyster Creek in New Jersey, remains in "alert" mode because of high water levels in its water intake structure").

[56] JAMES BRADBURY ET AL., CLIMATE CHANGE & ENERGY INFRASTRUCTURE EXPOSURE TO STORM SURGE & SEA-LEVEL RISE 11 (2015), https://perma.cc/3WKY-CVY9.

[57] U.S. DEPT. OF ENERGY, EFFECT OF SEA LEVEL RISE ON ENERGY INFRASTRUCTURE IN FOUR MAJOR METROPOLITAN AREAS 13 (2014), https://perma.cc/D23E-768D (predicting that, in Houston, 16 energy facilities could be inundated by 2050 and 67 by 2100. In Los Angeles, 11 facilities could be inundated by 2050

2.2 Climate Change Impacts on Transmission Facilities

Climate change will also have impacts on electricity transmission facilities and operations, though uncertainty remains as to the precise nature and extent of those impacts. The current state of knowledge, based on research to date, is summarized below.[58]

Increasing air temperatures: Higher ambient air temperatures, particularly when accompanied by higher humidity, increase transmission line resistance, which lowers the line's carrying capacity and increases the fraction of electricity lost rather than transmitted.[59] The impacts are likely to be particularly severe during future summer heat waves, when already high temperatures rise by large amounts over short periods.[60] NREL estimates that the 9°F (5°C) increase in summer temperatures expected in parts of California by 2100 could reduce transmission capacity by 7% to 8%.[61] Increasing temperatures will also reduce the useful life of some transmission equipment,[62] and cause lines to expand and sag, potentially resulting in them coming into more frequent contact with trees.[63] Furthermore, higher night-time temperatures (which have risen faster than day-time temperatures) will reduce or eliminate opportunities for transmission lines and equipment to cool.[64]

More frequent wildfires: Transmission facilities are also affected by wildfires which, due to

and 29 by 2100. In Miami, one facility could be inundated by 2050, and 49 by 2100. In New York, 17 facilities could be inundated by 2050 and 170 by 2100.)

[58] The authors are aware of conferences led by the Electric Power Research Institute (EPRI) and of EPRI-authored research focused on this subject area. *See, e.g.*, EPRI, How the Transmission Resiliency Research Fits Together (Dec. 2015); EPRI, Proceedings of EPRI/NATF 2014 Resiliency Summit (Dec. 2014); EPRI, Proceedings of the Industry Summit on Transmission System Resiliency to Severe Natural Events (June 2013). However, the results of such efforts sit behind very high paywalls and so are not publicly available. They also seem not to have prompted the sort of assessments we call for in this paper, nor to have put to rest the need for such assessments.

[59] Sathaye et al., *supra* note 22, at 25. See also Preston et al., *supra* note [20], at 16.

[60] Studies suggest that the impact of smaller temperature increases, occurring gradually over time, are likely to prove easier to manage. *See e.g.*, EDWARD VINE, ADAPTATION OF CALIFORNIA'S ELECTRICITY SECTOR TO CLIMATE CHANGE 10 (2008), https://perma.cc/JV3M-LMJF.

[61] Sathaye et al., *supra* note 22, at 27.

[62] 2016 DOE Report, *supra* note 21, at 10.

[63] 2013 DOE Report, *supra* note 21, at 13.

[64] *Id.* at 12.

higher temperatures and drought conditions, are expected to become more frequent and intense.[65] Wildfires can damage or destroy wooden transmission poles, and the associated soot and smoke can affect the operation of lines, causing leakage currents[66] and arcing.[67] Grid operation can also be affected by certain firefighting practices, including the use of fire retardants that foul lines.[68] While grid operators have traditionally been able to manage these impacts due to the redundancy built into the transmission system, management is likely to become increasingly difficult as more frequent, longer, and more severe wildfires threaten more facilities.[69] This will be a particular problem in California, where almost all transmission facilities are expected to face increased wildfire risk by 2100, in some cases by 45% annually.[70]

Storms and flooding: Storm-related transmission disruptions could also increase in the future as extreme weather events become more frequent and severe due to climate change.[71] Transmission facilities in some areas—e.g., the Midwest and Northeast—could be affected by more intense winter storms that cause ice to accumulate on lines and equipment, and thereby cause mechanical problems.[72] Transmission lines may also be damaged by trees felled by accumulated ice or uprooted during hurricanes.[73] Hurricane-related flooding is another problem, as seen in Texas in 2017, when floodwaters from Hurricane Harvey inundated a number of transmission substations, leading to outages.[74] In total, Harvey-related flooding and winds caused widespread high-voltage

