December 5, 2014

Ms. Sheila Holman
Director
North Carolina Division of Air Quality
1641 Mail Service Center
Raleigh, NC 27699-1641

Re: Petition for Rule-making, on Behalf of Hallie Turner, for Promulgation of a Rule Based on the Best Available Climate Science to Limit North Carolina’s Carbon Dioxide Emissions.

Dear Ms. Holman:

This Petition for Rule-making (“Petition”) is being filed on behalf of Hallie McKenzie Turner, age 13. Like the majority of Americans under 30 years old, she strongly supports government action to reduce greenhouse gas (GHG) emissions. Hallie has been involved in climate action since the fourth grade. She has attended rallies and marches in Washington D.C. and has spoken at several events, including the Climate Convergence on Raleigh in 2013 and the NC League of Conservation Voters Green Tie Awards Dinner in 2014. In addition, Hallie loves reading, writing, art, and spending time with her friends. She is a talented violinist and an enthusiastic soccer player. Hallie is determined to leave behind a small carbon footprint. She bikes and walks to school everyday, looks after her family garden, eats a local and pescatarian diet, and voices her climate concerns in her classroom, and at rallies and marches in North Carolina and Washington, D.C. She is very proud of her family’s solar panels and is excited to address the North Carolina Environmental Commission (“Commission” hereafter).

Hallie has always loved animals and nature. She worries that if we do not act now to stop climate change, many more species will vanish and many more ecosystems will be degraded. She knows that if we destroy Earth’s atmosphere with greenhouse gas overload, there will not be a second chance. Unable to stand by meekly, Hallie is especially passionate about engaging other youth, recognizing that they are the ones who will inherit the Earth created by today’s policies and practices unless they take action.

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1 See poll in Washington Post results available online at: http://www.washingtonpost.com/page/2010-2019/WashingtonPost/2014/06/02/National-Polling/question_14229.xml?uuuid=YYAdvup3Ee0xDICOzztZWA.
On her behalf, I submit this Petition for Rulemaking and supporting documents pursuant to and in accordance with N.C.G.S. § 150B-20 and 15A N.C.A.C. 02I.0501. North Carolina owes its citizens a mandatory and affirmative duty “to control and limit the pollution of our air and water” and to protect “in every other appropriate way to preserve as a part of the common heritage of this State its forests, wetlands, estuaries, beaches, historical sites, open lands, and places of beauty.” Petitioner seeks the adoption of a rule that will ensure the integrity of North Carolina’s climate system by adequately protecting our atmosphere, a public trust resource upon which all North Carolina residents rely for their health, safety, sustenance, and security. The State’s forests, wetlands, estuaries, beaches, historical sites, open lands, and places of beauty are threatened by climate change and a stable climate system is necessary to preserve these constitutionally protected resources. The harmful effects of climate change are already being felt in North Carolina and are the direct result of anthropogenic greenhouse gas emissions—primarily carbon dioxide.

The North Carolina General Assembly long ago entrusted the Commission with both the duty and power to adopt regulations for air quality and emissions control standards for air contaminant sources pursuant to N.C.G.S. § 143-215.107. In outlining the authorizing article for air pollution control, the N.C. Legislature incorporated the purpose and definitions of Article 21, Water and Air Resources. The purpose and intent authorizing the Commission to control air pollution was “to achieve and maintain for the citizens of the State a total environment of superior quality.” As detailed in this Petition for Rulemaking, reducing carbon dioxide emissions is essential to maintaining a total environment of superior quality.

Furthermore, the Legislature adopted these policies under the recognition that the water and air resources of the State belong to the people, and affirmed the ultimate responsibility of the State to preserve and develop these resources in the best interest of all the citizens and that the prudent utilization of these resources is essential to the general welfare. Long ago the North Carolina General Assembly directed the Commission to set pollution standards for air as follows: “Standards of water and air purity shall be designed to protect human health, to prevent injury to plant and animal life, to prevent damage to public and private property, to insure the continued enjoyment of the natural attractions of the State, to encourage the expansion of employment opportunities, to provide a permanent foundation for healthy industrial development and to secure for the people of North Carolina, now and in the future, the beneficial uses of these great natural resources.”

The Petition requests that Commission promulgate a rule that:

(1) Ensures that Statewide carbon dioxide ("CO₂") emissions peak in the year 2015;

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2 N.C. CONST. art. XIV § 5.
3 15A N.C.A.C. § 02A .0103.
4 N.C.G.S. § 143-215.105 specifically §§ 143-211 and 143-213.
5 N.C.G.A. § 143-211(a) (emphasis added).
6 Id.
(2) Adopts and implements a CO₂ emissions reduction plan that, consistent with the best available science, reduces Statewide CO₂ emissions by at least 4% annually until at least 2050;

(3) Establishes an accounting, verification, and inventory system for Statewide CO₂ emissions;

(4) Requires the issuance of annual reports providing the public with accurate data on the effectiveness of North Carolina’s efforts to reduce CO₂ emissions; and

(5) Requires the adoption of any policies or regulations necessary to implement the emissions reduction plan referred to in (1) through (4) above.

Petitioner’s proposed rule is based on the best available science. The best available science indicates that atmospheric CO₂ concentrations must return to 350 parts per million ("ppm") by century’s end.⁷ In order to meet this target, CO₂ emissions must be reduced by an adequate margin each year.⁸ The rate of emission reductions required to return the atmospheric CO₂ concentration to a safe level depends on the year in which emissions peaked.⁹ For example, “if emissions reduction had begun in 2005, reduction at 3.5%/year would have achieved 350 ppm at 2100.”¹⁰ A peak in 2012 or 2020 would require annual reductions of 6% and 15%, respectively.¹¹

According to North Carolina’s emissions data, CO₂ emissions in the State peaked in 2007.¹² Dr. Pushker A. Kharecha, co-author with Dr. James Hansen on the scientific publication, Assessing “Dangerous Climate Change”: Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature, which has been attached as Exhibit A, confirmed that with a peak year of 2007, CO₂ emissions must be reduced by 4% per year in order to achieve safe atmospheric CO₂ concentrations by century’s end.¹³ Accordingly, this petition is seeking a 4% annual CO₂ emission reduction rate.

The North Carolina Division of Air Quality ("DAQ") is the Division responsible for developing and implementing air quality standards pursuant to 15A N.C.A.C. 02I .0501(a), therefore, this Petition is addressed to Ms. Sheila Holman, the Director of the North Carolina Division of Air Quality. As required by 15A N.C.A.C. 02I .0501(a), a copy of this Petition in electronic form has been sent to the Recording Clerk of the Environmental Management Commission.

Pursuant to the North Carolina Administrative Procedures Act, I submit Hallie’s Petition for Rulemaking to the Commission for its consideration. Hallie will be ready to present her Petition

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⁸ Id.
⁹ Id. at 10, 18.
¹⁰ Id.
¹¹ Id. at 10, 18.
¹³ Dr. Pushker A. Kharecha conferred the best method of calculating the required annual rate of emissions reductions if the peak year was 2007 and that his recommendations are based upon best available science.
to the Air Quality Committee at its January meeting of 2015. Please confirm your receipt of this Petition by contacting me at the address listed at the end of the Petition.

The following sections are organized in order to mirror the information identified as needed for a petition for rule-making pursuant to 15A N.C.A.C. 021.0501(b) of the Commission’s rules. The language of the corresponding numbered subsections of that rule appears in bold and italic script below.

(1) Provide the text of the proposed rule(s) conforming to the Codifier of Rules’ requirements for publication of proposed rules in the North Carolina Register.

15A NCAC 2D § CARBON DIOXIDE EMISSIONS REDUCTION TARGETS

(1) The State must limit emissions of carbon dioxide to achieve the following emission reductions for North Carolina:

(a) Statewide carbon dioxide emissions must peak in 2015;
(b) Starting in 2016, statewide carbon dioxide emissions must be reduced by at least four percent per year each year until 2050.

(2) By January, 2015, the Environmental Management Commission and the Division of Air Quality shall adopt a carbon dioxide emissions reduction plan to achieve the limits set forth in (1)(a)-(b);

(3) Consistent with this directive, the Commission shall take the following actions:

(a) Publish annual progress reports on statewide carbon dioxide emissions on the Division of Air Quality website for public review. These reports shall include an accounting and inventory for each and every source of carbon dioxide emissions within the State, without exception. This accounting must be verified by an independent, third-party. Annual reports must be posted to the Division of Air Quality website and be made publicly available no later than December 31 of each year, beginning in the year 2015.

(b) Track progress toward meeting the emission reductions established in subsection 1(b), including the results from policies currently in effect, those that have been previously adopted by the State, and policies to be adopted in the future, and publicly report on that progress annually.

(4) By December 31st of each year beginning in 2015, the Division of Air Quality must report to the Governor and the appropriate Committees of the Senate and House of Representatives the total emissions of carbon dioxide for the preceding year, and totals in each major source sector. The Division of Air Quality shall ensure that reporting rules adopted under section (3)(a) allow it to develop a comprehensive inventory of emissions of carbon dioxide from all sectors of the state economy.

(5) To the extent that any rule in this section conflicts with any other rule in effect, the more stringent rule, favoring full disclosure of emissions and protection of the atmosphere, governs.
The purpose of this Petition and the proposed rule is to initiate a rulemaking process before the Division of Air Quality with the ultimate goal of having the DAQ promulgate a carbon dioxide emission reduction plan based on the best available science. Should the DAQ object to any particular word, phrase, or section of the proposed rule we request that the DAQ suggest an alternative phrasing that would accomplish the overall purpose of the Petition.

(2) **Provide the statutory authority for the agency to promulgate the rule(s).**

The North Carolina Environmental Management Commission ("Commission") is responsible for adopting rules for the protection and preservation of North Carolina's air quality and, in conjunction with the North Carolina Department of Environment and Natural Resources, oversees the Division of Air Quality. The Commission has the duty and power to adopt the rule proposed in this Petition for air quality and emissions control standards for air contaminant sources pursuant to N.C.G.S. § 143-215.107 and other statutes.\(^\text{14}\)

In outlining the authorizing article for air pollution control, the North Carolina General Assembly incorporated the purpose and definitions of Article 21, Water and Air Resources.\(^\text{15}\) According to N.C.G.S. § 143-211(a), it is the —

"public policy of this State to provide for the conservation of its water and air resources. Furthermore, it is the intent of the General Assembly, within the context of this Article and Articles 21A and 21B of this Chapter, to achieve and to maintain for the citizens of the State a total environment of superior quality. Recognizing that the water and air resources of the State belong to the people, the General Assembly affirms the State's ultimate responsibility for the preservation and development of these resources in the best interest of all its citizens and declares the prudent utilization of these resources to be essential to the general welfare," (emphasis added).

Long ago, the North Carolina General Assembly enacted a statutory scheme to confer the necessary duties and powers to administer programs of air pollution management, abatement, and control on the Department of Environment and Natural Resources. This Commission is responsible for adopting rules for the protection and preservation of North Carolina's air quality and, in conjunction with the North Carolina Department of Environment and Natural Resources, oversees the Division of Air Quality as it carries out these duties and implements this program of pollution control. Explicit statutory authority for the Environmental Management Commission to promulgate the proposed rule is provided in N.C.G.S. § 143-215.107(a)(1) and N.C.G.S. § 143-215.107(a)(5).

When authorizing the Commission to act, the North Carolina General Assembly required it to adopt air quality standards to protect our environment in the future and not merely correct

\(^\text{14}\) 15A N.C.A.C. § 02A .0103 (emphasis added).
\(^\text{15}\) N.C.G.S. § 143-215.105, specifically §§ 143-211 and 143-213.
violations found in the past. These standards are to be protective and not merely reactive. Pursuant to N.C.G.S. § 143-211(c),

"[s]tandards of air purity are to be designed to protect human health, to prevent injury to plant and animal life, to prevent damage to public and private property, to encourage the expansion of employment opportunities, to provide a permanent foundation for healthy industrial development and to secure for the people of North Carolina, now and in the future, the beneficial uses of these great natural resources."

There can be no permanent foundation for healthy industrial development while greenhouse gas concentrations rise out of control. There can be no secure enjoyment of the great natural resources in the future, if we fail to act today to limit greenhouse gas emissions.

The North Carolina General Assembly defined "air pollution" as "the presence in the outdoor atmosphere of one or more air contaminants in such quantities and duration as is or tends to be injurious to human health or welfare, to animal or plant life or to property or that interferes with the enjoyment of life or property." Carbon dioxide and other greenhouse gasses clearly meet the definition of air contaminants: "The term "air contaminant" means particulate matter, dust, fumes, gas, mist, smoke, or vapor or any combination thereof." Ambient air concentrations of carbon dioxide are nearing a global atmospheric concentration of 400 ppm and CO₂ can remain in the atmosphere for thousands of years. As detailed below and in attached supporting documents, this increased concentration of carbon dioxide is injurious to human health, human welfare, animal life, plant life, property and the enjoyment of life and property. Therefore, there is no doubt that carbon dioxide constitutes "air pollution."

To combat air pollution, the Commission was directed and empowered: (1) to prepare and develop a comprehensive plan for the prevention, abatement, and control of air pollution in the State; (2) to develop and adopt, after proper study, air quality standards to preserve and develop the State's air resources; and (3) to develop and adopt emission control standards as, in the judgment of the Commission, may be necessary to prohibit, abate, or control air pollution commensurate with established air quality standards.

It is abundantly clear that the General Assembly's purpose in promulgating the Commission's enabling statutes was to empower the Commission to have the power and authority necessary to protect air resources for both present and future generations. In addition to this clear mandate to protect air resources, additional sources of statutory authority that give the Commission authority to promulgate the proposed rule can be found in other provisions of N.C.G.S. § 143-215.107; N.C.G.S. § 143-215.108 (requiring permits before emitting air contaminants); and N.C.G.S. § 143-215.64 (requiring water and air quality reporting). Of course, the Commission is also required to adhere to the North Carolina Constitution, of which Article

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10 N.C.G.S. § 143-213(5).
17 N.C.G.S. § 143-213(2).
18 N.C.G.S. § 143-215.107(a)(1)-(3).
XIV, § 5 is most relevant for the purposes of this Petition, and its fiduciary obligations as a trustee under the Public Trust Doctrine. While the Constitution and Public Trust Doctrine are not sources of statutory authority, they are additional sources of authority for the Commission to promulgate the rule proposed in this Petition.

In sum, the Commission’s clear statutory mandate is to promulgate rules and regulations that protect and preserve North Carolina’s air. Accordingly, the Commission has been granted the statutory duty and power to promulgate rules and regulations necessary to achieve such goals and has the statutory duty and authority to promulgate the proposed rule in this Petition.

(3) Provide a statement of the reasons for adoption of the proposed rule.

