

FIDDLING AS THE WORLD FLOODS AND BURNS:
HOW CLIMATE CHANGE URGENTLY REQUIRES
A PARADIGM SHIFT IN THE PERMITTING
OF RENEWABLE ENERGY PROJECTS

BY

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This Article is among the first to integrate current climate change science, particularly ongoing impacts and predicted impacts, with a detailed roadmap for substantial reform of our environmental processes for reviewing proposed renewable energy projects. Most existing articles either focus only on climate science or on minor modifications to the regulatory system. Using offshore wind power as a case study, this Article demonstrates how, in an increasingly carbon-constrained world, our existing environmental laws and regulatory process no longer achieve their underlying goals of long-term ecosystem conservation. To the contrary, these laws and regulations are supporting a system with increasing greenhouse gas emissions that is annually costing trillions of dollars. We have little time left to create a practical path to achieving an 80% reduction in greenhouse gases by 2050—with failure resulting in average global temperatures rising more than the internationally-agreed targeted ceiling of 2°C. After examining the obstacles confronting a potential developer of offshore wind, this Article clearly lays out why and how the existing regulatory process should be quickly reformed so that offshore wind and other clean renewable energy sources can help us escape the escalating consequences of our carbon-intensive economic system.

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I. INTRODUCTION

*“Human beings, who are almost unique in having the ability
to learn from the experience of others, are also remarkable
for their apparent disinclination to do so.”*

—Douglas Adams¹

*“If you don't know where you're going,
when you get there you'll be lost.”*

—Yogi Berra²

This is not an Article debating whether twenty first century climate change is likely, very likely, or primarily caused by human emissions of greenhouse gases; how much global temperatures will rise by various dates; or whether to choose a carbon tax or cap-and-trade system. This Article also will not debate whether and how much to decrease subsidies of fossil fuel energy sources or increase those for renewable energy sources.

This Article instead will start with the oft-stated goal of increasing domestic and international reliance upon carbon-emission-free renewable energy sources³ while decreasing use of fossil fuel energy sources,⁴ and ask

¹ Gavin Schmidt & Joshua Wolfe, *A Final Note*, in CLIMATE CHANGE: PICTURING THE SCIENCE 279, 279 (Gavin Schmidt & Joshua Wolfe eds., 2009) (quoting Douglas Adams).

² Generally attributed to Yogi Berra. Another version is, “If you don't know where you're going, you might not get there.” YOGI BERRA & DAVID KAPLAN, WHEN YOU COME TO A FORK IN THE ROAD, TAKE IT!: INSPIRATION AND WISDOM FROM ONE OF BASEBALL'S GREATEST HEROES 53 (2001).

³ Renewable energy sources are those that naturally regenerate and can be sustained indefinitely. U.S. Energy Info. Admin., *Renewable Energy Explained*, http://www.eia.gov/energyexplained/index.cfm?page=renewable_home (last visited Nov. 18, 2012). Renewable

the question few have addressed concretely: how can we more quickly achieve that goal to slow the devastating effects of increasing greenhouse gases, if we do not first tackle the significant barriers posed by the outdated and often self-defeating maze of regulatory requirements? The need to act is urgent if we are to make sufficient and timely progress toward reduced fossil fuel reliance.

To best understand the urgency, Part II begins with a look at our current fossil and renewable energy mix in the generation of electricity,⁵ and then reviews the current and predicted climate change impacts on our energy choices. At stake are several hundred billion dollars of climate change-related damages each year just in the United States—from farming, fishing, and forestry industries increasingly harmed by changing temperature and precipitation patterns,⁶ to coastlines and cities progressively more threatened by rising sea levels.⁷ The business and insurance sectors have been hit by a growing number of extreme weather events (most recently Hurricane Sandy),⁸ public health is increasingly threatened by disease and mortality from our over-reliance on fossil fuels and from their resulting emissions,⁹ and U.S. national security is increasingly at risk from having to protect more foreign sources of fossil

energy sources include biomass, hydro, geothermal, solar, wind, tidal and wave action. U.S. Energy Info. Admin., *Renewable Energy Consumption and Electricity Preliminary 2006 Statistics*, http://www.eia.gov/cneaf/solar.renewables/page/prelim_trends/rea_prereport.html (last visited Nov. 18, 2012). Therefore, this Article does not consider nuclear power to be a renewable energy source.

⁴ President Obama is only the latest of the last eight Presidents who have said in essence that we need to break ourselves of our fossil fuel addiction and pursue energy independence with more usage of renewable sources; Obama proclaimed that Americans need to “face one of the great challenges of our time: confronting our dependence on foreign oil, addressing the moral, economic and environmental challenge of climate change, and building a clean energy future.” OBAMA FOR AMERICA, BARACK OBAMA AND JOE BIDEN: NEW ENERGY FOR AMERICA 1, (Aug. 4, 2008), *available at* http://energy.gov/sites/prod/files/edg/media/Obama_New_Energy_0804.pdf. For President Obama’s and his seven predecessors’ statements on the topic, see *The Daily Show* (Comedy Central television broadcast Jun. 16, 2010), *available at* <http://www.thedailyshow.com/watch/wed-june-16-2010/an-energy-independent-future>.

⁵ “In 2010, approximately 85[%] of the energy consumed in the United States (on a Btu basis) was produced through the combustion of fossil fuels.” U.S. ENVTL PROT. AGENCY, EPA 430-R-12-001, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990–2010, at ES-12 (2012), *available at* <http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html>. Electricity generation is the largest source of U.S. carbon dioxide emissions, followed by transportation (which extends from our almost exclusive reliance on petroleum to fuel our vehicles). U.S. Env’tl. Prot. Agency, *Greenhouse Gas Emissions: Carbon Dioxide Emissions*, <http://www.epa.gov/climatechange/ghgemissions/gases/co2.html> (last visited Nov. 18, 2012) [hereinafter *EPA CO₂ Emissions*]. Although this Article will focus upon electricity and not transportation, if sufficiently more carbon-free electricity were generated, that could also help reduce transportation’s carbon emissions through increased use of electric vehicles.

⁶ See *infra* notes 90–100, 112–18 and accompanying text.

⁷ See *infra* notes 73–86 and accompanying text.

⁸ See *infra* notes 63–66 and accompanying text.

⁹ See *infra* notes 67–70 and accompanying text.

fuels and from resource-related conflicts resulting in more violence and displaced persons.¹⁰

Unfortunately, as the economic and health costs from fossil fuel emissions have grown, so too has the byzantine labyrinth of laws and regulations to be navigated before a renewable energy project can be approved, let alone financed and developed.¹¹ The root cause goes back to the 1970s when some of our fundamental environmental laws were enacted—before we were aware of climate change threats—so as to slow down the review of proposed projects by requiring more studies of potential project impacts before approval.¹² But in our increasingly carbon-based twenty first century, we need a paradigm shift. While achieving important goals, those federal laws and regulations, and similar ones at the state and local levels, have become so unduly burdensome, slow, and expensive that they will chill investment in—and kill any significant growth of—renewable carbon-free energy sources and projects, thereby imposing huge economic, environmental, and social costs upon both our country and the world unless they are substantially changed.¹³ Indeed, by 2050 the U.S. must reduce its greenhouse gas emissions by 80% to even stabilize atmospheric levels of carbon, and can do so by increasing generated electricity from renewable

¹⁰ See *infra* notes 71–72 and accompanying text.

¹¹ For example, there are almost 50 different federal environmental and wildlife statutes and executive orders, largely enacted or promulgated since 1980 that create a daunting gauntlet of regulatory hurdles. See U.S. Env'tl. Prot. Agency, *Laws and Executive Orders*, <http://www.epa.gov/lawsregs/laws> (last visited Nov. 18, 2012). In fact, by this author's count there are about 52 books containing over 63,000 pages of federal regulations for environmental, energy, resource agency and wildlife issues. "The different areas of environmental law have become so voluminously complex that they become compartmentalized and unwieldy." ZYGMUNT J.B. PLATER ET AL., *ENVIRONMENTAL LAW AND POLICY: NATURE, LAW, AND SOCIETY* 5 (3d ed. 2004). Thus, to answer the question posed in Amy Wildermuth, *Is Environmental Law a Barrier to Emerging Alternative Energy Sources?*, 46 IDAHO L. REV. 509 (2010)—in which she says "not really," *id.* at 531—I and virtually everyone involved in trying to develop emerging renewable energy projects would emphatically answer "yes."

¹² See *infra* Part III.C.3–4 and accompanying text (discussing the National Environmental Policy Act and the Endangered Species Act as examples).

¹³ See *infra* notes 47–48, 62–72 and accompanying text. The consequence of delay and doing little to speed up the implementation of significant numbers of renewable energy projects can also be expressed in trillions of dollars, be it a reduction of anywhere from at least 5%–10% or 20% of global GDP by 2050. See NICHOLAS STERN, *STERN REVIEW: THE ECONOMICS OF CLIMATE CHANGE* vi (2007), available at http://webarchive.nationalarchives.gov.uk/+http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm (click on "Summary of Conclusions"); see also H.R. REP. NO. 111-137, at 315 (2009) [hereinafter ACESA REPORT], available at <http://www.gpo.gov/fdsys/pkg/CRPT-111hrpt137/pdf/CRPT-111hrpt137.pdf> ("Modeling results . . . show that if present trends continue, the total cost of four global warming impacts alone—hurricane damage, real estate losses, energy costs, and water costs—could cost the United States nearly \$1.9 trillion annually by 2100 (in constant 2008 dollars), or 1.8[%] of U.S. GDP."); NAT'L RESEARCH COUNCIL, *HIDDEN COSTS OF ENERGY: UNPRICED CONSEQUENCES OF ENERGY PRODUCTION AND USE* 294–99 (2010) [hereinafter NRC HIDDEN COSTS OF ENERGY] (discussing global economic consequences of a failure to reduce greenhouse gas emissions). On top of those four costs would be personal and insurance damages from more extreme weather events, public health and national security costs from heavy reliance on fossil fuels, and increasing pest and climate stresses to the farming, fishing, and forestry industries. See *infra* Part II.B.

sources from the current 13% up to 80%,¹⁴ but only if there are new targeted policy efforts to accelerate—fifty times faster than since 1990—implementation of clean, renewable energy sources.¹⁵

Thus, Part III focuses on one promising technology to demonstrate the flaws in current licensing permitting regimes, and makes concrete recommendations for reform.¹⁶ Wind power generation from onshore

¹⁴ See *infra* notes 24–28 and accompanying text (outlining what GHGs are and their effect in the atmosphere); see also NAT'L RESEARCH COUNCIL, CLIMATE STABILIZATION TARGETS: EMISSIONS, CONCENTRATIONS, AND IMPACTS OVER DECADES TO MILLENNIA 9, 14 (2011) [hereinafter NRC CLIMATE REPORT] (stating that we need to cut emissions by at least 80% by 2050 in order to begin to even stabilize carbon concentrations in the atmosphere); 1 NAT'L RENEWABLE ENERGY LAB., RENEWABLE ELECTRIC FUTURES STUDY A-78 (M.M. Hand et al. eds., 2012) [hereinafter NREL FUTURES 1] (“At 80% renewable electricity, annual GHG emissions in 2050 in the U.S. power sector [would be] reduced by approximately 80%.”); U.S. Energy Info. Admin., Pub. No. DOE/EIA-0226, *Electric Power Monthly*, June 2012, at 19, tbl.1.1, available at <http://www.eia.gov/electricity/monthly/pdf/epm.pdf> (stating that renewable energy sources are about 13% of net generation). In this Article, I am therefore focusing upon means of “mitigating” climate change impacts through reducing greenhouse gas emissions, as opposed to just climate change “adaptation,” which is focused upon reducing “vulnerability . . . against actual or expected climate change effects.” See INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: MITIGATION OF CLIMATE CHANGE 809, 818 (Ben Metz et al. eds., 2007), available at <http://www.ipcc-wg3.de/publications/assessment-reports/ar4/working-group-iii-fourth-assessment-report>.

¹⁵ Extensive modeling reported in July 2012 demonstrates that we must become 50 times more responsive to global temperature changes—such as through growth of new renewable energy sources—than we have been in the past 20 years. A.J. Jarvis et al., *Climate-Society Feedbacks and the Avoidance of Dangerous Climate Change*, 2 NATURE CLIMATE CHANGE 668, 668–71 (2012). I acknowledge that the U.S. is not the only contributor of carbon emissions and that even if all U.S. electricity generation was carbon-free, global climate change is still not solved. However, among large countries and economies, the U.S. is still the largest per capita emitter of greenhouse gases and a close second to China in total annual emissions. See Carbon Planet, *Greenhouse Gas Emissions by Country*, http://www.carbonplanet.com/country_emissions (last visited Nov. 18, 2012) (stating that the U.S. emits 19.1 metric tons of greenhouse gas per capita from fuel consumption as compared to China, which emits only 4.57 metric tons); U.S. Energy Info. Admin., *International Energy Statistics*, <http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=90&pid=44&aid=8> (last visited Nov. 18, 2012) (stating that the U.S. emitted 5,610.108 million metric tons of CO₂ emissions in 2010, as compared to China which emitted 8,320.963 million metric tons); see also U.S. ENVTL. PROT. AGENCY, ENDANGERMENT AND CAUSE OR CONTRIBUTE FINDINGS FOR GREENHOUSE GASES UNDER SECTION 202(A) OF THE CLEAN AIR ACT 15 (2009), available at <http://nnsa.energy.gov/sites/default/files/nnsa/inlinefiles/EPA%202009d.pdf> [hereinafter EPA GHG ENDANGERMENT REPORT] (“If U.S. Section 202(a) source category GHG emissions were ranked against total GHG emissions for entire countries, U.S. Section 202(a) emissions would rank behind only China, the United States as a whole, Russia, and India, and would rank ahead of Japan, Brazil, Germany, and every other country in the world.”). Therefore, significantly reducing our emissions will be a meaningful step to mitigating climate change impacts. As a result, there would be not just environmental benefits, but also the economic benefits from rapidly growing our renewable energy technologies, which can then be expanded domestically and abroad, creating new jobs and reducing trillions of dollars of climate-related costs. See ACESA REPORT, *supra* note 13, at 315 (stating that “the total cost of four global warming impacts alone could cost the United States nearly \$1.9 trillion annually by 2100”). All of this more than justifies the changes I propose in Part IV of this Article.

¹⁶ I am not thereby “picking winners” among the various renewable energy sources, including efficiency and combined heat and power. No single technology is the complete

installations is proven technology, generates no greenhouse gases, consumes no water,¹⁷ is increasingly cost-competitive with most fossil fuel sources,¹⁸ and can be deployed relatively quickly in many parts of the United States and the world.¹⁹ Offshore wind power is a relatively newer technology, especially deep-water floating projects, and is presently less cost-competitive than onshore wind.²⁰ However, because wind speeds are on average about 90% stronger and more consistent over water than over land, with higher power densities and lower shear and turbulence,²¹ America's offshore resources can provide more than its current electricity use.²²

solution or without challenges. However, I have chosen to focus on offshore wind energy for several reasons: 1) the magnitude of the resource and its proximity to significant electricity demand, see *infra* notes 17–23 and accompanying text; 2) it can significantly increase the odds of more quickly achieving NREL's goal of supplying 80% of our electricity from renewable energy technologies by 2050, see NREL FUTURES 1, *supra* note 14; and 3) it would reduce our power sector's annual greenhouse gas emissions by 80% and water withdrawal and consumption by 50%, all while having net land use impacts comparable to our golf courses, *id.* at A-48 to -53, -69, -78. Evaluation of energy efficiency—also a key tool for climate stabilization—is beyond the scope of this Article.

¹⁷ See INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, RENEWABLE ENERGY SOURCES AND CLIMATE CHANGE MITIGATION 570 (Ottmar Edenhofer et al. eds, 2012). These are important advantages of wind power, as even tropical hydropower projects “emit significant amounts of [GHGs,] especially methane.” Philip Fearnside & Salvador Pueyo, *Greenhouse-Gas Emissions from Tropical Dams*, 2 NATURE CLIMATE CHANGE 382, 382 (2012). Additionally, the NREL FUTURES 1 report, *supra* note 14, analyzed and rejected the concern that wind power's variability (it does not blow all the time) significantly impairs its ability to displace fossil-fueled emissions—to the contrary, NREL found that about 83%–85% of emissions from a fossil electricity source are displaced when our electricity mix has a roughly comparable amount of renewable electricity. See NREL FUTURES 1, *supra* note 14, app. at A-49, -53 to -54. Unlike wind, nuclear power emits GHGs and suffers from significant waste disposal costs and risks; like fossil fuels, nuclear power has the risk of accident or project failure that can kill humans, not just wildlife, as has occurred with the Chernobyl, Deepwater Horizon, and the Massey coal mine disasters.

¹⁸ See Press Release, Bloomberg New Energy Fin., Onshore Wind Energy to Reach Parity with Fossil-Fuel Electricity by 2016 (Nov. 10, 2011), *available at* <http://bnef.com/Downloads/pressreleases/172/pdf/172.pdf> (“The best wind farms in the world already produce power as economically as coal, gas and nuclear generators; the average wind farm will be fully competitive by 2016.”).

¹⁹ See Global Wind Energy Council, *How Long Does It Take To Build A Wind Farm?*, <http://www.gwec.net/faq/how-long-take-build-wind-farm/> (last visited Nov. 18, 2012) (noting that the construction time for a wind farm “is usually very short—a 10 MW wind farm can easily be built in two months”).

²⁰ See U.S. DEPT. OF ENERGY, 20% WIND ENERGY BY 2030: INCREASING WIND ENERGY'S CONTRIBUTION TO U.S. ELECTRICITY SUPPLY 49–50 (2008), *available at* <http://www.nrel.gov/docs/fy08osti/41869.pdf>.

²¹ See Cristina L. Archer & Mark Z. Jacobson, *Evaluation of Global Wind Power*, J. GEOPHYSICAL RES., June 2005, at 8, *available at* <http://www.stanford.edu/group/efmh/winds/2004jd005462.pdf>; see also 2 NAT'L RENEWABLE ENERGY LAB., RENEWABLE ELEC. FUTURES STUDY, at 11-17, 11-25 (2012) [hereinafter NREL FUTURES 2]. Offshore wind turbines, especially floating ones deployed in deeper waters, also would, comparatively, minimize seabed disturbance, as well as visual and noise impacts. *Id.* at 11-25.

²² See WALTER MUSIAL & BONNIE RAM, NAT'L RENEWABLE ENERGY LAB., NREL/TP-500-40745, LARGE-SCALE OFFSHORE WIND POWER IN THE UNITED STATES: ASSESSMENT OF OPPORTUNITIES AND BARRIERS 3–4 (2010), *available at* <http://www.nrel.gov/wind/pdfs/40745.pdf> (exploring the

Moreover, since these resources are near many major population centers that drive electricity demand, their exploitation would “reduc[e] the need for new high-voltage transmission from the Midwest and Great Plains to serve coastal lands.”²³ Therefore, in light of Part III’s spotlight on literally dozens of different federal (let alone state and local) statutes and their hundreds of regulations standing between an offshore wind project applicant and construction, Part IV makes concrete statutory and regulatory recommendations to more quickly enable the full potential of offshore wind energy to become a reality before it is too late.

II. OUR ENERGY USE AND ITS RESULTANT CLIMATE CHANGE IMPACTS

A. Overview

Greenhouse gases (GHGs) trap heat in the atmosphere.²⁴ The primary GHG emitted by human activities is carbon dioxide (CO₂), which in 2010 represented 84% of all human-sourced GHG emissions in the U.S.²⁵ “The combustion of fossil fuels to generate electricity is the largest single source of CO₂ emissions in the nation, accounting for about 40% of total U.S. CO₂ emissions and 33% of total U.S. greenhouse gas emissions in 2009.”²⁶ Beginning with the 1750 Industrial Revolution, atmospheric concentrations of GHGs have significantly increased with greater use of fossil fuels—which has in turn caused our world to warm and the climate to change.²⁷ In fact, climate change

potential of offshore wind power in the United States). See discussion *infra* Part III.A, regarding offshore wind technology.

²³ NREL FUTURES 2, *supra* note 21, at 11-45; see Steven Clarke et al., *U.S. Offshore Wind Energy: A Path Forward* 4 (Oct. 2009) (U.S. Offshore Wind Collaborative, Working Paper), available at <http://usoffshorewind.org/wp-content/uploads/2012/06/PathForward.pdf>; see also MUSIAL & RAM, *supra* note 22, at 13 (noting that the offshore wind resource supply is about four times the electricity generating capacity of the U.S. electric grid; 30 states border an ocean or Great Lake; 28 coastal states generate 75% of U.S. electricity, largely from fossil fuels). While there are about 4,000 platforms producing offshore oil and gas in federal waters, there are zero installed wind energy platforms or turbines in U.S. waters at the present time. See U.S. ENERGY INFO. ADMIN., OVERVIEW OF U.S. LEGISLATION AND REGULATIONS AFFECTING OFFSHORE NATURAL GAS AND OIL ACTIVITY 2 (2005), available at http://www.eia.gov/pub/oil_gas/natural_gas/feature_articles/2005/offshore/offshore.pdf.

²⁴ U.S. Env’tl. Prot. Agency, *Climate Change Basics*, <http://www.epa.gov/climatechange/basics/> (last visited Nov. 18, 2012).

²⁵ EPA CO₂ Emissions, *supra* note 5. The second key GHG of concern is methane, at 10% of 2010 U.S. GHG emissions. U.S. Env’tl. Prot. Agency, *Greenhouse Gas Emissions: Methane Emissions*, <http://www.epa.gov/climatechange/ghgemissions/gases/ch4.html> (last visited Nov. 18, 2012).

²⁶ EPA CO₂ Emissions, *supra* note 5. “The combustion of fossil fuels, such as gasoline and diesel to transport people and goods is the second largest source of CO₂ emissions, accounting for about 31% of total U.S. CO₂ emissions and 26% of total U.S. greenhouse gas emissions in 2010.” *Id.*

²⁷ “The current CO₂ level is higher than it has been in at least 800,000 years. . . . Methane is more abundant in Earth’s atmosphere now than at any time in at least the past 650,000 years.” U.S. Env’tl. Prot. Agency, *Causes of Climate Change*, <http://www.epa.gov/climatechange/science/causes.html> (last visited Nov. 18, 2012).

may be the single greatest threat to human society and wildlife, as well as to the ecosystems upon which each depends for survival.²⁸

In 1992, the U.S. signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC), the stated objective of which was:

[To achieve] stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.²⁹

In 2007, the Intergovernmental Panel on Climate Change (IPCC) concluded that it is “very likely”—at least 90% certain—that humans are responsible for most of the “unequivocal” increases in globally averaged temperatures of the previous fifty years.³⁰

²⁸ Climate change is defined as a “change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.” *United Nations Framework Convention on Climate Change*, 3, U.N. Doc. FCC/INFORMAL/84, GE.05-62220 (E) 200795 (1992) [hereinafter *UNFCCC*], available at <http://unfccc.int/resource/docs/convkp/conveng.pdf>. Furthermore:

Climate change is by far the most important and fundamental issue affecting all of our lives. It affects core development issues: poverty, water scarcity, disease, regional and political instability, global health. . . . [If we take on climate change], we can be in a much better position to address and resolve all of these issues. Climate change affects the future of humanity, and it affects the future of the planet Earth.

Bryan Walsh, *Q&A: The U.N.'s Ban Ki-Moon on Climate Change*, TIME, Dec. 11, 2009, http://www.time.com/time/specials/packages/article/0,28804,1929071_1929070_1947173,00.html (last visited Nov. 18, 2012) (quoting U.N. Secretary General Ban Ki-Moon).

²⁹ *UNFCCC*, *supra* note 28, at 4.

³⁰ RICHARD B. ALLEY ET AL., INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, SUMMARY FOR POLICYMAKERS: A REPORT OF WORKING GROUP I OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 2–5, 10–12 (2007), available at <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf>; see also LENNY BERNSTEIN ET AL., INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: SYNTHESIS REPORT 27, 37, 72 (2007) [hereinafter IPCC 2007 SYNTHESIS], available at http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf. The IPCC, established by the United Nations Environment Programme and the World Meteorological Organization, “is the leading international body for the assessment of . . . the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change” and its potential economic and environmental impacts. Intergovernmental Panel on Climate Change, *Organization*, <http://www.ipcc.ch/organization/organization.shtml#.UChjnqMR96g> (last visited Nov. 18, 2012). See NRC CLIMATE REPORT, *supra* note 14, at 55 tbl.1.1, for a table of climate system impacts attributed to greenhouse gas increases and other human factors by the 2007 IPCC Reports and more recent peer-reviewed literature. See generally Richard A. Muller, Op-Ed., *The Conversion of a Climate-Change Skeptic*, N.Y. TIMES, July 30, 2012, at A19 (noting that results from the Berkeley Earth Surface Temperature project demonstrate an average increase of 1.5°F over the Earth’s land in the past 50 years, and that it is “likely that essentially all of this increase results from the human emission of greenhouse gases”); U.S. GLOBAL CHANGE RESEARCH PROGRAM, GLOBAL CHANGE IMPACTS IN THE UNITED STATES 13–17, 19–21 (2009); EDMOND A. MATHEZ, CLIMATE CHANGE: THE SCIENCE OF GLOBAL WARMING AND OUR ENERGY FUTURE 134–35 (2009).

