

Stemming a Rising Tide: Why the Clean Air Act Following *Massachusetts v. E.P.A.* Provides a Sensible Vehicle Through Which to Regulate Greenhouse Gas Emissions

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Imagine ocean levels rising because of global ice melt. Imagine the next ice age beginning due to the increase in carbon dioxide and other greenhouse gases in the atmosphere. Imagine global plant life dying as a result of rising global temperatures. Imagine a fundamental shift in marine life as a direct consequence of the acidification of the world's waters. Finally, imagine increased greenhouse gases causing no impact on the world's biospheres at all. Scientists have predicted all of these possible results, and, while most reputable scientists agree that global climate change is real, there is far less agreement in the scientific community as to what the end result of man's dependence on fossil fuels will eventually be. So what should humanity do in the face of this uncertainty? Should we sit idly by in the hopes that the world will recover on its own? Or should humanity foster technological innovation through incentivization and regulation that may help avert any and all of these possible crises? This note argues that the very uncertainty as to the effects of a changing atmospheric composition should be the motivation needed to finally address humanity's addiction to carbon-laden fossil fuels. But in order to do this, society must make several difficult choices. If we choose to address these problems, luckily, the current regulatory framework of the United States provides a good starting point through which we can reach a comprehensive solution and stem the rising tide of greenhouse gas emissions.

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I. INTRODUCTION

The history of mankind is interwoven with amazing achievements that do nothing short of inspiring greatness and evoking mental imagery exhibiting that the capacity of man may well be limitless. We have gone to the moon and back. We have sent robots millions of miles into space while remotely controlling them from Earth.¹ Together, humanity has survived epidemics. We have found cures for some of the most deadly diseases known to man. Society has brought about wars seeking to destroy entire peoples, yet that same society has found a way to achieve a relative, modern peace in our time. To the casual observer or sheltered academic, with a little determination, humanity’s capacity knows no bounds. But for all of the astounding accomplishments of mankind, the misstep that may prove to be our most significant and costliest is failing to address mankind’s impact on the Earth.

Since long before the dawn of the industrial revolution, mankind has proven capable of fundamentally reshaping the Earth.² But with the dawn of the modern age in the Industrial Revolution, mankind accelerated the rate with which it could go about changing the very structure of the Earth.³ However, this newfound ability came at a cost—powering the new technological innovations were energy sources that when con-

1. See Brooks Barnes, *In a Breathtaking First, NASA’s Voyager 1 Exits the Solar System*, N.Y. TIMES, Sept. 12, 2013, at A1, available at http://www.nytimes.com/2013/09/13/science/in-a-breathtaking-first-nasa-craft-exits-the-solar-system.html?pagewanted=all&_r=0.

2. The Seven Wonders of the Ancient World come to mind. See, e.g., Mary R. Bynum, *Teaching the Seven Wonders of the Ancient World*, 92 CLASSICAL J. 271, 274 (1997).

3. See PETER N. STEARNS, THE INDUSTRIAL REVOLUTION IN WORLD HISTORY 66–68 (4th ed., 2013).

sumed released organic compounds⁴ into the air.⁵ From coal to kerosene to modern gasoline and diesel, these “fossil fuels” are composed primarily of hydrocarbons.⁶ To most legal students, scholars, and professionals, what fossil fuels are composed of is of little consequence. To the environmental lawyer or scientist, though, it is of the utmost importance.⁷

The consumption of hydrocarbons is crucial to the environmental lawyer because it results in the release of carbon molecules, primarily referred to as greenhouse gases.⁸ These gases are called *greenhouse gases* because they trap heat inside the Earth like the panels of a greenhouse.⁹ Among the gases that have this effect are carbon dioxide (CO₂), nitrous oxide (N₂O), ozone (O₃), chlorofluorocarbons (CFCs), and methane (CH₄).¹⁰ Several gases that are found in the lowest level of the atmosphere, the troposphere, do not allow heat energy—in the form of infrared radiation—to escape the Earth’s atmosphere, so sunlight reaching the Earth’s surface is converted to heat energy, which is then redistributed back upward into the atmosphere and trapped by greenhouse gases.¹¹ Over time, greenhouse gases cause the Earth’s temperature to actually increase by not allowing heat to escape the Earth’s atmosphere.¹²

In 1970,¹³ the United States Congress empowered the federal government to regulate emissions into the air through the Clean Air Act (“C.A.A.”).¹⁴ With this regulatory framework in place, the Environmental Protection Agency (“E.P.A.”) set out to regulate different materials emitted into the atmosphere. However, the E.P.A. was hesitant to regu-

4. An organic compound is a member of a large group of compounds that contain carbon. See WILLIAM H. BROWN & CHRISTOPHER S. FOOTE, *ORGANIC CHEMISTRY* 1 (3d ed. 2002).

5. See Leah H. Martinez, *Post Industrial Revolution Human Activity and Climate Change: Why the United States Must Implement Mandatory Limits on Industrial Greenhouse Gas Emissions*, 20 J. LAND USE & ENVTL. L. 403, 404 (2005).

6. A hydrocarbon is an organic compound consisting entirely of hydrogen and carbon atoms. See BROWN & FOOTE, *supra* note 4, at 51.

7. See discussion *infra* Part III.

8. See BROWN & FOOTE, *supra* note 4, at 89.

9. See René J. Borroto, *Global Warming, Rising Sea Level, and Growing Risk of Cholera Incidence: A Review of the Literature and Evidence*, 44 GEOJOURNAL 111, 112–13 (1998).

10. *Id.*

11. See *id.*

12. See *id.*

13. It is important to note that the federal government passed the Clean Air Act of 1963, which provided funding for the study and cleanup of air pollution. However, there was not an actual law giving authority for the regulation of air until the Clean Air Amendments of 1970. See Clean Air Act of 1963, Pub. L. No. 88-206, 77 Stat. 392 (codified throughout 42 U.S.C. (1964)).

14. Clean Air Amendments of 1970, Pub. L. No. 91-604, 84 Stat. 1676 (codified throughout 42 U.S.C. (1976)). This was an amendment of the Clean Air Act of 1963, *infra* note 44, but these amendments, along with the creation of the E.P.A., were what truly started regulation of air pollutants in the United States.

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late a handful of greenhouse gases in the face of rising scientific evidence, and, until twelve states sued the E.P.A. in federal court to compel it to do so, there was no mandate on the E.P.A. to determine whether greenhouse gases can or, in fact, must be regulated under the C.A.A.¹⁵ But twenty-three years after the last major amendments to the C.A.A.¹⁶ and six years after the Supreme Court of the United States ruled against it,¹⁷ the E.P.A. still has not authoritatively and conclusively determined how it will regulate the emission of greenhouse gases.¹⁸

Since *Massachusetts v. E.P.A.* was decided, the E.P.A. has laid down a handful of regulations. Specifically, the E.P.A. has promulgated the Timing Rule,¹⁹ the Tailpipe Rule,²⁰ and the Tailoring Rule.²¹ In the fall of 2013, the E.P.A. announced that it was proposing broader rules for the regulation of greenhouse gas emissions along with a caveat that these proposals would be followed by broader proposals in 2014 and 2015.²² So, there is little doubt that progress has been made, but there is still a long way to go before the E.P.A. can claim that it is truly *regulating* greenhouse gas emissions. The Timing, Tailpipe, and Tailoring Rules are not without shortcomings, and, while the 2013 proposal and the upcoming 2014 and 2015 proposals could go a long way towards filling these gaps, the fact still exists that what is being created is a patchwork regulatory system.²³

Until the E.P.A. is able to articulate a coherent strategy to fully regulate the emission of greenhouse gases, some or all of the relevant greenhouse-gas-producing industry players will try to evade the long

15. See *Massachusetts v. E.P.A.*, 549 U.S. 497, 533–34 (2007).

16. Clean Air Act Amendments of 1990, Pub. L. No. 101-549, 104 Stat. 2399 (1990) (codified throughout 42 U.S.C. (1994)).

17. In *Massachusetts v. E.P.A.*, the Supreme Court ruled that the E.P.A. must state on the record its reasons for action or inaction regarding greenhouse gases and their regulation under the C.A.A. *Id.* at 534–35. This will be discussed further *infra* Part II.C.

18. This is not to say that the E.P.A. has not considered policies or that the Obama Administration and its predecessors have not suggested possible solutions to the dilemma of greenhouse gases. It is simply to say that no single proposal to date has been authoritatively accepted and put in place.

19. Reconsideration of Interpretation of Regulations That Determine Pollutants Covered by Clean Air Act Permitting Programs, 75 Fed. Reg. 17004-01 (Apr. 2, 2010) (to be codified in various sections at 40 C.F.R. pts. 50, 51, 70, and 71).

20. Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, 75 Fed. Reg. 25324-01 (May 7, 2010) (to be codified in various sections at 40 C.F.R. pts. 85, 86, 600 and 49 C.F.R. pts. 531, 533, 536, 537, and 538).

21. Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule, 75 Fed. Reg. 31514-01 (June 3, 2010) (to be codified in various sections at 40 C.F.R. pts. 51, 52, 70, and 71).

22. Wendy Koch, *EPA Proposes Strict Emission Limits on New Power Plants*, USA TODAY (Sept. 20, 2013), <http://www.usatoday.com/story/news/nation/2013/09/19/epa-limits-emissions-coal-power-plants-carbon-capture-technology/2838391/>.

23. See discussion *infra* Part V.B.

arm of the E.P.A. For instance, if the E.P.A. fails to regulate mobile sources,²⁴ stationary source²⁵ industries will complain that they are bearing the burden that mobile sources were spared.²⁶ If the E.P.A. exempts an entire industry—such as agriculture—from regulation, other industries will cry foul.²⁷ Without a comprehensive solution to greenhouse gas regulation, the patchwork regulations that are currently being attempted by the E.P.A. are slightly less effective than attempting to put a Band-Aid on a compound fracture.

