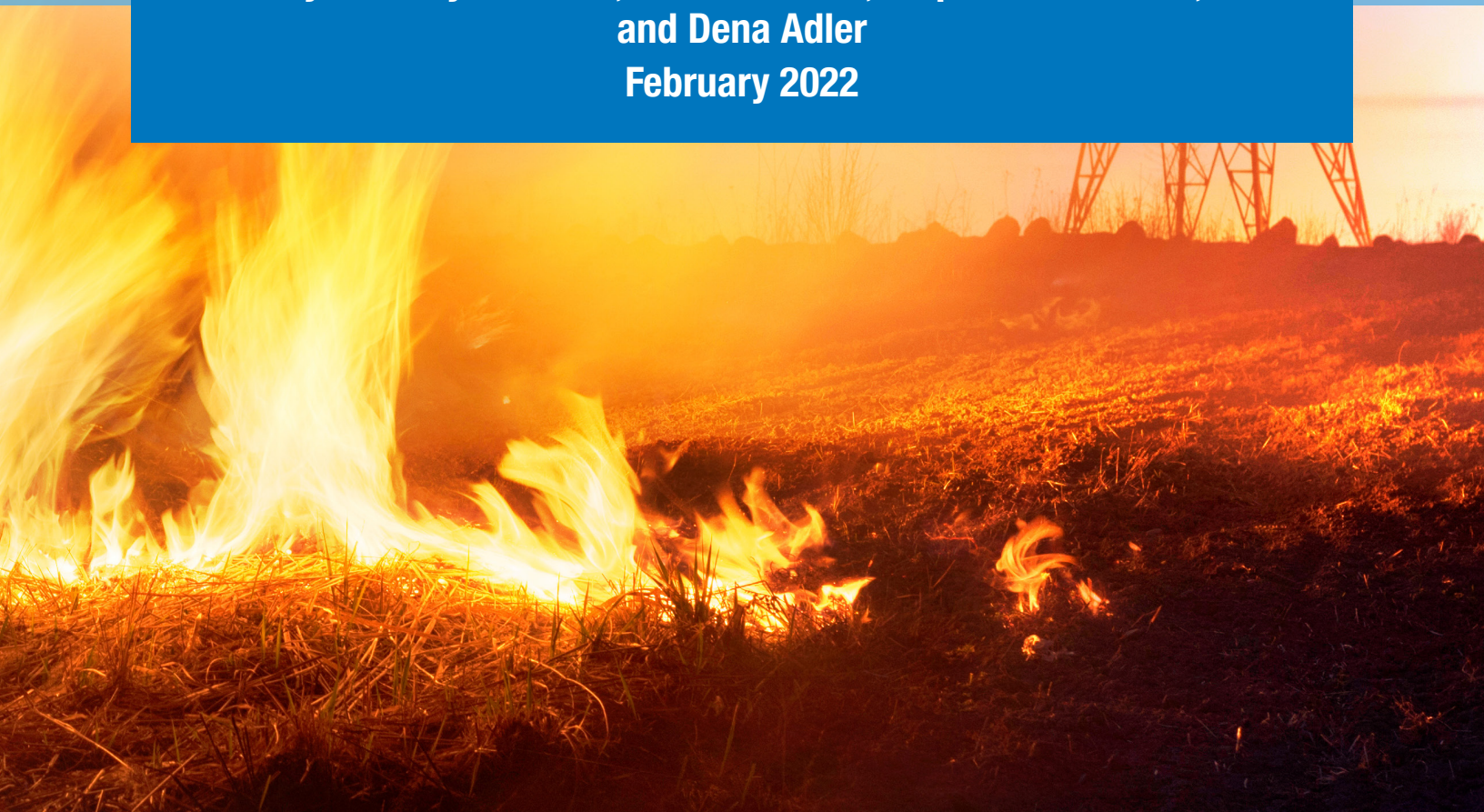


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EVALUATING CLIMATE RISK IN NEPA REVIEWS: CURRENT PRACTICES AND RECOMMENDATIONS FOR REFORM

**By Romany M. Webb, Michael Panfil, Stephanie H. Jones,
and Dena Adler
February 2022**



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ABOUT THE AUTHORS

Romany M. Webb is an Associate Research Scholar at Columbia Law School and Senior Fellow at the Sabin Center for Climate Change Law.

Michael Panfil is the Lead Counsel and Director of Climate Risk Strategies at EDF.

Stephanie H. Jones is a Climate Risk and Financial Regulations Attorney at EDF.

Dena Adler is a Research Scholar at the Institute for Policy Integrity at New York University School of Law. Dena Adler conducted research for this paper while an attorney at EDF.

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EXECUTIVE SUMMARY

In recent years, policymakers, practitioners, and scholars have increasingly considered how climate change should factor into existing environmental review obligations, including review of U.S. federal agency actions under the 1969 National Environmental Policy Act (“NEPA”).¹ Attention thus far has focused primarily on the critical question of how to account for an action’s contribution to climate change via direct, indirect, or cumulative greenhouse gas emissions.² However, less focus has been given to the equally critical question of how actions will be affected by, and can prepare for, the impacts of climate change.³ This paper combines an extensive review of previously conducted Environmental Impact Statements (“EIS”) with an examination of the legal framework, current practices, and next steps for integrating that latter category of climate effects—what we term “climate impact analysis”—into NEPA reviews.

The treatment of climate impacts in NEPA reviews is of increasing salience for several reasons. Climate change is now having a marked impact on historic weather patterns and environmental conditions, leading to higher average and extreme temperatures and associated sea level rise, for example. In addition to these slow onset changes, there has also been an increase in the severity of certain extreme weather events, including hurricanes. According to the National Oceanic and Atmospheric Administration, in 2021, “the U.S. experienced 20 separate billion-dollar weather and climate disasters that killed at least 688 people—the most disaster-related fatalities for the contiguous U.S. since 2011 . . . Damages from these disasters totaled approximately \$145 billion for all 20 events” which is a “record high.”⁴ More than “40% of Americans live in counties hit by climate disasters in 2021.”⁵

The impacts of climate change are increasingly foreseeable. Recent advances in climate detection and attribution science provide ever-growing information on how climate change

1 42 U.S.C. § 4321 et seq.

2 See, e.g., Aaron Flyer, *FERC Compliance Under NEPA: FERC’s Obligation to Fully Evaluate Upstream and Downstream Environmental Impacts Associated with Siting Natural Gas Pipelines and Liquefied Natural Gas Terminals*, 27 GEO. INT’L ENV’T L. REV. 301 (2015); Michael Burger & Jessica Wentz, *Downstream and Upstream Greenhouse Gas Emissions: The Proper Scope of NEPA Review*, 41 HARV. ENV’T L. REV. 109 (2017); James W. Coleman, *Beyond the Pipeline Wars: Reforming Environmental Assessment of Energy Transport Infrastructure*, 2018 UTAH L. REV. 119 (2018); Michael Burger & Jessica Wentz, *Evaluating the Effects of Fossil Fuel Supply Projects on Greenhouse Gas Emissions and Climate Change Under NEPA*, 44 WM. & MARY ENV’T L. & POL’Y REV. 423 (2020).

3 There is some scholarship on the requirement to consider climate change impacts in NEPA reviews, but it was published prior to significant case law and regulatory developments. See, e.g., Michael B. Gerrard, *Reverse Environmental Impact Analysis: Effect of Climate Change on Projects*, 247 N.Y. L. J., Mar. 8, 2012; Katrina Fischer Kuh, *Impact Review, Disclosure, and Planning*, in THE LAW OF ADAPTATION TO CLIMATE CHANGE 543 (Michael B. Gerrard & Katrina Fischer Kuh, eds. 2012); JENNIFER KLEIN & ETHAN STRELL, LEGAL TOOLS FOR CLIMATE ADAPTATION ADVOCACY: NEPA (2015), <https://perma.cc/5Z5E-KQSH>; 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 (2015), <https://perma.cc/2YNZ-SVQ8> [hereinafter “Wentz 2015”]; Jessica Wentz, *Planning for the Effects of Climate Change on Natural Resources*, 47 ENV’T L. REP. 10220 (2017) [hereinafter “Wentz 2017”].

4 Press Release, Nat’l Oceanic & Atmospheric Admin., U.S. saw its 4th-warmest year on record, fueled by a record-warm December (Jan. 10, 2022), <https://perma.cc/CBW2-AD6E>.

5 Sarah Kaplan & Andrew Ba Tran, *More than 40 percent of Americans live in counties hit by climate disasters in 2021*, WASH. POST (Jan. 5, 2022), <https://perma.cc/XR85-LH57>.

is contributing to extreme events and other weather and environmental changes. Advanced modeling techniques have also made highly detailed projections of future climate change impacts more readily available. For example, in recent years, various government and other bodies have published downscaled climate data and projections showing anticipated future conditions in specific local areas.⁶

Approach

Recognizing the significant and growing risks posed by climate change, in 2016, the Council on Environmental Quality issued guidance directing federal agencies to ensure “[f]ocused and effective consideration of climate change in NEPA reviews.”⁷ The 2016 guidance emphasized the need for federal agencies to consider “the effects of climate change on a proposed action and its environmental impacts” and noted that “climate change adaptation and resilience . . . are important considerations” in environmental reviews under NEPA.⁸ The courts have similarly confirmed that NEPA requires consideration of climate change impacts.⁹ Specifically, and at a minimum, federal agencies must analyze climate change impacts when (1) identifying the purpose of, and need for, a proposed action and defining alternative actions that could meet that purpose and need, (2) describing the area affected by the proposed action and alternatives, and (3) evaluating their impacts on the environment and measures to lessen those impacts.

This paper concludes that, in order for federal agencies to fulfill their legal obligations under NEPA, the EISs they prepare must contain a comprehensive climate impact analysis. Drawing on previously identified best practices,¹⁰ we define three key requirements for climate impact analysis, namely that the analysis be:

1. **Holistic**, meaning that it considers all reasonably foreseeable climate impacts and the risks they pose to all elements of the proposed action and alternatives.
2. **Specific**, which requires the use of climate data that is tailored to the proposed action’s area, timescale, and other relevant characteristics.
3. **Actionable**, providing the agency with the information it needs to take action to address climate-related risks.

⁶ See generally, Michael B. Gerrard & Edward McTiernan, *The Perils of Relying on FEMA Flood Maps in Real Estate Transactions*, N.Y. LAW J. (Sept. 2020).

⁷ Memorandum from Christina Goldfuss, Council on Environmental Quality, for Heads of Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews 3 (Aug. 1, 2016), <https://perma.cc/BUQ9-99JH>.

⁸ *Id.* at 20-25.

⁹ See e.g., *AquAlliance, et al., v. U.S. Bureau of Reclamation*, 287 F. Supp. 3d 969 (E.D. Cal. 2018); *National Wildlife Federation v. National Marine Fisheries Service*, 184 F. Supp. 3d 861, 875 (D. Or. 2016); *Friends of Wild Swan v. Jewell*, No. CV 13-61-M-DWM, 2014 U.S. Dist. LEXIS 116788, at *31 (D. Mont. Aug. 21, 2014); *Southern Utah Wilderness Alliance v. Burke*, 981 F. Supp. 2d 1099, 1110-1111 (D. Utah 2013).

¹⁰ Several U.S. jurisdictions have promulgated rules or issued guidance on incorporating climate change impacts into environmental reviews under laws similar to NEPA, including Massachusetts, New York State, New York City, Washington State, and King County, Washington. Relevant guidance has also been issued by foreign jurisdictions, including Australia, Canada (and the Canadian provinces of British Columbia and Nova Scotia), the European Union, the Netherlands, New Zealand, Spain, the United Kingdom. Legal scholars have also identified best practices for climate impact analysis. See e.g., Kuh, *supra* note 3; Wentz 2015, *supra* note 3; Wentz 2017, *supra* note 3.

Analysis

To determine whether federal agencies are conducting holistic, specific, and actionable climate impact analysis as required by NEPA, we reviewed all final EISs issued by federal agencies in connection with onshore energy projects in the five years from 2016 through 2020. We hypothesized that, because energy infrastructure is highly sensitive to climate change impacts (i.e., due to its place-based nature and condition-sensitive technology), energy-focused EISs should contain particularly high-quality climate impact analyses. Our review found the opposite: **None of the surveyed EISs contained sufficiently holistic, specific, and actionable climate impact analysis to inform agency decision-makers.** Among other things, the review showed that:

- While most EISs acknowledged that climate change would affect the local environment where a proposed action would occur, many did not take the critical next step of analyzing implications for the action or alternatives.
- Less than half of the reviewed EISs evaluated whether and how climate change might alter the environmental outcomes of the proposed action, and less than ten percent compared climate-related risks across alternatives.
- Even where federal agencies did analyze climate impacts, they often relied on outdated or incomplete data, limiting the usefulness of the analysis. Some federal agencies appear to be unaware of existing, publicly available data and tools that could enable a more robust analysis.

Recommendations

Given the clear relevance of climate change to the requirements of NEPA, **we recommend that CEQ and other federal agencies take immediate steps to ensure sufficiently holistic, specific, and actionable climate impact analysis is conducted in environmental reviews.** Specifically:

1. **CEQ should promulgate NEPA regulations and guidance that ensure climate impacts are considered in a holistic, specific, and actionable manner.** We recommend that CEQ promulgate new regulations to ensure that climate impacts relevant to federal actions are evaluated alongside other existing considerations in environmental reviews. At a minimum, the regulations should require federal agencies to account for climate impacts when defining the affected environment, and evaluating the environmental impacts of the proposed action and alternatives. To complement the new regulations, CEQ should issue updated guidance, identifying best practices for conducting climate impact analysis in NEPA reviews. This paper identifies existing guidelines and other resources that CEQ could use to formulate best practices. It also points to useful tools and data that CEQ could make available to federal agencies for use in the analysis (see recommendation 4 below).
2. **Federal agencies should review their own NEPA regulations and consider ways to improve NEPA implementation to better account for climate impacts.** CEQ

regulations should establish the floor, rather than the ceiling, for integrating climate impact analysis into NEPA reviews. Given the different ways climate change can impact different types of actions in different locations, individual agencies may encounter unique issues when conducting climate impact analysis. These are best addressed through agency-specific NEPA regulations or guidance. For example, agencies that deal with coastal infrastructure (e.g., the Federal Energy Regulatory Commission, Department of Transportation, and Army Corps of Engineers) could develop joint guidance that ensures use of the latest data and projections on sea level rise, as well as consideration of compound risks from that and other climate impacts. To reduce the burden of conducting climate impact analysis, federal agencies could also consider requiring project applicants to submit information on how the impacts of climate change will affect the project and the local area and possible actions to enhance resilience.

3. **CEQ should coordinate across federal agencies and relevant experts.** Multiple federal agencies have expertise relevant to climate impact analysis. CEQ should explore opportunities to coordinate with appropriate federal agencies, for example, through an Interagency Working Group or other mechanism to support coordination and collaboration. Such a mechanism could be convened to examine, among other things, the use of climate scenario analysis in environmental reviews under NEPA. This could in turn help to improve the consistency of NEPA reviews by ensuring all agencies use common scenarios. CEQ could also establish an expert advisory board to provide advice on scenario analysis or other topics.
4. **CEQ should create or support the creation of a publicly accessible centralized database of climate information relevant to NEPA analysis.** Government agencies and the public would benefit from improved access to information about the impacts of climate change. CEQ could help facilitate such access by creating or supporting the creation of a database of data and tools relevant to climate impact analysis. The database could also incorporate recommendations from technical experts, leveraging the work of an expert advisory board, for example (see recommendation 3 above).

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ACRONYMS

ANWR	Arctic National Wildlife Refuge
APD	Application for Permit to Drill
BLM	Bureau of Land Management
CE	Categorical Exclusion
CEQ	Council on Environmental Quality
DEIS	Draft Environmental Impact Statement
DOE	Department of Energy
DOI	Department of the Interior
DOT	Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FONSI	Finding of No Significant Impact
GCM	Global Climate Model
GSA	General Services Administration
IWG	Interagency Working Group
LNG	Liquefied Natural Gas
MEPA	Massachusetts Environmental Policy Act
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPS	National Park Service
NRC	Nuclear Regulatory Commission
REA	Rapid Ecoregional Assessment
RMP	Resource Management Plan
ROD	Record of Decision
ROW	Right of Way
SEQR	New York State Environmental Quality Review Act

1. INTRODUCTION

Congress passed the National Environmental Policy Act (“NEPA”) in 1969 to address growing public concern about environmental degradation and pollution.¹¹ For decades, NEPA has served as the nation’s “basic national charter for protection of the environment,”¹² requiring environmental reviews of major federal actions that could significantly affect the environment.¹³ As the dangers posed by climate change continue to grow, they demand increasing attention under the NEPA framework. Recognizing this, some agencies have recently begun considering the greenhouse gas emissions associated with federal actions, and how those emissions could be mitigated, in their NEPA reviews. Such analysis is critical to evaluating the environmental effects of an action, and scholars have rightly devoted increasing attention to how it should be conducted.¹⁴ Another equally important, but less discussed, issue is how **climate-related risks—that is, the risks that the impacts of climate change present for proposed actions, and the implications for those actions’ environmental outcomes**—should be addressed under NEPA.¹⁵

The treatment of climate risk in NEPA reviews is increasingly relevant in part due to the growing severity of certain types of extreme events and shifts in baseline weather and environmental conditions that are already occurring due to climate change. Advances in detection and attribution science have provided new and improved insights on how climate change is affecting weather and environmental conditions. Improvements in climate modeling and downscaling techniques have similarly made highly detailed projections of future climate change impacts more readily available to federal agencies and other decision-makers. Climate impacts are, therefore, increasingly foreseeable.

This paper argues that federal agencies have a legal obligation under NEPA to consider foreseeable climate change impacts when conducting environmental reviews of proposed

11 National Environmental Policy Act of 1969, § 2, 42 U.S.C. § 4321; NEPA.GOV, <https://perma.cc/6FE3-KHQ2> (last visited Dec. 9, 2021).

12 40 C.F.R. § 1500.1(a) (2019).

13 42 U.S.C. § 4332(2)(C).

14 See, e.g., Aaron Flyer, *FERC Compliance Under NEPA: FERC’s Obligation to Fully Evaluate Upstream and Downstream Environmental Impacts Associated with Siting Natural Gas Pipelines and Liquefied Natural Gas Terminals*, 27 GEO. INT’L ENV’T L. REV. 301 (2015); Michael Burger & Jessica Wentz, *Downstream and Upstream Greenhouse Gas Emissions: The Proper Scope of NEPA Review*, 41 HARV. ENV’T L. REV. 109 (2017); James W. Coleman, *Beyond the Pipeline Wars: Reforming Environmental Assessment of Energy Transport Infrastructure*, 2018 UTAH L. REV. 119 (2018); Michael Burger & Jessica Wentz, *Evaluating the Effects of Fossil Fuel Supply Projects on Greenhouse Gas Emissions and Climate Change Under NEPA*, 44 WM. & MARY ENV’T L. & POL’Y REV. 423 (2020).

15 There is also some scholarship on the legal requirement to consider climate change impacts in NEPA reviews, but it was published prior to significant case law and regulatory developments. See, e.g., Michael B. Gerrard, *Reverse Environmental Impact Analysis: Effect of Climate Change on Projects*, 247 N.Y. L. J., Mar. 8, 2012; Katrina Fischer Kuh, *Impact Review, Disclosure, and Planning*, in THE LAW OF ADAPTATION TO CLIMATE CHANGE 543 (Michael B. Gerrard & Katrina Fischer Kuh, eds. 2012); JENNIFER KLEIN & ETHAN STRELL, LEGAL TOOLS FOR CLIMATE ADAPTATION ADVOCACY: NEPA (2015), <https://perma.cc/5Z5E-KQSH>; 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 (2015), <https://perma.cc/2YNZ-SVQ8> [hereinafter “Wentz 2015”]; Jessica Wentz, *Planning for the Effects of Climate Change on Natural Resources*, 47 ENV’T L. REP. 10220 (2017) [hereinafter “Wentz 2017”].

federal actions. Although the paper is designed to be broadly relevant, it grounds analysis in NEPA reviews of energy projects. Those projects were chosen because of the particularly significant and growing risks climate change poses to energy infrastructure and its impacts on the environment. Increasing temperatures, changing precipitation patterns, and other climate change impacts could destroy, damage, or otherwise affect the performance of energy infrastructure.¹⁶ Climate impacts could also heighten the environmental and other risks associated with constructing, operating, and maintaining energy infrastructure.¹⁷ As an example, climate change-induced sea level rise could lead to more frequent flooding of coastal energy storage facilities, increasing the potential for releases causing water or soil contamination that endangers public health. Energy infrastructure projects could also have compounding effects on natural and human systems that are already impacted by climate change. For instance, dredging associated with the construction of a coastal facility might place added strain on nearby wetlands, which are already being impacted from saltwater intrusion due to sea level rise. The loss of those buffering wetlands could further exacerbate the risks faced by surrounding ecosystems, the facility, and nearby communities from climate change-amplified extreme weather events and flooding.

Avoiding these outcomes could require changes in the way energy infrastructure is designed, sited, constructed, and operated. While private parties develop most energy infrastructure, projects often require federal approval. Where that is the case, federal agencies may have an opportunity to assess the climate vulnerabilities of infrastructure projects and support the development of more resilient solutions. NEPA provides one pathway to help accomplish this goal. While NEPA does not require particular substantive outcomes, it does require federal decision-makers to consider relevant information about adverse impacts and ways to reduce or avoid them.

To determine the extent to which climate change impacts on energy infrastructure are considered under NEPA, this paper reviews all final Environmental Impact Statements (“EISs”) prepared by federal agencies for onshore energy activities from 2016 through 2020. None of the surveyed EISs addressed climate impacts in a sufficiently holistic, specific, and actionable way to fulfill the requirements of NEPA. While most acknowledged that climate change would affect the local area in which the proposed action would occur, the majority did not take the critical next steps of considering how and to what extent predicted climate impacts would matter to the proposed action, or its potential adverse environmental impacts.

This paper’s principal recommendation flows from that finding: the Council on Environmental Quality (“CEQ”)—the principal entity tasked with NEPA oversight—should take swift action through regulation, guidance, interagency coordination, and development of resources to ensure that the impacts of climate change are fully considered in environmental reviews as required by NEPA.

This paper proceeds as follows: Part 2 catalogues key climate impacts affecting energy infrastructure. Part 3 explains the history of, and key requirements imposed by, the NEPA

16 See *infra* Part 2.

17 *Id.*

statute and associated regulations. Part 4 explains the relevance of climate change considerations, particularly climate risk, for NEPA reviews. Part 5 analyzes treatment of climate change impacts in recent EISs, presenting and discussing results from our survey of energy EISs. Part 6 offers recommendations for enhancing consideration of climate risk in NEPA reviews. Part 7 concludes.

2. CLIMATE RISKS TO ENERGY INFRASTRUCTURE

Climate conditions have a major influence on the design, construction, and operation of many types of energy infrastructure. As the U.S. Department of Energy (“DOE”) has noted, “[e]nergy production, transport, and delivery infrastructure and operations are typically tailored either to take advantage of or to address regional differences in climate conditions.”¹⁸ Thus, for example, historic precipitation patterns and associated river flows have influenced the siting of hydroelectric generating facilities. Water availability has similarly influenced the siting of thermoelectric power plants that require water for cooling and are, therefore, often located on rivers or in coastal areas. The plants’ water intake and effluent systems are designed based on the normal range of water levels and temperatures. Air temperature ranges also affect the need for, and design of, cooling systems at thermoelectric generating plants and other facilities. For instance, according to DOE, electric “utilities typically equip their transformers with cooling systems that are adequate to prevent overheating in regions that historically experience extremely hot weather. Similarly, pipelines constructed on permafrost in Arctic Alaska are designed for an expected range of historic temperatures.”¹⁹ Pipeline, electricity transmission line, and other infrastructure developers also consider the prevalence of extreme weather events when constructing and operating facilities. Again, as explained by DOE, the owners of “oil and gas infrastructure along the Gulf Coast . . . typically incorporate the historical likelihood of severe hurricanes into risk management planning.”²⁰

Climate change is causing significant and growing shifts in historic weather patterns, including more frequent and severe extreme weather events, rising temperatures, and associated environmental changes (e.g., sea level rise), all of which are putting existing energy infrastructure under additional stress and increasing the potential for energy system disruptions.²¹ Indeed, in 2021 alone, energy systems were affected by extreme cold weather in Texas, heat waves in California, and hurricanes and flooding in Louisiana and several other states. Without changes in the design and operation of energy infrastructure, the frequency and severity of system disruptions will increase as climate change intensifies.²² This will, in turn, increase risks to the environment and communities.

While all energy systems are at risk from the impacts of climate change, the nature and extent of climate-related risks vary geographically for at least two reasons. First, as noted above, different regions are home to different types of energy infrastructure with varying vulnerabilities to climate impacts. Second, and relatedly, the nature and extent of climate impacts affecting energy infrastructure will also vary regionally. For example, compared to other parts of the U.S., southwestern states are more likely to experience prolonged drought

¹⁸ U.S. DEP’T OF ENERGY, CLIMATE CHANGE AND THE U.S. ENERGY SECTOR: REGIONAL VULNERABILITIES AND RESILIENCE SOLUTIONS 1-1 (2015), <https://perma.cc/3YEC-NFJ7>.

¹⁹ *Id.*

²⁰ *Id.* at 1-2.

²¹ *Id.* at 1-1; see also P.C.D. Milly et al., *Stationarity is Dead: Whither Water Management?* 319 SCIENCE 573, 573-574 (2008).

²² U.S. DEP’T OF ENERGY, *supra* note 18, at 1-1 - 1-2.

which could affect the operation of oil refineries and thermoelectric generating plants that rely on water for cooling.²³ In comparison, flooding may be a greater risk to refineries and generating plants in the southeast, which is likely to see more intense hurricanes.²⁴ All regions will, however, be impacted in some ways (see Figure 1).

Key climate impacts likely to affect energy infrastructure include:

- **Increasing temperatures:** According to the Fourth National Climate Assessment, annual average temperatures in the contiguous U.S. have increased by as much as 1.8°F since the start of the 20th century, and are projected to rise a further 2.5°F between 2021 and 2050.²⁵ The rise could, however, be significantly larger in some regions. In parts of the northeast, for example, maximum summer temperatures are expected to increase by up to 6.7°F.²⁶

Increasing temperatures pose particular risks to electricity generation, transmission, and distribution systems. Higher temperatures reduce the operating efficiency of thermoelectric generating plants, particularly nuclear and fossil fuel plants equipped with steam turbines.²⁷ High temperatures also accelerate the aging of transmission and distribution equipment, increase line losses, and cause lines to expand and sag, which can spark wildfires.²⁸ Together, the impacts on generation, transmission, and distribution make electricity more difficult to produce and deliver, which could strain electricity supplies. At the same time, higher temperatures will drive higher demand for electricity, increasing the potential for supply shortfalls.²⁹ This could lead to outages which pose major risks to public health and the environment. As an example, past outages have forced the discharge of untreated sewage into waterways, leading to contamination and associated public health issues.³⁰

23 *Id.* at 3-1.