The reason for the proposed rule is to ensure that North Carolina is doing its part to reduce carbon dioxide emissions that contribute to global climate change and ocean acidification. The impacts of climate change are already being felt in North Carolina and throughout the United States. Scientific observations clearly show global warming over the past 50 years is caused by anthropogenic emissions of greenhouse gasses, including CO₂, primarily from burning fossil fuels.¹⁹ In North Carolina, climate change is causing, among other things, more extreme heat, rising sea levels, more intense hurricanes, and changing precipitation patterns with extreme swings between drought and heavy rainfall.²⁰

The impacts of climate disruption have been extensively studied in North Carolina at the direction of the North Carolina General Assembly. In its final report, the North Carolina Legislative Commission formally endorsed the following list of impacts, which are likely to occur in the Southeastern United States, including North Carolina:

“Projected increases in air and water temperatures will cause heat-related stresses for people, plants, and animals. Effects of increased heat include more heat-related illness; declines in forest growth and agricultural crop production due to the combined effects of heat stress and declining soil moisture; declines in cattle production; increased buckling of pavement and railways; and reduced oxygen levels in streams and lakes, leading to fish kills and declines in aquatic species diversity. Decreased water availability is very likely to affect the region’s economy as well as its natural systems. Increasing temperatures and longer periods between rainfall events coupled with increased demand for water will result in decreased water availability. Sea-level rise and the likely increase in hurricane intensity and associated storm surge will be among the most serious consequences of climate change. Low-lying areas, including some communities,

will be inundated more frequently—some permanently—by the advancing sea. Current buildings and infrastructure were not designed to withstand the intensity of the projected storm surge, which would cause catastrophic damage. If sea-level rise increases at an accelerated rate (dependent upon ice sheet response to warming) a large portion of the Southeast coastal zone could be threatened. Ecological thresholds are likely to be crossed throughout the region, causing major disruptions to ecosystems and to the benefits they provide to people. Quality of life will be affected by increasing heat stress, water scarcity, severe weather events, and reduced availability of insurance for at-risk properties.\textsuperscript{21}

The North Carolina Division of Air Quality subcommittee, is acutely aware of how reliant our health and economy is upon healthy air and how fragile are our air resources. As the DAQ has explained:

"Clean air is \textit{essential to public health, the environment, and the economy in North Carolina}. We need clean air so people can breathe without triggering asthma and other health problems. We need clean air to preserve our forests, streams and lakes for public recreation and wildlife. We need clean air so citizens can view scenery in our mountains, parks and coastal areas. We need clean air to sustain tourism, forestry, and other aspects of the economy.

\textit{Despite the value of clean air, people often don't notice it unless there are problems such as smoke, haze, noxious fumes or bad odors}. That’s too bad. Consider this: Humans can live for days without water and weeks without food, but only a few minutes without air. That’s why we need laws and regulatory programs to protect air quality. In North Carolina, the Division of Air Quality is primarily responsible for protecting and improving air quality."\textsuperscript{22}

The United States Global Change Research Program\textsuperscript{23} has confirmed that global warming is occurring and adversely impacting the Earth's climate.\textsuperscript{24} The present rate of global heating is


\textsuperscript{22}\textit{NORTH CAROLINA DIVISION OF AIR QUALITY, Clearing the Air}, (NOVEMBER 24, 2014, 1:10 PM), \url{http://www.daq.state.nc.us/news/brochures/clearair.shtml} (emphasis added).

\textsuperscript{23}The U.S. Global Change Research Program (USGCRP) was established by Presidential Initiative in 1989 and mandated by Congress in the Global Change Research Act (GCRA) of 1990 to “assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change.” The organization’s vision is to produce “[a] nation, globally engaged and guided by science, meeting the challenges of climate and global change.” Their mission is “to build a knowledge base that informs human responses to climate and global change through coordinated and integrated Federal programs of research, education, communication, and decision support.”, (NOVEMBER 24, 2014, 9:40 AM), \url{http://www.globalchange.gov/about/legal-mandate}.

\textsuperscript{24}\textit{UNITED STATES GLOBAL CHANGE RESEARCH PROGRAM (USGCRP), Climate Change Impacts in the United States: Third National Climate Assessment 7 (2014)} [hereinafter Climate Change Impacts], (NOVEMBER 24, 2014, 9:45 AM), \url{http://nca2014.globalchange.gov/downloads} ("Evidence for climate change abounds, from the top of the atmosphere to the depths of the oceans . . . . Evidence of climate change is also visible in the observed and measured changes in location and behavior of species and functioning of ecosystems. Taken together, this evidence tells an
occurring as a result of human activities that release heat-trapping greenhouse gases ("GHGs") and intensify the Earth's natural greenhouse effect at an accelerated rate, thereby changing Earth's climate.\textsuperscript{25} This abnormal climate change is unequivocally human-induced,\textsuperscript{26} is occurring now, and will continue to occur unless drastic measures are taken to curtail it.\textsuperscript{27} Climate change is damaging both natural and human systems, and if unrestrained, will alter the planet's habitability.\textsuperscript{28}

A. Greenhouse Gas Emissions are Causing Climate Change to Endanger the Health and Welfare of Human Beings, Plants, and Animals

According to the United States Environmental Protection Agency ("EPA"), "the case for finding that greenhouse gases in the atmosphere endanger public health and welfare is compelling and, indeed, overwhelming."\textsuperscript{29} The EPA further stated in April 2009 that "the evidence points ineluctably to the conclusion that climate change is upon us as a result of greenhouse gas emissions, that climate changes are already occurring that harm our health and welfare, and that the effects will only worsen over time in the absence of regulatory action."\textsuperscript{30} North Carolina's Legislative Commission on Climate Change explicitly found that climate change is real, that human activity is in part responsible for climate change and that the Commission should take action to address climate change.\textsuperscript{31}

Human beings have significantly altered the chemical composition of the Earth's atmosphere and its climate system.\textsuperscript{32} Collectively, we have changed the atmosphere and the Earth's climate unambiguously; the planet is warming, and over the last half century, this warming has been driven primarily by human activity.\textsuperscript{\textendash\textendash\textendash\textendash\textendash\textendash\textendash\textendash\textendash\textendash\textendash\textendash\textendash\textendash\textendash\textendash\textendash\textendash\textendash\textendash\textendash\textendash}.

\textsuperscript{25} Id. ("Multiple lines of independent evidence confirm that human activities are the primary cause of the global warming of the past 50 years."); DEUTSCHE BANK CLIMATE CHANGE ADVISORS, Climate Change: Addressing the Major Skeptic Arguments 9 (Sept. 2010), (November 24, 2014, 9:45 AM), http://www.climateaccess.org/sites/default/files/Carr_Addressing%20Skeptic%20Arguments.pdf.

\textsuperscript{26} INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC), IPCC Fifth Assessment Report: Climate Change 2013 USGCRP, Climate Change Impacts, supra note 25, at 7.

\textsuperscript{27} Id. at 14 ("The cumulative weight of the scientific evidence contained in this report confirms that climate change is affecting the American people now, and that choices we make will affect our future and that of future generations."); IPCC, AR5 1.2.2, 124 (2013) ("Warning of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level.") (key statement from IPCC Fourth Assessment Report).

\textsuperscript{28} USGCRP, Climate Change Impacts, supra note 25, at 5 ("While some climate changes will occur slowly and relatively gradually, others could be rapid and dramatic, leading to unexpected breaking points in natural and social systems.").

\textsuperscript{29} Proposed Endangerment Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 18886, 18904 (Apr. 24, 2009) (to be codified in 40 C.F.R. Chapter 1) (emphasis added).

\textsuperscript{30} Id. (emphasis added).


\textsuperscript{32} NAOMI ORESKES, The Scientific Consensus on Climate Change, in CLIMATE CHANGE: WHAT IT MEANS FOR US, OUR CHILDREN, AND OUR GRANDCHILDREN 65, 93 (Joseph F. C. DiMento & Pamela Doughman eds., 2007) ("We
system by engaging in activities that produce or release GHGs into the atmosphere. \(^{33}\) Carbon dioxide ("CO\(_2\)"") is the key GHG, and there is abundant evidence that its emissions are largely responsible for the current warming trend. \(^{34}\) Although much of the excess carbon dioxide is absorbed by the oceans, plants, and forests, the increase of CO\(_2\) resulting from historic and present human activities has altered the Earth’s ability to maintain the delicate balance of energy it receives from the sun and that which it radiates back out into space. \(^{35}\)

In 2013, the CO\(_2\) concentration in our atmosphere exceeded 400 ppm for the first time in recorded history\(^{36}\) (compared to the pre-industrial concentration of 280 ppm). \(^{37}\) The monthly average atmospheric CO\(_2\) concentration for May 2014 was 401.88 ppm and the present annual mean is approximately 397 ppm. \(^{38}\) Current atmospheric CO\(_2\) concentrations are the highest they have been in the last 800,000 years. \(^{39}\)

Humans not only continue to add CO\(_2\) into the atmosphere at a rate that outpaces its removal through natural processes, \(^{40}\) but the current and projected CO\(_2\) increase is about one hundred times faster than any that has occurred over the past 800,000 years. \(^{41}\) This increase has to be

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\(^{33}\) Id.


\(^{35}\) John Abatzoglou et al., A Primer on Global Climate Change and Its Likely Impacts, in CLIMATE CHANGE: WHAT IT MEANS FOR US, OUR CHILDREN, AND OUR GRANDCHILDREN, 15-22 (Joseph F. C. DiMento & Pamela Doughman eds., 2007).

\(^{36}\) NOAA, Greenhouse Gases Continued Rising in 2013, 34 Percent Increase Since 1990, (May 2, 2012), (November 24, 2014, 10:30 AM), http://research.noaa.gov/News/NewsArchive/LatestNews/TabId/684/ArtMID/1768/ArticleID/10553/Greenhouse-gases-continued-rising-in-2013-34-percent-increase-since-1990.aspx ("We continue to turn the dial up on this ‘electric blanket’ of ours without knowing what the resulting temperatures will be.").


\(^{40}\) Dieter Lüthi et al., High-resolution carbon dioxide concentration record 650,000-800,000 years before present 453 NATURE 379, 379-382 (May 2008), (November 24, 2014, 10:36 AM), http://www.nature.com/nature/journal/v453/n7193/full/nature06949.html (Prior to this publication it was accepted atmospheric CO2 record extended back 650,000 years, but now research indicates that the record can be extended 800,000 years, or two complete glacial cycles).

\(^{41}\) Lüthi, supra note 40, at 379-382.
considered in light of the lifetime of greenhouse gases in the atmosphere. In particular, a substantial portion of every ton of CO\textsubscript{2} emitted by humans persists in the atmosphere for as long as a millennium or more.\textsuperscript{42} The current concentration of CO\textsubscript{2} in the atmosphere, therefore, is the result of both historic and current emissions. What this means is that the impacts associated with the CO\textsubscript{2} emissions of today will be mostly borne by our children and future generations.

Changes in different aspects of Earth’s climate system over the last century tell a coherent story: the impacts we see today are consistent with the scientific understanding of how the climate system should respond to GHG increases from human activities and how the Earth has responded in the past (reflected in such evidence as: ice cores that have trapped air from thousands and even a few million years ago, tree rings, and seabe sediments that show where sea level was thousands and even millions of years ago).\textsuperscript{43} Collectively, these changes cannot be explained as the product of natural climate variability alone.\textsuperscript{44} A large human contribution provides the best explanation of observed climate changes.\textsuperscript{45}

These well-documented and observable impacts from the changes in Earth’s climate system highlight that the current level of atmospheric CO\textsubscript{2} concentration has already taken the planet into a danger zone.\textsuperscript{46} The Earth will continue to warm in reaction to concentrations of CO\textsubscript{2} from past emissions as well as future emissions.\textsuperscript{47} Warming already in the pipeline is mostly attributable to climate mechanisms that slowly heat the Earth’s climate system in response to atmospheric CO\textsubscript{2}.\textsuperscript{48}

\textbf{B. Temperature Increases are Consistent and Trending Upwards}

One key observable change due to the increased concentration of CO\textsubscript{2} in the atmosphere is the rapid increase in recorded global surface temperatures.\textsuperscript{49} As a result of increased atmospheric

\textsuperscript{42} Hansen, Target Atmospheric CO\textsubscript{2}: Where Should Humanity Aim?; supra note 35, at 220; see also EPA, TS Endangerment Findings, supra note 38, at 16 (“Carbon cycle models indicate that for a pulse of CO\textsubscript{2} emissions, given an equilibrium background, 50% of the atmospheric increase will disappear within 30 years, 30% within a few centuries, and the last 20% may remain in the atmosphere for thousands of years.”); Abatzoglou, supra note 36, at 29 (“Since CO\textsubscript{2} has a lifetime of over one hundred years, these emissions have been collecting for many years in the atmosphere.”).

\textsuperscript{43} USGCRP, Climate Change Impacts, supra note 25, at 23.

\textsuperscript{44} Id. at 24.

\textsuperscript{45} Susan Solomon et al., Irreversible climate change due to carbon dioxide emissions, 106 PNAS 1704, 1704-09 (Feb. 10, 2009), (November 24, 2014, 10:45 AM), http://www.pnas.org/content/106/6/1704.full.pdf+html; IPCC, AR5, supra note 26, at 15.

\textsuperscript{46} USGCRP, Climate Change Impacts, supra note 25, at 7.

\textsuperscript{47} EPA, TS Endangerment Findings, supra note 38, at 26.


\textsuperscript{49} NSTC, Scientific Assessment, supra note 38, at 51; IPCC, AR5, supra note 26, at 1.3.1, 131; USGCRP, Climate Change Impacts, supra note 25, at 22; EPA, TS Endangerment Findings, supra note 38, 26-30; Nat’l Aeronautics and Space Admin. (NASA) & Goddard Institute for Space Studies (GISS), Global Surface Temperature, http://climate.nasa.gov/keyIndicators/#globalTemp (illustrating the change in global surface temperatures) (last visited June 10, 2014).
GHGs from human activities, based on fundamental scientific principles, the Earth has been warming as scientists have predicted.50 The increased concentrations of GHGs in our atmosphere have raised global surface temperature by 0.85°C (1.5°F) from 1880 to 2012.51 In the last century, the Earth has warmed at a rate “roughly ten times faster than the average rate of ice-age-recovery warming.”52

Because of year-to-year variations in these thermometer readings, as with daily readings, scientists compare temperature differences over a decade to determine patterns.53 Employing this decadal scale, the surface of the planet has warmed at a rate of roughly 0.12°C per decade since 1951.54 Global mean surface temperature has been decidedly higher during the last few decades of the twentieth century than at any time during the preceding four centuries.55 Global surface temperatures have been rising dramatically since 1951, and 2010 tied for the hottest year on record, while “[t]he year 2013 tied with 2009 and 2006 for the seventh warmest year since 1880.”56 April 2014 tied with April 2010 as the warmest April globally since 1880.57

The dramatic increase of the average global surface temperature is alarming. It has become quite clear that the past several decades present an anomaly, as global surface temperatures from 2000-2009 are registering higher than at any point in the past 1,300 years.58 The Intergovernmental Panel on Climate Change (“IPCC”) has observed that “[w]arming of the climate system is unequivocal.”59 The United States Environmental Protection Agency (“EPA”) has recognized the scientific consensus that has developed on the fact of global warming and its cause: the Earth is heating up due to human activities.60

50 IPCC, AR5, supra note 26, at TS.2.2.1, 37; USGCRP, Climate Change Impacts, supra note 8, at 22; EPA, TS Endangerment Findings, supra note 38, at 48.
51 IPCC, AR5, supra note 26, at B.1, 5; NASA, Climate Change: Key Indicators, http://climate.nasa.gov/key_indicators/globalTemp (last visited June 12, 2014).
53 IPCC, AR5, supra note 26, at TS.2.2.1, 37.
54 Id. at B.1, 5.
58 USGCRP, Climate Change Impacts, supra note 25, at 23.
59 IPCC, AR5, supra note 26, at B. 4.
60 EPA, TS Endangerment Findings, supra note 38, at ES-2 (“Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level . . . . Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations.”) (emphasis added).
Changes in many different aspects of Earth’s climate system over the past century are consistent with this warming trend. Based on straightforward scientific principles, human-induced GHG increases lead not only to warming of land surfaces, but also to the warming of oceans, increased atmospheric moisture levels, rises in the global sea level, and changes in rainfall and atmospheric air circulation patterns that affect water and heat distribution.