The effects of the E.P.A.'s failure to act are only exacerbated by the fact that growing greenhouse gas emissions are *not* limited to the United States. Authors such as Thomas Friedman have shown the interconnectedness of global markets and its effects on fossil fuel prices,²⁸ and academics have detailed the global effects of greenhouse gas emissions.²⁹ As the 2010 eruption of the Icelandic volcano Eyjafjallajökull exhibited, what is emitted into the air above one country has worldwide impacts due to the nature of air particles.³⁰ Eyjafjallajökull's emission of ash and other pollutants into the air led to the cancellation of 100,000 European flights, resulting in an economic impact of \$200 million per day in a weeklong air-traffic interruption that would become the longest peacetime interruption in aviation history.³¹ And it all was caused by a volcano in Iceland—over 1000 miles away from mainland Europe.³²

24. A mobile source is defined as a "source of air pollution that moves, such as cars, trucks, motorcycles, and airplanes." ROBERT V. PERCIVAL ET AL., ENVIRONMENTAL REGULATION: LAW, SCIENCE, AND POLICY 1262 (6th ed. 2009).

25. A stationary source is defined as a "a source of an air pollutant except those emissions resulting directly from an internal combustion engine for transportation purposes or from a nonroad engine or nonroad vehicle." 42 U.S.C. 7602(z) (2006).

26. See generally, e.g., *Coal. for Responsible Regulation, Inc. v. E.P.A.*, 684 F.3d 102 (D.C. Cir. 2012) (per curiam), *cert. granted in part sub nom.*, *Chamber of Commerce v. E.P.A.*, 81 U.S.L.W. 3621 (U.S. Oct. 15, 2013) (No. 12-1272). In *C.R.R. v. E.P.A.*, industry players as well as a handful of states brought suit against the E.P.A. alleging that the Obama Administration's rules with regards to both mobile and stationary sources were arbitrary and capricious. Although this challenge ended up being unsuccessful, this challenge underscores the argument that individual industries will fight against any regulations that the E.P.A. attempts to promulgate to at least delay the regulations from going into effect.

27. For a good example, see the exemption from the stormwater runoff regulations of the Clean Water Act for agriculture and the oil, gas, and mining industries. 33 U.S.C. 1342(l)(1-2) (2006).

28. See generally THOMAS L. FRIEDMAN, *THE WORLD IS FLAT: A BRIEF HISTORY OF THE TWENTY-FIRST CENTURY* (2007) (discussing the consequences of an interconnected world).

29. See William R. Moomaw, *Industrial Emissions of Greenhouse Gases*, 24 ENERGY POL. 951, 952-53 (1996).

30. See Steven Erlanger & Jack Ewing, *Air Travel Crisis Deepens as Europe Fears Wider Impact*, N.Y. TIMES, Apr. 18, 2010, at A8, available at <http://www.nytimes.com/2010/04/18/world/europe/18ash.html>.

31. See *id.*

32. See Karina Hamalainen, *Fire in the Sky*, SCI. WORLD, Jan. 2011, at 8, 10.

Without a comprehensive solution to greenhouse gas emissions within the United States, other countries are unable to follow the United States's potential lead on the issue.³³ Because of the United States's perceived hypocriticality on the issue of greenhouse gas emissions,³⁴ other countries—such as neighboring Canada—refuse to abide by agreed-upon international policies such as the Kyoto Protocol because the United States refuses to ratify and adopt them.³⁵ The failure of the United States to be at the forefront of this issue has left other countries—with which the United States directly competes with regards to both crude oil and other international trade markets—to their own devices.³⁶ Luckily, progress³⁷ is being made in the countries that most directly compete with the United States in the international fossil fuel markets, including Brazil, China, and India, but that progress comes at a time when global greenhouse gas emissions are continuing to increase at an alarming rate.³⁸

Until the United States formulates a comprehensive solution to greenhouse gas emissions and their regulation, be it through the current statutory framework or through congressional action, the United States will continue to fall behind the eight ball. At a time when American families are struggling, these failed policies only feed our nation's addiction to fossil fuels—an addiction that is only growing stronger every day. Without making the hard choices now, both the E.P.A. and Congress are mortgaging the well-being of future American families because of the fear of making things a little bit harder for current American families. Developing a comprehensive solution to greenhouse gas emissions may not only help to save the environment, but it will also help to save Americans from increased prices due to future volatilities in international fossil fuel markets.³⁹

33. See Jim Tankersley, *Summit Was 'No Failure': Analysts Say the Copenhagen Climate Conference Gained More Emission Pledges Than the Kyoto Accord*, L.A. TIMES, Apr. 2, 2010, at A17.

34. The United States is the world's leading producer of greenhouse gas emissions. This will be discussed further *infra* Part III.

35. See Tankersley, *supra* note 33.

36. Though the United States reducing its dependence on foreign oil may decrease the price of foreign oil in the long run, the policies to implement this long-term goal come with short-term increases in the supply curve, making the prices of fossil fuels higher in the short term for stability in the long term. This is why the issue is highly political in nature. In this area, John Maynard Keynes's axiom that "In the long run we are all dead," could not be more true. JOHN MAYNARD KEYNES, A TRACT ON MONETARY REFORM 80 (1923). Although the costs will ultimately be passed on to future generations due to the inaction of our current politicians, this is of little consequence to our current politicians.

37. Progress in the sense that these countries are beginning to self-impose some regulations on the pollutants that can be emitted into the air.

38. See Tankersley, *supra* note 33.

39. It is true that new innovations in the industry of fossil fuel production can do the same,

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For all of these reasons, the United States should take common-sense steps to implement greenhouse gas⁴⁰ emissions regulations. Using easy to understand examples of mobile source emissions and how large these emissions are, the author hopes to persuade the reader of the pressing nature of our emissions.⁴¹ After looking at the best of the suggested alternatives, this note hopes to convince the reader that a system of cooperative federalism under the C.A.A. proves to be the best way to comprehensively regulating greenhouse gas emissions.

II. REGULATORY BACKDROP

The federal government has been addressing the issue of air pollution since the passage of the Air Pollution Control Act of 1955,⁴² which allocated federal funds for research related to air pollution.⁴³ It was not until 1963, however, that the federal government began to regulate air pollution with the passage of the Clean Air Act of 1963.⁴⁴ In the Clean Air Act of 1963, Congress vested regulatory authority in the U.S. Public Health Service.⁴⁵ It was not until January 1, 1970, that Congress created the E.P.A. through the National Environmental Policy Act of 1969 (“N.E.P.A.”),⁴⁶ with the E.P.A. starting operations December 2, 1970.⁴⁷ Following the creation of the E.P.A. via N.E.P.A., Congress drastically overhauled the Clean Air Act of 1963 with the Clean Air Amendments

such as fracking, shale oil, and technological innovation that makes it possible to reach reserves that were previously out of our reach. However, none of these get at the core issue that the United States and other developed nations have a dependence on these fuels that will have *some* effect on the environment unless mitigated through policies to reduce the emissions.

40. The author is advocating for the regulation of all greenhouse gases, but will at times single out carbon dioxide emissions because it is the “primary” greenhouse gas that is emitted and the best known. Additionally, most models use a simplification whereby all greenhouse gases are measured in their equivalency to carbon dioxide in terms of efficacy. This is indicated by CO₂.

41. It is important to note that only about 30% of the U.S.’s emissions come from mobile sources, with the vast majority coming from stationary sources. However, the author believes that for the lay reader, mobile source emissions are easier to conceptualize and grasp while understanding that stationary sources are actually the larger source of emissions. It is easier to understand the action of starting a car and watching the fuel gauge fall than it is to think about every time a light switch is turned on and a room lit and the coal or natural gas that it took to make it happen. For this reason, the author focuses on mobile sources but admits that stationary source emissions play a significantly larger role in the U.S.’s yearly emissions.

42. Ch. 360, 69 Stat. 322 (1955) (codified at 42 U.S.C. §§ 7401–7642 (1958)).

43. See U.S. ENVTL. PROTECTION AGENCY, HISTORY OF THE CLEAN AIR ACT (2012), available at http://epa.gov/air/caa/caa_history.html.

44. Pub. L. No. 88-206, 77 Stat. 392 (1963) (codified throughout 42 U.S.C. (1964)); see U.S. ENVTL. PROTECTION AGENCY, HISTORY OF THE CLEAN AIR ACT, *supra* note 43; see also PERCIVAL ET AL., *supra* note 24, at 503.

45. See U.S. ENVTL. PROTECTION AGENCY, HISTORY OF THE CLEAN AIR ACT, *supra* note 43.

46. Pub. L. No. 91-190, 83 Stat. 852 (1970) (codified at 42 U.S.C. §§ 4321, 4331–4335, 4341–4347 (1976)).

47. U.S. ENVTL. PROTECTION AGENCY, HISTORY OF THE CLEAN AIR ACT, *supra* note 43.

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of 1970.⁴⁸ At last, there was an agency with the authority to regulate air pollution and a means by which to do it. Significant revisions to the C.A.A. were made in both 1977⁴⁹ and 1990,⁵⁰ but to this day there is still no comprehensive solution to greenhouse gas emissions regulation.⁵¹

A. *The Clean Air Act*

The basic framework of the C.A.A. is rather straightforward. Under the C.A.A., the E.P.A. is required to identify air pollutants that “in [the E.P.A. Administrator’s] judgment, cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare.”⁵² These pollutants are called *criteria pollutants* once they meet the above criteria, and the C.A.A. goes on to require that the E.P.A. set national ambient air quality standards⁵³ (“NAAQSs”) for these criteria pollutants.⁵⁴ To date, the E.P.A. has determined that six pollutants are criteria pollutants and set NAAQSs for them.⁵⁵

To those with a working knowledge of administrative law, it is readily apparent that the C.A.A. gives the E.P.A. a lot of leeway—and courts give the E.P.A. a lot of *Chevron*⁵⁶ deference because of the broad

48. Pub. L. No. 91-604, 84 Stat. 1676 (codified throughout 42 U.S.C. (1976)).

49. Clean Air Act Amendments of 1977, Pub. L. No. 95-95, Titles I–IV, 91 Stat. 685–796 (1977) (codified throughout 42 U.S.C. (1982)).

