Assessing the Impacts of Climate Change on the Built Environment: A Framework for Environmental Reviews

by Jessica Wentz

Jessica Wentz is an Associate Director and Postdoctoral Fellow at Columbia Law School's Sabin Center for Climate Change Law.

Summary

Federal agencies are beginning to incorporate descriptions of climate change impacts into environmental reviews for buildings and infrastructure, but there is no consistent methodology for evaluating these impacts and mitigating any foreseeable risks to the project or affected environment. This Article asserts that an assessment of climate-related risks and adaptation options falls within the scope of considerations that should be addressed under the National Environmental Policy Act and similar laws. It concludes with a set of recommended protocols for identifying the impacts of climate change on projects and their affected environment, evaluating physical and environmental risks, and selecting appropriate mitigation measures.

I. Introduction

Sea-level rise, heavy downpours, extreme heat, and other climate-related phenomena are already damaging buildings and infrastructure, and these damages are projected to increase with continued climate change. The potential impacts of climate change should therefore be considered in the location and design of major infrastructure projects. This Article recommends that existing procedures for environmental impact assessment (EIA) can and should be used to evaluate climate-related risks and adaptation options for such projects. Such an approach would be more pragmatic than developing a separate platform for conducting climate risk and vulnerability assessments, and is consistent with the legal requirements of the National Environmental Policy Act (NEPA)[1] and similar statutes. Many federal agencies have already begun to consider climate change impacts in their environmental reviews, but there is no consistent methodology for evaluating such impacts and mitigating any risks to the project or affected environment. The Article offers a set of model protocols for assessing the impact of climate change on infrastructure projects and selecting appropriate risk mitigation measures.

Recognizing the implications of climate change on the construction, maintenance, and operation of buildings and infrastructure, the Barack Obama Administration has issued several executive orders directing federal agencies to prepare for the impacts of climate change on federal operations and facilities.[2] The Council on Environmental Quality (CEQ) has also issued draft guidance directing federal agencies to account for these impacts when conducting environmental reviews under NEPA.[3]

The EIA process provides a useful framework for addressing the risks of climate change in the context

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1. 42 U.S.C. §§4321-4370f, ELR Stat. NEPA §§2-209.
2. Exec. Order No. 13693: Planning for Federal Sustainability in the Next Decade (2015); Exec. Order No. 13690: Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input (2015); Exec. Order No. 13677: Climate-Resilient International Development (2014); Exec. Order No. 13653: Preparing the United States for the Impacts of Climate Change (2013); The President's Climate Action Plan (2013); Exec. Order No. 13547: Stewardship of the Ocean, Our Coasts, and the Great Lakes (2010).
3. Council on Envtl. Quality (CEQ), 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. 77802 (proposed Dec. 24, 2014) [hereinafter CEQ 2014 Draft Guidance].

of specific projects.[4] Through EIA, decisionmakers can assess the potential impacts of climate change on a proposed project and the surrounding environment before the project is implemented, thus allowing the decisionmaker to modify design features, develop alternatives, or adopt other measures to mitigate climate-related risks. The publication of EIA documents also provides a collaborative mechanism through which agencies and other stakeholders can learn about the impacts of climate change and make recommendations on appropriate adaptation and resilience measures.

Federal agencies have begun to incorporate climate-related considerations into their NEPA review processes, and have taken the first steps toward addressing the impacts of climate change on proposed federal projects. However, the scope and depth of this analysis vary substantially across different agencies and projects, and it is still very rare for an agency to conduct an in-depth assessment of how climate change may impact a project and its surrounding environment.

CEQ's latest draft guidance directs agencies to consider the built environment during NEPA reviews by incorporating climate change projections into their assessments of baseline environmental conditions and environmental impacts from proposed actions. However, the draft guidance does not contain detailed instructions on how agencies should conduct this analysis. More specific guidelines or protocols would help to promote consistency in agency practice and ensure that federal agencies are adequately accounting for the impacts of climate change when conducting these assessments. To fill the gap, Columbia University's Sabin Center for Climate Change Law has developed a set of model protocols for assessing the impacts of climate change on the built environment under NEPA and state EIA laws. This Article summarizes the empirical and legal research underpinning the project and presents suggested model protocols.

II. Climate Change and the Built Environment

Climate change will have far-reaching impacts on buildings and infrastructure. The risks posed by climate change in this context are threefold. Climate-related phenomena such as flooding and heat waves can directly impair the performance and longevity of buildings and infrastructure. These phenomena can also alter the nature and magnitude of environmental impacts associated with a particular project, such as surface runoff and releases of hazardous substances. Finally, climate change can increase the vulnerability of the surrounding environment (human and natural) to the environmental impacts of a project. For example, prolonged drought can make aquatic ecosystems more vulnerable to water withdrawals or discharges from a project. Local changes in climate and ecosystem functioning can also make certain species more vulnerable to any disruptive impacts caused by a building project.

The Third National Climate Assessment, published by the U.S. Global Change Research Program (USGCRP) in 2014, described the observed and predicted impacts of climate change on different sectors of the U.S. economy. One key finding from the report was that climate change is already affecting much of our nation's infrastructure. USGCRP summarized the observed impacts as follows:

> Sea level rise, storm surge, and heavy downpours, in combination with the pattern of continued development in coastal areas, are increasing damage to U.S. infrastructure including roads, buildings, and industrial facilities, and are also increasing risks to ports and coastal military installations. Flooding along rivers, lakes, and in cities following heavy downpours, prolonged rains, and rapid melting of snowpack is exceeding the limits of flood protection infrastructure designed for historical conditions. Extreme heat is damaging transportation infrastructure such as roads, rail lines, and airport runways.[5]

Based on current greenhouse gas emissions trajectories, it is extremely likely that the scope and severity of these impacts will increase in the coming decades.

III. Rationale and Legal Context for Addressing Climate Change Impacts in EIA

Some concerns have been raised about the feasibility of integrating climate change projections into EIA, given the inherent uncertainty about these projections and the difficulty of downscaling climate models for regional and local impact assessments. But agencies and EIA consultants frequently confront uncertainty during environmental reviews, and there are methodologies that can be employed to conduct meaningful assessments in the context of sig-

4. Many commentators have endorsed the utilization of EIA to assess the impacts of climate change on proposed projects. *See, e.g.*, Teresa Parejo Navajas, *Reverse Environmental Assessment Analysis for the Adaptation of Projects, Plans, and Programs to the Effects of Climate Change in the EU: Evaluation of the Proposal for an EIA Directive* (Columbia Public Law Research Paper No. 14-445, 2015); Sean Capstick et al., *Incorporating Climate Change Impacts Into Environmental Assessments* (Conference of Internat'l Ass'n for Impact Assessment, 2014); Michael B. Gerrard, *Reverse Environmental Impact Analysis: Effect of Climate Change on Projects*, 45 N.Y. LJ. 247 (2012); Shardul Agrawala et al., Organization for Econ. Coop. & Dev. (OECD), *Incorporating Climate Change Impacts and Adaptation in Environmental Impact Assessments: Opportunities and Challenges* (OECD Environmental Working Paper No. 24, 2010) [hereinafter OECD Working Paper No. 24]; European Comm'n, White Paper on Adaptation to Climate Change: Towards a European Framework for Action 13 (2009); Inter-American Dev. Bank, Disaster Risk Management Policy Guidelines (2008); CARICOM, Guide to the Integration of Climate Change Adaptation Into the Environmental Impact Assessment (EIA) Process (2004); CBD & CARICOM, Sourcebook on the Integration of Natural Hazards Into the Environmental Impact Assessment (EIA) Process (2004).

5. U.S. Global Change Research Program (USGCRP), Climate Change Impacts in the United States: The Third National Climate Assessment 13 (2014).

nificant uncertainty.[6] Efforts are also being made to provide downscaled climate data and models that can be easily applied to regional and local impact analysis.[7]

In 2010, the Organization for Economic Cooperation and Development (OECD) published an international survey that found there is "ample scope for employing EIA procedures as a vehicle for enhancing the resilience of projects to the impacts of climate change."[8] The report also found that the project level was "particularly critical for the consideration of climate risks and for incorporating suitable adaptation measures" owing to the long duration of infrastructure projects and the fact that these projects can affect the vulnerability of natural and human systems, leading to maladaptation.[9] The U.S. Government Accountability Office (GAO) reached a similar conclusion in a 2015 report that highlighted the economic risks of climate change and concluded that better vulnerability assessments, planning processes, and physical preparation would be needed to reduce the federal government's fiscal exposure to these risks.[10]

Opponents of incorporating climate change into EIA have also argued that NEPA and similar laws only require (or permit) the assessment of a project's impact on the environment, and not the impact of the environment on the project.[11] The counterpoint to this argument is that the environmental impacts of a project are a consequence of both project design and the environmental conditions in which the project is located (for example, rain falls on a paved surface and creates runoff). An accurate impact assessment thus requires an accurate characterization of the baseline environment. To the extent that climate change may influence that baseline, it should factor into the environmental review process.