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[65] Wehner et al., *supra* note 18, at 249 (finding that "[t]he incidence of large forest fires in the western United States and Alaska has increased since the early 1980s . . . and is projected to further increase in those regions").
[66] Leakage currents may occur where particulate matter in soot accumulates on insulators. *See* Sathaye et al., *supra* note 22, at 40 (noting that "the insulators that attach the lines to the towers can accumulate soot, creating a conductive path and causing leakage currents").
[67] Arcing may occur where ionized air in smoke acts as a conductor. *See Id*. (finding that "[i]onized air in smoke can act as a conductor, causing arcing; either between lines, or between lines and the ground").
[68] *Id*.
[69] *Id*.
[70] *Id*. at 42 –45.
[71] J.P. Kossin et al., *Extreme Storms, in* CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT 257, 257 (D.J. Wuebbles et al. eds., 2017), https://perma.cc/TD85-T3H8.
[72] Hyde M. Merrill & James W. Feltes, *Transmission Icing: A Physical Risk with a Physical Hedge*, POWER ENGINEERING SOCIETY GENERAL MEETING 1 (2006). *See also* Preston et al., *supra* note [20], at 16.
[73] *Id*. at 10 & 16.
[74] Kenny Mercado, CenterPoint Energy's Response to Hurricane Harvey, Presentation to ERCOT Board of Directors (Oct. 17, 2017), https://perma.cc/5KCJ-V2VK.

transmission outages, including on six 345 kilovolt (kV) lines and more than 200 69 to 138 kV lines.[75]

2.3 Interrelated Impacts on Facilities and Load

The sections above identify various ways in which higher temperatures and other climatic changes could disrupt the operation of generation and transmission facilities. These disruptions would occur alongside higher peaks in electricity load—potentially high enough to strain transmission and generation facilities' capacities.[76] PJM experienced an instance of this in 1999, when a heat wave caused load to exceed projections by 10% and several transmission problems followed, including transformer failures and—as a result of an increase in imported energy—a depression in voltage.[77]

These strains create a pincer effect: higher load peaks amid higher temperatures increase the likelihood of bumping into technical and operational limits on the supply side, at the same time as higher temperatures also tighten those limits by reducing the efficiency and capacities of transmission and generation facilities.[78] Therefore, to usefully capture the full range of scenarios that BPS facilities can expect to face, ISO/RTOs must consider potentially synergistic combinations of coincident changes in operationally important factors. The California Energy Commission,[79] for one, seeks to do this by identifying what it calls "climate parameters" and incorporating those parameters into relevant design specifications and planning criteria.[80]

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[75] U.S. Energy Information Administration, *Hurricane Harvey Caused Electric System Outages & Affected Wind Generation in Texas*, TODAY IN ENERGY (Sep. 13, 2017), https://perma.cc/P7T3-QXMN.
[76] EPRI, Temperature Impacts on Electricity Demand for Cooling in New York State; 2017 Technical Update 3-2 l – 3-5 (Sept. 2017); Matthew Bartos et al., *Impacts of rising air temperatures on electric transmission ampacity and peak electricity load in the United States*, 11 ENVTL. RES. LETTERS 114008, 1 (Nov. 2016).
[77] EPRI, JOINT TECHNICAL SUMMIT ON RELIABILITY IMPACTS OF EXTREME WEATHER AND CLIMATE CHANGE 3-1 – 3-5 (2008), https://perma.cc/6FNY-8WYN.
[78] JAMES MCCALL ET AL., NAT'L RENEWABLE ENERGY LAB'Y, WATER-RELATED POWER PLANT CURTAILMENTS: AN OVERVIEW OF INCIDENTS AND CONTRIBUTING FACTORS (2016), https://perma.cc/9TXQ-VH9G (reporting 43 curtailments due to higher water temperatures).
[79] The California Energy Commission, formerly the Energy Resources Conservation and Development Commission, is the state's energy policy and planning agency, not to be confused with the California Public Utility Commission.
[80] Guido Franco, Cal. Energy Comm'n, Climate Parameters for the Energy System, 2017 IEPR Joint Agency Workshop: Climate Adaptation and Resilience for the Energy System, Sacramento, Aug. 29, 2017, https://perma.cc/JNK8-JQKB.