50. Clean Air Act Amendments of 1990, Pub. L. No. 101-549, 104 Stat. 2399 (1990) (codified at 42 U.S.C. §§ 7401–7671q (1994)).

51. It is true that the E.P.A. is slowly addressing the issue of greenhouse gas emissions through the Timing, Tailpipe, and Tailoring Rules as well as the regulations proposed in the fall of 2013, but these leave much to be desired. See discussion *infra* Part V.B.

52. 42 U.S.C. § 7408(a)(1)(A) (2006).

53. This, too, is a simplification. The Administrator may set either primary standards, secondary standards, or both. 42 U.S.C. § 7409 (2006). Primary standards are those necessary to protect public health. *Id.* By contrast, secondary standards are those requisite to protect the public welfare, such as providing protection to animals, crops, vegetation, and buildings. *Id.*

54. *Id.*

55. See U.S. ENVTL. PROTECTION AGENCY, WHAT ARE THE SIX COMMON AIR POLLUTANTS (2012), available at <http://www.epa.gov/airquality/urbanair/>. The six criteria pollutants that have been identified are: 1) ozone (O₃), which is poisonous to humans but is necessary in the stratosphere to protect humans from the harmful effects of ultraviolet radiation; 2) particulate matter (PM), a complex mixture of extremely small particles and liquid droplets; 3) carbon monoxide (CO), which is also poisonous to humans; 4) nitrogen oxides (NO_x), which are highly reactive gases that play a major role in the formation of ozone; 5) sulfur dioxide (SO₂), which reacts with water vapor in the atmosphere to produce sulfuric acid—the major source of acid rain; and 6) lead (Pb), which in high enough levels can cause lead poisoning in humans. For a full list of criteria pollutants and their corresponding NAAQSs, see 40 C.F.R. part 50 or go online to <http://www.epa.gov/air/criteria.html>.

56. See *Chevron, U.S.A., Inc. v. Natural Res. Def. Counsel, Inc.*, 476 U.S. 837, 843–45 (1984). There are three requirements for the courts to grant *Chevron* deference: a) the agency promulgating the regulation is an *expert* agency; b) the statutory framework in place contains an *ambiguity* that the expert agency must come up with an answer to; and c) the interpretation that

and simultaneously vague language contained in the C.A.A. and quoted in the paragraph above.⁵⁷ First, the C.A.A. leaves the designation of criteria pollutants to the “judgment” of the Administrator of the E.P.A.⁵⁸—provided, of course, that the Administrator grounds any determination in evidence that was presented on the record to the E.P.A.⁵⁹ Second, the C.A.A. provides that this designation be made for pollutants which “cause or contribute to air pollution.”⁶⁰ Third, the C.A.A. requires classification of pollutants that the E.P.A. Administrator feels “may reasonably be anticipated” to cause harm.⁶¹ Lastly, the E.P.A. Administrator must make the determination of whether the pollutant “endanger[s] public health or welfare.”⁶² Put very simply, the C.A.A. grants the E.P.A. a broad swath of discretion to regulate air pollutants through NAAQSs.

Once the E.P.A. determines which emittants are criteria pollutants, the E.P.A. must set NAAQSs for these chemicals.⁶³ When the NAAQSs have been set, states are given three years to develop state implementation plans (“SIPs”) to go about meeting the NAAQSs as promulgated by the E.P.A.⁶⁴ If states do not promulgate a SIP within three years, or if the E.P.A. finds that a SIP does not meet the requirements necessary to achieve the NAAQSs, the E.P.A. is given two years to prepare a federal implementation plan (“FIP”).⁶⁵ Also after NAAQSs have been set, geographic areas are classified as either being an attainment area—where criteria pollutants comply with the NAAQSs—or a non-attainment area—where criteria pollutants exceed the quantities as specified in the NAAQSs.⁶⁶

The C.A.A. calls for areas that are not in attainment to be brought into attainment “as expeditiously as practicable.”⁶⁷ The C.A.A. sets a hard-line standard that this should be accomplished within five years of

the agency made of the ambiguity is *reasonable*. If all of these requirements are met, courts will give agencies wide latitude in promulgating regulations.

57. See 42 U.S.C. § 7408 (2006).

58. See *id.*

59. The standard with which a reviewing court reviews this determination is dependent on whether the proceedings under which the determination or rulemaking occurred were formal or informal in nature. If the determination is made after a formal adjudication or rulemaking, the E.P.A. must be able to point to substantial evidence on the record. 5 U.S.C. § 706(e) (2006). If the determination is made after an informal hearing or adjudication, the E.P.A. faces an arbitrary and capricious standard on review. 5 U.S.C. § 706(a) (2006).

60. See 42 U.S.C. § 7408 (2006).

61. See *id.*

62. See *id.*

63. See 42 U.S.C. § 7409 (2006); see also discussion *supra* note 55.

64. See 42 U.S.C. § 7410 (2006).

65. See *id.*

66. See 42 U.S.C. § 7407 (2006).

67. 42 U.S.C. § 7502 (2006).

classification as a non-attainment area.⁶⁸ However, the C.A.A. allows the E.P.A. Administrator to grant exceptions for specific areas that give these areas up to ten years to be brought into attainment.⁶⁹ Under the C.A.A., the plan to bring the area into attainment must utilize all reasonably available control measures that are practicable and sets a standard of reasonably available control technology (“RACT”).⁷⁰ Since 1976, the E.P.A. has interpreted RACT to mean “the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility.”⁷¹

Within this regulatory framework, most of the existing sources of air pollution were effectively given a blanket exemption where geographic areas were determined to be in attainment, providing a substantial disincentive against updating existing facilities.⁷² While this may not have been Congress’s intention in writing the C.A.A., it has been the effective result in many ways.⁷³ New source review (“NSR”) and new source performance standards (“NSPS”) are triggered once some sort of modification is done to a facility, with routine maintenance exempted from review.⁷⁴ The definition of modification means a shift in the facility that leads to an increase in air pollution that is not negligible.⁷⁵ This has not only effectively grandfathered existing sources of air pollutions into new regulations, but it has also given the industry a disincentive against making any sort of modifications that could actually reduce their emissions of criteria pollutants, for fear that their modifications would subject them to permitting and harsher technological standards.⁷⁶

68. *See id.*

69. *See id.*

70. *See id.*

71. *Michigan v. Thomas*, 805 F.2d 176, 180 (6th Cir. 1986).

72. *See* BRANDON WU, U.S. PUB. INTEREST RESEARCH GRP., *LETHAL LEGACY: A COMPREHENSIVE LOOK AT AMERICA’S DIRTIEST POWER PLANTS* 10 (2003), available at http://www.csu.edu/cerc/documents/LethalLegacy_001.pdf.

73. *See* Liz Darling Edmondson, Note, *The Increased Emissions Test Under New Source Review: Regulatory Uncertainty Calls for an Amendment to the Clean Air Act*, 45 *BRANDEIS L.J.* 175, 176 (2006).

74. *See id.* at 177–80; *but see* *Env’tl. Def. v. Duke Energy Corp.*, 549 U.S. 561, 573–76 (2007) (holding that the E.P.A.’s definition of *modification* must measure an increase in the amount of any air pollutant increase).

75. *See* 42 U.S.C. 7412(5) (2006) (“The term ‘modification’ means any physical change in, or change in the method of operation of, a major source which increases the actual emissions of any hazardous air pollutant emitted by such source by more than a *de minimis* amount or which results in the emission of any hazardous air pollutant not previously emitted by more than a *de minimis* amount.”).

76. *See* WU, *supra* note 72. This is especially true where new innovation would greatly reduce the amount of one pollutant emitted but result in a new pollutant being emitted from the facility, which would trigger NSR and the NSPSs.

B. *Interpreting the Ambiguities of the Clean Air Act*

Where the E.P.A. has chosen to utilize the power granted to it by the C.A.A., it has faced a backlash from industries that would rather avoid regulation of their emissions. In many cases, industrial polluters have filed cases challenging the E.P.A.'s interpretation of different parts of the C.A.A.⁷⁷ For the most part, the E.P.A. has been able to withstand these challenges, and these successful litigations have strengthened the E.P.A.'s ability to regulate the emission of criteria pollutants under the C.A.A.⁷⁸ Even ultimately unsuccessful legal challenges, however, slow down the E.P.A.'s implementation of NAAQSs.