24 *Id.* at 8-1.

25 R.S. Vose et al., *Temperature Changes in the United States*, in CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT: VOLUME I 185, 186 & 195 (D.J. Wuebbels et al. eds., 2017), <https://perma.cc/TD85-T3H8>.

26 See, e.g., *Rising Temperatures*, MASS. CLIMATE CHANGE CLESRINGHOUSE, <https://perma.cc/9QMS-BCKE> (last visited Sept. 30, 2021) (predicting that maximum summer temperatures in Massachusetts will increase by 2.6 to 6.7°F by 2050).

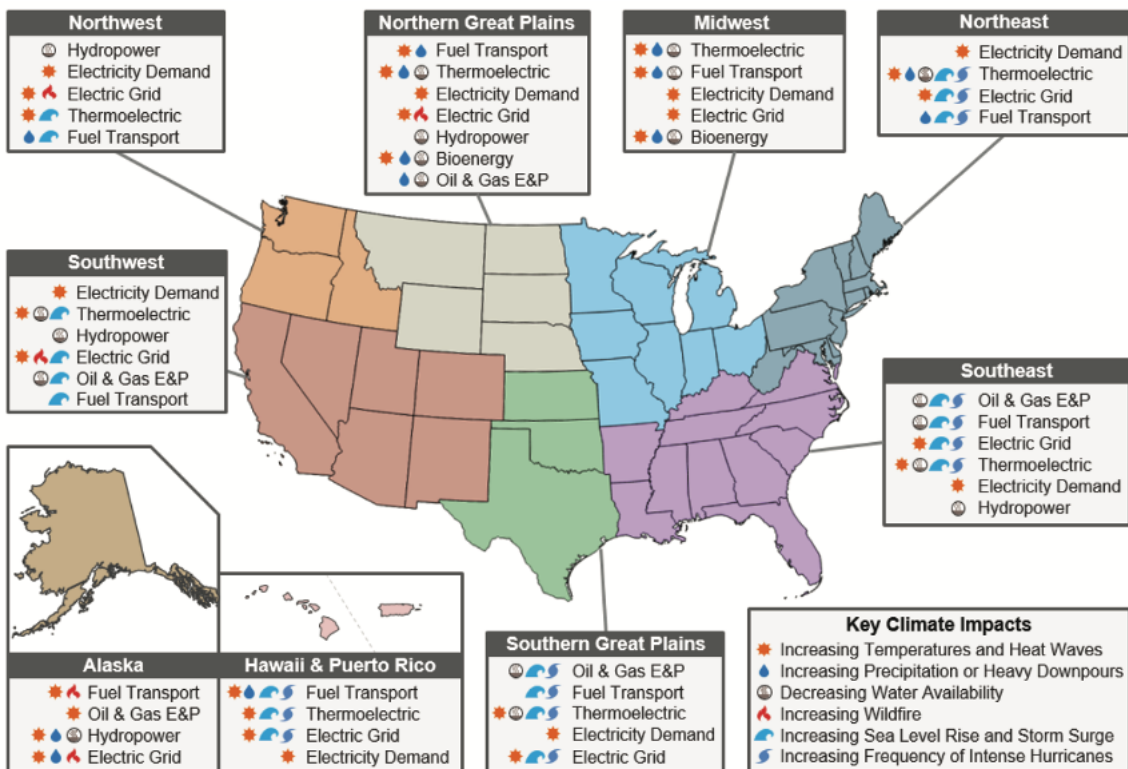
27 See generally JAYANT SATHAYE ET AL., ESTIMATING RISK TO CALIFORNIA ENERGY INFRASTRUCTURE FROM PROJECTED CLIMATE CHANGE 10-11 (2011), <https://doi.org/10.2172/1026811> (estimating that the output of natural gas generating plants could decline by up to one percent for each 1.8°F increase in temperatures).

28 See *id.* at 25-28; see also U.S. DEP'T OF ENERGY, CLIMATE CHANGE & THE ELECTRICITY SECTOR: GUIDE FOR CLIMATE CHANGE RESILIENCE PLANNING 10 (2016), <https://perma.cc/29MD-XWEE>.

29 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, 181 (D.R. Reidmiller et al. eds., 2018), <https://perma.cc/ZP2G-JJRK>.

30 See, e.g., Erika Martin et al., *17M gallon sewage spill at L.A. treatment plan closes Dockweiler, El Segundo beaches to swimming*, KTLA LOCAL NEWS (Jul. 12, 2021), <https://perma.cc/XA7M-33BR>.

Figure 1: Climate Change Impacts on the Energy Sector by Region³¹



- Heat waves and cold waves:** Climate change is increasing both the frequency and severity of extreme heat events, which can adversely affect the operation of energy systems.³² As noted above, heat waves pose particularly significant risks to certain electricity infrastructure. During a multi-day heat wave in California in August 2020, several natural gas-fueled electricity generating plants experienced forced outages and derates (i.e., a decrease in the plant’s maximum available capacity).³³ High temperatures, particularly when combined with high humidity, not only cause electricity demand to soar but also increase electric transmission line resistance and thus reduce the lines’ carrying capacity. Again, this could lead to electricity outages and associated impacts on public health, safety, and the environment. Maintaining and repairing infrastructure during “wet bulb” conditions, when both temperature and humidity are high, are also difficult and may expose workers to serious health risks.³⁴

³¹ U.S. DEP’T OF ENERGY, *supra* note 18, at i.

³² *Id.* at 1-1.

³³ CAL. INDEP. SYS. OPERATOR, CAL. PUB. UTILS. COMM’N, & CAL. ENERGY COMM’N, PRELIMINARY ROOT CAUSE ANALYSIS: MID-AUGUST 2020 HEAT STORM 50 (2020), <https://perma.cc/KAF2-SQWQ>.

³⁴ See generally *Best Practices to Protect Utility Workers from Heat Stress*, POWERLINE SERVICES, <https://perma.cc/N83Q-KEXN> (last updated July 5, 2018).

Cold waves can similarly disrupt energy systems, particularly if infrastructure has not been appropriately winterized. This occurred during Winter Storm Uri in Texas in 2021, when inadequately winterized oil and gas wells, pipelines, wind turbines, and other generating facilities were forced to shut down.³⁵ In a survey conducted after the storm, approximately 15% of natural gas producers reported production losses due to “equipment freeze-offs,” and 20% of gas pipeline operators reported service disruptions for the same reason.³⁶ While the scientific understanding of climate change’s influence on the frequency and severity of cold weather events continues to develop,³⁷ researchers have identified potential links between rapid warming in the Arctic and cold waves like Winter Storm Uri in mid-latitude regions.³⁸

- **Changing precipitation patterns:** The higher temperatures associated with climate change will result in more precipitation falling as rain rather than snow.³⁹ The total amount of precipitation could also change, with increases expected in higher-latitude regions, and declines in lower-latitude regions.⁴⁰ In all areas, there is expected to be an increase in heavy precipitation events, with longer dry periods in between.⁴¹ All of these changes could, again, affect energy infrastructure. For example, the shift from snow to rain will impair the operation of hydroelectric generating facilities, particularly in areas that rely on snowmelt to augment stream flows in summer.⁴² Other types of electricity generation, particularly thermoelectric facilities that rely on water for cooling, could also be forced to shut down or curtail output during periods of low rainfall.⁴³ Oil and biofuel refineries could be similarly affected because they too require large amounts of cooling water.⁴⁴ Where those or other facilities discharge wastewater into rivers and streams, reduced water flows could increase the potential for contamination (e.g., because the assimilative capacity of waterways is reduced). Similar contamination risks could also arise where flooding caused by heavy downpours impacts facilities; high flows can overwhelm the capacity of treatment plants and cause the discharge of untreated waste.

35 Benji Jones, *Texas blackouts explained: Arctic weather shut down power plants as demand for heat surged, and the state's grid is on its own*, BUSINESS INSIDER (Feb. 18, 2021), <https://perma.cc/4VV3-PPNJ>; see THE FEBRUARY 2021 COLD WEATHER OUTAGES IN TEXAS AND THE SOUTH CENTRAL UNITED STATES, FED. ENERGY REG. COMM'N ET AL. 18-20 (2021), <https://perma.cc/4KER-7VXX> (recommending improved weatherization practices).

36 ENVERUS, WINTER STORM URI – NATURAL GAS ANALYSIS 10, 14 (2021), <https://perma.cc/KV6H-WBUL>. The survey included natural gas producers representing 51% of production in Texas.

37 See Katharine Hayhoe et al., *Our Changing Climate*, in IMPACTS, RISKS AND ADAPTATION IN THE UNITED STATES: FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME II 72, 94 (D.R. Reidmiller et al. eds., 2018), <https://perma.cc/52K9-S8TW>.

38 See, e.g., Judah Cohen et al., *Linking Arctic variability and change with extreme winter weather in the United States*, 373 SCIENCE 1116, 1116-1121 (2021).

39 D.R. Easterling et al., *Precipitation Change in the United States*, in CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME I 207, 217 (D.J. Wuebbels et al. eds., 2017), <https://perma.cc/MV9S-NMAS>.

40 *Id.* at 216.

41 *Id.* at 218-220.

42 See U.S. DEP'T OF ENERGY, CLIMATE CHANGE & THE ELECTRICITY SECTOR: GUIDE FOR CLIMATE CHANGE RESILIENCE PLANNING 10, 11 (2016), <https://perma.cc/4WHR-EDFJ>.

43 JUSTIN GUNDERLACH & ROMANY WEBB, CLIMATE CHANGE IMPACTS ON THE BULK POWER SYSTEM: ASSESSING VULNERABILITIES AND PLANNING FOR RESILIENCE 9 (2018), <https://perma.cc/A2ZH-BBED>.

44 See, e.g., U.S. DEP'T OF ENERGY, *supra* note 18, at 3-12, 4-10 (discussing risks to oil refineries in the southwest and biofuel refineries in the northern Great Plains).

- **Storms, hurricanes, and flooding:** As noted above, climate change is increasing the frequency and severity of heavy rainfall events, as well as the severity of hurricanes. This could lead to more flood events affecting fossil fuel production sites, fuel refineries, fuel storage terminals, pipelines, and electric generating facilities.⁴⁵ Facilities located on the coast or along inland waterways are at particular risk.⁴⁶ With respect to coastal facilities, sea level rise is already contributing to higher storm surges, meaning that more facilities are at risk of inundation during storms. A 2015 study found that sea level rise could increase the number of energy facilities exposed to storm surge from a weak (category 1) hurricane by up to 67% from 711 to 1,025 by 2060.⁴⁷ Another study of just four coastal cities—Houston, Los Angeles, New York, and Miami— identified 315 energy facilities that are at risk of sunny-day or “nuisance” flooding caused by sea level rise alone by 2100.⁴⁸ Affected facilities may be forced to shut down; those that continue operating could present significant environmental risks. For example, flooding at energy storage facilities could lead to unplanned discharges of oil into waterways, or natural gas into the atmosphere. At some kinds of facilities, such as coal ash lagoons, flooding continues to present significant environmental risks even when the facilities are no longer in use.⁴⁹

Flood-related risks to energy infrastructure may be compounded by risks from high winds associated with hurricanes and other storms. During Hurricane Ida in 2021, for example, high winds damaged the eight major transmission lines that deliver electricity to New Orleans.⁵⁰ This, combined with damage to the city’s electricity distribution system, resulted in outages affecting approximately 1.1 million people.⁵¹ The hurricane also forced the closure of several refineries in Louisiana and Mississippi.⁵² Previous hurricanes and storms have resulted in oil spills and other toxic releases from refineries.⁵³

- **Wildfires:** The incidence and severity of wildfires are increasing due in part to higher temperatures associated with climate change. This has been, and will continue to be, a particular problem in the western U.S. where prolonged droughts are becoming more common. Parts of the west are also experiencing changing wind patterns which further increase wildfire risk. For example, in California, climate change is causing extreme

45 See *id.* at xiv.

46 Zamuda et al., *supra* note 29, at 176.

47 JAMES BRADBURY ET AL., CLIMATE CHANGE AND ENERGY INFRASTRUCTURE EXPOSURE TO STORM SURGE AND SEA-LEVEL RISE 3, 15 (2015), <https://perma.cc/3WKY-CVY9>.

48 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> (predicting that 67 energy facilities in Houston, 29 facilities in Los Angeles, 49 facilities in Miami, and 170 facilities in New York could be inundated by 2100).

49 Brady Dennis et al., *Dam breach sends toxic coal ash flowing into a major North Carolina river*, WASH. POST (Sept. 22, 2018), <https://www.washingtonpost.com/energy-environment/2018/09/21/dam-breach-reported-former-nc-coal-plant-raising-fears-that-toxic-coal-ash-may-pollute-cape-fear-river/>.

50 Peter Eavis & Ivan Penn, *Why Louisiana’s Electric Grid Failed in Hurricane Ida*, N.Y. TIMES (Sept. 17, 2021), <https://perma.cc/KF99-ZN2Z>.

51 Jacob Knutson, *Deadly Hurricane Ida leaves over 1 million without power in Louisiana*, AXIOS (Aug. 30, 2021), <https://perma.cc/9EXR-NKM4>.

52 Jason Metko, *Gulf coast refiners start shutdown for Ida: Update 2*, ARGUS (Aug. 27, 2021), <https://perma.cc/Z9QC-VVXK>.

53 See, e.g., Emily Flitter & Richard Valdmanis, *Oil and chemical spills from Hurricane Harvey big, but dwarfed by Katrina*, REUTERS (Sept. 15, 2017), <https://perma.cc/8A3Q-3GSZ>.

wind conditions (known as “Santa Ana” or “Diablo” winds) to occur later in the year, when vegetation is at its driest and thus poses the greatest fire hazard.⁵⁴

Wildfires can damage, destroy, or force the shutdown of above-ground energy infrastructure. In recent years, electricity transmission and distribution infrastructure has been particularly affected, with flow-on effects on electricity generation. In 2015, for example, a wildfire in Washington state forced the shutdown of a transmission line which, in turn, necessitated the curtailment of output from a hydroelectric generating plant.⁵⁵ More recently, in parts of California, transmission and distribution lines have had to be shut down preemptively to mitigate wildfire risk.⁵⁶ While undergrounding lines can help to avoid this, there are other wildfire-related risks to below-ground infrastructure. For example, wildfires increase the potential for landslides, which may damage below-ground transmission and distribution infrastructure and pipelines. Landslides and smoke from wildfires can also impair the operation of solar generating systems. For example, in September 2020, wildfire smoke caused a thirty percent decline in solar generation in California (compared to the July 2020 average).⁵⁷

While the above climate impacts are discussed separately, multiple impacts could occur simultaneously. Moreover, each impact could affect multiple parts of the energy system, resulting in compounding risks, and increasing the potential for widespread and prolonged system disruptions. Such disruptions pose a threat to public health, safety, and the environment and could have serious economic consequences.⁵⁸ For example, the electricity outages experienced in Texas as a result of Winter Storm Uri forced the shutdown of water treatment facilities, disrupted services at medical facilities, and cost the state approximately \$130 billion in lost economic activity.⁵⁹

Changes in the siting, design, construction, and operation of energy infrastructure could significantly reduce its exposure to climate-related risks.⁶⁰ For example, elevating coastal generating plants, or building floodwalls around them, can reduce their exposure to storm surge damage. Using high-efficiency cooling systems in refineries and generating plants can reduce their water needs, and thus their susceptibility to drought-induced shutdowns. Taking these and other steps to build in climate resilience at the time new infrastructure is developed will be easier and cheaper than retrofitting facilities in the future. Indeed, a recent study of climate risks to transmission and distribution infrastructure found that designing new

54 See generally, Norman L. Miller & Nicole J. Schlegel, *Climate change projected weather sensitivity: California Santa Ana wind occurrence*, 33 GEOPHYSICAL RESEARCH LETTERS L15711 (2006).

55 See CRYSTAL RAYMOND, SEATTLE CITY LIGHT CLIMATE CHANGE VULNERABILITY ASSESSMENT AND ADAPTATION PLAN 17, 49 (2015), <https://perma.cc/LYQ6-ZT3L>.

56 *PG&E Shutdown: 800,000 people to lose power to prevent California wildfires*, THE GUARDIAN (Oct. 9, 2019), <https://perma.cc/2BTB-MJLV>.

57 Energy Info. Admin., *Smoke from California wildfires decreases solar generation in CAISO*, TODAY IN ENERGY (Sep. 30, 2020), <https://perma.cc/T9QV-R29X>.

58 See generally Romany M. Webb et al., *Climate Risk in the Electricity Sector: Legal Obligations to Advance Climate Resilience Planning by Electric Utilities*, 51 ENV'T LAW 577, 583-84 (2021).

59 See Joshua W. Busby et al., *Cascading Risks: Understanding the 2021 Winter Blackout in Texas*, 77 ENERGY RES. & Soc. Sci. 102106, 1 (2021).

60 For a discussion of actions that may be taken to reduce climate-related risks to energy infrastructure, see U.S. DEP'T OF ENERGY, *supra* note 18.

infrastructure based on anticipated climate conditions over its useful life “roughly halves the expected costs of climate change experienced in 2090,” compared to a scenario in which no changes are made to infrastructure design.⁶¹

While private companies develop most energy infrastructure the federal government can nevertheless play an important role in ensuring that new infrastructure is climate resilient. Federal government approval is frequently required for energy projects (see Box 4). Before granting such approval, federal agencies must often conduct an environmental review under NEPA, which provides an opportunity to identify climate-related risks to proposed infrastructure and evaluate possible solutions to enhance the climate resilience of that infrastructure.⁶²

61 Charles Fant et al., *Climate Change Impacts and Costs to U.S. Electricity Transmission and Distribution Infrastructure*, 195 ENERGY 116899, 7 (2020).

62 Projects that are not subject to federal review under NEPA are often subject to review under the equivalent state-level environmental statutes, where the best practices for climate impact analysis discussed in this paper could likewise be implemented.

3. THE NATIONAL ENVIRONMENTAL POLICY ACT

3.1. NEPA Basics

Signed into law on January 1, 1970 by President Nixon, NEPA helped define a new wave of major national environmental statutes passed in the U.S.⁶³ Its enactment came shortly after the Santa Barbara oil spill and reflected increasing public and Congressional support for enhanced environmental protection.⁶⁴ NEPA established a national environmental policy whereby the federal government would “use all practicable means and measures . . . to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.”⁶⁵ The law sets forth specific, continuing responsibilities for the federal government, namely to:

(1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations; (2) assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings; (3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences; (4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice; (5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life’s amenities; and (6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.⁶⁶

To further the achievement of those goals, NEPA requires federal agencies to conduct an environmental review of any “major federal action[] significantly affecting the quality of the human environment.”⁶⁷ For each covered action (see Part 3.1.A below), the federal agency must prepare and publish a “detailed statement” (known as an “environmental impact statement” or “EIS”) that includes the following components:

(i) the environmental impact of the proposed action, (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented, (iii) alternatives to the proposed action, (iv) the relationship between local short-term uses of man’s environment and the maintenance and enhancement of long-term productivity, and (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.⁶⁸

63 NEPA.GOV, <https://perma.cc/6FE3-KHQ2> (last visited Dec. 9, 2021).

64 Nicholas C. Yost, *The Background and History of NEPA*, in THE NEPA LITIGATION GUIDE (2012), <https://perma.cc/6TW8-QMC9>.

65 42 U.S.C. § 4331(a).

66 Id. § 4331(b)(1)–(6).

67 Id. § 4332(2)(C).

68 Id. § 4332(2)(C)(i)–(v).

NEPA is a procedural statute, understood to convey two requirements upon major federal agency actions. First, agencies must “consider every significant aspect of the environmental impact of an action before proceeding with it.”⁶⁹ Second, the agency must accommodate public participation by sharing information during the decision-making process, providing the public with an opportunity to comment on drafts, and publicizing its ultimate decision.⁷⁰ NEPA’s purpose and function are thus not prescriptive, and agencies are not required to take any specific action following completion of their environmental reviews. NEPA does, however, require federal agencies to take a “hard look” at the environmental effects of their actions.⁷¹ Importantly, this “hard look” obligates real consideration. The environmental review required by NEPA is not meant to be an “abstract exercise,” but rather to be “incorporated as part of the agency’s process of deciding whether to pursue a particular federal action.”⁷² NEPA is thus only “satisfied if Federal agencies have considered relevant environmental information, and the public has been informed regarding the decision-making process.”⁷³ The theory is that improved process should result in better outcomes; the law is designed to “provide for informed decision making and foster excellent action.”⁷⁴

3.1.A Application of NEPA

Because NEPA requires federal agencies to prepare an EIS for any “major federal action[] significantly affecting the quality of the human environment,”⁷⁵ NEPA’s application turns on whether an action is “federal” in nature. For the purposes of NEPA, federal actions include “projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by Federal agencies.”⁷⁶ NEPA implementing regulations clarify that covered actions “tend to fall within one of the following categories”:

- (i) Adoption of official policy, such as rules, regulations, and interpretations adopted under the Administrative Procedure Act, 5 U.S.C. 551 et seq. or other statutes; implementation of treaties and international conventions or agreements, including those implemented pursuant to statute or regulation; formal documents establishing an agency’s policies which will result in or substantially alter agency programs.
- (ii) Adoption of formal plans, such as official documents prepared or approved by Federal agencies, which prescribe alternative uses of Federal resources, upon which future agency actions will be based.
- (iii) Adoption of programs, such as a group of concerted actions to implement a specific policy or plan; systematic and connected agency decisions allocating agency resources to implement a specific statutory program or executive directive.
- (iv) Approval of specific projects, such as

69 LINDA LUTHER, CONG. RESEARCH SERV., RL33152, THE NATIONAL ENVIRONMENTAL POLICY ACT: BACKGROUND AND IMPLEMENTATION 1 (2008), <https://perma.cc/UFN3-P7H6>.

70 *Id.* at 26.

71 *New York Natural Res. Def. Council, Inc. v. Kleppe*, 429 U.S. 1307, 1311 (1976) (internal quotations omitted).

72 *Baltimore Gas & Electric Co. v. Natural Res. Def. Council, Inc.*, 462 U.S. 87, 100 (1983).

73 40 C.F.R. § 1500.1(a). Unless otherwise indicated, all citations to the NEPA implementing regulations (40 C.F.R. § 1500.1 et seq.) in this paper are to the current regulations as of the time of publication—that is, the regulations as amended in 2020. CEQ has proposed amendments to these regulations, as further discussed in Part 3.2, *infra*.

74 40 C.F.R. § 1500.1(a).

75 42 U.S.C. § 4332(2)(C).

76 40 C.F.R. § 1508.1(q)(2).

construction or management activities located in a defined geographic area. Projects include actions approved by permit or other regulatory decision as well as Federal and federally assisted activities.⁷⁷

Even if an action is found to be federal in nature, an agency need only prepare an EIS if the action “significantly affect[s] the quality of the human environment.”⁷⁸ To determine whether this is the case, federal agencies must consider a variety of factors, including “the affected area . . . and its resources,” and the “degree of the effects,” such as “short- and long-term effects,” “beneficial and adverse effects,” “[e]ffects on public health and safety,” and “[e]ffects that would violate Federal, State, Tribal, or local law protecting the environment.”⁷⁹

3.1.B Environmental Review Process

If the effects of a federal action are known to be significant at the outset, the relevant federal agency may proceed directly to prepare an EIS. This is relatively rare, however. More commonly, agencies begin with more limited processes, known as categorical exclusions (“CEs”) or environmental assessments (“EAs”).⁸⁰

CEs apply to categories of actions that federal agencies determine, in advance, will not have a “significant effect on the human environment.”⁸¹ A CE may also apply to actions where circumstances or conditions reduce impacts to avoid significant effects. While the majority of CEs are established through agency-specific NEPA regulations, there are certain instances where CEs are statutorily designated, the most relevant of these being for certain types of oil and gas production on federal land.⁸² Actions covered by a CE require minimal documentation, obligating the agency only to produce a determination that further environmental review is unnecessary.⁸³

When an action is not covered by a CE, but is “not likely to have significant effects or when the significance of the effects is unknown,” the federal agency may conduct an EA.⁸⁴ EAs must include, among other things, a brief discussion of the proposed action’s purpose and need, a review of alternatives, and the predicted environmental impacts of the action and its alternatives.⁸⁵ On the basis of this information, the federal agency must determine next steps, which typically take one of two forms.⁸⁶ First, the agency may issue a Finding of No Significant Impact (“FONSI”), meaning that the action “will not have significant effects” on the

77 *Id.* § 1508.1(q)(3).

78 42 U.S.C. § 4332(2)(C).

79 40 C.F.R. § 1501.3(b)(1)–(2).

80 U.S. Gov. ACCOUNTABILITY OFF., GAO-14-369, NATIONAL ENVIRONMENTAL POLICY ACT: LITTLE INFORMATION EXISTS ON NEPA ANALYSES 7 (2014), <https://perma.cc/QY2Z-2PVE> (finding that “about 95 percent of NEPA analyses are CEs, less than 5 percent are EAs, and less than 1 percent are EISs”).

81 40 C.F.R. § 1501.4(a).

82 *See, e.g.*, 42 U.S.C. § 15942; *FEMA Statutory Exclusions*, FEMA, <https://perma.cc/585K-GM77> (last visited Dec. 9, 2021).

83 *See* KRISTEN ALEXANDER, CONG. RESEARCH SERV., RS20621, OVERVIEW OF NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) REQUIREMENTS 3 (2008), <https://perma.cc/2FYB-23G3>.

84 40 C.F.R. § 1501.5(a)–(b).

85 *Id.* § 1501.5(c).

86 *Id.* § 1501.5(c)(1).

human environment, and no further environmental review is required.⁸⁷ Alternatively, if the EA concludes that the proposed action may significantly affect the environment, the agency must conduct a second, more detailed review and prepare an EIS.⁸⁸

Where a federal agency determines that an EIS is required, it must issue a Notice of Intent (“NOI”) in the Federal Register.⁸⁹ The NOI signals the agency’s intent to proceed with an EIS, describes the proposed action, alternatives, and expected impacts, and provides information on the decision-making process and opportunities for participation.⁹⁰ In the project scoping process, the agency invites involvement and information from “likely affected Federal, State, Tribal, and local agencies and governments, the proponent of the action, and other likely affected or interested persons.”⁹¹

The federal agency must next prepare a draft EIS (“DEIS”), make it available to the public, and invite comments.⁹² The agency must “consider substantive comments timely submitted during the public comment period” and may respond by making modifications or explaining “why the comments do not warrant further agency response.”⁹³ Following the designated comment period and revision, the agency prepares and makes public a final EIS.⁹⁴ If the final EIS departs significantly from the DEIS or if significant new information or circumstances arise, an agency may determine that a supplemental EIS is necessary. This supplemental process follows the same steps as for the primary EIS, except for the scoping step.⁹⁵

Based upon the EIS (and, when applicable, supplemental EIS), the federal agency will issue a Record of Decision (“ROD”) in the Federal Register. The ROD is meant to provide a “concise public record” of the agency’s decision, including identification of alternatives considered, discussion of all factors “that the agency balanced in making its decision,” a statement on “whether the agency has adopted all practicable means to avoid or minimize environmental harm from the alternative selected,” and a certification that the agency has considered all commenters’ submissions.⁹⁶ The agency will then proceed with the selected action, consistent with the ROD. A ROD and the underlying environmental review process are subject to judicial review under the Administrative Procedure Act.