Yet in the twenty years since the UNFCCC, it also is unequivocal that GHG levels have not stabilized but continue to grow, ecosystems and food production have not been able to adapt, and our heavy reliance on fossil fuels perpetuates “dangerous anthropogenic interference with the climate system.”³¹ Equally unequivocal is that 2011 global temperatures were “the tenth highest on record and [were] higher than any previous year with a La Nina event, which [normally] has a relative cooling influence.”³² The warmest thirteen years of average global temperatures also “have all occurred in the [fifteen] years since 1997.”³³ Global emissions of carbon

³¹ *UNFCCC*, *supra* note 28, at 4. Indeed, the UNFCCC parties in Durban recently expressed “grave concern” with our failure to sufficiently reduce GHG emissions, because now “climate change represents an urgent and potentially irreversible threat to human societies and the planet.” United Nations Framework Convention on Climate Change, Conference of the Parties, Durban, S. Afr., Nov. 28–Dec. 11, 2011, *Report of the Conference of the Parties on its Seventeenth Session, Addendum, Part Two: Action Taken by the Conference of the Parties at its Seventeenth Session*, 2, U.N. Doc. FCCC/CP/2011/9/Add.1 (Mar. 15, 2012) [hereinafter *UNFCCC Durban*] (emphasis omitted), available at <http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf>. The U.S. Environmental Protection Agency did determine, in 2009, that GHGs may reasonably be anticipated to endanger public health or welfare, in response to the U.S. Supreme Court decision in *Massachusetts v. U.S. Envtl. Prot. Agency*, 549 U.S. 497, 528–29 (2007) (holding that GHGs were an “air pollutant” subject to regulation under the Clean Air Act, 42 U.S.C. § 7521(a)(1) (2006)). EPA’s “Endangerment Finding” was based on a detailed Technical Support Document that summarized the then-state of scientific knowledge about observed and projected effects from elevated GHG concentrations and climate change, which mirror the current science summarized in this Article. See generally EPA GHG ENDANGERMENT REPORT, *supra* note 15. Challenged in court, the Endangerment Finding was upheld and EPA was found to have evaluated the scientific record “in a rational manner.” *Coal. for Responsible Regulation, Inc. v. U.S. Envtl. Prot. Agency*, 684 F.3d 102, 122 (D.C. Cir. 2012) (quoting *Am. Petroleum Inst. v. Costle*, 665 F.2d 1177, 1187 (D.C. Cir. 1981)).

³² Press Release, World Meteorological Org., 2011: World’s 10th Warmest Year, Warmest Year with a La Niña Event, Lowest Arctic Sea Ice Volume (Nov. 29, 2011), http://www.wmo.int/pages/mediacentre/press_releases/pr_935_en.html (last visited Nov. 18, 2012).

³³ *Id.* Additionally, the “warmest decade on record” was 2000–2009. U.N. ENVIRONMENT PROGRAMME, MEASURING PROGRESS: ENVIRONMENTAL GOALS & GAPS, 5, U.N. DOC. DEW/1525/NA (June 2012), available at http://www.unep.org/geo/pdfs/geo5/Measuring_progress.pdf. “The globally-averaged land surface temperature for June–August 2012 was the all-time warmest June–August on record, at 1.03°C (1.85°F) above average.” Nat’l Oceanic & Atmospheric Admin., *State of the Climate: Global Analysis August 2012*, <http://www.ncdc.noaa.gov/sotc/global/2012/8> (last visited Nov. 18, 2012). “The Northern Hemisphere land surface temperature for July 2012 was the all-time warmest July on record, at 1.19°C (2.14°F) above average.” Nat’l Oceanic & Atmospheric Admin., *State of the Climate: Global Analysis July 2012*, <http://www.ncdc.noaa.gov/sotc/global/2012/7> (last visited Nov. 18, 2012). And in the United States, “[t]he January–August period was the warmest first eight months of any year on record for the contiguous United States. The national temperature of 58.7°F was 4.0°F above the 20[th] century average,” while “[t]he September 2011–August 2012 period was the warmest such 12-month period on record for the contiguous U.S., with an average temperature of 56.0°F, 3.2°F above average” since recordkeeping began in 1895. Nat’l Oceanic & Atmospheric Admin., *State of the Climate: National Overview August 2012*, <http://www.ncdc.noaa.gov/sotc/national/2012/8> (last visited Nov. 18, 2012). By the end of August 2012, almost 63% “of the contiguous U.S. . . . was [still] experiencing moderate-to-exceptional drought” conditions. *Id.*; see also *infra* notes 63, 66 (discussing the likelihood of a connection between extreme weather events and climate change in general, and the documented effects of Summer 2012’s drought and heat records in the United States).

dioxide also jumped 5.9% in 2010—500 million extra tons of carbon was pumped into the air—“the largest absolute jump in any year since the Industrial Revolution [began in 1750], and the largest percentage increase since 2003.”³⁴

In order to even have a fifty-fifty chance that the average global temperature will not rise more than 2°C³⁵ beyond the temperature of 1750,³⁶ our cumulative emissions of CO₂ after 1750 must not exceed one trillion tons. However, by mid-October 2012 we had already emitted over 561 billion tons, and at current rates, we will emit the trillionth ton in June 2043.³⁷ The consequence is that members of “the current generation are uniquely placed in human history: the choices we make now—in the next 10–20 years—will alter the destiny of our species (let alone every other species) unalterably, and forever.”³⁸ Unfortunately by the end of 2011, the more than 10,000

³⁴ Justin Gillis, *Carbon Emissions Show Biggest Jump Ever Recorded*, N.Y. TIMES, Dec. 4, 2011, <http://www.nytimes.com/2011/12/05/science/earth/record-jump-in-emissions-in-2010-study-finds.html> (last visited Nov. 18, 2012) (referencing the Global Carbon Project). Carbon dioxide accumulates in the atmosphere because it is so long-lived and causes “essentially irreversible changes in the climate”; there is no sustainable rate for anthropogenic emissions of CO₂ into the atmosphere; in fact, even if emissions stopped tomorrow, the amount of warming already “baked in” will persist for about a thousand years, and then decline only very gradually over the next thousand years. R.T. PIERREHUMBERT, CUMULATIVE CARBON AND JUST ALLOCATION OF THE GLOBAL CARBON COMMONS 3 (2012), available at <http://www.law.uchicago.edu/files/files/Pierrehumbert%20paper.pdf>. The current atmospheric concentration of carbon dioxide is about 391 ppm—see CO₂ Now, *What the World Needs to Watch*, <http://co2now.org> (last visited Nov. 18, 2012)—which is “the highest level in at least 800,000 years.” NRC CLIMATE REPORT, *supra* note 14, at 3.

³⁵ This Article will, consistent with scientific climate change literature, provide temperature in degrees Celsius (°C). One degree Celsius is equivalent to 1.8 degrees Fahrenheit.

³⁶ The threshold of 2°C is the widely-cited target to avoid the severely damaging consequences from climate change. See, e.g., Richard H. Moss et al., *The Next Generation of Scenarios for Climate Change Research and Assessment*, 463 NATURE 747, 750 (2010) (discussing the increased need and interest in developing climate scenarios at the 2°C “maximum”); Malte Meinshausen et al., *Greenhouse Gas Emission Targets for Limiting Global Warming to 2°C*, 458 NATURE 1158, 1158 (2009) (noting international consensus of the 2°C threshold and analyzing the probability of exceeding it). That threshold was also set in the Cancun Agreements reached on December 11, 2010 as part of the United Nations Framework Convention on Climate Change. See United Nations Framework Convention on Climate Change Conference of the Parties, Cancun, Mex., Nov. 29–Dec. 10, 2010, *Report of the Conference of the Parties on Its Sixteenth Session, Addendum, Part Two: Action Taken by the Conference of the Parties at Its Sixteenth Session*, 3, U.N. Doc. FCCC/CP/2010/7/Add.1 (Mar. 15, 2011), available at <http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf>.

³⁷ See Trillionthtonne.org, *Explaining the Need to Limit Cumulative Emissions of Carbon Dioxide*, <http://trillionthtonne.org> (last visited Nov. 18, 2012), developed at the University of Oxford, for an unsettling, by-the-second updated set of numbers on cumulative carbon emissions going into our atmosphere, and the calculation that for a three-in-four chance of remaining below a 2°C rise, emissions must stop at 750 billion tons—which the site predicts will be reached in early 2028. See also Meinshausen et al., *supra* note 36, at 1160 (predicting that limiting cumulative emissions between 2000 and 2050 to one trillion tons gives us a 25% probability of warming in excess of 2°C, but if annual CO₂ emission levels are not reduced to a quarter more than the measured 2000 levels by 2020, that probability rises to 75%).

³⁸ Catriona McKinnon, *Climate Change Justice: Getting Motivated In The Last Chance Saloon*, 14 CRITICAL REV. INT’L SOC. & POL. PHIL. 195, 197 (2011). “Generations prior to us did not know the havoc they were wreaking, and it will be too late for those who come after us. The

government and U.N. officials from all over the world attending the Durban climate change conference³⁹ agreed that there is a “significant gap between the aggregate effect of Parties’ mitigation pledges in terms of global annual emissions of greenhouse gases by 2020 and aggregate emission pathways consistent with having a likely chance of holding the increase in global average temperature below 2°C or 1.5°C above pre-industrial levels.”⁴⁰

What are some of the growing economic, public health, and environmental costs to our country proximately caused⁴¹ by our daily

current generation is drinking in the last chance saloon of [climate change] mitigation.” *Id.* Moreover, a recent study demonstrated that climate change decisions today will continue to impact the environment for at least a thousand years—“about one-third of the carbon dioxide emitted today will still be in the atmosphere 1,000 years from now”—and that deep ocean warming and sea level rise from increasing GHGs also will be impacted for a thousand years. Ronald Stouffer, *Future Impact of Today’s Choices*, 2 NATURE CLIMATE CHANGE 397, 397–98 (2012) (citing Susan Solomon et al., *Irreversible Climate Change Due to Carbon Dioxide Emissions*, 106 PROC. NAT’L ACAD. OF SCI. 1704, 1704 (2009)); see also NRC CLIMATE REPORT, *supra* note 14, at 3, 12 (“[E]mission reductions choices made today matter in determining impacts experienced not just over the next few decades, but in the coming centuries and millennia. . . . Indeed, some effects of 21st century human choices would contribute to climate change for more than 100,000 years.”).

³⁹ *Summary of the Durban Climate Change Conference: 28 November – 11 December 2011*, EARTH NEGOTIATIONS BULL. Dec. 13, 2011, at 1, available at <http://www.iisd.ca/download/pdf/enb12534e.pdf>.

⁴⁰ See *UNFCCC Durban*, *supra* note 31, at 2. In fact, recent extensive modeling demonstrates that to fulfill those outcomes negotiated in Durban, society will have to be about 50 times more responsive to global mean temperature change than it has been since 1990. See Jarvis, *supra* note 15, at 670. While that seems challenging to achieve, I do not agree with the recently stated perspective that “governments’ attempts to limit greenhouse-gas emissions through carbon cap-and-trade schemes and to promote renewable and sustainable energy sources are probably too late to arrest the inevitable trend of global warming.” Jasper Knight & Stephan Harrison, *The Impacts of Climate Change on Terrestrial Earth Surface Systems*, NATURE CLIMATE CHANGE, 1, 4 (forthcoming 2012) (published online Oct. 14, 2012) <http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate1660.html>. However, I do agree with Knight and Harrison that governments should (also) focus more on adaptation policies, a point especially driven home by the Halloween 2012 so-called “Frankenstorm” named Sandy. For a more grim prognosis, see PricewaterhouseCoopers, *Too Late for Two Degrees? Low Carbon Economy Index 2012*, available at http://www.pwc.com/en_GX/gx/low-carbon-economy-index/assets/pwc-low-carbon-economy-index-2012.pdf.

The PwC Low Carbon Economy Index evaluates the rate of decarbonisation of the global economy that is needed to limit warming to 2°C. This is based on a carbon budget that would stabilise atmospheric carbon dioxide concentrations at 450 ppm and give a 50% probability of limiting warming to 2°C. This report shows that global carbon intensity decreased between 2000 and 2011 by around 0.8% a year. In 2011, carbon intensity decreased by just 0.7%. The global economy now needs to cut carbon intensity by 5.1% every year from now to 2050 to achieve this carbon budget. This required rate of decarbonisation has not been seen even in a single year since the mid-20th century when these records began. Keeping to the 2°C carbon budget will require unprecedented and sustained reductions over four decades. Governments’ ambitions to limit warming to 2°C appear highly unrealistic.

Id. at 2.

⁴¹ Lawyers are familiar with the concept of “proximate cause” when evaluating cause and effect in and out of the courtroom. We rely on juries of laypeople to decide whether event or

burning of fossil fuels? The National Research Council (NRC) recently analyzed the “hidden” costs of energy production and use not reflected in market prices of coal, oil, and other energy sources, or in the prices of electricity and gasoline produced from them.⁴² For the year 2005 alone, the NRC estimated \$120 billion of damages to the U.S. from fossil fuel energy production and use, reflecting primarily health damages from air pollution associated with electricity generation and motor vehicle transportation.⁴³ Of that total, \$62 billion was due to coal-fired electricity generation;⁴⁴ \$56 billion from ground transportation (oil-petroleum);⁴⁵ and over \$2.1 billion from electricity generation and heating with natural gas.⁴⁶ The \$120 billion figure did not include damages from climate change, harm to ecosystems and infrastructure, insurance costs, effects of some air pollutants, and risks to national security, which the NRC examined but did not specifically monetize.⁴⁷ The NRC did, however, suggest that under some scenarios, climate damages from energy use could equal \$120 billion.⁴⁸ Thus, adding infrastructure and ecosystem damages, insurance costs, air pollutant costs, and fossil-fueled national security costs to reach a total of \$240 billion, it becomes clear that fossil consumption costs Americans almost \$300 billion each year⁴⁹—a “hidden” number likely to be larger in the future.

person A was a substantial (not the sole or primary) causative factor of the consequence to person B. *See* RESTATEMENT (SECOND) OF TORTS § 431 (1965).

⁴² *See generally* NRC HIDDEN COSTS OF ENERGY, *supra* note 13.

⁴³ *Id.* at 21.

⁴⁴ *Id.* at 6.

⁴⁵ *Id.* at 12.

⁴⁶ *Id.* at 8, 11.

⁴⁷ *See id.* at 46, 53, 66–67; *see also* Press Release, National Academy of Sciences, Report Examines Hidden Health and Environmental Costs of Energy Production and Consumption in the U.S. (Oct. 19, 2009), <http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=12794> (last visited Nov. 18, 2012). A related analysis was undertaken by the EPA, which is required by section 812 of the 1990 Clean Air Act Amendments to periodically estimate the costs and benefits of the Act. The EPA did not examine carbon dioxide or methane, but rather six other air pollutants regulated by the Clean Air Act. It estimated that by 2020, the net annual benefits from reductions in those air pollutants would be \$2 trillion (in 2010, \$1.3 trillion). The bulk of the benefits are—as discussed in NRC HIDDEN COSTS OF ENERGY, *supra* note 13—attributable to prevention of premature deaths. The EPA estimated about 230,000 avoided deaths by 2020. *See* U.S. ENVTL. PROT. AGENCY, THE BENEFITS AND COSTS OF THE CLEAN AIR ACT FROM 1990 TO 2020, at 2-2, 5-24, 7-5 (2011), *available at* <http://www.epa.gov/oar/sect812/feb11/fullreport.pdf>.

⁴⁸ One of the report’s authors, Thomas McKone, stated that “damages from GHGs appear to be on the same order of magnitude as those for human health.” Allan Chen, *The Hidden Costs of Energy Production—\$120 Billion in 2005*, BERKELEY LAB NEWS CTR., Oct. 21, 2009, <http://newscenter.lbl.gov/feature-stories/2009/10/21/hidden-costs-of-energy> (last visited Nov. 18, 2012) (quoting Thomas McKone).

⁴⁹ *See id.* In light of recent events and trends involving Hurricane Sandy, *see infra* notes 63–66, 85–86 and accompanying text, the \$300 billion figure is likely conservative. I have calculated it using the NRC’s 2005 numbers: \$120 billion from fossil fuel damages; \$120 billion from climate damages; and an estimated \$60 billion from harm to ecosystems and infrastructure, insurance costs, effects of air pollutants, and risks to national security. *See supra* notes 42–49. Damages from Hurricane Sandy alone are \$50 billion, and the military is increasingly concerned about national security risks and needed measures. *See infra* notes 71–72 and accompanying text.

What does the future hold for a carbon-stressed world? Most scientific analyses presently predict that by 2050 the Earth will warm by 2–2.5°C due to the rising level of GHGs in the atmosphere; at the high-end of projections, the 2050 warming could exceed 4.5°C.⁵⁰ But those increases are not consistent globally; rather, “[i]n all possible [predicted] outcomes, the warming over land would be roughly twice the global average, and the warming in the Arctic greater still.”⁵¹

For example, the NRC expects that each degree Celsius increase will produce double to quadruple the area burned by wildfires in the western United States, a 5%–15% reduction in crop yields, more destructive power from hurricanes, greater risk of very hot summers, and more changes in precipitation frequency and amounts.⁵² Globally, a summary of studies predicts that at a 1°C global average temperature rise would reduce Arctic sea ice by an annual average of 15% and by 25% in the month of September;⁵³ at 2°C Europe suffers greater heat waves, the Greenland Ice Sheet significantly melts, and many land and marine species are driven to extinction;⁵⁴ at 3°C the Amazon suffers severe drought and resultant firestorms that will release significantly more carbon into the atmosphere;⁵⁵ at 4°C hundreds of billions of tons of carbon in permafrost melts, releasing methane in immense quantities, while the Arctic Ocean ice cap disappears and Europe suffers greater droughts.⁵⁶

To presently assess what a 5°C rise will mean, we must look back into geological time, 55 million years ago, when the Earth abruptly experienced dramatic global warming due to the release of methane hydrates—a

⁵⁰ The Club of Rome, a global think tank, recently predicted a global average temperature rise of 2°C by 2052 and 2.8°C by 2080, while “the University of Oxford and Princeton University said global warming was likely to be between 1.4 and 3 degrees[°C] by 2050, but that 3 degrees was at the upper end of what was likely” by then. Nina Chestney, *Club of Rome Sees 2 Degree Celsius Rise in 40 Years*, REUTERS, May 8, 2012, <http://www.reuters.com/article/2012/05/08/us-climate-clubofrome-idUSBRE8470JE20120508> (last visited Nov. 18, 2012); Club of Rome, *The Count-Up to 2052: An Overarching Framework for Action*, <http://www.clubofrome.org/?p=703> (last visited Nov. 18, 2012); see also DAVID ARCHER & STEFAN RAHMSTORF, *THE CLIMATE CRISIS: AN INTRODUCTORY GUIDE TO CLIMATE CHANGE* 132 (2010) (“IPCC has changed the range for the first time: in the [2007 Fourth Report] it is given as 2–4.5°C [by 2100], with a best estimate of 3°C.”). But see *infra* note 60 and accompanying text (describing the recent 6°C warming from the International Energy Agency).

⁵¹ Justin Gillis, *Clouds’ Effect on Climate Change Is Last Bastion for Dissenters*, N.Y. TIMES, May 1, 2012, at A1, A14.

⁵² See NRC CLIMATE REPORT, *supra* note 14, at 6–8, 23, 119–20.

⁵³ *Id.* at 8. See generally MARK LYNAS, *SIX DEGREES: OUR FUTURE ON A HOTTER PLANET* 46–51 (2008) (discussing the impact of a 1°C rise in temperature on Arctic sea ice.).

⁵⁴ LYNAS, *supra* note 53 at 75–83, 86–98.

⁵⁵ *Id.* at 140–43. Three degrees Celsius also will cause nine out of ten summer seasons in the U.S. to be hotter than all but one summer out of twenty for nearly all land areas during the last decades of the twentieth century. NRC CLIMATE REPORT, *supra* note 14, at 31. One more degree will make all summers “exceptionally warm.” *Id.*

⁵⁶ LYNAS, *supra* note 53 at 189–92, 199–201, 210–12; see also National Geographic, *Six Degrees Could Change the World*, <http://channel.nationalgeographic.com/channel/videos/six-degrees-could-change-the-world/> (last visited Nov. 18, 2012) (depicting the six degrees’ impacts on different parts of the globe).

substance presently found on subsea continental shelves.⁵⁷ Fossils demonstrate that crocodiles were in the Canadian high Arctic along with rain forests of dawn redwood, and the Arctic Ocean saw water temperatures of 20°C within 200 km of the North Pole itself.⁵⁸ And a 6°C average rise takes us even further back—to the end of the Permian period, 251 million years ago—when up to 95% of species relatively abruptly became extinct.⁵⁹ This may sound extreme, but the International Energy Agency warned this year that the 6°C mark is in reach by 2050 at current rates of fossil fuel usage.⁶⁰

However, even given the severity of these forecasts, many still question the extent to which our climate is changing,⁶¹ and thus reject moving away from our largely fossil-fueled electricity, transportation, and heating sources. Therefore, in this next subsection I provide the latest scientific data documenting specific climate impacts to multiple parts of the U.S. and global daily lives, and the costly consequences that establish the urgency for undertaking the major regulatory reforms I recommend in Part IV of this Article.

B. Specific Climate Threats and Consequences

1. When Weather Extremes Increase

A 2011 IPCC Special Report predicted that:

It is virtually certain [99–100% probability] that increases in the frequency of warm daily temperature extremes and decreases in cold extremes will occur throughout the 21st century on a global scale. It is very likely [90–100%

⁵⁷ LYNAS, *supra* note 53, at 220–27.

⁵⁸ *See id.* at 220, 225.

⁵⁹ *Id.* at 250–59.

⁶⁰ “Energy-related CO₂ emissions are at historic highs; under current policies, we estimate that energy use and CO₂ emissions would increase by a third by 2020, and almost double by 2050. This would likely send global temperatures at least 6°C higher. Such an outcome would confront future generations with significant economic, environmental and energy security hardships—a legacy that I know none of us wishes to leave behind.” Press Release, International Energy Agency, IEA Urges Governments to Seize the Opportunity to Accelerate Clean Energy Deployment (Apr. 25, 2012), <http://www.iea.org/newsroomandevents/pressreleases/2012/april/name,26949,en.html> (last visited Nov. 18, 2012) (quoting IEA Deputy Executive Director Ambassador Richard H. Jones).

⁶¹ A June 2012 poll in this country found that compared to 2006, more people today 1) do not think the world’s temperature has been going up over the past 100 years; 2) do not think it is a very serious problem if nothing is done to reduce future global warming; and compared to 2010, most people today, 3) do not think the world’s temperature will go up over the next 100 years if nothing is done to prevent it. Press Release, Wash. Post & Stanford Univ., Global Warming Poll: June 13 to 21, 2012, at 2–4, *available at* <http://www.washingtonpost.com/wp-srv/national/documents/global-warming-poll-2.pdf>. At least, however, the trend since 2009 has been in the direction of more people believing that the Earth is warming (67%) and that the warming is mostly caused by human activity, such as burning fossil fuels (still only 42%, as opposed to 50% in 2006). PEW RESEARCH CTR., MORE SAY THERE IS SOLID EVIDENCE OF GLOBAL WARMING 1 (2012), *available at* <http://www.people-press.org/files/legacy-pdf/10-15-12%20Global%20Warming%20Release.pdf>.

probability] that heat waves will increase in length, frequency, and/or intensity over most land areas. . . . It is very likely that average sea level rise will contribute to upward trends in extreme sea levels in extreme coastal high water levels.⁶²

Similarly, a House of Representatives committee report (ACESA Report) found that “[t]here is a broad scientific consensus that the United States is vulnerable to weather hazards that will be exacerbated by climate change.”⁶³ It also found that the “cost of damages from weather disasters has increased markedly from the 1980s, rising to more than 100 billion dollars in 2007. In addition to a rise in total cost, the frequency of weather disasters costing more than one billion dollars has increased.”⁶⁴ In 2011, the U.S. faced the most billion-dollar climate disasters ever, with fourteen distinct disasters alone costing at least \$54 billion to our economy.⁶⁵ In the first six

⁶² INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, IPCC SPECIAL REPORT ON MANAGING THE RISKS OF EXTREME EVENTS AND DISASTERS TO ADVANCE CLIMATE CHANGE ADAPTATION 2 (2012), available at http://www.ipcc.ch/news_and_events/docs/srex/SREX_fact_sheet.pdf; NRC CLIMATE REPORT, *supra* note 14, at 23, 31, 123 (noting that each additional 1°C creates a greater risk of very hot summers—top 5% of summers from 1971 to 2000—and greater precipitation amounts during the heaviest events). See also *Future Warming Likely to be on High Side of Climate Projections, Analysis Finds*, NCAR ATMOSNEWS, Nov. 8, 2012, <https://www2.ucar.edu/atmosnews/news/8264/future-warming-likely-be-high-side-climate-projections-analysis-finds> (last visited Nov. 18, 2012) (suggesting IPCC models may be too conservative, and that global temperature increases may be as high as 7°C by 2100).