One of the key, landmark cases regarding the C.A.A. was *Lead Industries*, which stood as the leading authority on the C.A.A. for over twenty years.⁷⁹ Following the promulgation of new NAAQSs for lead, industrial emitters of lead challenged the new regulations in federal court, contending that the E.P.A. had not shown enough evidence that the new NAAQSs were necessary to protect public health and to prevent against serious injury to children.⁸⁰ The industrial challengers argued that the legislative history surrounding the C.A.A. showed that Congress intended to protect against harms to the public health, which are clear.⁸¹ However, the D.C. Circuit agreed with the E.P.A. that "requiring the E.P.A. to wait until it can conclusively demonstrate that a particular effect is adverse to health before it acts is inconsistent with both the [C.A.A.]'s precautionary orientation and the nature of the Administrator's statutory responsibilities."⁸² The *Lead Industries* Court went on to note that "[a]waiting certainty will often allow for only reactive, not preventative regulat[ory action]."⁸³

Addressing the same scope of discretion at bar in *Lead Industries*, the Supreme Court further defined the scope of the C.A.A. in *American Trucking*.⁸⁴ In *American Trucking*, industrial polluters were challenging

77. See, e.g., *Env'tl. Def. v. Duke Energy Corp.*, 549 U.S. at 573–76; *Alaska Dept. of Env'tl. Conservation v. E.P.A.*, 540 U.S. 461, 484–88 (2004) (holding that the E.P.A. can review state permitting procedures to make sure that the substance of the procedure is in accordance with the C.A.A.); *Whitman v. Am. Trucking Ass'n*, 531 U.S. 457, 464–71 (2001) (holding that the E.P.A. is forbidden from considering costs when regulating through the C.A.A.); *Lead Indus. Ass'n, Inc. v. E.P.A.*, 647 F.2d 1130, 1148–56 (D.C. Cir. 1980) (noting that "some uncertainty about the health effects of air pollution is inevitable").

78. See *Whitman v. Am. Trucking Ass'n*, 531 U.S. at 464–71; *Lead Indus. Ass'n, Inc. v. E.P.A.*, 647 F.2d at 1148–56.

79. See *id.*

80. See *id.* at 1142–43.

81. See *id.* at 1152.

82. *Id.* at 1155.

83. *Id.* at 1154 (quoting *Ethyl Corp. v. E.P.A.*, 541 F.2d 1, 25 (D.C. Cir. 1976)).

84. *Whitman v. Am. Trucking Ass'n*, 531 U.S. 457, 472–76 (2001).

the E.P.A.'s promulgation of NAAQSs for ozone emissions as not containing an intelligible principle to guide the E.P.A.⁸⁵ Here, the Supreme Court held that the C.A.A.

at a minimum requires that “[f]or a discrete set of pollutants and based on published air quality criteria that reflect the latest scientific knowledge, [the] E.P.A. must establish uniform national standards at a level that is requisite to protect public health from the adverse effects of the pollutant in the ambient air.”⁸⁶

Finding that the C.A.A. furnished the E.P.A. with much more of an intelligible principle than most other statutes that the Court had chosen to uphold,⁸⁷ the Court, per Justice Scalia, stated that the C.A.A. requires the “E.P.A. to set air quality standards at the level that is ‘requisite’ that is, not lower or higher than is necessary—to protect the public health with an adequate margin of safety.”⁸⁸ So, the bounds of the E.P.A.’s discretion to regulate criteria pollutants under the C.A.A. have been made *reasonably* clear by the courts.

Also in *American Trucking*, the Court made clear that the C.A.A. is explicit on one point: In formulating NAAQSs, the E.P.A. *is not to consider costs*.⁸⁹ Making this point unequivocally clear, the Court gave the E.P.A. its strongest weapon for future cases in which the E.P.A. decides to address criteria pollutants. Accordingly, when the E.P.A. decides to classify carbon dioxide and the other greenhouse gases as criteria pollutants, it will be barred from considering the costs associated with any NAAQSs that it sets, which would inevitably be into the hundreds of billions of dollars.⁹⁰ This endangerment finding was, in fact, made in 2009, following *Massachusetts v. E.P.A.*⁹¹

C. Massachusetts v. E.P.A.

The E.P.A.’s duties to regulate air pollutants under the C.A.A. were made clear in the landmark case of *Massachusetts v. E.P.A.*⁹² *Massachusetts* represents a paradigm shift in environmental law for a few different reasons. First, the Court, per Justice Stevens, held that the Commonwealth of Massachusetts had standing to petition for review of the

85. *See id.*

86. *Id.* at 473 (alteration in original).

87. The Supreme Court has only ever stricken down two statutes for violating the nondelegation doctrine. *See generally* *Schechter Poultry Corp. v. United States*, 295 U.S. 495 (1935); *Panama Refining v. Ryan*, 293 U.S. 388 (1935).

88. *Am. Trucking Ass’n*, 531 U.S. at 474–76.

89. *Id.* at 464–71.

90. *See supra* note 39 and accompanying text.

91. Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66496-01 (Dec. 15, 2009).

92. 549 U.S. 497, 531–32 (2007).

E.P.A.'s failure to regulate.⁹³ Second, the Court held that the C.A.A. vests the power of classification of criteria pollutants in the E.P.A.⁹⁴ Lastly, the *Massachusetts* Court held that the E.P.A. can avoid regulatory action *only* if it determines that the pollutant's emissions do not contribute to climate change or impact humans.⁹⁵

Massachusetts was groundbreaking because it was the first instance of a state suing the E.P.A. for failing to promulgate regulations pursuant to the C.A.A.⁹⁶ It is worth noting that the C.A.A. does have a provision that allows for citizen suits,⁹⁷ but, here, a state was challenging the E.P.A.'s actions—not a single citizen or group of citizens.⁹⁸ So long as a state can meet the requirements of standing—injury, causation, and a remedy—the state can challenge the E.P.A.'s action.⁹⁹

Next, the Court addressed the issue of whether the E.P.A. had the authority to regulate the emission of greenhouse gases under the C.A.A. Stating that a hardline rule would quickly render a statute granting authority to a regulatory agency obsolete, the Court reached the conclusion that greenhouse gases fit well within the C.A.A.'s definition of an air pollutant.¹⁰⁰ The E.P.A. had attempted to avoid regulation of greenhouse gas emissions, as these emissions are already regulated by fuel efficiency standards from the Department of Transportation, but the Court stated that this is simply the E.P.A.'s attempt “to shirk its environmental responsibilities.”¹⁰¹

Lastly, the Court had to address the issue of whether the E.P.A. was required to regulate greenhouse gas emissions under the C.A.A. When the E.P.A. is to make a finding of endangerment, the Court held, the C.A.A. *requires* the E.P.A. to issue regulations.¹⁰² Further, the Court found that the E.P.A. had refused to comply with the C.A.A. in light of clear evidence.¹⁰³ It is *not* enough for the E.P.A. to claim that uncertainty is too great, the Court concluded.¹⁰⁴ The Court then remanded *Massachusetts* back to the circuit court to make a determination of whether the E.P.A. must make an endangerment finding in regards to

93. *See id.* at 526.

94. *See id.* at 528–31.

95. *See id.* at 531–32.

96. *See id.* at 526.

97. *See* 42 U.S.C. § 7604 (2006).

98. *See* 549 U.S. at 526. However, as a collection of citizens, the Commonwealth of Massachusetts was suing under the citizen-suit provision.

99. *See id.* at 521–26.

100. *See id.* at 528–32.

101. *Id.* at 531–32.

102. *See id.* at 532–33.

103. *See id.*

104. *See id.* at 534–35.

greenhouse gas emissions.¹⁰⁵

This endangerment finding was finally made late in 2009.¹⁰⁶

III. THE SCIENCE BEHIND GREENHOUSE GAS EMISSIONS

Since the science behind greenhouse gas emissions is relatively straightforward and not in dispute,¹⁰⁷ it is worth a brief introduction for those readers not well-versed in the science behind the phenomena that this note seeks to address. Even if we do not yet know what the end result of greenhouse gas emissions will be,¹⁰⁸ we do know where the rising greenhouse gas levels are coming from, and the sheer magnitude of this increase is worth its own consideration. For this reason and to exhibit to the reader the compelling need for regulation in the face of uncertainty, the author hopes that the reader finds the following exhibition in large numbers worthwhile.

A. *The Combustion of Hydrocarbons Explained*

For the most part, fossil fuels¹⁰⁹ are composed of hydrocarbons.¹¹⁰ A hydrocarbon is a chemical structure that is entirely made up of carbon and hydrogen atoms.¹¹¹ Examples of hydrocarbons include methane, ethane, propane, butane, pentane, hexane, heptane, octane, nonane, and decane—the list goes on and on with the name of the fuel depending on the number of carbon atoms in the molecule and the arrangement of the bonds between the carbon atoms.¹¹² Why does any of this matter when advocating for the regulation of greenhouse gas emissions? Because until one understands the science of hydrocarbons and the fact that nearly every single fuel used by man is comprised of hydrocarbons, including *green* fuels such as corn-based ethanol and biodiesel, one does not truly understand what regulating energy-related greenhouse gas emissions entails—let alone regulating the levels of greenhouse gases present in the atmosphere.

The simplest hydrocarbon is methane, for which the chemical com-

105. *See id.*

106. Endangerment and Cause or Contribute Finding for Greenhouse Gases under Section 202(a) of the Clean Air Act, *supra* note 91.

107. *See* discussion *infra* Part IV.

108. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2013: THE PHYSICAL SCIENCE BASIS (2013), available at <http://www.ipcc.ch/report/ar5/wg/#.UmUyJWSgnlm>

109. Although carbon emissions are caused by more than just the combustion of hydrocarbons, hydrocarbons provide a good starting point to exhibit the complexity and the sheer magnitude of the increase in greenhouse gases that the Earth is facing.

110. *See* BROWN & FOOTE, *supra* note 4, at 51.