87 *Id.* § 1501.6(a).

88 *Id.* § 1501.3(a)(3).

89 *Id.* § 1501.9(d).

90 *Id.*

91 *Id.* § 1501.9(b).

92 *Id.* § 1502.9(b).

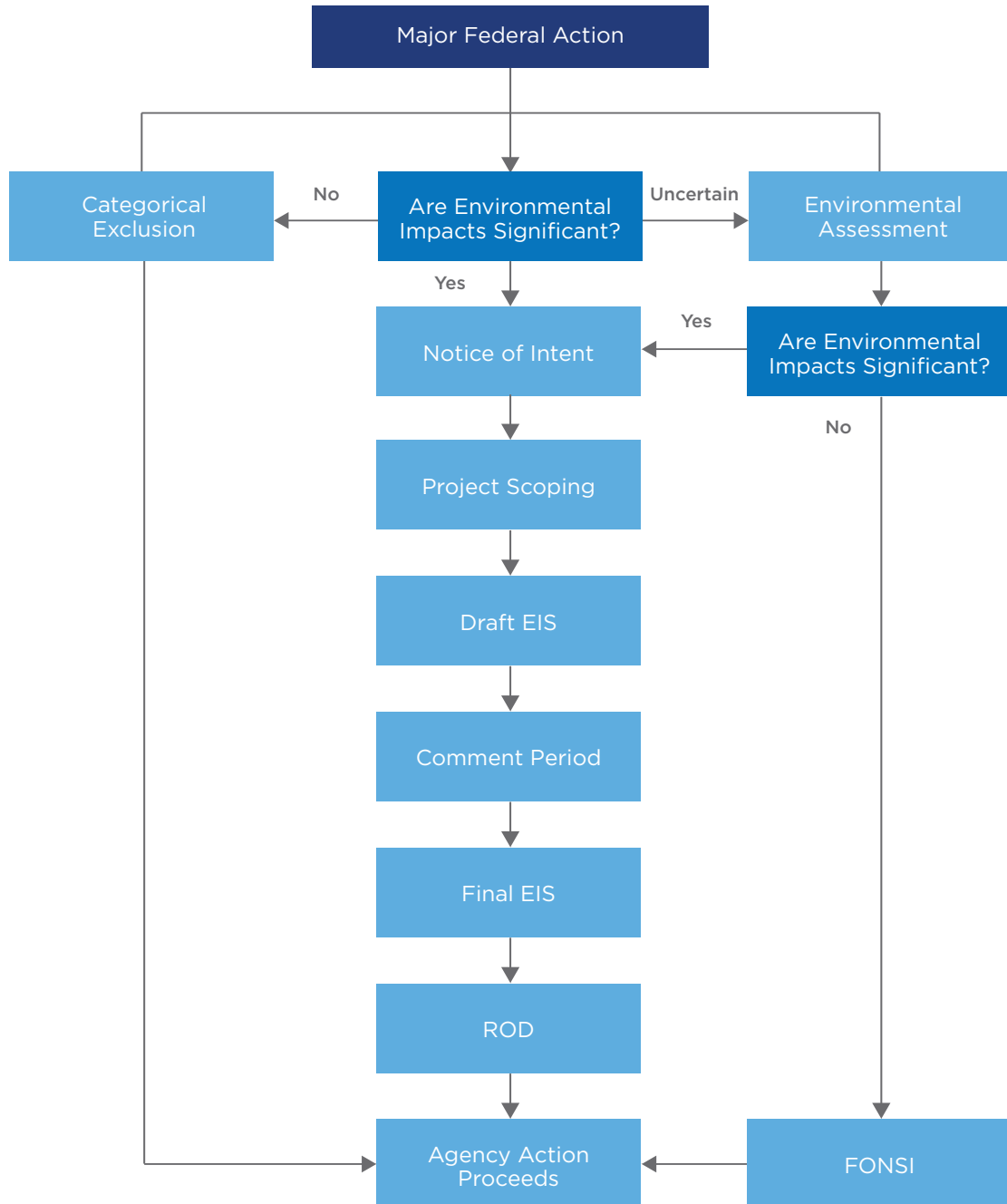
93 *Id.* § 1503.4(a).

94 *Id.* §§ 1502.9(c), 1502.20.

95 *Id.* § 1502.9(d).

96 *Id.* § 1505.2(a)-(b).

Figure 2: The NEPA process⁹⁷



97 LUTHER, *supra* note 69, at 22.

3.2. NEPA Implementation and Regulatory History

In addition to setting forth requirements for federal agency environmental review, NEPA established CEQ, which is responsible for the law’s implementation (among other things).⁹⁸ CEQ’s responsibility does not supplant individual agency action, and each federal agency is responsible for issuing its own regulations to comply with NEPA.⁹⁹ CEQ may, however, issue NEPA-related regulations applicable across federal agencies.¹⁰⁰

3.2.A 1978 Rule Regulatory History

CEQ first promulgated regulations to implement NEPA in 1978 at 40 C.F.R. parts 1500 through 1508.3 (“1978 Rule”).¹⁰¹ CEQ made technical corrections to the 1978 Rule in 1979¹⁰² and promulgated minor amendments in 1986,¹⁰³ but otherwise left its regulatory framework largely untouched for over forty years, until 2020 (see Part 3.2.B below). For this reason, agency practice and case law are largely based upon the 1978 Rule.

The 1978 Rule provided federal agencies with guidance on preparing EISs, including setting forth four key components to an EIS. First, the 1978 Rule required the agency preparing the EIS to include a “Purpose and Need Statement” to outline the core purpose of the proposed federal action and the “need to which the agency is responding.”¹⁰⁴ This statement is considered foundational in the EIS process and should include a discussion of both “the goals and objective of an action” and “existing conditions that call for some improvement.”¹⁰⁵

Second, the 1978 Rule required the agency to identify the “affected environment” by “succinctly describ[ing] the environment of the area(s) to be affected or created by the alternatives under consideration.”¹⁰⁶

Third, the 1978 Rule obligated the agency to identify alternatives to the proposed federal action.¹⁰⁷ Under the 1978 Rule, alternatives were to be considered from a “technical, economic, and common-sense standpoint,” rather than only those “simply desirable from the standpoint of the agency or a potentially affected stakeholder.”¹⁰⁸

Fourth, the 1978 Rule required the agency to analyze the “environmental consequences” of the proposed action and each alternative.¹⁰⁹ As part of this analysis, the agency was required

98 42 U.S.C. §§ 4342, 4344.

99 40 C.F.R. § 1507.3.

100 See *id.* § 1500.3(a); see also CONG. RESEARCH SERV., *supra* note 69, at 1 (noting that CEQ does not have authority to enforce regulations).

101 See *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act*, 43 Fed. Reg. 55,978, 55,978–56,007 (Nov. 29, 1978).

102 See *Implementation of Procedural Provisions; Corrections*, 44 Fed. Reg. 873, 873–874 (Jan. 3, 1979).

103 See *National Environmental Policy Act Regulations; Incomplete or Unavailable Information*, 51 Fed. Reg. 15,618, 15,618–15,626 (Apr. 25, 1986) (amending 40 C.F.R. 1502.22).

104 40 C.F.R. § 1502.13 (1978); see also CONG. RESEARCH SERV., *supra* note 69, at 19.

105 CONG. RESEARCH SERV., *supra* note 69, at 19.

106 40 C.F.R. § 1502.15 (1978).

107 *Id.* § 1502.14.

108 See CONG. RESEARCH SERV., *supra* note 69, at 20.

109 40 C.F.R. § 1502.16 (1978).

to consider “probable beneficial and adverse social, economic, and environmental effects of each alternative.”¹¹⁰

The 1978 Rule also required that EISs, and indeed all forms of environmental reviews, consider three different types of “reasonably foreseeable” effects: (1) direct, (2) indirect, and (3) cumulative. Under the 1978 Rule, direct effects were defined as those that “are caused by the action and occur at the same time and place.”¹¹¹ Indirect effects were defined as those that “are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.”¹¹² Indirect effects “may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.”¹¹³ Lastly, cumulative impacts were defined as those which “result[] from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.”¹¹⁴ These cumulative impacts “can result from individually minor but collectively significant actions taking place over a period of time.”¹¹⁵

In addition to setting forth core elements of an EIS and defining different types of reasonably foreseeable effects, the 1978 Rule defined a process for CEQ to “provide further guidance concerning NEPA and its procedures.”¹¹⁶ CEQ has issued such guidance from time to time across a varied set of topics and subjects, ranging from consideration of climate change (see Box 1) to the incorporation of biodiversity considerations under NEPA.¹¹⁷

110 CONG. RESEARCH SERV., *supra* note 69, at 19.

111 40 C.F.R. § 1508.8(a) (1978).

112 *Id.* § 1508.8(b).

113 *Id.*

114 *Id.* § 1508.7.

115 *Id.*

116 *Id.* § 1506.7.

117 See U.S. Dep’t of Energy, *CEQ Guidance Documents*, OFFICE OF NEPA POLICY AND COMPLIANCE, <https://perma.cc/77Y2-7ATB> (last visited Dec. 7, 2021).

Box 1: Guidance on Considering Climate Change in NEPA Reviews

CEQ drafted, but did not finalize, guidance on considering climate change in NEPA reviews in 1997, 2010, and 2014.¹¹⁸ In August 2016, CEQ issued final guidance (“2016 Climate Guidance”) explicitly providing that “[c]limate change is a fundamental environmental issue, and its effects fall squarely within NEPA’s purview.”¹¹⁹ The 2016 Climate Guidance was intended to promote greater clarity and consistency in how agencies address climate change in environmental reviews under NEPA.¹²⁰ It discussed how agencies should analyze both greenhouse gas emissions associated with proposed federal actions¹²¹ and the climate-related risks to those actions and the surrounding environment.¹²²

CEQ withdrew the 2016 Climate Guidance in 2017 at the direction of President Trump.¹²³ In 2019, CEQ proposed replacement climate guidance, focused specifically on the treatment of greenhouse gas emissions in NEPA reviews (“2019 Proposed Climate Guidance”).¹²⁴ The 2019 proposal was withdrawn under the Biden Administration without ever being finalized.¹²⁵

Some federal agencies have also developed their own climate guidance or similar documents. For example, in 2009, the National Park Service (“NPS”) issued “draft interim guidance” on considering climate change in NEPA analyses.¹²⁶ The guidance recommended that NPS staff conducting environmental reviews under NEPA “evaluat[e]

118 See Katherine Lee, *CEQ’s Draft Guidance on NEPA Climate Analyses: Potential Impacts on Climate Litigation*, 45 ENVTL. L. REP. 10925, 10926 n. 17 (2015) (noting that “CEQ issued an earlier version of [the 2010] draft guidance in 1997, but it was never distributed publicly and received very little attention from either agencies or the courts”); Memorandum from Nancy H. Sutley, Chair, Council on Environmental Quality for Heads of Federal Departments and Agencies (Feb. 18, 2010), <https://perma.cc/DB97-JLR8>; Revised Draft Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews, 79 Fed. Reg. 77,802 (Dec. 24, 2014) [hereinafter “2014 Draft Climate Guidance”].

119 Memorandum from Christina Goldfuss, Council on Environmental Quality, for Heads of Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews (Aug. 1, 2016), <https://perma.cc/BUQ9-99JH> [hereinafter “2016 Climate Guidance”]; See also Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews, 81 Fed. Reg. 51,866 (Aug. 5, 2016) (announcing issuance of the 2016 Climate Guidance).

120 2016 Climate Guidance, *supra* note 119, at 2.

121 *Id.* at 9–20.

122 *Id.* at 20–25.

123 Withdrawal of Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews, 82 Fed. Reg. 16,576, 16,576–16,577 (Apr. 5, 2017) [hereinafter “2017 Withdrawal”]. See also Executive Order 13,783: Promoting Energy Independence and Economic Growth, 82 Fed. Reg. 16,093, 16,094 (Mar. 31, 2017) (directing CEQ to rescind the 2016 Climate Guidance).

124 Draft National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions, 84 Fed. Reg. 30,097, 30,097–30,099 (June 26, 2019) [hereinafter “2019 Proposed Climate Guidance”].

125 National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions, 86 Fed. Reg. 10,252, 10,252 (Feb. 19, 2021) [hereinafter “2021 Withdrawal”].

126 NAT’L PARK SERV., DRAFT INTERIM GUIDANCE: CONSIDERING CLIMATE CHANGE IN NATIONAL PARK SERVICE NEPA ANALYSIS 1 (2009), <https://perma.cc/76SA-7DND>.

the issue of climate change” and identified tools and resources that could be used in that evaluation.¹²⁷ The Forest Service also issued similar guidance on considering climate change in NEPA reviews in 2009.¹²⁸ The Army Corps of Engineers published and has periodically updated guidance on evaluation of, and adaptation to, sea level rise in decision-making, including NEPA processes.¹²⁹

3.2.B Recent Regulatory Changes

CEQ departed from roughly four decades of practice in July 2020 when, under the Trump Administration, it finalized new NEPA implementing regulations (“2020 Rule”).¹³⁰ Among other changes, the 2020 Rule sought to standardize environmental assessments, potentially limiting the ability of agencies to craft their own, more specific regulations that go beyond CEQ’s baseline requirements. The 2020 Rule also narrowed a number of definitions, including what constituted a major federal action, purpose and need, reasonable alternative, and effects or impacts. The definition of effects or impacts in the 2020 Rule removed language requiring consideration of direct, indirect, and cumulative impacts¹³¹ and replaced it with a more restrictive definition, as follows:

Effects or impacts means changes to the human environment from the proposed action or alternatives that are reasonably foreseeable and have a reasonably close causal relationship to the proposed action or alternatives, including those effects that occur at the same time and place as the proposed action or alternatives and may include effects that are later in time or farther removed in distance from the proposed action or alternatives.¹³²

Environmental and other groups opposed the 2020 Rule during rulemaking and in subsequent litigation.¹³³ When the Biden Administration took office, it signaled interest in revisiting the NEPA regulations.¹³⁴ On October 7, 2021, CEQ issued a notice of proposed rulemaking for

127 *Id.* at 1–2.

128 FOREST SERV., CLIMATE CHANGE CONSIDERATIONS IN PROJECT LEVEL NEPA ANALYSIS 1 (2009), <https://perma.cc/GK5B-E9AZ>.

129 See U.S. ARMY CORPS OF ENGINEERS, PROCEDURES TO EVALUATE SEA LEVEL CHANGE: IMPACTS, RESPONSES, AND ADAPTATION (2019), <https://perma.cc/NPY8-PP3G>.

130 The rule was finalized on July 15, 2020 and became effective on September 14, 2020. See Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act, 85 Fed. Reg. 43,304 (July 16, 2020).

131 *Id.* at 43,343–43,344.

132 40 C.F.R. § 1508.1 (2020). Although direct, indirect, and cumulative impacts language was removed, the 2020 Rule did not prohibit the ability for agencies to consider such effects and impacts.

133 See, e.g., Sabin Center for Climate Change Law at Columbia Law School and Environmental Defense Fund, Comment Letter on Proposed Amendments to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act (Mar. 10, 2020), <https://perma.cc/P368-FH52>; Wild Va. v. Council on Env’tl. Quality, 3:20-cv-00045, U.S. Dist. LEXIS 114616, at *3 (W.D. Va. June 21, 2021).

134 See Exec. Order No. 13,990, 86 Fed. Reg. 7037, 7042 (Jan. 25, 2021).

a Phase 1 revision (“2021 Proposed Rule”).¹³⁵ The 2021 Proposed Rule restores two critical features of the 1978 Rule: (1) agencies’ flexibility to determine the “purpose and need” of a proposed project and analyze reasonable alternatives; and (2) the express requirement to consider the direct, indirect, and cumulative impacts of a project.¹³⁶ The 2021 Proposed Rule also clarifies that CEQ’s NEPA regulations “provide a floor for environmental review procedures” and that “agencies have the discretion and flexibility to develop procedures beyond the CEQ regulatory requirements.”¹³⁷

CEQ has indicated that it intends to issue a second proposed rule (“Phase 2 Rule”) in the near future to “help ensure full and fair public involvement in the environmental review process; meet the nation’s environmental, climate change, and environmental justice challenges; provide regulatory certainty to stakeholders; and promote better decision-making consistent with NEPA’s goals and requirements.”¹³⁸

135 National Environmental Policy Act Implementing Regulations Revisions, 86 Fed. Reg. 55,757, 55,757–55,769 (Oct. 7, 2021).

136 *Id.* at 55,760–55,761.

137 *Id.* at 55,757 & 55,761; see also Press Release, The White House, CEQ Proposes to Restore Basic Community Safeguards during Federal Environmental Reviews (Oct. 6, 2021), <https://perma.cc/SDU8-UN3M>.

138 *Id.*

4. CONSIDERING CLIMATE RISK UNDER NEPA

4.1. NEPA and Climate Change

Climate change's relevance to the NEPA process is reflected in case law and CEQ activity. With respect to the former, numerous federal court decisions have held that federal agencies have an obligation to consider climate change in environmental reviews under NEPA.¹³⁹ As to the latter, CEQ has similarly long recognized that NEPA requires consideration of climate change and has previously issued guidance to assist federal agencies in meeting the statutory requirements (see Box 1). CEQ is currently reviewing the 2016 Climate Guidance but has instructed that, until its review is completed, "agencies should consider all available tools and resources in assessing GHG emissions and climate change effects of their proposed actions, including, as appropriate and relevant, the 2016 [Climate] Guidance."¹⁴⁰

The 2016 Climate Guidance identifies two broad categories of climate change considerations requiring analysis under NEPA. The first concerns the effects of the project on climate change, or more specifically the greenhouse gas emissions associated with an action and their contribution to worsening climate change. The second, and subject of this paper, concerns how the impacts of climate change will affect a proposed action and its surrounding environment. This is referred to as "climate impact analysis" below. With respect to this second category, the 2016 Climate Guidance explicitly recognizes the need to consider "the effects of climate change on a proposed action and its environmental impacts"¹⁴¹ and emphasizes that "climate change adaptation and resilience . . . are important considerations" in NEPA reviews.¹⁴²

The requirement to consider greenhouse gas emissions under NEPA has received relatively more scrutiny in the courts, agency guidance documents, and scholarship.¹⁴³ Notably, however, several federal court decisions have recognized that NEPA also requires consideration of the impacts of climate change on proposed federal actions.¹⁴⁴ As discussed in Part 4.2 below, courts have held that climate impacts must be considered by federal agencies when defining the local environment affected by the proposed action, and evaluating the environmental consequences of that action and alternatives. It should be noted, however, that successful plaintiffs in the cases have typically prevailed on narrow fact-specific grounds, and thus the decisions do not provide

139 See *infra* Part 4.2.

140 2021 Withdrawal, *supra* note 125, at 10,252.

141 2016 Climate Guidance, *supra* note 119, at 20-25, 24 ("Climate change effects on the environment and on the proposed project should be considered in the analysis of a project considered vulnerable to the effects of climate change such as increasing sea level, drought, high intensity precipitation events, increased fire risk, or ecological change.").

142 *Id.* at 20.

143 See, e.g., *supra* note 14.

144 Our research identified at least sixteen cases in which federal courts have recognized a requirement to consider climate change impacts under NEPA. All of the cases are from the Ninth, Tenth and D.C. Circuits and their district courts. The courts in most cases did not expressly identify the legal basis of the requirement. Some did, however, specify that climate impacts must be analyzed when defining the environment affected by proposed actions and evaluating proposed actions' cumulative impacts. See *infra* Part 4.2.B.

an overarching definition of what constitutes an adequate climate impact analysis. We identify best practices, drawn from scholarship and state and international experience, in Part 4.3 below.

4.2. Legal Basis for Considering Climate Impacts Under NEPA

NEPA obligations to consider climate impacts are anchored in multiple, independently valid statutory and regulatory provisions. First, on a planet increasingly altered by climate change, federal agencies can only fulfill the statutory purpose of NEPA by integrating climate change considerations into environmental reviews. Second, in order to conduct environmental reviews that meet the requirements of NEPA and the implementing regulations, federal agencies must consider climate change when defining the affected environment, evaluating the purpose and need, and assessing the environmental consequences of proposed federal actions.

4.2.A Statutory Purpose of NEPA

Consideration of climate impacts is essential to achieve the federal policy, declared in NEPA, “to use all practicable means and measures . . . to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.”¹⁴⁵ NEPA further requires all federal agencies to conduct their activities in a manner that will “assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings” and “attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences,” among other things.¹⁴⁶ Agencies can no longer reasonably accomplish these objectives without considering whether and how the present and future impacts of climate change may compromise their activities or worsen any negative environmental and public health effects of those activities.

For example, the calculus of environmental and public health impacts versus benefits for coastal fossil fuel infrastructure should consider the heightened risk of spills due to climate change-induced sea level rise, more intense hurricanes, and heavier precipitation events. Federal agencies should also consider whether a coastal facility may become less productive over time because more frequent and severe extreme weather events interfere with its operation. Weighing these factors could shift the calculus on whether a proposed action should proceed. Moreover, even if the agency does decide to proceed, these considerations will enable it to better assess alternatives or adaptation measures, such as relocating or protecting the facility, which could make the action more resilient and lessen its adverse environmental impacts. As the 2016 Climate Guidance recognized:

Focused and effective consideration of climate change in NEPA reviews will allow agencies to improve the quality of their decisions. Identifying important interactions between a changing climate and the environmental impacts from a proposed action can help Federal agencies and other decision makers identify practicable opportunities to . . . improve environmental outcomes, and contribute to safeguarding communities and their infrastructure against the effects of extreme

¹⁴⁵ 42 U.S.C. § 4331(a).

¹⁴⁶ *Id.* § 4331(b)(2)-(3).

weather and other climate-related impacts.¹⁴⁷

This is fully consistent with the goals underlying NEPA’s environmental review requirement. As noted in the 1978 Rule, that requirement is “intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment.”¹⁴⁸ Without first considering the how climate impacts will affect a project and the surrounding environment, agencies cannot possibly hope to make a decision that reflects the most “beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and intended consequences,”¹⁴⁹ and are thus at risk of violating their statutory responsibilities.

4.2.B Statutory and Regulatory Requirements for Environmental Review

As discussed in Part 3.1 above, NEPA establishes baseline requirements for federal agencies’ environmental reviews, including identifying key components which must be included in all EISs. CEQ’s implementing regulations and court decisions have further elaborated on NEPA requirements. The court decisions make clear that, in order to meet the statutory and regulatory requirements, federal agencies must include an analysis of climate change impacts in their EISs. Specifically, and at a minimum, federal agencies must analyze climate change impacts when (1) identifying the purpose of, and need for, a proposed action and defining alternative actions that could meet that purpose and need, (2) describing the area affected by the proposed action and alternatives, and (3) evaluating the impacts of the proposed action and alternatives on the environment and measures to lessen those impacts.

With respect to (1), all EISs must describe the “underlying purpose and need for the proposed action,”¹⁵⁰ and identify a “reasonable range of alternatives” that would also meet that purpose and need.¹⁵¹ The impacts of climate change could affect the need for a particular action and the available alternatives to that action.¹⁵² For example, climate change is expected to lead to more frequent and longer-lasting droughts in some areas, which could make hydroelectric generation less feasible or even impossible.¹⁵³ Anticipated future drought conditions are, therefore, a relevant factor to be taken into account in determining the need for a proposed hydroelectric generating facility. Similarly, climate change might lead to the relocation of communities in areas prone to drought or at risk from sea level rise, thus reducing or

147 2016 Climate Guidance, *supra* note 119, at 3. See also NAT’L PARK SERV., *supra* note 126, at 8 (warning that “[f]ailing to consider current and anticipated [climate] impacts may lead to decisions that do not adequately consider changing conditions and changing resources.”).

148 40 C.F.R. § 1500.1(c) (1978).

149 42 U.S.C. § 4331(b)(3).

150 40 C.F.R. § 1502.13.

151 *Id.* §§ 1502.14, 1508.1(z) (defining “reasonable alternatives”).

152 See generally, FOREST SERV., *supra* note 128, at 3 (stating that the evaluation of purpose and need should “consider whether climate change may affect the ability to reach a desired condition. For example, the success of the proposal to restore aspen in a particular location may be reduced by expected warmer temperatures or lower rainfall during the next century”).

153 See, e.g., Decl. of Javier Dib in Supp. of Ch. 11 Pets. and First Day Mots., 3, *In re Alto Maipo Delaware LLC*, No. 21-11507 (Bankr. D. Del. Nov. 17, 2021) (“[C]limate change has significantly impacted the hydrology of the Maipo Valley, where the Project is being constructed, and lower precipitation levels reduce in turn the amount of power that the Project can produce. As a result, Alto Maipo can no longer rely on its prior revenue projections . . .”).

eliminating the need for additional natural gas pipelines to serve that area. Sea level rise and other climate impacts might also limit where such pipelines can be located and thus constrain the range of alternatives. Additionally, climate impacts could limit the useful life of infrastructure or necessitate additional maintenance or repairs, all of which need to be considered when evaluating purpose and need.

With respect to (2), EISs must also describe the environment of the area affected by the proposed action, as well as any alternatives being considered.¹⁵⁴ Courts have recognized that accurately defining this environmental baseline is integral to an effective evaluation of the proposed action's environmental consequences.¹⁵⁵ It is well accepted that the baseline must account for "reasonably foreseeable environmental trends and planned actions in the area(s)."¹⁵⁶ The 2016 Climate Guidance specifies that "the reasonably foreseeable affected environment" includes "[t]he current and projected future state of the environment."¹⁵⁷ According to the 2016 Climate Guidance, the future state of the affected environment "should be described based on authoritative climate change reports," which document the impacts of climate change "both globally and at a localized level."¹⁵⁸ The Guidance further indicates that federal agencies should consider climate impacts on the affected environment throughout the expected life of the proposed action.¹⁵⁹

The courts have confirmed that climate impacts must be accounted for in the discussion of the affected environment. In *AquAlliance v. U.S. Bureau of Reclamation*, plaintiffs successfully challenged the NEPA analysis prepared for a water transfer program on the basis that the agency failed to adequately consider how climate change would affect the timing of precipitation and snowmelt in the local area.¹⁶⁰ The court in *National Wildlife Federation v. National Marine Fisheries Service* similarly determined that the Army Corps of Engineers violated NEPA when it used old EISs to issue a new order because the affected environment identified in the old EISs did not reflect new information about climate change.¹⁶¹

The courts have similarly held that federal agencies must consider the implications of climate change for the proposed action, alternatives, and their respective environmental outcomes (i.e., point (3) above). Under NEPA, EISs must include a discussion of the "reasonably foreseeable" effects of the proposed action and alternatives on the human environment, including "ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic

154 40 C.F.R. § 1502.15.