As expected (and consistent with the temperature increases in land surfaces), ocean temperatures have also increased. This has led to changes in the ocean’s ability to circulate heat around the globe, which can have catastrophic implications for the global climate system. The average temperature of the global ocean has increased significantly despite its amazing ability to absorb enormous amounts of heat before exhibiting any indication thereof. In addition, the most significant indicator of the planet’s energy imbalance due to human-induced GHG increases is the long-term increase in global average ocean heat content over the last 50 years, extending down to several thousand meters below the ocean surface.

In North Carolina, average temperatures are expected to rise by 4-5°F in the winter and 6-7°F in the other seasons by 2100 as a result of CO₂ and other GHG emissions, producing more intense and frequent heat waves. The expected results include reduced recreation and tourism, increased demand for electricity for cooling, reduced agricultural production, and an increase in heat-related injury and death.

C. Sea Level is Rising

As expected, global sea levels have risen as a result of increasing CO₂ emissions. Sea levels have been rising at an average rate of 3.2 millimeters per year (0.13 inches) based on

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61 IPCC, AR5, supra note 26, at TS.2.2.1.37.
62 Id. at TS.2.2.3.38.
63 USGCRP, Climate Change Impacts, supra note 25, at 33; B.D. Santer et al., Identification of Human-Induced Changes in Atmospheric Moisture Content, 104 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES 15248, 15248-53 (Sept. 25, 2007), (November 24, 2014, 10:52 AM), http://www.pnas.org/content/104/39/15248.full.pdf+html
64 IPCC, AR5, supra note 26, at TS.2.6.46.
65 USGCRP, Climate Change Impacts, supra note 25, at 26, 32-33, 36.
66 IPCC, AR5, supra note 26, at TS.2.4.39.
EPA, TS Endangerment Findings, supra note 38 at ES-2.
68 USGCRP, Climate Change Impacts, supra note 25, at 560.
71 Id.
72 Id. at 34.
73 USGCRP, Climate Change Impacts, supra note 25, at 44; EPA, TS Endangerment Findings, supra note 38, at ES-3; IPCC, AR5, supra note 26, at B.4.11
measurements from 1993 to 2010. Though sea levels rose about 6.7 inches over the last century, within the last decade, that rate has nearly doubled. Rising seas, brought about by melting of polar icecaps and glaciers, as well as by thermal expansion of the warming oceans, will cause flooding in coastal and low-lying areas. The combination of rising sea levels and more severe storms creates conditions conducive to severe storm surges during high tides. In coastal communities this can overwhelm coastal defenses (such as levees and sea walls), as witnessed during Hurricane Katrina.

Sea level is not uniform across the globe, because it depends on variables such as ocean temperature and currents. Unsurprisingly, the most vulnerable lands are low-lying islands, river deltas, and areas that already lie below sea level because of land subsidence. Based on these factors, scientists have concluded that the immediate threats to the United States from rising seas are the most severe on the Gulf and Atlantic Coasts. Worldwide, hundreds of millions of people live in river deltas and vulnerable coastlines.

In a comprehensive review of studies on sea level rise in the 21st century published by the British Royal Society, researchers estimated the probable sea level rise for this century between 0.5 and 2 meters (1½ to 6½ feet), continuing to rise for several centuries after that, depending on future CO2 levels and the behavior of polar ice sheets. "Today, rising sea levels are submerging low-lying lands, eroding beaches, converting wetlands to open water, exacerbating coastal flooding, and increasing the salinity of estuaries and freshwater aquifers.

Low-lying lands are especially vulnerable to sea level rise. Between 1996 and 2011, 20 square miles of land were inundated by rising sea levels along the Atlantic coast. Scientists have predicted that wetlands in the Mid-Atlantic region of the United States cannot withstand a 7-millimeter per year rise in

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74 IPCC, AR5, supra note 26, at B.4, 11.
76 EPA, TS Endangerment Findings, supra note 38, at ES-7; USGCRP, Climate Change Impacts, supra note 25, at 45.
77 USGCRP, Climate Change Impacts, supra note 25, at 45; EPA, TS Endangerment Findings, supra note 38, at 75.
78 EPA, TS Endangerment Findings, supra note 38, at 86, 118.
79 IPCC, AR5, supra note 26, at B.6, 26.
80 EPA, TS Endangerment Findings, supra note 38, at 121.
81 Id. at 128; USGCRP, Climate Change Impacts, supra note 25, at 589 (Annual damage resulting from sea level rise "in the Gulf region alone could be $2.7 to $4.6 billion by 2030, and $8.3 to $13.2 billion by 2050.").
82 EPA, TS Endangerment Findings, supra note 38, at 159.
sea levels. As wetlands are inundated, further impacts from sea level rise will multiply, as “protection of coastal lands and people against storm surge will be compromised.”

Glacial and ice cap melting is one of the major causes of global sea level change. When glaciers and ice caps melt, this adds water to the ocean. Another cause is that as ocean water warms, it expands and takes up more space. Therefore, “sea level rise is expected to continue well beyond this century as a result of both past and future GHG emissions from human activities.”

The rate of sea-level rise (“SLR”) on North Carolina’s coast has already reached 18 inches per century, but is projected to accelerate due to climate change, resulting in SLR of 39-55 inches, approximately three to four feet, by 2100. The North Carolina Coastal Resources Commission recommended adopting a projected SLR of 39 inches by 2100 for policy development and planning purposes. This alarming SLR will result in damage to coastal property and infrastructure, a decline in coastal tourism, damage to coastal agriculture and fisheries, increased flooding, saltwater intrusion into water supplies, and the outright loss of beaches.

D. Ocean Acidification

The negative effects of increased CO₂ emissions are not limited to changes in our climate systems. Rather, CO₂ emissions are also having a severe impact on our oceans. As it stands, the oceans absorb around 30 percent of global CO₂ emissions. This absorption has greatly mitigated the effects CO₂ otherwise would have had on our climate. However, the cost of this mitigation has been a pernicious change in our ocean’s chemistry.

Ocean acidification is defined as “a reduction in the pH of seawater for an extended period of time due primarily to the uptake of carbon dioxide from the atmosphere by the ocean.” Over
the last 250 years, humans have increased atmospheric CO₂ concentrations by 40 percent. The oceans, in turn, have absorbed about a quarter of this CO₂. As CO₂ has been absorbed and dissolved in the seawater it has had an acidifying effect. As a result, "[o]ver the last 250 years, the average upper-ocean pH has decreased by about 0.1 units, from about 8.2 to 8.1." This drop in pH corresponds with a 30 percent increase in surface ocean acidity.

Ocean acidity has been rising at a geologically unprecedented rate. Currently, acidity is rising at least 100 times faster than at any other period during the last 100,000 years. There have been periods during which atmospheric CO₂ concentration and oceanic pH have been higher than today's levels. However, the rate at which these levels were reached was much slower than the rate at which atmospheric CO₂ and oceanic pH are changing today. For example, around 55 million years ago, during the Paleocene-Eocene Thermal Maximum ("PETM"), atmospheric CO₂ concentrations increased to around 1800 ppm and the pH of the oceans declined by around 0.45 units over roughly 5000 years. This rise in pH resulted in an extinction event, during which "about half of benthic foraminifera (tiny shelled protists) species went extinct over a 1000-year period." Today, the rate at which acidity is rising is nearly ten times faster than during the period leading up the PETM extinction event. The danger here is that the rate of acidification may outpace the natural capacity of the ocean to buffer the excess CO₂ levels. Scientists have projected that if anthropogenic CO₂ emissions continue at present trends, oceanic pH may drop another 0.5 units by 2100. This represents a threefold decrease from pre-industrial times. Such a drop would also bring oceanic pH outside the natural range of CO₂.


98 Id. at 9.
99 Id.
100 Id.
101 Id.
102 Id.
103 Harradour-Kolb, Acid Test, supra note 95, at 7.
105 Id.; P. Jardine, Patterns in Palaeontology: The Paleocene-Eocene Thermal Maximum, Palaeontology Online (Jan. 10, 2011), available at http://www.palaeontologyonline.com/articles/2011/the-paleocene-eocene-thermal-maximum/ (last visited June 12, 2014) ("This warming has been linked to a similarly rapid increase in the concentration of greenhouse gases in Earth's atmosphere, which acted to trap heat and drive up global temperatures by more than 5 °C in just a few thousand years. The fossil record gives us the means of understanding how life was affected by the PETM, and so provides an excellent opportunity to study the relationships between evolution, extinction, migration and climate change.").
106 Id.
107 Id.
108 Id.
The results of ocean acidification create similar impacts in shellfish and other crustaceans as osteoporosis creates in humans.\textsuperscript{110} Many important marine organisms, including shellfish and corals, require sufficient concentrations of carbonate and bicarbonate in order to build structures, such as shells, out of calcium carbonate (CaCO\textsubscript{3}).\textsuperscript{111} As acidity increases, shells become thinner, growth slows down and death rates rise.\textsuperscript{112} Calcium carbonate will dissolve in seawater unless the water is saturated with carbonate ions.\textsuperscript{113} Calcium carbonate also becomes more soluble as temperature decreases and pressure increases.\textsuperscript{114} As a result, as depth increases, causing temperature to decrease and pressure to increase, calcium carbonate becomes more soluble.\textsuperscript{115} These variables (carbonate ion concentrations, temperature, and pressure) interact to create a natural barrier, known as a saturation horizon, below which calcium carbonate will dissolve, and above which calcium carbonate is capable of forming.\textsuperscript{116} As more anthropogenic CO\textsubscript{2} has dissolved, the carbonate ion concentration has decreased causing the saturation horizon for calcium carbonate to rise.\textsuperscript{117} To survive, calcium carbonate-dependent species must live above the saturation horizon.\textsuperscript{118} As the saturation horizon rises, it poses a greater threat to calcium carbonate-dependent marine species by reducing their habitat.\textsuperscript{119} Without immediate science-based action to curb carbon dioxide emissions, the oceans undergo mass extinctions of marine animals, significantly altering the marine food web dynamics, and impacting the lives and sustenance of coastal citizens, including those in North Carolina.

Duke University researchers have found evidence of dramatic pH changes occurring to North Carolina’s coastal waters over a short time frame, which are compounded by the long-term increasing acidification of the oceans. Water samples taken at the marine lab on Piver’s Island over the course of a year showed variability in the acidity of the waters that exceeded the expected change in ocean acidity predicted in the world’s oceans for the next 100-years.\textsuperscript{120}

\textsuperscript{110} NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION, transcript, Ocean Acidification's Impact on Oysters and Other Shellfish, available at http://www.pmel.noaa.gov/co2/story/Ocean+Acidification%27s+impact+on+oysters+and+other+shellfish (December 4, 2014, 11:20 AM)
\textsuperscript{111} Royal Society, Ocean Acidification Due to Increasing Atmospheric Carbon Dioxide vi (2005), at 10.
\textsuperscript{113} Royal Society, Ocean Acidification Due to Increasing Atmospheric Carbon Dioxide vi (2005), at 10.
\textsuperscript{114} Id.
\textsuperscript{115} Id.
\textsuperscript{116} Id.
\textsuperscript{117} Id.
\textsuperscript{118} Id. at 11.
\textsuperscript{119} Id.
\textsuperscript{120} Zackary I. Johnson, Dramatic Variability of the Carbonate System at a Temperate Coastal Ocean Site (Beaufort, North Carolina, USA) Is Regulated by Physical and Biogeochemical Processes on Multiple Timescales, December 17, 2013, DOI: 10.1371/journal.pone.0085117; see also North Carolina Coastal Federation, WORKING TOGETHER FOR A HEALTHY COAST: Cesting New Light on Ocean Acidity, February 2, 2014 http://www.nccoast.org/m/article.aspx?k=8665aen9-11e7-4cd1-b125-1a5449cc4a04 (December 4, 2014, 10:50 AM)
In many U.S. East Coast estuaries ocean acidification is quickly threatening shellfish like Eastern oysters, hard clams, soft-shelled clams, mussels, and bay clams.\(^{121}\) In 2010, the value of shellfish landings in Mid-Atlantic and Southeastern coastal states totaled $497 million.\(^{122}\) The 2012 value of North Carolina shellfish aquaculture from commercial landings alone was nearly $42 million.\(^{123}\)

**E. Precipitation Patterns are Being Disrupted**

As predicted, precipitation patterns have changed due to increases in atmospheric moisture levels and changes in atmospheric air circulation patterns, another indicator that the Earth is warming.\(^{124}\) Moisture levels increase when temperature increases because warmer air generally holds more moisture.\(^{125}\) In more arid regions, however, higher temperatures lead to greater evaporation.\(^{126}\) These changes in the Earth’s hydrological cycle increase the potential for, and severity of, severe storms, flooding, and droughts.\(^{127}\) Storm-prone areas are already experiencing a greater chance of severe storms, and this will continue.\(^{128}\) Even in arid regions, increased precipitation is likely to cause flash flooding, and will be followed by drought.\(^{129}\) Droughts in parts of the midwestern, southeastern, and southwestern United States have increased in frequency and severity within the last fifty years, coinciding with rising temperatures.\(^{130}\) Most of the recent heat waves can be attributed to human-caused climate disruption.\(^{131}\) Climate change is already causing, and will continue to result in, more frequent, extreme, and costly weather events (such as hurricanes).\(^{132}\) The annual number of major tropical storms and hurricanes has increased over the past 100 years in North America, coinciding with increasing temperatures in the Atlantic sea surface.\(^{133}\)

As the 2010 Russian summer heat wave graphically demonstrated, heat can destroy crops, trigger wildfires, exacerbate air pollution, and cause increased illness and deaths.\(^{134}\) Similar impacts are occurring across the United States. Precipitation and stream temperatures are


\(^{122}\) Id.


\(^{124}\) USGCRP, *Climate Change Impacts*, supra note 25, at 1, 27, 32, 36.

\(^{125}\) EPA, *TS Endangerment Findings*, supra note 38, at 111.