⁶³ ACESA REPORT, *supra* note 13, at 307. There is disagreement as to whether particular extreme weather events are caused by climate change. However, a recent analysis of the 2010 Moscow and 2011 Texas and Oklahoma heat waves concludes that they were “a consequence of global warming because their likelihood in the absence of global warming was exceedingly small.” James Hansen et al., *Perception of Climate Change*, 109 PNAS 14726, 14726, (2012), available at <http://www.pnas.org/content/109/37/E2415.full.pdf+html>. Similarly, there is some scientific consensus that while climate change did not cause the 2012 Hurricane-Superstorm Sandy, it was strengthened by conditions of sea level rise, warmer waters in the Atlantic, and possibly an Arctic “blocking high” caused by faster-melting Arctic sea ice. See, e.g., Larry O’Hanlon, *How Much Climate Change Was In Hurricane Sandy?*, DISCOVERY NEWS, Nov. 2, 2012, <http://news.discovery.com/earth/sandy-and-the-record-arctic-sea-ice-melt121102.html> (last visited Nov. 18, 2012); Paul M. Barrett, *It’s Global Warming, Stupid*, BUS. WK., Nov. 1, 2012, <http://www.businessweek.com/articles/2012-11-01/its-global-warming-stupid> (last visited Nov. 18, 2012); Andrew Freedman, *How Global Warming Made Hurricane Sandy Worse*, CLIMATE CENT., Nov. 1, 2012, <http://www.climatecentral.org/news/how-global-warming-made-hurricane-sandy-worse-15190> (last visited Nov. 18, 2012).

⁶⁴ ACESA REPORT, *supra* note 13, at 307.

⁶⁵ ELIZABETH FERRIS & DANIEL PETZ, BROOKINGS INST., THE YEAR THAT SHOOK THE RICH: A REVIEW OF NATURAL DISASTERS IN 2011, at 19–20 (2012), available at <http://www.brookings.edu/research/reports/2012/03/natural-disaster-review-ferris>; see also *id.* at 3 (“Globally, economic losses attributed to natural disasters in 2011 reached \$380 billion”); John Wihbey, *Limited Coverage: Climate Change and the Insurance Industry*, YALE FORUM ON CLIMATE CHANGE & THE MEDIA, June 6, 2012, <http://www.yaleclimatemediaforum.org/2012/06/limited-coverage-climate-change-and-the-insurance-industry/> (last visited Nov. 18, 2012) (“In 2010, U.S. insurance payouts resulting from abnormal weather totaled about \$40 billion.”). Following the massive damages in the U.S. in 2011, California, Washington, and New York insurance regulators announced that all major insurance companies operating in their states will be required to assess and publicly disclose the climate-change related risks they face. Felicity Barringer, *Three States to Require Insurers to Disclose Climate-Change Response Plans*, N.Y.

months of 2012 in the U.S., there were more than 40,000 hot temperature records, horrendous wildfires, major droughts, oppressive heat waves, major flooding, and a powerful derecho wind storm, followed in August by Hurricane Isaac (\$2 billion damages), and in October by Hurricane Sandy (\$50 billion damages).⁶⁶

The IPCC Synthesis identified impacts from growing weather hazards upon public health to include: more frequent and more intense heat waves; more people suffering death, disease, and injury from floods, storms, fires, and droughts; increased cardio-respiratory morbidity and mortality associated with ground-level ozone pollution; changes in the range of some infectious disease carriers spreading, for example, malaria and the West Nile virus; and increased malnutrition and consequent disorders.⁶⁷ The NRC

TIMES, Feb. 2, 2012, at B3; *see also infra* notes 75–76 (noting the growing risks of coastal property damage). On October 17, 2012, just two weeks before Hurricane Sandy struck the United States mainland, the large reinsurance company Munich Re issued a report whose data analysis revealed:

Nowhere in the world is the rising number of natural catastrophes more evident than in North America. The [report] shows a nearly quintupled number of weather-related loss events in North America for the past three decades, compared with an increase factor of 4 in Asia, 2.5 in Africa, 2 in Europe and 1.5 in South America. Anthropogenic climate change is believed to contribute to this trend, though it influences various perils in different ways. Climate change particularly affects formation of heat-waves, droughts, intense precipitation events, and in the long run most probably also tropical cyclone intensity.

Press Release, Munich Re, North America most affected by increase in weather-related natural catastrophes, (Oct. 17, 2012), http://www.munichre.com/en/media_relations/press_releases/2012/2012_10_17_press_release.aspx (last visited Nov. 18, 2012).

⁶⁶ Seth Borenstein, *This US Summer Is 'What Global Warming Looks Like'*, MYWAY, Jul. 3, 2012, <http://apnews.myway.com/article/20120703/D9VP9J681.html> (last visited Nov. 18, 2012); Jennifer Daniel, *Rising Tide*, BUS. WK., Nov. 1, 2012, <http://www.businessweek.com/articles/2012-11-01/rising-tide> (“The number of natural disasters since 1996 costing \$1 billion or more doubled compared with the previous 15-year period.”) (last visited Nov. 18, 2012). This summer, over 55% of the contiguous U.S. suffered drought conditions exceeded only by those in the 1930s and mid-1950s; by the end of August, 39% of the area was suffering severe to extreme drought. NAT'L OCEANIC & ATMOSPHERIC ADMIN., STATE OF THE CLIMATE: NATIONAL OVERVIEW AUGUST 2012, <http://www.ncdc.noaa.gov/sotc/national/2012/8> (last visited Nov. 18, 2012); Jon Herskovitz, *WMO: 2011 One of the Hottest Years on Record*, REUTERS, Nov. 30, 2011, <http://www.reuters.com/article/2011/11/29/us-climate-conference-idUSTRE7AS0MQ20111129> (last visited Nov. 18, 2012). One consequence is that “the concrete, steel and sophisticated engineering that undergird the nation’s infrastructure are being taxed to worrisome degrees by heat, drought and vicious storms.” Matthew Wald & John Schwartz, *Weather Extremes Leave Parts of U.S. Grid Buckling*, N.Y. TIMES, July 26, 2012, at A4, <http://www.nytimes.com/2012/07/26/us/rise-in-weather-extremes-threatens-infrastructure.html> (last visited Nov. 18, 2012). A second consequence is that the drought is contracting the soil beneath building foundations, “causing shifting that can lead to cracked basements and foundations, as well as damage aboveground.” Jim Salter, *U.S. Drought Damage: Homes See Cracking Due to Parched Soil*, HUFFINGTON POST, Aug. 31, 2012, http://www.huffingtonpost.com/2012/08/31/us-drought-damage-homes_n_1846712.html?utm_hp_ref=green (last visited Nov. 18, 2012).

⁶⁷ *See* IPCC SYNTHESIS, *supra* note 30, at 48. Similar findings and predictions were made by the U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 30, at 89–98, and in a congressional committee report, *see* ACESA Report, *supra* note 13, at 308–10. A new report forecasts “severe and widespread droughts in the next 30–90 years over many land areas”, including “severe drought conditions by the late half of this century over many densely populated areas such as

Hidden Costs of Energy report's damage assessment concluded that the vast majority of the \$120 billion per year were based on health damages,⁶⁸ including an additional 10,000–20,000 deaths per year.⁶⁹ By 2050, cumulative additional heat-related deaths from unabated climate change are predicted to be roughly 33,000 in the forty largest U.S. cities, with more than 150,000 additional deaths by 2100.⁷⁰

Weather extremes also threaten our national security, which is premised on stability. In 2007, the CNA Corporation's report *National Security and the Threat of Climate Change* described climate change as a "threat multiplier for instability" and warned that:

Projected climate change poses a serious threat to America's national security. The predicted effects of climate change over the coming decades include extreme weather events, drought, flooding, sea level rise, retreating glaciers, habitat shifts, and the increased spread of life-threatening diseases. These conditions have the potential to disrupt our way of life and to force changes in the way we keep ourselves safe and secure.⁷¹

The following year, in the first ever U.S. government analysis of climate change security threats, the National Intelligence Council issued an

Europe, the eastern USA, southeast Asia and Brazil." Aiguo Dai, *Increasing Drought Under Global Warming In Observations And Models*, *NATURE CLIMATE CHANGE* 1, 7, Aug. 5, 2012, available at <http://www.nature.com/nclimate/journal/vaop/ncurrent/pdf/nclimate1633.pdf>.

⁶⁸ NRC HIDDEN COSTS OF ENERGY, *supra* note 13, at 4–5, 21. "Health damages include premature mortality and morbidity (for example, chronic bronchitis, asthma, emergency hospital admissions for respiratory and cardiovascular disease), and are calculated using concentration-response functions employed in regulatory impact analyses by the U.S. Environmental Protection Agency (EPA)." *Id.* at 68.

⁶⁹ *Id.* at 97–98. There are no firm estimates on climate change related mortality, but the World Health Organization estimates that climate change has been causing more than 150,000 deaths per year. Health & Env't Linkages Initiative, *Climate Change*, <http://www.who.int/heli/risks/climate/climatechange/en>. Global Humanitarian Forum, an organization led by former U.N. Secretary General Kofi Annan, pegs the number at 300,000 deaths per year; while others argue the numbers are lower. Andrew C. Revkin, *Forum Says Climate Shift Brings Deaths*, *N.Y. TIMES*, May 29, 2009, at A5. Some also reference the 2.5–3 million people worldwide who die prematurely from air pollution caused by the burning of biofuels and fossil fuels. *See, e.g.*, Mark Z. Jacobson, *Securing Public Health Forever with Clean Energy*, *AL JAZEERA*, Feb. 7, 2012, <http://www.aljazeera.com/indepth/opinion/2012/02/20122784223420350.html> (last visited Nov. 18, 2012).

⁷⁰ NATURAL RES. DEF. COUNCIL, No. IB:12-05-C, *KILLER SUMMER HEAT: PROJECTED DEATH TOLL FROM RISING TEMPERATURES IN AMERICA DUE TO CLIMATE CHANGE* 5 tbl.2 (2012), available at <http://www.nrdc.org/globalwarming/killer-heat/files/killer-summer-heat-report.pdf>. While these numbers seem very high, note that in 2003 the European heat wave caused about 70,000 excess deaths across sixteen countries. NRC CLIMATE REPORT, *supra* note 14, at 193.

⁷¹ CNA CORP., *NATIONAL SECURITY & THE THREAT OF CLIMATE CHANGE* 1, 6 (2007); *see also* NRC CLIMATE REPORT, *supra* note 14, at 212 ("Long-term fluctuations of global wars and death rates since 1400 are correlated with shifts in temperature. . . . In Africa, civil wars since 1980 have been roughly 50% more likely in years 1°C warmer than average" (internal citations omitted)); ACESA REPORT, *supra* note 13, at 313 (predicting that global warming will "directly impact U.S. military infrastructure at risk of damage from extreme weather and melting permafrost. . . . For example, the East and Gulf Coasts will be at increased risk from storm surge . . . [as will] U.S. coastal military installations around the world.").

assessment warning, in part, that climate change could threaten U.S. security by leading to political instability, mass movements of refugees, terrorism, and conflicts over water and other resources.⁷²

2. When Frozen Water Melts

In 2007, the IPCC predicted that sea levels would rise by eight to twenty-four inches above current levels by 2100;⁷³ since then, however, numerous scientists and studies have suggested that the 2007 prediction is already out-of-date and that sea levels will likely rise up to 1.4 meters (m), or 55 inches, given upwardly trending CO₂ emissions.⁷⁴ The 2009 ACESA Report found that rising sea levels are:

[A]lready causing inundation of low-lying lands, corrosion of wetlands and beaches, exacerbation of storm surges and flooding, and increases in the salinity of coastal estuaries and aquifers. . . . Further, about one billion people live in areas within 75 feet elevation of today's sea level, including many US cities on the East Coast and Gulf of Mexico, almost all of Bangladesh, and areas occupied by more than 250 million people in China.⁷⁵

⁷² See *National Intelligence Assessment on the National Security Implications of Global Climate Change to 2030: Hearing Before the H. Select Comm. on Energy Independence and Global Warming*, 110th Cong. 4–5 (2008) (statement of Dr. Thomas Fingar, Deputy Director of National Intelligence for Analysis and Chairman of the National Intelligence Council), available at http://www.dni.gov/files/documents/Newsroom/Testimonies/20080625_testimony.pdf. More recently, the National Research Council issued a lengthy report on climate change and U.S. national security that stated, as one of its conclusions:

Given the available scientific knowledge of the climate system, it is prudent for security analysts to expect climate surprises in the coming decade, including unexpected and potentially disruptive single events as well as conjunctions of events occurring simultaneously or in sequence, and for them to become progressively more serious and more frequent thereafter, most likely at an accelerating rate. The climate surprises may affect particular regions or globally integrated systems, such as grain markets, that provide for human well-being.

NAT'L RESEARCH COUNCIL, CLIMATE AND SOCIAL STRESS: IMPLICATIONS FOR SECURITY ANALYSIS, S-2, 3-16 (2012), available at http://www.nap.edu/catalog.php?record_id=14682. See also Dominic Kniveton et al., *Emerging Migration Flows in a Changing Climate in Dryland Africa*, 2 NATURE CLIMATE CHANGE, June 2012, at 444–47 (2012); Etienne Piguet, *The Drivers of Human Migration*, 2 NATURE CLIMATE CHANGE, June 2012, at 400–01; CHRISTIAN PARENTI, TROPIC OF CHAOS: CLIMATE CHANGE AND THE NEW GEOGRAPHY OF CHAOS 6–7 (2011); ACESA Report, *supra* note 8, at 312–14.

⁷³ ACESA Report, *supra* note 13, at 305.

⁷⁴ See, e.g., CHRIS WOLD ET AL., CLIMATE CHANGE AND THE LAW 20 (2009); ACESA Report, *supra* note 13, at 305; see also NRC CLIMATE REPORT, *supra* note 14, at 37 (noting that some “models predict sea level rise up to 1.6 meters [63 inches] by 2100” from an increase of 3.1°C).

⁷⁵ ACESA REPORT, *supra* note 13, at 305–06. “More than 70[%] of the world's population lives on coastal plains, and eleven of the world's fifteen largest cities are on the coast.” *Id.* at 306. With a 0.5 meter rise, up to 4 million people face permanent displacement from erosion of over 98,000 square miles (about the size of Oregon); with a one meter rise, flooding will threaten between 10million to 300 million people. See NRC CLIMATE REPORT, *supra* note 14, at 43–44.

This year NASA's Chief Scientist testified to Congress that two-thirds of sea level rise from the last three decades is derived from the Greenland and Antarctic ice sheets and the melting Arctic region; he then warned:

[T]he West Antarctic ice sheet (WAIS), an area about the size of the states of Texas and Oklahoma combined . . . contains the equivalent of 3.3 m of sea level, and all that ice rests on a soft-bed that lies below sea level. In this configuration, as warm seawater melts the floating ice shelves, causing them to retreat and the glaciers that feed them to speed up, there is no mechanism to stop the retreat and associated discharge, if warming continues. Thus the WAIS exhibits great potential for substantial and relatively rapid contributions to sea level rise.

In Greenland, the situation is not as dramatic, since the bed that underlies most of the ice is not below sea level, and the potential for unabated retreat is limited to a few outlet glaciers. In Greenland, however, summer air temperatures are warmer and closer to ice's melting point, and we have observed widespread accumulation of meltwater in melt ponds on the ice sheet surface.⁷⁶

In the West Antarctic ice sheet region, glacier retreat appears to be widespread, as the air has "warmed by nearly 6°F since 1950."⁷⁷ As for Greenland's ice sheet, it also is at greater risk than the IPCC had thought.

⁷⁶ *Impacts of Rising Sea Levels on Domestic Infrastructures: Hearing Before the S. Comm. on Energy & Natural Resources*, 112th Cong. 3 (Apr. 19, 2012) (statement of Dr. Waleed Abdalati, Chief Scientist, Nat'l Aeronautics & Space Admin.), available at <http://www.hq.nasa.gov/legislative/hearings/2012%20hearings/4-19-2012%20ABDALATI.pdf>. "A complete melting of the Greenland ice sheet alone would cause a 20-foot rise in sea level, and complete melting of the West Antarctic ice sheet would cause a 16-foot sea level rise." ACESA REPORT, *supra* note 13, at 306. In mid-July 2012, NASA satellite photographs revealed that an iceberg twice the size of Manhattan, 46 square miles, broke off one of Greenland's largest glaciers, prompting a NASA glaciologist to say, "This is not part of natural variations anymore." *46-Square-Mile Iceberg Breaks Off Greenland Glacier*, PORTLAND PRESS HERALD, July 18, 2012, http://www.pressherald.com/news/nationworld/46-square-mile-iceberg-breaks-off-greenland-glacier_2012-07-18.html (last visited Nov. 18, 2012).

⁷⁷ WOLD ET AL., *supra* note 74, at 18. A comprehensive reconstruction of a 15,000 year climate history finds that the rapid rate of Antarctic warming over the past 50 years is not consistent with historic trends, suggesting human-caused warming as an influence; as warming continues, "[t]emperatures will soon exceed the stable conditions that persisted in the eastern Antarctic Peninsula for most of the Holocene. The association between atmospheric temperature and ice-shelf stability in the past demonstrates that as warming continues ice-shelf vulnerability is likely to progress farther southwards along the Antarctic Peninsula coast to affect ice shelves that have been stable throughout the Holocene, and may make them particularly susceptible to changes in oceanographic forcing." Robert Mulvaney et al., *Recent Antarctic Peninsula Warming Relative To Holocene Climate And Ice-Shelf History*, 489 NATURE 141, 143 (2012). Another study found that of 244 mapped glaciers on the Antarctic Peninsula, 87% were retreating. A.J. Cook et al., *Retreating Glacier Fronts on the Antarctic Peninsula over the Past Half-Century*, 308 SCIENCE 541, 541-44 (2005). "Satellite measurements of the change in surface elevation of the ice shelves indicate [rates up to] (18 feet) per year from 1992 to 2001, which amounts to a loss of 1 to 7[%] of their thickness in the nine-year period[.]" MATHEZ, *supra* note 30, at 165. Models predict a loss in Antarctic sea-ice cover of about "10-50% in winter and 33-100% in summer from a warming of 1.7 to 4.4°C". NRC CLIMATE REPORT, *supra* note 14, at 35.

Recent studies with more complete modeling suggest that the warming threshold leading to an essentially ice-free state is not the previous estimate of an additional 3.1°C, but only 1.6°C. Thus, the 2°C target may be insufficient to prevent loss of much of the ice sheet and resultant significant sea level rise.⁷⁸

The ACESA Report also identified the Arctic as “one of the hotspots of global warming”⁷⁹ because “[o]ver the past 50 years average temperatures in the Arctic have increased as much as 7°F, five times the global average.”⁸⁰ Moreover, in “2007, a record 386,000 square miles of Arctic sea ice melted away, an area larger than Texas and Arizona combined and as big a decline in one year as has occurred over the last decade.”⁸¹ “Arctic sea ice is melting faster than climate models [had] predict[ed,] and is about [thirty] years ahead” of the 2007 IPCC predictions, thus indicating that the Arctic Ocean could be ice-free in the late summer beginning sometime between 2020 and 2037.⁸²

⁷⁸ Radar and satellite-based measurements that provide an estimate of total mass of ice corroborate that Greenland lost “59 cubic miles[] of ice per year from April 2002 to April 2006; furthermore, the mass loss has been accelerating such that between May 2004 and April 2006, the loss was more than double the loss” in the preceding two years. MATHEZ, *supra* note 30, at 163; *see also* Isabella Velicogna & John Wahr, *Acceleration of Greenland Ice Mass Loss in Spring 2004*, 443 NATURE 329, 329–31 (2006). The Ice Sheet’s recent rate of loss is four times what it was a decade ago. *The Melting North*, ECONOMIST, June 16, 2012, at 7.

⁷⁹ ACESA REPORT, *supra* note 13, at 303.

⁸⁰ *Id.* Indeed, while the global atmospheric carbon concentration as of Spring 2012 reached 395 ppm (up from the 275 ppm at the start of the Industrial Revolution), the Arctic is the first region in the 21st century world to break the 400 ppm level—a level the world has not seen for more than 800,000 years. Seth Borenstein, *Climate Change: Arctic Passes 400 Parts per Million Milestone*, CHRISTIAN SCI. MONITOR, May 31, 2012, <http://www.csmonitor.com/Science/2012/0531/Climate-change-Arctic-passes-400-parts-per-million-milestone> (last visited Nov. 18, 2012). “The fact that it’s 400 is significant,” said NOAA’s global monitoring director. *Id.* (quoting Jim Butler). “It’s just a reminder to everybody that we haven’t fixed this and we’re still in trouble.” *Id.*

⁸¹ ACESA REPORT, *supra* note 13, at 303. “[A]nnually averaged Arctic sea ice area reductions of about 15% are expected per degree C of global average warming.” NRC CLIMATE REPORT, *supra* note 14, at 34.

⁸² *See* WOLD ET AL., *supra* note 74, at 18; Muyin Wang & James E. Overland, *A Sea Ice Free Summer Arctic Within 30 Years?*, 36 GEOPHYSICAL RESEARCH LETTERS, Apr. 2009, at L07502, <http://www.agu.org/journals/gl/gl0907/2009GL037820/2009GL037820.pdf> (last visited Nov. 18, 2012). “For 800,000 to a million years, at least some of the Arctic has been covered by ice throughout the year. That’s an indication that, if we are heading for an ice-free Arctic, it’s a really dramatic change and something that is unprecedented almost within the entire record of human species.” David Adam, *Meltdown Fear as Arctic Ice Cover Falls to Record Winter Low*, GUARDIAN, May 14, 2006, <http://www.guardian.co.uk/world/2006/may/15/antarctica.environment> (last visited Nov. 18, 2012). Just six years later, on September 16, 2012, the extent of Arctic sea ice was at a record low—roughly 49% less than the average from 1979 to 2000—continuing the trend that the “six lowest seasonal minimum ice extents in the satellite record have all occurred in the last six years (2007 to 2012).” Nat’l Snow and Ice Data Ctr., *Arctic Sea Ice Extent Settles At Record Seasonal Minimum*, ARTIC SEA ICE NEWS & ANALYSIS, Sept. 19, 2012, <http://nsidc.org/arcticseaicenews/2012/09/arctic-sea-ice-extent-settles-at-record-seasonal-minimum/> (last visited Nov. 18, 2012). For context, “[i]n the 1980s, [Walt] Meier said, summer sea ice would cover an area slightly smaller than the Lower 48 states. Now it is about half that.” Seth Borenstein, *Arctic Sea Ice Shrinks to Record Low*, PORTLAND PRESS HERALD, Sept. 20, 2012, http://www.pressherald.com/news/nationworld/arctic-sea-ice-shrinks-to-record-lowextent_2012-09-20.html (last visited Nov. 18, 2012).