155 *AquAlliance v. U.S. Bureau of Reclamation*, 287 F. Supp. 3d 969, 1016 (E.D. Cal. 2018) (stating that the requirement to define the affected environment "stems from the uncontroversial proposition that it would be 'simply impossible' to evaluate the effects of a project if an agency fails to gather information on the" environmental baseline) (quoting *LaFlamme v. FERC*, 852 F.2d, 389, 400 (9th Cir. 1988)).

156 40 C.F.R. § 1502.15.

157 2016 Climate Guidance, *supra* note 119, at 20.

158 *Id.* at 20–21; see also NAT'L PARK SERV., *supra* note 126, at 9–10 (stating that the description of the affected environment "should . . . describe the shifts that will occur to . . . baseline conditions as a result of climate change" and recommending that the description be based on reports that "address[] predicted impacts of climate change [in the relevant] geographic region.").

159 2016 Climate Guidance, *supra* note 119, at 9, 21.

160 287 F. Supp. 3d at 1028–29, 1032.

161 184 F. Supp. 3d 861, 875 (D. Or. 2016).

(such as the effects on employment), social, or health effects.”¹⁶²

CEQ has determined that federal agencies must consider the impacts of climate change as part of their analysis of environmental effects. The 2016 Climate Guidance notes that climate change may exacerbate the effects of a proposed action by increasing the vulnerability of both human communities and natural systems to such effects.¹⁶³ It offers the example of how a “proposed action may require water from a stream that has diminishing quantities of available water because of decreased snow pack in the mountains, or add heat to a water body that is already warming due to increasing atmospheric temperatures.”¹⁶⁴ It further emphasizes that these climate “considerations are squarely within the scope of NEPA and can inform decisions on whether to proceed with, and how to design, the proposed action to eliminate or mitigate impacts exacerbated by climate change.”¹⁶⁵

The courts have affirmed the above approach. Multiple courts have held that agencies are required to consider climate change when evaluating the cumulative impacts of a proposed action and alternatives. For example, in *Southern Utah Wilderness Alliance v. Burke*, plaintiffs challenged the NEPA analysis conducted for a Bureau of Land Management (“BLM”) plan that designated certain areas in Utah for off-highway vehicle use.¹⁶⁶ The court held that, “under NEPA, the BLM must take a ‘hard look’ at the cumulative impacts of [off-highway vehicle] use and climate change.”¹⁶⁷ In *Friends of the Wild Swan v. Jewell*, a challenge to the U.S. Fish and Wildlife Service’s issuance of an incidental take permit for bull trout, the court similarly held that the Service was required to consider the cumulative impacts of climate change and the taking of bull trout in its NEPA analysis.¹⁶⁸

As well as considering how climate change might affect the proposed action’s environmental outcomes, federal agencies must also consider the implications of climate change for the environmental outcomes of alternative actions. This is necessary to enable comparison of the proposed action and alternatives as required under NEPA. In this regard, the 2020 Rule states that “[t]he alternatives section [of an EIS] should present the environmental impacts of the proposed action and the alternatives in comparative form,” with sufficient detail such “that reviewers may evaluate their comparative merits.”¹⁶⁹ The merits of each alternative will depend, at least in part, on how climate change affects it and its environmental outcomes and the availability of mitigation measures. Thus, for example, the 2009 NPS climate guidance stated that the analysis of alternatives should “account[] for known and predicted changes . . . resulting from climate change . . . [I]f an alternative’s impact on a [resource] would be of a particular intensity in the present but would become more severe if anticipated climate change impacts came into fruition during the life of the [project] you should disclose this.”¹⁷⁰ As noted above, climate change could also reduce the useful life of a project or lead to added

162 42 U.S.C. § 4332(2)(C)(ii); 40 C.F.R. §§ 1502.16, 1508.1(g).

163 2016 Climate Guidance, *supra* note 119, at 21.

164 *Id.*

165 *Id.*

166 981 F. Supp. 2d 1099, 1110–1111 (D. Utah 2013).

167 *Id.* at 1110.

168 No. CV 13-61-M-DWM, 2014 U.S. Dist. LEXIS 116788, at *31 (D. Mont. Aug. 21, 2014).

169 40 C.F.R. § 1502.14.

170 NAT’L PARK SERV., *supra* note 126, at 10.

costs (e.g., for maintenance or repair of facilities), which must similarly be taken into account in evaluating alternatives.¹⁷¹

4.3. Best Practices for Considering Climate Impacts in NEPA Reviews

As discussed in Part 4.1 above, the 2016 Climate Guidance directs federal agencies to “take into account the ways in which a changing climate may impact the proposed action and any alternative actions, change the action’s environmental effects over the lifetime of those effects, and alter the overall environmental implications of such actions.”¹⁷² The 2016 Climate Guidance recommends that federal agencies use “authoritative climate change reports,” but provides little other detailed advice on how to analyze climate change impacts.¹⁷³ Federal agencies can, however, draw best practices from many other sources: recommendations from legal experts;¹⁷⁴ guidance from state, local, and foreign jurisdictions with laws similar to NEPA;¹⁷⁵ and assessment tools made available by other agencies, organizations, and the private sector.¹⁷⁶ A list of key resources is included in Appendix 2 to this paper. Drawing on those resources, we define three requirements for effective climate impact analysis in NEPA reviews (see Box 2), and identify existing data and other resources federal agencies can use to conduct such analysis.

This paper proposes that the central goal for an EIS’s climate impact analysis should be that it is sufficiently **holistic**, **specific**, and **actionable** to improve the agency’s decision-making. To that end, the EIS should include an analysis of all reasonably foreseeable climate impacts on the affected environment, the proposed action, and alternatives, and evaluate adaptation measures to address those impacts. Across all areas, the EIS should use high-quality data and information, and should consider intersections with environmental justice communities.

171 See *supra* Parts 2 & 4.2.A

172 2016 Climate Guidance, *supra* note 119, at 9.

173 *Id.* at 20-21.

174 See e.g., Kuh, *supra* note 15; Wentz 2015, *supra* note 15; Wentz 2017, *supra* note 15.

175 Several U.S. jurisdictions have promulgated rules or issued guidance on incorporating climate change impacts into environmental reviews under laws similar to NEPA, including Massachusetts, New York State, New York City, Washington State, and King County, Washington. Relevant guidance has also been issued by foreign jurisdictions including Australia, Canada (and the Canadian provinces of British Columbia and Nova Scotia), the European Union, the Netherlands, New Zealand, Spain, the United Kingdom. See Appendix 2 for a list of relevant documents.

176 See *infra* Part 4.3.A.

Box 2: Requirements for Effective Climate Impact Analysis

Each EIS prepared by a federal agency under NEPA should include an analysis of climate change impacts that is:

1. **Holistic:** The analysis should encompass all types of climate impacts that could reasonably foreseeably affect the local environment, proposed action, or alternatives. The analysis of effects on the local environment should consider risks to all natural and human systems and resources required for, or impacted by, the proposed action. Climate-related risks to all elements of the proposed action and alternatives should similarly be considered.
2. **Specific:** The analysis should use climate-related information and data that is tailored to the proposed action's local area, timescale, and other relevant characteristics.
3. **Actionable:** The analysis should enable the agency to take informed action to address climate impacts. To that end, the analysis should be fully integrated into the agency's assessment of baseline environmental conditions, and environmental impacts associated with the action and alternatives. The agency should also consider possible adaptation measures to reduce the environmental impacts of the proposed action that are exacerbated by climate change and enhance the climate resilience of the proposed action.

As discussed in Part 2, climate change is shifting weather baselines (e.g., average temperatures) and increasing the frequency and severity of extreme weather events (e.g., storms). This is, in turn, causing various environmental changes (e.g., sea level rise). To be “holistic,” the climate impact analysis in an EIS must thoroughly and accurately assess all reasonably foreseeable climate impacts, both weather-related and environmental. The analysis should take into account climate impacts that are already occurring or anticipated to occur during the lifespan of the proposed action and any associated decommissioning activities. The analysis of anticipated impacts should be based on forward-looking climate projections, reflecting anticipated future conditions in the relevant local area. It is imperative that the analysis not only use historic weather data which, in the age of climate change, is no longer a good predictor of future conditions. Agencies should similarly avoid relying upon flood maps and other tools that are generated using historic weather data unless they are updated or supplemented to account for projected future changes. Thus, for example, some states with NEPA equivalents have recommended that agencies not base their climate impact analysis on flood maps prepared by the Federal Emergency Management Agency (“FEMA”). For example, draft guidance issued under the Massachusetts Environmental Policy Act (“MEPA”) (i.e., Massachusetts’ equivalent to NEPA) warns that FEMA flood maps “are generally based on

historic observations” and thus “may not sufficiently represent future conditions.”¹⁷⁷

While the trend direction of many climate impacts (such as rising sea levels and increasing temperatures) is clear, their severity may be somewhat uncertain. The latter will depend, to some extent, on the trajectory of future greenhouse gas emissions, which could follow multiple pathways. Given this, the climate impact analysis should be based on multiple climate projections reflecting a range of possible outcomes, including a “worst” case scenario consistent with high greenhouse gas emissions.¹⁷⁸ Federal agencies may benefit from using probabilistic climate projections, which incorporate probability distributions for each climate parameter, and thus provide an indication of the relative likelihood of different climate outcomes.¹⁷⁹ Because future climate impacts will vary regionally, localized or “downscaled” projections should be used to ensure the analysis is “specific” to the proposed action (see Box 3).¹⁸⁰ As recommended by CEQ and others, agencies should “remain aware of the evolving body of scientific information,” and use the most up-to-date projections available.¹⁸¹

177 MASS. EXEC. OFF. OF ENERGY & ENV'T AFFAIRS, DRAFT MEPA CLIMATE CHANGE ADAPTATION AND RESILIENCY POLICY 6, 8 (2015), <https://perma.cc/VV2J-MJRU>; See also N.Y. DEP'T OF ENV'T CONSERVATION, THE SEQR HANDBOOK: 4TH EDITION 125 (2020), <https://perma.cc/3Q66-GNDV> (recommending that, when reviewing “projects in areas subject to tidal influence[,] [agencies] should incorporate . . . sea level rise projections . . . to assess future flooding and storm-surge risks that may increase over the anticipated lifecycle of the project.”).

178 This is supported by both legal scholars and government bodies. See, e.g., Wentz 2015, *supra* note 15, at 50 (stating that “[d]ue to the uncertainty of the pace and magnitude of climate change, agencies should take a precautionary approach when assessing and disclosing the potential impacts of climate change: they should evaluate impacts by using multiple scenarios, including the most severe climate change projections developed by the IPCC and other authoritative bodies.”); GOV'T OF CANADA, INCORPORATION CLIMATE CHANGE CONSIDERATIONS IN ENVIRONMENTAL ASSESSMENT: GENERAL GUIDANCE FOR PRACTITIONERS (2003), <https://perma.cc/E632-A2C5> (recommending that, when conducting environmental reviews under the Canadian equivalent to NEPA, agencies “consider the range of possible climate change scenarios.”).

179 Use of such projections is, again, supported by both legal scholars and government bodies. See e.g., Wentz 2015, *supra* note 15, at 50 (recommending that agencies disclose “[t]he probabilities of each of the [climate] scenarios” analyzed); GOV'T OF CANADA, *supra* note 177 (recommending that agencies “Identify [and disclose] the level of confidence associated with the applicable climate change projections”).

180 See generally, GOV'T OF CANADA, *supra* note 177 (recommending that agencies use data region-specific climate data).

181 2016 Climate Guidance, *supra* note 119, at 21. Others have also emphasized the importance of utilizing the most up-to-date projections. See, e.g., WASH. STATE DEP'T OF TRANSP., GUIDANCE FOR NEPA AND SEPA PROJECT-LEVEL CLIMATE CHANGE EVALUATIONS 5 (2017), <https://perma.cc/M6LG-ZFUM>

Box 3: Downscaled Climate Projections

Future climate outcomes are projected using global climate models (GCMs) that mathematically simulate key components of the earth's climate system (e.g. atmosphere, land surface, ocean, and sea ice).¹⁸² Using GCMs, scientists can estimate how changes in atmospheric greenhouse gas concentrations will affect key climate variables (e.g., temperature).¹⁸³ Most GCMs provide relatively coarse-resolution projections, reflecting conditions within grid cells that may extend thirty miles or more on one side.¹⁸⁴ However, with advanced downscaling techniques, scientists can process and refine GCM projections to estimate climate impacts at finer geographic scales (e.g., 1 square mile or less).¹⁸⁵ There are two main approaches to downscaling: (1) dynamic downscaling, which uses high-resolution dynamical models to estimate the effects of global climate processes at regional or local scales; and (2) statistical downscaling, which uses statistical techniques to determine the relationship between global climate patterns and observed local climate responses.¹⁸⁶

Federal agencies should evaluate how each climate impact will affect the local environment where a proposed action will take place and include this information in the description of the “affected environment” in the EIS.¹⁸⁷ Detailed guidance on how to approach the analysis has been provided in previous Sabin Center reports including, of particular relevance to this paper, a 2015 report on *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*.¹⁸⁸ The 2015 report recommended, among other things, that federal agencies consider and disclose “the likelihood and severity of climate change impacts in the affected environment over the duration of the project” and:

the extent to which specific components of the affected environment are vulnerable and/or resilient to the impacts of climate change. The environmental components that should be reviewed include: i. Natural systems that are affected by the project; ii. Human systems that are affected by the project; and iii. Key resources required for project and systems impacted by project (e.g., water resources).¹⁸⁹

The EIS should also analyze the implications of climate change for the proposed federal action, alternatives, and their respective environmental outcomes. This requires consideration of three interrelated questions:

182 Hayhoe et al., *Climate Models, Scenarios, and Projections*, in *CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME I* 133, 141 (D.J. Wuebbles et al., 2017), <https://perma.cc/HB9P-F8EL>.

183 *Id.*

184 *Id.* at 141-143.

185 *Id.* at 144.

186 *Id.* at 144-146.

187 Wentz 2015, *supra* note 15, at 53.

188 *Id.*

189 *Id.* at 53-54.

1. Will the impacts of climate change damage, destroy, or otherwise impair the operation or performance of the proposed action or any alternative? (e.g., could future sea level rise shorten the useful life of a coastal liquified natural gas (“LNG”) facility?)¹⁹⁰
2. Will the impacts of climate change alter the nature and magnitude of environmental risks associated with the proposed action or alternatives? (e.g., could sea level rise increase the potential for flooding of a coastal LNG facility during storms and thereby lead to unintended discharges causing soil or water pollution?)¹⁹¹
3. Will the impacts of climate change make the local environment and/or human populations more vulnerable to adverse environmental impacts from the proposed action or alternatives? (e.g., could longer-lasting droughts and associated water shortages increase the adverse effects of water pollution from unintended discharges?)¹⁹²

Again, detailed recommendations for addressing these issues are provided in the 2015 Sabin Center report, as well as guidance documents published by state and foreign jurisdictions with laws similar to NEPA.¹⁹³ Consistent with our recommendation for a “holistic” analysis, it is generally advised that agencies consider climate-related risks to all components of a proposed action. For example, draft guidance issued under the MEPA directs state agencies to consider climate-related risks to “all project elements” including “[e]xisting or proposed structures” and other infrastructure on which the project relies, such as “[p]ublic or private roadways and parking areas” and “[p]ublic or private utilities including stormwater management infrastructure.”¹⁹⁴

When evaluating climate-related risks and resilience, federal agencies should take into account the presence of any environmental justice communities in the impacted area. Environmental justice communities are those with disproportionately high environmental burdens and/or vulnerable populations.¹⁹⁵ Federal agencies should identify any environmental justice communities in range of the proposed action, assess whether the proposed action could have disproportionate effects on those communities, and discuss any nexus between climate change impacts and environmental justice impacts. In this regard, a 2016 interagency working group report on environmental justice in NEPA reviews stated: “Agencies may wish to consider how impacts from the proposed action could potentially amplify climate change-related hazards (e.g., storm surge, heat waves, drought, flooding, and sea level change) in minority populations and low-income populations in the affected environment, and vice versa.”¹⁹⁶ The report provides guidance on identifying relevant populations and analyzing impacts,

190 See *id.* at 54.

191 See *id.* at 54–55.

192 See *id.*

193 See, e.g., *id.* at 50–55; MASS. EXEC. OFF. OF ENERGY & ENV’T AFFAIRS, *supra* note 176, at 6–7.

194 MASS. EXEC. OFF. OF ENERGY & ENV’T AFFAIRS, *supra* note 176, at 6.

195 See, e.g., U.S. Env’t. Prot. Agency, EJS SCREEN: Environmental Justice Screening and Mapping Tool, Frequent Questions about EJS SCREEN, <https://www.epa.gov/ejscreen/frequent-questions-about-ejscreen> (last visited Jan. 21, 2022).

196 FEDERAL INTERAGENCY WORKING GROUP ON ENVIRONMENTAL JUSTICE & NEPA COMMITTEE, PROMISING PRACTICES FOR EJ METHODOLOGIES IN NEPA REVIEWS 31 (2016), <https://perma.cc/P3DX-KYYG>.

mitigation, and monitoring.¹⁹⁷ The working group also developed a National Training Product to improve consideration of environmental justice issues in NEPA reviews by providing “best practices, lessons learned, research, analysis, training, consultation, and other experiences of federal NEPA practitioners.”¹⁹⁸

To provide sufficient information for decision-making, the EIS’s discussion of each climate impact on the affected environment, proposed action, and alternatives should be proportional to its risks. This requires not only identifying the possibility of a climate impact but assessing its severity and likelihood. For example, regulations issued under the New York State Environmental Quality Review Act (“SEQR”) (i.e., New York state’s equivalent to NEPA) require EISs to include a description of potential adverse impacts “at a level of detail that reflects the severity of the impacts and the reasonable likelihood of their occurrence.”¹⁹⁹ Wherever possible, the EIS should monetize or otherwise quantify impacts in order to estimate their severity and enable comparison of climate-related risks between the proposed action and alternatives.²⁰⁰ However, this does not diminish the importance of identifying, describing, and considering types of impacts that are difficult to monetize or quantify.

For any climate impacts identified, the EIS should discuss possible resilience measures that could be employed to manage those impacts.²⁰¹ For example, where one or more climate impacts could impair the operation of the proposed action, the EIS should identify possible adaptation measures to enhance the action’s climate resilience. The EIS should also discuss possible adaptation measures to lessen any adverse environmental effects of the action that are exacerbated by the impacts of climate change. In this regard, guidance issued under the Washington State Environmental Policy Act (i.e., Washington’s equivalent to NEPA) recommends that agencies consider the expected life of each project and ask whether, “[a]s part of its standard design, th[e] project has incorporated features that will provide greater resilience and function with the potential effects brought on by climate change.”²⁰² Guidance issued under the MEPA similarly emphasizes the need to consider climate resilience.²⁰³ The 2021 MEPA Interim Protocol on Climate Change Adaptation and Resilience requires the proponent of any project subject to environmental review under the MEPA to indicate whether they have “considered alternative locations for the project in light of climate change risk.”²⁰⁴ The proponent must also indicate whether “the project [has] taken measures to adapt to climate change” and, if so, describe those measures and the climate projections that informed them.²⁰⁵ Where no adaptation measures have been taken, the proponent must explain why.²⁰⁶

197 *Id.* at 21-50.

198 *Id.* at 51

199 N.Y. COMP. CODES R. & REGS. tit. 6, § 617.9(b)(5)(iii); See also N.Y. DEP’T OF NVTL. CONSERVATION, *supra* note 176, at 124 (explaining when and how climate impacts should be considered in SEQR reviews and stating that “the depth of analysis required for climate change considerations . . . should be tailored to the magnitude of the action or project”).

200 See Wentz 2015, *supra* note 15, at 55.

201 See *id.*

202 WASH. STATE DEP’T OF TRANSP., *supra* note 180, at 7.

203 See MASS. EXEC. OFF. OF ENERGY & ENV’T AFFAIRS, MEPA INTERIM PROTOCOL ON CLIMATE CHANGE ADAPTATION AND RESILIENCY (2021), <https://perma.cc/VC35-RK27>

204 *Id.* at 5.

205 *Id.* at 4-5.

206 *Id.* at 4.

When evaluating possible adaptation measures, federal agencies should consider the potential for maladaptation. Maladaptation occurs where action taken to address the symptom of a particular risk exacerbates its underlying cause or leads to other unintended and undesirable consequences. According to the World Bank, in the climate context, maladaptive measures include those “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.”²⁰⁷ Maladaptation may also occur where “adaptation fails or has been conducted in an unsustainable manner.”²⁰⁸ This might occur where, for example, a flood wall built to protect coastal facilities against sea level rise increases erosion.

4.3.A Data and Tools Available for Climate Impact Analysis

To implement the practices recommended above, federal agencies will need relevant data (including climate projections) and analytical tools. The NEPA implementing regulations, as amended in the 2020 Rule, require federal agencies to “make use of reliable existing data and resources” and state that “[a]gencies are not required to undertake new scientific and technical research to inform their analyses.”²⁰⁹

Consistent with this directive, federal agencies can base their climate impact analysis on available climate data. Downscaled climate data and projections, suitable for use by federal agencies in NEPA reviews, have been published by various government, academic, and nonprofit entities (and commercial entities additionally prepare specialized projections on a proprietary basis).²¹⁰ For example, DOE, the National Aeronautics and Space Administration (“NASA”), and the National Oceanic and Atmospheric Administration (“NOAA”) have jointly published zip code-level temperature projections and county-level precipitation and sea level rise projections.²¹¹ Regional and local climate projections have also been published by other federal agencies, including the U.S. Geological Survey²¹² and Bureau of Reclamation,²¹³ and several regional, state, and local bodies.²¹⁴ This data could be used in NEPA reviews to define the likely future state of the affected environment and evaluate how the proposed action and alternatives will be impacted by climate change. The latter is done by comparing anticipated

207 JANE EBINGER & WALTER VERGARA, WORLD BANK, CLIMATE IMPACTS ON ENERGY SYSTEMS: KEY ISSUES FOR ENERGY SECTOR ADAPTATION 90 (2011), <https://perma.cc/3WVZ-MPJC>.

208 Orr Karassin, Mind the Gap: Knowledge and Need in Regulating Adaptation to Climate Change, 22 GEO. INT’L ENG’G L. REV. 383, 389 n.31 (2010).

209 40 C.F.R. § 1502.23.

210 See generally, Michael B. Gerrard & Edward McTiernan, *The Perils of Relying on FEMA Flood Maps in Real Estate Transactions*, N.Y. LAW J. (Sept. 2020).

211 *Energy Data Gallery*, U.S. CLIMATE RESILIENCE TOOLKIT, <https://toolkit.climate.gov/topics/energy/energy-data-gallery> (last updated Sept. 24, 2019).

212 *Regional Climate Change Viewer*, U.S. GEOLOGICAL SURVEY, <http://regclim.coas.oregonstate.edu/visualization/rccv/index.html> (last visited Nov. 30, 2021).

213 *Downscaled CMIP3 and CMIP5 Climate and Hydrology Projections*, U.S. BUREAU OF RECLAMATION ET AL., https://gdo-dcp.ucllnl.org/downscaled_cmip_projections/dcpInterface.html (last visited Nov. 30, 2021).

214 See, e.g., *Great Lakes Regional Climate Change Maps*, GLISA, <https://glisa.umich.edu/great-lakes-regional-climate-change-maps/> (last visited Nov. 30, 2021); Climate Tools, CAL-ADAPT, <https://cal-adapt.org/tools/> (last visited Nov. 30, 2021); Michael R. Bloomberg et al., *Forewords: Climate Change Adaptation in New York City: Building a Risk Management Response*, 1196 ANNALS N.Y. ACAD. SCI. 1 (2010); *New York City Panel on Climate Change 2019 Report: Executive Summary*, 1439 ANNALS N.Y. ACAD. SCI. 11 (2019).

future climate conditions against the proposed action’s design and operating parameters. This can help federal agencies identify climate vulnerabilities—e.g., where a facility is defined to operate at an average temperature that is lower than that anticipated in the future or to withstand flood levels that will likely be exceeded in the future due to climate change—and evaluate possible resilience measures.

In addition to climate data and projections, federal agencies can use a number of other publicly available tools and resources to aid in climate impact analysis. Several tools with particular relevance to evaluating energy projects are listed below:

- The U.S. Climate Resilience Toolkit, developed by NOAA in collaboration with other federal agencies in the U.S. Global Change Research Program, provides a database of over 200 digital tools relevant to climate vulnerability studies and resilience planning.²¹⁵ The Toolkit includes resources designed specifically to evaluate the climate vulnerability of energy infrastructure²¹⁶ and materials discussing ways to enhance energy system climate resilience.²¹⁷
- The U.S. Department of Transportation (“DOT”) has made available a Climate Data Processing Tool that can be used to convert climate projections into statistics relevant to transportation planning (e.g., temperature projections can be used to estimate “changes in the frequency of very hot days . . . that may affect transportation infrastructure”).²¹⁸ DOT also offers a Transportation Climate Change Sensitivity Matrix, which provides information on the impact of climate stressors including increased temperature, flooding, drought, wildfires, storms, and permafrost thaw on six types of transportation assets: oil and gas pipelines, railways, ports and waterways, airports and heliports, bridges, and roads and highways.²¹⁹ For each stressor and asset, the matrix presents analysis of the relationship, thresholds, indicators, key sources, and additional notes and examples.²²⁰ Agencies could use this tool to assess climate risks to transportation elements of energy projects and consider alternatives and adaptation measures.
- The Pacific Northwest National Laboratory Emissions Quantification Tool “estimates the impacts of specific smart grid infrastructure projects on load profile.”²²¹ Modeling a project’s impact on load profile could assist an agency in assessing how climate risks to the electricity system could interact with a project and its environment.

215 *Meet the Challenges of a Changing Climate*, U.S. CLIMATE RESILIENCE TOOLKIT, <https://toolkit.climate.gov/> (last visited Nov. 30, 2021).

216 Energy Data Gallery, U.S. CLIMATE RESILIENCE TOOLKIT, <https://toolkit.climate.gov/topics/energy/energy-data-gallery> (last updated Sept. 24, 2019).

217 *Building Resilience in the Energy Sector*, U.S. CLIMATE RESILIENCE TOOLKIT, <https://toolkit.climate.gov/topics/energy-supply-and-use/building-resilience-energy-supply-and-use> (last updated Oct. 25, 2019).

218 *Climate Change Adaptation Tools*, <https://www.fhwa.dot.gov/environment/sustainability/resilience/tools/> (last visited Jan. 22, 2022).

219 *Id.*

220 *Id.*

221 *Greenhouse Gas (GHG) Accounting Tools*, NEPA.GOV, <https://ceq.doe.gov/guidVance/ghg-accounting-tools.html> (last visited Dec. 8, 2021); Grid Project Impact Quantification, GRIDPIQ, <https://gridpiq.pnnl.gov/gridpiq-landing-page/> (last visited Dec. 8, 2021).