\(^{126}\) Id.

\(^{127}\) Id.

\(^{128}\) Id. at 120-21; USGCRP, *Climate Change Impacts*, supra note 25, at 43.


\(^{130}\) Id. at 143, 145, 148.

\(^{131}\) USGCRP, *Climate Change Impacts*, supra note 25, at 38 (“The summer 2011 heat wave and drought in Texas was primarily driven by precipitation deficits, but the human contribution to climate change approximately doubles the probability that the heat was record-breaking.”).

\(^{132}\) USGCRP, *Climate Change Impacts*, supra note 25, at 38.

\(^{133}\) NSTC, *Scientific Assessment*, supra note 38, at 7.

increasing in most of the continental United States. The growth of many crops and weeds is being stimulated with adverse impacts outweighing any short-term benefits. Up to 30 percent of the millions of species on our planet could go extinct following just a few tenths of a degree warming above present. Coastal storms and associated storm surges, paired with increased sea level rise, have the power to erode shorelines, move barrier islands, and disrupt human habitation. The number of Category 4 and 5 hurricanes in the Atlantic basin has increased substantially since the early 1980s compared to the historical record that dates back to the mid-1880s. Although no one storm can be directly linked to climate change, the increase in number of storms and their intensity is consistent with the increase in GHG emissions. Experts state that this trend of increasing hurricane intensity is expected to continue, causing increased damage to critical infrastructure, losses to businesses, storm-related injury and death, human displacement, and degradation of coastal resources.

Normally, coastal storm risks would be passed on to insurance companies. However, over 40 percent of the insurance policies written in North Carolina’s coastal area are “Beach Plan” policies. The “Beach Plan” was intended as an insurance plan of last resort where homeowners and other insureds could turn when they could not purchase satisfactory private insurance. Because this insurance is not purchased on the open market, it is not underwritten by private insurers and the costs and risks are carried by the citizens of North Carolina. In fact, insurance companies operating in North Carolina have recently asked for up to 25-35 percent rate increases citing the increasing practice of consent-to-rate plans and “Beach Plan” reliance as evidence that they cannot effectively cover North Carolina’s hurricane risk exposure even under the status quo.

F. Crop, Livestock, and Forest Losses are Attributable to Greenhouse Gas Emissions

The disruption in the hydrological cycle due to climate change alters water supplies and water quality and will impact agriculture in the United States. Increased heat and associated issues such as pests, crop diseases, and weather extremes, will all impact crop and livestock production and quality. For example, climate change in the United States has produced warmer summers, enabling the mountain pine beetle to produce two generations of beetles in a

135 IPCC, AR5, supra note 26, at 4.3.2.5, 30.
136 RIGGS et al., supra note 92, at 24.
137 U.S. Global Change Research Program, supra note 24, at 398.
138 WOODRUFF et al., supra note 21 at 42.
141 2014 Homeowners Insurance Rate Hearing Transcripts, supra note 140, at 31.
143 USDS, Climate Action Report, supra note 143.
single summer season, where it had previously only been able to produce one. In Alaska, the spruce beetle is maturing in one year when it had previously taken two years. The expansion of the forest beetle population has killed millions of hectares of trees across the United States and Canada and resulted in millions of dollars lost from decreased timber and tourism revenues.

Agriculture is extremely susceptible to climate changes and higher temperatures generally reduce yields of desirable crops while promoting pest and weed proliferation. Global climate change is predicted to decrease crop yields, increase crop prices, decrease worldwide calorie availability, and by 2050 increase child malnutrition by 20 percent.

In 2007 North Carolina suffered its worst drought in more than 100 years. The frequency and intensity of droughts in North Carolina is expected to increase in the future due to climate change. This may cause decreased agricultural production, decreased production of electricity, water-use restrictions, and reduced water quality. Furthermore, drier conditions due to drought may increase the frequency and intensity of wildfires.

G. Climate Change is Causing Adverse Human Health Impacts

Fossil fuel burning and the resulting climate change are already contributing to an increase in asthma, cancer, cardiovascular disease, stroke, heat-related morbidity and mortality, food-borne diseases, and neurological diseases and disorders. The World Health Organization has stated that “[l]ong-term climate change threatens to exacerbate today’s problems while undermining tomorrow’s health systems, infrastructure, social protection systems, and supplies of food, water, and other ecosystem products and services that are vital for human health.” Climate change is not only expected to affect the basic requirements for maintaining health (clean air and water, sufficient food, and adequate shelter), but is likely to present new challenges for controlling

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145 Id.
146 USCCSP & USDA, The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity, in SYNTHESIS AND ASSESSMENT PRODUCT 4.3 59 (May 2008), (“Many weeds respond more positively to increasing CO2 than most cash crops, ... Recent research also suggests that glyphosate, the most widely used herbicide in the United States, loses its efficiency on weeds grown at CO2 levels that likely will occur in the coming decades.”).
147 Id.
148 Id. at 6.
149 Id. at 20.
150 Id.
151 Id. at 23.
infectious disease and even “halt or reverse the progress that the global public health community is now making against many of these diseases.”

H. Climate Change Increases Threats to National Security and Disrupts Global Politics

The changing climate also raises national security concerns, as “climate change will add to tensions even in stable regions of the world.” The U.S. Department of Defense has acknowledged the severity of climate change and its connections to national security. The Quadrennial Defense Review classified climate change as a “threat multiplier.” Specifically, “Pentagon leaders have identified three main ways that climate change will affect security: accelerating instability in parts of the world wrecked by drought, famine, and climate-related migrations; threatening U.S. military bases in arid Western states or on vulnerable coastlines; and increasing the need for U.S. forces to respond to major humanitarian disasters.” The United States may experience an additional need to accept immigrant and refugee populations as droughts increase and food production declines in other countries. Increased extreme weather events (such as hurricanes) will also present an increased strain on foreign aid and call for military forces. For instance, by 2025, 40 percent of the world’s population will be living in countries experiencing significant water shortages, while sea-level rise could cause displacement of tens, or even hundreds, of millions of people.

I. The Public Trust Doctrine Requires North Carolina to Protect its Air Resources

The Public Trust Doctrine holds government responsible, as a perpetual trustee, for the protection of essential natural resources—such as air, water, and the sea—for the benefit of present and future generations. Governments, including the State of North Carolina, have a fiduciary obligation to protect these essential natural resources, the trust res, for the benefit of all people, including generations yet unborn. The public trust doctrine is an inalienable attribute of sovereignty that no government can disclaim. The Public Trust Doctrine traces its roots back to 530 A.D. to the legal reforms of the Roman Emperor Justinian:

156 Keith Johnson, A Clear and Present Danger, Foreign Policy 3 (May 6, 2014), (November 24, 2014, 11:22 AM), http://www.foreignpolicy.com/articles/2014/05/06/a_clear_and_present_danger (“Environmental issues, energy issues—they are all connected, and they are all integrated into our national security.”).
157 Id. at 3.
158 Id.
159 CNA Corporation, supra note 156, at 7.
160 Id.
161 Id. at 16.
By the law of nature, these things are common to mankind—the air, running
water, the sea, and consequently the shores of the sea. No one, therefore, is
forbidden to approach the seashore, provided that he respects habitations,
monuments, and buildings which are not, like the sea, subject only to the law of
nations.\textsuperscript{163}

While early cases recognized marine resources, tidal waters and the submerged lands beneath
them, and navigable waters as public trust resources, the scope of the doctrine as evolved over
the years. Most relevant for the purposes of this Petition, the atmosphere has been recognized in
various Constitutional provisions and cases as a public trust resource.\textsuperscript{164}

In North Carolina, public trust rights are defined in N.C.G.S. § 1-45.1 and referenced
elsewhere in the North Carolina General Statutes and judicial opinions.\textsuperscript{165} Public trust rights
mean “those rights held in trust by the State for the use and benefit of the people of the State in
common. They are established by common law as interpreted by the courts of this State. They
include, but are not limited to, the right to navigate, swim, hunt, fish, and enjoy all recreational
activities in the watercourses of the State and the right to freely use and enjoy the State’s ocean
and estuarine beaches and public access to the beaches.”\textsuperscript{166}

In North Carolina, the Public Trust Doctrine has already been used to protect the rights of the
public in navigable waters and in the land adjoining them. In \textit{Capune v. Robbins}, for example,
the North Carolina Supreme Court, citing a New York opinion written by Justice Cardozo,
acknowledged the right of adjoining riparian owners to build piers, but only to the point that it
did not unnecessarily obstruct the public’s right.\textsuperscript{167} In \textit{State ex rel. Rohrer v. Credle}, the
defendant argued he had acquired rights to an oyster bed under navigable waters through
prescription. The North Carolina Supreme Court, in the context of title under navigable waters,
stated that the lands were held in trust by the State for the benefit of the public. Moreover, the
Court stated that under the Public Trust Doctrine, property subject to the public trust could only
be regulated or disposed of if it could be done without substantial impairment of the public’s
interest.\textsuperscript{168}

The atmosphere, a most critical natural resource essential to human existence, is an asset that
belongs to all people and the State of North Carolina holds it in trust for all citizens of North
Carolina. Under North Carolina’s public trust law, the atmosphere is held in trust by the State for
the benefit of its citizens similar to navigable waters and the land adjacent. Thus, the State has an
obligation to ensure that emitters of GHGs do not intrude on the public’s rights by acting in a

\textsuperscript{163} Justinian, Institutes, 1.2.1, 2.1.1 (T. Sandars trans. 1st Am. Ed n. 1876).
\textsuperscript{164} See, e.g., \textit{Robinson Twp. v. Commonwealth}, 83 A.3d 901, 955 (Pa. 2013) (plurality opinion); Hi CONST. art XI, §
1.
\textsuperscript{165} N.C.G.S. § 113-131, N.C.G.S. § 113A-134; see also, \textit{Friends of Hatteras Island Nat’l Historic Maritime
\textsuperscript{166} N.C.G.S. § 1-45.1 (emphasis added).
387 (1892).
manner that substantially impairs the atmosphere and the environment. The State is not allowed
to cede its responsibility to protect the atmosphere and cannot allow property subject to the
public trust, such as the atmosphere, to be substantially impaired by excessive GHG emissions.

In addition, continued failure to protect the atmosphere from the adverse impacts of climate
disruption will impair the public’s rights of use in waters. Streams and rivers will dry up, flood,
or both. Seashores will disappear in front of seawalls and groynes designed to protect structures
but sacrificing beaches. Failure to act is an abdication of responsibility. This Commission cannot
continue to ignore this pressing problem without violating its public trust duties to North
Carolina’s youth, such as Hallie.

J. North Carolina’s Emissions are Significant Globally

The most direct way to significantly reduce the severity of climate change is to reduce
greenhouse gas emissions, such as CO2. Of course North Carolina cannot solve climate change
on its own and other states, the federal government, and other countries must also do their part to
reduce their CO2 emissions. However, it is important to note that North Carolina’s carbon
dioxide emissions are significant globally. If North Carolina were a country, it would be the 39th
largest CO2 emitter in the world, out of 216 countries and territories (based on 2012 emissions
data). Thus, while North Carolina cannot solve climate change on its own, a solution to
climate change must include emission reductions from North Carolina.

Please see the film *Thin Ice: The Inside Story of Climate Science*, a copy of which is attached
hereto and incorporated herein as Exhibit D. The film is also available to be streamed online at
http://thiniceclimate.org/.

Given the harmful impacts of climate change discussed above and North Carolina’s
contribution to global carbon dioxide emissions, the Division of Air Quality should adopt the
rule proposed in this Petition to reduce North Carolina’s share of global CO2 emissions.

(4) Provide a statement of the effect on existing rules or orders.

A. Effect on N.C.G.S. § 62-133.8

The Renewable Energy and Energy Efficiency Portfolio Standard (“REPS”) requires electric
utilities in the State to increase the renewable energy in their portfolios to 12.5 percent by
2021. If carbon dioxide emissions are reduced pursuant to the rule proposed in this Petition by
shifting electricity generation from carbon-intensive coal-fired plants to renewable sources such

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170 This figure was calculated after comparing North Carolina’s 2012 CO2 emissions with the CO2 emissions from
each country. The emissions data for other countries is available from U.S. Energy Information Administration,
171 See N.C.G.S. § 62-133.8.
as wind and solar, (and reducing emissions from other sources set forth in Table 2 herein) compliance with the proposed rule will be consistent with and support compliance with REPS.

B. Effect on N.C.G.S. § 143-215.107D

The amount of nitrogen oxide and sulfur dioxide that certain coal-fired power plants may emit is limited by N.C.G.S. § 143-215.107D. If carbon emissions are reduced pursuant to the rule proposed in this Petition by shifting electricity generation away from carbon-intensive coal-fired plants, emissions of nitrogen oxide and sulfur dioxide from those plants will also be reduced. The proposed rule will thus encourage compliance with § 143-215.107D.

C. Effect on N.C.G.S. § 150B-19.3

N.C.G.S. § 150B-19.3 prohibits North Carolina agencies from adopting certain environmental rules that are more stringent than their federal counterparts. The rule proposed in this Petition does not presently conflict with § 150B-19.3 because there are no federal rules in force that limit carbon dioxide emissions. Even if the EPA promulgated a carbon dioxide emission reduction goal through the Clean Power Plan, the proposed rule in this Petition would not conflict with that rule because the rule proposed in this Petition does not seek to only limit emissions from power plants but rather seeks emission reductions from all sources. Thus, there would still not be a federal counterpart that the rule proposed in this Petition would conflict with.

Furthermore, it is important to note that any federal regulations on carbon dioxide emissions would only be a floor and that under federal law, states would be allowed to enact more stringent regulations. If N.C.G.S. § 150B-19.3 impeded North Carolina's authority to reduce greenhouse gas emissions in such a way that led to violation of North Carolina's constitutional mandate “to control and limit the pollution of our air and water” and to protect “in every other appropriate way to preserve as a part of the common heritage of this State its forests, wetlands, estuaries, beaches, historical sites, open lands, and places of beauty” such an application of N.C.G.S. § 150B-19.3 would be unconstitutional; a statute cannot displace a constitutional obligation.

D. Effect on N.C.G.S. § 143-215.107

N.C.G.S. § 143-215.107 empowers the Environmental Management Commission to develop air quality standards. The proposed rule does not conflict with the statute but rather would help the Commission fulfill its statutory obligations.

E. Effect on EPA’s proposed Clean Power Plan

The EPA recently proposed a rule known as the Clean Power Plan that would require North Carolina to reduce its CO2 emissions from existing, fossil-fuel fired Electric Utility Generating

172 N.C. CONST. art. XIV § 5.
Units.\textsuperscript{173} Adopting the rule proposed in this Petition would encourage compliance with the Clean Power Plan if North Carolina chooses to accomplish the proposed CO\textsubscript{2} reductions by limiting CO\textsubscript{2} emissions caused by electric power generated by burning fossil fuels. The EPA has pointed out that "[State] Programs already in place . . . would apply toward the state’s 2030 CO\textsubscript{2} emission goal. Thus, states with existing programs will be better positioned to achieve the goals."\textsuperscript{174}

(5) Provide copies of any documents and data supporting the proposed rule(s).