How is the Arctic's plight linked to non-Arctic impacts? "The Arctic region arguably has the greatest concentration of potential tipping elements in the Earth system, including Arctic sea ice, the Greenland ice sheet, North Atlantic deep-water formation regions, boreal forests, permafrost and marine methane hydrates."⁸³ Additionally:

Warming of the Arctic region is proceeding at three times the global average Loss of Arctic sea ice has been tentatively linked to extreme cold winters in Europe Near complete loss of the summer sea ice, as forecast for the middle of this century, if not before, will probably have knock-on effects for the northern mid-latitudes, shifting the jet streams and storm tracks.⁸⁴

Since 1980, sea levels have been rising three to four times faster than the global average between Cape Hatteras, North Carolina and Boston, Massachusetts.⁸⁵ "[P]ast and future global warming more than doubles the estimated odds of 'century' or worse floods occurring within the next 18 years" for most coastal U.S. locations.⁸⁶

⁸³ Carlos Duarte et al., *Abrupt Climate Change in the Arctic*, 2 NATURE CLIMATE CHANGE 60, 60 (2012). "Tipping points have been defined as critical points . . . at which a small perturbation can qualitatively alter its future state. Tipping elements are those large-scale components of the Earth system that can exhibit a tipping point." *Id.*

⁸⁴ *Id.* at 60–61. A recent study also has found a new risk as well: in over 100,000 square kilometers of the northwestern Eurasian tundra, willow and alder shrubs have grown into "pop-up forests" in the past 30–40 years. Marc Macias-Fauria et al., *Eurasian Arctic Greening Reveals Teleconnections and the Potential for Structurally Novel Systems*, 2 NATURE CLIMATE CHANGE 613, 613 (2012). The problem is that as the Arctic greens, it may speed Arctic warming by as much as 1°C to 2°C by 2100, because the darker foliage absorbs sunlight that would otherwise have been reflected back into space by the white snowy tundra. *Id.* In addition, a June 2012 report published in OCEANOGRAPHY has received more attention following the unusual Arctic "blocking high" that helped steer Hurricane Sandy directly into the New Jersey coast. The report finds that the Northern Hemisphere is likely to have more weather extremes during the winter due to the extent of summer sea ice melting in the Arctic as a result of polar vortex and jet stream changes. Charles H. Greene & Bruce C. Monger, *An Arctic Wild Card in the Weather*, 25 OCEANOGRAPHY 7, 8 (2012), available at http://www.tos.org/oceanography/archive/25-2_greene.pdf.

⁸⁵ Asbury Sallenger, Jr., *Hotspot Of Accelerated Sea-Level Rise On The Atlantic Coast Of North America*, NATURE CLIMATE CHANGE 1, (forthcoming 2012) (published online June 24, 2012), <http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate1597.html>.

⁸⁶ BEN STRAUSS ET AL., SURGING SEAS: SEA LEVEL RISE, STORMS & GLOBAL WARMING'S THREAT TO THE US COAST 2 (2012), available at <http://slr.s3.amazonaws.com/SurgingSeas.pdf>. "For over half the locations analyzed, warming at least triples the odds of century-plus floods over the same period." *Id.* "At three quarters of the 55 sites analyzed in [the] report, century levels are higher than 4 feet above the high tide line[—yet] nearly 5 million people live in 2.6 million homes [located] less than 4 feet above high tide," *id.*, and nearly 300 energy facilities are also sited within that zone. Ben Strauss & Remik Ziemiński, *Sea Level Rise Threats to Energy Infrastructure*, CLIMATE CENT., Apr. 19, 2012, at 2, available at <http://slr.s3.amazonaws.com/SLR-Threats-to-Energy-Infrastructure.pdf>. "In 285 cities and towns," including New York City and major Florida cities, "more than half the population lives on land below this line." STRAUSS ET AL., *supra*, at 2. "[A]bout \$30 billion in taxable property is vulnerable below the three-foot line in just three counties in southeast Florida, not including . . . Miami-Dade." *Id.* Meanwhile, New York City's future climate effects may cause current 100-year flooding to occur every 3 to 20 years—impacting over 33,000 buildings worth over \$18 billion. Jeroen Aerts & W.J.

Although land-based glacier melts are not major contributors to sea level rise, they do impact peoples' food and water supplies. Virtually all of the world's glaciers, which store 75% of the world's freshwater, are receding in direct response to global warming, aggravating already severe water scarcity—both in the United States and abroad.⁸⁷ While over 15% of the world's population currently relies on glacial melt and snow cover for drinking water and irrigation for agriculture, the IPCC projects a 60% volume loss in glaciers in various regions and widespread reductions in snow cover throughout the twenty-first century.⁸⁸ Likewise, snowpack has been decreasing, and it is expected that snow cover duration will significantly decrease in eastern and western North America and Scandinavia by 2020 and globally by 2080.⁸⁹

Climate change thus increases food insecurity by reducing yields of grains, such as corn and wheat, through increased water scarcity and intensification of severe hot conditions, thereby causing corn price volatility to sharply increase.⁹⁰ Globally, the number of people living in “severely

Wouter Botzen, *Managing Exposure to Flooding in New York City*, 2 NATURE CLIMATE CHANGE 377, 377 (2012); see also NRC CLIMATE REPORT, *supra* note 14, at 184–85. The preceding two footnotes were written months before the late October 2012 Hurricane Sandy struck the East Coast, confirming the roles that rising sea level and warmer waters can play in extremely high and devastating storm surges. See *supra* notes 63–66 and accompanying text; see also Freedman, *supra* note 63 (“The storm surge at The Battery in Lower Manhattan was the highest ever recorded at that location. It surpassed even the most pessimistic forecasts, with the maximum water level reaching 13.88 feet above the average of the daily lowest low tide of the month, known as Mean Lower Low Water, including a storm surge component of 9.23 feet. That broke the official record of 10.5 feet above Mean Lower Low Water set in 1960 during Hurricane Donna, as well as a record set during a hurricane in 1821. Or, to put it in simpler terms, the water level reached 9.15 feet above the average high-tide line.”).

⁸⁷ ACESA REPORT, *supra* note 13, at 301. A recent comparison of glacier fluctuations in the Southern Alps of New Zealand and the European Alps suggests “that the net glacier recession and atmospheric warming in both regions over the past century is anomalous in the context of earlier Holocene variability and corresponds with anthropogenic emissions of greenhouse gases.” Aaron E. Putnam et al., *Regional Climate Control of Glaciers in New Zealand and Europe During the Pre-Industrial Holocene*, 5 NATURE GEOSCIENCE 627, 627 (2012).

⁸⁸ INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE AND WATER: IPCC TECHNICAL PAPER VI 27–28 (Bryson Bates et al. eds., 2008), available at <http://www.ipcc.ch/pdf/technical-papers/climate-change-water-en.pdf>. The European Alps could lose 80% of their glaciers by the end of the century. See Michael Zemp et al., *Alpine Glaciers to Disappear Within Decades?*, 33 GEOGRAPHY RES. LETTERS 1, 4 (2006), available at <http://www.agu.org/journals/gl/gl0613/2006GL026319/2006GL026319.pdf>. Downstream impacts also exist; “500 million people use water from the Ganges River, and yet [70%] of the Ganges' low summer flows come from just one massive glacier which is receding at [forty] meters a year.” WOLD ET AL., *supra* note 74, at 19.

⁸⁹ NRC CLIMATE REPORT, *supra* note 14, at 140–41.

⁹⁰ Noah S. Diffenbaugh et al., *Response of Corn Markets to Climate Volatility Under Alternative Energy Futures*, 2 NATURE CLIMATE CHANGE 514, 514–18 (2012). Climate change also will increasingly challenge food and livestock production due to increased heat, pests, diseases, water stress, and extreme weather events. See U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 30, at 71–78. Yields of corn in the U.S. and Africa, and wheat in India, will likely drop 7%–15% per degree Celsius of global warming. NRC CLIMATE REPORT, *supra* note 14, at 38–39. Indeed, as of July 9, 2012, a widespread drought in the Midwest was causing a surge in corn and soybean prices, as 30% of the corn and 27% of the soybean crops were considered in poor or very poor

stressed” river basins will increase “by one to two billion people in the 2050s. About two-thirds of global land area is expected to experience increased water stress.”⁹¹

3. *When Liquid Water Warms*

Over the past century, oceans, which cover 70% of the Earth’s surface, have been warming. Global sea-surface temperatures have increased about 1.3°F and the heat has penetrated almost two miles into the deep ocean.⁹² This increased warming is contributing to the destruction of seagrass meadows, causing an annual release back into the environment of 299 million tons of carbon.⁹³ Elevated atmospheric CO₂ concentrations also are leading to higher absorption of CO₂ into the upper ocean, making the surface waters more acidic (lower pH).⁹⁴ “[O]cean chemistry currently is

condition. *Corn Prices Surge as USDA Reports 18 States Hurt by Drought*, USA TODAY, July 9, 2012, <http://www.usatoday.com/news/nation/story/2012-07-09/midwestdrought/56117886/1?csp=34news> (last visited Nov. 18, 2012); see also *supra* note 67 and accompanying text.

⁹¹ ARCHER & RAHMSTORF, *supra* note 50, at 170. Another consequence of water stress is that “thermoelectric [nuclear and fossil-fueled] power in Europe and the United States is vulnerable to climate change owing to the combined impacts of lower summer river flows and higher river water temperatures,” thus causing “a summer average decrease in capacity of power plants of 6.3%–19% in Europe and 4.4%–16% in the United States.” Michelle T.H. van Vliet et al., *Vulnerability of US and European Electricity Supply to Climate Change*, 2 NATURE CLIMATE CHANGE 676, 676 (2012).

⁹² See S. Levitus et al., *Warming of the World Ocean, 1955–2003*, 32 GEOPHYSICAL RES. LETTERS 1 (2005); see also MATHEZ, *supra* note 30, at 136. For the first half of 2012, the Northeast Shelf Ecosystem (the large marine ecosystem extending from the Gulf of Maine south to Cape Hatteras and from the coast seaward to the edge of the continental shelf) experienced the highest sea surface temperature on record, as well as above average temperatures in all parts of the ecosystem. See Ne. Fisheries Sci. Ctr., *Ecosystem Advisory for the Northeast Shelf Large Marine Ecosystem: Summary of Conditions of the Northeast Shelf Ecosystem*, Aug. 27, 2012, <http://www.nefsc.noaa.gov/ecosys/advisory/current/advisory.html>; see also Ne. Fisheries Sci. Ctr., *Ecosystem Advisory for the Northeast Shelf Large Marine Ecosystem: Spring Sea Surface Temperature Distribution*, Aug. 27, 2012, <http://www.nefsc.noaa.gov/ecosys/advisory/current/adv5.html>; Ne. Fisheries Sci. Ctr., *Ecosystem Advisory for the Northeast Shelf Large Marine Ecosystem: Temperature from Spring Survey* (Aug. 31, 2012), <http://www.nefsc.noaa.gov/ecosys/advisory/current/adv10.html>. A new comparison of ocean temperatures between the 1870s and 2005 finds, to depths of 3,000 feet, “a centennial timescale for the present rate of global warming.” Dean Roemmich et al., *135 Years Of Global Ocean Warming Between The Challenger Expedition And The Argo Programme*, 2 NATURE CLIMATE CHANGE 425, 425–28 (2012).

⁹³ James W. Fourqurean et al., *Seagrass Ecosystems as a Globally Significant Carbon Stock*, 5 NATURE GEOSCIENCE 505, 505 (2012). This grim situation is reinforced by a related finding that the warming climate is eradicating the Mediterranean seagrass (*Posidonia oceanica*) a species that holds more carbon than most other species, and is likely to be extinct before 2050. Gabriel Jorda et al., *Mediterranean Seagrass Vulnerable to Regional Climate Warming*, 2 NATURE CLIMATE CHANGE 1, 3 (forthcoming 2012) (published online May 20, 2012), http://www.nature.com/nclimate/journal/v2/n11/full/nclimate1533.html?WT.ec_id=NCLIMATE-201211. The warming has also likely been contributing to stronger, more extreme weather events such as the recent Hurricane Sandy. See *supra* notes 63–66, 85–86, and accompanying text.

⁹⁴ “[T]he oceans have absorbed so much additional CO₂ in recent years (approximately 118 billion tons since 1800[, or 25% of human-produced emissions]) that they are becoming

changing at least 100 times more rapidly than it has changed during the 650,000 years preceding our [fossil-fueled] industrial era.”⁹⁵ This acidification has serious implications for the calcification rates of organisms and plants living at all levels within the global ocean. Coral reefs—habitat for over a million marine species—are collapsing, endangering more than a third of all coral species.⁹⁶ Indeed, temperature thresholds for the majority of coral reefs worldwide are expected to be exceeded, causing mass bleaching and complete coral mortality.⁹⁷ “[T]he productivity of plankton, krill, and marine snails, which compose the base of the ocean food-chain, [also] declines as the ocean acidifies,”⁹⁸ adversely impacting populations of “everything from whales to salmon”⁹⁹—species that are also being harmed by the oceans’ warming.¹⁰⁰

measurably more acidic.” WOLD ET AL., *supra* note 74, at 21; *see also* NRC CLIMATE REPORT, *supra* note 14, at 40–43, 154–58 (detailing ocean acidification trends and impacts).

⁹⁵ ACESA REPORT, *supra* note 13, at 304.

⁹⁶ *See* RICHARD A. FEELY ET AL., CARBON DIOXIDE AND OUR OCEAN LEGACY 2 (2006), *available at* <http://www.pmel.noaa.gov/pubs/PDF/feel2899/feel2899.pdf>; Dan Vergano, *Rough Seas: One-third of Coral Reef Species Face Extinction*, USA TODAY, July 13, 2008, http://www.usatoday.com/tech/science/columnist/vergano/2008-07-13-coral-threat_N.htm (last visited Nov. 18, 2012); K. Frieler et al., *Limiting Global Warming to 2°C is Unlikely to Save Most Coral Reefs*, NATURE CLIMATE CHANGE, 1, 5 (forthcoming 2012) (published online Sept. 16, 2012), *available at* <http://www.nature.com/nclimate/journal/vaop/ncurrent/pdf/nclimate1674.pdf>. The U.S. government has estimated “the total economic value of coral . . . to be \$30 billion.” ACESA REPORT, *supra* note 13, at 305.

⁹⁷ *See* NRC CLIMATE REPORT, *supra* note 14, at 43; *see also* Frieler et al., *supra* note 96 at 1, 4, 5 (“Even under optimistic assumptions regarding corals’ thermal adaptation, one-third (9–60%, 68% uncertainty range) of the world’s coral reefs are projected to be subject to long-term degradation under the most optimistic new IPCC emissions scenario, RCP3-PD [1.3–2.0°C]. Under RCP 4.5 [2.0–3.2°C] this fraction increases to two-thirds (30%–88%, 68% uncertainty range) . . . There is little precedent for the rate and magnitude of warming in the recent geological history of corals, including the transition into the warm Eemian period.”).

⁹⁸ WOLD ET AL., *supra* note 74, at 21. A recent report also found severely reduced growth and survival in fish in direct response to expected increased levels of carbon dioxide in their environment. “These findings challenge the belief that ocean acidification will not affect fish populations, because even small changes in early life survival can generate large fluctuations in adult-fish abundance.” Hannes Baumann et al., *Reduced Early Life Growth and Survival in a Fish in Direct Response to Increased Carbon Dioxide*, 2 NATURE CLIMATE CHANGE 38 (2012). Another recent report found severe tissue damage from increasing ocean acidification in Atlantic cod (*Gadus morhua*) larvae; this is significant because cod is a commercial species. Andrea Y. Frommel et al., *Severe Tissue Damage In Atlantic Cod Larvae Under Increasing Ocean Acidification*, 2 NATURE CLIMATE CHANGE 42 (2012).

⁹⁹ WOLD ET AL., *supra* note 74, at 21 (citing Joan A. Klepyas et al., NAT’L CTR. FOR ATMOSPHERIC RES., *Impacts of Ocean Acidification on Coral Reefs and Other Marine Calcifiers: A Guide for Future Research*, (2006), *available at* http://www.ucar.edu/communications/Final_acidification.pdf). “In the United States alone, commercial and recreational fisheries contribute \$60 billion to the economy each year and employ more than 500,000 people.” ACESA REPORT, *supra* note 13, at 305. Food supplies for millions of people will also be impaired. MATTHEW HUELSENBECK, OCEAN-BASED FOOD SECURITY THREATENED IN A HIGH CO₂ WORLD 11 (Oceana 2012), *available at* http://oceana.org/sites/default/files/reports/Ocean-Based_Food_Security_Threatened_in_a_High_CO2_World.pdf.

¹⁰⁰ Changes in the oceans include a poleward shift of fish, plankton, and algae species as ocean waters warm. *See* ARCHER & RAHMSTORF, *supra* note 50, at 156; NRC CLIMATE REPORT, *supra* note 14, at 210–11. In the northern Atlantic, plankton have moved north by 1,000

Extinctions from climate change also are expected to be significant and widespread. The IPCC Fourth Assessment found that “approximately 20–30% of plant and animal species assessed so far are likely to be at increased risk of extinction if increases in global average temperature exceed 1.5–2.5°C”¹⁰¹—a range likely to be exceeded in the coming decades. “[R]ecent studies have linked global warming to declines in such [] species as [] blue crabs, penguins, gray whales, salmon, walruses, and ringed seals; [] bird extinction rates are predicted to be as high as 38[%] in Europe and 72[%] in northeastern Australia, if global warming exceeds 2°C above pre-industrial levels.”¹⁰² Between now and 2050, Conservation International estimates that one species will face extinction every twenty minutes;¹⁰³ the current extinction rate is one thousand times faster than the average during Earth’s history,¹⁰⁴ in part because the climate is changing more than 100 times faster than the rate at which many species can adapt.¹⁰⁵

4. When Land Dries Out

The warming trends toward the Earth’s poles and higher latitudes are threatening people not just from melting ice and sea level rise, but also from the predicted thawing of 30%–50% of permafrost by 2050, and again as much or more of it by 2100.¹⁰⁶ “The term *permafrost* refers to soil or rock that has

kilometers over the past 40 years. See U.N. Env’tl. Programme & GRID Arendal, *Increasing Sea Temperatures Already Cause Changes in Distribution of Marine Life*, <http://www.grida.no/publications/rr/in-dead-water/page/1248.aspx> (last visited Nov. 18, 2012). Likewise, recent climate modeling in the North Pacific shows “a substantial northward shift,” of up to 1,000 kilometers, “in biodiversity across the North Pacific for species with both commercial and conservation value.” Elliott L. Hazen et al., *Predicted Habitat Shifts of Pacific Top Predators in a Changing Climate*, NATURE CLIMATE CHANGE 1, 3, (forthcoming 2012) (published online Sept. 23, 2012), available at http://www.gfdl.noaa.gov/cms-filesystem-action?file=user_files/rrr/hazen_et_al_2012_no_supp.pdf.

¹⁰¹ IPCC 2007 SYNTHESIS, *supra* note 30, at 48 (emphasis omitted). The IPCC has also estimated that between 40% and 70% of the Earth’s species could be at risk of extinction with a 3.5°C rise in temperature, which could occur by the end of the century. *Id.* at 54. This would be an extinction event on a scale second only to the Earth’s largest mass extinction that occurred 250 million years ago.

¹⁰² WOLD ET AL., *supra* note 74, at 25–26.

¹⁰³ Conservation Int’l, *Ensuring Species Survival*, <http://www.conservation.org/learn/biodiversity/species/pages/overview.aspx>.

¹⁰⁴ *Id.*; WILLIAM H. RODGERS, JR. ET AL., CLIMATE CHANGE: A READER 277 (2011).

¹⁰⁵ See A. Michelle Lawing & P. David Polly, *Pleistocene Climate, Phylogeny, and Climate Envelope Models: An Integrative Approach to Better Understand Species’ Response to Climate Change*, PLOS ONE, Dec. 2, 2011, at 8, available at <http://www.plosone.org/article/info:doi/10.1371/journal.pone.0028554>. The study finds that the rate of future change in suitable habitat in a clade of rattlesnakes will be two to three orders of magnitude greater than the average change over the past 300 millennia, a time that included three major glacial cycles and significant variation in climate and temperature. *Id.* at 11.

¹⁰⁶ See WOLD ET AL., *supra* note 74, at 19; Edward Schuur & Benjamin Abbot, *High Risk of Permafrost Thaw*, 480 NATURE 32, 33 (2011) (“Collectively, we hypothesize that the high warming scenario will degrade 9–15% of the top 3 metres of permafrost by 2040, increasing to 47–61% by 2100 and 67–79% by 2300 . . .”). For information on the most recent U.S. Geological Survey study discussing potential climate change impacts on the arctic permafrost, see Press

been below 0°C (32°F) and frozen for at least two years.”¹⁰⁷ Permafrost underlies about 25% of the land area in the northern hemisphere, and is “estimated to hold 30[%] or more of all carbon stored in soils worldwide”—which equates to four times more than all the carbon humans have emitted in modern times.¹⁰⁸ Given the increasing average air temperatures in eastern Siberia, Alaska, and northwestern Canada, thawing of the Northern permafrost would release massive amounts of carbon dioxide (doubling current atmospheric levels) and methane into the atmosphere.¹⁰⁹ Indeed, there are about 1.7 trillion tons of carbon in northern soils (roughly twice the amount in the atmosphere), about 88% of it in thawing permafrost.¹¹⁰ Permafrost thus may become an annual source of carbon equal to 15%–35% of today’s annual human emissions.¹¹¹ But like seagrass meadows and unlike power plant emissions, we cannot trap or prevent permafrost carbon emissions at the source.

Similarly, forests, which “cover about 30[%] of the Earth’s land surface and hold almost half of the world’s terrestrial carbon . . . act both as a source of carbon emissions to the atmosphere when cut, burned, or otherwise degraded and as a sink when they grow.”¹¹² A combination of droughts, fires, and spreading pests, though, are causing economic and environmental havoc: “In 2003 . . . forest fires in Europe, the United States, Australia, and Canada accounted for more global [carbon] emissions than any other source.”¹¹³ There have been significant increases in both the

Release, U.S. Geological Survey, No-so-Permanent Permafrost (Oct. 24, 2012), www.usgs.gov/newsroom/article.asp?ID=3436#UKf71OQ1mvi (last visited Nov. 18, 2012), and Jennifer W. Harden et al., AGU: GEOPHYSICAL RESEARCH LETTERS, *available at* www.agu.org/journals/gl/g1215/2012GL051958/2012GL051958.pdf.

¹⁰⁷ MATHEZ, *supra* note 30, at 156–57.

¹⁰⁸ WOLD ET AL., *supra* note 74, at 19–20; Schuur & Abbot, *supra* note 106, at 32–33. Once thawed, permafrost’s organic matter releases not only carbon dioxide but also methane and nitrates—all powerful greenhouse gases. *Id.* (projecting releases of between 30 and 63 billion tons of carbon by 2040 and 232 to 380 billion tons by 2100).

¹⁰⁹ Methane is many times more effective at trapping heat as a greenhouse gas than carbon dioxide—62 times more over a 20-year span, and 23 times more over a century. V. RAMASWAMY ET AL., RADIATIVE FORCING OF CLIMATE CHANGE, *in* CLIMATE CHANGE 2001: THE SCIENTIFIC BASIS CONTRIBUTION OF WORKING GROUP I TO THE THIRD ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 349, 388 § 6.12.2 tbl.6.7 (J.T. Houghton et al. eds., 2001), *available at* <http://www.ipcc.ch/ipccreports/tar/wg1/248.htm#tab67>. Methane releases from thawing permafrost and warming sea floors could be significant dangerous tipping points for the climate system. NRC CLIMATE REPORT, *supra* note 14, at 222–25.

¹¹⁰ See Justin Gillis, *As Permafrost Thaws, Scientists Study the Risks*, N.Y. TIMES, Dec. 17, 2011, at A1, A16; Schuur & Abbot, *supra* note 106, at 32.

¹¹¹ See Gillis, *supra* note 110 at A16.

¹¹² ACESA REPORT, *supra* note 13, at 310 (internal citations omitted). “Forests store 45% of the carbon found in terrestrial ecosystems, comprise 50% of terrestrial net primary production and may sequester as much as 25% of annual anthropogenic carbon emissions to the atmosphere.” William R. L. Anderegg et al., *Consequences of Widespread Tree Mortality Triggered by Drought and Temperature Stress*, NATURE CLIMATE CHANGE 1, (forthcoming 2012) (published online Sept. 9, 2012), *available at* <http://www.nature.com/nclimate/journal/vaop/ncurrent/pdf/nclimate1635.pdf>.