- The U.S. Department of Agriculture’s Forest Service contributes to the i-Tree effort, which produces applications with forest analysis functions.²²² Of relevance to assessment of climate impacts, the i-Tree Eco application includes analysis of extreme weather impacts,²²³ and the i-Tree Landscape application offers data on risks including species shifts, droughts, and wildfires.²²⁴ As detailed above, energy infrastructure can both cause and be harmed by wildfires, so that information may be particularly important for proposed energy actions.
- The U.S. General Services Administration’s (“GSA”) Sustainable Facilities Tool site provides climate resilience planning resources for agencies’ assets and supply chains.²²⁵ It includes a model “workshop process” to identify, assess, and address climate risks.²²⁶ The workshop process “combines best practices from the federal adaptation community to help users identify climate risks and develop strategies to secure vulnerable real property investments and supply chains.”²²⁷ The process breaks down risk assessment and management into concrete questions and steps; items of particular importance for proposed energy actions include identification of critical thresholds for assets (e.g. temperature thresholds where assets would fail), assessment of the consequences of climate impacts in terms of disruption to services and operations, and consideration of government and private sector partners for implementation of adaptation strategies.²²⁸
- The Louisiana Coastal Protection and Restoration Authority provides an interactive map for exploring changes to land, flood risk, and coastal vegetation under various scenarios over the next 50 years, as well as the social vulnerability of communities to flood risk.²²⁹ Agencies evaluating proposed energy projects in Louisiana may benefit from considering this information and the accompanying resources to reduce risk.

222 Learn More About i-Tree, I-TREE, <https://www.itreetools.org/> (last visited Dec. 8, 2021).

223 i-Tree Eco, I-TREE, <https://www.itreetools.org/tools/i-tree-eco> (last visited Dec. 8, 2021).

224 Welcome to i-Tree Landscape, I-TREE LANDSCAPE, <https://landscape.itreetools.org/> (last visited Dec. 8, 2021).

225 Climate Risk Management, SFTOOL, <https://sftool.gov/plan/430/enhancing-resilience-reducing-vulnerability-observed-expected-climate> (last visited Dec. 8, 2021); Framework for Managing Climate Risks to Federal Agency Supply Chains, SFTOOL, <https://sftool.gov/plan/553/framework-managing-climate-risks-federal-agency-supply-chains> (last visited Dec. 8, 2021).

226 Climate Risk Management, SFTOOL, <https://sftool.gov/plan/430/enhancing-resilience-reducing-vulnerability-observed-expected-climate> (last visited Dec. 8, 2021).

227 Wentz 2015, *supra* note 15, 18-19.

228 Framework for Managing Climate Risks to Federal Agency Supply Chains, SFTOOL, <https://sftool.gov/plan/553/framework-managing-climate-risks-federal-agency-supply-chains>.

229 Master Plan Data Viewer, LA. COASTAL PROT. AND RESTORATION AUTH., <https://cims.coastal.louisiana.gov/masterplan/> (last visited Jan. 21, 2022).

5. TREATMENT OF CLIMATE RISK IN RECENT NEPA REVIEWS

5.1. Findings of Previous EIS Surveys

The Sabin Center has been tracking federal agencies' consideration of climate change in NEPA reviews for nearly a decade. In 2012, the Sabin Center published the first of several white papers, analyzing the extent to which climate change considerations are discussed in federal EISs.²³⁰ The 2012 paper identified 227 EISs published between January 2009 and December 2011 (inclusive) that discussed issues relating to climate change.²³¹ In most of the identified EISs, the discussion centered on how the proposed action would contribute to climate change, for example, by directly emitting greenhouse gases or inducing other emitting activities (e.g., vehicle travel).²³² The 2012 study found that “[w]hile greenhouse gas emissions from [proposed actions] are frequently addressed in EISs, the effects of climate change on the [actions] are considered far less often.”²³³ The study further found that, even where the effects of climate change were considered in EISs, there was often only a “brief[.]” discussion of climate impacts on the affected environment and no analysis of the implications for the proposed action.²³⁴ The study did not report on whether EISs addressed climate impacts in the analysis of alternatives to, or the development of measures to mitigate any adverse effects of, the proposed action.

The 2012 study was updated in 2016 with the publication of a second white paper, which analyzed the extent to which climate change was discussed in 238 EISs issued from July 2012 through December 2014.²³⁵ Ninety percent of the EISs analyzed were found to contain some discussion of climate change, with approximately 72% discussing greenhouse gas emissions associated with the proposed federal action (or induced activities), and 70% discussing how climate-related impacts may affect the proposed action and/or the area in which it will occur.²³⁶ The latter was, however, often very limited. According to the 2016 analysis, many EISs “simply acknowledged that climate change would affect certain aspects of the project environment and did not discuss the issue further.”²³⁷ EISs relating to actions in coastal areas were found to be most likely to discuss how climate impacts would affect the action itself (as opposed to the local environment). However, the extent of the discussion varied, and it often was “unclear whether the discussion . . . had any bearing on the agency’s final decisions about the design, location, and operation of the project.”²³⁸ The 2016 study did not report on whether climate change impacts were considered in the analysis of alternatives or development of mitigation measures.

230 PATRICK WOOLSLEY, CONSIDERATION OF CLIMATE CHANGE IN FEDERAL EISs, 2009 – 2011 (2012), <https://perma.cc/8RPQ-Y24V>.

231 *Id.* at 3.

232 *See id.* at 5–8.

233 *Id.* at 8.

234 *Id.*

235 JESSICA WENTZ ET AL., SURVEY OF CLIMATE CHANGE CONSIDERATIONS IN FEDERAL ENVIRONMENTAL IMPACTS STATEMENTS, 2012–2014 ii (2016), <https://perma.cc/C7HE-MJE9>.

236 *Id.*

237 *Id.* at 18.

238 *Id.* at 19–20.

Two smaller studies have examined the treatment of climate change impacts in EISs in greater detail. The first, published by Defenders of Wildlife in 2013, reviewed 154 EISs issued between July 2011 and April 2012 to determine whether they implemented the recommendations in the *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions*²³⁹ published by CEQ in 2010.²⁴⁰ Among other things, Defenders of Wildlife looked at whether the EISs examined how climate impacts would affect the proposed action, alternatives, and their respective environmental outcomes. The majority (68%) of EISs reviewed did not include any analysis of climate impacts, with nearly one-fifth of those (12% of the total reviewed) not even mentioning climate change.²⁴¹ Of the EISs that discussed climate impacts, most focused solely on effects on the proposed action and/or its environmental outcomes.²⁴² Notably, according to Defenders of Wildlife, none of the EISs “fully integrated climate change into the alternatives comparison as envisioned by the [draft CEQ] guidance.”²⁴³

A second study, conducted by Columbia University students in partnership with the Sabin Center in 2017, suggested that federal agencies may have made progress on identifying climate change impacts in the years since the Defenders of Wildlife study, but still found major deficiencies in their EIS analyses.²⁴⁴ The study assessed the extent to which climate impacts were discussed in thirty-one EISs published from September through November 2016.²⁴⁵ In contrast to the findings reported by Defenders of Wildlife in 2013, the 2017 Columbia study found that most EISs included some discussion of climate change impacts, though the extent and quality of the discussion varied considerably.²⁴⁶ While many EISs (81% of the total reviewed) identified likely climate impacts on the affected environment, few discussed how those impacts would affect the proposed action (23%) or alter its environmental outcomes (39%), or compared climate risks across alternatives (32%).²⁴⁷ Just over a quarter identified adaptation measures to enhance the climate resilience of the proposed action and even fewer discussed measures to mitigate climate change-exacerbated effects of the action.²⁴⁸ This suggests that, even where climate change impacts are analyzed, the analysis does not end up influencing the design or conduct of federal actions.

The 2017 study attributed the failure to thoroughly consider the impacts of climate change to the fact that federal agencies are “[h]eavily focused on short-term implementation of project plans” rather than “long-term[] resilience.”²⁴⁹ Others have pointed to challenges faced by

239 Memorandum from Nancy H. Sutley, Chair, Council on Environmental Quality, for Heads of Federal Departments and Agencies on Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions (Feb. 18, 2010), <https://perma.cc/VUM7-E6E9>.

240 DEFENDERS OF WILDLIFE, REASONABLE FORESEEABLE FUTURES: CLIMATE CHANGE ADAPTATION AND THE NATIONAL ENVIRONMENTAL POLICY ACT 3 (2013), <https://perma.cc/J8BJ-5AV7>.

241 *Id.* at 11–13.

242 *Id.* at 10–11, 13.

243 *Id.* at 10.

244 SALONI JAIN ET AL., HOW DID FEDERAL ENVIRONMENTAL IMPACT STATEMENTS ADDRESS CLIMATE CHANGE IN 2016? (2017), <https://perma.cc/M45R-498G>.

245 *Id.* at i.

246 *Id.* at iv.

247 *Id.* at 19.

248 *Id.*

249 *Id.* at 31.

federal agencies in evaluating climate impacts. For example, the Sabin Center’s 2012 paper noted that “agencies face considerable scientific uncertainty about the severity and exact nature of climate change impacts at the regional level, and projections are even more difficult at the local level.”²⁵⁰ Similarly, in its 2013 report, Defenders of Wildlife concluded that federal agencies may find it difficult to locate and utilize climate projections.²⁵¹ While that may have been true at the time, in the almost decade since, the availability of climate data has increased significantly. This raises the question: are federal agencies making use of this data to better evaluate climate-related risks in their NEPA reviews?

5.2. 2021 Survey Scope and Methodology

To determine whether and to what extent federal agencies are considering climate risks to energy projects, we surveyed 65 final EISs issued by federal agencies in connection with onshore energy-related activities: coal mining, oil and natural gas-related infrastructure, electricity transmission and generating facilities, and renewable energy development. This reflects all final EISs relating to onshore energy activities that were published by federal agencies in the five years from January 2016 through December 2020 and posted to the U.S. Environmental Protection Agency’s (“EPA”) EIS database, except those prepared by the federal power marketing administrations.²⁵²

Box 4: Federal Oversight of Energy Projects

Federal government approvals are required for many energy-related activities undertaken by private parties. This is particularly true where activities occur on federally-owned land. The federal government owns approximately 650 million acres of land in the U.S., much of which contains fossil fuel resources or is suitable for renewable energy development.²⁵³ Private parties wanting to use federal lands for energy-related purposes may, depending on the nature of the proposed use, require various federal government approvals.

Most federal land is managed by the U.S. Department of the Interior (“DOI”), principally through BLM, which uses resource management plans (“RMPs”) to guide its land management decisions.²⁵⁴ Broadly, each RMP identifies resource goals for a designated area of federal land, and specifies management practices and land uses that are consistent with the achievement of those goals.²⁵⁵ Energy and other activities can only occur on federal land that has been designated, in the applicable RMP, as suitable therefor.²⁵⁶ Where

250 Woolsley, *supra* note 229, at 8.

251 Defenders of Wildlife, *supra* note 239, at 15.

252 To identify relevant EISs, we searched the EPA’s database using keywords that describe energy sources and energy-related activities (“oil,” “natural gas,” “liquefied natural gas,” “coal,” “pipeline,” “generation,” “transmission,” etc.). EISs prepared by the four power marketing administrations were excluded from analysis because of the unique nature of those entities. Supplemental EISs were not included in the analysis.

253 See generally Adam Vann, Cong. Research Serv., R40806, Energy Projects on Federal Lands: Leasing and Authorization (2012), <https://perma.cc/MEE3-9MBK>.

254 See *id.* at 1-3.

255 See generally *Planning 101*, Bureau of Land Mgmt., <https://perma.cc/38FQ-845F> (last visited Oct. 6, 2021).

256 43 U.S.C. § 1712; 43 C.F.R. § 1610.5-3.

an RMP identifies a particular area of land as inappropriate for a particular type of energy development (or another activity), it would need to be amended before such development (or other activity) could take place in the area.

Private parties may develop energy projects on suitable federal land after obtaining authorization from the relevant federal land manager.²⁵⁷ The required authorizations differ depending on the nature of the project and where it will occur.²⁵⁸ Wind and solar energy and transmission projects on federal land administered by BLM are generally authorized through rights-of-way (“ROW”) issued under the Federal Land Policy and Management Act.²⁵⁹ Oil and natural gas projects on BLM-administered land must be authorized under the Mineral Leasing Act. Pursuant to that Act, BLM issues oil and natural gas leases, which authorize the holder to develop oil and natural gas resources on a specific tract of federal land.²⁶⁰ Notably, however, prior to undertaking any development on the leased land, the lessee must obtain a separate authorization from BLM in the form of an application for permit to drill (“APD”).²⁶¹

Each time BLM adopts or amends an RMP or issues a ROW, lease, or APD for energy development it performs a “federal action” for the purposes of NEPA. As discussed in Part 3, under NEPA, an EIS must be prepared for any major federal action that will “significantly affect[] the quality of the human environment.”²⁶² BLM typically prepares an EIS before adopting or amending an RMP. Separate EISs are sometimes, but not always, prepared in connection with BLM’s issuance of ROWs, leases, and APDs. In the past, BLM has sometimes sought to streamline the NEPA process by engaging in “tiering,” whereby it uses a programmatic EIS to analyze the effects of multiple similar actions. BLM has, for example, issued programmatic EISs for large-scale solar and wind energy development on federal lands in the western U.S.²⁶³ When specific projects are proposed, BLM must conduct another environmental review, but can “tier” that review to the programmatic EIS.

Other federal agencies, aside from BLM, may also be involved in permitting energy projects and thus required to conduct NEPA reviews thereof. For example, a permit is

257 See generally Adam Vann, Congressional Research Service, Energy Projects on Federal Lands: Leasing and Authorization 8 & 16-17 (2012), <https://perma.cc/GM5N-6FVD>.

258 *Id.*

259 See 43 U.S.C. § 1761(a)(4).

260 See 30 U.S.C. § 223.

261 See 43 C.F.R. § 3162.3-1; Onshore Oil and Gas Order Number 1: Approval of Operations, 83 Fed. Reg. 2906 (Jan. 10, 2017), <https://perma.cc/EB3A-FL2T>.

262 43 U.S.C. § 4332(2)(C).

263 See BUREAU OF LAND MGMT., FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT ON WIND ENERGY DEVELOPMENT ON BLM-ADMINISTERED LANDS IN THE WESTERN UNITED STATES (2005), <https://perma.cc/99QC-LNXH>; BUREAU OF LAND MGMT., FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT (PEIS) FOR SOLAR ENERGY DEVELOPMENT IN SIX SOUTHWESTERN STATES (2012), <https://perma.cc/TVS9-VY3K>.

required from the Federal Energy Regulatory Commission (“FERC”) to construct an interstate natural gas pipeline,²⁶⁴ LNG terminal,²⁶⁵ or hydroelectric generating facility²⁶⁶ on federal or non-federal lands. Nuclear generating facilities must be permitted by the Nuclear Regulatory Commission (“NRC”).²⁶⁷ Many energy projects require permits from the Army Corps of Engineers under the Clean Water Act for discharges of material.²⁶⁸ In all cases, the issuance of a permit is a federal action for the purposes of NEPA, meaning that an EIS must be prepared if there is the potential for significant environmental effects.²⁶⁹

5.2.A EISs Reviewed

A full list of the surveyed EISs, the preparing agency, and publication date is included in Appendix A to this paper. As indicated there, over three quarters of the surveyed EISs were prepared by just two federal entities—DOI (29 EISs or 48% of the total) and FERC (19 EISs or 23% of the total). Of the DOI-prepared EISs, most were issued by BLM (15 EISs or 23% of the total) and the U.S. Fish and Wildlife Service (8 EISs or 12% of the total). Other preparing agencies were the NRC (6 EISs or 9% of the total), U.S. Department of Agriculture’s Forest Service (6 EISs or 9% of the total), DOE (2 EISs or 3% of the total), and Air Force, Army Corps of Engineers, and Rural Utilities Service (1 EIS or 1% of the total each).

Table 1: Number of EISs Reviewed (by Category)

	Category	Number of EISs Reviewed
1	Coal mining	3
2	Oil and natural gas development	9
3	Liquefied natural gas (LNG) terminals	10
4	Natural gas pipelines	6
5	Electricity transmission facilities	11
6	Nuclear electric generating facilities	7
7	Hydroelectric generating facilities	4
8	Solar energy development	6
9	Wind energy development	6
10	Geothermal energy development	3

264 15 U.S.C. § 717f(c).

265 *Id.* § 717b(e).

266 16 U.S.C. §§ 797(e) & 817. Permits are required to construct hydroelectric generating facilities “across, along, or in any of the navigable waters of the United States, or upon any part of the public lands or reservations of the United States.” See *id.* § 817.

267 42 U.S.C. §§ 2131 & 2133.

268 33 U.S.C. § 1344.

269 See 43 U.S.C. § 4332(2)(C).

Table 1 above categorizes the surveyed EISs based on the type of energy activity involved. The nature of the federal actions under review in the EISs varied between and, in some cases, within categories. Across all categories, the vast majority of EISs related to federal agencies’ approval of, or support for, energy activities proposed to be undertaken by non-federal (e.g., private or state) actors. Only one EIS—in the nuclear category—involved a federal government agency itself undertaking energy activities.

5.2.B Scope of Evaluation

To ensure consistency in the review, all EISs (regardless of categorization) were evaluated using a standard rubric, comprising fifteen questions designed to reveal whether climate change impacts were analyzed and enable an assessment of the quality of the analysis (if any). The full list of questions is shown in Table 2 below.

Table 2: EIS Evaluation Rubric

Climate Impacts on the Affected Environment	Does the EIS describe how the impacts of climate change may affect the local environment where the proposed action will take place? If yes, list the climate change impacts described.
Climate Impacts on the Proposed Action	Does the EIS describe whether any elements of the action may be damaged or need to be reconstructed, repaired, or otherwise restored due to the impacts of climate change? If yes, list the climate change impacts discussed. Does the EIS monetize or otherwise quantify any of the climate change impacts on the action? Does the EIS describe the implications of climate change for the environmental impacts of the action? If yes, for which environmental impacts are climate change implications described.
Alternatives	Does the EIS compare risks from climate change / resilience to climate change between the proposed action and alternatives?
Adaptation Measures	Does the EIS identify possible adaptation measures to eliminate or mitigate the environmental impacts associated with the proposed action that are exacerbated by climate change? Does the EIS identify possible adaptation measures to make the action more resilient to the effects of climate change? If yes, do the measures involve changes to infrastructure, operations, monitoring, or other activities? Does the EIS discuss any possible maladaptation of adaption measures? Do any of the recommended measures involve increasing production or use of fossil fuels?
Data and Information Quality	On which of the following levels of granularity are climate change impacts discussed: global, national, regional, state, or local? Does the EIS use downscaled climate data or models to predict local climate change impacts? Does the EIS rely on historical data or trends to predict future climate change impacts?
Environmental Justice	Does the EIS identify any environmental justice communities within the local area(s) impacted by the proposed action? Does the EIS conclude that the proposed action will have environmental justice impacts? Does the EIS discuss any nexus or overlap between environmental justice communities or impacts and climate change?

As indicated in Table 2 above, to determine if “climate impacts on the affected environment” were discussed, we looked at whether each EIS identified climate change impacts (e.g., increasing temperatures, sea level rise, more frequent and severe storms, etc.) that are occurring or likely to occur in the affected environment. An EIS was only considered to have identified such impacts if they were discussed at the regional, state, or local level—a general discussion of global climate change impacts was considered insufficient. We also examined whether each EIS analyzed the implications of climate change for the proposed action’s environmental outcomes. An EIS was considered to analyze those implications if it discussed (1) the potential for climate change to increase the vulnerability of affected environmental resources and thus make the proposed action more damaging thereto or (2) the potential for compounding effects from the proposed action and climate change that together impact environmental resources (e.g., where both the proposed action and climate change may increase the risk of wildfires that put endangered species at risk).

The review of “climate impacts on the proposed action” focused on whether EISs analyzed the potential for climate change to damage infrastructure or otherwise affect the operation of facilities or related activities. An EIS was considered to include such analysis if it identified potential risks from climate change, even if it ultimately dismissed those risks as insignificant or concluded that no action was required to mitigate or manage them.

To evaluate the extent to which the analysis of climate change impacts (if any) influenced agency decisions about the design, location, or other aspects of a proposed action, EISs were reviewed for any discussion of “adaptation measures” that could make the action more resilient to climate change or lessen any environmental effects that are exacerbated by climate change. As part of this review, we considered whether the EISs discussed any risk of maladaptation—i.e., where a proposed adaptation measure would indirectly increase vulnerability to climate change impacts.

We also tracked whether and to what extent EISs addressed environmental justice considerations. This is important to consider because environmental justice communities are often at disproportionate risk from the impacts of climate change and may experience compounding negative effects from climate change and energy development.

5.3. Survey Results

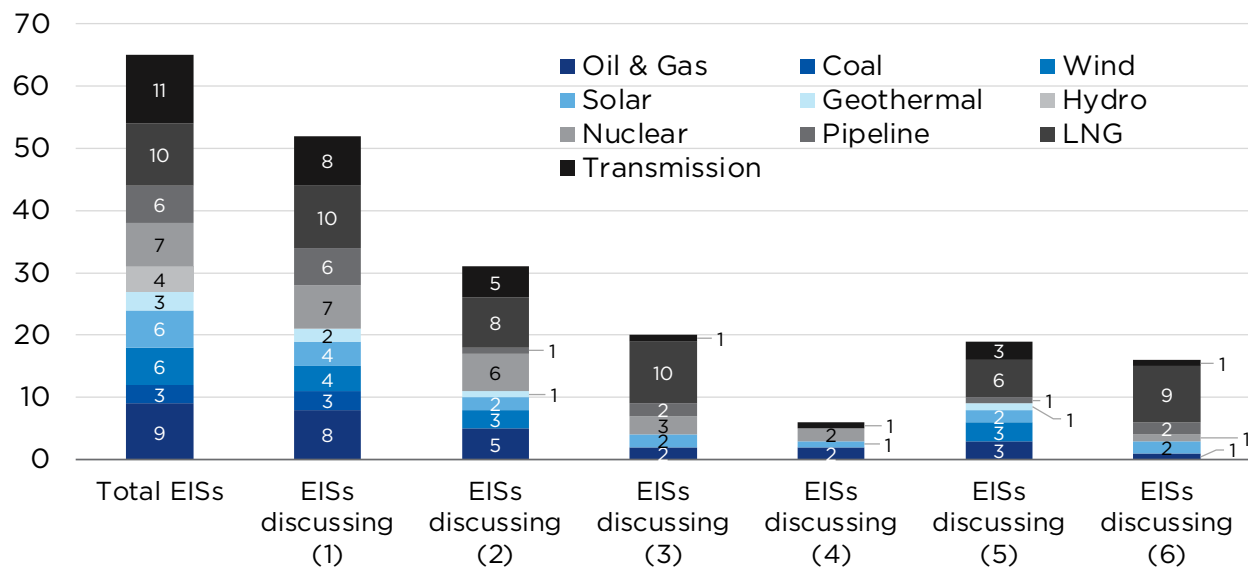
Evaluated against the best practices identified in Part 4.3, none of the surveyed EISs included an effective climate impact analysis that was holistic, specific, and actionable (see Box 2). Each of the components of an effective climate impact analysis was present in some EISs, demonstrating that each component is feasible, but no EIS included all components. A complete climate impact analysis—including comprehensive consideration of impacts on the affected environment, impacts on the proposed action, comparative risks across alternatives, adaptation measures, and environmental justice intersections—is needed for an agency to effectively incorporate climate risk into its decision-making. As our survey focused specifically on climate impact analysis, we make no assessment of the adequacy of any other equally crucial categories of analysis in these EISs, such as consideration of greenhouse gas emissions. Any favorable reference to a particular component of an EIS’s analysis should not be taken as an endorsement of the adequacy of that EIS more broadly.

As discussed further below, while most EISs acknowledged that climate change is impacting

the affected environment, many did not go on to analyze the implications for the proposed action or alternatives. Indeed, less than half of the EISs evaluated whether and how climate change might alter the environmental outcomes of the proposed action, and less than 30% discussed other climate-related risks to the action (e.g., the potential for damage to, or early retirement of, infrastructure).²⁷⁰ Less than 10% compared climate-related risks across alternatives.²⁷¹ Even where EISs did discuss climate impacts on the affected environment, the proposed action, and/or alternatives, the discussion was rarely holistic or specific. Many EISs only discussed a subset of potential climate impacts and some did so based solely on national or regional data which may not accurately reflect local climate conditions.²⁷² Others relied on data and studies that were clearly out of date.²⁷³

The limited analysis of climate impacts led to equally limited evaluation of possible adaptation measures to lessen climate risks to proposed actions.²⁷⁴ Adaptation measures were discussed in only a small subset of the surveyed EISs. Notably, and perhaps unsurprisingly, EISs that included a more thorough discussion of climate impacts were more likely to identify adaptation measures. Of the subset of EISs that discussed the potential for climate change to worsen the environmental impacts of the proposed action, 64% also identified some measures to reduce or manage those impacts. Similarly, of the subset of EISs that discussed climate-related risks to the proposed action itself, 80% also identified measures to reduce or manage those risks.

Figure 3: Extent of Climate Impact Analysis in Surveyed EISs



Key: (1) Climate impacts on the affected environment (2) Implications of climate change for environmental outcomes (3) Climate impacts on the proposed action (4) Climate risk / resilience across alternatives (5) Measures to reduce environmental impacts exacerbated by climate change (6) Measures to enhance climate resilience of proposed action

270 See *infra* Part 5.3.B.
 271 See *infra* Part 5.3.C.
 272 See *infra* Part 5.3.E.
 273 *Id.*
 274 See *infra* Part 5.3.D.

These findings are broadly consistent with the results of the previous surveys²⁷⁵ and suggest that, at least as far as energy projects are concerned, federal agencies have generally made insufficient progress in integrating climate conditions into their NEPA reviews. There are, however, some notable differences between project categories. Significantly more of the EISs issued in connection with nuclear and LNG projects discussed climate impacts on the local environment and the proposed actions (compared to the EISs issued for other projects). The nuclear project EISs were also more likely to compare climate risks across alternatives, but generally did not include a detailed analysis of climate adaptation or resilience measures. Such measures were more commonly discussed in the EISs issued in connection with LNG projects.

At the other end of the spectrum, there was no climate impact analysis in any of the EISs issued for hydroelectric projects. Interestingly, all of the hydroelectric EISs were prepared by FERC, which also prepared the LNG EISs that included a fairly detailed climate impact analysis. In one of the hydroelectric EISs, FERC noted that EPA recommended “includ[ing] a discussion of climate change and its potential effects on the action alternatives,” and responded that it is “not aware of any climate-predicting models that have the accuracy to predict resource-specific impacts at the individual project site level.”²⁷⁶ Such data is, however, available from various sources. As one example, for more than a decade, the Bureau of Reclamation has worked with other federal bodies, universities, and private sector entities to downscale global climate projections to local levels.²⁷⁷ Using local temperature and precipitation data, the project team has projected hydrological conditions at the watershed level.²⁷⁸ The Bureau of Reclamation has used the hydrological projections to evaluate climate change impacts on water management projects. For instance, in an EIS issued in 2016, the Bureau of Reclamation evaluated how climate change would affect the allocation, release, and delivery of water from the Rio Grande Project in New Mexico and Texas.²⁷⁹ Using downscaled projections of future climate and hydrological conditions in the Rio Grande Basin, the Bureau of Reclamation identified three “equally likely” climate outcomes—a “drier scenario,” a “central tendency or median scenario,” and a “wetter scenario”—and evaluated how stream flows, runoff, and reservoir storage would change under each.²⁸⁰ FERC could employ a similar approach to evaluate the impact of changing water availability on hydroelectric projects.