111. *See id.*

112. *See id.* at 53.

position is CH₄.¹¹³ Chemically, this means that methane is a single carbon atom with four hydrogen atoms covalently bonded to it.¹¹⁴ All hydrocarbons are important because the breaking of the covalent bond between a hydrogen atom and a carbon atom yields energy, such as the combustion of methane:¹¹⁵



As it combusts, the methane molecule (CH₄) reacts with atmospheric oxygen (O₂).¹¹⁶ In this combustion process, the methane and the atmospheric oxygen react, breaking the covalent bonds between the carbon atom and its hydrogen atoms.¹¹⁷ Breaking these bonds releases a great deal of energy, in this case in the form of heat.¹¹⁸ But along with releasing a great deal of heat, the reaction also produces two byproducts: One molecule of carbon dioxide (CO₂) and two molecules of water (H₂O), which is generally in the state of water vapor.¹¹⁹ It should be noted that this reaction occurs when there is the right ratio of methane molecules to atmospheric oxygen—a two-to-one ratio.¹²⁰

If the proportion of atmospheric oxygen to molecular methane is slightly different, however, the reaction is a little bit different.¹²¹



In this reaction, there is not the same ratio of atmospheric oxygen present, even though it looks very similar to the straightforward reaction exhibited above. But, it is very different. Rather than releasing carbon *dioxide* and water vapor, this reaction releases carbon *monoxide* (CO) and water vapor.¹²²

While carbon dioxide may be relatively harmless directly to human beings at current atmospheric levels,¹²³ carbon monoxide is not.¹²⁴

113. *See id.*

114. *See id.* A covalent bond is where an electron pair is shared between two atoms, and sharing this electron pair is what holds the atoms together as a molecule.

115. *See* Joo H. Lee & David L. Trimm, *Catalytic Combustion of Methane*, 42 FUEL PROCESSING TECH. 339, 339 (1995).

116. *See id.*

117. *See id.*

118. *See id.*

119. *See id.*

120. *See id.* As the authors call it “a gross simplification with the actual reaction mechanism involving very many free radical chain reactions.”

121. *See id.* at 340.

122. *See id.*

123. On the current micro scale, carbon dioxide is harmless to humans in comparison to other gases. However, as carbon dioxide levels continue to rise, it will cause harm to humans by other means. Additionally, if carbon dioxide levels rise enough, carbon dioxide *itself* can be poisonous to humans.

124. *See* J. Homer, *Carbon Monoxide: The Invisible Killer*, 118 J. ROY. SOC. HEALTH 141, 141–42 (1998).

Thousands of people are killed in the United States each year due to carbon monoxide poisoning, and thousands more suffer symptoms without ever knowing that they have been exposed to carbon monoxide.¹²⁵ The reason that these thousands never know that they have been exposed is because the symptoms of carbon monoxide poisoning—drowsiness, headaches, chest pains, dizziness, sickness, diarrhea, and stomach pains—are also caused by a variety of other ailments, such as influenza.¹²⁶ Accordingly, the E.P.A. decided to classify carbon monoxide as a criteria pollutant,¹²⁷ triggering the provision in the C.A.A. that requires the E.P.A. to promulgate national ambient air quality standards for carbon monoxide.¹²⁸ As the reader will see, carbon dioxide is the only byproduct of fossil fuel combustion other than water vapor that is not currently regulated on a widespread scale by the E.P.A.¹²⁹

B. Emissions Implications

This means that every time a person engages in an activity where hydrocarbons are consumed through combustion, such as starting or running a car, a certain amount of carbon dioxide and carbon monoxide is emitted into the air. In 2011, the E.P.A. put out some rough estimates of how much carbon dioxide and carbon monoxide were emitted per mile driven.¹³⁰ Using estimates of emissions per gallon of fuel of 8.887 kilograms per gallon and an average fuel economy of 21 miles per gallon, the E.P.A. was able to calculate that the average vehicle emits 423 grams of carbon dioxide per mile driven—nearly a pound of carbon dioxide per mile. The following are the E.P.A.'s more complete 2008 calculations:¹³¹

125. *See id.*

126. *See id.*

127. *See* U.S. ENVTL. PROTECTION AGENCY, CRITERIA POLLUTANTS (2013), available at <http://www.epa.gov/eogapti1/course422/ap5.html>.

128. *See* 40 C.F.R. § 50.8 (2012).

129. Again, in this controlled simplification. In the real world, all of the greenhouse gases and other products result. This is a product of leaving a controlled environment.

130. *See* U.S. ENVTL. PROTECTION AGENCY, QUESTIONS & ANSWERS: GREENHOUSE GAS EMISSIONS FROM A TYPICAL PASSENGER VEHICLE at 1 (2011), available at <http://www.epa.gov/otaq/climate/documents/420f11041.pdf>.

131. U.S. ENVTL. PROTECTION AGENCY, EMISSION FACTS: AVERAGE ANNUAL EMISSIONS AND FUEL CONSUMPTION FOR GASOLINE-FUELED PASSENGER CARS AND LIGHT TRUCKS at 3–5 (2008), available at <http://www.epa.gov/otaq/climate/documents/420f11041.pdf>. The calculations were based on an average in-use fuel economy of 24.1 miles per gallon for passenger cars and 17.3 miles per gallon for light trucks.

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TABLE 1: PASSENGER CAR EMISSIONS AND FUEL CONSUMPTION PER MILE¹³²

Component	Emission Rate and Fuel Consumption per Mile
Gasoline	0.04149 gallons
Carbon Monoxide	9.4 grams
Carbon Dioxide	368.4 grams
Nitrogen Oxides	0.693 grams

TABLE 2: LIGHT TRUCK EMISSIONS AND FUEL CONSUMPTION PER MILE¹³³

Component	Emission Rate and Fuel Consumption per Mile
Gasoline	0.0578 gallons
Carbon Monoxide	11.84 grams
Carbon Dioxide	513.5 grams
Nitrogen Oxides	0.95 grams

These numbers may appear to be very low, but keep in mind that this is just a per mile calculation. When factoring in the fact that the average passenger car is driven 12,000 miles per year and that the average light truck is driven 15,000 miles per year, these numbers become much larger:¹³⁴

TABLE 3: PASSENGER CAR EMISSIONS AND FUEL CONSUMPTION PER YEAR¹³⁵

Component	Total Annual Pollution Emitted and Fuel Consumed
Gasoline	497.93 gallons
Carbon Monoxide	248.46 pounds
Carbon Dioxide	9,737.44 pounds
Nitrogen Oxides	18.32 pounds

132. *Id.*

133. *Id.*

134. *Id.*

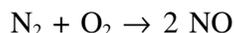
135. *Id.* at 2. To calculate, each number from Table 1 was multiplied by the average annual mileage driven of a passenger car, 12,000 miles. Additionally, the amount of carbon monoxide was converted into pounds using a conversion rate of 454 grams per pound.

TABLE 4: LIGHT TRUCK EMISSIONS AND FUEL CONSUMPTION PER YEAR¹³⁶

Component	Total Annual Pollution Emitted and Fuel Consumed
Gasoline	693.64 gallons
Carbon Monoxide	312.95 pounds
Carbon Dioxide	13,572.69 pounds
Nitrogen Oxides	25.11 pounds

Suddenly, as these numbers become much larger, it is readily apparent why the E.P.A. cannot just choose to ignore mobile source emissions.¹³⁷

If this has been easy to follow thus far, keep in mind that this has been simplified down to the most basic level. Additionally, there is more in the air reacting with hydrocarbons than pure atmospheric oxygen.¹³⁸ To be precise, the Earth's atmosphere is only about twenty percent atmospheric oxygen.¹³⁹ Of the remaining eighty percent, about seventy-eight percent of the air is atmospheric nitrogen (N₂).¹⁴⁰ At high enough temperatures, atmospheric nitrogen reacts with atmospheric oxygen to form nitrogen oxides (NO_x).¹⁴¹ Because the combustion of hydrocarbons emits heat, often enough to catalyze the reaction between atmospheric nitrogen and atmospheric oxygen, nitrogen oxides are a necessary byproduct of hydrocarbon combustion:¹⁴²



This is important because nitrogen oxide (NO) in the air reacts with organic chemicals in the air to produce nitrogen dioxide (NO₂) in a cycle where nitrogen dioxide is photolyzed by sunlight back to nitrogen oxide. In the process, an oxygen atom is freed from nitrogen dioxide, and this oxygen atom (O) reacts with atmospheric oxygen under sunlight to produce ozone (O₃). The sum of the reaction looks like this:

136. *Id.* To calculate, each number from Table 2 was multiplied by the average annual mileage driven of a light truck, 15,000 miles. Additionally, the amount of carbon monoxide was converted into pounds using a conversion rate of 454 grams per pound.

137. *See supra* note 24 and accompanying text.

138. *See* PETER V. HOBBS, INTRODUCTION TO ATMOSPHERIC CHEMISTRY 262 (2000).

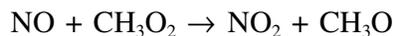
139. *Id.*

140. *Id.*

141. *See, e.g.,* Anna Ponzio et al., *Nitrogen Release During Thermochemical Conversion of Single Coal Pellets in Highly Preheated Mixtures of Oxygen and Nitrogen*, 88 FUEL 1127, 1127 (2009).

142. A simplified combustion of a hydrocarbon in the atmosphere is exhibited as follows:





Put simply, the combustion of hydrocarbons produces nitrogen oxides, which go on to produce ozone.

So, why does this matter? Because this note has just exhibited to the reader the fact that a simplified combustion of hydrocarbons produces six byproducts: 1) carbon monoxide; 2) carbon dioxide; 3) energy; 4) nitrogen oxides; 5) ozone; and 6) water vapor. Three of these six byproducts are regulated by the E.P.A. as criteria pollutants—carbon monoxide, nitrogen oxides, and ozone. Two of the other six byproducts are harmless in this state to humans—water vapor and energy. Then, there is carbon dioxide, which the author is advocating is one of the greenhouse gases that should be classified as a criteria pollutant, allowing the E.P.A. to regulate it through NAAQSs.