¹¹³ WOLD ET AL., *supra* note 74, at 23. The climate-driven economic havoc for forests also is predicted to result from shifts in tree species distribution; for example:

number of major wildfires and the area of forests burned in the U.S. and Canada.¹¹⁴ Fires fed by hot, dry weather have killed enormous stretches of forest in Siberia and in the Amazon, which “recently suffered two ‘once a century’ droughts just five years apart.”¹¹⁵

Climate change also is exacerbating the geographic spread and intensity of insect infestations. For example:

[I]n British Columbia . . . the mountain pine beetle extended its range north and has destroyed an area of soft-wood forest three times the size of Maryland, killing 411 million cubic feet of trees—double the annual take by all the loggers in Canada. Alaska has also lost up to three million acres of old growth forest to the pine beetle.¹¹⁶

Over the past fifteen years the spruce bark beetle extended its range into Alaska, where it has killed about 40 million trees more “than any other insect in North America’s recorded history.”¹¹⁷ The drying and burning forests, and

[T]he expected value of European forest land will decrease owing to the decline of economically valuable species in the absence of effective countermeasures. . . . by 2100—depending on the interest rate and climate scenario applied—this loss varies between 14% and 50% (mean: 28% for an interest rate of 2%) of the present value of forest land in Europe, excluding Russia, and may total several hundred billion Euros.

Marc Hanewinkel et al., *Climate Change May Cause Severe Loss in the Economic Value of European Forest Land*, NATURE CLIMATE CHANGE 1, (forthcoming 2012) (published online Sept. 23, 2012), available at <http://www.nature.com/nclimate/journal/vaop/ncurrent/pdf/nclimate1687.pdf>.

¹¹⁴ ACESA REPORT, *supra* note 13, at 311. As of July 4, 2012, over 2.1 million acres of U.S. forests had burned in wildfires. See Timothy Egan, *The Fires This Time*, N.Y. TIMES, July 5, 2012, <http://opinionator.blogs.nytimes.com/2012/07/05/the-fires-this-time> (last visited Nov. 18, 2012); Borenstein, *supra* note 66. Indeed, it is predicted that for each degree of warming, the average area burned in the western U.S. will increase by 200%–400%. See NRC CLIMATE REPORT, *supra* note 14, at 180 fig.5.8, 8 fig.syn.3.

¹¹⁵ Justin Gillis, *With Deaths of Forests, a Loss of Key Climate Protectors*, N.Y. TIMES, Oct. 1, 2011, <http://www.nytimes.com/2011/10/01/science/earth/01forest.html?pagewanted=all> (last visited Nov. 18, 2012). Warmer temperatures are causing mountain snowpack to melt earlier in most years, causing more severe water deficits in the summer, resulting in conditions for intense fires. In Siberia, in a given year 30 million acres have burned—an area the size of Pennsylvania. *Id.*

¹¹⁶ WOLD ET AL., *supra* note 74, at 23–24. Another report suggests 630 million cubic feet “of merchantable lodgepole pine was killed in British Columbia alone in a recent outbreak of mountain pine beetle.” Anderegg et al., *supra* note 112, at 4. Winter temperatures used to, but no longer, “fall to 40 degrees below zero in the [Western] mountains every few years, killing off many pine beetles.” Gillis, *supra* note 115. “Warmer temperatures can also increase reproductive rates of insects, resulting in two generations in a single year.” ACESA REPORT, *supra* note 13, at 311. Mountain pine “[b]eetles are now emerging in mid May, rather than late July, and the length of the flying season is allowing multiple generations to emerge in the same year; second generation [pine beetles] have been observed emerging in August and September.” Mark Squillace & Alexander Hood, *NEPA, Climate Change, and Public Lands Decision Making*, 42 ENVTL. L. 469, 494–95 (2012). Worse, “a study found that the cumulative impact of the beetle epidemic from 2000 to 2020 would turn the British Columbia forests from a net carbon sink to a large net carbon source, emitting a total of 471 megatons of CO₂e during the worst years of 2003 through 2007”—or almost 13% of Canada’s total CO₂e emissions during the same period. *Id.* at 495–96.

¹¹⁷ John Whitfield, *Alaska’s Climate: Too Hot to Handle*, 425 NATURE 338, 338 (2003). Climate change also is causing devastation of ponderosa pine and pinion pine in the American southwest, losses in the mixed conifer forests of the Sierra Nevada, and significant insect

other increasingly dry landscapes, also are causing “flora and fauna [to move] to higher latitudes or to higher altitudes in the mountains.”¹¹⁸

The human and environmental costs from failing to promptly reduce dependence on carbon-dioxide emitting sources for electricity, heating, and transportation are dire and indisputable. Rather than being the leader among major countries in per capita GHG emissions, our country urgently needs to lead the world in cutting 80% of our emissions by 2050 and using our renewable energy resources and technological advances to help other major emitting countries do the same. However, significantly increasing our use of carbon-free renewable sources to protect current and future generations of all species—human and non-human—requires concrete changes in how our legal system regulates and permits renewable energy sources. One source with the potential for significant energy production and comparable elimination of fossil fueled GHGs near major American and global population centers is offshore wind.

III. THE OFFSHORE WIND POWER PERMITTING AND LEASING OBSTACLE COURSE

A. Overview of Technology and Attributes

As noted in Part I, offshore wind energy projects have the potential to generate large quantities of pollutant-free electricity near many of the world’s major population centers, and thus to help reduce the ongoing and projected economic, health, and environmental damages from climate change. Wind speeds over water are stronger and more consistent than over land, and “have a gross potential generating capacity four times greater than the nation’s present electric capacity.”¹¹⁹ The net capacity factor¹²⁰ for offshore turbines is greater than standard land-based turbines, and their

outbreaks in western North America lodgepole pine forests. RODGERS ET AL., *supra* note 104, at 441–49. It now appears that these insect outbreaks and resultant forest die-offs are also adversely impacting municipal water supplies through “[c]hanges in hydrology . . . such as decreased interception, increased erosion and particulate transport” resulting in greater total organic carbon concentrations in surface and groundwaters. Kristin Mikkelsen, et al., *Water-Quality Impacts from Climate-Induced Forest Die-Off*, NATURE CLIMATE CHANGE, (forthcoming 2012) (published online Oct. 28, 2012), available at <http://www.nature.com/nclimate/journal/vaop/ncurrent/pdf/nclimate1724.pdf>.

¹¹⁸ ARCHER & RAHMSTORF, *supra* note 50, at 153. Many mammals in Yosemite National Park have moved up in elevation an average of 500 meters between 1920 and 2006. NRC CLIMATE REPORT, *supra* note 14, at 199.

¹¹⁹ MUSIAL & RAM, *supra* note 22, at 1; see also NREL FUTURES 2, *supra* note 21, at 11–3, 11–4.

¹²⁰ The net capacity factor of a power plant is the ratio of its actual output over a period of time divided by its potential output if it had operated at full nameplate capacity the entire time. See Energy Nos., *Capacity Factors at Danish Offshore Wind Farms*, <http://energynumbers.info/capacity-factors-at-danish-offshore-wind-farms> (last visited Nov. 18, 2012). Newer European offshore wind farms can achieve between 44% and 48% net capacity. See *id.* For onshore wind farms, the net capacity factor is generally between 30% and 40%. Clean Technica, *Wind Turbine Net Capacity Factor—50% the New Normal?*, <http://cleantechnica.com/2012/07/27/wind-turbine-net-capacity-factor-50-the-new-normal/> (last visited Nov. 18, 2012).

blade-tip speeds are higher than their land-based counterparts.¹²¹ Offshore wind turbine substructure designs mainly fall into three depth categories: shallow (30 m or less), transitional (30 m to 60 m), and deep water (greater than 60 m).¹²² Most of the grid-scale offshore wind farms in Europe have monopole foundations embedded into the seabed in water depths ranging from 5 m to 30 m;¹²³ the proposed American projects such as Cape Wind in Massachusetts and Block Island in Rhode Island would likewise be shallow-water installations.¹²⁴

In deeper water, it is not economically feasible to affix a rigid structure to the sea floor, and floating platforms are envisioned. The three concepts shown below have been developed for floating platform designs, each of which is tethered but not built into the seabed.¹²⁵

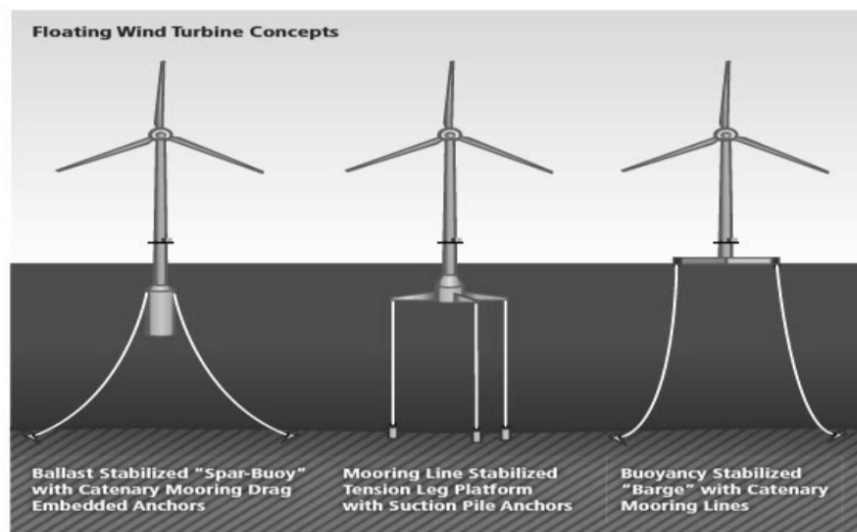


Figure 1: Floating Wind Turbine Concepts.

Each design uses a different method for achieving static stability, and some small pilot efforts are underway to demonstrate the performance of different turbines.¹²⁶ Greater wind speeds and thus available energy capture

¹²¹ MUSIAL & RAM, *supra* note 22, at 69.

¹²² *Id.* at 5–6. “In shallow water, the substructure extends to the sea floor and includes monopoles, gravity bases, and suction buckets. In the transitional depth, new technologies are being created, or adapted from the oil and gas industry, including jacket substructures and multi-pile foundations, which also extend to the sea floor.” *Id.* at 5.

¹²³ EUROPEAN WIND ENERGY ASS’N, THE EUROPEAN OFFSHORE WIND INDUSTRY KEY 2011 TRENDS AND STATISTICS 16 (2012).

¹²⁴ U.S. DEP’T OF THE INTERIOR, CAPE WIND ENERGY PROJECT DRAFT ENVIRONMENTAL IMPACT STATEMENT 4-20 (2008) *available at* <http://www.masstech.org/offshore/docs/CapeWindDEIS.pdf>; *see also* DEEPWATER WIND, BLOCK ISLAND WIND FARM ENVIRONMENTAL REPORT/CONSTRUCTION AND OPERATIONS PLAN 1-2 fig. 1.1-1, 2-9 (2012), *available at* <http://dwwind.com/docs/Environmental%20Report.pdf> (illustrating that the Block Island Wind Farm array will be constructed at depths of 20 to 30 meters).

¹²⁵ NREL FUTURES 2, *supra* note 21, at 11-24 fig.11-11.

¹²⁶ There are demonstration floating wind projects off the coast of Norway (Statoil’s Hywind project, one turbine launched in 2009), Portugal (Principle Power’s Wind Float turbine launched

are found further from shore, particularly at ocean depths greater than 60 m.¹²⁷ These attributes, combined with their proximity to major coastal cities and energy consumers,¹²⁸ are why, in our carbon-stressed world, offshore wind requires serious consideration and prompt implementation. As demonstrated in the following pages, however, the maze of federal and state regulatory requirements facing renewable energy projects in general and offshore wind in particular, is especially burdensome.¹²⁹ These requirements undermine the fundamental goal of significantly increasing reliance on emission-free renewable energy sources¹³⁰ and, unless substantially revised, will effectively preclude any meaningful efforts to mitigate the many damaging human and economic impacts of climate change.

B. Federal and State Jurisdiction

U.S. jurisdiction over the ocean and seafloor extends from the coast 200 nautical miles seaward.¹³¹ Within the umbrella of U.S. jurisdiction, ocean governance is divided between the federal government and individual states.¹³² Individual state governments retain title to submerged land within three nautical miles of shore,¹³³ and may regulate activities within that area,

in 2012); Japan (one small turbine launched in June 2012 off the coast of Kabashima Island); and the University of Maine intends to deploy a small-scale floating turbine in the Gulf of Maine in 2013. MAIN(E) INT'L CONSULTING LLC, FLOATING OFFSHORE WIND FOUNDATIONS: INDUSTRY CONSORTIA AND PROJECTS IN THE UNITED STATES, EUROPE AND JAPAN, 4, 6, 8, 18, 35, 37 (2012), available at <http://maine-intl-consulting.com/resources/Floating+Offshore+Wind+Platforms+Consortia+for+web.pdf>.

¹²⁷ MUSIAL & RAM, *supra* note 22, at 3 fig.1-2, 59 tbls.4-1 & 4-2; NREL FUTURES 2, *supra* note 21, at 11-5 fig.11-3. In fact, the U.S. resource potential is tripled past 60 meters in depth on the Great Lakes, in parts of the Gulf of Mexico, and on both Atlantic and Pacific coasts. MUSIAL & RAM, *supra* note 22, at 59 tbls.4-1 & 4-2.

¹²⁸ See *supra* note 23 and accompanying text.

¹²⁹ To make the point clear, to get a federal lease for renewable energy projects on the Outer Continental Shelf one must address about two dozen different federal statutes and programs that are administered by a dozen or more different agencies. A preliminary chart of them in one textbook runs five single-spaced pages. Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf, 74 Fed. Reg. 19,638, 19,648-51 (2009) (codified at 30 C.F.R. pts. 250, 285, 290), reprinted in RICHARD G. HILDRETH ET AL., CLIMATE CHANGE LAW: MITIGATION AND ADAPTATION 609-13 (Thomson Reuters 2009). For a slightly longer chart see MUSIAL & RAM, *supra* note 22, app. A at 211-14 tbl.A-1; *id.* at app. B, 215-21 tbl.B-1 (listing the 26 different project studies required of the Cape Wind project developer just to complete its Environmental Impact Study).

¹³⁰ See *supra* note 4 (discussing the Obama administration's comprehensive energy plan).

¹³¹ See United Nations Convention on the Law of the Sea, art. 76, Dec. 10, 1982, 1833 U.N.T.S. 397, available at http://www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf. The United States has not ratified the U.N. Convention on the Law of the Sea; however, it is widely regarded as customary international law and, in general, the United States has so recognized it. See ADAM VANN, CONG. RESEARCH SERV., R40175, WIND ENERGY: OFFSHORE PERMITTING I (2010).

¹³² See VANN, *supra* note 131, at 2.

¹³³ Submerged Lands Act, 43 U.S.C. § 1301(a)(2) (2006). Three nautical miles is 3.45 miles or 5.6 kilometers. The exceptions are Texas and the gulf coast of Florida, where the states retain jurisdiction nine nautical miles from shore. See *id.* § 1301(a)(2), (b).

subject to federal law.¹³⁴ The federal government retains title and authority over all remaining waters out to 200 nautical miles from shore—the Outer Continental Shelf (OCS).¹³⁵

The federal government also retains some jurisdiction within state coastal waters,¹³⁶ thus numerous federal laws impact offshore wind development occurring solely within state waters. Likewise, several statutes, most notably the Coastal Zone Management Act (CZMA),¹³⁷ allow for state review of certain federal activities occurring solely in federal waters. These instances are discussed in greater detail below.

C. Federal Permitting and Licensing

Although federal jurisdiction over offshore wind development on the OCS is clear, the determination as to which *agency* exercises that jurisdiction has been anything but.

1. The Energy Policy Act—Clarifying Interagency Jurisdiction

Before 2005, when Congress enacted the Energy Policy Act (EPAct),¹³⁸ the U.S. Army Corps of Engineers (Corps) maintained the primary role in permitting offshore wind projects in the OCS.¹³⁹ The Corps assumed this jurisdiction under section 10 of the Rivers and Harbors Act,¹⁴⁰ which was amended by the Outer Continental Shelf Lands Act (OCSLA).¹⁴¹ However, because the Corps' jurisdiction over offshore wind projects was not explicit, some uncertainty existed as to whether the agency had ultimate authority over offshore wind.¹⁴²

Seeking to clarify the federal government's role, the EPAct amended the OCSLA to provide the Secretary of the Interior (Interior)—through the Minerals Management Service (MMS)—with specific “legal authority for federal review and approval of various offshore energy-related projects,” including wind power.¹⁴³ The Secretary of the Interior through MMS, may grant a “lease, easement, or right-of-way on the [OCS]” for wind power.¹⁴⁴ The Corps retains its section 10 jurisdiction, however, as project proponents are still subject to the Rivers and Harbor Act.¹⁴⁵

¹³⁴ See VANN, *supra* note 131, at 2; 43 U.S.C. §§ 1311(a)(2), 1314(a) (2006).

¹³⁵ See 43 U.S.C. § 1302 (2006); VANN, *supra* note 131, at 1.

¹³⁶ See 43 U.S.C. § 1314(a) (2006).

¹³⁷ 16 U.S.C. §§ 1451–1466 (2006).

¹³⁸ Energy Policy Act of 2005, Pub. L. 109-58, 119 Stat. 604 (codified primarily in scattered sections of 16 U.S.C. and 42 U.S.C.).

¹³⁹ VANN, *supra* note 131, at 4.

¹⁴⁰ Rivers and Harbors Appropriation Act of 1899, 33 U.S.C. § 403 (2006).

¹⁴¹ 43 U.S.C. §§ 1331–1356a (2006 & Supp. II 2008).

¹⁴² VANN, *supra* note 131, at 4.

¹⁴³ *Id.*

¹⁴⁴ 43 U.S.C. § 1337(p)(1)(C) (2006).

¹⁴⁵ See 33 U.S.C. § 403 (2006).

Although the EPAct clarified Interior's role in relation to the Corps, lingering jurisdictional issues remained between MMS and the Federal Energy Regulatory Commission (FERC). This was clarified in 2009 through a memorandum of understanding between Interior and FERC, which "confirmed the exclusive jurisdiction of the Secretary of the Interior, exercised through the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), [the first successor to MMS], over the production, transportation, or transmission of energy from non-hydrokinetic¹⁴⁶ renewable energy projects on the OCS."¹⁴⁷ Although BOEMRE, now known as BOEM,¹⁴⁸ retains primary jurisdiction over the licensing and leasing of offshore wind projects, the EPAct does not affect the authority of other "federal agencies with permitting authority under other federal laws."¹⁴⁹ Accordingly, the Corps, NOAA Fisheries, and other federal agencies retain separate permitting authority under the myriad laws discussed in detail below, thereby creating multiple permitting hurdles.

2. Overview of BOEM's Licensing Process

BOEM's regulations for offshore wind development on the OCS allow for the competitive or non-competitive lease of access rights on the OCS as well as permitting and licensing of test sites for new technologies related to the development of renewable energy.¹⁵⁰ Generally, commercial leases last for twenty-five years and allow "development, construction, and ultimately commercial production activities."¹⁵¹

After BOEM first grants a preliminary lease, the lessee has six months to submit a Site Assessment Plan (SAP) that details the proposed site surveys and resource assessments¹⁵² and is subject to review under the National Environmental Protection Act (NEPA).¹⁵³ Upon the SAP's approval, the lessee receives a five-year lease during which the lessee conducts site assessment activities necessary for the submission of a Construction

¹⁴⁶ "Hydrokinetics" is a form of renewable energy generated by moving water, but not involving dams; examples include wave, tidal, and ocean current power. See Bryn Dixon, *Hydrokinetics*, <http://www.hydrokinetics.com> (last visited Nov. 18, 2012); NREL FUTURES 2, *supra* note 21, at 9-1.

¹⁴⁷ VANN, *supra* note 131, at 5 (internal quotations omitted).

¹⁴⁸ BOEMRE was bifurcated into a licensing and permitting agency, the Bureau of Ocean Energy Management (BOEM), and an enforcement agency, the Bureau of Safety and Environmental Enforcement. See Bureau of Ocean Energy Mgmt., *The Reorganization of the Former MMS*, <http://www.boem.gov/About-BOEM/Reorganization/Reorganization.aspx> (last visited Nov. 18, 2012). Since it is the former that has the regulatory authority over offshore wind projects in federal waters, for the sake of clarity this Article will only refer to BOEM.

¹⁴⁹ VANN, *supra* note 131, at 5; see also 43 U.S.C. § 1337(p)(9) (2006).

¹⁵⁰ Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf, 74 Fed. Reg. 19,638, 19,639 (Apr. 29, 2009) (codified at 30 C.F.R. pts. 250, 285, 290); see also MUSIAL & RAM, *supra* note 22, at 141-43; VANN, *supra* note 131, at 5-8.

¹⁵¹ 74 Fed. Reg. at 19,670.

¹⁵² *Id.* at 19,840-41.

¹⁵³ *Id.* at 19,689-90. NEPA is found at National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321-4347 (2006).

Operation Plan (COP), a detailed description of the project activities, construction, and operations that is also subject to NEPA review.¹⁵⁴ To somewhat “reduce the review time and gain efficiency,” however, BOEM allows a project developer to combine its SAP and COP submissions for NEPA review purposes.¹⁵⁵ Upon final approval of the COP, a developer’s twenty-five year operations lease term begins.¹⁵⁶

Additionally, the Department of the Interior recently began implementing its “Smart from the Start” approach to offshore wind development.¹⁵⁷ The thrust of this approach is the designation of several “Wind Energy Areas” (WEAs) along the Atlantic coast, which aims to allow for “coordinated environmental studies, large-scale planning and expedited approval processes to speed offshore wind energy development.”¹⁵⁸ Although the long-term impact of such designations is not yet known, WEAs are likely to partially simplify the leasing process for certain future offshore wind projects.

3. *National Environmental Policy Act*

Undoubtedly, NEPA is the most onerous statute for offshore wind developers, requiring detailed environmental review of “major [f]ederal actions significantly affecting the quality of the human environment.”¹⁵⁹ NEPA also created the Council on Environmental Quality (CEQ) which has the power to promulgate regulations for the implementation of NEPA.¹⁶⁰ The CEQ regulations define “major” as “significant,”¹⁶¹ and “federal action” to include any federal licensing or permitting process (e.g., section 10 permits under the Rivers and Harbors Act) and therefore encompass the vast majority, if not all, offshore wind projects.¹⁶² Not surprisingly, the broad scope of the Act—and the potential for time-consuming litigation¹⁶³—makes NEPA a crucial component of any successful offshore wind development.¹⁶⁴

¹⁵⁴ Jacqueline S. Roller, Comment, *Offshore Wind Energy in the United States: Regulations, Recommendations, and Rhode Island*, 15 ROGER WILLIAMS U. L. REV. 217, 224 (2010); see also 74 Fed. Reg. at 19,670, 19,688.

¹⁵⁵ Roller, *supra* note 154, at 224 (quoting 74 Fed. Reg. at 19,690). However, even with that “reduction” the process would still take years.

¹⁵⁶ *Id.*

¹⁵⁷ Press Release, U.S. Dep’t of the Interior, Salazar, Chu Announce Major Offshore Wind Initiatives (Feb. 7, 2011), <http://www.doi.gov/news/pressreleases/Salazar-Chu-Announce-Major-Offshore-Wind-Initiatives.cfm> (last visited Nov. 18, 2012).

¹⁵⁸ *Id.*

¹⁵⁹ National Environmental Policy Act of 1969, 42 U.S.C. § 4332(2)(C) (2006).

¹⁶⁰ *Id.* § 4342.

¹⁶¹ 40 C.F.R. §§ 1508.18, .27 (2011).

¹⁶² See *id.* § 1508.18(b)(4).

¹⁶³ See, e.g., Kevin Grandia, *History of the Cape Cod Offshore Wind Energy Project*, ENERGYBOOM, Apr. 28, 2010, <http://www.energyboom.com/wind/history-cape-cod-offshore-wind-energy-project> (last visited Nov. 18, 2012); *Alliance to Protect Nantucket Sound, Inc. v. U.S. Dep’t of the Army*, 398 F.3d 105 (1st Cir. 2005).

¹⁶⁴ In addition, recommendations concerning NEPA would also be germane for the fifteen states and District of Columbia that have comparable NEPA review programs, also known as “mini-NEPAs.” JEFFREY A. THALER & DUSTIN TILL, TREATMENT OF GREENHOUSE GASES UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT §1.02(1) n.6 (Bradley M. Marten ed.), LexisNexis Global

The NEPA process generally begins with a determination as to whether a categorical exclusion applies.¹⁶⁵ If a categorical exclusion applies, further NEPA review is not required;¹⁶⁶ if a categorical exclusion does not apply, the project developer must conduct an environmental assessment (EA) that discusses the need for the proposal, alternatives, and environmental impacts.¹⁶⁷ Any project other than a small-scale pilot will likely require an EA, which generally requires a year or more to complete and be approved.¹⁶⁸ A consulting agency—BOEM in the case of offshore wind—then reviews the EA.¹⁶⁹ If the consulting agency determines that the proposed action will not significantly affect the environment, the agency issues a “finding of no significant impact” (FONSI).¹⁷⁰ However, if the consulting agency determines, based on the EA, that the project will significantly affect the environment, an environmental impact statement (EIS)—usually taking three to four years to complete—is required.¹⁷¹

Broadly, an EIS must detail:

- (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

Climate Change Special Pamphlet Series (2010); see also Jeff Thaler, *Greenhouse Gas Litigation and NEPA: A Split in the Courts*, ABA TRENDS, May–June 2012, at 12, 13, available at http://www.americanbar.org/publications/trends/2011_12/may_june/greenhouse_gas_litigation_and_nepa_split_in_the_courts.html.