3. PLANNING FOR THE IMPACTS OF CLIMATE CHANGE

Given the potential for higher temperatures, more intense storms, and other climate-driven phenomenon to disrupt operation of the BPS, FERC and ISO/RTOs' resilience planning efforts must recognize and account for the present and foreseeable future effects of climate change. Ignoring rather than assessing those effects would invite a circumstance in which the BPS may be unable to deliver reliable electricity services at just and reasonable rates as required by the FPA. To explain, under the FPA, FERC must ensure that rates for the interstate[81] transmission and wholesale sale[82] of electricity are just and reasonable and not unduly discriminatory or preferential, and that the BPS operates reliably.[83] To that end, ISO/RTOs under FERC's jurisdiction operate markets, which are intended to encourage the development of plentiful electricity supplies at low prices.[84] Both ISO/RTOs and FERC have recognized that, to achieve these goals, markets must be designed so as to incentivize investment in new facilities capable of reliably delivering electricity.

This was the motivation behind recent reforms to the capacity market operated by PJM Interconnection, L.L.C. (PJM).[85] PJM argued, and FERC accepted, that its pre-existing capacity market design failed to ensure the delivery of electricity during extreme weather and other emergencies.[86] To address this issue, PJM proposed market changes, which would have the effect of increasing the compensation paid to facilities that reliably delivered electricity during emergencies.[87] In approving the proposal, FERC emphasized that it would "incentivize existing reliable resources to stay in the market, while facilitating the entry of new reliable resources to displace less reliable ones."[88]

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[81] For the purposes of the FPA, the transmission and sale of electricity is "interstate" whenever electric energy moves from the buyer to the seller via an interstate transmission grid, such as the eastern or western interconnect. *See* Fed. Power Comm'n v. Florida Power & Light Co. 404 U.S. 452 (1972).

[82] Under the FPA, "sales at wholesale are defined to mean sales to any person for resale. *See* 16 U.S.C. § 824(d).

[83] 16 U.S.C. §§ 824d(a)-(b) & 824o.

[84] FERC, *Electricity Markets: National Overview* (last updated Apr. 13, 2017), https://perma.cc/PJX9-2A8X . *See also* FERC v. Electric Power Supply Association 136 S. Ct. 760 (2015).

[85] PJM operates the BPS in Delaware, Maryland, New Jersey, Pennsylvania, Virginia, the District of Columbia, and parts of Illinois, Michigan, North Carolina, Ohio, Tennessee, and West Virginia

[86] P.J.M Interconnection, L.L.C., 151 FERC ¶ 61,208 (2015), *order on reh'g*, 155 FERC ¶ 61,157 (2016).

[87] *Id*.

[88] *Id*.

FERC's reasoning in the PJM case suggests that, to provide appropriate incentives for investment, markets must account for differences in the risk profiles of BPS facilities.[89] This can only occur if there is a thorough mapping of risks which, to our knowledge, has not yet occurred in the context of climate change. While a number of BPS facility owners have identified climate change as a source of material physical risk to their operations,[90] there has been no comprehensive assessment of such risks at the ISO/RTO level.[91] Rather, to the extent that any assessments have occurred, they have generally been partial and piecemeal.

A prime example is ISO-New England[92] (ISO-NE)'s 2017 Regional System Plan, which identifies resource and transmission facilities needed to maintain BPS reliability over the next ten years.[93] The plan assumes, for the purposes of projecting peak loads, that summer temperatures will increase as they have done in the recent past, but does *not* consider the implications of summer heat for transmission facility efficiency or lifespan.[94] Thus, even though ISO-NE is assuming that increasing levels of summer heat will drive load and load peaks higher, as the Department of Homeland Security observed in 2016, it "is not addressing climate change in its planning activities to determine the grid enhancement requirements necessary to meet future demand given projected temperature increases."[95] ISO-NE's planning is often based on historic trends which, given the existence of climate change, are not a good proxy for future conditions. In particular, ISO-NE's annual Capacity, Energy, Loads and Transmission Report, which forecasts key details like expected transmission and large transformer losses and peak loads, looks to "historical demand" and "weather data," among other factors, but not climate projections.[96]

155 FERC ¶ 61,157 (2016).

[90] See 10-Ks listed in note 15, *supra*.

[91] *See* note 58, *supra*.

[92] ISO-NE operates the BPS in Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

[93] ISO-NE, 2017 REGIONAL SYSTEM PLAN (2017), https://perma.cc/4YSP-UWW5.

[94] *Id*. at 19 & 41.

