CLIMATE RESILIENCE PLANNING PROCESS

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I. INTRODUCTION

Climate resilience planning is a valuable tool to integrate climate considerations and protect electricity infrastructure and ratepayers. Climate resilience planning is generally a two-stage process, involving the development of (1) climate vulnerability assessments and (2) climate resilience plans.[2] Vulnerability assessments are intended to identify where and under what conditions electric utility assets are at risk from the impacts of climate change. Based on vulnerability assessments, electric utilities can then develop resilience plans, which evaluate risk management options to reduce vulnerabilities and enhance system resilience. Vulnerability assessments and resilience plans should be periodically reviewed and updated as new information becomes available.[3]

Various government agencies and independent bodies have published guides to assist electric utilities in conducting climate vulnerability assessments and preparing climate resilience plans. Drawing on those guides, this supplement outlines best practices for climate resilience planning. It also discusses one recent example of an electric utility engaging in effective resilience planning.

I. VULNERABILITY ASSESSMENT

Utilities can assess their climate vulnerability by identifying assets and operations exposed to climate impacts, the likelihood and degree of damage from those impacts, and the likely consequences if those impacts and damages occur.[4] Utilities should prioritize and identify how they will engage with public stakeholders throughout this process and the resilience planning process.[5] The timeframe for the assessment should reflect the anticipated useful life of the asset, including any decommissioning period.[6] A risk profile should be developed for each asset based on the likelihood and consequences of it being impacted by climate change.[7]

One critical input into vulnerability assessments is climate data and projections (see *State of the Science*). Utilities should utilize forward-looking, downscaled projections of future climate conditions in their respective

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[2] Romany M. Webb et al., *Climate Risk in the Electricity Sector: Legal Obligations to Advance Climate Resilience Planning by Electric Utilities*, 51 ENVTL. L. REV. 577, 584 (2021), https://perma.cc/WV5Y-U2HL.
[3] *See* U.S. DEP'T OF ENERGY, CLIMATE CHANGE & THE ELECTRICITY SECTOR: GUIDE FOR CLIMATE CHANGE RESILIENCE PLANNING 86–88 (2016), https://perma.cc/29MD-XWEE [hereinafter DOE Planning Guide]
[4] *Id.* at 54.
[5] *Id.* at 6–8.
[6] JUSTIN GUNDLACH AND ROMANY WEBB, CLIMATE CHANGE IMPACTS ON THE BULK POWER SYSTEM: ASSESSING VULNERABILITIES AND PLANNING FOR RESILIENCE 22 (2018), https://perma.cc/A2ZH-BBED; DOE Planning Guide, *supra* note 3, at 80.
[7] DOE Planning Guide, *supra* note 3, at 54–59.

service territories.[8] Forward-looking data is necessary because, in the age of climate change, historical weather patterns are no longer an accurate representation of future conditions.[9] Downscaled or localized projections are necessary because the nature and extent of future climate impacts will vary regionally (see *State of the Science* and *Climate Risks to Electricity Infrastructure*). Utilities should consider projections for the full range of climate impacts expected to occur within their service territory.

Vulnerability assessments should be based on multiple climate projections reflecting a range of possible climate change scenarios, including "best" and "worst" case scenarios.[10] This so-called "bounded parameters" approach can help utilities manage uncertainty regarding future emission levels and associated climate impacts.[11] To supplement this approach, electric utilities can utilize probabilistic modeling, which provides an indication of the likelihood of different climate outcomes.[12]

Once they have a clear picture of the climate change impacts expected to occur in their service territories, electric utilities can then evaluate the climate vulnerability of their assets and operations. To do that, each utility must compile an inventory of assets and operations, and their attributes.[13] Asset attributes—such as the asset's age, design lifetime and specifications, elevation, replacement cost, and outage cost—will vary based on the type of asset.[14] Each utility will also have unique attributes for its operations, such as number and types of staff, location of critical facilities, communications methods, and data necessary for scheduling, planning, and conducting maintenance operations.[15] Utilities must assess how each asset or operation, given its unique attributes, will be affected by anticipated future conditions.[16] For example, if an asset needs water at a certain temperature for cooling, and climate projections indicate that the temperature of rivers or streams from which water is currently withdrawn will increase above the level the asset can withstand, that asset is at risk.

Utilities should assess the potential exposure of each asset and operation to climate impacts and the likelihood and severity of damage or disruption.[17] For each vulnerable asset or operation, utilities should calculate the costs of climate impacts. Ultimately, climate impacts may result in direct, indirect, or induced costs.[18] Direct costs include economic losses to an electric utility, such as restoration and repair costs. [19] Indirect and induced costs include costs experienced by consumers, other companies, or by society as a whole.[20] Indirect and induced costs may include residential property damage and public health effects. Costs will further vary depending upon the asset, operation, location, and nature and severity of climate impacts.[21]

In some circumstances, utilities may need to consider risks to assets that are outside of their ownership, but on which they rely to deliver services to consumers, such as electricity generation assets. The California Public Utilities Commission has noted that in states with restructured electricity markets, "utilities no longer own all

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[8] Webb et al., *supra* note 2, at 586; 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].
[9] *See* 2016 Partnership Report, *supra* note 8, at 12.
[10] Webb et al., *supra* note 2, at 588.
[11] *Id.*
[12] *Id.* at 588–89.
[13] DOE Planning Guide, *supra* note 3, at 26.
[14] *Id.*
[15] *Id*. at 27.
[16] *Id.* at 31.
[17] *Id.*
[18] *Id.* at 42–50.
[19] *Id.* at 43.
[20] *Id.* at 45–46.
[21] *Id.*

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."[22]

II. Resilience Plans

Once vulnerabilities are identified, utilities should evaluate measures to enhance their resilience to climate impacts. Resilience measures can take a variety of forms, some of which may require large capital investments (e.g., hardening or relocating assets).[23] It is, however, important to note that resilience can often be enhanced through non-capital intensive actions, such as operational changes, planning updates, and/or design modifications (see *Climate Risks to Electricity Infrastructure*).