¹⁶⁵ See DANIEL R. MANDELKER, NEPA LAW & LITIGATION § 7:10 (2d ed. 2012). Categorical exclusions are “actions which do not individually or cumulatively have a significant effect on the human environment.” 40 C.F.R. § 1508.4 (2011).

¹⁶⁶ See Memorandum from the Council on Env’tl. Quality to the Heads of Fed. Dep’ts & Agencies 2 (Nov. 23, 2010), available at http://ceq.hss.doe.gov/ceq_regulations/NEPA_CE_Guidance_Nov232010.pdf. However, a categorical exclusion does not excuse an agency from consultation obligations under other federal laws, such as the Endangered Species Act. See, e.g., U.S. Forest Serv., *Proposed Soil and Water Restoration Categorical Exclusions Frequently Asked Questions*, http://www.fs.fed.us/emc/nepa/restorationCE/includes/CE_QAs_pdf_version062712.pdf. (last visited Nov. 18, 2012) (“Agencies must conduct appropriate consultation with Federal and state regulatory agencies, such as those required by the Endangered Species Act”).

¹⁶⁷ See 40 C.F.R. §§ 1501.3, 1508.9(b) (2011).

¹⁶⁸ See, e.g., JENNIFER DILL, WHAT INFLUENCES THE LENGTH OF TIME TO COMPLETE NEPA REVIEWS? 9 (2005), available at <http://dot.alaska.gov/stwddes/desenviron/assets/pdf/resources/nepareviewtime.pdf>.

¹⁶⁹ See Press Release, *supra* note 157.

¹⁷⁰ A finding of “no significant impact” means the project “will not have a significant effect on the human environment.” 40 C.F.R. § 1508.13 (2011). “Human environment” is broader than just impact on humans. “Human environment” shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment. . . . This means that economic or social effects are not intended by themselves to require preparation of an environmental impact statement.” *Id.* § 1508.14.

¹⁷¹ The average EIS for all federal entities takes 3.4 years. Piet deWitt & Carole A. deWitt, *How Long Does it Take to Prepare an Environmental Impact Statement?*, 10 ENVTL. PRAC. 164, 164 (2008).

irretrievable commitments of resources involved in the proposed action should it be implemented.¹⁷²

The lengthy NEPA process imposes a significant time and financial burden, as demonstrated by the Cape Wind project. In 2001, Cape Wind Associates first submitted its proposal to develop the Cape Wind project in federal waters off the coast of Massachusetts.¹⁷³ An EIS was required, and the final Record of Decision on the EIS was not issued, nor was the commercial lease issued by BOEM, until 2010.¹⁷⁴ Throughout this process, citizen groups opposing the project initiated numerous court challenges based on alleged NEPA violations and other grounds, further augmenting an already time-consuming and costly process.¹⁷⁵

4. *Endangered Species Act*

Depending on the size and location of a proposed offshore wind project, the Endangered Species Act (ESA)¹⁷⁶ will also likely place a significant burden upon a project developer. In essence, section 9 of the ESA prohibits a “take” of any listed species.¹⁷⁷ “Take” is defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct.”¹⁷⁸ Because even the unintended taking of one member of a listed species is sufficient to trigger liability, a

¹⁷² National Environmental Policy Act of 1969, 42 U.S.C. § 4332(C) (2006). NEPA regulations require consideration of direct, indirect and cumulative impacts, 40 C.F.R. § 1508.25(c) (2011), as well as a “rigorous” evaluation of “all reasonable alternatives.” *See id.* § 1502.14.

¹⁷³ *See Grandia, supra* note 163.

¹⁷⁴ *Id.* Deepwater Wind, which has been pursuing plans for a wind farm off Block Island and another, larger one, also near Rhode Island, began its work back in 2008, with the goal of commencing construction in 2010 and completion in 2012. However, at this time no construction has begun, and at best it will be 2013 before it begins on the smaller Block Island project. *See* Deepwater Wind, *Deepwater Wind News Archive*, <http://dwwind.com/deepwater-news-archive> (last visited Nov. 18, 2012).

¹⁷⁵ *See, e.g.,* *Town of Barnstable, Mass. v. Fed. Aviation Admin.*, 659 F.3d 28 (D.C. Cir. 2011); *Alliance to Protect Nantucket Sound, Inc. v. U.S. Dept. of the Army*, 398 F.3d 105 (1st Cir. 2005); *Ten Taxpayer Citizens Grp. v. Cape Wind Assoc., LLC*, 373 F.3d 183, 185–86 (1st Cir. 2004); *Alliance to Protect Nantucket Sound, Inc. v. Dep’t of Pub. Utils.*, 959 N.E.2d 413 (Mass. 2012); *Alliance to Protect Nantucket Sound, Inc. v. Energy Facilities Siting Bd.*, 932 N.E.2d 787 (Mass. 2010); *see also* Kenneth Kimmell & Dawn Stolfi Stalenhoef, *The Cape Wind Offshore Wind Energy Project: A Case Study of the Difficult Transition to Renewable Energy*, 5 GOLDEN GATE U. ENVTL. L. J. 197, 200–11 (2011) (discussing the various legal and political challenges to the Cape Wind project).

¹⁷⁶ Endangered Species Act of 1973, 16 U.S.C. §§ 1531–1544 (2006 & Supp. IV 2011).

¹⁷⁷ *See id.* § 1538(a)(1)(B). Under the ESA species are listed as either “endangered” or “threatened” based on the risk of their extinction. An “endangered” species is “any species which is in danger of extinction throughout all or a significant portion of its range.” *Id.* § 1532(6). A “threatened” species is “any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” *Id.* § 1532(20). However, for practical purposes, both categories of listed species trigger the ESA’s take prohibition and the Act’s section 7 consultation requirements. *See id.* §§ 1536(a)(1)–(2), 1538(a)(1)(B).

¹⁷⁸ *Id.* § 1532(19).

wind project needs to pursue an incidental take¹⁷⁹ permit (ITP) under section 10 of the ESA.¹⁸⁰ In order to receive an ITP, the applicant first must prepare a detailed habitat conservation plan (HCP)¹⁸¹ outlining, among other elements, the likely impacts from the anticipated taking, mitigation measures to minimize such impacts, and alternatives considered.¹⁸² The HCP process involves many studies and consultations, and “can last several years.”¹⁸³ Depending on the species involved, the ITP will be issued if the U.S. Fish and Wildlife Service (USFWS) and/or NOAA Fisheries (NOAA) finds, in part, that 1) the taking would be incidental; 2) that the applicant will “to the maximum extent practicable, minimize and mitigate the impacts of such taking[;]” and 3) that the taking “will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.”¹⁸⁴

Moreover, as under NEPA, any federal action—including permitting or licensing that may affect a listed species—is subject to a separate section 7 consultation under the ESA.¹⁸⁵ Section 7 requires that the project proponent (for offshore wind, both the project developer and BOEM) undergo what can be fairly lengthy and involved consultation with USFWS, NOAA, or both so that the project will not “jeopardize the continued existence of” a listed species or adversely modify a listed species’ critical habitat.¹⁸⁶

The section 7 consultation process is procedurally similar to the EA and EIS process under NEPA. If a listed species is present in the “action area,” “informal consultation” is required: the project proponent must complete a Biological Assessment detailing the likely impacts of the proposed action.¹⁸⁷ If it is determined, based on the Biological Assessment, that the project “may affect listed species or [its designated] critical habitat,” then “formal consultation” is required with either NOAA Fisheries or USFWS,¹⁸⁸ as well as preparation of a Biological Opinion detailing the likely effects of the agency action, and preparation of a final determination

¹⁷⁹ “Incidental take” refers to “takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant.” 50 C.F.R. § 402.02 (2011).

¹⁸⁰ See 16 U.S.C. 1539(a)(1)(B) (2006) (stating that a permit may be granted “if [the] taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity”).

¹⁸¹ *Id.* § 1539(a)(2)(A).

¹⁸² *Id.*

¹⁸³ J.B. Ruhl, *Harmonizing Commercial Wind Power and the Endangered Species Act through Administrative Reform* 14 (Vanderbilt Law Review, Working Paper No. 12-21, 2012), available at <http://ssrn.com/abstract=2070891>.

¹⁸⁴ See 16 U.S.C. § 1539(a)(2)(B) (2006).

¹⁸⁵ *Id.* § 1536(a)(2).

¹⁸⁶ *Id.* NOAA Fisheries and the USFWS “share responsibility for implementing the ESA. Generally, USFWS manages land and freshwater species, while NMFS [NOAA Fisheries] manages marine and ‘anadromous’ species.” Nat’l Oceanic & Atmospheric Admin., *Endangered Species Act (ESA)*, <http://www.nmfs.noaa.gov/pr/laws/esa/> (last visited Nov. 18, 2012). “Jeopardize the continued existence of” is not defined in the statute, but rather, in regulations, to mean to “engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild.” 50 C.F.R. § 402.02 (2011).

¹⁸⁷ 50 C.F.R. § 402.10, 402.12 (2011).

¹⁸⁸ See *id.* § 402.14(a).

as to whether the proposed action is likely to jeopardize the species or destroy or adversely modify its critical habitat.¹⁸⁹ If jeopardy or adverse modification is likely, the consulting agency identifies any “reasonable and prudent alternatives” that would mitigate project harms.¹⁹⁰ The formal consultation process, often taking a year or more, typically results in adjustments to the project description and conditions, as well as issuance of an “incidental take statement”¹⁹¹ that allows for the proposed project to result in a pre-determined number of takes without triggering criminal or civil penalties under the ESA.¹⁹²

One of the problems facing an applicant working with the ESA and NEPA is the length of time involved in agency consultations. Even though there is a statutory requirement that consultations shall be completed within a 90-day period,¹⁹³ agencies frequently miss that deadline and the applicant has no practical recourse.¹⁹⁴ Indeed, one federal study found that nearly 40% of USFWS consultations were not completed within the statutory timeframe.¹⁹⁵

5. Marine Mammal Protection Act

With some variation based on the size and location of a proposed project, the Marine Mammal Protection Act (MMPA)¹⁹⁶ is almost certain to apply to most offshore wind developments. Similar to the ESA, the MMPA prohibits takes of any marine mammal within U.S. waters.¹⁹⁷ NOAA Fisheries and the USFWS jointly administer the Act,¹⁹⁸ and may authorize incidental takes of marine mammals provided that the take “will have a negligible impact on the species or stock and will not have an unmitigable adverse impact on the availability of the species or stock.”¹⁹⁹ The MMPA’s implementing regulations detail the procedure for application and authorization of incidental takes, which—like the ESA process—can require considerable time and expense.²⁰⁰

¹⁸⁹ *Id.* § 402.14(h).

¹⁹⁰ *Id.* § 402.14(h)(3). Moreover, NOAA Fisheries and the USFWS may impose reasonable and prudent alternatives in order to preclude an adverse modification or jeopardy finding. *See id.* § 402.14(i).

¹⁹¹ *See* 50 C.F.R. § 402.14(i)(1)–(3) (2011). An incidental take statement is triggered where there is federal action involved in the underlying project; an incidental take permit is available for a non-federal activity.

¹⁹² Endangered Species Act of 1973, 16 U.S.C. § 1536(b)(4) (2006); 50 C.F.R. § 402.14(i)(5) (2011).

¹⁹³ 16 U.S.C. § 1536(b)(1)(A) (2006).

¹⁹⁴ *See* U.S. GOV’T ACCOUNTABILITY OFFICE, GAO-04-93, ENDANGERED SPECIES: MORE FEDERAL MANAGEMENT ATTENTION IS NEEDED TO IMPROVE THE CONSULTATION PROCESS 2–3, 18 (2004), available at <http://www.gao.gov/assets/250/241766.pdf>.

¹⁹⁵ *Id.* at 3.

¹⁹⁶ Marine Mammal Protection Act of 1972, 16 U.S.C. §§ 1361–1421(h) (2006).

¹⁹⁷ *Id.* § 1372(a).

¹⁹⁸ *See id.* § 1362(12)(A).

¹⁹⁹ *Id.* § 1371(5)(A)(i).

²⁰⁰ 50 C.F.R. § 18.27 (2011) (USFWS regulations); 50 C.F.R. pt. 216 (2011) (NOAA Fisheries regulations).

6. *Migratory Bird Treaty Act*

The Migratory Bird Treaty Act (MBTA)²⁰¹ is relatively unique compared to other species protection laws in that it only provides for criminal sanctions and does not allow for incidental takes.²⁰² The MBTA codifies and implements four separate treaties between the United States and Mexico, Great Britain, Japan, and Russia, respectively.²⁰³ The MBTA imposes strict liability, prohibiting the taking or killing of migratory birds.²⁰⁴ Under the MBTA, “take” means to “pursue, hunt, shoot, wound, kill, trap, capture, or collect,”²⁰⁵ and includes both intentional and unintentional actions.²⁰⁶

Wind turbines can present hazards to birds and bats including “[c]ollisions with the turbine blades, towers, power lines, or with other related structures, and electrocution on power lines.”²⁰⁷ Recent estimates put the annual U.S. avian death toll from onshore wind turbines at 444,000,²⁰⁸ although that is far less than mortality caused by glass windows, cars, motor vehicles, transmission lines, agriculture, communication towers, or hunting.²⁰⁹ Given that there is no incidental take permit under the MBTA—subjecting violators to strict liability—and that the Act protects virtually

²⁰¹ 16 U.S.C. §§ 703–712 (2006 & Supp. IV 2011).

²⁰² *See id.* §§ 706–707. Consequently, the MBTA exists as a lingering threat over existing and proposed offshore wind development, with potentially significant liabilities.

²⁰³ *Id.* § 703(a).

²⁰⁴ *See id.* The Act allows for a misdemeanor conviction based upon strict liability, while a felony conviction requires a knowing violation of the Act. *Id.* § 707(a)–(b). For a list of birds that receive protection under the MBTA, see 50 C.F.R. § 10.13 (2011).

²⁰⁵ 50 C.F.R. § 10.12 (2011).

²⁰⁶ *See id.* (omitting any intent requirement in the definition of take or possession).

²⁰⁷ Hadassah M. Reimer & Sandra A. Snodgrass, *Tortoises, Bats, and Birds, Oh My: Protected-Species Implications for Renewable Energy Projects*, 46 IDAHO L. REV. 545, 563 (2010).

²⁰⁸ Press Release, Am. Bird Conservancy, Leading Bird Conservation Group Formally Petitions Feds to Regulate Wind Industry (Dec. 14, 2011), *available at* <http://www.abcbirds.org/newsandreports/releases/111214.html>. To view the full petition, see AM. BIRD CONSERVANCY, RULEMAKING PETITION TO THE U.S. FISH & WILDLIFE SERVICE FOR REGULATING THE IMPACTS OF WIND ENERGY PROJECTS ON MIGRATORY BIRDS (2011), *available at* http://www.abcbirds.org/abcprograms/policy/collisions/pdf/wind_rulemaking_petition.pdf.

²⁰⁹ Studies have approximated annual avian mortality to be: from glass windows, 100–900 million; transmission lines, 170 million; cats, 100 million; motor vehicles, 50–100 million; agriculture (pesticides, poisons), 67 million; hunting, 15–100 million; and communication towers, 6–10 million. Sibley Guides, *Causes of Bird Mortality*, <http://www.sibleyguides.com/conservation/causes-of-bird-mortality/> (last visited Nov. 18, 2012); *see also* WALLACE P. ERICKSON ET AL., U.S. FOREST SERV., PSW-GTR-191, A SUMMARY AND COMPARISON OF BIRD MORTALITY FROM ANTHROPOGENIC CAUSES WITH AN EMPHASIS ON COLLISIONS 1029–33, 1036 (2005), *available at* <http://studentaffairs.case.edu/farm/doc/birdmortality.pdf>; Travis Longcore et al., *An Estimate of Avian Mortality at Communication Towers in the United States and Canada*, 7 PLOS ONE 1, 13, (Apr. 2012), <http://www.plosone.org/article/info:doi/10.1371/journal.pone.0034025>. Additionally, a major new study in the United Kingdom found that a large majority of bird species can co-exist or thrive with wind farms once they are operating, but that there is more mortality risk during the construction phase. James W. Pearce-Higgins et al., *Greater Impacts of Wind Farms on Bird Populations During Construction Than Subsequent Operation: Results of a Multi-Site and Multi-Species Analysis*, 49 J. APPLIED ECOLOGY 386, 390 (2012).

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“every species of bird in the United States, except for exotic or invasive species . . . there may be no way to avoid take prohibited by the MBTA.”²¹⁰

The one caveat to the Act’s application to wind projects, however, is that prosecution for takes is left solely to the discretion of the USFWS; there is no citizen suit provision under the MBTA.²¹¹ Consequently, the USFWS may exercise prosecutorial discretion when “a wind developer has employed mitigation measures intended to minimize risk to avian species.”²¹² For instance, the USFWS and the Edison Electric Institute’s Avian Power Line Interaction Committee collaborated to draft and implement Avian Protection Plans through which the USFWS implicitly agreed not to prosecute avian mortality under the MBTA.²¹³ The USFWS, various wind energy developers, and environmental groups also recently developed voluntary guidelines in part to minimize avian impact risks due to wind energy generation.²¹⁴ However, while a recent report makes the legal case for development of a permit program for incidental take of migratory birds that would be consistent with the treaty terms,²¹⁵ pending such a program, the lack of explicit authorization and guarantee against prosecution has created significant uncertainty in the industry, further impeding development.²¹⁶

D. State Permitting of Projects on the OCS

Although the federal government has clear authority over the OCS, states still play a role in the federal permitting process. The CZMA encourages states to complete coastal zone management plans designed to protect coastal habitat and resources within state waters.²¹⁷ State coastal

²¹⁰ Reimer & Snodgrass, *supra* note 207, at 566. Compounding the situation is that there have only been two federal appellate court decisions applying the strict liability standard under the Act to industrial settings involving indirect harm, over thirty years apart—and do not provide consistent guidance to developers or regulators. See Kalyani Robbins, *Paved With Good Intentions: The Fate of Strict Liability Under the Migratory Bird Treaty Act*, 42 ENVTL. L. 579, 598–603 (2012).

²¹¹ Reimer & Snodgrass, *supra* note 207, at 566.

²¹² *Id.*

²¹³ *Id.* at 566, n.206; see also U.S. FISH & WILDLIFE SERV. ET AL., AVIAN PROTECTION PLAN GUIDELINES 1–3 (2005), available at <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/APP/AVIAN%20PROTECTION%20PLAN%20FINAL%204%2019%2005.pdf>.

²¹⁴ See U.S. FISH AND WILDLIFE SERV., U.S. FISH AND WILDLIFE SERVICE LAND-BASED WIND ENERGY GUIDELINES vi, 53–54 (2012), available at http://www.fws.gov/windenergy/docs/WEG_final.pdf.

²¹⁵ The report, prepared for the natural gas pipeline industry, would be applicable as well to wind developers. HOLLAND & HART, LLC, DEVELOPMENT OF A PERMIT PROGRAM FOR INCIDENTAL TAKE OF MIGRATORY BIRDS iii–v, 35–36 (2011), available at <http://www.ingaa.org/File.aspx?id=11062>.

²¹⁶ See Melanie McCammon, Comment, *Environmental Perspectives on Siting Wind Farms: Is Greater Federal Control Warranted?*, 17 N.Y.U. ENVTL. L.J. 1243, 1258 (2009) (discussing how liability uncertainties could slow wind development); see also AM. BIRD CONSERVANCY, *supra* note 208, at 89–90.

²¹⁷ Coastal Zone Management Act, 16 U.S.C. §§ 1451–1452 (2006).

zone management plans (CZMP) must, among other things, designate conservation measures and permissible uses for land and water resources.²¹⁸

The CZMA mandates, through its consistency provision, that once a state develops a coastal zone management plan, all federally permitted activities off that state's coast, including an offshore wind project based in federal waters, must comply with its coastal zone programs.²¹⁹ Any applicant for a federal permit to conduct activities that would impact a state's land or water use or natural resource in or outside the coastal zone must provide a certification showing that the activity would comply with the state's federally approved coastal zone program.²²⁰ Thus, the consistency review provision provides states a procedural basis to ensure consistency between federal activities and state coastal zone management regulation.

Specific to offshore wind development, consistency review is triggered by the lease sale and SAP process, and by approval of the COP; also, because the COP is considered a federal license or permit under the CZMA, state approval of the Secretary of Commerce's consistency determination is required.²²¹ For a competitive lease sale, if the state objects to a consistency determination, then BOEM can go forward if it concludes that the sale is consistent with that state's CZMP and it so notifies the state.²²² For a noncompetitive lease sale, a state's consistency objection triggers an applicant's ability to submit an amended plan to BOEM.²²³ BOEM then requests the state's consistency determination; if the state objects to the modified plan, then BOEM cannot override its decision, but the applicant can attempt to address any continuing state concerns with another modified plan.²²⁴

Additionally, because any wind project occurring on the OCS must, ultimately, construct transmission lines and other land-based projects, coastal states and municipalities may exert regulatory control over portions of a federally permitted project. Although the regulatory regime for near-shore wind projects varies from state to state, "the majority of states . . . operate coastal zone management under 'networks' of parallel agencies, with various roles defined by policy guidance and memoranda of

²¹⁸ *Id.* § 1455(d).

²¹⁹ *Id.* § 1456(a), (c). Because offshore wind energy projects did not exist when most, if not all, state coastal zone management programs were developed, those states wishing to coherently address the new technology can submit what is called a "routine program change" to the Department of Commerce, Office of Ocean and Coastal Resource Management. *See* 15 C.F.R. § 923.84(b) (2011).

²²⁰ 16 U.S.C. § 1456(c)(3)(A) (2006); 15 C.F.R. § 930.50 (2011).

²²¹ *See* 16 U.S.C. § 1456(c)(1)(A), (1)(C), (3)(A) (2006); Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf, 74 Fed. Reg. 19,638, 19,691 (Apr. 29, 2009) (codified at 30 C.F.R. pts. 250, 285, 290). *See generally*, Peter J. Schaumberg & Angela F. Colamaria, *Siting Renewable Energy Projects on the Outer Continental Shelf: Spin, Baby, Spin!*, 14 ROGER WILLIAMS U. L. REV. 624, 659 (2009) (explaining the federal and state relationship in the process of licensing renewable energy developments).

²²² *See* 15 C.F.R. § 930.43(d), (e) (2011). The procedure BOEM follows also is found in the Preamble to the Final Rules, 74 Fed. Reg. at 19,651–52.

²²³ *See* 15 C.F.R. §§ 930.77–.78, .82 (2011).

²²⁴ *See id.* § 930.84.

understanding (MOUs).²²⁵ Consequently, offshore wind projects, even those occurring entirely within the OCS, are likely to be subject to a multitude of state and even local regulation and permitting authorities, especially given that they must connect to an onshore transmission system at some point.²²⁶

In sum, the multiple statutory and regulatory requirements that have accumulated over forty years for the permitting and licensing of renewable energy projects in general have inevitably created substantial delays, costs, risks, and deterrents to project implementation—especially for offshore wind projects. In light of the urgency to substantially reduce GHG emissions from electricity generation in order to stabilize atmospheric concentrations of carbon dioxide and mitigate the climate change impacts presented in Part II, we must first substantially reform the process for review and approval of renewable energy projects like offshore wind. But, we also must remember where we are going as we evaluate needed reform measures: from laws and regulations that have focused on project proposals in isolation and only in terms of close-proximity impacts, to a carbon-constrained world where renewable energy projects with material local impacts have emerged as clearly preferable to their fossil-fueled counterparts. Such clean energy sources promote the conservation of species and ecosystems, and their project-by-project contribution toward mitigation of a crisis of national and global scale requires prioritization. I present such measures in Part IV in the hope that the talk of GHG emissions reductions can be concretely translated not just into a walk, but a sprint into reality in time to avoid devastating climate harms.