Accordingly, decisionmakers should account for the impacts of climate change when describing the natural resources, ecosystems, and communities that will be affected by a project.[12] Decisionmakers should also assess the impacts of climate change on the project itself and whether these impacts may exacerbate any environmental consequences or generate new risks. For example, if sea-level rise or extreme inland precipitation cause or worsen flooding at a hazardous waste management facility, a chemical storage facility, or a nuclear power plant, dangerous materials could be released into the environment. Similarly, rising groundwater levels would have implications for the design of landfills and underground storage facilities, as additional measures may be required to prevent water contamination. It would also be necessary to account for increases in average and extreme precipitation events when designing stormwater and drainage systems. As discussed below, such considerations fit squarely within the scope of analysis required by NEPA and other EIA laws.

There are multiple benefits to be realized from incorporating an assessment of climate change impacts into project-level EIA. The main goal, noted above, would be to facilitate the successful "climate proofing" of projects and to avoid maladaptation to climate change. Such efforts can reduce the risk of adverse environmental consequences and reduce the government's fiscal exposure in the long term. In addition, OECD notes that EIA is a "well consolidated and publicly accepted process in many countries and in bilateral and multilateral development co-operation agencies."[13] Based on these benefits, OECD states that it is probably "more efficient and effective to broaden the scope of existing EIA modalities to include climate change and adaptation considerations, as opposed to establishing and implementing parallel procedures for screening projects for climate change risks."[14]

EIAs are governed by NEPA, state laws, and other statutes. A review of these legal charters supports the argument that climate change should be routinely incorporated into EIAs.

IV. Relevant Federal and State Laws

A. *NEPA*

NEPA requires federal agencies to review the environmental impacts of major proposed actions and prepare an environmental impact statement (EIS) for any action that will have a significant effect on the environment.[15] These statements must describe the affected environment and any direct, indirect, and cumulative impacts accruing from the action and reasonable alternatives.[16] The agency conducting the analysis must make a draft EIS available for public comment and respond to these comments in the

6. For example, NEPA regulations instruct federal agencies on how to address incomplete or unavailable information about the environmental impacts of proposed projects. 40 C.F.R. §1502.22.
7. *See* Jessica Wentz, *Assessing the Impacts of Climate Change on the Built Environment Under NEPA and State EIA Laws: A Survey of Current Practices and Recommendations for Model Protocols, App. A: Informational Resources* (2015), *available at* http://web.law.columbia.edu/climate-change/resources/nepa-and-state-nepa-eis-resource-center/model-eia-protocols.
8. OECD Working Paper No. 24, *supra* note 4, at 3.
9. *Id.* at 8.
10. U.S. Government Accountability Office (GAO), Limiting the Federal Government's Fiscal Exposure by Better Managing Climate Change Risks (2015), *available at* http://www.gao.gov/highrisk/limiting_federal_government_fiscal_exposure/why_did_study. *See also* Risky Business: *The Economic Risks of Climate Change in the United States* (2014), *available at* http://riskybusiness.org/.
11. A California court of appeal has endorsed this viewpoint. *See* Ballona Wetlands Land Trust v. City of Los Angeles, 201 Cal. App. 4th 455 (Cal. Ct. App. 2011). This decision, and other California case law, is discussed in detail below.
12. *See* Jones & Stokes Climate Focus Grp., *Addressing Global Warming in CEQA and NEPA Documents in the Post AB 32 Regulatory Environment* 15 (2007):

> Consider a project that would create a new industrial plant that discharges wastewater into a nearby lake. To determine the possible impacts of the discharge on the water body, one has to characterize the baseline future condition of the lake for the dates that the plant will be in operation. If climate change may potentially change the depth of the lake within the foreseeable future, one could consider the most conservative lake depth for baseline analysis.

13. OECD Working Paper No. 24, *supra* note 4, at 9.
14. *Id.*
15. NEPA §102, 42 U.S.C. §4332.
16. NEPA §102(2)(C), 42 U.S.C. §4332(2)(C); 40 C.F.R. §§1502.14 to 1502.16.

final EIS.[17] The dual purpose of these requirements is to ensure that agencies take a hard look at the potential consequences of their activities and disclose this information to the public—the ultimate goal being to promote better-informed decisionmaking.[18]

CEQ's revised draft guidance on NEPA and climate change instructs agencies to consider "the ways in which a changing climate over the life of the proposed project may alter the overall environmental implications of such actions."[19] Such impacts may include "more frequent and intense heat waves, more severe wildfires, degraded air quality, more heavy downpours and flooding, increased drought, greater sea-level rise, more intense storms, harm to water resources, harm to agriculture, and harm to wildlife and ecosystems."[20] CEQ notes that such considerations are:

> [S]quarely within the realm of NEPA, informing decisions on whether to proceed with and how to design the proposed action so as to minimize impacts on the environment, as well as informing possible adaptation measures to address these impacts, ultimately enabling the selection of smarter, more resilient actions.[21]

The justification for requiring such analysis during NEPA reviews can be traced back to several different statutory and regulatory provisions.

First, NEPA declares a continuing federal policy "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."[22] In accordance with this policy, NEPA directs all federal agencies to conduct their programs in a manner that will "assure 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 or intended consequences," among other things.[23] To accomplish these objectives, it is necessary for agencies to consider whether climate change may compromise the productivity of their activities or exacerbate any environmental and public health threats associated with those activities.

Second, when preparing an EIS under NEPA, agencies must describe the affected environment[24] and assess the environmental impacts of the project and reasonable alternatives (including a "no action" alternative).[25] As noted above, climate change can increase the risk of certain impacts, such as spillage from a hazardous waste containment facility. Climate change can also impact baseline environmental conditions, which would influence the agency's analysis of the affected environment and the "no action" alternative. Thus, CEQ's draft guidance instructs agencies to consider the extent to which climate change may "increase the vulnerability of a resource, ecosystem, human community" within the affected environment of the project, both to establish baseline conditions and to determine if these resources will be more susceptible to impacts or risks posed by the project.[26] The bottom line is that an accurate characterization of environmental impacts requires consideration of the future conditions in which a facility will operate.

Third, the EIS must describe the purpose of and need for the project,[27] the "relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity" and "any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented."[28] If climate change significantly reduces the useful life of a project subject to NEPA or requires extensive repairs (as with a flooded airport, transit system, or housing project), the benefits of the project may be much different than those anticipated in an EIS that was prepared without consideration of these issues. The project may be significantly less productive than otherwise anticipated and additional resources may be needed to maintain its operation. CEQ's draft guidance therefore instructs agencies to examine whether a facility is vulnerable to climate change and implement measures "to avoid the environmental and, as applicable, economic consequences of rebuilding should potential climate change impacts such as sea level rise and more intense storms shorten the projected life of the project."[29]

Fourth and finally, NEPA instructs all federal agencies to "recognize the worldwide and long-range character of environmental problems."[30] The analysis of global climate change and its effect on agency actions clearly fits within the purview of this mandate.

B. Other EIA Laws and Guidelines

Many states have enacted laws with similar requirements for EIA, which are sometimes referred to as "little NEPAs." New York, for example, introduced its State Environmental Quality Review Act (SEQRA) in 1975.[31] The European Union and various foreign jurisdictions have also enacted laws modeled after NEPA. Although an in-depth analysis of these laws is beyond the scope of this Article, the model protocols proposed below could be

17. 40 C.F.R. §§1502.9, 1503.1, 1503.4, 1506.6.
18. Baltimore Gas & Elec. Co. v. Natural Res. Def. Council, Inc., 462 U.S. 87, 97-98, 13 ELR 20544 (1983).
19. CEQ 2014 Draft Guidance, *supra* note 3, 79 Fed. Reg. at 77825.
20. *Id.*
21. *Id.*, 79 Fed. Reg. at 77828-29.
22. NEPA, 42 U.S.C. §4331(a).
23. NEPA, 42 U.S.C. §4331(b)(2), (3).
24. 40 C.F.R. §1502.15.
25. 42 U.S.C. §4332(2)(C)(i)-(iii); 40 C.F.R. §§1502.14, 1502.16.
26. *Id.*
27. 40 C.F.R. §1502.13.
28. 42 U.S.C. §4332(2)(C)(iv), (v).
29. CEQ 2014 Draft Guidance, *supra* note 3, 79 Fed. Reg. at 77829.
30. 42 U.S.C. §4332(2)(F).
31. N.Y. State Environmental Quality Review Act (SEQRA), N.Y. Envtl. Conservation Law (ECL) art. 8.

utilized for environmental reviews conducted under many different EIA regimes.