275 See *supra* Part 5.1.

276 FED. ENERGY REGUL. COMM’N, ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSE: BEAR RIVER NARROWS PROJECT—FERC PROJECT NO. 12486-008-IDAHO E-5 (2016), <https://www.ferc.gov/final-environmental-impact-statement-bear-river-narrows-hydroelectric-project-p-12486-008-issued> [hereinafter “Bear River EIS”].

277 About, DOWNSCALED CMIP3 AND CMIP5: CLIMATE AND HYDROLOGY PROJECTIONS, <https://perma.cc/7HPC-FXSQ> (last visited Dec. 14, 2021).

278 *Id.* See also Levi Brekke et al., Downscaled CMIP3 and CMIP5 Hydrology Projections (2014), <https://perma.cc/G68Q-H6U2>.

279 BUREAU OF RECLAMATION, CONTINUED IMPLEMENTATION OF THE 2008 OPERATING AGREEMENT FOR THE RIO GRANDE PROJECT, NEW MEXICO AND TEXAS: ENVIRONMENTAL IMPACT STATEMENT (2016), <https://cdxapps.epa.gov/cdx-enepa-ll/public/action/eis/details?eisId=218219>.

280 *Id.* at 60-73.

Project Category	Total EISs	EISs discussing:											
		(1) climate impacts on the affected environment		(2) implications of climate change for environmental outcomes		(3) climate impacts on the proposed action		(4) climate risk / resilience across alternatives		(5) measures to reduce environmental impacts exacerbated by climate change		(6) measures to enhance climate resilience of proposed action	
		#	%	#	%	#	%	#	%	#	%	#	%
Oil & gas	9	8	88.9%	5	55.5	2	22.2%	2	22.2%	3	33.3%	1	11.1%
Coal	3	3	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Wind	6	4	66.7%	3	50.0%	0	0.0%	0	0.0%	3	50.0%	0	0.0%
Solar	6	4	66.7%	2	33.3%	2	33.3%	1	16.7%	2	33.3%	2	33.3%
Geothermal	3	2	66.7%	1	33.3%	0	0.0%	0	0.0%	1	33.3%	0	0.0%
Hydro	4	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Nuclear	7	7	100.0%	6	85.7%	3	42.9%	2	28.6%	0	0.0%	1	14.3%
Pipeline	6	6	100.0%	1	16.6%	3	50.0%	0	0.0%	1	16.6%	2	33.3%
LNG	10	10	100.0%	8	80.0%	10	100%	0	0.0%	6	60.0%	9	90.0%
Transmission	11	8	72.7%	5	45.5%	1	9.1%	1	9.1%	3	27.3%	1	9.1%
Total	65	52	80.0%	31	47.7%	20	30.8%	6	9.2%	19	29.2%	16	24.6%

Agency	Project Category	Total EISs	EISs discussing:																	
			(1) climate impacts on the affected environment		(2) implications of climate change for environmental outcomes		(3) climate impacts on the proposed action		(4) climate risk / resilience across alternatives		(5) measures to reduce environmental impacts exacerbated by climate change		(6) measures to enhance climate resilience of proposed action							
			#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%		
DOI	Oil & gas	8	6	75.0%	4	50.0%	2	25.0%	2	25.0%	3	37.5%	1	12.5%						
	Coal	2	2	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%						
	Wind	6	4	66.7%	3	50.0%	0	0.0%	0	0.0%	3	50.0%	0	0.0%						
	Solar	5	3	60.0%	1	20.0%	1	20.0%	1	20.0%	1	20.0%	1	20.0%	1	20.0%				
	Geothermal	1	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%				
	Transmission	7	6	85.7%	4	57.1%	1	14.3%	0	0.0%	3	42.9%	1	14.3%						
	Hydro	4	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%				
FERC	Pipeline	5	5	100.0%	1	20.0%	2	40.0%	0	0.0%	1	20.0%	2	40.0%						
	LNG	10	10	100.0%	8	80.0%	10	100.0%	0	0.0%	6	60.0%	9	90.0%						
	Nuclear	6	6	100.0%	6	100.0%	2	33.3%	1	16.7%	0	0.0%	0	0.0%						
USDA (Forest Service)	Oil & gas	1	1	100.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%						
	Geothermal	2	2	100.0%	1	50.0%	0	0.0%	0	0.0%	1	50.0%	0	0.0%						
	Pipeline	1	1	100.0%	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%						
	Transmission	2	1	50.0%	0	0.0%	0	0.0%	1	50.0%	0	0.0%	0	0.0%						
Other	Coal	1	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%						
	Solar	1	1	100.0%	1	100.0%	1	100.0%	0	0.0%	1	100.0%	1	100.0%						
	Nuclear	1	1	100.0%	0	0.0%	1	100.0%	1	100.0%	0	0.0%	1	100.0%						
	Transmission	2	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%						

5.3.A Analysis of Climate Impacts on the Affected Environment

Most of the surveyed EISs (80%) discussed the impacts of climate change on the affected environment but, in most cases, the discussion was neither holistic nor specific. Many of the EISs focused on only a subset of climate impacts. For example, in 2019, BLM issued an EIS in relation to its proposed approval of a transmission line crossing federal land in California and Arizona.²⁸¹ The EIS noted that climate change would impact the frequency and severity of storms and other extreme weather events in the area where the transmission line would be constructed.²⁸² However, it did not discuss other climate impacts that could affect the local environment and the transmission line, such as higher temperatures, drought, and wildfire.

Some EISs only discussed climate impacts in qualitative, and not quantitative, terms. For example, several of the EISs issued by FERC in connection with LNG projects noted the potential for climate change-induced sea level rise to affect coastal property, but did not quantify the extent of future sea level rise.²⁸³ Without such quantification, it is impossible to determine whether coastal facilities are at risk of inundation, or assess the need for changes in design or operational parameters to reduce that risk.

In most EISs, the discussion of climate impacts on the local environment was based on national or regional data (e.g., projecting the increase in average temperatures nationwide or in a multi-state region). For example, in 2017, FERC issues an EIS in connection with the construction of natural gas pipeline infrastructure in parts of Pennsylvania and New Jersey.²⁸⁴ When describing the “affected environment,” the EIS identified climate change impacts expected to occur in the northeastern U.S., but did not focus specifically on the states (or sub-state areas) where construction would occur.²⁸⁵ This regional focus may have obscured some climate impacts. Pennsylvania and New Jersey (i.e., where the project would take place) are already experiencing different, and in some cases, more severe impacts than the more northern states. As just one example, whereas the northern states saw less than 1 foot of sea level rise between 1901 and 2012, sea level rise was higher (1 to 2 feet) in parts of Pennsylvania and New Jersey.²⁸⁶ Thus, as this example demonstrates, relying on regional data puts federal agencies at risk of underestimating climate-related risks.

5.3.B Analysis of Climate Impacts on the Proposed Action

Thirty percent of the EISs surveyed analyzed how the impacts of climate change might affect the proposed action (e.g., by damaging infrastructure or reducing its useful life). Almost half considered the potential for climate impacts to worsen or exacerbate negative environmental

281 BUREAU OF LAND MGMT., FINAL ENVIRONMENTAL IMPACT STATEMENT AND PROPOSED RESOURCE MANAGEMENT PLAN AMENDMENTS FOR THE TES WEST LINK TRANSMISSION LINE PROJECT (2019), <https://cdxapps.epa.gov/cdx-enepa-ll/public/action/eis/details?eisId=280737>.

282 See *id.* at 4-33-4-34.

283 FED. ENERGY REGUL. COMM’N, GOLDEN PASS LNG EXPORT PROJECT: FINAL ENVIRONMENTAL IMPACT STATEMENT 4-253 (2016), <https://cdxapps.epa.gov/cdx-enepa-ll/public/action/eis/details?eisId=212821>.

284 FED. ENERGY REGUL. COMM’N, PENNEAST PIPELINE PROJECT: FINAL ENVIRONMENTAL IMPACT STATEMENT (2017), <https://cdxapps.epa.gov/cdx-enepa-ll/public/action/eis/details?eisId=230721>.

285 *Id.* at 4-335.

286 *Sea Level is Rising*, U.S. CLIMATE RESILIENCE TOOLKIT, <https://perma.cc/J92K-88Q7> (last visited Nov. 23, 2021).

outcomes associated with the proposed action. Whether and how those issues were addressed differed significantly between project categories, however.

Analysis of the implications of climate change for the proposed action and its environmental outcomes was most commonly found in the EISs relating to LNG and nuclear energy projects. Notably, none of the coal EISs, and only a small subset of the oil / gas EISs discussed risks to the proposed action from the impacts of climate change. This may be due to the fact that, in most of the coal and oil / gas EISs, the proposed action did not involve the approval of any physical work or infrastructure. Rather, most of the EISs related to proposed amendments to RMPs to designate federal land as suitable for coal, oil, or gas development, or the leasing of such land for development. While those activities pave the way for work on federal lands, they do not themselves authorize such work. Thus, for example, additional permits are needed to drill oil and natural gas wells on federal land. At the time land is leased, the exact nature, location, and timing of drilling and other work are generally not known. Without that information, the implications of climate change for such activities and their environmental consequences may be difficult to assess at a site-specific level. However, it is still often possible—and important—for federal agencies to predict impacts in landscape-level terms. One example is in BLM’s 2019 EIS relating to oil and gas leasing in the Arctic National Wildlife Refuge (“ANWR”). There, BLM noted that accelerated melting of permafrost in ANWR due to climate change would affect the construction and maintenance of buildings, roads, and other structures needed for oil and gas development.²⁸⁷ BLM did not consider climate impacts on future infrastructure in EISs prepared in connection with other leasing decisions.

The quality of the analysis of climate impact on the proposed action also varied significantly. The analysis in many EISs focused on only a subset of climate impacts. For example, the EISs prepared by FERC in connection with LNG terminals typically included a robust discussion of risks to the facilities from sea level rise, but little (if any) analysis of other climate-related risks, including the potential for compounding effects from sea level rise and other climate impacts.²⁸⁸ In some other EISs, climate-related risks were identified, but dismissed with little explanation. For example, a 2019 EIS prepared by the Forest Service for a proposed natural gas pipeline noted that, due to climate change, the project area would see more heavy precipitation events “leading to greater flood risk and stormwater management challenges.”²⁸⁹ While the risks to underground pipelines from flooding have been well documented,²⁹⁰ the EIS concluded, without explanation, that there was no risk to the project because “the buried pipeline is not anticipated to be impacted.”²⁹¹

287 BUREAU OF LAND MGMT., COASTAL PLAIN OIL AND GAS LEASING PROGRAM: ENVIRONMENTAL IMPACT STATEMENT 3-9-3-10 (2019), <https://cdxapps.epa.gov/cdx-enepa-ll/public/action/eis/details?eisId=281210> [hereinafter “Coastal Plain EIS”]. However, note that plaintiffs including the Gwich’in Steering Committee filed a suit alleging other inadequacies in this EIS, including with regard to its consideration of the proposed action’s greenhouse gas emissions, impacts on wildlife, and impacts on subsistence uses and resources and its discussion of mitigation measures for these impacts. See Compl., *Gwich’in Steering Comm. v. Bernhardt*, No. 3:20-cv-00294 (D. Alaska Aug. 24, 2020).

288 See, e.g., FED. ENERGY REGUL. COMM’N, ANNOVA LNG BROWNVILLE PROJECT: FINAL ENVIRONMENTAL IMPACT STATEMENT 4-249 (2019), <https://cdxapps.epa.gov/cdx-enepa-ll/public/action/eis/details?eisId=270641>; FED. ENERGY REGUL. COMM’N, TEXAS LNG PROJECT: FINAL ENVIRONMENTAL IMPACT STATEMENT 4-243 - 2-244 (2019), <https://cdxapps.epa.gov/cdx-enepa-ll/public/action/eis/details?eisId=267820>.

289 FOREST SERVICE, FINAL ENVIRONMENTAL IMPACT STATEMENT: CROW CREEK PIPELINE PROJECT 3-7 (2019), <https://cdxapps.epa.gov/cdx-enepa-ll/public/action/eis/details?eisId=270664>.

290 See, e.g., Jack Nicas, Floods Put Pipelines at Risk, WALL ST. J., Dec. 3, 2012, <https://perma.cc/Q6HE-52RG>.

291 Forest Service, *supra* note 287, at 3-7.

5.3.C Comparison of Climate Risks Across Alternatives

The climate risks associated with alternatives to the proposed action were rarely discussed in the surveyed EISs. Overall, less than 10% of EISs compared risks from, or resilience to, climate change across all alternatives. Such comparison only appeared in a small number of EISs issued in relation to oil / gas, solar, nuclear, and transmission projects. None of the EISs issued for other types of projects compared climate risk or resilience across alternatives.

The analysis of climate risks to alternatives (where it did appear) was often neither holistic nor specific. Some of the EISs did not include any analysis and simply concluded, without explanation, that climate risks would not differ materially between alternatives. One exception was a 2016 EIS issued by NRC in connection with its proposed licensing of a new nuclear reactor at an existing nuclear power plant in Pennsylvania.²⁹² The EIS evaluated the environmental impacts of constructing and operating the reactor at several alternative sites and considered how impacts on water resources, aquatic ecosystems, terrestrial species, human health, and land use might be worsened by climate change.²⁹³

5.3.D Analysis of Climate Adaptation Measures

Less than 30% of the EISs surveyed identified possible adaptation measures to eliminate or reduce the environmental impacts of the proposed action that would be exacerbated by climate change. Less than 25% identified measures to enhance the climate resilience of the proposed action. Notably, however, resilience measures were identified in most (80%) of the subset of EISs that analyzed climate risks to the proposed action. The identified resilience measures generally involving relocating or hardening proposed infrastructure. For example, the EISs issued in connection with LNG projects often discussed the possibility of elevating structures or placing them behind floodwalls to minimize risks from sea level rise.²⁹⁴ One EIS issued for a solar project similarly discussed the use of drainage channels or systems to reduce flood risk.²⁹⁵ Some EISs also discussed changes to infrastructure operation to reduce its exposure to climate risks and the adoption of specialized monitoring and maintenance plans.²⁹⁶

5.3.E Data and Information Quality

In several EISs, the climate impact analysis was based on national or regional data, which may not accurately reflect the specific climate-related risks associated with the proposed action. As discussed in Part 4.2, because the nature and extent of future climate impacts will vary

292 U.S. NUCLEAR REGUL. COMM'N, FINAL REPORT: ENVIRONMENTAL IMPACT STATEMENT FOR THE COMBINED LICENSE (COL) FOR THE BELL BEND NUCLEAR POWER PLANT (2016), <https://cdxapps.epa.gov/cdx-enepa-ll/public/action/eis/details?eisId=207201>.

293 See *id.* at 9-64, 9-80, 9-87, 9-108, 9-124, 9-128, 9-151, 9-171, 9-185-9-186, 9-190, 9-205, 9-211-9-212, 9-232 -9-233.

294 See, e.g., FED. ENERGY REGUL. COMM'N, RIO GRANDE LNG PROJECT: FINAL ENVIRONMENTAL IMPACT STATEMENT 4-349-4-353 (2019), <https://cdxapps.epa.gov/cdx-enepa-ll/public/action/eis/details?eisId=271019>; FED. ENERGY REGUL. COMM'N, FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE JORDAN COVE ENERGY PROJECT 4-783 (2019), <https://cdxapps.epa.gov/cdx-enepa-ll/public/action/eis/details?eisId=284352> [hereinafter "Jordan Cove EIS"].

295 See, e.g., DEP'T OF AIR FORCE & KERN COUNTY PLANNING & NAT. RES. DEP'T, FINAL ENVIRONMENTAL IMPACT STATEMENT / ENVIRONMENTAL IMPACT REPORT FOR THE EDWARDS AFB SOLAR PROJECT 3.8-35 (2020), <https://cdxapps.epa.gov/cdx-enepa-ll/public/action/eis/details?eisId=288175>.

296 See, e.g., Jordan Cove EIS, *supra* note 291, at 4-795-4-796.

regionally, it is essential that federal agencies use localized data, showing anticipated climate conditions in the specific area where the proposed action will occur. Some federal agencies appear to be unaware that localized data is available. For example, after EPA recommended that it consider climate impacts in the EIS for a hydroelectric project, FERC stated: “[w]e are not aware of any climate-predicting models that have the accuracy to predict resource-specific impacts at the individual project site level.”²⁹⁷ Similarly, in an EIS issued for a coal project, the Army Corps of Engineers stated that “[e]xisting climate prediction models are global and regional in nature; therefore they are not at the appropriate scale to identify site-specific climate changes.”²⁹⁸ While that is true, downscaling techniques can be used to refine the projections from global climate models and thus estimate climate impacts at finer geographic scales, often on the order of 5 square miles or less.²⁹⁹ A number of government and other entities have made downscaled climate data publicly accessible online,³⁰⁰ but that data is seemingly not being used in environmental assessments under NEPA.

Equally concerning, many of the surveyed EISs cited reports or studies that had been superseded, or were otherwise out of date. For example, in a 2018 EIS issued in connection with the leasing of federal land for coal development, BLM relied on the Intergovernmental Panel on Climate Change’s Fourth Assessment Report from 2007, despite the fact that an updated Fifth Assessment Report was published in 2014.³⁰¹ Similarly, in a 2016 EIS issued in connection with a pipeline project, FERC relied on a 2009 report prepared by the U.S. Global Change Research Program, rather than the updated version of the report published in 2014.³⁰² In other EISs, FERC relied on out-of-date flood maps, in some cases dating from the 1980s, which do not account for recent or future impacts of climate change.³⁰³

5.3.F Environmental Justice Considerations

All of the surveyed EISs, except those in the hydroelectric project category, included a discussion of environmental justice issues. Most of the EISs identified environmental justice communities that could be affected by the proposed action and some concluded that there would be environmental justice impacts from the proposed action. However, with limited exceptions, the EISs did not discuss any nexus or overlap between environmental justice communities or impacts and climate change. One of the few EISs that did include such a discussion was prepared by BLM in connection with oil and gas leasing in the ANWR coastal plain.³⁰⁴ The EIS concluded that leasing and subsequent oil and gas development in ANWR

297 Bear River EIS, *supra* note 275, at E-5.

298 S. ARMY CORPS OF ENGINEERS, REGIONAL ENVIRONMENTAL IMPACT STATEMENT FOR SURFACE COAL AND LIGNITE MINING IN TEXAS 3.7-16 (2016), <https://cdxapps.epa.gov/cdx-enepa-ll/public/action/eis/details?eisId=206821>.

299 See Hayhoe, *supra* note 181, at 144.

300 See *supra* Part 4.3.

301 See BUREAU OF LAND MGMT., ALTON COAL TRACT LEASE BY APPLICATION: FINAL ENVIRONMENTAL IMPACT STATEMENT 4-323, 6-12 (2018), <https://cdxapps.epa.gov/cdx-enepa-ll/public/action/eis/details?eisId=253488>.

302 FED. ENERGY REGUL. COMM’N, ROVER PIPELINE, PANHANDLE BACKHAUL, AND TRUNKLINE BACKHAUL PROJECTS: FINAL ENVIRONMENTAL IMPACT STATEMENT 4-291 (2016), <https://cdxapps.epa.gov/cdx-enepa-ll/public/action/eis/details?eisId=212837>.

303 See, e.g., FED. ENERGY REGUL. COMM’N, FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE PLAQUEMINES LNG AND GATOR EXPRESS PIPELINE PROJECT 4-4-4-5, 4-257 (2019), <https://cdxapps.epa.gov/cdx-enepa-ll/public/action/eis/details?eisId=271726>.

304 See Coastal Plain EIS, *supra* note 286, at 3-278–3-280.

could disproportionately impact Native Americans and Alaska Natives, including members of the Iñupiat, Nuiqsut, and Gwich'in indigenous groups.³⁰⁵ The EIS noted that those groups are also disproportionately impacted by climate change, including because they engage in subsistence activities that are “particularly dependent on ice, wind, and permafrost conditions.”³⁰⁶ It recognized that:

[c]limate change is changing the environment of the North Slope and affecting subsistence users' ability to access subsistence resources at appropriate times The reduction of sea ice has worsened coastal erosion, the weather has become less predictable, the shore ice in spring is less stable for whaling, fall travel for caribou is hampered by a late and unreliable freeze up, spring hunting for geese is hampered by an early breakup, and ice cellars provide less reliable food storage. All of these issues create significant concerns for many Iñupiat because they are factors that cannot be controlled and that are threatening their way of life.³⁰⁷

There was no similar discussion of a nexus between climate change and disproportionate impacts on environmental justice communities in most other EISs.

305 *Id.*

306 *Id.* at 3-280.

307 *Id.* As previously referenced, *supra* note 286, plaintiffs including the Gwich'in Steering Committee filed a suit alleging inadequacies in this EIS. See Compl., *Gwich'in Steering Comm. v. Bernhardt*, No. 3:20-cv-00294 (D. Alaska Aug. 24, 2020).

6. RECOMMENDATIONS FOR REFORM

CEQ and other federal authorities should take steps to incorporate climate risk and resilience considerations into NEPA processes. In particular, this paper recommends that: (1) CEQ promulgate NEPA regulations and guidance to ensure that climate impacts are considered in a holistic, specific, and actionable manner; (2) federal agencies review their NEPA regulations and consider ways to update and improve NEPA implementation to better account for climate impacts; (3) CEQ coordinate across federal agencies and relevant experts on, among other things, climate scenario analysis; and (4) CEQ create or support the formation of a publicly accessible centralized database of climate information relevant to NEPA analysis.

6.1. Recommendation 1: CEQ should promulgate NEPA regulations and guidance that ensure climate impacts are considered in a holistic, specific, and actionable manner

As explained in Part 4 above, in order to fulfill their legal obligations under NEPA, federal agencies must evaluate and disclose relevant climate impacts in their environmental reviews.³⁰⁸ CEQ should promulgate new regulations to ensure that climate impacts relevant to federal actions are evaluated alongside other existing considerations in environmental reviews. This could occur as part of CEQ’s planned Phase 2 rulemaking, which is intended to “promote better decision-making consistent with NEPA’s goals and requirements,” among other things.³⁰⁹ As CEQ has already recognized, consideration of climate change “effects fall[s] squarely within NEPA’s purview,”³¹⁰ and is essential to achieve its goal of “attain[ing] the widest range of beneficial uses of the environment without degradation . . . or other undesirable and unintended consequences.”³¹¹

Any new CEQ regulations should ensure that climate impact analysis is embedded across NEPA and present in all facets of environmental review. Thus, for example, climate impact analysis should not only feature in EISs but also EAs. This is important because, in some cases, an action may only be found to have significant environmental impacts (and thus require preparation of an EIS) after the potential for compounding effects from the action and climate change are considered. Without requirements to consider climate impacts in EAs, agencies may dismiss them, without further consideration.³¹²

To ensure holistic, specific, and actionable climate impact analysis appears in all EAs, CEQ could revise its existing regulations at 40 C.F.R. §1501.5 (governing “environmental

308 See *supra* Part 4.2.

309 Press Release, The White House, CEQ Proposes to Restore Basic Community Safeguards during Federal Environmental Reviews (Oct. 6, 2021), <https://perma.cc/SDU8-UN3M>.

310 2016 Climate Guidance, *supra* note 119, at 2.

311 42 U.S.C. § 4331(b)(3).

312 This has already been demonstrated to be an issue with consideration of greenhouse gas emissions in environmental review. See Institute for Policy Integrity, Comments on the National Environmental Policy Act Implementing Regulations Revisions 21-22 (2021), <https://perma.cc/U7BU-ZRNX>.

assessments”). That section currently requires EAs to “briefly discuss the purpose and need for the proposed action alternatives . . . and the[ir] environmental impacts.”³¹³ CEQ should consider adding an express requirement for agencies to evaluate how reasonably foreseeable impacts of climate change, including both event-based and non-event-based impacts, will alter the purpose and need for the proposed action, the available alternatives, and their environmental outcomes.³¹⁴

CEQ should also considering revising its existing regulations at 40 C.F.R. Part 1502 (governing “Environmental Impact Statements”) to ensure holistic, specific, and actionable climate impact analysis in EISs. Specifically, and among other things, CEQ should consider revising:

- Section 1502.13 (Purpose and need) to direct agencies to *consider whether and how the reasonably foreseeable impacts of climate change, including both event-based and non-event-based impacts, could alter the underlying purpose and need for the proposed action.*
- Section 1502.14 (Alternatives including the proposed action) to direct agencies to *account for climate change when identify alternative actions and evaluating their environmental consequences. A new sub-section could be added requiring agencies to include, in the alternatives analysis, a discussion of how the reasonably foreseeable impacts of climate change, including both event-based and non-event-based impacts, will affect each alternative and its environmental consequences over its full useful life, including any decommissioning period.*
- Section 1502.15 (Affected environment) to direct agencies to *account for the reasonably foreseeable impacts of climate change, including both event-based and non-event-based impacts, when evaluating environmental trends in the area(s) to be affected or created by the alternatives under consideration.*
- Section 1502.16 (Environmental consequences) to direct agencies to *account for climate change when evaluating the environmental consequences of the proposed action and alternatives.* Again, a new sub-section could be added requiring agencies to *discuss all reasonably foreseeable impacts of climate change, including both event-based and non-event-based climate impacts, that could alter the environmental consequences of the proposed action and each alternative over their full useful life, including any decommissioning period.* Consideration should also be given to revising existing subsection (a)(5), which requires agencies to discuss “possible conflicts between the proposed action and the objectives of Federal, regional, State, Tribal, and local land use plans, policies and controls.” Amending that subsection to expressly require consideration of Federal, regional, State, Tribal, and local climate, clean energy, and other environmental policies could help to guard against maladaptation (see below).
- Section 1502.23 (Methodology and scientific accuracy) to expressly state that *agencies must use forward-looking projections when evaluating the reasonably foreseeable*

313 See 40 C.F.R. § 1501.5(c)(2).

314 Here and in the following bulletpoints, italics denote suggested regulatory text.

impacts of climate change. A new section could also be added to specify that climate projections should not be regarded as unreliable merely because they were developed using mathematical or other models that project a range of possible future outcomes.

Addressing these topics in regulation will best achieve durable and enforceable outcomes. Subsequent guidance would also be useful to highlight best practices.³¹⁵ For example, guidance could clarify that mere reference to general climate impacts on the affected area is insufficient and direct agencies to data and tools (e.g., downscaled climate projections and scenarios analysis) that can be used to conduct a holistic, specific, and actionable climate impact analysis. Guidance could also provide agencies with advice on considering adaptation measures to address the impacts of climate change on the proposed action and its environmental consequences. Among other things and given the critical importance of additionally considering greenhouse gas mitigation, agencies should be directed to consider the potential for maladaptation, which occurs where adaptation measures address the symptoms of climate change, while simultaneously contributing to its underlying cause.³¹⁶ The CEQ guidance should ensure that climate impact analysis includes consideration of whether particular adaptation measures risk or present maladaptive outcomes.