IV. CONCRETE STEPS TO MODERNIZE ENVIRONMENTAL REVIEW OF PROPOSED OFFSHORE WIND PROJECTS

The forty-four page 2011 White House Blueprint for a Secure Energy Future omits a critical component: the blueprint does not tackle the issue of streamlining regulatory and permitting processes and requirements for a secure supply of renewable energy.²²⁷ This makes the blueprint largely irrelevant to the challenges of preparing renewable energy projects for investment risks, design, regulatory review, and construction within the

²²⁵ VANN, *supra* note 131, at 3.

²²⁶ The decade-plus long regulatory and courtroom paths endured by the Cape Wind project, *see supra* text accompanying notes 164, 172–74, demonstrate how the federal, state and local levels presently all have legal hurdles that an offshore wind project must get over before it can commence construction.

²²⁷ *See* WHITE HOUSE, BLUEPRINT FOR A SECURE ENERGY FUTURE (2011), *available at* http://www.whitehouse.gov/sites/default/files/blueprint_secure_energy_future.pdf. In its recent assessment of climate change and renewable energy, the IPCC also fails to focus on or address the barriers to renewable energy development created by slow, overlapping, and burdensome regulatory approval processes. *See generally* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, SPECIAL REPORT ON RENEWABLE ENERGY SOURCES AND CLIMATE CHANGE MITIGATION (Ottmar Edenhofer et al. eds., 2012) [hereinafter IPCC RENEWABLE SOURCES REPORT], *available at* http://srren.ipcc-wg3.de/report/IPCC_SRREN_Full_Report.pdf.

time frames demanded by the climate change crisis.²²⁸ Missing are concrete steps that would:

- 1) Prioritize and streamline the regulatory review of renewable energy projects by proclaiming in laws like NEPA and other major environmental statutes that quickly building significant numbers of such projects is of great strategic importance to the U.S.;
- 2) Establish clear, expedited timelines for agency review, consultation and coordination, as well as any judicial review of agency decisions;
- 3) Develop the expanded use of categorical exclusions under NEPA for offshore wind demonstration, testing, and small-scale projects; and
- 4) Require that the “hidden” costs of fossil-fueled energy be taken into account, along with the comparative life cycle impacts of competing energy sources, as part of NEPA’s no-action alternative analysis and other regulatory reviews.

Steps to achieve these goals can be undertaken through a combination of federal legislation,²²⁹ presidential executive orders,²³⁰ new CEQ and other

²²⁸ The March 22, 2012, Executive Order also sounds good on paper. *See* Improving Performance of Federal Permitting and Review of Infrastructure Projects, Exec. Order No. 13,604, 77 Fed. Reg. 18,887 (Mar.28, 2012). The same could be said of CEQ’s “interagency rapid response team” for transmission projects, *see* Council on Env’tl. Quality, *Interagency Rapid Response Team for Transmission*, <http://www.whitehouse.gov/administration/eop/ceq/initiatives/interagency-rapid-response-team-for-transmission> (last visited Nov. 18, 2012). However, the reality is quite different. Earlier this year, over the lone dissent of the Department of Energy, the other participating Cabinet members took a proposed target of two to three years for review of transmission projects, and made it 51 months—which is heading in the wrong direction. Question and Answer Session with Steven Chu, Sec’y, U.S. Dep’t of Energy, in Denver, Colo. (May 16, 2012). In 2009, nine federal agencies entered into an MOU to move forward with transmission siting on federal lands. Press Release, Council on Env’tl. Quality, Nine Federal Agencies Enter into a Memorandum of Understanding Regarding Transmission Siting on Federal Lands (Oct. 28, 2009), http://www.whitehouse.gov/administration/eop/ceq/Press_Releases/October_28_2009 (last visited Nov. 18, 2012). Furthermore, Secretary Chu also said on May 16 that it is harder to put a transmission line on federal land than it is on private land. Interview with Steven Chu, *supra*. There is supposed to be a rapid response team for renewable energy projects, but my May 2012 communications with Department of Energy staff confirmed that it had still not yet been implemented. E-mail from Alison LaBonte, U.S. Dep’t of Energy (May 22, 2012) (on file with author).

²²⁹ One legal commentator rejects any consideration of legislative reforms for wind power under the Endangered Species Act, instead only focusing on limited “administrative” measures. Ruhl, *supra* note 183, at 7–8. I believe that to be far too limited, especially in light of the evidence I have collected in Part II of this Article, and the documented ongoing impacts on species from climate change.

²³⁰ U.S. Presidents have issued executive orders since 1789, usually to help and direct officers and agencies of the executive branch manage the operations within the federal government itself. JOHN CONTRUBIS, CONG. RESEARCH SERV., 95-772A, EXECUTIVE ORDERS AND PROCLAMATIONS, at CRS-2 to -3 (1999), *available at* <http://www.llsdc.org/attachments/wysiwyg/544/crs-95-772.pdf>. Executive orders have the full force of law, since issuances are typically made to clarify or further the objectives of certain Acts of Congress. *Id.* at CRS-2, -22 to -23. The President’s source of authority to issue Executive Orders can be found in Article II, Section 1 of the Constitution, which grants to the President the “executive Power.” U.S. CONST. art. II, § 1. Section 3 of Article II further directs the President to “take Care that the Laws be faithfully executed.” *Id.* § 3.

agency regulations, and MOUs.²³¹ Comparable steps have previously been taken for prioritizing fossil fuel energy.²³² Given the twenty first century exigencies of climate change, the playing field must not just be leveled for renewable clean energy projects, but tilted in their favor. I first focus on changes that will or may require congressional action, and then on changes that may be accomplished through other means.

A. Needed Legislative Action

The BOEM leasing and NEPA analysis processes take the most amount of time for any offshore wind project, and underscore the need for reform. The fundamental goals of the OCSLA and NEPA (drafted in 1953 and 1969, respectively) must be newly implemented in the carbon-stressed world of today. As NEPA section 101 notes: “it is the continuing policy of the Federal Government, in cooperation with State and local governments . . . to use all practicable means and measures” to “improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may—1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations; [and] 2) assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings.”²³³ Likewise, Congress declared in the OCSLA that the “outer Continental Shelf . . . should be made available for expeditious and orderly development, subject to environmental safeguards, in a manner consistent with the maintenance of competition and other national needs,”²³⁴ and that the Secretary of the Interior should develop a leasing program (then only for oil and gas) that “will best meet national energy needs for the five-year period following its approval or reapproval.”²³⁵

In other words, given the well-documented public health, economic, national security, and environmental harms to the United States from carbon-fueled climate changes as summarized in Part III, it is strategically imperative that all “practicable means” be utilized to expedite the carbon-free energy source development of the OCS by BOEM in order to help best meet national energy, health, safety, and intergenerational environmental needs. To do so first requires amending NEPA and the OCSLA to prioritize, streamline, and expedite project reviews of offshore wind project proposals.

There are a number of examples where Congress has taken steps to streamline NEPA and related statutes in proceedings related to energy and other matters. For example, within 18 months after passage of the Oil Shale,

²³¹ CEQ has the power to amend its existing regulations, as well as to issue guidance. *See* Administrative Procedure Act, 5 U.S.C. § 553 (2006). Moreover, if CEQ or other agencies were to fail to act, then by law, an interested person has the right to petition for the issuance, amendment, or repeal of a regulation. *Id.* at § 553(e).

²³² *See, e.g., infra* notes 236–41 and accompanying text.

²³³ National Environmental Policy Act of 1969, 42 U.S.C. § 4331(a)–(b) (2006).

²³⁴ Outer Continental Shelf Lands Act, 43 U.S.C. § 1332(3) (2006).

²³⁵ *Id.* § 1344(a) (2006).

Tar Sands, and Other Strategic Unconventional Fuels Act of 2005 (UFA),²³⁶ the Secretary of the Interior was required to develop a Programmatic EIS (PEIS) “for a commercial leasing program on public lands in the Green River Basin of Colorado, Utah and Wyoming,” in order to streamline the leasing process for oil shale and tar sands leases.²³⁷ Regulations were then to be developed within six months.²³⁸ Legislation to streamline the regulatory process to “promote oil or natural gas production on the outer continental shelf”²³⁹ has been enacted as the Deepwater Port Act,²⁴⁰ which requires that the NEPA and public hearing process be completed within 240 days of a completed project application, and a final decision rendered within ninety days of the last public hearing.²⁴¹

The EPAct states, in part, that the “sense of Congress” was that the Secretary of the Interior “should,” within ten years after the Act’s 2005 enactment, “seek to have approved non-hydroelectric power renewable energy projects located on public lands with a generation capacity of at least 10,000 megawatts of electricity.”²⁴² The Act also provides for a process to streamline and expedite the siting of interstate electric transmission

²³⁶ 42 U.S.C. § 15927 (2006). In September 2007, the task force charged with implementing the Act released a report of analyses and recommendations for developing an “unconventional fuels” industry. U.S. DEP’T OF ENERGY, STRATEGIC UNCONVENTIONAL FUELS ACTIVITIES AND ACCOMPLISHMENTS: ANNUAL REPORT TO CONGRESS 2 (2010), *available at* http://www.unconventionalfuels.org/publications/reports/2009_DOE_Annual_Report_to_Congress.pdf. “The Task Force defined unconventional fuels to be coal-derived liquids, oil shale, tar sands, heavy oil, and carbon dioxide enhanced oil recovery.” *Id.*

²³⁷ 42 U.S.C. § 15927(d)(1).

²³⁸ *Id.* § 15927(d)(2). See Domenic A. Cossi, Comment, *Getting Our Priorities Straight: Streamlining NEPA to Hasten Renewable Energy Development on Public Land*, 31 PUB. LAND & RESOURCES L. REV. 149, 150 (2010); Irma S. Russell, *Streamlining NEPA To Combat Global Climate Change: Heresy or Necessity?*, 39 ENVTL. L. 1049, 1059 (2009). “The ultimate regulations promulgated to implement [the] UFA allowed for a single developer to develop 300,000 acres” in the three states. After completion of the PEIS, subsequent EISs “for individual leases within the region could be largely recycled from previously gathered information.” Cossi, *supra*. A PEIS allows agencies to conduct “broad-scale analyses to focus the scope of alternatives, environmental effects analysis, and mitigation in subsequent tiered levels of documentation.” NEPA TASK FORCE, REPORT TO THE COUNCIL ON ENVIRONMENTAL QUALITY: MODERNIZING NEPA IMPLEMENTATION 38 (2003), *available at* <http://ceq.hss.doe.gov/ntf/report/chapter3.pdf>.

²³⁹ Deepwater Port Act of 1974, 33 U.S.C. § 1501(a)(6) (2006).

²⁴⁰ 33 U.S.C. §§ 1501–1524 (2006).

²⁴¹ *Id.* § 1504(g)–(i); see also Office of Deepwater Ports & Offshore Activities, *Deepwater Port Licensing Program*, http://www.marad.dot.gov/ports_landing_page/deepwater_port_licensing/dwp_licensing_requirements/dwp_licensing_requirements.htm (last visited Nov. 18, 2012).

²⁴² Energy Policy Act of 2005, Pub. L. 109-58, § 211 (2005). Additionally, Congress in the Energy Policy Act expressly singled out the Gulf of Mexico for less rigorous oversight under NEPA of development and production plans, and required the Department of the Interior (DOI) to approve a lessee’s exploration plan within 30 days of submission unless there is probable cause the project would cause serious harm or damage. 43 U.S.C. § 1340(c)(1) (2006). DOI regulations issued in 1981 also categorically excluded exploration plans for most of the Gulf of Mexico from NEPA review. NAT’L COMM’N ON THE BP DEEPWATER HORIZON OIL SPILL & OFFSHORE DRILLING, DEEP WATER: THE GULF OIL DISASTER AND THE FUTURE OF OFFSHORE DRILLING: REPORT TO THE PRESIDENT, 62, 80–81 (2011), *available at* <http://www.gpo.gov/fdsys/pkg/GPO-OILCOMMISSION/pdf/GPO-OILCOMMISSION.pdf>; 43 U.S.C. § 1351(a)(1) (2006).

facilities.²⁴³ And a bill now pending in Congress, the Hydropower Regulatory Efficiency Act of 2012,²⁴⁴ was unanimously passed by the House of Representatives on July 9, 2012, in light of evidence that hydropower permitting could take five to seven years or more because of reviews by different federal agencies with conflicting policy goals. This bill would amend the current law to allow FERC to exempt small hydroelectric facilities with a generating capacity of ten megawatts or less from FERC's licensing requirements, and require the Secretary of Energy to study the feasibility of a two-year permitting process for certain hydropower projects.²⁴⁵

Offshore wind energy could be considered an "unconventional" energy or fuel source in that it is not a "conventional" source of carbon-based, fossil-fuel-emitting energy.²⁴⁶ The EPA Act has resulted in some onshore wind development on public lands by the Bureau of Land Management through the use of a PEIS and the expedited issuance of a three-year site-specific or project-area grant for testing and monitoring of wind projects.²⁴⁷ This effort, though, will fall far short of meeting the 2005 mandate of developing at least 10,000 MW of non-hydropower renewable energy projects on federal public lands by 2015.²⁴⁸ Moreover, the initiative and goals have not been translated to apply to the federal public lands under the Great Lakes and oceans. While BOEM has recently begun the process of identifying some Wind Energy Areas,²⁴⁹ this has not resulted in the approval of any offshore wind projects.

If oil shale, tar sands, natural gas, and cell and transmission towers are important enough to warrant greater federal control to expedite their development, then so too is legislation to amend NEPA and the OCSLA to provide clear federal policy encouraging the development of offshore wind energy projects, both generally and by streamlining and standardizing the permitting and licensing processes.²⁵⁰ Under NEPA and the OCSLA, projects are killed through delays in the BOEM and other permitting or leasing

²⁴³ See 16 U.S.C. § 824p (2006).

²⁴⁴ H.R. 5892, 112th Cong. (2012).

²⁴⁵ *Id.* §§ 3–6; see also CONG. BUDGET OFFICE, H.R. 5892, HYDROPOWER REGULATORY EFFICIENCY ACT OF 2012, at 1 (2012), available at <http://www.cbo.gov/publication/43365>; GOP, *Legislative Digest: H.R. 5892 Hydropower Regulatory Efficiency Act of 2012*, <http://www.gop.gov/bill/112/2/hr5892> (last visited Nov. 18, 2012). Its fate in the Senate is unknown at the time of this writing.

²⁴⁶ Such energy could be an "unconventional" fuel for electric vehicles, for example.

²⁴⁷ See U.S. BUREAU OF LAND MGMT., FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT ON WIND ENERGY DEVELOPMENT ON BLM-ADMINISTERED LANDS IN THE WESTERN UNITED STATES 1-1 (2005) [hereinafter BLM EIS], available at <http://windeis.anl.gov/documents/fpeis/index.cfm>; U.S. BUREAU OF LAND MGMT., RECORD OF DECISION: IMPLEMENTATION OF A WIND ENERGY DEVELOPMENT PROGRAM 5 (2005), available at <http://windeis.anl.gov/documents/docs/WindPEISROD.pdf>.

²⁴⁸ See BLM EIS, *supra* note 247, at 2-28 to 2-30 (listing current wind development ventures resulting in a total additional megawatt increase significantly less than the 10,000 megawatt mandate).

²⁴⁹ See *supra* notes 157–58 and accompanying text.

²⁵⁰ See generally Jack K. Sterne et al., *The Seven Principles of Ocean Renewable Energy: A Shared Vision and Call for Action*, 14 ROGER WILLIAMS U. L. REV. 600, 605, 610 (2009) (recommending agency consideration of licensing and permitting practices for oceanic renewable energy); *infra* notes 268 (telecommunication towers), 306 (transmission lines).

regimes, or at least their costs are significantly increased.²⁵¹ NEPA and the OCSLA should be amended to impose agency consultation and review deadlines. There must be binding time limits for each step of the NEPA and BOEM processes—for example, the Department of Energy (DOE), the Corps, or other lead agency must turn around the draft EA or EIS within a specific number of days, or else waive amendments or revisions. Likewise, consulting agencies must be required to submit any comments within a specified number of days, or be precluded from commenting.²⁵² Precedent for such waivers exists in the CZMA.²⁵³

Likewise, Congress should learn from the experiences of other countries and even individual states about ways to develop better coordinated and streamlined regulatory reviews of renewable energy projects. For example, Denmark successfully created a streamlined permitting regime making the Danish Energy Authority the one-stop shop for siting offshore wind.²⁵⁴ The Authority has sole jurisdiction “over the tendering of bids for renewable energy construction; approval of pre-investigation of sites, environmental impact assessments, construction and operation; and licenses to produce electricity.”²⁵⁵ The Authority requires streamlined permitting, which “shortens . . . lead times . . . simplifies the siting process, hedges against uncertainty and risk [for generators],” and has resulted in over 300 offshore wind turbines being approved and installed since 2003.²⁵⁶

In the United States, when the Maine legislature promulgated the state’s Wind Energy Act, it found that “it is in the public interest to reduce the potential for controversy regarding siting of grid-scale wind energy development by expediting development in places where it is most compatible with existing patterns of development and resource values when considered broadly at the landscape level,”²⁵⁷ and established wind energy development as a permitted use subject to expedited treatment in many parts of the state.²⁵⁸ On the West Coast, Oregon, California, and Washington each has some form of

²⁵¹ See RAY CLARK & LARRY CANTER, ENVIRONMENTAL POLICY AND NEPA: PAST, PRESENT, AND FUTURE 151 (1997).

²⁵² As opposed to relying on unenforced statutory timelines that carry no consequences for agencies, using waiver or presumed concurrence provisions to deal with delay should be required. Cf. U.S. GOV’T ACCOUNTABILITY OFFICE, *supra* note 194 (discussing, in part, the inefficiencies and delays involved in the ESA consultation process).

²⁵³ Under the Coastal Zone Management Act, an untimely response by a state agency to a consistency determination means that its concurrence is presumed. For example, for a lease or grant sale, the state agency only has 60 days to respond once BOEM submits its consistency determination, or else it is presumed to concur. 15 C.F.R. § 930.41(a) (2011). For approval of an applicant’s Site Assessment Plan and Construction and Operations Plan, the state agency’s concurrence is presumed if it does not respond to BOEM within six months from the start of its consistency review. *Id.* § 930.62(a).

²⁵⁴ Benjamin K. Sovacool et al., *Is the Danish Wind Energy Model Replicable for Other Countries?*, 21 ELEC. J. 27, 31 (2008).

²⁵⁵ *Id.*; see also Erica Schroeder, Comment, *Turning Offshore Wind On*, 98 CALIF. L. REV. 1631, 1659–60 (2010).

²⁵⁶ Sovacool et al., *supra* note 254, at 35.

²⁵⁷ ME. REV. STAT. ANN., tit. 35-a, § 3402(2) (2011).

²⁵⁸ *Id.*; see also *id.* § 3451(3) (providing “expedited permitting area” regulations).

one-stop and/or expedited permitting process for proposed energy facilities. In Oregon, the Oregon Energy Facility Siting Council is the one-stop forum that determines compliance with state standards for thermal electric power plants with a nominal electric generating capacity of twenty-five megawatts or more, and for renewable electric power plants with an average electric generating capacity of thirty-five megawatts or more.²⁵⁹ Gas-fired plants of any size may qualify for a special criteria expedited process; wind or solar facilities with a nominal capacity of under 300 megawatts may qualify for a slightly expedited review process.²⁶⁰ In California, only thermal power plants of fifty megawatts or more qualify for a twelve-month, one-stop permitting process before the state's Energy Commission,²⁶¹ thereby leaving wind projects to the vagaries of local review.

In Washington, the Energy Facility Site Evaluation Council has jurisdiction over stationary thermal power plants of 350 megawatts or more, and over all wind projects regardless of size.²⁶² The local government (county and city) for a proposed project has a vote on the Council, but it is the Council, not the locality, that determines consistency with local plans and ordinances.²⁶³ Moreover, an applicant can seek expedited treatment where the “environmental impact of the proposed energy facility is not significant or will be mitigated to a nonsignificant level,”²⁶⁴ and if there is a coal-fired generating plant in the county where a new project is proposed, then the Council must expedite its processing of the application and must report its recommendations to the Governor within 180 days.²⁶⁵

However, statutes expediting agency review of offshore wind projects solve only part of the problem—after all, litigation delayed and plagued the Cape Wind project even after it received its multiple regulatory approvals.²⁶⁶ Thus, as in Maine, there should be both expedited and limited judicial reviews of agency decisions on offshore wind projects.²⁶⁷

²⁵⁹ OR. REV. STAT. §§ 469.300–469.559 (2011). See generally Or. Dep't of Energy, *The Siting Process for Energy Facilities*, <http://www.oregon.gov/energy/Siting/Pages/process.aspx> (last visited Nov. 18, 2012).

²⁶⁰ For regulations governing expedited natural gas facility permitting see OR. REV. STAT. § 469.373 (2011) and OR. ADMIN. R. 345-015-0310, -0320 (2012). OR. ADMIN. R. 345-015-0300 (2012) (providing the procedures for expedited review for certain energy facilities); see also Or. Dep't of Energy, *supra* note 260 (noting that “a wind or solar facility with nominal capacity of less than 300 megawatts qualifies for expedited review.”). Interestingly, when adopting standards for carbon dioxide emitting energy facilities, the Oregon Energy Facility Siting Council must consider “impacts of those emissions on climate change.” OR. REV. STAT. § 469.501(1)(o) (2011).

²⁶¹ CAL. PUB. RES. CODE §§ 25120 (defining “Thermal powerplant”), *id.* § 25540.6 (providing an expedited review process for Thermal powerplants) (2012); Cal. Energy Comm'n, *Energy Facilities Siting/Licensing Process*, <http://www.energy.ca.gov/sitingcases/#license> (last visited Nov. 18, 2012).

²⁶² WASH. REV. CODE § 80.50.060 (2012); Energy Facility Site Evaluation Council, *Siting/Review Process*, <http://www.efsec.wa.gov/cert.shtml> (last visited Nov. 18, 2012).

²⁶³ WASH. REV. CODE § 80.50.030(4)–(5) (2012). See also *id.* § 80.50.040 (enumerating the powers granted to the Council).

²⁶⁴ *Id.* § 80.50.075.

²⁶⁵ *Id.* § 80.50.100.

²⁶⁶ See *supra* notes 173–75.

²⁶⁷ See, e.g., ME. REV. STAT. tit. 35-A, § 3458 (2011) (providing that judicial appeal of a municipal decision regarding permitting of an expedited wind project must be heard and

Any effort toward national-scale coordinated and streamlined review of offshore wind projects must also consider the separate state and local regulatory obstacles before a project can begin construction. Again, there is federal precedent for limiting the delay or denial of deserving projects that are deemed critical to the country's economic, energy, or environmental interests. For example, the role of state and local agencies in permitting, licensing, or regulating nuclear and hydroelectric power projects, cell towers, and vehicle emissions has been restricted by Congress with the support of the courts.²⁶⁸ Comparable legislation for siting and permitting offshore wind projects, including their associated transmission corridors, is in order. Just as state and local governments cannot regulate cell tower siting on the basis of impacts from the radio frequency emissions,²⁶⁹ those governments should also be prohibited from regulating on the basis of harm to wildlife if the proposed project follows federal guidelines and laws, such as the ESA, the MMPA, and the MBTA.

The CZMA federal consistency requirement also provides many opportunities to delay approval of offshore wind energy projects. One set of proposals has been to streamline the CZMA process, as well as to legislatively include in the Act “an explicit mandate for offshore wind power development where appropriate and feasible on all U.S. coasts; [t]o require revisions to [states'] CZMPs in accordance with this new mandate; and [t]o increase funding and other incentives for offshore wind power [planning and] development.”²⁷⁰ One consequence would be requiring “changes to many states' CZMPs to reflect the new national priority for offshore renewable energy sources, including offshore wind.”²⁷¹ A second consequence would be that the “federal government would likely certify

determined by the trial court expeditiously). Maine's Supreme Judicial Court has exclusive jurisdiction of any appeals from final agency decision for expedited wind energy projects. *See* ME. REV. STAT. tit. 12, § 689 (2011); ME. REV. STA. tit. 38, § 346(4) (2011). Comparable treatment is afforded to demonstration-scale offshore wind energy projects in Maine pursuant to a 60-day general permit process that includes expedited judicial review of decisions. *See* ME. REV. STAT. tit. 38, §§ 346(4), 480-HH (2011).