[95] U.S. DEP'T OF HOMELAND SECURITY (DHS), CASCO BAY REGIONAL CLIMATE CHANGE RESILIENCY ASSESSMENT 40 (2016), https://perma.cc/8JL9-RWXJ.

[96] The "2017-2026 Forecast Report of Capacity, Energy, Loads, and Transmission" is a source of assumptions for use in electric planning and operations reliability studies. *See* ISO-NE, 2017 CELT REPORT: 2017-2026 FORECAST REPORT OF CAPACITY, ENERGY, LOADS AND TRANSMISSION (2017), https://perma.cc/Y3LV-F8D8. Its "energy and peak load forecasts integrate state historical demand, economic and weather data, and the

We do not mean to single out ISO-NE here. It is by no means alone in its failure to comprehensively assess the impacts of climate change on the BPS using downscaled climate projections. ISO/RTOs typically leave such considerations to the states in which they operate or the owners of facilities they oversee. By and large, however, those entities have not considered or addressed the likely effects of future climate change on the BPS or its component parts. To illustrate what this might mean, consider an example from the distribution segment of the grid: testimony given before the New York Public Service Commission during the post-Sandy rate case in 2013 revealed that Consolidated Edison[97] had specified design parameters for its equipment that would be incompatible with the summer temperatures expected to occur during the useful life of that equipment.[98] Climate vulnerability assessments of existing or planned segments of the BPS could detect this sort of incompatibility—and failure to conduct such assessments is likely to leave them present, but obscured from the analysis of risks to and constraints on BPS performance.

3.1 Approach to Planning

As discussed in section 2 above, the impacts of climate change on the BPS will vary by region, as will the solutions available to ensure the system is climate resilient. Given this regional variation, there can be no "one-size fits-all" approach to planning, though a number of general principles have been identified to guide the process. DOE, for example, has outlined eight key steps for climate change resilience planning in the electricity sector (see Figure 2).[99] Most of the steps relate to the conduct of a vulnerability assessment which aims to identify where and under what conditions facilities may be affected by rising temperatures, more intense storms, and other

impacts of utility-sponsored conservation and peak-load management programs." *See* ISO-NE, *CELT Reports*, https://perma.cc/3PRT-RQJH (accessed Feb. 1, 2018).

[97] Consolidated Edison is a distribution utility operating in New York City and Westchester County in New York.

[98] Report of Klaus H. Jacob on behalf of the New York State Office of the Attorney General, In re Con Edison Major Rate Proceedings, Case Nos. 13-E-0030 et al., 10 tbl.2 (May 31, 2013) (listing expected departure from 1971-2000 baseline in 2020s, 2050s, and 2080s for, inter alia, ambient temperature); *see also* Consolidated Edison Company of New York, Inc., Storm Hardening and Resiliency Collaborative Report 81 tbl.12 (Dec. 2013) (listing design standards under review for likely revision, including "temperature variable" and "heat waves").

[99] 2016 DOE Report, *supra* note 21.

climate-driven weather changes.[100] Based on the results of the vulnerability assessment, a resilience plan can be developed, identifying actions that should be taken to mitigate critical vulnerabilities, either by reducing the probability of damage or disruption to facilities (e.g., through relocation or hardening) or the consequences of any damage or disruption (e.g., by enhancing recoverability).

It is important that any planning effort take a long-term view and consider climate-related risks over the expected useful life of transmission and generation facilities. Currently however, stakeholders in the BPS planning process tend to employ ten to fifteen-year time horizons when evaluating risks to reliability (and resilience),[101] whereas generation and transmission facilities tend to have useful lives of twenty-five to forty years or more.[102] Thus, as DOE's Quadrennial Energy Review notes, "[p]lanning for decarbonization and climate resilience reaches beyond typical planning horizons for grid operators."[103]

While taking a longer view is essential to adequately assess how the impacts of climate change could constrain and disrupt BPS operations, simply expanding planning horizons would add complexity and uncertainty to the plans developed by ISO/RTOs[104]—to a potentially unworkable degree. Changes in technology, regulation, consumer demand, and other important factors cannot be foreseen several decades in advance, yet the likelihood of such changes also cannot be ignored because they could significantly affect the grounds for ISO/RTOs' initial