Several jurisdictions have also promulgated laws, policies, or agency guidance that specifically call for the consideration of climate change effects on actions subject to environmental review. Massachusetts is the only U.S. jurisdiction that has expressly amended its EIA statute to require consideration of climate change effects.[32] Massachusetts has also promulgated draft guidelines for implementing this statutory requirement.[33] And although they have not amended their EIA laws, New York State,[34] New York City,[35] Washington State,[36] and King County, Washington,[37] have all issued policies or guidance documents calling for the consideration of climate change effects and adaptation considerations during environmental reviews (at least for some agencies and some projects).

Notably, California is not included among the U.S. jurisdictions noted above. This is because there has been some controversy as to whether the California Environmental Quality Act (CEQA) requires an evaluation of how climate change will impact a project and its affected environment. In 2007, state lawmakers enacted Senate Bill 97, calling for an amendment of the CEQA guidelines to provide for analysis of "mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions."[38] The revised CEQA guidelines, adopted in a regulatory amendment in 2010, specified that environmental impact reports (EIRs) prepared under CEQA should "evaluate any potentially significant impacts of locating development in other areas susceptible to hazardous conditions (e.g., floodplains, coastlines, wildfire risk areas) as identified in authoritative hazard maps, risks assessments or in land use plans addressing such hazards areas."[39] According to the Governor's Office of Planning and Research, "lead agencies must analyze potentially significant impacts associated with placing projects in hazardous locations, including locations potentially affected by climate change."[40]

However, in the 2011 decision *Ballona Wetlands Land Trust v. City of Los Angeles*, a California court of appeal held that this component of the CEQA guidelines was invalid because "the purpose of an EIR is to identify the significant effects of a project on the environment, not the significant effects of the environment on the project."[41] According to the court, "identifying the effects on the project and its users of locating the project in a particular environmental setting is neither consistent with CEQA's legislative purpose nor required by the CEQA statutes."[42] Thus, the appellate court held that the EIR for a real estate development was not required to discuss the impact of sea-level rise on the project.

Despite the *Ballona Wetlands* decision, California agencies still consider climate risks when conducting environmental reviews under CEQA.[43] There have also been at least two more recent state court decisions holding that consideration of sea-level rise does fall within the scope of CEQA considerations, at least to the extent that it has implications for the environmental consequences of a project. In *Sierra Club v. City of Oxnard*, a California superior court issued a trial order requiring a local government to evaluate the impacts of sea-level rise on a proposed mixed-use development project.[44] In *No Wetlands Landfill Expansion v. County of Marin*, a California court of appeal affirmed a decision holding that a county had properly considered sea-level rise in an EIR for a proposed landfill expansion, even though the landfill was located miles from the ocean, because sea-level rise may impact the level of waterways adjacent to the ocean.[45] Both cases held that *Ballona Wetlands* was not controlling because it did not address whether an EIR should address sea-level rise to the extent that it may alter the affected environment or the environmental impacts of the project.[46] The decision in *City of Oxnard* also questioned the rule in *Ballona Wetlands* that EIRs need not evaluate the significant effects of the environment on the project, noting that land use compatibility is an "integral part of EIR analysis" and a "two-way

32. Mass. Gen. Laws ch. 30, §61, *amended by* Massachusetts Global Warming Solutions Act (GWSA), ch. 298 of the Acts of 2008, §7. *See also* Mass. Code Regs. §11.12(5)(a) ("In considering and issuing permits, licenses, and other administrative approvals and decisions, the respective agency, department, board, commission or authority shall also consider reasonably foreseeable climate change impacts, including additional greenhouse gas emissions, and effects, such as predicted sea level rise.").
33. Commonwealth of Mass., Draft MEPA Climate Change Adaptation and Resiliency Policy (2014).
34. New York State Dep't of Envtl. Conservation (DEC), Commissioner's Policy: Climate Change and DEC Action (2010), *available at* http://www.dec.ny.gov/regulations/65034.html. New York State also adopted the Community Risk and Resiliency Act in 2014, which does not specifically amend SEQRA, but does require the assessment of climate change impacts and risks for certain projects. Similarly, the draft regulations for the Waterfront Revitalization Program will require consideration of sea-level rise and coastal impacts.
35. NYC Mayor's Office of Environmental Coordination (MOEC), City Environmental Quality Review (CEQR) Technical Manual (2014), *available at* http://www.nyc.gov/html/oec/html/ceqr/technical_manual_2014.shtml.
36. Washington State Dep't of Transp., Guidance for NEPA and SEPA Project-Level Climate Change Evaluations (2014), *available at* http://www.wsdot.wa.gov/NR/rdonlyres/BDF7C3DA-4F27-4CD5-8D02-6813027A928B/0/WSDOT_ClimateGuidance.pdf.
37. Climate Impacts Grp., King Cnty., Wash., & ICLEI, Preparing for Climate Change: A Guidebook for Local, Regional, and State Governments (2007), *available at* http://www.cses.washington.edu/db/pdf/snoveretalgb574.pdf.
38. Cal. S.B. 97, §1 (2007), *amending* Cal. Pub. Res. Code. §21083.05.
39. Cal. Code Regs. tit. 14, §15126.2.
40. Cal. Office of Plan. & Research, *CEQA and Climate Change*, http://www.opr.ca.gov/s_ceqaandclimatechange.php.
41. 201 Cal. App. 4th 455, 473 (Cal. Ct. App. 2011).
42. *Id.* at 474.
43. This finding is based on our review of federal EISs located in California, which were prepared in accordance with both NEPA and CEQA and routinely reviewed sea-level rise and other climate change impacts on projects, as well as an independent review of approximately 20 EIRs prepared under CEQA.
44. 2012 WL 7659201 (Cal. Super. Ct. Oct. 15, 2012) (Trial Order).
45. 2014 WL 7036032 (Cal. Ct. App. Dec. 12, 2014).
46. *See No Wetlands Landfill*, 2014 WL 7036032 at *16, n.9 ("*Ballona Wetlands* is distinguishable because, although the EIR may not specifically say so, future sea rise here presumably would not only impact the project but would also impact the environment by contaminating waterways"); *City of Oxnard*, 2012 WL 7659201 at *47 (noting that the project at issue may have significant adverse consequences on the proper inland migration of wetlands and related biota in light of sea-level rise, and this analysis involves "the significant effects of the NSP [northern specific plan] on the environment").

street" that requires consideration of whether a project is located in an area subject to hazards such as sea-level rise.[47]

C. Foreign Jurisdictions

Foreign jurisdictions are also beginning to develop standardized procedures for addressing climate impact considerations. The European Union,[48] Kiribati,[49] and Vanuatu[50] have all expressly amended their EIA laws to require an analysis of climate change effects.[51] Canada[52] and Fiji[53] have also published guidance directing project applicants to conduct such analysis without formally amending their EIA statutes or regulations. Other foreign jurisdictions have signaled their intention to integrate climate considerations within EIA processes in policies and planning documents, but these statements fall short of a legally binding requirement. For example, the Spanish National Climate Change Adaptation Plan of 2006 proposes the development of guidelines and regulations to incorporate climate change impacts into the EIA process, with a special focus on projects in the water sector.[54] The Spanish Ministry of Environment also considers EIA to be an entry point for integrating adaptation considerations into development projects.[55] Other countries that have signaled their intent to incorporate these considerations into EIA processes include Samoa,[56] the Solomon Islands,[57] the Cook Islands,[58] Dominica,[59] St. Lucia,[60] and Bangladesh.[61]

A complete list of existing policies and guidelines for evaluating climate change impacts during EIA is available on the Sabin Center website.[62] These resources were consulted prior to drafting the model protocols set forth below. They include official guidance documents issued by government agencies, as well as technical guides published by intergovernmental and nongovernmental organizations. Notably, many of the documents were published in the absence of any express amendment to EIA laws, based on an understanding that the consideration of how climate change will impact a project and its surrounding environment already fall within the scope of existing EIA requirements.

V. Survey of Federal Practice Under NEPA

The Sabin Center conducted two surveys of federal EISs prepared between 2009 and 2014 to evaluate how these EISs addressed climate-related considerations.[63] During the five-year period, it became increasingly common for federal agencies to acknowledge that climate change may affect a proposed project and its surrounding environment. However, in the absence of final guidance from CEQ, many of the surveyed EISs did not address any potential climate change impacts. In the EISs that did consider such impacts, the scope and depth of the analysis varied substantially, and it was rare for an agency to conduct an in-depth assessment of how climate change may affect a project and its surrounding environment.