Supporting documents/evidence are attached as:

- **Exhibit A** – Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature, by Dr. Pushker A. Kharecha, co-author with Dr. James Hansen


- **Exhibit C** – Measuring the Impacts of Sea-Level Rise on Coastal Real Estate in North Carolina by Okmyung Bin (2008).

- **Exhibit D** – Thin Ice: The Inside Story of Climate Science; 2013; A David Sington/Simon Lamb Film (The University of Oxford and Victoria); (The film is enclosed and can be streamed at the link at [http://hiniceclimate.org/](http://hiniceclimate.org/).)

(6) Provide a statement of the effect of the proposed rule on existing practices in the area involved, including cost factors for persons affected by the proposed rule(s).

A. The Costs of Action are Largely at the Discretion of the Committee but Some Guidance can be Provided.

Although the proposed rule provides the Committee with broad discretion how the goals will be achieved, some preliminary information on the costs of the proposed rule can be provided. There are strengths and weakness to the different approaches. Under EPA’s authority through the Clean Air Act of 1970, this summer the EPA proposed the Clean Power Plan. This proposal is targeted at lowering the GHG emissions at fossil fuel-fired power generators. Under the plan, the EPA will create a target CO\textsubscript{2} emission goal and leave implementation to the states to determine how best to comply.\textsuperscript{175} The EPA provides some recommendations such as: renewable energy standards; efficiency improvements; switching power generators to natural gas; carbon storage technology; and market-based trading programs.\textsuperscript{176} Others have suggested compliance could be met more efficiently under a carbon tax.\textsuperscript{177} Furthermore, whatever steps are taken earlier will

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\textsuperscript{173} See 79 Fed. Reg. at 34830.

\textsuperscript{174} Id. at 34839.


\textsuperscript{177} Michael Wara et. al., How the EPA Should Modify Its Proposed 111(d) Regulations to Allow States to Comply By Taxing Pollution, THE BROOKINGS INSTITUTION, October 28, 2014, (November 24, 2014, 11:45 AM),
apply towards compliance at the time the proposal becomes law. Now is the time to get out ahead of forthcoming regulation and take ownership of the problem.

i. Market Based Approaches

Both the International Monetary Fund and the Organisation for Economic Co-operation and Development ("OECD") have recommended carbon emission taxes and trading systems as the most effective and least expensive methods to regulate CO₂ emissions. This revenue can be reinvested into the State either to further green technology or other legislative goals. To date, California has generated over 850 million dollars through the state's auction-based, emissions trading program and has plans to earmark the money for infrastructure reinvestment and affordable housing among others.

At the economic level, carbon taxation and cap and trade systems functionally operate the same. Both systems encourage greater efficiency in allocating resource and investment in green technology to avoid paying an emission-based fee. Under a trading policy, the maximum amount of CO₂ emissions is set and the trade price is determined by the market; the environmental impact is known but the economic impact is unknown. Under a taxing policy, the environmental impact must be guessed at but the price per emission is set by the tax rate. The price for this economic certainty is an unknown environmental impact—difficult to reconcile with our proposed rule. However, a carbon tax is cheaper to administer, provides greater pricing predictability for planning purposes, is less volatile, and works better with additional GHG-reducing policies.

Creating governmental market-based approaches to mitigating CO₂ is in line with current business practices. Many companies are already taking into account possible carbon taxes and cap and trade programs in internal planning. ConocoPhillips calculates cost of carbon emissions in determining potential revenue at a price between 8 and 46 dollars a ton. Shell applies a carbon price of 40 dollars per ton to some current operations in an effort to determine its high polluting facilities and to quantify its risks. Disney actually taxes the cost of its investments in


Id.


Id.
carbon offsets against its subsidiaries in proportion to their carbon pollution. Businesses are already braced for change; it is time for the State, as trustee of the public’s air, to seize ownership of the problem.

ii. Government Subsidies

A multi-national survey conducted by the OECD to determine the effective prices of carbon emissions found that capital subsidies and feed-in tariffs are currently the least efficient method of abating carbon emissions. Feed-in tariffs are policies that encourage the development of renewable energy by allowing targeted energy sources to charge more for the energy they produce. In the electricity generation sector, on average, carbon abatement costs more than one hundred and fifty dollars per ton of CO₂ abated using capital subsidies and feed-in tariffs and, in some cases, cost as much as eight hundred dollars per ton.

Another study, when postulating a relatively high social cost of carbon globally, noted that many sources of renewable energy were actually cheaper than energy generated by fuel-fired plants due to the damage CO₂ causes to the environment. This social cost reflects the fact that those most impacted are developing countries in regions that will be disparately affected by climate changes. This indicates that, if desired, feed-in tariffs could be used to ameliorate some of the social costs of carbon emissions.

iii. Natural Gas

While the rule proposed in this Petition does not mandate a particular method for achieving the four percent annual reduction in CO₂ emissions, one possible method is phasing out coal-fired electric generation capacity in favor of less carbon-intensive methods. REPS already requires electric utilities to maintain 12.5 percent of their portfolios with renewable sources by 2021. Assuming electric utilities satisfy that requirement with zero-emissions methods such as wind, solar, or hydroelectric generation, replacing the remaining coal portfolio with natural gas would help satisfy the four percent annual reduction of Statewide CO₂ emissions required by the rule proposed here. Approximately three percent of the reductions could come through REPS compliance and replacing coal with natural gas. The remaining one percent could come from transitioning from fossil fuels as an electricity source to renewable energy (see § 6.A.v below for more on this additional one percent). After REPS requirements are satisfied, the cost of replacing the electricity generated by coal-fired plants with natural gas-fired plants is approximately $2.67 billion. See § 7.F infra for calculations.

iv. Carbon Dioxide Capture and Sequestration

184 Id.
185 OECD, Effective Carbon Prices 52 fig. 3-7.
187 N.C.G.S. § 62-133.8(b).
Carbon dioxide capture and sequestration ("CCS") has been suggested as a potential method to prevent CO₂ from entering the atmosphere. The premise is that CO₂ emissions can be prevented from entering the atmosphere by capturing the gas at the point of entry, transporting it and injecting it into underground formations of non-porous rock. An international study has suggested that the relative cost of abating CO₂ emissions with CCS could cost approximately 25 to 37 dollars per ton of emissions abated by 2030.\(^\text{188}\)

A 2007 study on the feasibility of carbon capture and sequestration concluded that it was "not economically or technically feasible within North Carolina" because the state lacks the capacity to store much more than three years of worth of captured CO₂. The study points out that CCS "may be viable if the captured CO₂ is piped out of North Carolina and stored elsewhere."\(^\text{189}\) This would require prohibitive investment necessitating new pipelines to be created to transport the emissions.

There are possible alternatives. The Southeast Regional Carbon Sequestration Partnership maintains a field site at a coal seam in Russell County Virginia where CO₂ emissions might be transported.\(^\text{190}\) Furthermore, a more recent preliminary study than the 2007 study suggests that there may be possible CCS sites in Dare, Hyde, and Tyrrell counties near Nucor Corporation and Weyerhaeuser NR Co. plants.

Although Carbon Capture and Sequestration has been suggested as a potential method of abating CO₂ emissions, at least in North Carolina, it is not the most efficient alternative due to lack of storage capacity in the state.


Other measures that would help North Carolina achieve the proposed rule would be to develop renewable energy projects, including wind and solar, and promote energy efficiency and energy conservation measures. The costs associated with these projects vary. However, according to one expert’s analysis, the cost of eliminating CO₂ emissions from fossil fuels used to generate electricity is between $10-40 per metric ton of CO₂ emissions.\(^\text{191}\) Assuming that three percent of emissions reduction would come from meeting the REPS requirement and transitioning from coal to natural gas (as described in § 6.A.iii above), an additional one percent of emission reductions could come from replacing fossil fuels with renewable energy sources for electricity generation. As explained more in § 7.G below, it would cost approximately $1.34


\(^{190}\) The Southeast Regional Carbon Sequestration Partnership operates a Coal Seam Project in North Carolina, more information *available at* http://www.scarbon.org/ (November 24, 2014).

billion in total (i.e., not annually), between 2016 and 2025, to reduce CO$_2$ emissions by an additional one percent by using renewable energy sources for electricity generation.

While reducing carbon dioxide emissions does require a short-term increase in spending, in the long-term these costs would be largely or fully offset by reduced energy costs and other benefits. For example, new jobs would be created in the renewable energy sector that could boost North Carolina’s economy. In short, any short-term costs would be outweighed by long-term economic benefits.

When considering the costs of reducing emissions, it is also important to consider damages avoided by reduced emissions. The federal government has developed the social cost of carbon ("SCC") analysis to estimate the climate benefits of rulemaking that seek to reduce CO$_2$ emissions.\textsuperscript{192} The SCC represents the value of damages avoided by a reduction in CO$_2$ emissions. The EPA and IPCC both note that the SCC does not include all damages and is likely to underestimate the damages. Nevertheless, it can be a helpful tool when considering the benefits of a proposed rule. For 2015, the "central value" (or average) SCC is $37 per metric ton of CO$_2$.\textsuperscript{193} This means that the benefit of emission reductions ($37 a ton) outweighs the average estimated cost of emission reductions ($25 per metric ton)\textsuperscript{194} and thus it makes sound economic sense to reduce CO$_2$ emissions and replace fossil fuels with renewable energy sources.

\textit{vi. Summary}

Depending on how the Commission chooses to implement the rule proposed in this Petition the costs will vary. However, the preceding sections provide important guidance on different ways in which the Commission could achieve the emissions reductions sought in the proposed rule and analysis on the economic impacts. The Petitioner feels strongly that North Carolina should be transitioning away from all fossil fuels as a source of electricity generation and transportation and should be aggressively pursuing renewable energy sources. Pursuing renewable energy sources makes economic sense and is best for the health of the atmospheric resource.

\textbf{B. The Costs of Inaction are Substantial and Impact a Surprising Swath of Economic Sectors Including Real Estate, Recreation, Infrastructure, Agriculture and Human Lives.}

While the cost of reducing CO$_2$ emissions from fossil fuels may seem high, the costs of inaction far exceed the costs related to reducing CO$_2$ emissions.\textsuperscript{195} The effects of unmitigated


\textsuperscript{193} \textit{Id.} (The central value is determined by calculating the average value of the 5% average ($12), 3% average ($39), and 2.5% average ($61)).

\textsuperscript{194} This $25 figure was arrived at by taking the average of the $10-40 estimate noted in the first paragraph of this sub-section.

\textsuperscript{195} CTR. FOR INTEGRATIVE ENVTL. RESEARCH, UNIV. OF MD., \textit{ECONOMIC IMPACTS OF CLIMATE CHANGE ON NORTH CAROLINA} 4 (2008).
climate change are expected to impose serious costs on the value of coastal real estate, beach recreation, agriculture, infrastructure, and human health. The costs of restricting CO₂ emissions are small in comparison. When possible, all dollar amounts below have been normalized to 2014 dollars.¹⁹⁶

i. **Adopting the proposed rule will help prevent lost property value in North Carolina’s coastal communities.**

Compared to the recommended projection of 39 inches of sea level rise by 2100,¹⁹⁷ a projection of 26 cm (about 10 inches) of SLR by 2080 is extremely conservative. Even given that conservative projection, SLR caused by unmitigated climate change will still have a devastating impact on coastal property value. A study of four representative North Carolina coastal counties (Dare, Carteret, Bertie, and New Hanover) estimates the results of unmitigated SLR below.¹⁹⁸ All figures represent the present value of property that will be lost given SLR of 26 cm by 2080. Property is considered “lost” when the projected SLR would inundate a property based on its present elevation above sea level.¹⁹⁹

In New Hanover County, over $191 million in residential and $99.49 million in non-residential property will be lost.²⁰⁰ In Dare County, $1.55 billion in residential and $904.25 million in non-residential property would be lost.²⁰¹ In Carteret County, $152.39 million in residential and $80.6 million in non-residential property would be lost.²⁰² In Bertie County, $12.59 million in residential and $5.04 million in non-residential property will be lost.²⁰³

In sum, $2.5 billion of property value is projected to be lost given the conservative assumption of 26 cm of SLR, far less than the recommended 39 inch SLR projection. Furthermore, that figure represents property lost in just four of North Carolina’s twenty coastal counties, so it dramatically understates total potential losses. It bears reiterating that this loss is driven solely by real property damages. These numbers do not reflect the losses cost by business migration and closings or by displaced human populations. By adopting the proposed rule to limit CO₂ emissions, DAQ can help mitigate climate change-induced SLR mitigating the costs it will impose on coastal property owners.

¹⁹⁷ Sci. Panel on Coastal Hazards, supra note 93 at 12.
¹⁹⁹ Id. at 2.
²⁰⁰ Id. at 16.
²⁰¹ Id. at 19.
²⁰² Id. at 22.
²⁰³ Id. at 24.
ii. Adopting the proposed rule will help prevent reduced recreation on North Carolina’s beaches.

Recreational beach trips, including shore fishing trips, will be impacted by climate change-induced SLR. In assessing the impact of SLR on beach recreation, both (1) welfare costs to beachgoers in the form of fewer beach trips and lower quality beach trips and (2) reduced trip expenditures on regional economic activity are considered. All figures presented here are based on the conservative assumption that there will be no population or income growth in the affected areas.

By 2080, the total welfare cost to beachgoers is projected to be $255 million. The loss in trip expenditures is projected to be $113.35 million for day trips and $2.46 billion for overnight trips. For recreational shore fishing, the welfare costs are projected to be $1.24 billion.

In sum, just due to SLR related losses, failure to mitigate climate change will negatively impact the recreational activities of beachgoers and shore fishers, resulting in costs totaling approximately over $4 billion by 2080. Adopting the proposed rule to limit CO₂ emissions will help mitigate those costs by preventing the SLR that will cause them.

iii. Adopting the proposed rule will help mitigate infrastructure costs for the State of North Carolina.

State Highway 12, which runs along the Outer Banks, has, by itself, cost the North Carolina Department of Transportation approximately $100 million in repairs since 1983 due to frequent storm and flood damage. To cope with continuing SLR and increasing storm intensity, proposals to permanently adapt at-risk portions of Highway 12 are projected to cost, at a minimum, $602 million. In addition to coastal roads, beaches are threatened by SLR. The cost of nourishing an additional two feet of beach eroded by SLR for North Carolina’s 138 miles of shoreline will be $11.01 million annually. Given this rate, the present value of beach nourishment required to adapt to sea level rise from 2015 to 2080 is $715.65 million.