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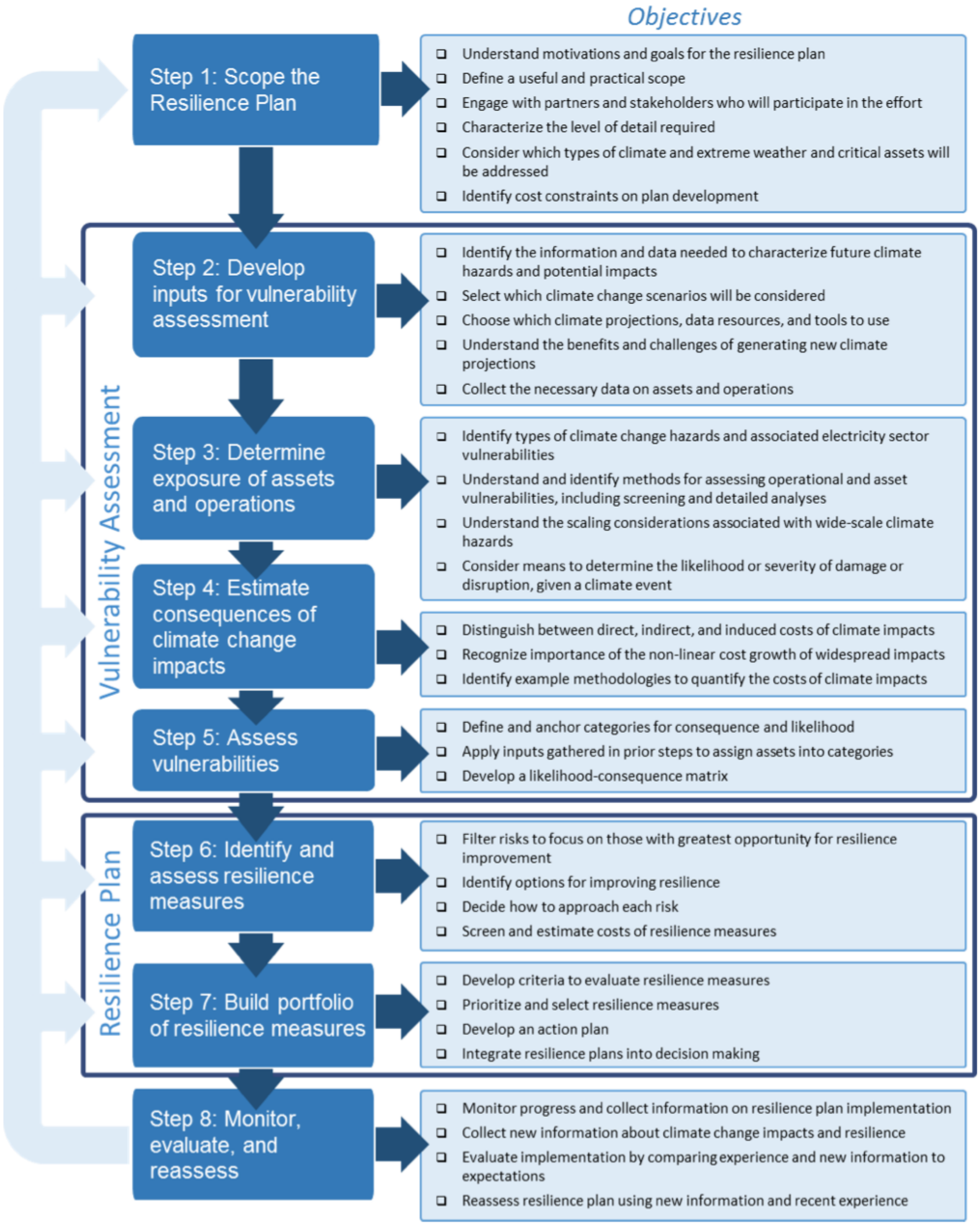
[100] *Id*. at iii.
[101] *See e.g.*, PJM, 2017 PJM Baseline Reliability Assessment for the 2017–2032 Period (Jan. 2018) (using 15-year planning horizon).
[102] *See e.g.*, NERC, *Reliability Assessments*, https://perma.cc/XFC8-F6LP (accessed Feb. 5, 2018) ("Long-Term Reliability Assessments annually assess the adequacy of the Bulk Electric System in the United States and Canada over a 10-year period. The reports project electricity supply and demand, evaluate transmission system adequacy, and discuss key issues and trends that could affect reliability."); U.S. Energy Information Administration, *Nuclear Regulatory Commission resumes license renewals for nuclear power plants*, TODAY IN ENERGY (Oct. 29, 2014), https://perma.cc/D7HG-V2Q9 (reporting approvals of 20-year extensions on 40-year operating licenses for 74 nuclear reactors); Edison Electric Institute, Transmission Projects: At A Glance (Dec. 2016), https://perma.cc/433Q-WQL7 (". . . transmission assets are built to be in use for several decades . . . ."); Electric Power Research Institute, Plant Support Engineering: Common Medium-Voltage Cable Specification for Nuclear Power Plants, at vi (Oct. 2009) ("The existing fleet's medium-voltage cable population has an average age of roughly 30 years.").
[103] Quadrennial Energy Review (Second Installment): Transforming the Nation's Electricity System 4-7 (Jan. 2017).
[104] 2016 DOE Report, *supra* note 21, at 86.