A. Sabin Center Study of Federal EISs 2009-2011

The Sabin Center published two previous papers on how federal EISs engaged with issues related to climate change. In July 2012, the Center published "Consideration of Climate Change in Federal EISs, 2009-2011," which tracked the analysis of climate change in 227 EISs prepared between January 1, 2009, and December 31,

47. *City of Oxnard*, 2012 WL 7659201 at *47.
48. European Union (EU), EIA Directive 2014/52/EU (2014), Annex III, §1(f); Annex IV, §5(f) (EIA should address "the risk of major accidents and/or disasters which are relevant to the project concerned, including those caused by climate change, in accordance with scientific knowledge" and "the vulnerability of the project to climate change"). *See also* European Commission (EC), Guidance on Integrating Climate Change and Biodiversity Into Strategic Environmental Assessment (2013).
49. Kiribati, Environment Act §33(1)(d) (EIA must include a description of how climate change and climate variability may impact on the activity). *See also* Carmen Elrick & Robert Kay, Adaptation Handbook: Undertaking Risk Treatment for Coastal Climate Change Risks in the Republic of Kiribati (2009) (prepared for government of Kiribati Adaptation Project Phase II (KAP II)), *available at* http://www.coastalmanagement.com/wp-content/uploads/2013/08/adaptation-handbook_kap-ii-component-1.3.2_low_res.pdf; (2009). World Bank, Reducing the Risk of Disasters and Climate Variability in the Pacific Islands: Republic of Kiribati Country Assessment.
50. Vanuatu, Environmental Management and Conservation (Amendment) Act of 2010, §3 (amending Environmental Management and Conservation Act of 2002, §2) (changing the definition of "significant environmental impact" to include "the degree to which the adaptation to, and mitigation of climate change is affected"). *See also* CARICOM, *Guide to the Integration of Climate Change Adaptation Into the Environmental Impact Assessment (EIA) Process* (2004), *available at* http://dms.caribbeanclimate.bz/M-Files/openfile.aspx?objtype=0&docid=2358.
51. Several European jurisdictions have introduced policies or guidance to implement the EU Directive on Climate Change and EIA, but they are not listed here because they fall within the scope of the legal requirements outlined in the EU directive. The relevant guidance documents are listed in Wentz, *supra* note 7, §3 (Existing Guidance and Assessment Tools).
52. Canadian Envtl. Assessment Agency, Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners (2003); Nova Scotia Env't, Guide to Considering Climate Change in Environmental Assessments in Nova Scotia (2011).
53. Fiji Dep't of Env't, Environment Impact Assessment (EIA) Guidelines (2008).
54. Oficina Española de Cambio Climático, Plan Nacional de Adaptación al Cambio Climático (2006).
55. Oficina Española de Cambio Climático, Plan Nacional de Adaptación al Cambio Climático: Segundo Programa de Trabajo (2009).
56. Samoa, First National Communication to UNFCCC (1999); National Adaptation Programme of Actions (2005).
57. Solomon Islands, National Adaptation Programme of Actions (2008).
58. Cook Islands, Initial National Communication Under the United Nations Framework Convention on Climate Change (2000).
59. Commonwealth of Dominica, Initial National Communication Under the United Nations Framework Convention on Climate Change (2001).
60. Saint Lucia, Initial National Communication Climate Change (2001).
61. People's Republic of Bangladesh, National Water Management Plan Project; Guidelines for Environmental Assessment of Water Management (Flood Control, Drainage, and Irrigation) Projects (2005).
62. Sabin Ctr. for Climate Change Law, *EIA Guidelines for Assessing Climate Risk*, http://web.law.columbia.edu/climate-change/resources/nepa-and-state-nepa-eis-resource-center/eia-guidelines-assessing-climate-risk (last visited Sept. 14, 2015).
63. The full report (*see* Author's Note, *supra*) also discusses the results from a similar survey: Defenders of Wildlife, Reasonably Foreseeable Futures: Climate Change, Adaptation and NEPA (2013).

2011.[64] One of the analytical areas covered in that paper was the impact of climate change on the project[65]; 102 of the 227 EISs (44%) included some discussion of how climate change would impact the project or its surrounding environment. The key findings from the report were summarized as follows:

> While greenhouse gas emissions from projects are frequently addressed in EISs, the effects of climate change on the proposed projects are considered far less often. Preparing 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. Infrastructure project EISs often briefly analyze the impacts of climate change on the region or locality in which the project is located without addressing the direct impacts of climate change on the project itself. Climate impacts in the project region are often discussed in order to consider their effect on a resource which the project might also impact. For example, an EIS for a project which adversely impacts surrounding wetlands may also address climate change impacts on the wetland and consider the cumulative effect of both climate and project impacts on the wetland.
>
> The degree to which impacts of climate change on a project are included correlates more with project type and location than with the preparing agency. The potential effects of climate change on a project are most likely to be considered for coastal or water-related projects (irrigation and reservoirs, ports, bridges, waterfront development), military projects and land management or forestry EISs. Most commonly, impacts such as sea level rise and flooding are included for projects in coastal locations and water supply projects. Many types of coastal infrastructure are vulnerable to sea level rise and increased storm intensity, including ports, coastal nuclear reactors and military facilities. Projects in marine or coastal settings are likely to consider the effects of sea level rise and increased storm intensity, as well as impacts on marine habitats from rising sea temperatures. However, these impacts are often considered not in relation to the project itself, but rather to its surrounding environment.
>
> In EISs which do not involve coastal sites or water projects, analysis of the impact of climate change on a project is often limited to a brief discussion of climate impacts on wildlife species or vegetation as a secondary or compounding impact. Projects in desert areas, such as solar energy projects or transmission lines, are also likely to discuss the impacts of climate change and temperature increase on the surrounding ecosystem, although impact analyses are often limited to their effect on the environment rather than on the project.[66]

In March 2013, the Center published a more targeted study on the analysis of climate change-related water impacts in federal EISs prepared between January and September of 2012.[67] This study examined how federal EISs addressed issues relating to water usage, water shortage and drought, sea-level rise and water tables, and flooding. The study found that there was considerable variation in the treatment of these issues across different projects and agencies. Unsurprisingly, projects with more significant water usage impacts tended to include a more extensive discussion of water-related issues in the EIS, but this discussion did not necessarily include any analysis of how climate change may impact future water supply. The one context where climate change did frequently factor into the analysis was when sea level was assessed for coastal infrastructure projects; however, the quality of the discussion varied considerably, and some coastal projects did not even discuss sea-level rise.[68]

B. Sabin Center Study of Federal EISs 2012-2014

The Sabin Center conducted a follow-up study of over 300 federal EISs prepared between July 2012 and December 2014 to determine if climate change had become a more prevalent consideration in the documents. The scope of that study was broader than the scope of this Article: it covered all categories of EISs, including land management actions, and a variety of topics relating to both mitigation and adaptation. For the purposes of this Article, we selected 117 projects that involve public infrastructure and construction, and applied a more targeted set of questions to those projects:

1. Does the EIS contain *any* discussion of how climate change will impact the project or its surrounding environment?
2. Does the EIS discuss how climate change will impact the quantity or quality of *water resources* to be used or affected by the project?
3. Does the EIS examine how climate change will impact the *affected environment* of the project, taking into account the various environmental and human resources in the area?[69]
4. Does the EIS examine the impacts of climate change on the *project itself* and any implications that this may

64. Patrick Woolsey, *Consideration of Climate Change in Federal EISs 2009-2011* (Sabin Ctr. for Climate Change Law, 2012).
65. As noted in the study, "[t]his category includes the effects of rising sea levels and water tables, increased flooding, extreme weather events, greater temperature variations, water shortages, reduced snowpack and other occurrences that require adaptation." *Id.* at 6.
66. *Id.* at 15-16.
67. Cathy Li, *Discussion of Climate Change-Related Water Impacts in Federal Environmental Impact Statements (EISs), January-September 2012* (Sabin Ctr. for Climate Change Law, 2013).
68. *Id.* at 9.
69. EISs that merely acknowledged that an impact such as sea-level rise may occur in the project area without discussing how it would affect one or more aspects of the local environment were not included under this category. Similarly, EISs that only discussed impacts on water supply (without discussing impacts on aquatic ecosystems or species) were not included because this issue was captured in the second category.

Table 1: Consideration of Climate Change Impacts in Federal EISs Involving Physical Infrastructure, July 2012 – December 2014

EIS Category	Total	Q1		Q2		Q3		Q4		Q5	
Low-Carbon Electric Generation	13	12	(92%)	11	(85%)	11	(85%)	3	(23%)	1	(7%)
Electric Transmission	8	4	(50%)	2	(25%)	4	(50%)	1	(12.5%)	1	(12%)
Energy Development and Mining	26	23	(88%)	14	(54%)	22	(85%)	8	(31%)	4	(15%)
Transportation	40	10	(25%)	0	(0%)	4	(10%)	4	(10%)	1	(2%)
Public Works	18	16	(88%)	13	(72%)	9	(50%)	12	(67%)	9	(50%)
Buildings and Real Estate	12	7	(58%)	6	(50%)	4	(33%)	4	(33%)	2	(16%)
Total (all categories)	117	72	(61%)	46	(39%)	54	(46%)	32	(27%)	18	(15%)

have for the resilience of the project or the environmental consequences of the project?

5. Did the analysis of climate change impacts influence the agency's final decision in any way; for example, by causing the agency to: (i) conclude that an otherwise insignificant impact was significant; (ii) modify design features; or (iii) implement additional mitigation measures?

The results of the survey are summarized in Table 1, above, and discussed in further detail below.