In sum, protecting key parts of Highway 12 and continuing to nourish beaches will cost the State at least $1.318 billion by 2080. There will undoubtedly be millions, if not billions, of additional costs related to other infrastructure in North Carolina that is threatened by climate impacts such as sea level rise and extreme weather events. Adopting the proposed rule to limit

205 Id. at 48.
206 Id. at 49.
207 Id. at 57.
208 Riggs et al., supra note 92 at 73.
209 Id. at 76.
CO$_2$ emissions will help mitigate those costs by preventing the SLR and increased storm intensity that will cause them.

iv. *Adopting the proposed rule will help prevent business interruptions and damage to the agriculture and forestry industries.*

North Carolina can expect even more significant damage from hurricanes than it has experienced in the past if nothing is done to mitigate climate change.\textsuperscript{210} Considering only Bertie, Carteret, Dare, and New Hanover counties, more intense Category 3 hurricanes caused by climate change are projected to cause approximately $1.81$ billion in additional business interruption by 2080.\textsuperscript{211} Higher intensity storms also produce greater damage to agriculture.\textsuperscript{212} If climate change strengthens what would have been a Category 1 storm into a Category 2, an additional $188.91$ million in damages to agriculture and livestock is projected.\textsuperscript{213} Further, if climate change strengthens a Category 2 storm into a Category 3, damage to the forestry sector is estimated to double, and based on historical data that could cause an additional $629.7$ million in damage.\textsuperscript{214}

In sum, more intense hurricanes due to climate change are projected to cost an additional $2.629$ billion. Adopting the proposed rule to limit CO$_2$ emissions will help mitigate those costs by reducing the likelihood of more intense hurricanes.

v. *Adopting the proposed rule will help prevent an increase in heat-related deaths.*

Increased temperatures caused by climate change could increase heat-related deaths in North Carolina from 20 deaths to 35 deaths every summer.\textsuperscript{215} Given the EPA values a statistical life at $8.73$ million ($7.4$ million in 2006 dollars),\textsuperscript{216} the economic impact of the additional loss of life is valued at $130.99$ million every year, or $8.51$ billion by 2080. Adopting the proposed rule will help prevent the expected loss of life and the associated economic impacts.

**Table 1: Summary of costs associated with adopting proposed rule**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Impact</th>
<th>Cost Prevented (billions of 2014 dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal Real Estate</td>
<td>Inundation due to SLR</td>
<td>$2.5</td>
</tr>
</tbody>
</table>

\textsuperscript{210} WOODRUFF et. al., *supra* note 21 at 39.
\textsuperscript{211} BII et. al., *supra* note 264 at 76.
\textsuperscript{212} *Id.* at 78.
\textsuperscript{213} *Id.* at 84.
\textsuperscript{214} *Id.* at 81.
\textsuperscript{215} Ctr. for Integrative Envl. Research, *supra* note 195 at 12.
Recreation and Tourism
Inundation due to SLR $4.06
Infrastructure
Inundation due to SLR, $1.318
damage from increased
storm intensity
General business / $2.629
agriculture / forestry
Damage from increased
storm intensity
Human health
Heat injury from $8.51
increased average
temperature.

Total Costs Prevented: $19.017 billion

COSTS INCURRED\textsuperscript{217}

\begin{center}
\begin{tabular}{|l|l|l|}
\hline
Sector & Impact & Cost Incurred \\
\hline
Electric power utilities & Replacement of coal-fired & $2.67 \\
& power generation with & \\
& natural gas generation. & \\
Renewable energy & Replacing fossil-fuel & $1.34 \\
& electricity generation with & \\
& renewable energy sources & \\
\hline
\end{tabular}
\end{center}

Total Costs Incurred: $4.01

(7) Provide a statement explaining the computation of the cost factors.

A. Calculation of impact on coastal real estate

The economic impact of climate change-induced SLR discussed in section 6.A supra relies on a paper produced by Okmyung Bin, Associate Professor of Economics at East Carolina University, entitled \textit{Measuring the Impacts of Sea-Level Rise on Coastal Real Estate in North Carolina}.\textsuperscript{218} A summary of the methods used in that paper are included here, but for a complete discussion see the full paper attached as Exhibit C.

The four counties studied represent a cross-section of the North Carolina coastline in geographic distribution and economic development.\textsuperscript{219} Real estate data for the study, including assessed values and other structural characteristics, were obtained from each county’s tax office.\textsuperscript{220} Inundation maps used to identify property that would be lost under different SLR scenarios were obtained using high-resolution topographic LIDAR (Light Detection and

\textsuperscript{217} The exact costs incurred will depend on how the Commission chooses to implement the proposer rule. This chart represents the costs incurred under one scenario of emission reductions.

\textsuperscript{218} BIN, \textit{supra} note 198.

\textsuperscript{219} \textit{Id.} at 2.

\textsuperscript{220} \textit{Id.}
Ranging data, the net loss associated with inundation is measured as follows. First, hedonic price models are estimated to predict the contribution of each attribute to the value of the property; second, the value of risks and amenities of the lost properties are purged from the total value of the lost properties; third, the predicted value of each lost property is inflated to 2080. Lastly, all figures from the paper were here converted from 2004 to 2014 dollars.

B. Calculation of impact on coastal recreation

The economic impact of climate change-induced SLR discussed in section 6.B supra relies on a paper produced by Okmyung Bin, Associate Professor of Economics at East Carolina University, et al., entitled Measuring the Impacts of Climate Change on North Carolina Coastal Resources. A summary of the methods used in that paper are included here, but for a complete discussion see the full paper attached as Exhibit B.

All of coastal North Carolina is included in the recreational fishing analysis, but recreational beach-going and swimming is limited to Brunswick, New Hanover, Pender, Onslow, and Carteret counties. Impacts to the beach tourism industry are analyzed at the county level as a result of SLR, and economic effects are estimated using a recreation demand methodology on data gathered by the U.S. Army Corps of Engineers. Information from a geospatial analysis is used to identify beach recreation sites that may become unavailable due to SLR. Then, a nested logit random utility model is used to simulate site closure at these locations and the resulting reallocation for beach recreation trips. These estimates are combined with trip expenditures data to estimate the economic effects on North Carolina coastal counties. The projected economic impact of changes in recreational fishing is based on data gathered by the National Marine Fisheries Service. Information from a geospatial analysis is used to identify fishing sites that may become unavailable due to SLR. Then, a nested logit site selection model is used to simulate site closure at those locations and the resulting reallocation of shore-based fishing trips. Lastly, all figures from the paper are here converted from 2004 to 2014 dollars.

C. Calculation of impact on infrastructure

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221 Id.
222 Id. at 7.
223 CPI Inflation Calculator.
224 Bin et. al., supra note 204.
225 Id. at 2-3.
226 Id. at 3.
227 Id.
228 Id.
229 Id.
230 Id.
231 Id.
232 Id.
233 CPI Inflation Calculator.
The cost projection to adapt portions of Highway 12 to SLR used in section 6.C supra is based on several alternative scenarios centered on Pea Island. Pea Island is a simple barrier island that has been subject to inlet formation and overwash for hundreds of years.\textsuperscript{234} Both inlet formation and overwash threaten Highway 12 at several “hot-spots.”\textsuperscript{235} One proposal to address the hot-spots is to build a new bridge parallel to the present bridge, maintain the Pea Island road on its present right-of-way, and rebuild new segments of road as needed.\textsuperscript{236} Minimum estimates for that proposal range from $602 million to $1.58 billion.\textsuperscript{237} Another alternative is to build a back-barrier, bridge-causeway across the Oregon Inlet flood-tide delta and into the deeper water of the Pamlico Sound. This 17-mile-long structure would return to the barrier island in the village of Rodanthe.\textsuperscript{238} Minimum cost estimates for the back-barrier corridor range from $1.3 billion to $1.8 billion.\textsuperscript{239} Because $602 million is the least expensive alternative, we adopt it as a conservative estimate of costs for adapting Highway 12 to SLR. This figure was not converted to 2014 dollars because the source for the estimate did not indicate the dollar year.

The estimated annual cost of nourishing all 138 miles of North Carolina shoreline is $831 million every 10 years before accounting for SLR.\textsuperscript{240} So assuming the annual cost of beach nourishment in North Carolina is one-tenth that figure, or $83.1 million, the present value of annual beach nourishment from 2015 to 2080 (65 years) is about $5.4 billion. According to personnel at the U.S. Army Corps of Engineers, one cubic yard per running foot of beach is needed to replace each foot of eroding beach—so a one mile stretch of beach would require 10,560 cubic yards of sand per mile to replace an average annual two feet of erosion per mile assumed in the Bin et al., study.\textsuperscript{241} The average cost of sand is $6 per cubic yard.\textsuperscript{242} So, given 138 miles of beach, the annual cost to replace two additional feet of eroded beach due to climate-change-induced SLR is $8.74 million.\textsuperscript{243} Therefore, climate change-induced SLR will result in an additional cost of $568.1 million for nourishing North Carolina’s beaches after for 65 years (2015-2080). This figure is here converted from 2004 dollars to 2014 dollars,\textsuperscript{244} resulting in the final estimate of $715.45 million. The total estimated cost of adapting North Carolina infrastructure to climate change is the sum of the projected beach nourishment costs ($715.45 million) and the projected costs of adapting Highway 12 ($602 million), or $1.317 billion.

D. Calculation of impact to coastal businesses, agriculture, livestock, and forestry

The projected economic impact of increased hurricane intensity caused by climate change discussed in section 6.D supra relies on a paper produced by Okmyung Bin, Associate Professor

\textsuperscript{234} RIGGS et. al., supra note 101 at 76.
\textsuperscript{235} Id.
\textsuperscript{236} Id.
\textsuperscript{237} Id.
\textsuperscript{238} Id.
\textsuperscript{239} Id.
\textsuperscript{240} BIN et. al., supra note 204.
\textsuperscript{241} Id. at 89
\textsuperscript{242} Id.
\textsuperscript{243} Id.
\textsuperscript{244} CPI Inflation Calculator.
of Economics at East Carolina University, et. al., entitled *Measuring the Impacts of Climate Change on North Carolina Coastal Resources.* A summary of the methods used in that paper are included here, but for a complete discussion see the full paper attached as Exhibit B.

This analysis is based on projected changes in the severity of tropical storms and hurricanes due to climate change, and focuses on impacts to agriculture, forestry, and general “business interruption.” Business interruption impacts are temporary reductions in business activity or output caused by hurricane strikes, and are produced by power loss, inaccessibility due to damaged infrastructure, and supply chain interruption. Estimates of business interruption are based on the Wilmington region and use an existing study that estimated business interruption impacts by industry sector for hurricane strikes in Wilmington in the 1990s. The impacts are adjusted for inflation, and for counties other than New Hanover, impacts are adjusted according to differences in industry mix using the IMPLAN economic impact software database. Incremental storm damages to agriculture and forestry from more intense storms caused by climate change are assessed by comparing historical storm damages across storm categories, i.e., the difference in dollar value between damage to agriculture after a Category 2 versus a Category 3 hurricane. Lastly, all figures from the paper are here converted from 2004 to 2014 dollars.

**E. Calculation of impact of heat-related injury**

Heat-related deaths per summer are expected to increase by 15 due to climate change. The EPA values a statistical life at $7.4 million. So for each summer affected by climate change, the statistical value of additional lives lost is 15 * $7.4 million = $111 million per summer. To project costs by 2080, that figure is multiplied by 65 summers (summers of 2015 through 2080). $111 million * 65 summers = $7.215 billion. Lastly, this figure is here converted from 2006 to 2014 dollars, resulting in an estimated loss of $8.51 billion.

**F. Calculation of impact on electric utilities**

Calculating the cost the rule proposed in this Petition will impose on electric utilities is difficult because the rule does not require the State to dictate whether, or how, electric utilities will reduce CO₂ emissions. It requires only that statewide emissions be reduced by at least 4 percent annually. The following scenario, however, is illustrative of how electric utilities could

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245 Bin et. al., *supra* note 204.
246 *Id.* at 3.
247 *Id.* at 4.
248 *Id.*
249 *Id.*
250 *Id.*
251 CPI Inflation Calculator.
252 Ctr. for Integrative Envtl. Research, *supra* note 195 at 12.
254 CPI Inflation Calculator.
help meet the requirement by reducing their CO₂ emissions and what the associated costs would be.

It is possible for electric utilities alone to cause a statewide reduction of carbon dioxide emissions from fossil fuel combustion by 3 percent annually by shifting their electric power generation from coal-fired power plants to natural gas combined-cycle plants ("NGCC"). In 2012, the electric power industry in North Carolina generated 116,681,763 megawatt hours (Mwh) of electric power.\(^{255}\) Of that total, utility-owned coal-fired power plants generated 50,932,180 Mwh,\(^{256}\) resulting in 49,260,000 metric tons of CO₂ emissions.\(^{257}\) That translates to a ratio of .97 metric tons of CO₂ emitted per Mwh produced with coal. Natural gas-fired power plants in North Carolina generated 19,302,008 Mwh in 2012,\(^{258}\) resulting in 8,271,000 metric tons of CO₂ emissions.\(^{259}\) That translates to a ratio of .43 metric tons of CO₂ emitted per Mwh produced with natural gas. In 2012, North Carolina also generated 3,867,429 Mwh with zero-emission renewable resources (3,727,938 Mwh from hydroelectric and 139,491 Mwh from solar).

Pursuant to N.C.G.S. § 62-133.8(b), electric utilities are already required to have renewable energy and energy efficiency compose 12.5 percent of their energy portfolios by 2021.\(^{260}\) Therefore, utilities must generate an additional 10,717,791 Mwh from renewables by 2021 to meet that requirement.\(^{261}\) Assuming that electric utilities meet the REPS requirements by replacing coal capacity with zero-emission renewable capacity like wind and solar, that still leaves 40,214,389 Mwh of coal-generated electricity available for replacement with natural gas.\(^{262}\) The levelized cost of electricity for new NGCC capacity is $66.3/Mwh.\(^{263}\) Therefore, the cost of NGCC capacity required to replace the remaining coal-generated electricity assuming no growth in overall generation is approximately $2.67 billion.\(^{264}\)

The following tables detail a possible scenario where (1) coal generation is replaced with NGCC and renewable generation, (2) REPS is satisfied by increasing renewable generation to


\(^{256}\) Id.

\(^{257}\) Id.

\(^{258}\) Id.


\(^{260}\) N.C.G.S. § 62-133.8(b).

\(^{261}\) Calculation: 116,681,763 Mwh (total generated in 2012) * 12.5% (renewables required by REPS) = 14,585,220 Mwh; 14,585,220 Mwh (required capacity) – 3,867,429 Mwh (current capacity from hydro and solar) = 10,717,791 Mwh.

\(^{262}\) Calculation: 50,932,180 Mwh (total coal generated) – 10,717,791 Mwh (renewables for REPS) = 40,214,389 Mwh.


\(^{264}\) Calculation: 40,214,389 Mwh (available for capture from coal) * $66.3 (cost of NGCC capacity per Mwh) = $2,666,213,991.
12.5 percent by 2021, (3) additional renewable energy projects are used to reduce reliance on electricity from fossil fuel sources, and (4) the rule proposed in this Petition is satisfied by reducing Statewide CO₂ emissions by at least 4 percent annually. Importantly, this scenario assumes that no additional steps will be taken to encourage energy efficiency or conservation and that there will be no reductions from the transportation sector. As highlighted below, energy generation makes up less than a quarter of easily attained emissions abatement. Table 2 was taken from the EPA’s calculated impacts of its Clean Power Plan proposal based, in part, on the most recent year for which CO₂ emissions are available, 2012. This 3% provides a “stepping stone” towards quick, affirmative action to reduce GHG emissions.