Figure 2: DOE's Recommended Approach to Resilience Planning in the Electricity Sector[105]



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105 *Id*. at 3.

planning decisions. And, of course, they could also alter aspects of the BPS's vulnerability to climate change and the options available to enhance its climate resilience. What to do? The approach taken by California's Pacific Gas and Electric (PG&E),[106] a distribution utility, to assessing climate-related risk and resilience is instructive here.[107] As part of its periodic Risk Assessment Mitigation Phase (RAMP) effort PG&E has identified climate-driven hazards, potential impacts of those hazards, and resilience measures that can mitigate or avoid them. But unlike other types of risk which it assesses in just one timeframe, PG&E considers two time frames—2022 and 2050—when assessing risks arising from climate-driven hazards.[108] This approach serves to highlight looming risks and likely constraints without forcing PG&E to speculate unduly about the future. Furthermore, because PG&E's RAMP efforts are periodic, it will revisit its assessment of vulnerabilities and resilience options, updating them as appropriate.[109]

3.2 Existing Tools and Resources

As the foregoing discussion makes clear, significant information will be required to conduct vulnerability assessments and prepare resilience plans, including localized climate change projections. Such projections may be found in existing publicly available tools, datasets, and reports developed by governmental, academic, and other independent bodies.[110] Examples include:

- NASA downscaled datasets;[111]
- U.S. Geological Survey (USGS) National Climate Change and Wildlife Science Center downscaled datasets;[112]

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[106] PG&E provides retail electricity services in the northern two-thirds of California, from Bakersfield to almost the Oregon border.

[107] PG&E, 2017 RISK ASSESSMENT AND MITIGATION PHASE 22-i – 22-20 (2017); PG&E, CLIMATE CHANGE VULNERABILITY ASSESSMENT AND RESILIENCE STRATEGIES (2016), https://perma.cc/5LXQ-83U7.

[108] *Id.* at 22-3.

[109] 2016 DOE Report, *supra* note 21, at 86–89 (calling for adaptive approach involving periodic review and update).

[110] Among the hundreds of datasets accessible via Data.gov, dozens capture information on climate-related topics like precipitation, solar radiation, and temperature. *See* Data.gov, https://www.data.gov/climate/ (accessed Feb. 16, 2018). For a collection and description of tools and data useful for this and related purposes, see JESSICA WENTZ, ASSESSING THE IMPACTS OF CLIMATE CHANGE ON THE BUILT ENVIRONMENT UNDER NEPA AND STATE EIA LAWS: A SURVEY OF CURRENT PRACTICES AND RECOMMENDATIONS FOR MODEL PROTOCOLS 15–26 (2015), https://perma.cc/M6MQ-S2UB.

[111] National Aeronautics and Space Administration, NASA Earth Exchange (NEX) Downscaled Climate Projections (NEX-DCP30).

- ClimateNA (short for North America) dataset.[113]
- New York City Panel on Climate Change data and reports;[114] and
- Cal-Adapt's data, tools, and other resources;[115]

These resources draw on the climate models used by the Intergovernmental Panel on Climate Change, an international body which periodically assesses global climate trends,[116] and the U.S. Global Change Research Program, which prepares national climate assessments.[117] ISO/RTOs may find it useful to review those bodies' reports, which provide the most authoritative projections of national and regional climate change trends.

Given uncertainty regarding the pace and magnitude of climate change—which will depend on future emissions levels and any mitigation action taken—ISO/RTOs planning should take into account multiple projections covering a range of scenarios (e.g., "high emissions," "medium emissions," and "low emissions").[118] Plans should not be based solely on historic data, particularly records of past storms and other extreme events, which are unlikely to reflect the intensity of future events.