Key Findings. The percentage of EISs that discussed the impacts of climate change increased as compared with previous years, but the scope of the analysis varied quite substantially between project categories. There were also considerable differences between EISs within any given category. Moreover, although it had become more common for agencies to acknowledge the impacts of climate change on a project and/or the surrounding environment, it was still quite rare for agencies to actually incorporate this into final decisions about project design, selection of alternatives, or mitigation measures—only 15% of the EISs indicated that climate change considerations had factored into final decisions about how to proceed with the project.

The chief justification for ignoring the impacts of climate change on a project and the surrounding environment was that the project would not generate a significant level of greenhouse gas emissions.[70] In some EISs, it also appeared that there was confusion about the difference between evaluating the contribution of a project to climate change and evaluating the impacts of climate change on the project. For example, in response to an EPA request to "evaluate climate change effects on" a proposed dam modification, the U.S. Army Corps of Engineers (the Corps) responded: "The proposed project's impact on greenhouse gas emissions on climate change was evaluated in the DEIS [draft environmental impact statement]. It is located in section 3.5-Air Quality, in the DEIS."[71]

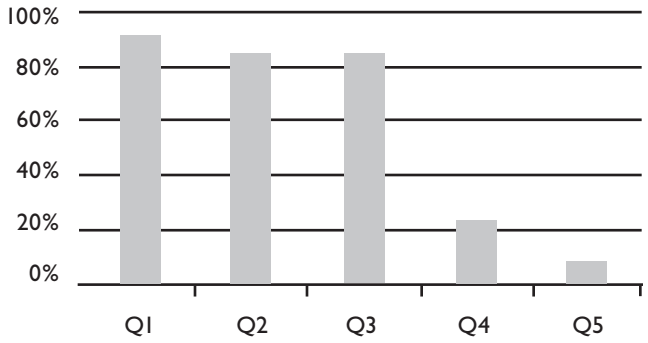
Low-Carbon Electric Generation. The low-carbon electric generation category included hydroelectric, solar, wind, nuclear, and carbon capture and sequestration facilities (see Figure 1). The study results showed that 92% (12/13) of the EISs for electric generation projects contained some discussion of how climate change would affect the project or surrounding environment, and 85% (11/13) included a discussion of how climate change would affect water resources required for the project. However, only three of the EISs in this category actually analyzed how those impacts may influence the construction or operation of the facilities, and only one EIS provided for modified design features to address those impacts. Specifically, the EIS for the Blythe Solar Project in Palm Springs, California, noted the impacts that climate change may have on water supply in the context of both the proposed action and alternatives, and identified mitigation measures that could be implemented if there was reduced recharge to the underlying groundwater basin.[72] Interestingly, many of the EISs for renewal of nuclear plants contained a detailed description of climate impacts on the surrounding environment (for example, water resources), but did not discuss the

70. *See, e.g.*, U.S. Dep't of Energy, Final Champlain Hudson Power Express [(CHPE)] EIS 5-188 to 5-189 (2014) ("At present, there is no methodology that would allow DOE to estimate the specific impacts (if any) this increment of climate change would produce near the proposed CHPE Project or elsewhere.").

71. U.S. Army Corps of Eng'rs, Isabella Lake Dam Safety Modification Project, to Remediate Seismic, Seepage, and Hydrologic Deficiencies in the Main Dam, Spillway and Auxiliary Dam FEIS [Final Environmental Impact Statement] A-17 (2012).

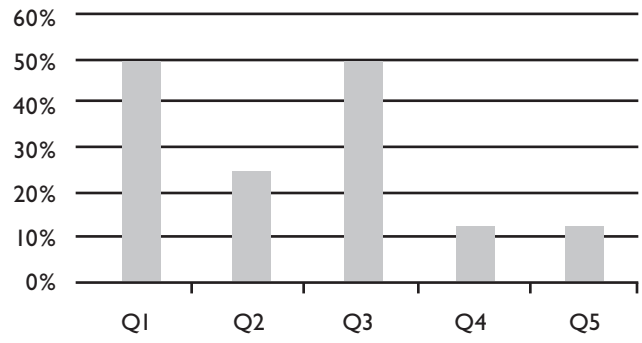
72. U.S. Dep't of the Interior, Bureau of Land Mgmt., Modified Blythe Solar Power Project, Proposed Amendment to Right-of-Way Grant FEIS 4.3-8 (2014).

Figure 1: Climate Impact Assessment in Low-Carbon Electric Generation Projects



Q1: Any discussion of CC impacts on project or affected environment
Q2: CC impacts on water resources
Q3: CC impacts on affected environment
Q4: CC impacts on project
Q5: Discussion of how CC impacts influenced significance determinations, project design, or alternatives selection

Figure 2: Climate Impact Assessment in Electric Transmission Projects



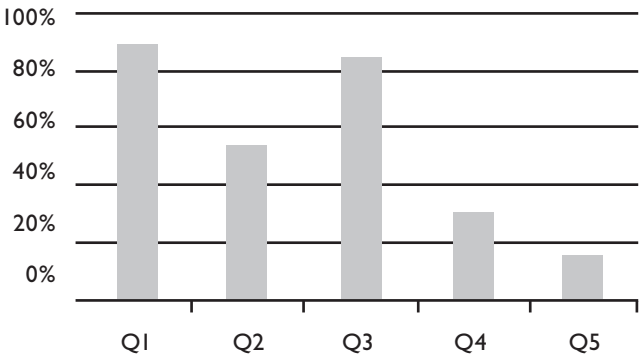
Q1: Any discussion of CC impacts on project or affected environment
Q2: CC impacts on water resources
Q3: CC impacts on affected environment
Q4: CC impacts on project
Q5: Discussion of how CC impacts influenced significance determinations, project design, or alternatives selection

subsequent implications for power plant performance or environmental consequences such as runoff and spill risk.

Electric Transmission: One-half (4/8) of the EISs for electric transmission projects contained some discussion of how climate change could impact the project or its surrounding environment, but this discussion tended to be quite limited (see Figure 2). For example, one EIS merely included a paragraph about the global impacts of climate change and then briefly mentioned that climate change may affect one of the species located in the project area.[73] Another EIS included a very detailed description of the impacts of climate change in the state where the project was located (Arizona), but did not address any corresponding implications for the construction, operation, or maintenance of the transmission line, or for the environmental resources that may be impacted by the project.[74]

Energy Development and Mining: This category included coal, oil and gas development; mining projects; and associated infrastructure (for example, tailings facilities, pipelines, and liquefaction projects) (see Figure 3). Of the projects reviewed, 88% (23/26) contained some discussion of climate change impacts, 85% (22/26) provided a summary of climate impacts on the affected environment, and 54% (14/26) evaluated impacts on water resources required for the project. The quality of the discussion varied substantially, perhaps due to the diversity of projects within this category. Some EISs, such as those prepared for the Keystone XL Pipeline, the Rosemont Copper Mine, and the Tarmac King Road Limestone Mine, contained an extremely detailed analysis of how climate change could affect both the project and the surrounding environment.

Figure 3: Climate Impact Assessment in Energy Development and Mining Projects



Q1: Any discussion of CC impacts on project or affected environment
Q2: CC impacts on water resources
Q3: CC impacts on affected environment
Q4: CC impacts on project
Q5: Discussion of how CC impacts influenced significance determinations, project design, or alternatives selection

The Tarmac King Road Limestone Mine also included a mitigation plan with specific measures to address the impacts of climate change on the surrounding environment; for example, "the [mitigation plan] will provide potential replacement habitat for salt marsh and coastal hydric hammock in the event of continued climate change and sea level rise."[75] In contrast, the EIS for an expansion of the Greens Creek Mine Tailings Disposal Facility Expansion, located on a small island off the coast of

73. U.S. Dep't of Agric., Antelope Valley Station to Neset Transmission FEIS 3-41, 4-32 (2014).
74. U.S. Dep't of the Interior, Bureau of Land Mgmt., APS Sun Valley to Morgan 500/230kV Transmission Line FEIS 3-12, 3-16 (2013).
75. U.S. Army Corps of Eng'rs, Tarmac King Road Limestone Mine FEIS, app. G: Mitigation Plan 2 (2013).