To be clear, the petitioner is not advocating replacing coal generation with natural gas given that natural gas is still a fossil fuel with significant GHG emissions, including carbon dioxide and methane. Replacing coal generation with renewable energy sources will ultimately be necessary to avoid the worst impacts of climate change. Table 3 demonstrates the costs of further reducing North Carolina CO₂ emissions by 1% by traditional energy generation with modern renewable sources. The figures in Table 3 were calculated by subtracting the 3% emissions that will come from NGCC transitioning from our rule’s 4% proposed reduction. The total figure was determined by multiplying the remaining 1% by $25 per metric ton.²⁶⁵

These costs will not be incurred overnight and have been presented over a thirty year horizon recognizing that on-going capital improvements will be prorated over the years. In fact, spread over the residents of North Carolina over the thirty year horizon period, each individual would only pay approximately $4.55 more per year to account for this.²⁶⁶ Furthermore, these numbers cannot reflect technologies being developed to streamline renewable energy generation and make it more efficient; nor can these numbers reflect the positive economic impact that new, green-energy job creation will have. Lastly, because the timeline details have been left to the discretion of the Commission, these numbers have not been adjusted for present value or inflation.

²⁶⁵ This cost estimate comes from Arjun Makhijani, CARBON-FREE AND NUCLEAR-FREE (2007). In this study, based on a joint study by the Institute of Energy and Environmental Research and the Nuclear Policy Research Institute, the author calculated the cost of eliminating CO₂ emissions with renewable sources to be between $10-40 per metric ton. For planning purposes, this window has been averaged to provide a more definite total.
²⁶⁶ Population data taken from the United States Census Bureau, available at, http://quickfacts.census.gov/qfd/states/37000.html (December 4, 2014, 2:00 pm), ($4.55 = \text{Total Estimated Cost \div 9,848,060 N.C. Population \div 30 yr Timeline}$)
### Table 2: Projected Costs of 3% Reduction in CO2 Emissions Statewide

<table>
<thead>
<tr>
<th>Year</th>
<th>Natural Gas†</th>
<th>Renewable Energy†</th>
<th>Coal CO2 Emissions‡</th>
<th>Natural Gas CO2 Emissions‡</th>
<th>Annual Reduction of CO2 Emissions‡</th>
<th>Remaining Statewide CO2 Emissions‡</th>
<th>Cost of NG Replacement (2014 dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>50,932,180</td>
<td>19,302,008</td>
<td>3,867,429</td>
<td>49,260,000</td>
<td>8,271,000</td>
<td>120,600,000</td>
<td>120,600,000</td>
</tr>
<tr>
<td>2016</td>
<td>45,441,003</td>
<td>22,863,983</td>
<td>5,796,631</td>
<td>44,077,773</td>
<td>9,831,513</td>
<td>116,982,000</td>
<td>236,158,915</td>
</tr>
<tr>
<td>2017</td>
<td>40,443,023</td>
<td>23,932,761</td>
<td>7,725,834</td>
<td>39,229,732</td>
<td>11,151,087</td>
<td>113,472,540</td>
<td>203,459,988</td>
</tr>
<tr>
<td>2018</td>
<td>35,833,482</td>
<td>28,398,743</td>
<td>9,869,382</td>
<td>34,758,477</td>
<td>12,211,460</td>
<td>110,068,384</td>
<td>163,494,633</td>
</tr>
<tr>
<td>2020</td>
<td>27,639,277</td>
<td>31,577,120</td>
<td>14,885,220</td>
<td>26,810,098</td>
<td>13,578,162</td>
<td>103,563,324</td>
<td>83,563,924</td>
</tr>
<tr>
<td>2021</td>
<td>21,637,222</td>
<td>37,879,075</td>
<td>14,585,220</td>
<td>20,988,202</td>
<td>16,288,002</td>
<td>100,456,244</td>
<td>417,819,619</td>
</tr>
<tr>
<td>2022</td>
<td>15,992,962</td>
<td>43,523,435</td>
<td>14,585,220</td>
<td>15,513,173</td>
<td>18,715,077</td>
<td>97,442,731</td>
<td>374,221,050</td>
</tr>
<tr>
<td>2023</td>
<td>10,348,602</td>
<td>49,167,795</td>
<td>14,585,220</td>
<td>10,038,144</td>
<td>21,142,152</td>
<td>94,519,449</td>
<td>374,221,050</td>
</tr>
<tr>
<td>2024</td>
<td>5,087,840</td>
<td>54,428,557</td>
<td>14,585,220</td>
<td>4,935,204</td>
<td>23,404,280</td>
<td>91,683,866</td>
<td>348,788,551</td>
</tr>
<tr>
<td>2025</td>
<td>0</td>
<td>59,516,397</td>
<td>14,585,220</td>
<td>0</td>
<td>25,592,051</td>
<td>27,474,33</td>
<td>337,323,767</td>
</tr>
</tbody>
</table>

$2,666,213,990

### Table 3: Effect of Additional 1% Reduction on Remaining CO2 Emissions by Transitioning to Renewable Energy

<table>
<thead>
<tr>
<th>Year</th>
<th>Remaining Statewide CO2 Emissions‡</th>
<th>4% reductions‡</th>
<th>Difference of Additional 1% Emissions‡</th>
<th>Cost of Renewables Replacement (2014 dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>120,600,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>116,982,000</td>
<td>115,776,000</td>
<td>1,206,000</td>
<td>30,150,000</td>
</tr>
<tr>
<td>2017</td>
<td>113,472,540</td>
<td>111,144,960</td>
<td>2,327,580</td>
<td>58,189,500</td>
</tr>
<tr>
<td>2018</td>
<td>110,408,384</td>
<td>106,699,162</td>
<td>3,369,222</td>
<td>84,230,550</td>
</tr>
<tr>
<td>2019</td>
<td>106,766,313</td>
<td>102,431,195</td>
<td>4,335,118</td>
<td>108,377,950</td>
</tr>
<tr>
<td>2020</td>
<td>103,563,324</td>
<td>98,333,947</td>
<td>5,229,377</td>
<td>130,734,425</td>
</tr>
<tr>
<td>2021</td>
<td>100,456,424</td>
<td>94,400,589</td>
<td>6,055,835</td>
<td>151,395,875</td>
</tr>
<tr>
<td>2022</td>
<td>97,442,731</td>
<td>90,624,566</td>
<td>6,818,165</td>
<td>170,454,125</td>
</tr>
<tr>
<td>2023</td>
<td>94,519,449</td>
<td>86,999,583</td>
<td>7,519,866</td>
<td>187,996,650</td>
</tr>
<tr>
<td>2024</td>
<td>91,683,866</td>
<td>83,519,600</td>
<td>8,164,266</td>
<td>204,106,650</td>
</tr>
<tr>
<td>2025</td>
<td>88,933,350</td>
<td>80,178,816</td>
<td>8,754,534</td>
<td>218,863,350</td>
</tr>
</tbody>
</table>

$1,344,499,075

† In Megawatt Hours
‡ In Metric Tons
G. Calculation on the costs of transitioning from fossil fuels as a source of electricity to renewable energy sources

Assuming that the scenario described in section 7.F is adhered to, North Carolina would need to reduce emissions by an additional one percent to comply with the proposed rule. One possible way that could be achieved is by replacing some of the fossil fuel electricity generation with renewable energy sources. According to one national expert, it costs between $10-40 to eliminate one metric ton of CO$_2$ from the electricity sector by transitioning from fossil fuel sources of electricity to renewable energy sources$^{267}$. In order to calculate how much an additional one percent of emission reductions would cost, the cumulative metric tons of an addition one percent of North Carolina’s CO$_2$ emissions was calculated—this equaled 53,779,963 metric tons of CO$_2$ between 2016 and 2025. This number was then multiplied by $25$, the average of $10-40$. That gives an estimated cost of replacing an additional one percent of emissions with renewable energy sources of $\textcolor{red}{\$1.34\ billion}$ in total between 2016 and 2025 (see Table 3).

(8) Provide a description, including the names and addresses, if known, of those most likely to be affected by the proposed rule.

We anticipate the rule proposed in this Petition will have indirect positive effects on all residents of North Carolina because it will help mitigate the impacts of climate change that, if left unmitigated, will affect everyone. More specifically, residents of coastal counties will be vulnerable to climate-change induced SLR if carbon dioxide emissions are not reduced. We also anticipate the rule having direct effects on electric power and related industries. In general, we expect the rule will result in a reduction of emissions from coal-fired power plants because energy and electricity will be generated by lower emitting sources such as renewable power and natural gas plants.

Facilities that emit 25,000 or more GHG per year are required to report their emissions to the Environmental Protection Agency$^{268}$. By August 18, 2014, 107 facilities located in North Carolina reported their 2013 CO$_2$ emissions to the EPA. The parent companies of these facilities are listed in Table 4, below. Duke Energy owns 17 of the 107 highest emitters of CO$_2$ and has already begun to take charge of its emissions. In 2010, Duke Energy voluntarily established carbon reduction goals attempting to reduce or offset CO$_2$ emissions by 17 percent of their 2005 levels by 2020$^{269}$. In fact, for the last two years its internal goal has already been met. However, Duke Energy’s emissions alone make up over 84 percent of the total reported emissions to the EPA. Duke Energy’s initial efforts demonstrate that environmental conservation and good business practices are not mutually exclusive and provide opportunities of common interest. However, there is much more to be done.


\footnote{268} The table is available from the EPA at www.ghgdata.epa.gov/ghgpp/main.do. (November 24, 2014).

Power generation makes up only 22 percent of the total “low-hanging” CO₂ emissions that can be abated over the next decades. ²⁷⁰ Nearly a quarter of these emission reductions could be attained in the building and transportation sector. ²⁷¹ This abatement could be achieved through lowering the consumer demand for electricity through such simple means as improving the insulation of new buildings. ²⁷² Lowering CO₂ emissions and other GHG emissions is not a simplistic matter of ensnaring “the usual suspects” in further and more complicated regulations but instead an exercise in innovative problem solving.

The Table 4 below sets forth a list of parties that are known emitters of carbon dioxide. While we do not know the names, addresses, or descriptions of all the specific parties likely to be directly affected, the table below describes them with as much specificity as is known:

**TABLE 4: Parties likely to be most affected by the proposed rule**

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allegheny Technologies Inc.</td>
<td>1000 Six PPG Place</td>
<td>A specialty materials &amp; components supplier with a facility operating in</td>
</tr>
<tr>
<td></td>
<td>Pittsburgh, PA 15222</td>
<td>Monroe, NC.</td>
</tr>
<tr>
<td>Blue Ridge Paper Products Inc.</td>
<td>41 Main Street</td>
<td>A specialty paper and paperboard packaging facility in Canton, NC.</td>
</tr>
<tr>
<td></td>
<td>Canton, NC 28716-4331</td>
<td></td>
</tr>
<tr>
<td>Bridgestone Americas Tire Operations, LLC</td>
<td>535 Marriot Drive</td>
<td>A tire-producing factory located in Wilson, NC.</td>
</tr>
<tr>
<td></td>
<td>Nashville, TN 37214-5092</td>
<td></td>
</tr>
<tr>
<td>Buncombe County New Landfill</td>
<td>81 Panther Branch Road</td>
<td>A landfill operated by Buncombe County.</td>
</tr>
<tr>
<td></td>
<td>Alexander, NC 28701</td>
<td></td>
</tr>
<tr>
<td>Campbell Soup Co.</td>
<td>1 Campbell Place</td>
<td>A food manufacturing facility for Campbell Soup in Maxton, NC.</td>
</tr>
<tr>
<td></td>
<td>Camden, NJ 08103-1701</td>
<td></td>
</tr>
<tr>
<td>Cardinal Glass Industries</td>
<td>775 Prairie Center Dr. #200</td>
<td>A glassware manufacturer with a facility located in Mooresville, NC.</td>
</tr>
<tr>
<td></td>
<td>Eden Prairie, MN 55344</td>
<td></td>
</tr>
<tr>
<td>Cargill Inc.</td>
<td>15407 McGinty Rd W, MS26</td>
<td>An agricultural company with specific facilities located in Charlotte,</td>
</tr>
<tr>
<td></td>
<td>Wayzata, MN 55391</td>
<td>Fayetteville, and Raleigh, NC.</td>
</tr>
<tr>
<td>Carolina Stalite Co.</td>
<td>205 Klumac Rd</td>
<td>A slate lightweight aggregate manufacturer with a facility located in</td>
</tr>
<tr>
<td></td>
<td>Salisbury, NC 28144</td>
<td>Gold Hill, NC.</td>
</tr>
<tr>
<td>Catawba County</td>
<td>100 A SW Blvd</td>
<td>Blackburn landfill operated by Catawba County.</td>
</tr>
<tr>
<td></td>
<td>Newton, NC 28658</td>
<td></td>
</tr>
</tbody>
</table>


²⁷¹ Id.