This encouragement to consult climate projections would be incomplete if it did not also warn against reliance on data that are incomplete and/or ignore the future. The Flood Insurance

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112 U.S. Geological Survey, New Statistically Downscaled Climate Data Available for the Conterminous U.S., http://bit.ly/2abfdNu (accessed Feb. 8, 2018); *see also* Adrienne Wootten et al., U.S. Geological Survey, Downscaled Climate Projections for the Southeast United States: Evaluation and Use for Ecological Applications, Open-File Report 2014–1190 (2014), https://perma.cc/7UYP-AF9R.

113 Tongli Wang et al., *Locally Downscaled and Spatially Customizable Climate Data for Historical and Future Periods for North America*, PLoS ONE (June 2016) (describing ClimateNA software package, useful for deriving downscaled climate data for North American locations).

114 *Building the Knowledge Base for Climate Resiliency: New York City Panel on Climate Change 2015 Report*, 1336 Ann. N.Y. Acad. Scis. 1–150 (2015).

115 *See* http://cal-adapt.org/ (accessed Feb. 8, 2018), Cal-Adapt is the product of a collaboration among state agencies, universities, and private companies based in California. Susan Wilhelm, Cal. Energy Comm'n, Unveiling Cal-Adapt 2.0: Facilitating Energy Sector Resilience and Providing Foundational Scenarios for California's Fourth Climate Change Assessment, IEPR Workshop on Adaptation and Resilience for the Energy System, Sacramento, California, Aug. 29, 2017, https://perma.cc/27TJ-H2J7.

116 *See* Intergovernmental Panel on Climate Change, https://perma.cc/Y2S6-2GDA (accessed Feb. 9, 2018).

117 *See* U.S. Global Change Research Program, *Climate Science Special Report*, https://perma.cc/2XL4-SBDN (accessed Feb. 9, 2018).

118 Consistent with this recommendation, PG&E's Climate Resilience RAMP considers two emissions scenarios. PG&E, *supra* note 107, at 22-3.

Rate Maps (FIRMs) developed by the Federal Emergency Management Authority (FEMA) for use in the National Flood Insurance Program (NFIP) usefully illustrate this danger. To begin, FIRMs are strictly backward looking, even though the risks they purport to depict are highly sensitive to several climate-driven impacts. FIRMs also suffer from several other problematic limitations, resulting from their design parameters and the funding and administration of mapping efforts.[119] Currently, for instance, the maps do not reflect flood risks arising from the rapid accumulation of precipitation, such as occurred in Houston during Hurricane Harvey. The Technical Mapping Advisory Council (TMAC), established to review and suggest improvements to the maps, has issued a host of recommendations to FEMA,[120] most of which have gone largely unheeded.[121] A 2017 Inspector General's report highlighted several programmatic deficiencies as well, such as the slow rate of updating and poor application of quality control measures.[122] Thus BPS planning decisions should not rely exclusively on FEMA flood maps to determine flood risk in the near or long-term.

4. RECOMMENDATIONS

To ensure that the BPS continues to deliver reliable electricity services at just and reasonable rates, FERC and ISO/RTOs must plan for the impacts of climate change. Recommendations to guide the planning process are set out below.

- A detailed climate change vulnerability assessment should be undertaken to determine how the components and operations of each ISO/RTO's system will be affected by increasing

[119] For an overview of the key issues, see Michael Keller et al., *Outdated and Unreliable: FEMA's Faulty Flood Maps Put Homeowners at Risk*, Bloomberg, Oct. 6, 2017, https://perma.cc/QWN8-PNRL. Notably, mapping efforts were an incidental feature of the NFIP until 2012, when new legislation incorporated them into the independently authorized and funded National Flood Mapping Program. *See* Biggert-Waters Flood Insurance Reform Act of 2012, Pub. L. No. 112-132, 126 Stat. 365 (May 31, 2012), *codified at* 42 U.S.C. § 4101b.

[120] *See* TMAC, National Flood Mapping Program Review (June 2016), http://bit.ly/2sclUaH; TMAC, Future Conditions Risk Assessment and Modeling (Dec. 2015), http://bit.ly/2fJY7Vq.

[121] *See* Comment letter from Sabin Center for Climate Change Law to FEMA, re National Flood Insurance Program Draft Nationwide Programmatic, June 1, 2017, at 7–10, https://perma.cc/3AGQ-Q7SF.