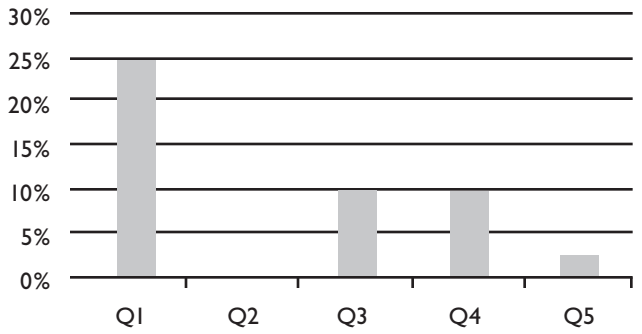
Alaska, briefly mentioned climate impacts, but concluded that it was unnecessary to analyze these in the context of the project.[76]

Transportation. Surprisingly, only 25% of EISs prepared for transportation projects considered *any* climate-related impacts (see Figure 4). Issues such as increased average and extreme temperatures and increased precipitation were largely ignored for this category. The EISs for transportation projects located in coastal areas typically acknowledged the potential for sea-level rise, but only one project was specifically designed to withstand future sea-level rise (the San Francisco Ferry Terminal Expansion Project, a joint EIS/EIR prepared under both NEPA and CEQA).[77] The other EISs that identified climate impacts either concluded that impacts would not interfere with the operation and maintenance of the infrastructure or simply ignored climate impacts in final determinations about project design and alternatives selection. One noteworthy example is the EIS for the replacement of the harbor bridge and certain sections of US Highway 181 in Corpus Christi, Texas (a coastal town). That EIS contained several general statements acknowledging projections of sea-level rise in the area, but did not analyze the structural impact of sea-level rise on the proposed project or alternatives.[78]

Public Works: The EISs in this category included water management, storm management, navigation, and landscape restoration projects, most of which were implemented by the Corps (see Figure 5). Of the projects in this category, 89% (16/18) mentioned the impacts of climate change on the project, and 73% (13/18) discussed the impact of climate change on water resources required for the project, but only 50% (9/18) provided additional details on how these impacts may affect the surrounding environment. Interestingly, this was the only category where more of the EISs (67%, 12/18) discussed the impact of climate change on the project itself as opposed to the impacts of climate change on the surrounding environment. Because many of these projects dealt with water management, changes in rainfall patterns were discussed more than any other impacts. Sea-level rise also factored into the analysis of coastal projects.

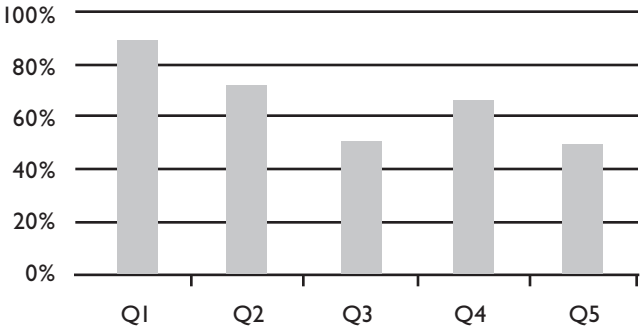
Whereas climate change rarely factored into the final decisionmaking process in other EIS categories, 50% (9/18) of the EISs reviewed in this category indicated that consideration of climate change impacts had influenced the final design of the project. Overall, the EISs in this category contained the most comprehensive and analytical assessment of climate change impacts and their implications for project operation. One noteworthy example is the Arkansas Valley Conduit in Colorado, which considered the impact of climate change on the operation of the project (and water resources required of the project), as well as the impact of climate change on *every* aspect of the affected environment.[79] This was one of two projects in the category that were implemented by the U.S. Bureau of Reclamation; the rest were implemented by the Corps.

Figure 4: Climate Impact Assessment in Transportation Projects



Q1: Any discussion of CC impacts on project or affected environment
Q2: CC impacts on water resources
Q3: CC impacts on affected environment
Q4: CC impacts on project
Q5: Discussion of how CC impacts influenced significance determinations, project design, or alternatives selection

Figure 5: Climate Impact Assessment in Public Works Projects

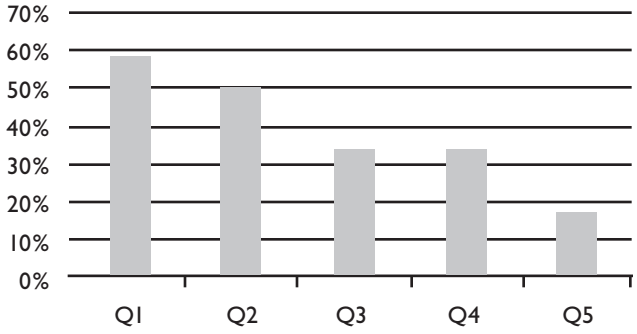


Q1: Any discussion of CC impacts on project or affected environment
Q2: CC impacts on water resources
Q3: CC impacts on affected environment
Q4: CC impacts on project
Q5: Discussion of how CC impacts influenced significance determinations, project design, or alternatives selection

76. U.S. Forest Serv., Greens Creek Mine Tailings Disposal Facility Expansion FEIS 3-201, 3-301 to 3-302 (2013).
77. San Francisco Bay Area Water Emergency Transp. Auth. & U.S. Dep't of Transp. Federal Transit Admin., Downtown San Francisco Ferry Terminal Expansion Project, Final EIS and Record of Decision/Environmental Impact Report (2014).
78. Federal Highway Admin. & Texas Dep't of Transp., US 181 Harbor Bridge Project: From Beach Avenue to Morgan Avenue at the Crosstown Expressway Final EIS/Section 4(f) Evaluation 3-97, 3-99, 3-101 (2014).
79. U.S. Bureau of Reclamation, Arkansas Valley Conduit Long-Term Excess Capacity Master Contract FEIS 4-5 to 4-9; 4-11; 4-36; 4-37; 4-44; 4-76 to 4-77; 4-84; 4-100 to 4-101; 4-109 to 4-110; 4-138 to 4-139; 4-150; 4-161; 4-163; 4-170 (2013).

Buildings and Real Estate: This category included land use planning actions and private-sector construction projects requiring a federal permit (see Figure 6). Of the EISs studied, 58% (7/12) mentioned the impacts of climate change on the project or surrounding environment; 50% (6/12) described the impacts of climate change on water resources required for the project; and 33% (4/12) provided additional details on how these impacts would affect the surrounding environment. The quality of the analysis varied substantially. Two of the projects contained an in-depth analysis of climate impacts as well as modified design features to account for those impacts. The first, the Halletts Point Rezoning Project, was located on land covered by New York City's new regulations requiring consideration of climate impacts and sea-level rise for new development as well as SEQRA and City Environmental Quality Review (CEQR). It included a detailed discussion of flood risk and sea-level rise for a waterfront development project.[80] The second, the Cloverdale Rancheria Casino Project, assessed the significance of climate impacts with respect to each alternative and discussed how mitigation measures would address any potentially significant impacts.[81]

Figure 6: Climate Impact Assessment in Building and Real Estate Projects



Q1: Any discussion of CC impacts on project or affected environment

Q2: CC impacts on water resources

Q3: CC impacts on affected environment

Q4: CC impacts on project

Q5: Discussion of how CC impacts influenced significance determinations, project design, or alternatives selection

C. Trends and Best Practices in Federal EISs 2012-2014

The EISs that discussed climate change impacts were analyzed to identify trends and best practices. For purposes of this analysis, we considered eight of the 10 questions originally put forth by Defenders of Wildlife in a similar survey of federal EISs[82]:

1. Does the EIS include relevant and recent information?
2. Does the EIS include downscaled modeling?
3. Are projections made using appropriate timescales?
4. Does the EIS discuss the impact of climate change on the reasonably foreseeable future condition of affected resources under No Action?
5. Does the EIS discuss the impact of climate change on the reasonably foreseeable future condition of affected resources under the various alternatives?
6. Does the EIS discuss the impact of climate change on the success or outcome of the proposed action?
7. Does the EIS identify and work through climate-related uncertainties?
8. Does the project include a monitoring program adequate to detect effects of climate change?

Several of these questions involve subjective determinations (for example, as to the relevancy of data, what constitutes a "downscaled" impact model, and the appropriateness of timescales), and thus it was not possible to conduct a quantitative analysis using this rubric. Instead, we focused on a qualitative examination of how EISs in our sample selection addressed these issues.

1. Quality of Data

The EISs typically relied on the most recent data available from the Intergovernmental Panel on Climate Change (IPCC), USGCRP, the National Oceanic and Atmospheric Administration (NOAA), and other federal agencies. The EISs also used data from academic articles and other climate assessments to evaluate regional and local climate impacts, where such resources were available. These data were most frequently used to develop multiple scenarios for assessing climate impacts. However, the EISs did not always explain how they were using this data in their analysis, nor did they disclose all of the underlying assumptions and uncertainties associated with the data.

2. Geographic Scale of Analysis

The EISs relied on regional climate projections for their analysis, since this was the most local scale at which credible data was available.

3. Time Frame for Analysis

The EISs used the projected duration of the project as the time frame for analyzing climate impacts. These typically fell within 50-100 years. Several EISs distinguished among

80. New York City Dep't of City Planning & U.S. Dep't of Housing and Urban Dev. (HUD), Halletts Point Rezoning FEIS 17-9 to 17-14 (2013).
81. U.S. Dep't of the Interior, Bureau of Indian Affairs, Cloverdale Rancheria of Pomo Indians' Proposed 65-Acre Fee-to-Trust Acquisition and Resort Casino Project FEIS (2013) at 4.4-8, 4.4-14, 4.4-19, 4.4-25 & 4.4-31.
82. Defenders of Wildlife, *supra* note 63.

short-term, mid-term, and long-term impacts, but they generally did not attempt to specify precisely what impacts would fall within a given period, due to the inherent uncertainty of this analysis.