C. Atmospheric Implications

If carbon dioxide is the primary byproduct of the combustion of hydrocarbons,¹⁴³ all this carbon dioxide must be going somewhere. It is going directly into the atmosphere. Remember that the average passenger car in the United States emits about 9,750 pounds of carbon dioxide per year. As of September 24, 2013, the U.S. Census Bureau estimated that the population of the United States was 316,746,902 and that the population of the world was 7,113,390,885.¹⁴⁴ So, if everyone in the United States drove a passenger car the average mileage, as provided by the E.P.A., this would amount to 3.1 trillion pounds of carbon dioxide emitted per year, or 1.54 billion tons of carbon dioxide emitted per year.¹⁴⁵ If everyone in the world had a passenger car and drove it the same amount as the average American, these figures would be 69.4 trillion pounds, or 37.68 billion tons, of carbon dioxide emitted into the air per year—just from automobiles.¹⁴⁶ Luckily, not everyone in the world drives an automobile. Not so luckily, automobiles are just one source of carbon dioxide emissions.

143. This is not even to mention the fact that further hydrocarbons are consumed in the exploration of, procurement of, shipping of, and storage of hydrocarbons.

144. U.S. CENSUS BUREAU, U.S. & WORLD POPULATION CLOCKS (Sept. 24, 2013, 7:56 AM), <http://www.census.gov/popclock/>.

145. These numbers are attained simply by multiplying the U.S.'s population estimate with the average amount of carbon dioxide emitted by each passenger car in the U.S. each year.

146. These numbers are attained simply by multiplying the world's population estimate with the average amount of carbon dioxide emitted by each passenger car in the U.S. each year.

In 2011,¹⁴⁷ a combined 38.2 billion tons of carbon dioxide were pumped into the air by all of the world's nations, primarily from the burning of fossil fuels such as coal and oil-derived products.¹⁴⁸ All told, this means that more than 2.4 million pounds of carbon dioxide were released into the air each and every second.¹⁴⁹ What is more startling, though, is that the United States is no longer the world's largest emitter—China is.¹⁵⁰ With an estimated population of 1.344 billion people in 2011,¹⁵¹ China's population was 4.31 times the size of the United States's population in the same year.¹⁵² Yet, in 2011, China emitted 10 billion tons of carbon dioxide to the United States's 5.9 billion tons.¹⁵³ This means that while China had a population 4.31 times the size of the United States, the United States out-emitted China on a *per capita* basis by a 2.54-to-1 margin. This margin is even worse when it comes to the third-largest polluter, India, which had a population nearly four times the size of the United States in 2011,¹⁵⁴ but which the United States out-emitted on a *per capita* basis by a 9.40-to-1 margin.¹⁵⁵ All told, if the rest of the world emitted at the same rate as the United States, the worldwide emissions of carbon dioxide in 2011 would have totaled 133.78 trillion tons, or 267.56 quadrillion pounds.

These numbers are crucial for a few reasons. First, the molecular mass of carbon dioxide is 44.01 g/mol.¹⁵⁶ Keeping in mind that according to Avogadro's Constant, the amount of molecules in a mol, is 6.02×10^{23} ,¹⁵⁷ this means that a single molecule of carbon dioxide weighs 7.31

147. 2011 is used because it is the last year for which there is a full estimate of the emissions of both the United States and the world.

148. *Carbon Dioxide Emissions Rise to 2.4 Million Pounds Per Second*, CBSNEWS.COM (December 2, 2012, 4:35 PM), http://www.cbsnews.com/8301-205_162-57556678/carbon-dioxide-emissions-rise-to-2.4-million-pounds-per-second/.

149. *Id.*

150. *Id.*

151. THE WORLD BANK, DATA: CHINA (2012), available at <http://data.worldbank.org/country/china>.

152. THE WORLD BANK, DATA: UNITED STATES (2012), available at <http://data.worldbank.org/country/united-states>.

153. *Carbon Dioxide Emissions*, *supra* note 148.

154. See THE WORLD BANK, DATA: INDIA (2012), available at <http://data.worldbank.org/country/india>.

155. *Carbon Dioxide Emissions*, *supra* note 148.

156. Calculated by using the molar mass of carbon, 12.01 g/mol (as attained from any periodic table of elements), and the molar mass of oxygen, 16.00 g/mol (similarly attained from any periodic table of elements), then adding 12.01 g/mol (the weight of a carbon atom) to the quantity 16.00 g/mol (the weight of an oxygen atom) times two (the amount of oxygen atoms in a molecule of carbon dioxide).

157. R. O. Davies, *Avogadro's Number and Avogadro's Constant*, 8 PHYSICS EDUC. 275, 275 (1973).

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$\times 10^{-23}$ grams.¹⁵⁸ Accordingly, it takes 13.7 sextillion molecules, or 1.37×10^{22} molecules, of carbon dioxide to weigh just one gram.¹⁵⁹ This is the equivalent of 6.21 septillion molecules, or 6.21×10^{24} molecules, of carbon dioxide per pound.¹⁶⁰ Considering that the world emissions of carbon dioxide in 2011 were 38.2 billion tons,¹⁶¹ this means that 475 undecillion molecules, or 4.75×10^{38} molecules, of carbon dioxide were emitted into the atmosphere.¹⁶² To aid the reader in understanding, there were approximately

474,623,004,488,253,000,000,000,000,000,000,000,000

carbon dioxide molecules emitted into the air in 2011. Alternatively, there were approximately

1,300,336,998,597,950,000,000,000,000,000,000,000,000

carbon dioxide molecules emitted into the air *each day* in 2011. This calculates out to approximately

15,050,196,743,031,900,000,000,000,000,000,000

carbon dioxide molecules emitted into the air *each second* in 2011.¹⁶³ Even if scientists have not reached a definitive conclusion as to what effects the emission of carbon dioxide into the atmosphere may have long-term, the sheer size of these numbers should be awe-inspiring to our world leaders—and each of us as willing participants in this system—and bring us all pause. For this reason, the foregoing exercise in

158. The weight of one molecule of carbon dioxide is achieved by dividing molecular weight, calculated *supra* note 156, of 44.01 g/mol by Avogadro's Constant, 6.02×10^{23} .

159. This number was calculated by dividing the number one by 7.31×10^{-23} . A sextillion is the internationally recognized term for the number one followed by twenty-one zeroes. See WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY 1549 (3d ed., 1961), available at <http://www.merriam-webster.com/dictionary/sextillion>.

160. This number was calculated by multiplying the number 1.37×10^{22} by 454, or the number of grams in a pound. See Ralph Segmen, *Pounds or Grams?*, 76 SCI. NEWSL. 106, 106 (1959). A septillion is the internationally recognized term for the number one followed by twenty-four zeroes. See WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY, *supra* note 159, available at <http://www.merriam-webster.com/dictionary/septillion>.

161. *Carbon Dioxide Emissions*, *supra* note 148.

162. This number was calculated by multiplying the number 6.21×10^{24} by 2000, the amount of pounds in a ton, and multiplying that number by 38.2×10^9 . An undecillion is the internationally recognized term for the number one followed by thirty-six zeroes. See WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY, *supra* note 159, available at <http://www.merriam-webster.com/dictionary/undecillion>.

163. This works out to an average of one carbon dioxide molecule being emitted every 6.64×10^{-32} seconds. By comparison, the speed of light is 299,792,458 m/sec in a vacuum, meaning that it takes about 3.3 nanoseconds, or 3.3×10^{-9} seconds, for a beam of light to travel one meter. See J. Terrien, *International Agreement on the Value of the Velocity of Light*, 10 METROLOGIA 9, 9 (1974). In the same amount of time that it takes humans to emit one molecule of carbon dioxide into the atmosphere, a beam of light would travel only 19.92 yoctometers, or 19.92 septillionths of a meter, or 19.92×10^{-24} meters.

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very large numbers had a fundamental purpose in understanding what we are dealing with.

The second reason that the amount of carbon dioxide emitted each year is so crucial is because carbon dioxide comprises such a small portion of the atmosphere. As previously alluded to, the Earth's atmosphere is not composed primarily of atmospheric oxygen, it consists, in fact, mostly of atmospheric nitrogen.¹⁶⁴ In fact, over seventy-eight percent of the Earth's atmosphere is nitrogen, and nearly twenty-one percent of the Earth's atmosphere is oxygen.¹⁶⁵ Even if one is averse to numbers, it is easy to tell that this leaves *less than one percent* of the Earth's atmosphere to be composed of *every other* gaseous molecule. Carbon dioxide, in other words, is not the largest component of Earth's atmosphere.¹⁶⁶ Nor is it the second-largest component, nor the third-, nor the fourth-; no, carbon dioxide is the fifth-largest component of the Earth's atmosphere.¹⁶⁷ This is why the amount of carbon dioxide molecules that humans emit per second, per day, and per year is so crucial—because the relative percentage of the Earth's atmosphere that is carbon dioxide is very low to begin with.

Carbon dioxide currently comprises only 0.0395 percent of the Earth's atmosphere.¹⁶⁸ That means that out of every million gaseous molecules that you or a tree breathe in, you will breathe in 395 carbon dioxide molecules.¹⁶⁹ Remember the number of carbon dioxide molecules that were emitted *every second* in 2011.¹⁷⁰ These gargantuan numbers matter in the long run.

In 1927, carbon dioxide comprised just 0.03 percent of the Earth's atmosphere.¹⁷¹ In 2000, carbon dioxide comprised 0.0385 percent of the Earth's atmosphere.¹⁷² In August of 2013, carbon dioxide comprised 0.0395 percent of the Earth's atmosphere.¹⁷³ Regardless of whether one

164. HOBBS, *supra* note 138.

165. *Id.*

166. *Id.*

167. *Id.*

168. NAT'L ATMOSPHERIC AND OCEANIC ADMIN., EARTH SYS. RESEARCH LAB., TRENDS IN ATMOSPHERIC CARBON DIOXIDE: AUGUST 2013 (2013), *available at* <http://www.esrl.noaa.gov/gmd/ccgg/trends/>.