6.2. Recommendation 2: Federal agencies should review their own NEPA regulations and consider ways to improve NEPA implementation to better account for climate impacts

As recognized in the 2021 Proposed Rule, CEQ regulations should establish the floor, rather than the ceiling, for integrating climate impact analysis into NEPA processes.³¹⁷ Given the different ways climate change can impact different types of actions in different locations, individual federal agencies may find value in taking additional steps to incorporate climate risk considerations in their own NEPA regulations. We recommend that all federal agencies review their NEPA regulations and consider whether to amend those regulations to better ensure holistic, specific, and actionable climate impact analysis.

Agency-specific NEPA regulations might be best suited to address particular forms of climate risk. For example, DOI could adopt regulations or guidance on how to address climate-related risks at the landscape level to ensure that such risks are accounted for in a holistic way, early on in planning processes (see Part 5.3(B)). FERC, potentially in cooperation with the Bureau of Reclamation, could adopt guidance on accounting for future hydrologic conditions in environmental reviews of hydroelectric projects. Agencies that deal with coastal infrastructure (e.g., FERC, the Department of Transportation, and the Army Corps of Engineers) could develop joint guidance that ensures use of the latest data and projections on sea level rise, as well as consideration of compound risks from that and other climate impacts (e.g., more intense storms).

³¹⁵ For a discussion of best practices for climate impact analysis, see *supra* Part 4.3.

³¹⁶ JANE EBINGER & WALTER VERGARA, WORLD BANK, CLIMATE IMPACTS ON ENERGY SYSTEMS: KEY ISSUES FOR ENERGY SECTOR ADAPTATION 90 (2011), <https://perma.cc/3WVZ-MPJC>.

³¹⁷ National Environmental Policy Act Implementing Regulations Revisions, 86 Fed. Reg. 55,757, 55,757 & 55,761 (Oct. 7, 2021).

To reduce the burden of conducting climate impact analysis, federal agencies could consider requiring project applicants to submit information on how the impacts of climate change will affect the project and the local area, and actions to enhance resilience. Many federal agencies already specify information that applicants must submit in their agency-specific NEPA regulations. For instance, FERC's NEPA regulations require applicants for permits for LNG terminals to submit a "safety and reliability report," which identifies potential hazards to the public from failure of the facility due to accidents or natural catastrophes.³¹⁸ In the future, FERC could also require applicants to submit information about risks posed by climate change, and whether and how those risks have been addressed. This is consistent with the approach taken by some states under their little NEPA statutes. For example, Massachusetts requires applicants to complete a "climate adaptation and resilience" form, which asks about the extent to which the applicant has considered climate risks and built-in resilience.³¹⁹ Adopting a similar approach at the federal level could help to alleviate the (arguably unfounded) concerns expressed by some federal agencies about the difficulties of obtaining information for climate impact analysis.³²⁰ It should be noted, however, that any information submitted by applicants would need to be carefully scrutinized by federal agencies. Where an applicant uses, or engages third parties who use, proprietary software or confidential information in the analysis, federal agencies' ability to review and verify that analysis may be limited.

6.3. Recommendation 3: CEQ should coordinate across federal agencies and relevant experts

CEQ is only one of many agencies across the federal government with a statutory mandate implicated by the impacts of climate change. Likewise, CEQ is only one of many agencies with expertise relevant to the evaluation of climate impacts. A wide array of federal authorities, from financial regulators like the Commodity Futures Trading Commission and Securities and Exchange Commission,³²¹ to environmental and scientific centers like EPA, NOAA, NASA, and the Federal Acquisition Regulatory Council,³²² to health and work safety regulators like the Occupational Safety and Health Administration,³²³ have expertise relevant to the identification and management of climate-related risks.

318 18 C.F.R. §§ 380.3 & 380.12(m).

319 MASS. EXEC. OFF. OF ENERGY & ENV'T AFFAIRS, *supra* note 202.

320 Contrary to the claims of some federal agencies, data and tools suitable for use in climate impact analysis are already publicly available. See *supra* Part 4.3 and 5.3.E.

321 See, e.g., CLIMATE-RELATED MARKET RISK SUBCOMMITTEE OF THE CFTC MARKET RISK ADVISORY COMMITTEE, MANAGING CLIMATE RISK IN THE U.S. FINANCIAL SYSTEM (2020), <https://perma.cc/NUD5-3LRE>; SEC Response to Climate and ESG Risks and Opportunities, SEC. & EXCH. COMM'N, <https://perma.cc/K7HJ-7APV> (last visited Dec. 9, 2021) (listing SEC initiatives on climate risk including request for public input on climate-related disclosures and examination and enforcement efforts).

322 See, e.g., Climate Change Adaptation Resource Center (ARC-X), U.S. ENV'T PROT. AGENCY, <https://www.epa.gov/arc-x> (last visited Dec. 3, 2021); Climate Change Impacts and Risk Analysis (CIRA), U.S. ENV'T PROT. AGENCY, <https://www.epa.gov/cira> (last visited Dec. 3, 2021); Climate Change Impacts, NAT'L OCEANIC & ATMOSPHERIC ADMIN., <https://www.noaa.gov/education/resource-collections/climate/climate-change-impacts> (last visited Dec. 3, 2021); Global Climate Change, NAT'L AERONAUTICS & SPACE ADMIN., <https://climate.nasa.gov/> (last visited Dec. 3, 2021); Federal Acquisition Regulation: Minimizing the Risk of Climate Change in Federal Acquisitions, 86 Fed. Reg. 57,404 (Oct. 15, 2021) (Advance Notice of Proposed Rulemaking).

323 See, e.g., Heat Injury and Illness Prevention in Outdoor and Indoor Work Settings, 86 Fed. Reg. 59,309 (Oct. 27, 2021) (Advance Notice of Proposed Rulemaking).

We recommend that CEQ explore ways to coordinate with relevant federal agencies, for example, through an Interagency Working Group (“IWG”). IWGs could be well-suited for situations such as this, where a cohesive regulatory approach can improve technical analysis and reduce regulatory duplication. IWGs have previously been convened primarily through Executive Orders, for purposes including setting a standardized estimate for the social cost of carbon dioxide and other greenhouse gases, and providing guidance on environmental justice issues.³²⁴

An IWG or other mechanism established to improve agency coordination on climate risk could address a number of issues. One issue that should be addressed as a priority is the use of climate scenario analysis in environmental reviews. Climate scenario analysis refers to the development of a range of hypothetical climate futures, where the consequences of climate change vary from more moderate to more severe, depending upon projected reductions in global greenhouse gas emissions. The assessment of climate impacts on a federal action may diverge significantly depending upon the climate scenario analysis used. Without an IWG or other mechanism to coordinate work across agencies, the decision of which climate scenario(s) to use may be left to individual entities or agencies, leading to diverging, second-best, and/or contradictory approaches.

Relatedly, we recommend that CEQ convene an expert advisory board or similarly structured body to solicit expert recommendation to supplement and complement activities coordinated under an IWG or other mechanism. Expert advisory boards are designed to provide federal agencies with advice and recommendations, creating important communication channels between technical experts and policymakers.³²⁵ Although board duties are solely advisory, establishment of a board could help to ensure CEQ has access to best-practice, industry standard, up-to-date, and critical policy, technical, and scientific expertise.

CEQ should also explore other opportunities to engage with technical experts and interested stakeholders. One important engagement CEQ should undertake is with environmental justice groups and community leaders to solicit their input on, among other things, best practice for evaluating for climate change impacts on environmental justice communities. This would enhance CEQ and other federal agencies’ ability to address the potential for compounding impacts on those communities from climate change and any proposed federal action.

6.4. Recommendation 4: CEQ should create or support the creation of a publicly accessible centralized database of climate information relevant to NEPA analysis

Both government agencies and the public would benefit from greater access to data, tools, and other resources needed for climate impact analysis. As discussed in Part 5.3(E) above, while many useful resources are already publicly available, some federal agencies appear to be unaware of or unwilling to use them. For example, FERC has argued that it is unable to

³²⁴ Madison Condon et al., *Mandating Disclosure of Climate-Related Financial Risk*, 23 N.Y.U. J. LEGIS. & PUB. POL’Y (forthcoming 2021) (manuscript at 37–38), <https://perma.cc/TQ7Y-VH46>.

³²⁵ See, e.g., Secretary of Energy Advisory Board, ENERGY.GOV, <https://perma.cc/Z7KA-R3RQ> (last visited Dec. 9, 2021)

perform detailed climate impact analysis for hydroelectric projects because it lacks access to localized climate projections, but useful projections have been published by other government agencies.³²⁶ In the context of their own NEPA reviews, some agencies have also developed analytic tools and other resources, which could be useful to FERC and others. However, because of the structure of NEPA, where each agency individually implements its own NEPA regulation and conducts its own environmental reviews, climate impact analysis data and tools developed by one agency are not necessarily shared with others. The public may be similarly unaware of the data and tools held by different agencies.

CEQ could assist federal agencies in identifying and using existing data, tools, and other resources needed for climate impact analysis. To that end, we recommend that CEQ create or support the creation of a publicly accessible centralized database of climate risk information relevant to NEPA analysis. While CEQ has previously developed a list of tools to account for greenhouse gas emissions in NEPA reviews,³²⁷ no equivalent recommendations have been developed for considering climate risks in such reviews. A climate risk-focused, centralized database would serve as a useful resource for agencies. It would also improve accountability to, and access, for the public, thus furthering a core goal of NEPA.

One avenue to construct a climate-risk database would be through CEQ itself. Another could be through joint effort with other federal agencies. The database could provide (among other things) compiled and synthesized climate data, analytic tools, best practice manuals, training modules, and other guidance documents. (A list of key data, tools, and guidance documents are provided in Part 4.3 and Appendix 2 to this paper.) The database could also identify good examples of climate impact analysis in EISs, and incorporate recommendations from federal agencies that have conducted such analysis and/or technical experts, leveraging the work of an expert advisory board as recommended above.

326 See *supra* Parts 4.3 and 5.3.E.

327 *Greenhouse Gas (GHG) Accounting Tools*, NEPA.GOV, <https://perma.cc/WY94-H63S> (last visited Dec. 8, 2021); Grid Project Impact Quantification, GRIDPIQ, <https://gridpiq.pnnl.gov/gridpiq-landing-page/> (last visited Dec. 8, 2021).

7. CONCLUSION

Climate change is already causing, and will increasingly cause, unprecedented shifts in once stable patterns such as temperature, precipitation, and sea-level. This will, in turn, have significant ecological, geological, and societal impacts. Given the pervasive and increasing ways that climate change influences the environment, ignoring climate change impacts in environmental reviews is inconsistent with NEPA's purpose and requirements.

Despite the salience of climate risk to NEPA, our review of recent EISs for energy projects uncovered that, while many agencies recognized that climate change will affect the local environment in which a proposed action would occur, most failed to consider the implications of climate change for the action itself or alternatives. Compounding this issue, EISs often relied upon data that was outdated, incomplete, or insufficiently tailored to the proposed action's location or timeframe. Moreover, most EISs recognized the presence of environmental justice communities in the area of the proposed action, but failed to consider the cumulative impacts of climate change and other environmental harms on those communities.

Holistic, specific, and actionable climate impact analysis is a necessary precursor for informed climate adaptation and resilience actions. To ensure U.S. federal agencies conduct such analysis in NEPA reviews, CEQ should develop regulations, guidance, and accessible resources on climate impact analysis. Agency-specific regulations and guidance can build on this foundation and thereby ensure that NEPA reviews continue to serve their intended purpose in the face of a changing climate.

APPENDIX 1: ENVIRONMENTAL IMPACT STATEMENTS SURVEYED

	Lead Agency	Title	Publication Date
Coal Mining			
1	Department of the Interior, Bureau of Land Management	Alton Coal Tract Lease by Application	07/20/2018
2	Department of the Interior, Office of Surface Mining	Western Energy Company's Rosebud Mine Area F	11/30/2018
3	U.S. Army Corps of Engineers	Surface Coal and Lignite Mining	04/29/2016
Oil and Natural Gas Development			
4	Department of the Interior, Bureau of Indian Affairs	Osage County Oil and Gas	10/16/2020
5	Department of the Interior, Bureau of Land Management	Monument Butte Area Oil and Gas Development Project, Duchesne and Uintah County, Utah	06/24/2016
6	Department of the Interior, Bureau of Land Management	Previously Issued Oil and Gas Leases in the White River National Forest	08/05/2016
7	Department of the Interior, Bureau of Land Management	Proposed Resource Management Plan Amendment and Final Environmental Impact Statement for Oil and Gas Leasing and Development	05/10/2019
8	Department of the Interior, Bureau of Land Management	Coastal Plain Oil and Gas Leasing Program	09/20/2019
9	Department of the Interior, Bureau of Land Management	Converse County Oil and Gas Project	07/31/2020
10	Department of the Interior, Fish and Wildlife Service	National Wildlife Refuge System Revision of Regulations Governing Non-Federal Oil and Gas Rights	08/19/2016
11	Department of the Interior, National Park Service	Revision of 9B Regulations Governing Non-Federal Oil and Gas Activities	09/02/2016
12	Department of Agriculture, Forest Service	Oil and Gas Leasing in Portions of the Wyoming Range in the Bridger-Teton National Forest	12/16/2016
LNG Terminals			
13	Federal Energy Regulatory Commission	Golden Pass LNG Export Project	08/05/2016
14	Federal Energy Regulatory Commission	Driftwood LNG Project	02/01/2019
15	Federal Energy Regulatory Commission	Texas LNG Project-Texas LNG Brownsville LLC	03/22/2019
16	Federal Energy Regulatory Commission	Eagle LNG Partners Jacksonville, LLC Jacksonville Project	04/19/2019
17	Federal Energy Regulatory Commission	Annova LNG Brownsville Project	04/26/2019

	Lead Agency	Title	Publication Date
LNG Terminals (cont.)			
18	Federal Energy Regulatory Commission	Gulf LNG Liquefaction Project	04/26/2019
19	Federal Energy Regulatory Commission	Rio Grande LNG Project	05/03/2019
20	Federal Energy Regulatory Commission	Plaquemines LNG and Gator Express Pipeline Project	05/10/2019
21	Federal Energy Regulatory Commission	Jordan Cove Energy Project	11/22/2019
22	Federal Energy Regulatory Commission	Alaska LNG Project	03/13/2020
Natural Gas Pipelines			
23	Federal Energy Regulatory Commission	Rover Pipeline, Panhandle Backhaul, and Trunkline Backhaul Projects	08/05/2016
24	Federal Energy Regulatory Commission	Nexus Gas Transmission Project and Texas Eastern Appalachian Lease Project	12/09/2016
25	Federal Energy Regulatory Commission	PennEast Pipeline Project	04/14/2017
26	Federal Energy Regulatory Commission	Atlantic Coast Pipeline and Supply Header Project	07/28/2017
27	Federal Energy Regulatory Commission	Midcontinent Supply Header Interstate Pipeline Project	06/29/2018
28	Department of Agriculture, Forest Service	Crow Creek Pipeline Project	04/26/2019
Electricity Transmission Facilities			
29	Department of Energy	Northern Pass Transmission Line Project	08/18/2017
30	Department of the Interior, Bureau of Land Management	Energy Gateway South Transmission Project	05/13/2016
31	Department of the Interior, Bureau of Land Management	Vantage to Pomona Heights 230kV Transmission Line Project	10/21/2016
32	Department of the Interior, Bureau of Land Management	Boardman to Hemingway Transmission Line Project	11/25/2016
33	Department of the Interior, Bureau of Land Management	Ten West Link Transmission Line Project	09/13/2019
34	Department of the Interior, Fish and Wildlife Service	Proposed Habitat Conservation Plan for the Endangered American Burying Beetle for American Electric Power in Oklahoma, Arkansas, and Texas	10/19/2018
35	Department of the Interior, Fish and Wildlife Service	Issuance of an Incidental Permit and Implementation of Habitat Conservation Plan for the R-Project Transmission Line	02/08/2019
36	Department of the Interior, Fish and Wildlife Service	Authorization of Incidental Take and Implementation of the LCRA Transmission Services Corporation Habitat Conservation Plan	09/06/2019

	Lead Agency	Title	Publication Date
Electricity Transmission Facilities (cont.)			
37	Department of Agriculture, Forest Service	Kake to Petersburg Transmission Line Intertie Project	07/01/2016
38	Department of Agriculture, Forest Service	Bordertown to California 120kV Transmission Line	06/22/2018
39	Rural Utilities Service	Cardinal-Hickory Creek 345-kV Transmission Line Project	10/25/2019
Nuclear Electric Generating Facilities			
40	Department of Energy	Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling at the Idaho National Laboratory	10/07/2016
41	Nuclear Regulatory Commission	Combined License for the Bell Bend Nuclear Power Plant	04/29/2016
42	Nuclear Regulatory Commission	License Renewal of Nuclear Plants Supplement 56 Regarding Fermi 2 Nuclear Power Plant, NUREG-1437	09/30/2016
43	Nuclear Regulatory Commission	Combine Licenses (COLs) for Turkey Point Nuclear Plant Units 6 and 7	11/04/2016
44	Nuclear Regulatory Commission	License Renewal of Nuclear Plants, Supplement 58, Regarding River Bend Station, Unit 1	11/16/2018
45	Nuclear Regulatory Commission	Early Site Permit at the Clinch River Nuclear Site	04/12/2019
46	Nuclear Regulatory Commission	License Renewal of Nuclear Plants, Supplement 10, Second Renewal, Regarding Subsequent License Renewal for Peach Bottom Atomic Power Station Units 2 and 3	01/31/2020
Hydroelectric Generating Facilities			
47	Federal Energy Regulatory Commission	Bear River Narrows Hydroelectric Project P-12486	05/06/2016
48	Federal Energy Regulatory Commission	Sweetheart Lake Hydroelectric Project	06/10/2016
49	Federal Energy Regulatory Commission	Grant Lake Hydroelectric Project	05/10/2019
50	Federal Energy Regulatory Commission	Don Pedro Hydroelectric Project and La Grange Hydroelectric Project	07/17/2020
Solar Energy Development			
51	Department of the Interior, Bureau of Indian Affairs	Aiya Solar Project	06/10/2016
52	Department of the Interior, Bureau of Indian Affairs	Eagle Shadow Mountain Solar Project	12/20/2019
53	Department of the Interior, Bureau of Land Management	Desert Quartzite Solar Project	09/27/2019

	Lead Agency	Title	Publication Date
Solar Energy Development (cont.)			
54	Department of the Interior, Bureau of Land Management	Gemini Solar	12/27/2019
55	Department of the Interior, Bureau of Land Management	Yellow Pine Solar Project	09/04/2020
56	United States Air Force	Edwards AFB Solar Project	01/24/2020
Wind Energy Development			
57	Department of the Interior, Bureau of Indian Affairs	Campo Wind Project with Boulder Brush Facilities	01/31/2020
58	Department of the Interior, Bureau of Land Management	Borderlands Wind Project	04/10/2020
59	Department of the Interior, Fish and Wildlife Service	Na Pua Makani Wind Project and Habitat Conservation Plan	07/22/2016
60	Department of the Interior, Fish and Wildlife Service	Eagle Take Permits for the Chokecherry and Sierra Madre Phase I Wind Energy Project	12/09/2016
61	Department of the Interior, Fish and Wildlife Service	Skookumchuck Wind Energy Project Proposed Habitat Conservation Plan and Incidental Take Permit for Marbled Murrelet, Bald Eagle, and Golden Eagle Lewis and Thurston Counties, Washington	05/31/2019
62	Department of the Interior, Fish and Wildlife Service	Incidental Take Permits for Four Wind Energy Projects in Hawai'i	08/02/2019
Geothermal Energy Development			
63	Department of the Interior, Bureau of Land Management	Haiwee Geothermal Leasing Area	01/24/2020
64	Department of Agriculture, Forest Service	Big Creek Geothermal Leasing Project	03/02/2018
65	Department of Agriculture, Forest Service	Santa Fe National Forest Geothermal Leasing	05/11/2018

APPENDIX 2: RELEVANT GOVERNMENT GUIDANCE DOCUMENTS

Table 1: Guidance on Integrating Climate Impact Analysis into Environmental Reviews under NEPA or Equivalent Statutes

Issuing Body	Document Title	Description
U.S. Federal Agency Guidance		
Council on Environmental Quality	Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and Effects of Climate Change in National Environmental Policy Act Review (2016) ³²⁸	Instructs federal agencies to consider “the ways in which a changing climate may impact the proposed action and any alternative actions, change the action’s environmental effects . . . and alter the over-all environmental implications of such actions.” Provides recommendations for evaluating climate impacts on the affected environment, the proposed action, and alternatives.
Department of Transportation, Federal Highway Administration	Climate Change in NEPA Case Studies (undated) ³²⁹	Provides examples of how climate change impacts were addressed in the NEPA reviews of four transportation projects. Identifies lessons learned and offers recommendations for future reviews of transportation projects.
Department of Agriculture, Forest Service	Climate Change Considerations in Project-Level NEPA Analysis (2009) ³³⁰	Identifies “two types of climate change effects” that should be considered in NEPA reviews: (1) “the effects of a proposed project on climate change” and (2) “the effect of climate change on a proposed project.” With respect to (2), provides guidance on considering the effects of climate change on natural resource management, and identifies relevant tools and resources.
Department of the Interior, National Park Service	Draft Interim Guidance: Considering Climate Change in National Park Service NEPA Analysis (2009) ³³¹	Recommends that “(1) climate change stemming from greenhouse gas emissions and (2) certain impacts to park resources and values resulting from climate change should be . . . considered during the . . . [NEPA] planning process.” With respect to (2), recommends that climate impacts be considered when assessing the purpose and need for a proposed action, defining the affected environment, and evaluating the environmental impacts of the proposed action and alternatives. Provides a check-list of key issues to address in each area.

328 2016 Climate Guidance, *supra* note 119.

329 U.S. Dep’t of Transp., Fed. Highway Admin., Climate Change Adaptation Case Studies, <https://perma.cc/Q4Z8-QRVH> (last visited Dec. 15, 2021).

330 FOREST SERV., *supra* note 128.

331 NAT’L PARK SERV., *supra* note 126.

Issuing Body	Document Title	Description
U.S. Federal Agency Guidance (cont.)		
U.S. Army Corps of Engineers	Procedures to Evaluate Sea Level Change: Impact, Responses, and Adaptation (2019) ³³²	Provides guidance on evaluating and adapting to the “direct and indirect physical effects of projected future sea level rise . . . on USACE projects” in NEPA and other planning processes. Indicates that, when evaluating the effects of climate change on projects in NEPA reviews, “methods are needed to compare project performance across a range of possible futures.” Identifies data and tools that can be used for such comparison.
U.S. State and Local Government Guidance		
Massachusetts Executive Office of Energy and Environmental Affairs	Draft MEPA Climate Adaptation and Resiliency Policy (2015) ³³³	Provides guidance on assessing climate impacts in environmental reviews under MEPA. Establishes a framework for assessing “the risk and vulnerabilities of a project or action under reasonably foreseeable scenarios and conditions associated with climate change.” Focuses on “impacts associated with sea level rise, [changes in] the amount, frequency and timing of precipitation, and increases in average temperatures and the frequency of extreme temperature events.”
	Interim Protocol on Climate Adaptation and Resiliency (2021) ³³⁴	Requires the proponents of projects subject to environmental review under MEPA to provide specified information “to assist in evaluation of a project’s climate risks and adaptation strategies.” States that project proponents should “utilize the best available climate science data and projections for Massachusetts in evaluating risks and impacts associated with sea level rise, [changes in] the amount, frequency and timing of precipitation, and increases in average temperature [and] frequency of extreme events.”
Minnesota Environmental Quality Board	Environmental Review Advisory Panel Report (2018) ³³⁵	Recommends that environmental reviews under the Minnesota Environmental Policy Act assess “the project’s adaptation planning and emission mitigation opportunities.” Further recommends that project proponents be required to “provide climate impact information” to inform the assessment.
	Revised Environmental Assessment Worksheet (EAW) Guidance: Developing a Carbon Footprint and Incorporating Climate Adaptation and Resilience (2022) ³³⁶	Provides guidance on assessing “[h]ow climate change may influence [the] environmental effects [of a project] and potential adaptations to reduce risk and increase resilience” in environmental reviews under the Minnesota Environmental Policy Act. Identifies key climate change trends that should be considered and recommends using “historic climate trends data for conditions at the start of the project, and projected (future) climate data for conditions during the life of the project.” Identifies tools and data for use in the analysis.

332 U.S. ARMY CORPS OF ENGINEERS, *supra* note 129.

333 MASS. EXEC. OFF. OF ENERGY & ENV’T AFFAIRS, *supra* note 176.

334 MASS. EXEC. OFF. OF ENERGY & ENV’T AFFAIRS, *supra* note 202.

335 MINN. ENVTL. QUALITY BD., ENVIRONMENTAL REVIEW ADVISORY PANEL (2018), <https://perma.cc/L9QX-HZAB>.

336 MIN. ENVTL. QUALITY BD., REVISED ENVIRONMENTAL ASSESSMENT WORKSHEET (EAW) GUIDANCE: DEVELOPING A CARBON FOOTPRINT AND INCORPORATING CLIMATE ADAPTATION AND RESILIENCE (2022), <https://perma.cc/N5BW-QDBY>.

Issuing Body	Document Title	Description
U.S. State and Local Government Guidance (cont.)		
New York State Department of Environmental Conservation	Chapter 5: Environmental Impact Statements, in The SEQR Handbook (4th edition) (2020) ³³⁷	Notes that regulations implementing SEQR require “climate change impacts [to] be considered in” environmental reviews. Identifies key climate impacts that should be analyzed in environmental reviews and offers recommendations for conducting the analysis. Identifies resilience measures to reduce the impacts of climate change on projects.
New York City Mayor’s Office of Environmental Coordination	Chapter 18: Greenhouse Gas Emissions and Climate Change, in CEQR Technical Manual (2020) ³³⁸	States that “[t]he City has determined that consideration of [greenhouse gas] emissions is appropriate” in environmental reviews. States that it may also “be appropriate to provide a qualitative discussion of the potential effects of climate change on a proposed project in environmental review.” Offers specific recommendations for evaluating risks from sea level rise, increases in storm surge, and coastal flooding and links to relevant datasets and mapping tools.
Washington Department of Transportation	Guidance for NEPA and SEPA Project-Level Climate Change Evaluations (2017) ³³⁹	Directs staff “to examine available information about climate trends and use the results of [the Department’s] assessment of vulnerable infrastructure” when conducting environmental reviews of transportation projects under the Washington State Environmental Policy Act. Identifies key climate impacts that should be considered and provides a checklist for assessing how those impacts will affect the project under review. Provides specific guidance on evaluating “whether the effects of a proposed project on environmental resources and on vulnerable populations will be exacerbated by climate change related vulnerabilities.”