4. Impact of Climate Change on Baseline Environmental Conditions and the No Action Alternative

There was significant variation in terms of: (i) whether impacts on baseline environmental conditions were considered; (ii) how these impacts were considered; and (iii) where this analysis was located in the EIS. Some EISs discussed climate change in the description of the affected environment, and others discussed this only in the context of cumulative impacts or in a separate section that dealt with climate change. There were a few exemplary EISs that integrated climate impact considerations into the discussion of various affected resources; for example, groundwater, surface water, and biological diversity. This analysis was typically more informative than EISs that only discussed climate change in a separate section. Even within individual EISs, there was inconsistency in terms of where and how climate impacts were addressed; for example, an EIS may list certain climate impacts in the context of one aspect of the affected environment, and ignore climate impacts in the context of other affected resources.

5. Impact of Climate Change on Preferred and Other Alternatives

As noted in Table 1, only 27% of the EISs actually discussed the impact of climate change on the proposed project. There were only a handful of exemplary EISs (several of which are highlighted below) that discussed impacts on other alternatives, and whether those alternatives might be more resilient to those impacts. In the vast majority of EISs, climate change impacts had no bearing on the initial identification of alternatives or the final decision on which alternative to implement.

6. Impact of Climate Change on the Outcome or Success of the Proposed Action

This issue was discussed in some EISs, but the analysis tended to be quite brief. The EISs that confronted the issue at all would typically acknowledge that climate change may affect project performance or environmental outcomes, but then conclude that these effects were too speculative for further analysis. Several EISs did examine the issue further, but ultimately concluded that climate change would not alter the significance of environmental impacts or the performance of the project. For example, many of the coastal infrastructure projects concluded that sea-level rise would not affect the project because critical structures and equipment would be located at a sufficient height to withstand future sea-level rise.

7. Uncertainty

Almost all of the EISs mentioned uncertainty, but the extent to which they worked through that uncertainty varied substantially. The EISs with the most detailed analysis used scenario modeling to address uncertainties, which typically corresponded with different global climate models and emissions scenarios. The Keystone XL Pipeline EIS took a precautionary approach, justifying their conclusions about project impacts and design features by referring to worst-case scenarios of climate change.[83]

8. Monitoring

Aside from several coastal projects that included monitoring for coastal storms, there were no EISs that included a specific monitoring program for climate change effects.

Based on this analysis, we identified several EISs that contained a particularly in-depth analysis of climate change impacts. A summary of these EISs and their discussion of climate change impacts is available in Section 5 of the full report, and excerpts from the EISs are included in Appendix C to that report.[84]

VI. Model Protocols for Assessing the Impacts of Climate Change on the Built Environment Under NEPA and State EIA Laws

Given the findings above regarding the inconsistency in practices with which EIAs incorporate climate change considerations, model protocols could help ensure more consistent analysis of climate's impact on projects and projects' impacts on the environment. These model protocols are meant to complement CEQ's guidance for considering climate change effects under NEPA, but they could also be adapted for use in environmental reviews conducted under state EIA laws.[85] They are based on the legal and empirical research presented in the Sabin Center study and were revised to reflect input from a stakeholder workshop hosted by the Sabin Center on June 18, 2015.[86]

83. U.S. Dep't of State, Keystone XL Project, Final Supplemental EIS (2014).
84. The report and all appendices are available online. Sabin Center for Climate Change Law, *Model EIA Protocols*, http://web.law.columbia.edu/climate-change/resources/nepa-and-state-nepa-eis-resource-center/model-eia-protocols (last visited Sept. 14, 2015).
85. NEPA terminology is used throughout the protocols. Many states use different terminology for the same concepts.
86. The stakeholders who were present at the June 18, 2015, workshop included representatives from CEQ and other federal agencies, state agencies, EIA consulting groups, environmental organizations, and academic institutions. Additional information about the workshop outcomes is available in the full report. *See* Author's Note, *supra*.

A. Overarching Principles

1. Evaluate and Disclose

Agencies should evaluate and disclose the impacts of climate change when conducting environmental reviews in accordance with NEPA and its state equivalents. These impacts should be considered in the approval of a categorical exclusion (CE), the preparation of an environmental assessment (EA), and the scoping and preparation of an EIS.

2. Contextual Analysis

Agencies should assess the impacts of climate change in the following contexts:

a. Future baseline: Whether climate change may influence the future baseline conditions that would exist in the absence of the proposed action (the No Action alternative).

b. Project description: Whether the project may be vulnerable to the impacts of climate change, taking into account the location of the project, its expected useful life, and the resilience of design features, construction materials, operational processes, and decommissioning processes.

c. Purpose and need for project: Whether climate change may influence the need for the proposed project or the ability of the project to fulfill its intended purpose.

d. Affected environment and resources: Whether climate change may increase the vulnerability of the affected environment and any natural and human resources that are impacted by the project.

e. Implications for the environmental consequences of the project: Whether the impacts of climate change may exacerbate the environmental consequences of the project or generate new consequences that would not have otherwise occurred.

3. Precautionary Approach

Due 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. Agencies should evaluate impacts by using multiple scenarios, including the most severe climate change projections developed by the IPCC and other authoritative bodies. The probabilities of each of the scenarios should be disclosed if they can be estimated.

4. Time Frame

The time frame for this analysis should reflect the anticipated duration of the project, taking into account the operational lifetime as well as any decommissioning activities.

5. Proportionality

The scope and depth of this analysis should be proportional to the magnitude of the risk posed by climate change and the correlated vulnerability of the action and its affected environment to the impacts of climate change.

6. Decisions

The analysis of climate change impacts should inform the selection of design features, alternatives, site location, mitigation measures, and other aspects of the final decision undertaken by the agency.

B. Categorical Exclusions

1. CE Lists

When reviewing existing or approving new CE lists, agencies should consider whether any existing CEs should be removed or modified as a result of climate-related considerations. Specifically, agencies should consider whether the category of actions may individually or cumulatively have a significant effect on the human environment, taking into account the impacts of climate change on those actions and the environmental settings in which they are typically located.

2. Application of CEs

Before approving a CE for a particular action, agencies should consider whether the impacts of climate change on the project and its affected environment constitute "unusual circumstances" that require the agency to conduct additional environmental studies to determine whether the CE classification is proper. Specifically, agencies should consider whether otherwise insignificant impacts may become significant due to the impacts of climate change on the project and its affected environment.

C. Environmental Assessments

1. Considerations

When preparing an EA, agencies should:

a. Identify the potential impacts of climate change on the project and its affected environment. To identify all relevant impacts, agencies should consider using a checklist such as the model offered below in *Appendix A: Checklist for Identifying Climate Change Impacts*.

b. Evaluate whether any of these impacts will influence the agency's significance determination by, among other possibilities, altering the context or intensity of a particular impact. For example, an agency could conclude that an otherwise insignificant risk of spills or contamination from a hazardous waste facility located on a coastline will be significant in light of sea-level rise and increased storm intensity, or that an otherwise insignificant impact on water resources will be significant in light of decreased stream flow caused by precipitation and snowpack changes.

2. Implications

Agencies should also consider whether the impacts of climate change will have implications for:

a. The purpose and need of the proposed project.

b. The selection of alternatives.

c. The implementation of any mitigation measures that the agency has relied upon to justify a finding of no significant impact (FONSI).

D. Environmental Impact Statements

1. Step 1: Identifying Climate Change Impacts During the Scoping Process

a. The potential impacts of climate change on the project and its affected environment should be identified and disclosed to the public during the scoping phase of an EIS. This will enable agencies to receive public input on climate-related impacts that warrant evaluation in the EIS before the publication of the draft EIS. To simplify the process, agencies should consider using a checklist such as the model offered in *Appendix A: Checklist for Identifying Climate Change Impacts*.

b. During the scoping process, agencies should also solicit information from relevant stakeholders regarding any climate-related considerations and local data or knowledge that is relevant for the purpose of assessing the impact of climate change on the project and its affected environment. Relevant stakeholders may include:

i. Other government agencies who are directly involved in the project;

ii. Tribal, state, and local authorities in the area where the project will be sited;

iii. Any tribal, state, or local agency or nongovernmental entity with specific expertise on climate change impacts in the area where the project will be sited; and

iv. Members of the affected public.

c. When deciding how many resources to dedicate to the scoping and subsequent assessment of climate change impacts, agencies should pay special attention to actions that are particularly sensitive to climate change due to the nature of the action or the geographic location where it will occur. To identify highly sensitive projects, agencies should consider:

i. Geographic location

- Coastal projects;
- Projects in arid climates and regions subject to heat wave and/or drought; and
- Projects in areas that are frequently exposed to storms or flooding.

ii. Nature of the project

- Projects that require substantial water resources, such as electricity generation facilities or water supply facilities;
- Projects that are particularly susceptible to increased temperatures, such as electric transmission and distribution systems, residential buildings, hospitals, nursing homes, and prisons;
- Projects that have particular risks that may be further compounded by climate impacts, such as wastewater treatment facilities and hazardous and nuclear waste facilities; and
- Critical facilities, such as hospitals and electric infrastructure.