[122] DHS OFFICE OF THE INSPECTOR GENERAL, FEMA NEEDS TO IMPROVE MANAGEMENT OF ITS FLOOD MAPPING PROGRAMS (2017), http://bit.ly/2nNoLkV.

temperatures, changing precipitation patterns, more intense storms, droughts, and other climate-driven weather extremes expected in their respective regions.

- Vulnerability assessments should be based on downscaled projections of future climate change in their respective operating regions. Many projections are available in existing datasets, including those developed by NASA and the USGS.
- Where even downscaled projections fail to provide data for key variables (e.g., humidity (wet-bulb temperature) or temperatures at particular times of day) the entity conducting the assessment should, at minimum, acknowledge the lack of complete information, and, if possible, seek to supplement available data sets.
- Multiple projections reflecting a range of possible climate change scenarios, including a "worst case" (i.e., assuming continued high greenhouse gas emissions lead to large temperature increases and rapid rates of sea level rise), should be considered in the vulnerability assessment.
- The timeframe for the vulnerability assessment should reflect the anticipated useful life of existing facilities or facilities scheduled for construction in the relevant ISO/RTO's region.
- The vulnerability assessment should be periodically reviewed and updated as new information becomes available.

- Based on the vulnerability assessment, a resilience plan should be developed, outlining measures that can be taken to prevent or manage system disruptions.

5. CONCLUSION

FERC and NERC's ongoing efforts to address risks to electric reliability aim to, among other things, "identif[y] long-term emerging issues and trends that do not necessarily pose an immediate threat to reliability but will influence future [BPS] planning, development and system analysis."[123] The resilience of the BPS to climate-driven impacts—and to other impacts amid climate-related constraints—falls cleanly within this mandate. The implications of climate change for the BPS should inform efforts by ISO/RTOs, FERC, and NERC to ensure its resilience to all manner of disruptions.

[123] NERC, *Reliability Assessment and Performance Analysis*, https://perma.cc/TMZ9-BXCL (accessed Feb. 1, 2018).

APPENDIX A

Potential Impacts of Climate Change on the Generation and Transmission Segments of the BPS

Climate Change Phenomenon		Potential BPS Impacts: Generation	Potential BPS Impacts: Transmission	ISO/RTO Regions Impacted
Temperature	Rising air temperatures More frequent and severe heat waves	↑ electricity load and the height of peak load ↓ thermoelectric and solar photovoltaic generating efficiency and capacity Shifts in timing of hydroelectric generation (e.g., due to earlier snow melt)	↓ transmission line carrying capacity ↑ transmission line losses ↑ transmission outages (e.g., due to sagging lines contacting trees)	All
	Higher water temperatures	↓ thermoelectric generating efficiency and capacity ↑ thermoelectric generating facility curtailment and shutdown (e.g., due to temperature of cooling water exceeding technical specifications)	N/A	All
Precipitation	Lower annual precipitation More frequent and severe droughts	↓ thermoelectric and hydroelectric generating capacity ↑ thermoelectric generating facility curtailment and shutdown (e.g., due to water levels falling below water intake structures) ↑ hydroelectric generating facility curtailment and shutdown (e.g., due to insufficient water flows) Shifts in timing of hydroelectric generation (e.g., from summer to winter)	N/A	California ISO, Mid-continent-ISO, Southwest Power Pool (SPP)

Climate Change Phenomenon		Potential BPS Impacts		ISO/RTO Regions Impacted
		Generation	Transmission	
	Shift from snow- to rain-fall	↓ hydroelectric generating capacity (e.g., due to lower annual water storage) ↑ hydroelectric generating facility curtailment and shutdown (e.g., due to insufficient water flows) Shifts in timing of hydroelectric generation (e.g., from summer to winter)	N/A	All
	More heavy rainfall events	↑ generation facility curtailment and shutdown (e.g., due to flooding)	↑ transmission outages (e.g., due to trees falling on lines)	All
Storms	More frequent and severe storms	↑ thermoelectric generating facility shutdown (e.g., due to flooding) ↑ hydroelectric facility shutdown (e.g., due to dam damage)	↑ transmission outages (e.g., due to trees falling on lines)	All
Coastal impacts	Sea level rise	↑ generating facility shutdown (e.g., due to flooding)	↑ transmission outages (e.g., due to flooding)	All except SPP
	Increased storm surge			
Wildfire	Increased wildfire risk	↑ generating facility shutdown (e.g., due to fire damage)	↑ transmission outages (e.g., due to destruction or fouling of lines)	California ISO