A utility's resilience plan should prioritize a set of measures to reduce and manage critical vulnerabilities. Utilities should compare costs and impacts of different measures and determine whether, when, and how to invest based on each asset's risk profile.[24]

Cost-benefit analysis is often used in the electric utility sector to assess the financial viability of projects that have large upfront costs but deliver benefits over many years. In cost-benefit analysis, a project's benefits and costs are expressed in monetary terms, discounted to present value, and then compared.[25] Cost-benefit analysis can be difficult to apply to resilience projects because key benefits may be unknown or difficult to quantify. Thus, additional evaluation tools may be needed.[26] One strategy that can aid planning is a "flexible resilience pathways" approach, which encourages the immediate implementation of no- and low-regrets resilience measures as well as the establishment of thresholds for taking other actions.[27] Utilities can also use a "breakeven analysis," which estimates the value of avoiding outages, then calculates how many outages would need to be mitigated by a resilience measure in order to realize sufficient value to justify investing in that measure.[28] This calculation can then be compared to the probability of future climate-related outages to assess the expected benefits of investment. Another strategy utilities can use is a "robust decision making" framework, where measures are assessed under a wide range of possible future outcomes to determine which will perform best under a variety of circumstances.[29]

III. Consolidated Edison Climate Study

In its 2013 rate case proceeding following Superstorm Sandy, Consolidated Edison Company of New York, Inc. ("Con Ed") 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."[30] Con Ed's focus solely on storms prompted criticism from several environmental and other groups, who pushed for consideration of a broader range of climate impacts.[31]

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[22] Kristin Ralff-Douglas, Cal. Pub. Utils. Comm'n, Climate Adaptation in the Electric Sector: Vulnerability Assessments & Resilience Plans 17 (2016), https://perma.cc/R6NW-F6GV.
[23] *See* DOE Planning Guide, *supra* note 3, at 60, 65, 66–68.
[24] Webb et al., *supra* note 2, at 584*; See* DOE Planning Guide, *supra* note 3, at 77–84.
[25] Webb et al., *supra* note 2, at 590.
[26] *Id.*
[27] *Id.*
[28] *Id.*
[29] *Id.*
[30] 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), https://perma.cc/YPL5-N9KW.
[31] *See* 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

In response, the New York Public Service Commission ("NYPSC") convened a "Resiliency Collaborative" to explore issues related to storm hardening and climate resilience. The 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.[32] This ultimately led to a settlement requiring Con Ed to complete a climate vulnerability assessment by 2014.[33] Con Ed missed that deadline, but published the findings of its assessment in 2019.

Con Ed's 2019 "Climate Change Vulnerability Study" is widely regarded as the gold standard for climate resilience planning in the electric utility sector.[34] The study analyzed projected changes in temperature, humidity, precipitation, sea level, and extreme weather in Con Ed's service territory during seven time periods spanning from 2020 through 2080. Con Ed worked with scientists to develop downscaled projections for three sub-regions within its service territory based on climate data from thirty-two global climate models.[35] Con Ed utilized a probabilistic modeling approach in which it analyzed the likelihood and consequences of a range of plausible climate outcomes.[36] This approach enabled Con Ed to identify vulnerabilities within its assets and operations and to design flexible resilience pathways to manage those vulnerabilities.[37]

The Climate Change Vulnerability Study was followed by a Climate Change Implementation Plan that applied the study's findings.[38] The Implementation Plan "explains how [Con Ed] will incorporate climate change projections for heat, precipitation, and sea level rise from the . . . Vulnerability Study into its operations to mitigate climate change risks to its assets and operations and establishes an ongoing process to reflect the latest science in the Company's planning."[39] The Implementation Plan focuses on 5-, 10-, and 20-year actions that Con Ed will take with respect to load forecasting, load relief planning, reliability planning, asset management, system planning, emergency response activities, and worker safety protocols.[40] Con Ed also established steps to incorporate climate projections into Company practices and governance structure.

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.

[32] *See* N.Y. Pub. Serv. Comm'n, Notice of Collaborative Meeting Concerning Storm Hardening and Resiliency Issues, Case 13-E-0030 (July 1, 2013), https://perma.cc/92Y3-6HJG; 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 8 (Feb. 21, 2014), https://perma.cc/Y78W-GY8H [hereinafter NYPSC Order]

[33] NYPSC Order, *supra* note 32, at 71.

[34] 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 53 (Feb. 18, 2020), https://perma.cc/RLM6-Z4DA.

[35] ConEd Climate Change Vulnerability Study, 17–19 (Dec. 2019), https://perma.cc/AT9S-2VAV.

[36] *See id.* at 12–15, 18.

[37] *See id.* at 32–49, 57–61.

[38] ConEd Climate Change Implementation Plan, Case Nos. 19-E-0065 and 19-G-0066 (Dec. 29, 2020), https://perma.cc/9SRM-FLC5 [hereinafter "Con Ed Implementation Plan"]; ConEd Climate Change Resilience and Adaptation: Summary of 2020 Activities (Jan. 2021), https://perma.cc/T4V4-XQNV.

[39] Con Ed Implementation Plan at 1.

[40] *Id.* at 5–10.