169. *See id.*

170. In case the reader forgot, that number was 15,050,196,743,031,900,000,000,000,000 carbon dioxide molecules per second.

171. W. J. Humphreys, *The Atmosphere: Origin and Composition*, 24 SCI. MONTHLY 214, 217 (1927). The author concedes that this may be misleading when the other numbers are presented to the ten-thousandth. However, as it would now round to .04 if rounded to the hundredth, this is still telling.

172. HOBBS, *supra* note 138.

173. NAT'L OCEANIC AND ADMINISTRATION ADMIN., TRENDS IN ATMOSPHERIC CARBON DIOXIDE: AUGUST 2013, *supra* note 168.

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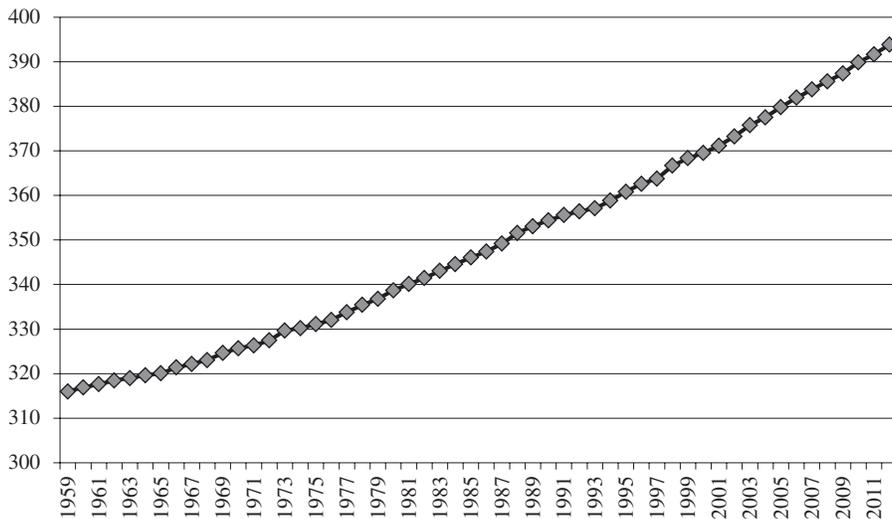
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believes that rising carbon dioxide levels will lead to global warming, no one can argue with the fact that the numbers are on a steady, upward trend.

Since 1959, the National Oceanic and Atmospheric Administration has been tracking carbon dioxide levels at a facility in Mauna Loa, Hawaii.¹⁷⁴ From a low of 315.97 parts per million (ppm) in 1959, the mean carbon dioxide concentrations in 2012 reached a high of 393.82 ppm.¹⁷⁵ While the increase differed from year to year, the numbers show a consistent upward trend, with the mean during the month of August 2013 reaching 395.15 ppm.¹⁷⁶ The following graph is a sampling of that data:

FIGURE 1: ANNUAL MEAN CONCENTRATION OF CARBON DIOXIDE IN PARTS PER MILLION¹⁷⁷



Also telling about this data is the fact that the concentration of carbon dioxide as an annual mean never falls. While the monthly mean rises and falls from month to month along with seasonal variations in global plant life and consumption of fossil fuels along the population centers of the northern hemisphere, the annual mean is consistently rising. Much like the Eyjafjallajökull example used above, Mauna Loa is thousands of miles from the nearest mainland cluster of a human, car-

174. NAT'L OCEANIC AND ATMOSPHERIC ADMIN., EARTH SYS. RESEARCH LAB., MAUNA LOA ANNUAL MEAN DATA (2013), available at ftp://ftp.cmdl.noaa.gov/ccg/co2/trends/co2_annmean_mlo.txt.

175. *Id.*

176. *Id.*

177. Based on the data of the National Oceanic and Atmospheric Administration. *See id.*

bon-emitting population, and, therefore, shows a fair sampling of ambient carbon dioxide levels. This allows Mauna Loa to be a good barometer of global ambient carbon dioxide levels.

There may not yet be certainty as to what the end result of rising global carbon emissions means, but the fact of the matter is simple: Atmospheric concentrations of carbon dioxide are rising at alarming rates. Even if we are able to mitigate the rising carbon levels before we hit the two-degree threshold,¹⁷⁸ we have already begun to fundamentally change the Earth.

IV. WHY GREENHOUSE GAS EMISSIONS REGULATIONS ARE NECESSARY NOW

There are many reasons that greenhouse gas emissions regulations are necessary as soon as possible. First, there are environmental reasons for doing so. Next, there are political rationales necessitating these regulations. Lastly, there are economic purposes for the regulation of greenhouse gas emissions. There are other bases for regulation, but the author will address these three in turn.

A. *Environmental Reasons for Regulation of Greenhouse Gas Emissions*

As hinted at throughout this note, there is overwhelming scientific consensus that *something* will occur as a result of increasing carbon levels and global climate change.¹⁷⁹ There is not, however, consensus as to what exact effect or effects the rising concentrations of carbon dioxide *will* have worldwide. For instance, a large majority of scientists predict that some combination of the following will occur: a) rising greenhouse gas levels will cause increasing temperatures;¹⁸⁰ b) global warming will lead to melting of the global deposits of ice, leading to rising tides;¹⁸¹ c) a link existing between rising water temperatures, ocean acidity levels, carbon dioxide levels, and what has become known

178. The two-degree threshold is where the average temperature would rise 2° Celcius. See *infra* note 237 and accompanying text.

179. This is in contrast to the general population of the United States, where just 44% of Americans believe that humans are causing global warming. *Environment Update*, Rasmussen Reports (Oct. 11, 2013), http://www.rasmussenreports.com/public_content/politics/current_events/environment_energy/environment_update.

180. See, e.g., Susan Solomon et al., *Irreversible Climate Change Due to Carbon Dioxide Emissions*, 106 PROC. NAT'L ACAD. SCI. 1704, 1704–09 (2009); Thomas G. Moore, *Global Warming: The Good, the Bad, the Ugly, and the Efficient*, 9 EUR. MOLECULAR BIOLOGY ORG. REP. S41, S41–S45 (2008); R. A. Warrick, *Carbon Dioxide, Climatic Change, and Agriculture*, 154 GEOGRAPHIC J. 221, 221–232 (1988).

181. See, e.g., Borroto, *supra* note 9, at 111–20; Paulo Antonio Pirazzoli, *Possible Defenses Against a Sea-Level Rise in the Venice Area, Italy*, 7 J. COASTAL RES. 231, 231–48 (1991); Richard Warrick & Graham Farmer, *The Greenhouse Effect, Climatic Change, and Rising Sea*

as coral bleaching;¹⁸² d) rising carbon levels will have an effect on global plant life;¹⁸³ and e) increasing greenhouse gas levels and ice melt will actually destroy the gulf stream, plunging the East Coast of the United States and Northern Europe into the next ice age.¹⁸⁴ Then, there is the dwindling minority of scientists and political leaders that acknowledge that greenhouse gas levels are rising, but are confident that either this will have no effect on the environment and it is not caused by humans or both.¹⁸⁵

1. GLOBAL WARMING

Scientists have been conducting research on the possible link between rising greenhouse gas levels and rising global temperatures for decades,¹⁸⁶ but it was not until 2006 that “global warming” was pushed to the forefront of social policy in the United States, when former Vice President Al Gore’s documentary, *An Inconvenient Truth*, took the nation by storm.¹⁸⁷ Following the release of *An Inconvenient Truth*, Al Gore won the 2007 Nobel Peace Prize,¹⁸⁸ and global warming was dis-

Level: Implications for Development, 15 *TRANSACTIONS INST. BRIT. GEOGRAPHERS* 5, 5–20 (1990).

182. See, e.g., K. R. N. Anthony et al., *Ocean Acidification Causes Bleaching and Productivity Loss in Coral Reef Builders*, 105 *PROC. NAT’L ACAD. SCI.* 17442, 17442–46 (2008); O. Hoegh-Guldberg et al., *Coral Reefs Under Rapid Climate Change and Ocean Acidification*, 318 *SCI.* 1737, 1737–42 (2007); Thomas J. Goreau & Raymond L. Hayes, *Coral Bleaching and Ocean “Hot Spots,”* 23 *ROYAL SWEDISH ACAD. SCI.* 176, 176–80 (1994); S.V. Smith & R. W. Buddemeier, *Global Change and Coral Reef Ecosystems*, 23 *ANN. REV. ECOLOGICAL SYS.* 89, 89–118 (1992).

183. See, e.g., Riitta Hyvönen et al., *The Likely Impact of Elevated CO₂, Nitrogen Deposition, Increased Temperature, and Management on Carbon Sequestration in Temperate and Boreal Forest Ecosystems: A Literature Review*, 173 *NEW PHYTOLOGIST* 463, 463–80 (2007); James W. Raich et al., *Temperature Influences Carbon Accumulation in Moist Tropical Forests*, 87 *ECOLOGY* 76, 76–87 (2006); Graeme M. J. Hall, *Mitigating an Organization’s Future Net Carbon Emissions by Native Forest Restoration*, 11 *ECOLOGICAL APPLICATIONS* 1622, 1622–33 (2001).