2. Step 2: Evaluating the Impacts of Climate Change

After identifying the potential impacts of climate change on the project and its affected environment, agencies should evaluate and disclose those impacts in accordance with the following framework.

a. Evaluate the impacts of climate change on the affected environment of the proposed action.

i. Identify sources of information and uncertainty: Identify scientific studies and planning documents that contain information about the impacts of climate change within the project area and the corresponding vulnerability of the local environment. Identify any major information gaps or areas of uncertainty.

ii. Summary of climate change impacts: Disclose any existing information about the likelihood and severity of climate change impacts in the affected environment over the duration of the project, and integrate this information into the description of the environmental baseline (the

No Action alternative). When making this disclosure, agencies may incorporate by reference any scientific studies and planning documents, as long as the materials are reasonably available for inspection by potentially interested persons in accordance with 40 C.F.R. §1502.21.

iii. Vulnerability and/or resilience of affected environment: Disclose any existing information about 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:

- Natural systems that are affected by the project;
- Human systems that are affected by the project; and
- Key resources required for project and systems impacted by project (for example, water resources).

b. Address uncertainty by:

i. Describing impacts under a range of different scenarios, including any worst-case scenarios published by the IPCC and USGCRP;

ii. Considering past extremes as an indicator of future trends; and

iii. Complying with the regulatory guidelines for dealing with "incomplete or unavailable information" in NEPA reviews (40 C.F.R. §1502.22).

c. Clearly state all underlying assumptions and sources of data used.

d. Describe how the proposed action will be affected by the impacts of climate change:

i. Identify project-specific impacts: Identify any climate change impacts that will directly affect the physical or operational elements of the proposed project.

ii. Assess project resilience: Determine whether any of the project-specific impacts may have an adverse effect on the project (for example, by impairing longevity and/or productivity) and assess the resilience of the project with respect to those effects.

iii. Project need and resources: Determine whether any of the project-specific impacts will modify the need for the project or the resources that must be committed to the project.

iv. Identify adaptation options: Identify design features or operational changes that could be used to improve the resilience of the project to any adverse effects identified in this analysis.

e. Determine whether the impacts described in Step 1 or 2 will have implications for the environmental consequences of the proposed project.

i. Implications for project impacts: Evaluate whether climate change may alter the nature or magnitude of the environmental impacts of the action or generate new impacts that would not have otherwise occurred.

ii. Implications for susceptibility of resources to project impacts: Evaluate whether any of the environmental systems or resources that are affected by climate change will be more susceptible (or more resilient) to the adverse environmental consequences of the project as a result of climate change.

f. Conduct a similar assessment for all reasonable alternatives to the project.

i. Environmental baseline: The No-Action alternative should simply reflect the baseline environmental analysis conducted in Step 1.

ii. Comparison of alternatives: For other alternatives, the agency should identify where the analysis regarding climate change impacts is the same as that conducted for the preferred alternative, and should discuss any climate change impacts that may differ across alternatives.

g. Identify resilience/adaptation measures when impacts are deemed significant or risks are deemed unacceptable. Such measures may include the selection of a more resilient alternative, modifications to the preferred alternative, or the implementation of actions to mitigate adverse environmental impacts that are exacerbated by climate change.

i. Modified design elements: Consider opportunities to incorporate adaptation and resilience into the design of the project, the operational plan for the project, and any environmental management plans or mitigation measures that are implemented as part of the project.

ii. Siting decisions: Consider whether the project could be sited in an alternate location to address concerns about the impacts of climate change and the implications of those impacts for the environmental consequences of the project.

iii. Adaptation measures with co-benefits: Consider adopting adaptation and resilience measures that have environmental and/or economic co-benefits (for example, building insulation that improves energy efficiency).

iv. Addressing uncertainty: To address uncertainty about future impacts, the agency should consider whether to expressly incorporate monitoring and risk management procedures into the final project or action, and whether to include provisions for incremental adaptation measures that can be implemented in the event that certain impacts do occur (for example, operational changes).

3. Step 3: Justifying the Final Decision

a. In making its final decision, the agency should describe how its analysis of climate change impacts on the action and the affected environment has influenced the following components:

   i. The selection of design features and operational practices;

   ii. The choice between the preferred alternative and other reasonable alternatives (including the No Action alternative); and

   iii. The selection of measures to mitigate any adverse environmental impacts that are exacerbated or caused by climate change.

b. Monitoring for incremental adaptation measures: If an agency decides to mitigate climate-related risks through a system of incremental adaptation measures (measures conditioned on the occurrence of specific climate impacts), the agency should also include adequate monitoring and evaluation mechanisms to accompany these measures.

4. Step 4: Communicating Results to the Public

a. Clear communication of both analysis and decisional outcomes: The agency's assessment of climate change impacts and the manner in which its assessment has influenced the agency's final decision should be clearly communicated to the public in both the draft and final EIS.

b. Summary for public review: To better inform the public about the analysis conducted on climate change impacts and risks, agencies should consider summarizing the information in a table such as the model offered in *Appendix B: Table Summarizing Climate Change Impacts and Response Measures.*

VII. Conclusion

Based on the Sabin Center's review of federal EISs published between 2012 and 2014, it appears that the incorporation of climate change considerations into EIA has become increasingly common in the past few years. The fact that some of the EISs contain a robust discussion of climate change impacts that informed final design decisions demonstrates that it is possible for agencies to assess these impacts and draw meaningful conclusions, even in the context of extreme uncertainty about climate change. There is also evidence that climate change is being mainstreamed into local decisionmaking and city planning processes.[87] This finding reinforces the conclusion that it is technically feasible to account for climate change when making decisions about public infrastructure and building projects.

Standardized protocols such as those proposed here would help to ensure that agencies and other project proponents apply a rigorous and consistent assessment methodology when evaluating climate change impacts. Standardized protocols would improve decisionmaking in the context of specific projects while providing a broader and more detailed universe of information on climate change impacts and assessment opportunities that can be used to inform future decisionmaking.

87. *See* Urban Climate Change Governance Survey, http://www.urbanclimatesurvey.com/.

Appendix A: Checklist for Identifying Climate Change Impacts

Climate-Related Phenomena		Possible Impact on Project or Affected Environment?
Temperature and Humidity	Increased average temperatures	
	Increased peak temperatures (heat waves)	
	Freeze-thaw damage (e.g., melting permafrost)	
	Cold spells	
	Increased humidity	
Precipitation	Increased average precipitation in project area	
	Decreased average precipitation in project area	
	Increase in extreme precipitation events in project area	
	Drought	
	Increased precipitation in upstream area, modifying flow quality or quantity of water resources in affected environment	
	Decreased precipitation upstream, modifying flow quality or quantity of water resources in affected environment	
	Change in the type of precipitation in project area or upstream (e.g., rainfall instead of snow)	
Storms	Increased storm severity	
	Increased storm frequency	
	Increased uncertainty associated with storm patterns	
Inland Flooding	Inland flooding, erosion, and other on-the-ground impacts from altered precipitation and storms	
Coastal Impacts	Sea-level rise	
	Higher storm surge	
	Coastal inundation, erosion, subsidence	
	Saltwater intrusion	
Air Quality	Reduced local air quality	
Wildfire	Greater wildfire risk due to heat and/or drought impacts	
Biodiversity	Increased vulnerability of species and habitats	
	Invasive species	
Public Health	Threats to public health	
Other Impacts	Humidity	

Appendix B: Table Summarizing Climate Change Impacts and Response Measures

Impact	Likelihood	Severity	Risk to Affected Environment	Risk to Project	Implications for Environmental Impacts	Response and Mitigation

Likelihood: The likelihood that a particular impact will occur within the project area (e.g., certain, almost certain, likely, possible, unlikely, rare, or N/A).
Severity: The magnitude of the impact (e.g., minor, moderate, significant, severe).
Risk to Affected Environment: The extent to which the impact poses a risk to environmental systems and resources within the affected environment (this could be assigned a ranking—e.g., low, medium, high—or a qualitative description could be provided in the appropriate box).
Risk to Project: The extent to which the impact poses a risk to the physical or operational aspects of the project (ranking or qualitative description).
Implications for Environmental Impacts: Whether the climate-related impact will have implications for the environmental consequences of the project.
Response and Mitigation: Summary of how the agency intends to respond to and mitigate any risks to the affected environment and project or implications for the environmental impact of the project (e.g., through modified design features, selection of alternatives, or adoption of measures to mitigate an environmental impact).