²⁶⁸ *See, e.g.*, Telecommunications Act of 1996, 47 U.S.C. § 332(c)(7)(B)(iv) (2006) (“No State or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's regulations concerning such emissions.”); *Pac. Gas & Elec. Co. v. State Energy Res. Conservation & Dev. Comm'n*, 461 U.S. 190, 206 (1983) (stating that California can regulate as to the economics of the proposed nuclear power plant, but not safety issues, which are within the sole purview of the Nuclear Regulatory Commission); *Hackett v. J.L.G. Props., LLC.*, 940 A.2d 769, 776, 778–79, 786 (Conn. 2008) (concluding that the town zoning regulations were preempted because Congress intended, through the Federal Power Act, to create a “complete scheme of national regulation” for all aspects of hydroelectric power projects—although states still do have some regulatory involvement in aspects of proposed projects). For vehicle emission regulations, nearly all state and local regulations are expressly preempted under the Energy Policy and Conservation Act, 49 U.S.C. § 32919(a) (2006), and the Clean Air Act, 42 U.S.C. § 7543(a) (2006).

²⁶⁹ *See* 47 U.S.C. § 332(c)(7)(B)(iv) (2006).

²⁷⁰ Schroeder, *supra* note 260, at 1660–61.

²⁷¹ *Id.* at 1662.

offshore wind projects as consistent with states' revised CZMPs because development of offshore renewable energy would be an explicit goal in the states' CZMPs under the revised CZMA.²⁷²

Likewise, when evaluating the direct and cumulative impacts of an offshore wind project, or a different renewable energy project, regulators should be required to weigh those impacts against the fossil-fueled energy sources and emissions that the new project would displace.²⁷³ For decades, almost all environmental statutes have drawn a fairly narrow circle around a project's impacts and have not evaluated the project in comparison to the costs and impacts of competing energy sources. That must change given the accelerating emissions of GHGs into our atmosphere that are causing accelerated harm to societies and species worldwide.²⁷⁴ Instead, as NREL has recommended, the evaluation of large-scale offshore wind projects should reflect their risk in comparison with other OCS uses (e.g., oil, gas) and with life cycle options for electricity supply.²⁷⁵ This would involve utilizing the life cycle assessment of the different energy technologies:

Life cycle assessment is a standardized technique that tracks all material, energy, and pollutant flows of a system—from raw material extraction, manufacturing, transport, and construction to operation and end-of-life disposal. Life cycle assessment can help determine environmental burdens from “cradle to grave” and facilitate comparisons of energy technologies.²⁷⁶

After reviewing over 2,100 published references and choosing about 300 of the best-performed analyses, NREL developed a “harmonized,”²⁷⁷ composite chart, which demonstrated that “lifecycle GHG emissions normalized per unit of electrical output (g CO₂eq/kWh) from technologies powered by renewable

²⁷² *Id.* Thus, states would have greater “difficulty finding inconsistency with their revised state CZMPs,” and if they did object, “the Secretary of Commerce could overrule the state’s objection as inconsistent with the new objectives of the CZMA.” *Id.*

²⁷³ Just like, for example, Oregon has done in requiring evaluation for “energy facilities that emit carbon dioxide [and] the impacts of those emissions on climate change.” OR. REV. STAT. § 469.501(1)(o) (2011).

²⁷⁴ I reject the conclusion of a forthcoming legal paper that it is “preposterous” to think that current climate and species modeling could support an assessment of the benefits of wind power—such as its substantially reduced GHG emissions and water consumption compared with fossil fuel alternatives—upon climate change in comparison to the costs of wind projects. Ruhl, *supra* note 183, at 21. That paper contains none of the analysis undertaken in this Article of climate science, life cycle assessment, or the NREL studies on the future of renewable electricity sources, and therefore I find its conclusion regrettably misguided.

²⁷⁵ MUSIAL & RAM, *supra* note 22, at 161 (describing NREL’s Life Cycle Assessment methodology).

²⁷⁶ Nat’l Renewable Energy Lab., *Life Cycle Assessments of Energy Technologies*, http://www.nrel.gov/analysis/sustain_lca_about.html (last visited Nov. 18, 2012). This is a separate approach from the social cost of carbon, which assigns a price to the costs of climate change. Pricing carbon, although possibly a worthy endeavor, is beyond the scope of this Article. See generally Squillace & Hood, *supra* note 116, at 514–18 (describing the methods and functions of pricing the social cost of carbon).

²⁷⁷ Nat’l Renewable Energy Lab., *supra* note 276.

resources are generally found to be considerably less than from those powered by fossil fuel-based resources,²⁷⁸ as documented in this figure:

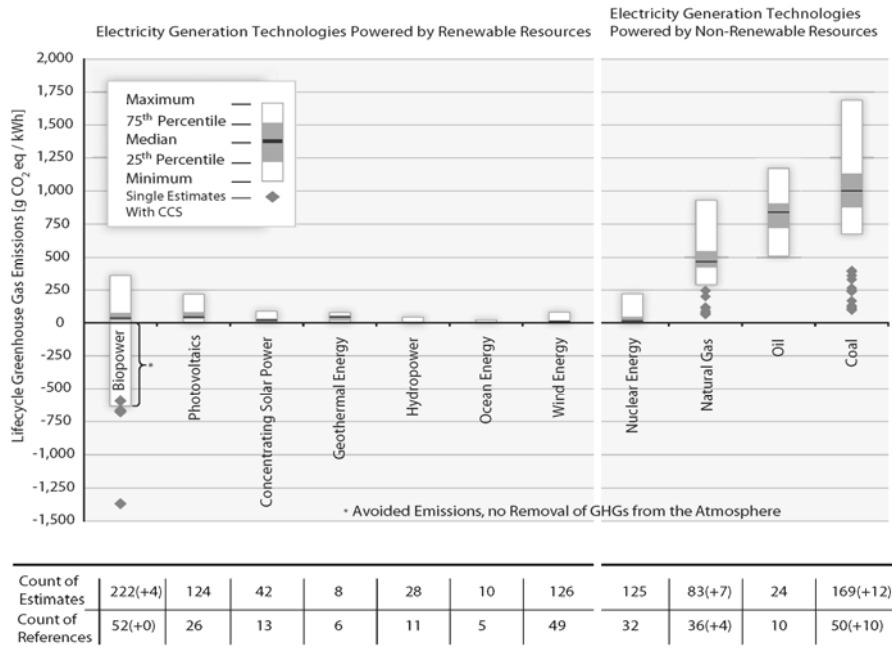


Figure 2: This figure represents “[e]stimates of lifecycle GHG emissions (g CO₂eq/kWh) for broad categories of electricity generation technologies, plus some technologies integrated with [carbon capture and storage] (CCS). Land-use related net changes in carbon stocks (mainly applicable to biopower and hydropower from reservoirs) and land management impacts are excluded; negative estimates for biopower are based on assumptions about avoided emissions from residues and wastes in landfill disposals and co-products. . . . Numbers reported in parentheses pertain to additional references and estimates that evaluated technologies with CCS.”²⁷⁹

Thus, life cycle scientific data, along with assessments like the National Research Council’s Hidden Costs of Energy Report²⁸⁰ and NREL’s Renewable

²⁷⁸ IPCC RENEWABLE SOURCES REPORT, *supra* note 228, at 732–33.

²⁷⁹ *Id.* at 732 fig.9.8. To consult the report’s references and methodology, see *id.* at 973–1000. For a slightly different chart also prepared by NREL, see NREL FUTURES 1, *supra* note 14, at A-51, fig.A-17; Nat’l Renewable Energy Lab., *Life Cycle Assessment Harmonization Results and Findings*, http://www.nrel.gov/analysis/sustain_lca_results.html (last visited Nov. 18, 2012). It is important to note that the natural gas assessment does not distinguish between conventional and unconventional extraction (shale gas extracted by hydraulic fracturing or “fracking”). This is important, as some scientists assert that LCA emissions of shale gas are higher than those for coal. See, e.g., J. DAVID HUGHES, LIFECYCLE GREENHOUSE GAS EMISSIONS FROM SHALE GAS COMPARED TO COAL: AN ANALYSIS OF TWO CONFLICTING STUDIES 18 (2011), *available at* <http://www.postcarbon.org/reports/PCI-Hughes-NETL-Cornell-Comparison.pdf>.

²⁸⁰ See NRC HIDDEN COSTS OF ENERGY, *supra* note 13; see also *supra* notes 47–48 and accompanying text.

Electricity Futures Study,²⁸¹ should be used by all decision-makers in evaluating any proposed electricity generation project. We must look beyond a project's immediate ecosystem impacts in order to be more consistent with the existing congressional goals of: 1) preventing damage and degradation to the environment while being mindful of "the responsibilities of each generation as trustee of the environment for succeeding generations,"²⁸² and 2) conserving ecosystems for the benefit of all citizens.²⁸³

Other legislative changes should make greater use of evidentiary rebuttable presumptions to determine when environmental impacts from offshore wind projects should be deemed acceptable absent compelling scientific evidence to the contrary.²⁸⁴ For example, under Maine's Wind Energy Act, the visual impacts of onshore wind projects are presumed reasonable for a project more than 2,500 feet from someone's full-time residence; therefore affected parties must prove significant harm that is irreparable in order to possibly defeat the project.²⁸⁵

Similarly, the ESA/MMPA incidental take or biological assessment process should: 1) compare the positive GHG emission-free environmental benefits from offshore wind projects with the negative harms to species and habitat nationwide from continued carbon emissions in the absence of the wind project, and 2) utilize rebuttable presumptions that—instead of currently erring on the side of caution and assuming harm in the absence of scientific consensus on a given issue²⁸⁶—would presume an offshore wind project's benefits to the ecosystem. In the absence of strong evidence to the

²⁸¹ See NREL FUTURES 1, *supra* note 14; see also *supra* notes 17, 21 and accompanying text.

²⁸² National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321, 4331(a)–(b) (2006).

²⁸³ Endangered Species Act of 1973, 16 U.S.C. § 1531 (2006).

²⁸⁴ Contrary to the way the 1970s-era environmental laws were drafted or have been applied, where there is uncertainty about the impact of a clean renewable energy project upon a particular species or variable, the benefit of the doubt should now go to approval of the project, not denial. Additionally, fossil fuel energy sources have already benefited from rebuttable presumptions. See *infra* note 292 and accompanying text.

²⁸⁵ See Maine's Wind Energy Act, ME. REV. STAT. ANN. tit. 35-A, § 3452(4) (2011) ("There is a rebuttable presumption that a visual impact assessment is not required for those portions of the development's generating facilities that are located more than 3 miles, measured horizontally, from a scenic resource of state or national significance. The primary siting authority may require a visual impact assessment for portions of the development's generating facilities located more than 3 miles and up to 8 miles from a scenic resource of state or national significance if it finds there is substantial evidence that a visual impact assessment is needed to determine if there is the potential for significant adverse effects on the scenic resource of state or national significance. Information intended to rebut the presumption must be submitted to the primary siting authority by any interested person within 30 days of acceptance of the application as complete for processing. The primary siting authority shall determine if the presumption is rebutted based on a preponderance of evidence in the record.").

²⁸⁶ This is the Precautionary Principle, advocated by many groups and people opposing particular projects or change: "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically." Sci. and Envtl. Health Network, *Wingspread Conference on the Precautionary Principle*, <http://www.sehn.org/wing.html> (last visited Nov. 18, 2012).

contrary, and considering the climate-driven extinction risks and the National Renewable Energy Lab (NREL)'s assessment that each megawatt of GHG-free wind power could displace close to 90% of the GHGs being emitted by a megawatt of carbon-based electricity—these presumptions should govern the assessment process.²⁸⁷ Concerns about uncertain local wildlife impacts from an offshore wind project—even given regional or national benefits from displacement of GHGs—can be adequately addressed through mitigation and adaptive management approaches that are either required by law or regulation.²⁸⁸

One final suggested legislation is amending the MBTA to allow for an incidental take permit, as presently is allowed under the ESA and the MMPA.²⁸⁹ Whether through legislation or through new regulations, the ESA and the MMPA (as well as the MBTA, if a take permit is allowed) should provide that if a proposed project has been designed to operate consistent with federal wildlife guidelines, such as those developed by the USFWS for wind projects,²⁹⁰ then a take is not a violation of law.²⁹¹

²⁸⁷ See NREL FUTURES 1, *supra* note 14, at A-53. In light of the NREL report and the many other studies analyzed in this Article, I again must disagree with the forthcoming paper that declares that having the ESA place a green “thumb” on the scale for wind and other renewables would “subvert the ESA’s precautionary purpose.” Ruhl, *supra* note 183, at 5, 23. To the contrary, it would be consistent with the purposes of the ESA to conserve ecosystems in order to avoid extinctions—all of which are being directly impacted by fossil-fueled climate changes. See 16 U.S.C. § 1531 (2006); *supra* Part II.B.3.

²⁸⁸ See MUSIAL & RAM, *supra* note 22, at 179–81 (discussing the need for a flexible regulation process incorporating ongoing research and risk assessment).

Uniform policies would help developers comply with environmental requirements and allow them to develop standard streamlined [and] less costly baseline studies, as well as needed mitigation methods and possible adaptive management approaches. Adaptive management provides a useful tool to minimize impacts to the environment after a project has been constructed and measures to reduce them might need to be taken.

NREL FUTURES 2, *supra* note 21, at 9-31. “Adaptive management is a structured, iterative process of optimal decision making in the face of uncertainty, which aims to reduce uncertainty over time via system monitoring. In this way, decision making simultaneously maximizes one or more resource objectives and, either passively or actively, accrues information needed to improve future management.” *Id.* at 9-31 n.71. See also B.K. WILLIAMS ET AL., ADAPTIVE MANAGEMENT: THE U.S. DEPARTMENT OF THE INTERIOR TECHNICAL GUIDE v (2009), available at <http://www.doi.gov/initiatives/AdaptiveManagement/TechGuide.pdf>. Likewise, BOEM and other agencies should not be allowed to require two or more years of pre-construction (normally pre-permit application) studies, as is currently often the case, but rather should require more post-installation monitoring for adaptive management.

²⁸⁹ See *supra* Part III.C.4–5.

²⁹⁰ See *supra* note 214 and accompanying text.

²⁹¹ The incidental take program is especially needed because many courts have held that the term “take” must be construed “in the broadest possible manner to include every conceivable way in which a person can ‘take’ or attempt to ‘take’ any fish or wildlife.” *Strahan v. Coxe*, 127 F.3d 155, 162 (1st Cir. 1997) (quoting S. REP. NO. 93-307, at 7 (1973)); see also *Forest Conservation Council v. Rosboro Lumber Co.*, 50 F.3d 781, 784 (9th Cir. 1995) (quoting S. REP. NO. 93-307, at 7 (1973)); *Strahan v. Holmes*, 595 F. Supp. 2d 161, 165 (D. Mass. 2009) (holding that accidental entanglement of a humpback whale in lobster gear was a “capture” and thus an unauthorized “take”). Because there is no “de minimis” defense to take liability, the take of even

B. Needed Non-Legislative Actions

As discussed in the preceding subsection, some of the recommended reforms—such as life cycle assessments, expediting and coordinating regulatory reviews, and instituting rebuttable presumptions—could be initiated through a combination of executive orders, rulemaking, and inter-agency memoranda of understanding, to the extent that they are not undertaken legislatively. An area of reform that would require action specifically by CEQ and key regulatory agencies has to do with the categorical exclusion process under NEPA.

Again, non-renewable energy sources have previously been accorded favorable treatment. For example, oil and gas have benefitted from a rebuttable presumption that Categorical Exclusions (Cat-Exs) apply to certain proposals on public lands and in national forest system lands “if the activity is conducted pursuant to the Mineral Leasing Act for the purpose of exploration or development of oil or gas.”²⁹² Likewise, the Nuclear Regulatory Commission has been allowed to create numerous Cat-Exs through its regulations for many activities.²⁹³

The development of new or broader Cat-Exs for offshore wind demonstration and testing projects should also be undertaken, whether by CEQ Guidance²⁹⁴ or rulemaking within agencies themselves. Presently, there are a few Cat-Exs that might apply for offshore wind, but DOE, for example, has too narrowly crafted them if not outright undercut them, and has yet to grant one for any aspect of an offshore wind project. In theory, an offshore wind project can only be considered for a Cat-Ex if it is small-scale,²⁹⁵ temporary (under 2–3 years), and/or in a previously disturbed or developed

one individual is prohibited. *See* *Loggerhead Turtle v. Cnty. Council of Volusia Cnty.*, 896 F. Supp. 1170, 1180 (M.D. Fla. 1995).

²⁹² Energy Policy Act of 2005, 42 U.S.C. § 15942(a) (2006) (citation omitted).

²⁹³ *See* Criterion for Categorical Exclusion, 10 C.F.R. § 51.22(b)–(c) (2012). *See generally* Russell, *supra* note 238, at 1063–64 (describing the rebuttable presumption of categorical exclusion and nuclear regulatory commission criteria).

²⁹⁴ CEQ in 2010 issued guidance on when a new Cat-Ex should be developed: “Federal agencies should develop and propose a categorical exclusion whenever they identify a category of actions that under normal circumstances does not have, and is not expected to have, significant individual or cumulative environmental impacts.” Memorandum from Nancy H. Sutley, Chair, Council on Env’tl. Quality, to the Heads of Fed. Dep’ts & Agencies, Establishing and Applying Categorical Exclusions under the National Environmental Policy Act 3 (Feb. 18, 2010), *available at* http://ceq.hss.doe.gov/nepa/regs/Categorical_Exclusion_Draft_NEPA_Guidance_FINAL_02182010.pdf.

²⁹⁵ 10 C.F.R. § 1021.410(g)(2) (2012) (“DOE considers terms such as ‘small’ and ‘small-scale’ in the context of the particular proposal, including its proposed location. In assessing whether a proposed action is small, in addition to the actual magnitude of the proposal, DOE considers factors such as industry norms, the relationship of the proposed action to similar types of development in the vicinity of the proposed action, and expected outputs of emissions or waste. When considering the physical size of a proposed facility, for example, DOE would review the surrounding land uses, the scale of the proposed facility relative to existing development, and the capacity of existing roads and other infrastructure to support the proposed action.”)

area.²⁹⁶ The Cat-Exs that might apply are for: 1) “[s]mall-scale research and development, laboratory operations, and pilot projects” (less than 2 years);²⁹⁷ 2) “[s]mall-scale renewable energy research and development projects and small-scale pilot projects, provided that the projects are located within a previously disturbed or developed area”;²⁹⁸ and 3) “[s]mall-scale renewable energy research and development projects and small-scale pilot projects located in [certain] aquatic environments.”²⁹⁹ However, until agencies apply one or more of these Cat-Exs to offshore wind, new exclusions must be added to help offshore wind catch up to and surpass the speedy reviews and exclusions previously afforded other energy projects.³⁰⁰

Another area of reform that can be undertaken without legislation is the use of the no-action alternative³⁰¹ to account for the hidden costs of fossil-based energy. CEQ should revise its NEPA regulations and policies guiding the implementing agencies so that the benefits of renewable energy sourcing (such as no GHG emissions) are quantified under project impacts. All costs, including the National Research Council’s “hidden” costs or externalities of fossil fuel emissions and resultant ecosystem consequences,³⁰² must be assessed as part of NEPA’s no-action alternative analysis of *not* converting to renewables. Indeed, CEQ should now act on its thirty-month-old draft guidance, *Consideration of the Effects of Climate Change and Greenhouse Gas Emissions*,³⁰³ which requires agency decisionmaking to consider climate change impacts. Although the guidance has its flaws, it would at least acknowledge that climate change impacts must not be ignored at each stage of NEPA.³⁰⁴

²⁹⁶ *Id.* § 1021.410(g)(1). (“Previously disturbed or developed” refers to land that has been changed such that its functioning ecological processes have been and remain altered by human activity. The phrase encompasses areas that have been transformed from natural cover to non-native species or a managed state, including, but not limited to, utility and electric power transmission corridors and rights-of-way, and other areas where active utilities and currently used roads are readily available.”)

²⁹⁷ 10 C.F.R. pt. 1021, subpt. D, app. B3.6 (2012).

²⁹⁸ *Id.* at app. B5.15.

²⁹⁹ *Id.* at app. B5.25.

³⁰⁰ See MUSIAL & RAM, *supra* note 22, at 161 (suggesting “new categorical exclusions for testing activities on the OCS”). Whether by intent or inadvertence, in 2011 the Department of Energy (DOE) promulgated Categorical Exclusion B5.18 for wind turbines under 200 feet high in previously disturbed areas that would not have the potential to significantly impact bird, bat, or human populations—but then, in the last sentence, limited the exclusion to onshore installations. National Environmental Policy Act Implementing Procedures, 76 Fed. Reg. 63,764, 63,796 (Oct. 13, 2011) (to be codified at 10 C.F.R. pt. 1021). DOE staff has interpreted this to mean that it trumps aquatic-based exclusions like B5.25, even for temporary or pilot offshore wind projects. See *supra* notes 295–99 and accompanying text.

³⁰¹ See 40 C.F.R. §§ 1502.14(d), 1508.25(b)(1) (2011). CEQ, in its NEPA regulations, requires that the “alternative of no action” shall be included in any environmental assessment or impact statement. 40 C.F.R. §§ 1502.14(d), 1508.25(b)(1) (2011). However, the term is never defined, nor is the purpose of such an evaluation articulated in the regulations.

³⁰² See *supra* notes 47–48 and accompanying text.

³⁰³ 75 Fed. Reg. 8046, 8046 (Feb. 23, 2010).

³⁰⁴ For more analysis of the draft guidance, see THALER & TILL, *supra* note 234, at 16–22, 46–48.

Essential to considering all costs of an energy source is a consistent measure of its cumulative climate change impact and a method of measuring the reduction in GHGs associated with the project. This measurement, which can be based in whole or part upon the life cycle assessment database developed by NREL,³⁰⁵ must be consistent throughout various agencies and also be applied in NEPA reviews of proposed non-renewable projects. This will even the playing field to a certain extent and help quantify and price the externalities associated with carbon-based energy. The goal is to evolve NEPA from a statute that only looks at the costs of doing something, to a statute that also looks at the costs of doing nothing in the face of climate-driven need for more GHG emission-free electricity generation.

Finally, there should also be memoranda of understanding signed by all relevant federal agencies, comparable to those for transmission line and high-speed rail projects, in order to accelerate the speed of federal permitting and review processes for offshore wind energy development.³⁰⁶

V. CONCLUSION

The window of opportunity to stabilize carbon levels in our atmosphere and prevent escalating climate-driven damage to our world is rapidly closing. We must first understand where our carbon-driven energy and electricity technologies are taking us, and learn from the experiences and lessons climate change scientists are trying to teach us, because we are on the verge of losing—for the next thousand or more years—the environmental and economic quality of life that we inherited.

Second, we must understand, in an increasingly carbon-constrained world, how our existing environmental laws and regulatory processes no longer achieve their underlying goals of long-term ecosystem conservation. To the contrary, that process is supporting an increasingly GHG-emitting system that is annually costing trillions of dollars and is reducing the chances of constructing sufficient new, pollutant-free and less water-intensive power sources in time to limit the average global temperature rise to less than the internationally agreed ceiling of 2°C.

³⁰⁵ See *supra* notes 276–78 and accompanying text.

³⁰⁶ See Press Release, Council on Env'tl. Quality, *supra* note 229 (announcing a transmission line MOU); Press Release, Council on Env'tl. Quality, U.S. Department of Transportation Announce Effort to Cut Costs, Fast Track Construction and Job Creation for High-Speed Rail Projects in the Northeast Corridor (Jan. 13, 2012), available at http://www.transitattorneys.com/files/DOT_Press_Release_011312.pdf (announcing a CEQ and U.S. Department of Transportation (DOT) pilot project “aimed at expediting the environmental reviews for high-speed passenger rail service in the Northeast Corridor”); see also Patricia E. Salkin & Ashira Pelman Ostrow, *Cooperative Federalism and Wind: A New Framework for Achieving Sustainability*, 37 HOFSTRA L. REV. 1049, 1092 (2009) (arguing that “a federal wind siting policy should: (a) prohibit local governments from banning wind energy facilities; (b) require local governments to make decisions on wind siting within a reasonable period of time; and (c) require such decisions to be made in writing and supported by substantial evidence.”).

Third, we must act on the evidence presented in Parts II and III to significantly revamp the legal process in order to greatly accelerate the development of renewable energy projects like offshore wind power. My recommendations and road map in Part IV are a call to climate, economic, and energy policymakers to act on needed reforms, and to remove the many obstacles in the path of achieving an 80% reduction in GHG emissions by 2050.

I acknowledge that my recommendations are only a part of what must be done—but they are a necessary part. Unless there is an immediate public demand for action to reform how renewable energy—and offshore wind in particular—are licensed and permitted, the accelerating climate changes presented in Part II will ensure that none of us escape the consequences of our carbon-intensive economic system.