337 N.Y. DEP’T OF ENV’T CONSERVATION, *supra* note 176.

338 N.Y.C. MAYOR’S OFFICE OF ENVTL. COORDINATION, CITY ENVIRONMENTAL QUALITY REVIEW TECHNICAL MANUAL (2020), <https://perma.cc/H7Z8-GMLY>.

339 WASH. STATE DEP’T OF TRANSP., *supra* note 180.

Table 2: Guidance on Assessing Climate Risks in Infrastructure Planning, Design, Construction, Operation, and Maintenance (select materials published by government entities since 2015)

Issuing Body	Document Title	Description
U.S. Federal Agency Guidance		
Department of Energy	Climate Change & The Electricity Sector: Guide for Climate Change Resilience Planning (2016) ³⁴⁰	Provides a step-by-step guide for as-sessing the vulnerability of electricity infrastructure to climate change and evaluating measures to enhance the infrastructure's climate resilience.
	Vulnerability Assessments and Resilience Planning Guidance (2021) ³⁴¹	Outlines a climate change vulnerability assessment and resilience planning process that can be used to identify and manage climate-related risks to Department assets and operations.
Department of Energy, National Renewable Energy Laboratory	Power Sector Resilience Planning Guidebook: A Self-Guided Reference for Practitioners (2019) ³⁴²	Provides guidance on evaluating climate and other risks to the energy system and identifying and prioritizing responses.
Department of Defense	Regional Sea Level Scenarios for Coastal Risk Management: Managing the Uncertainty of Future Sea Level Change and Extreme Water Levels for Department of Defense Coastal Sites Worldwide (2016) ³⁴³	Provides guidance on using scenario analysis to assess the vulnerability of coastal facilities to sea level rise. Discusses approaches to planning for, and managing, vulnerabilities in the context of uncertainty.
Department of the Interior, National Park Service	Planning for a Changing Climate: Climate-Smart Planning and Management in the National Park Service (2021) ³⁴⁴	Outlines a six-step process for identifying climate-related risks to, and developing climate adaptation strategies for, National Park Service resources and assets. Includes a discussion of climate-related risks to National Park Service facilities infrastructure (e.g., buildings and roads) and examples of adaptation strategies to mitigate and manage those risks.

340 U.S. DEP'T OF ENERGY, *supra* note [16].

341 U.S. DEP'T OF ENERGY, VULNERABILITY ASSESSMENTS AND RESILIENCE PLANNING GUIDANCE (2021), <https://perma.cc/W5ZU-R2AW>.

342 U.S. DEP'T OF ENERGY NTL. RENEWABLE ENERGY LAB. & U.S. AGENCY FOR INT'L. DEV., POWER SECTOR RESILIENCE PLANNING GUIDEBOOK: A SELF-GUIDED REFERENCE FOR PRACTITIONERS (2019), <https://perma.cc/8QAP-QHNU>.

343 U.S. DEP'T OF DEFENSE, REGIONAL SEA LEVEL SCENARIOS FOR COASTAL RISK MANAGEMENT: MANAGING THE UNCERTAINTY OF FUTURE SEA LEVEL CHANGE AND EXTREME WATER LEVELS FOR DEPARTMENT OF DFEFENSE COASTAL SITES WORLDWIDE (2016), <https://perma.cc/64YP-J9BH>.

344 U.S. DEP'T OF THE INTERIOR, NAT'L PARK SERV., PLANNING FOR A CHANGING CLIMATE: CLIMATE-SMART PLANNING AND MANAGEMENT IN THE NATIONAL PARK SERVICE (2021), <https://perma.cc/WPD5-D986>.

Issuing Body	Document Title	Description
U.S. Federal Agency Guidance (cont.)		
Department of Transportation, Federal Highway Administration	Highways in the Coastal Environment (3rd edition) (2020) ³⁴⁵	Identifies tools for evaluating risks to coastal highways from sea level rise and extreme events and guidance on addressing those risks in highway planning, design, and operation.
	Vulnerability Assessment and Adaptation Framework (3rd edition) (2020) ³⁴⁶	Provides guidance on assessing the vulnerability of transportation infrastructure to climate impacts and integrating climate adaptation considerations into transportation decision-making.
	Transportation Infrastructure Resiliency: A Review of Practices in Denmark, the Netherlands, and Norway (2017) ³⁴⁷	Discusses international best practice for integrating climate projections into highway planning, with a particular focus on approaches for managing uncertainty.
	Synthesis of Approaches for Addressing Resilience in Project Development (2017) ³⁴⁸	Provides guidance on using climate change data in transportation project planning and engineering assessments.
	Highways in the River Environment: Floodplains, Extreme Events, Risk, and Resilience (2016) ³⁴⁹	Provides guidance and tools for assessing climate-related risks to transportation facilities in riverine environments.
	Climate Change Adaptation Guide for Transportation Systems Management, Operations, and Maintenance (2015) ³⁵⁰	Provides guidance and tools on evaluating how the impacts of climate change will affect transportation management, operations, and management and options for enhancing the resilience of transportation infrastructure.
Department of Transportation – John A. Volpe National Transportation Systems Center	Integrating Climate Change in Transportation and Land Use Scenario Planning: An Example from Central New Mexico (2015) ³⁵¹	Provides an example of the use of scenario analysis to evaluate the impacts of climate change in transportation and land use planning processes. Focuses on climate impacts on transportation and land use in the Albuquerque region of New Mexico.

345 DEP'T OF TRANSP., FED. HIGHWAY ADMIN., HIGHWAYS IN THE COASTAL ENVIRONMENT (3rd Ed.) (2020), <https://perma.cc/3BAL-BNSZ>.

346 DEP'T OF TRANSP., FED. HIGHWAY ADMIN., VULNERABILITY ASSESSMENT AND ADAPTATION FRAMEWORK (3rd Ed.) (2017), <https://perma.cc/UH8F-GEZQ>.

347 DEP'T OF TRANSP., FED. HIGHWAY ADMIN., TRANSPORTATION INFRASTRUCTURE RESILIENCY: A REVIEW OF PRACTICES IN DENMARK, THE NETHERLANDS, AND NORWAY (2017), <https://perma.cc/6M5Z-7FZ2>.

348 DEP'T OF TRANSP., FED. HIGHWAY ADMIN., SYNTHESIS OF APPROACHES FOR ADDRESSING RESILIENCE IN PROJECT DE (2017), <https://perma.cc/7ECQ-NZQB>.

349 DEP'T OF TRANSP., FED. HIGHWAY ADMIN., HIGHWAYS IN THE RIVER ENVIRONMENT – FLOODPLAINS, EXTREME EVENTS, RISK, AND RESILIENCE (2016), <https://perma.cc/X6DH-D7PJ>.

350 DEP'T OF TRANSP., CLIMATE CHANGE ADAPTATION GUIDE FOR TRANSPORTATION SYSTEMS MANAGEMENT, OPERATIONS, AND MAINTENANCE (2015), <https://perma.cc/2VXM-ZTD3>.

351 DEP'T OF TRANSP., JOHN A. VOLPE NAT'L TRANSP. SYSTEMS CENTER, INTEGRATING CLIMATE CHANGE IN TRANSPORTATION AND LAND USE SCENARIO PLANNING: AN EXAMPLE FROM CENTRAL NEW MEXICO (2015), <https://perma.cc/6WYG-7ZFD>.

Issuing Body	Document Title	Description
U.S. Federal Agency Guidance (cont.)		
Environmental Protection Agency	Planning Framework for a Climate-Resilient Economy (2016) ³⁵²	Provides guidance to local governments on assessing how community assets will be affected by climate change and the associated economic impacts.
	Being Prepared for Climate Change: Checklists of Potential Climate Change Risks (2021) ³⁵³	Explains how different climate impacts could affect different environmental resources and provides a checklist for evaluating effects.
General Services Administration	Climate Risk Management: Workshop Process (undated) ³⁵⁴	Outlines a process for using workshops to assess climate-related risks to, and develop strategies to enhance the climate resilience of, government-owned property and supply chains.
U.S. Agency for International Development	Climate Vulnerability Assessment: An Annex to the USAID Climate-Resilient Development Framework (2016) ³⁵⁵	Provides guidance on conducting climate vulnerability assessments and identifies publicly accessible repositories of historical climate data and climate projections.
U.S. State and Local Government Guidance		
California Public Utilities Commission	Climate Adaptation in the Electric Sector: Climate Vulnerability Assessments and Resilience Plans (2016) ³⁵⁶	Provides guidance on assessing the vulnerability of electricity infrastructure to climate change and evaluating measures to enhance the infrastructure's climate resilience.
California Natural Resources Agency & Ocean Protection	State of California Sea-Level Rise Guidance (2018) ³⁵⁷	Outlines a methodology for state and local governments to assess the risks associated with sea level rise in their planning, permitting, and investment decisions.
California Office of Emergency Services	California Adaptation Planning Guide (2020) ³⁵⁸	Outlines a four-phase process for local governments to assess vulnerabilities to climate change and develop resilience plans.

352 ENVTL. PROTECTION AGENCY, PLANNING FRAMEWORK FOR A CLIMATE-RESILIENT ECONOMY (2016), <https://perma.cc/W382-23QN>.

353 ENVTL. PROTECTION AGENCY, BEING PREPARED FOR CLIMATE CHANGE: CHECKLISTS OF POTENTIAL CLIMATE CHANGE RISKS (2021), <https://perma.cc/NL8H-2WQC>.

354 GENERAL SERVICES ADMINISTRATION, *Climate Risk Management*, <https://perma.cc/R7PC-UEK2> (last visited Dec. 15, 2021).

355 U.S. AGENCY FOR INT'L DEV., CLIMATE VULNERABILITY ASSESSMENT: AN ANNEX TO THE USAID CLIMATE-RESILIENT DEVELOPMENT FRAMEWORK (2016), <https://perma.cc/ERW5-XFTB>.

356 KRISTIN RALFF-DOUGLAS, CAL. PUB. UTILS. COMM'N, CLIMATE ADAPTATION IN THE ELECTRIC SECTOR: VULNERABILITY ASSESSMENTS AND RESILIENCE PLANS (2016), <https://perma.cc/29MD-XWEE.E>

357 CAL. NAT. RES. AGENCY & OCEAN PROT. COUNCIL, STATE OF CALIFORNIA SEA-LEVEL RISE GUIDANCE (2018), <https://perma.cc/Y6UH-69D4>.

358 CAL. OFFICE OF EMERGENCY MGMT., CAL. ADAPTATION PLANNING GUIDE (2020), <https://perma.cc/84GK-X2UW>.

Issuing Body	Document Title	Description
U.S. State and Local Government Guidance (cont.)		
Colorado Department of Local Affairs, Resiliency Office	Colorado Resiliency Playbook (2019) ³⁵⁹	Identifies processes through which state agencies can integrate climate resilience considerations into their planning and decision-making and identifies relevant tools and other resources.
Delaware Department of Natural Resources and Environmental Control	Avoiding and Minimizing Risk of Flood Damage to State Assets: A Guide for Delaware State Agencies (2016) ³⁶⁰	Outlines a set of principles and step-by-step instructions for integrating flood risk, including new risks posed by climate change, into project planning.
Florida Department of Environmental Protection	Florida Adaptation Planning Guidebook (2018) ³⁶¹	Provides guidance to local governments on assessing the vulnerability of community infrastructure to sea level rise and developing resilience plans.
Massachusetts Department of Transportation	A Proposed Method for Assessing the Vulnerability of Road-Stream Crossings to Climate Change: Deerfield River Watershed Pilot (2018) ³⁶²	Provides a framework for identifying and ranking climate-related risks to road-stream crossings. Focuses on risks to infrastructure in the Deerfield River Watershed but concludes that the framework could “be implemented beyond the original study area.”
Massachusetts – City of Boston	Climate Resiliency Review Policy (2017) ³⁶³	Provides a checklist for determining whether climate impacts have been adequately considered and addressed in the planning and design of construction projects.
New Jersey Department of Environmental Protection	Resilient NJ: Local Planning for Climate Change Toolkit (undated) ³⁶⁴	Provides a step-by-step guide for local governments to assess their vulnerability to climate change and evaluate solutions to enhance resilience. Includes links to climate data, mapping tools, worksheets, templates, and other resources.

359 Co. DEP’T OF LOCAL AFFAIRS, RESILIENCY OFFICE, COLORADO RESILIENCY PLAYBOOK (2019), <https://perma.cc/ALU2-XRYK>

360 DE. DEP’T OF NATURAL RES. AND ENVTL. CONTROL, AVOIDING AND MINIMIZING RISK OF FLOOD DAMAGE TO STATE ASSETS: A GUIDE FOR DELAWARE STATE AGENCIES (2016), <https://perma.cc/Q4XC-HB4D>.

361 FL. DEP’T ENVTL. CONSERVATION, FLORIDA ADAPTATION PLANNING GUIDEBOOK (2018), <https://perma.cc/ZK52-L73Y>.

362 Mass. Dep’t of Transp., A Proposed Method for Assessing the Vulnerability of Road-Stream Crossings to Climate Change: Deerfield River Watershed Pilot (2018),

363 BOSTON PLANNING & DEV. AGENCY, CLIMATE RESILIENCY REVIEW POLICY (2017), <https://perma.cc/K8YV-TQDB>.

364 N.J. Dep’t of Env’t Prot., *Resilient NJ: Local Planning for Climate Change Toolkit*, <https://perma.cc/7TS8-V5CG> (last visited Jan. 22, 2022).

Issuing Body	Document Title	Description
U.S. State and Local Government Guidance (cont.)		
New York Department of Transportation	Climate Vulnerability and Economic Assessment for At-Risk Transportation Infrastructure in the Lake Champlain Basin, New York (2015) ³⁶⁵	Provides a framework for assessing the vulnerability of transportation infrastructure to climate change.
Oregon Department of Land Conservation and Development	State Agency Climate Adaptation Framework (2021) ³⁶⁶	Identifies key risks posed by climate change and outlines a framework through which state and local agencies can identify and evaluate resilience strategies.
Wisconsin Department of Natural Resources	Coastal Resilience Issues / Impacts / Strategies Table (2018) ³⁶⁷	Lists key climate impacts occurring or expected to occur in Wisconsin, explains how each climate impact will affect different types of coastal infrastructure, and identifies strategies to enhance infrastructure resilience.

365 N.Y. DEP'T OF TRANSP., CLIMATE VULNERABILITY AND ECONOMIC ASSESSMENT FOR AT-RISK TRANSPORTATION INFRASTRUCTURE IN THE LAKE CHAMPLAIN BASIN, NEW YORK (2015), <https://perma.cc/UNY9-HQFH>.

366 OR. DEP'T OF LAND CONSERVATION & DEV., 2021 STATE AGENCY CLIMATE CHANGE ADAPTATION FRAMEWORK (2021), <https://perma.cc/DW3P-5HGD>.

367 WISCONSIN DEPARTMENT OF NATURAL RESOURCE, INITIATIVE ON CLIMATE CHANGE IMPACTS, WICCI COASTAL RESILIENCE ISSUES / IMPACTS / STRATEGIES TABLE (2018), <https://perma.cc/2GED-5T8V>.

APPENDIX 3: CHECKLIST OF CLIMATE RISK CONSIDERATIONS FOR ENERGY INFRASTRUCTURE

The table below lists key climate impacts that could affect the construction or operation of energy projects and/or alter their environmental outcomes. The table provide a useful starting point for federal agencies to identify climate-related risks that require evaluation in environmental reviews under NEPA. The tables may be incomplete and thus we recommend that federal agencies also consult with scientists and other stakeholders to ensure they are conducting a comprehensive analysis.

Climate Impact	Effect on Project and Environmental Outcomes
Coal, Oil, and Gas Development	
Water stress: Changes in temperature and precipitation will affect hydrologic conditions, water temperature, and water quality. Water stress may occur due to drier and hotter conditions. Increases in water demand from other sources may exacerbate water stress.	<ul style="list-style-type: none"> ● Potential reduction in water resources available for mining/drilling operations ● Cumulative effects of project, other water uses, and climate change on watershed
Extreme precipitation, storms, flooding: Increases in the frequency and/or severity of extreme precipitation and storms may exacerbate flood risk.	<ul style="list-style-type: none"> ● Damage to infrastructure ● Accidents/release of hazardous substances ● Risk to workers
Extreme heat: Climate change will increase the frequency of heat waves and high temperature days.	<ul style="list-style-type: none"> ● Effect on mining/drilling operations ● Risk to workers
Extreme cold: Climate change may increase the frequency and/or severity of cold waves.	<ul style="list-style-type: none"> ● Effect on mining/drilling operations ● Risk to workers
Arctic impacts: Rising temperatures will melt snow, ice, and permafrost and cause land subsidence in the Arctic.	<ul style="list-style-type: none"> ● Damage to infrastructure ● Accidents/release of hazardous substances
Habitat stress: Changing bioclimatic conditions may put stress on natural ecosystems and biotic resources.	<ul style="list-style-type: none"> ● Cumulative effects of project, other land uses, and climate change on landscape³⁶⁸ ● Cumulative risk to endangered species
LNG Terminals	
Coastal risks and extreme weather: Sea level rise can contribute to flooding, coastal erosion, and saltwater intrusion. Climate change will also cause increases in the frequency and/or severity of hurricanes and severe coastal weather. Storm surge will be higher due to combined effects of sea level rise and more intense storms.	<ul style="list-style-type: none"> ● Damage to infrastructure ● Accidents/release of LNG ● Cumulative effects of project, other land uses, and climate change on coastline

³⁶⁸ The analysis of cumulative landscape effects should take place early in the planning process, ideally when agencies are developing resource and land management plans.

Climate Impact	Effect on Project and Environmental Outcomes
LNG Terminals (cont.)	
Extreme heat: Climate change will increase the frequency of heat waves and high temperature days.	<ul style="list-style-type: none"> ● Effect on mining/drilling operations ● Risk to workers
Extreme cold: Climate change may increase the frequency and/or severity of cold waves.	<ul style="list-style-type: none"> ● Effect on mining/drilling operations ● Risk to workers
Arctic impacts: Rising temperatures will melt snow, ice, and permafrost and cause land subsidence in the Arctic.	<ul style="list-style-type: none"> ● Damage to infrastructure ● Accidents/release of natural gas
Habitat stress: Changing bioclimatic conditions may put stress on natural ecosystems and biotic resources in project area.	<ul style="list-style-type: none"> ● Cumulative effects of project, other land uses, and climate change on coastline ● Cumulative risk to endangered species
Natural Gas Pipelines	
Extreme precipitation, storms, flooding: Increases in the frequency and/or severity of extreme precipitation and storms may exacerbate flood risk.	<ul style="list-style-type: none"> ● Damage to pipeline infrastructure ● Accidents/releases of natural gas
Extreme cold: Climate change may increase the frequency and/or severity of cold waves.	<ul style="list-style-type: none"> ● Pipeline “freeze offs” and associated shutdowns
Arctic impacts: Rising temperatures will melt snow, ice, and permafrost and cause land subsidence in the Arctic.	<ul style="list-style-type: none"> ● Damage to pipeline infrastructure ● Accidents/releases of natural gas
Coastal risks and extreme weather: Sea level rise can contribute to flooding, coastal erosion, and saltwater intrusion. Climate change will also cause increases in the frequency and/or severity of hurricanes and severe coastal weather. Storm surge will be higher due to combined effects of sea level rise and more intense storms.	<ul style="list-style-type: none"> ● Damage to pipeline infrastructure ● Accidents/releases of natural gas
Electricity Transmission and Distribution Facilities	
Extreme winds: Climate change may affect the timing and severity of extreme wind events, tornadoes, and hurricanes, which can topple power infrastructure.	<ul style="list-style-type: none"> ● Damage to infrastructure ● Power outages ● Potential for ignition of wildfires
Increases in average temperatures, extreme heat, and humidity: Climate change will increase average temperatures as well as the frequency of heat waves and high temperature days. Increases in temperature will also cause increases in peak electricity demand.	<ul style="list-style-type: none"> ● Effect on infrastructure ● Effect on power supply and outages ● Risk to workers, especially during high “wet bulb” temperature conditions
Extreme cold: Climate change may increase the frequency and/or severity of cold waves, ice storms, and other severe winter conditions.	<ul style="list-style-type: none"> ● Effect on infrastructure ● Effect on power supply and outages ● Risk to workers
Extreme precipitation, storms, and flooding: Climate change will increase the frequency and/or severity of extreme precipitation and exacerbate flood risk.	<ul style="list-style-type: none"> ● Effect on infrastructure ● Effect on power supply and outages ● Risk to workers

Climate Impact	Effect on Project and Environmental Outcomes
Electricity Transmission and Distribution Facilities (cont.)	
<p>Wildfires: Changing temperature and precipitation patterns will contribute to drier conditions and heightened wildfire risk.</p>	<ul style="list-style-type: none"> ● Effect on infrastructure ● Power outages compounding wildfire risk (e.g., impaired notification systems)
<p>Coastal risks and extreme weather: Sea level rise can contribute to flooding, coastal erosion, and saltwater intrusion. Climate change will also cause increases in the frequency and/or severity of hurricanes and severe coastal weather. Storm surge will be higher due to combined effects of sea level rise and more intense storms.</p>	<ul style="list-style-type: none"> ● Effect on infrastructure and operation ● Effect on power supply and outages ● Risk to workers
<p>Habitat stress: Changing bioclimatic conditions may put stress on natural ecosystems and biotic resources.</p>	<ul style="list-style-type: none"> ● Cumulative effects of project, other land uses, and climate change on landscape ● Cumulative risk to endangered species
Nuclear Electric Generating Facilities	
<p>Extreme precipitation, storms, and flooding: Climate change will increase the frequency and/or severity of extreme precipitation and exacerbate flood risk.</p>	<ul style="list-style-type: none"> ● Damage to infrastructure (including waste storage) ● Effect on electric generation ● Potential for nuclear accidents
<p>Increases in average temperatures, extreme heat, and humidity: Climate change will increase average temperatures as well as the frequency of heat waves and high temperature days. Increases in temperature will also cause increases in peak electricity demand.</p>	<ul style="list-style-type: none"> ● Reduced operating efficiency ● Effect on cooling facilities ● Other effects on plant operation (e.g., due to higher electricity demand)
<p>Water stress: Changes in temperature and precipitation will affect hydrologic conditions, water temperature, and water quality. Water stress may occur due to drier and hotter conditions. Increases in water demand from other sources may exacerbate water stress.</p>	<ul style="list-style-type: none"> ● Effect on electric generation and cooling ● Cumulative effects of project, other water uses, and climate change on water-shed
<p>Coastal risks and extreme weather: Sea level rise can contribute to flooding, coastal erosion, and saltwater intrusion. Climate change will also cause increases in the frequency and/or severity of hurricanes and severe coastal weather. Storm surge will be higher due to combined effects of sea level rise and more intense storms.</p>	<ul style="list-style-type: none"> ● Damage to infrastructure (power generation or waste storage) ● Effect on electric generation ● Accidents/release of hazardous substances
<p>Habitat stress: Changing bioclimatic conditions may put stress on natural ecosystems and biotic resources.</p>	<ul style="list-style-type: none"> ● Cumulative effects of project, other land uses, and climate change on landscape ● Cumulative risk to endangered species

Climate Impact	Effect on Project and Environmental Outcomes
Hydroelectric Generating Facilities	
<p>Hydrologic changes: Changes in temperature and precipitation patterns will affect hydrologic conditions, potentially causing:</p> <ul style="list-style-type: none"> ● Drier conditions and water stress ● Wetter conditions, increases in flow, and flooding ● Changes in the timing of water flows ● Increases in erosion and sediment loading ● Evaporative loss from water bodies ● Power outages compounding wildfire risk (e.g., impaired notification systems) 	<ul style="list-style-type: none"> ● Potential impacts on reservoir and hydroelectric production: <ul style="list-style-type: none"> - Drier conditions: Reduced reservoir volume and hydroelectric production - Wetter conditions: Possible need to increase discharges; possible downstream effects; risks to infrastructure - Shift from snow to rain: Reduced hydroelectric production at facilities that rely on snowmelt ● Cumulative effects of hydroelectric project, other water uses, and climate change on affected water bodies
<p>Habitat stress: Changing bioclimatic conditions may put stress on natural ecosystems and biotic resources.</p>	<ul style="list-style-type: none"> ● Cumulative effects of project, other land uses, and climate change on landscape ● Cumulative risk to endangered species
Solar Energy Development	
<p>Increases in average temperatures, extreme heat, and humidity: Climate change will increase average temperatures as well as the frequency of heat waves and high temperature days. Increases in temperature will also cause increases in peak electricity demand.</p>	<ul style="list-style-type: none"> ● Reduced operating efficiency ● Other effects on operation (e.g., due to changes in electricity demand)
<p>Wildfires: Changing temperature and precipitation patterns will contribute to drier conditions and heightened wildfire risk.</p>	<ul style="list-style-type: none"> ● Damage to solar infrastructure ● Impact of smoke on solar generation
<p>Habitat stress: Changing bioclimatic conditions may put stress on natural ecosystems and biotic resources.</p>	<ul style="list-style-type: none"> ● Cumulative effects of project, other land uses, and climate change on landscape ● Cumulative risk to endangered species
Wind Energy Development	
<p>Increases in average temperatures, extreme heat, and humidity: Climate change will increase average temperatures as well as the frequency of heat waves and high temperature days. Increases in temperature will also cause increases in peak electricity demand.</p>	<ul style="list-style-type: none"> ● Effects on operation (e.g., due to changes in electricity demand)
<p>Extreme cold: Climate change may increase the frequency and/or severity of cold waves, ice storms, and other severe winter conditions.</p>	<ul style="list-style-type: none"> ● Effect on infrastructure ● Effect on power supply and outages
<p>Extreme wind: Climate change may affect the timing and severity of extreme wind events, tornadoes, and hurricanes.</p>	<ul style="list-style-type: none"> ● Damage to infrastructure ● Power outages
<p>Habitat stress: Changing bioclimatic conditions may put stress on natural ecosystems and biotic resources.</p>	<ul style="list-style-type: none"> ● Cumulative effects of project, other land uses, and climate change on landscape ● Cumulative risk to endangered species

Climate Impact	Effect on Project and Environmental Outcomes
Geothermal Energy Development	
<p>Water stress: Changes in temperature and precipitation will affect hydrologic conditions, water temperature, and water quality. Water stress may occur due to drier and hotter conditions. Increases in water demand from other sources may exacerbate water stress.</p>	<ul style="list-style-type: none"> ● Effect on operations (e.g., reduction in water available to inject into depleted geothermal reservoirs) ● Cumulative effects of project, other water uses, and climate change on watershed
<p>Increases in average temperatures, extreme heat, and humidity: Climate change will increase average temperatures as well as the frequency of heat waves and high temperature days. Increases in temperature will also cause increases in peak electricity demand.</p>	<ul style="list-style-type: none"> ● Effect on operation (e.g., due to changes in electricity demand)
<p>Habitat stress: Changing bioclimatic conditions may put stress on natural ecosystems and biotic resources.</p>	<ul style="list-style-type: none"> ● Cumulative effects of project, other land uses, and climate change on landscape ● Cumulative risk to endangered species

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