²⁷² Id. at 42.
<table>
<thead>
<tr>
<th>Company Name</th>
<th>Address/Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlotte Pipe and Foundry Co.</td>
<td>2109 Randolph Road, Charlotte, NC 28207</td>
<td>A manufacturer of pipe and fittings for plumbing and industrial systems located in Charlotte, NC.</td>
</tr>
<tr>
<td>City of Fayetteville</td>
<td>955 Old Wilmington Rd, Fayetteville, NC 28301</td>
<td>A public waste facility operated by the City of Fayetteville, NC.</td>
</tr>
<tr>
<td>City of Lexington</td>
<td>28 West Center St., Lexington, NC 27292</td>
<td>A public waste facility operated by the City of Lexington, NC.</td>
</tr>
<tr>
<td>City of Winston-Salem</td>
<td>101 N. Main Street, Winston-Salem, NC 27101</td>
<td>Hanes Mill road landfill operated by the City of Winston-Salem.</td>
</tr>
<tr>
<td>Clearwater Paper Corp.</td>
<td>601 W. Riverside Ave, Suite 1100, Spokane, WA 99201-0644</td>
<td>A tissue products manufacturer with a facility located in Shelby, NC.</td>
</tr>
<tr>
<td>CMS Energy Corp.</td>
<td>1730 Rhode Island Ave, NW, Suite 1007, Washington, D.C. 20036</td>
<td>A combination electric and natural gas utility operating Craven County Wood Energy in New Bern, NC.</td>
</tr>
<tr>
<td>CPI USA North Carolina LLC</td>
<td>700 Commerce Drive, Suite 160, Oak Brook, IL 60523-8733</td>
<td>A power company with facilities in Roxboro and Southport, NC serving the local region.</td>
</tr>
<tr>
<td>Cree, Inc.</td>
<td>460 Silicon Drive, Durham, NC 27703-8475</td>
<td>Manufactures light bulbs and light fixtures among others.</td>
</tr>
<tr>
<td>Cumberland County Solid Waste Management</td>
<td>698 Ann Street, Fayetteville, NC 28301</td>
<td>A landfill operated by Cumberland County.</td>
</tr>
<tr>
<td>DAK Americas LLC</td>
<td>5925 Carnegie Blvd. Ste 500, Charlotte, NC 28209</td>
<td>PET resin manufacturer and polyester staple fibers producer located in Charlotte, NC. Wholly owned by Alfa S.A.B. de C.V. of Monterrey, Mexico.</td>
</tr>
<tr>
<td>Dominion North Carolina Power</td>
<td>P.O. Box 26543, Richmond, VA 23290</td>
<td>Investor-owned utility serving NC residents that owns coal-fired plants.</td>
</tr>
<tr>
<td>Domtar Paper Co., LLC</td>
<td>100 Kingsley Park Drive, Fort Mill, SC 29715-6476</td>
<td>An investor-owned paper manufacturer with a paper mill operating in Plymouth, NC.</td>
</tr>
<tr>
<td>DSM Pharmaceuticals Product</td>
<td>P.O. Box 650, 6401 JH Heerlen (NL)</td>
<td>Producer of food ingredients and nutritional additives with a facility operating in Greenville, NC.</td>
</tr>
<tr>
<td>Duke Energy Carolinas</td>
<td>550 South Tryon Street, Charlotte, NC 28202</td>
<td>Investor-owned utility serving NC residents that owns coal-fired plants.</td>
</tr>
<tr>
<td>Duke University</td>
<td>114 S. Buchanan Blvd., Box 90144</td>
<td>A private research university located in Durham, North Carolina.</td>
</tr>
<tr>
<td>Edgecombe Genco, LLC</td>
<td>327 Hillsborough Street, Raleigh, NC 27603-1725</td>
<td>A fossil fuel electric power generator located in Battleboro, NC owned by Calypso Holdings, LLC.</td>
</tr>
<tr>
<td>Company Name</td>
<td>Address</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>DU PONT DE NEMOURS &amp; CO</td>
<td>1007 Market St Wilmington, DE, 19898</td>
<td>Du Pont operates two reporting facilities in NC. One in Fayetteville that produces a variety of building materials and one in Kinston involved in industrial bioscience.</td>
</tr>
<tr>
<td>ELEMENTIS Worldwide</td>
<td>469 Old Trenton RD East Windsor, NJ, 08512</td>
<td>An investor-owned chemical manufacturing company based out of the United Kingdom.</td>
</tr>
<tr>
<td>Evonik Goldschmidt Corporation</td>
<td>914 East Randolph Road Hopewell, VA 23860</td>
<td>A multinational, investor-owned chemical manufacturing company.</td>
</tr>
<tr>
<td>Frito-Lay, Inc.</td>
<td>7701 Legacy Drive Plano, TX 75024-4099</td>
<td>A food manufacturing company with a facility located in Greensboro, NC.</td>
</tr>
<tr>
<td>Gas Natural Inc.</td>
<td>1 First Avenue South Great Falls, MT 59401</td>
<td>A natural gas distributor with a facility located in Elkin, NC.</td>
</tr>
<tr>
<td>Gerdau Ameristeel US Inc.</td>
<td>4221 W. Boy Scout Blvd, Suite 600 Tampa, FL 33607-5760</td>
<td>A steel manufacturer with a facility located in Charlotte, NC.</td>
</tr>
<tr>
<td>GlaxoSmithKline</td>
<td>5 Crescent Drive Philadelphia, PA 19112-1001</td>
<td>A specialty medical products manufacturer with a facility in Research Triangle Park.</td>
</tr>
<tr>
<td>International Automotive Components North America</td>
<td>28333 Telegraph Road Southfield, MI 48034-1953</td>
<td>An automotive part manufacturer with a facility located in Albemarle, NC.</td>
</tr>
<tr>
<td>International Paper Co.</td>
<td>6400 Poplar Avenue Memphis, TN 38197-0100</td>
<td>A paper and packaging manufacturer in Riegelwood, NC.</td>
</tr>
<tr>
<td>Kapstone Paper &amp; Packaging Corp.</td>
<td>1101 Skokie Blvd, Suite 300 Northbrook, IL 60062-4124</td>
<td>A corrugated paper products manufacturer with a paper mill located in Roanoke Rapids, NC.</td>
</tr>
<tr>
<td>Koch Industries Inc.</td>
<td>P.O. Box 2256 Wichita, KS 67201-2256</td>
<td>Its subsidiary, Invista, is a chemical, fibers, and plastics manufacturer with a facility located in Wilmington, NC.</td>
</tr>
<tr>
<td>MILLERCOORS LLC</td>
<td>250 S. Wacker Dr., Suite 800 Chicago, IL 60606-5888</td>
<td>An alcoholic beverage manufacturer with a facility in Eden, NC.</td>
</tr>
<tr>
<td>New Hanover County</td>
<td>3002 U.S. Highway 421 North Wilmington, NC 28401</td>
<td>A county owned public waste facility operated by New Hanover County.</td>
</tr>
<tr>
<td>New NGC Inc.</td>
<td>2001 Rexford Rd Charlotte, NC 28211-3498</td>
<td>A gypsum wallboard manufacturing facility in Mount Holly, NC.</td>
</tr>
<tr>
<td>NGK North America</td>
<td>1105 North Market St, #1300 Wilmington, DE 19801</td>
<td>An automotive parts manufacturer with a facility in Mooresville, NC.</td>
</tr>
<tr>
<td>Company Name</td>
<td>Address</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>North Carolina Electric Membership Corporation</td>
<td>3400 Sumner Blvd, Raleigh, NC 27616</td>
<td>An energy distribution cooperative operating in North Carolina.</td>
</tr>
<tr>
<td>North Carolina State University</td>
<td>Campus Box 7001, A Holladay Hall Raleigh, NC 27695-7001 1915 Rexford Road Charlotte, NC 28211-3465</td>
<td>A public university located in Raleigh, NC.</td>
</tr>
<tr>
<td>Nucor Corporation</td>
<td></td>
<td>A steel manufacturing facility located in Cofield, NC.</td>
</tr>
<tr>
<td>Owens-Illinois, Inc.</td>
<td>One Michael Owens Way Perrysburg, OH 43551-2999</td>
<td>A glass bottle manufacturer for beers, wines, and other bottled products located in Lexington, NC.</td>
</tr>
<tr>
<td>PCS Phosphate Company Incorporated</td>
<td>1101 Skokie Boulevard, Suite 400 Northbrook, IL 60062-4123</td>
<td>A fertilizer, industrial and animal feed producer located in Aurora, NC.</td>
</tr>
<tr>
<td>Perdue Farms Inc.</td>
<td>31149 Old Ocean City Rd. Salisbury, MD 21804-1806</td>
<td>A poultry processing plant in Lewiston, NC.</td>
</tr>
<tr>
<td>Performance Fibers Operations Inc.</td>
<td>13620 Reese Blvd., Suite 400 Huntersville, NC 28078-6415</td>
<td>An industrial polyester fabric and fiber manufacturer located in Salisbury, NC.</td>
</tr>
<tr>
<td>Piedmont Natural Gas Co.</td>
<td>4720 Piedmont Row Dr. Charlotte, NC 28210-4269</td>
<td>A natural gas distribution company located in Charlotte servicing North Carolina, South Carolina, and Tennessee out of the same location.</td>
</tr>
<tr>
<td>Pilkington North America, Inc.</td>
<td>811 Madison Ave Toledo, OH 43604-5684</td>
<td>A glass manufacturer for building and automotive purposes with a facility located in Laurinburg, NC.</td>
</tr>
<tr>
<td>PPG Industries Inc.</td>
<td>327 Hillsborough St. Raleigh, NC 27603 300 Lindenwood Dr. Valleybrooke Corporate Center Malvern, PA 19355-1740</td>
<td>A fiberglass manufacturer located in Lexington and Shelby, NC.</td>
</tr>
<tr>
<td>PQ Corp.</td>
<td></td>
<td>A chemical manufacturer with a facility in Apex, NC.</td>
</tr>
<tr>
<td>R F Micro Devices</td>
<td>7628 Thorndike Rd. Greensboro, NC 27409</td>
<td>Manufacturer of integrated RF circuits and semiconductor components.</td>
</tr>
<tr>
<td>ReEnergy Holdings, LLC</td>
<td>30 Century Hill Dr., Suite 101 Latham, NY 12110</td>
<td>Owners of a retrofitted coal-fired electrical generation plant. It now runs on biomass as its primary fuel. Located in Kenansville, NC.</td>
</tr>
<tr>
<td>Reynolds American Inc.</td>
<td>401 North Main Street Winston-Salem, NC 27101-3804</td>
<td>A tobacco manufacturer with a facility located in Winston-Salem.</td>
</tr>
<tr>
<td>Saint-Gobain Containers Inc.</td>
<td>750 E. Swedesford Road Valley Forge, PA 19482</td>
<td>A glass bottle producing factory with facilities located in Henderson and Wilson, NC.</td>
</tr>
<tr>
<td>Name</td>
<td>Address</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>----------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>SCANA Corp</td>
<td>220 Operation Way, Cayce, SC 29033-3701</td>
<td>A natural gas company with a facility located in Gastonia, NC.</td>
</tr>
<tr>
<td>Smith Beecham Corporation</td>
<td>980 Great West Road, Brentford, Middlesex</td>
<td>A GSK, Inc. company.</td>
</tr>
<tr>
<td>Smithfield Packing Company, Inc.</td>
<td>200 Commerce Street, Smithfield, VA 23430</td>
<td>A meat packing facility located in Tar Heel, NC.</td>
</tr>
<tr>
<td>Southern Company</td>
<td>30 Ivan Allen Jr. Blvd, Atlanta, GA 30308</td>
<td>A power company with generating facilities located in Grover and Salisbury, NC.</td>
</tr>
<tr>
<td>Starpet, Inc.</td>
<td>801 Pineview Rd, Asheboro, NC 27203</td>
<td>A PET resin manufacturing facility located in Asheboro, NC. It has been acquired by Indorama Ventures an international PET producer that is headquartered out of Thailand.</td>
</tr>
<tr>
<td>Sun Capital</td>
<td>300 N Greene St., Ste 1750, Greensboro, NC</td>
<td>Owns Performance Fibers, Inc. an industrial polyester fabric and fibers manufacturer with a facility in New Hill, NC.</td>
</tr>
<tr>
<td>The Goodyear Tire &amp; Rubber Company</td>
<td>200 Innovation Way, Akron, OH 44316-0001</td>
<td>A rubber manufacturing company with a facility located in Fayetteville, NC.</td>
</tr>
<tr>
<td>Tyson Foods, Inc.</td>
<td>2200 W. Don Tyson Parkway, Springdale, AR 72762</td>
<td>A food manufacturer with facilities in Harmony and Wilkesboro, NC.</td>
</tr>
<tr>
<td>Valley Proteins, Inc.</td>
<td>1309 Industrial Dr, Fayetteville, NC 28301-6323</td>
<td>An animal byproduct recycling and restaurant grease rendering company with facilities in Gastonia, Rose Hill, Wadesboro, and Fayetteville, NC.</td>
</tr>
<tr>
<td>Westmoreland Coal Company</td>
<td>9540 South Maroon Circle, Suite 200, Englewood, CO 80112</td>
<td>Owns the Roanoke Valley Energy Facility a power plant located in Weldon, NC.</td>
</tr>
<tr>
<td>Weyerhaeuser NR Co.</td>
<td>33663 Weyerhaeuser Way, South Federal Way, WA 98001-9620</td>
<td>A paper and packaging company with a facility located in Vanceboro, NC.</td>
</tr>
<tr>
<td>Williams Partners, LP</td>
<td>One Williams Center 5000, Tulsa, OK 74172-0172</td>
<td>A natural gas company with facilities located in Mooresville, Lexington, and Reidsville, NC.</td>
</tr>
<tr>
<td>Coal production/transportation industries</td>
<td>Unknown</td>
<td>Reducing demand for coal in NC will result in less coal being shipped in from out of state.</td>
</tr>
<tr>
<td>Natural gas production/</td>
<td>Unknown</td>
<td>Reduced demand for natural gas in NC will result in less being shipped in from</td>
</tr>
</tbody>
</table>
(9) Provide the name(s) and address(es) of the petitioner(s).

Hallie Turner

Gayle Goldsmith Tuch
P.O. Box 1006
3540 Clemmons Road, Suite 107
Clemmons, NC 27102

Conclusion

North Carolina’s atmosphere is a precious resource, essential to the survival and well being of all North Carolina’s residents and the environment and natural resources they rely on. North Carolina has an affirmative duty to protect the environment, and although we call for action with regards to carbon dioxide in particular, this does not abrogate North Carolina’s obligation generally.

The Public Trust Doctrine requires that, as co-tenant trustee the State of North Carolina and its agencies, the North Carolina Environmental Management Commission and the North Carolina Department of Environment and Natural Resources, hold vital natural resources in trust for both present and future generations of its citizens. In recognition of this responsibility, the Commission was entrusted with both the duty and power to adopt regulations for air quality and emissions control standards for air contaminant sources pursuant to N.C.G.S. § 143-215.107. North Carolina’s atmosphere is a shared natural resource vital to the health, welfare, and survival of its citizens. Because only the State has the technology and power to protect it, the atmosphere has been entrusted the State’s care for its preservation and protection as a common property interest. As such, the State of North Carolina has a fiduciary, perpetual, affirmative duty to preserve and protect the atmosphere for the present citizens and future generations of the State as beneficiaries of this trust asset.
Ms. Sheila Holman  
December 5, 2014  
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This duty is articulated in the Public Trust Doctrine but also in the Commission’s enabling statutes and the North Carolina Constitution. For example, the State’s affirmative duty to preserve the atmosphere under the public trust doctrine is demanded by the State’s public policy “to provide for the conservation of its water and air resources [and] to achieve and to maintain for the citizens of the State a total environment of superior quality. Recognizing that the water and air resources of the State belong to the people, the General Assembly affirms the State’s ultimate responsibility for the preservation . . . of these resources in the best interest of all its citizens[.]”

And so, for the reasons above, it is with utmost respect that this Petition is hereby submitted on behalf of Hallie Turner, the citizens of the State of North Carolina, and present and future generations of minor children. The petitioner respectfully requests that the North Carolina Environmental Management Commission and the Division of Air Quality promulgate a rule that requires the agency to take the necessary steps in order to protect the integrity of Earth’s climate by adequately protecting our atmosphere, a public trust resource upon which all North Carolina residents rely for their health, safety, sustenance, and security.

The Petitioner respectfully request an opportunity for a public hearing on the rule proposed in the Petition and a written decision on whether or not to proceed with the rulemaking process. We appreciate your consideration of this Petition. If you have any questions or need additional information, please contact me.

Very truly yours,

[Signature]

Gayle Goldsmith Tuch

Enclosures

cc: Lois Thomas-Spence, EMC Clerk  
Kelly Turner, mother of Hallie Turner  
Hallie Turner

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273 N.C.G.S. § 143-211(a) (emphasis added).