184. See, e.g., Suzanne Goldenberg, *Greenland Ice Sheet Melted at Unprecedented Rate During July*, *GUARDIAN* (July 24, 2012), <http://www.guardian.co.uk/environment/2012/jul/24/greenland-ice-sheet-thaw-nasa>; Suzanne Goldenberg, *Greenland Ice Sheet Faces ‘Tipping Point in 10 Years,’* *GUARDIAN* (August 10, 2010), <http://www.guardian.co.uk/environment/2010/aug/10/greenland-ice-sheet-tipping-point>; Thom Hartmann, *How Global Warming May Cause the Next Ice Age*, *COMMON DREAMS* (January 30, 2004), <http://www.commondreams.org/views/04/0130-11.htm>.

185. See, e.g., Dennis Byrne, *Sick and Tired of that Global Warming Whine*, *CHI. TRIB.* (July 10, 2012), http://articles.chicagotribune.com/2012-07-10/news/ct-oped-0710-byrne-20120710_1_global-warming-climate-change-intergovernmental-panel; Claude Allegre et al., *No Need to Panic About Global Warming*, *WALL ST. J.*, <http://online.wsj.com/article/SB10001424052970204301404577171531838421366.html> (last visited February 11, 2013).

186. See Warrick, *supra* note 180.

187. *AN INCONVENIENT TRUTH* (Lawrence Bender Productions 2006).

188. Gore, *U.N. Climate Panel Win Nobel Peace Prize*, *NBCNEWS.COM* (Oct. 12, 2007), http://www.nbcnews.com/id/21262661/ns/us_news-environment/t/gore-un-climate-panel-win-nobel-peace-prize/#.URiuwWeD18E.

cussed across the United States in earnest for the first time.¹⁸⁹ Although the debate over global warming had been raging for years among scientists and the European community,¹⁹⁰ the general population of the United States and the American media finally took an interest in the topic and it became part of the American lexicon.¹⁹¹

The science behind global warming is quite simple: Sunlight reaching the Earth's surface is converted to heat energy, which is then redistributed back upward into the atmosphere.¹⁹² Several gases that are found in the lowest level of the atmosphere, the troposphere, do not allow this heat energy—in the form of infrared radiation—to escape.¹⁹³ These gases are called *greenhouse gases* because their trapping of heat is similar to the panels on a greenhouse trapping heat inside.¹⁹⁴ Again, among the gases that have this effect are carbon dioxide, nitrous oxide, ozone, chlorofluorocarbons, and methane.¹⁹⁵ Together with clouds, these gases trap heat inside the Earth's atmosphere, not allowing the heat to dissipate back into space.¹⁹⁶ Those who believe in the existence of the *greenhouse effect*—this author included—believe that global temperatures will rise indefinitely, which could have substantial effects on the Earth.¹⁹⁷

To be sure, global warming has its critics.¹⁹⁸ These critics point to empirical data compiled by the E.P.A. and other bodies to exhibit there being a natural cycle of ebbs and flows in global temperatures.¹⁹⁹ The Earth's temperature averages about sixty degrees Fahrenheit.²⁰⁰ According to the National Research Council, the Earth's average surface tem-

189. See Robert J. Samuelson, *Global Warming's Real Inconvenient Truth*, WASH. POST (July 5, 2006), <http://www.washingtonpost.com/wp-dyn/content/article/2006/07/04/AR2006070400789.html>.

190. For instance, the United Nations held a conference in Kyoto in 1997, of which 192 nations were party to negotiations. UNITED NATIONS, FRAMEWORK CONVENTION ON CLIMATE CHANGE: STATUS OF RATIFICATION OF THE KYOTO PROTOCOL, http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php (last visited Sept. 24, 2013).

191. See generally Laura W. Johnston, *How An Inconvenient Truth Expanded the Climate Change Dialogue and Reignited an Ethical Purpose in the United States* (Apr. 3, 2013) (unpublished M.A. thesis, Georgetown University) (on file with Georgetown University), available at http://repository.library.georgetown.edu/bitstream/handle/10822/558371/Johnston_georgetown_0076M_12090.pdf?sequence=1.

192. See Borroto, *supra* note 9, at 112–13.

193. See *id.*

194. See *id.*

195. See *id.*

196. See *id.*

197. See *id.*

198. See Allegre, *supra* note 185.

199. See Manav Tanneeru, *Global Warming: A Natural Cycle or Human Result?*, CNN.COM (July 11, 2007), http://articles.cnn.com/2007-07-11/tech/globalwarming.overview_1_average-surface-temperature-warming-united-nations-intergovernmental-panel?_s=PM:TECH.

200. See *id.*

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perature has risen about one degree Fahrenheit over the last century.²⁰¹ According to the E.P.A., the Earth's temperatures were relatively constant from about 1880 to 1910, then rose until about 1945, cooled until about 1975, and have risen steadily since then.²⁰²

There is little dispute that the Earth's average temperature has risen over the last 150 years—since the birth of the industrial revolution.²⁰³ The crux of the dispute centers around whether this phenomenon is a natural occurrence or anthropogenic—i.e. caused by human actors.²⁰⁴

2. RISING TIDES

Whether or not the Earth's average temperature is increasing, the fact is that the Earth's supply of global ice mass has been decreasing since the end of the last ice age some 10,000 years ago.²⁰⁵ As this ice is converted through melting into its liquid state, it must go somewhere.²⁰⁶ Over the last century, the global mean sea level has risen an estimated four to ten inches.²⁰⁷ Mathematical models in the 1990s predicted that global sea levels may continue to rise an additional six inches to three feet over the course of the next century, meaning that low-lying coastal areas *may* be flooded by sea water.²⁰⁸ New mathematical models conducted by the National Oceanic and Atmospheric Administration at the end of 2012 pushed these estimates higher, to anywhere between eight inches and eight feet.²⁰⁹

As many areas along both the East and West Coasts of the United States are very low-lying and densely populated, these new models suggest that as many as eight million Americans may be at risk of being affected by flooding.²¹⁰ The great disparity between eight inches and eight feet comes from the uncertainty surrounding the amount of water

201. *See id.*

202. *See id.*

203. *See id.*

204. *See id.* Although the size of the chorus of those decrying the anthropogenic nature of global climate change has been steadily decreasing over the last decade, there are still those for which the current evidence is not enough to establish that man is the source of global climate change.

205. Jerry Bono, *In the End, Mother Nature Will Do what She Likes*, KENNEBEC J. (Feb. 10, 2013), http://www.kjonline.com/opinion/in-the-end-mother-naturewill-do-what-she-likes_2013-02-10.html.

206. Borroto, *supra* note 9, at 113–14. Of course, that is assuming that it is not sublimated directly into atmospheric oxygen.

207. *Id.* Although the information is presented in centimeters, the author has converted it to a standard unit of measurement to aid the reader.

208. *Id.* Again, the unit of measurement has been converted to a standard unit for the ease of the reader.

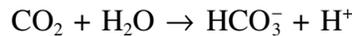
209. Wendy Koch, *NOAA Sees Sea Level Rise of Up to 6.6 Feet by 2100*, USA TODAY (Dec. 6, 2012), <http://www.usatoday.com/story/news/nation/2012/12/06/noaa-sea-level-rise/1750945/>.

210. *Id.*

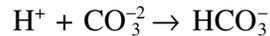
that could come from ice melts in Greenland and Antarctica.²¹¹ Still others have predicted that as much as a twenty-three foot rise in global sea levels could come from the ice masses of both Antarctica and Greenland melting.²¹²

3. OCEAN ACIDIFICATION

As atmospheric concentrations of carbon dioxide rise, so do oceanic concentrations of carbon dioxide.²¹³ The result is an increased saturation of carbon dioxide in the world's oceans.²¹⁴ But while rising atmospheric levels of carbon dioxide simply involve an increase in atmospheric carbon dioxide levels, rising oceanic levels of carbon dioxide lead to increased acidity.²¹⁵ As carbon dioxide dissolves into water, carbonic acid (HCO_3^-) is produced, as follows:²¹⁶



Along with producing a molecule of carbonic acid, this reaction leaves a highly reactive hydrogen proton, which tends to combine with a carbonate molecule (CO_3^{2-}) producing another molecule of carbonic acid, as exhibited by:²¹⁷



This is hugely important because it can lead to, among other things, a phenomenon known as coral bleaching.²¹⁸ When corals are stressed by changes in their environment, they expel the algae with which they have a symbiotic relationship, causing them to turn completely white.²¹⁹ Additionally, the primary structure of coral reefs is calcium carbonate (CaCO_3), which cannot be produced without adequate concentrations of carbonate.²²⁰ So, when increased acidification of the oceans occurs, coral reefs are affected in two ways—both by the increased acidity of the water and the decreased proportion of the water that is available as carbonate to the reef.²²¹

While a variety of factors can cause coral bleaching, three main, possible causes are suspected—water temperature, exposure to sunlight,

211. *Id.*

212. Goldenberg, *Greenland Ice Sheet Faces 'Tipping Point in 10 Years,' supra* note 184.

213. Hoegh-Guldberg, *supra* note 182, at 1737–38.

214. *Id.*

215. *See id.*

216. *Id.*

217. *Id.*

218. *Id.*

219. NAT'L OCEANIC AND ATMOSPHERIC ADMIN., NAT'L OCEAN SERV., WHAT IS CAUSING CORAL BLEACHING? (2013), available at http://oceanservice.noaa.gov/facts/coral_bleach.html.

220. *Id.*

221. *See id.*

and water acidity.²²² In 2005, the United States lost close to half of its Caribbean coral reefs due to a massive bleaching event.²²³ Satellite imagery exhibited that thermal stress in 2005 was greater than the combination of thermal stress on the region of the previous twenty years together.²²⁴ Warmer water temperatures, though, are not the sole cause of coral bleaching.²²⁵

Lastly, one of the major sureties of global climate change is the rising of global sea levels, which forces existing coral reefs further under water. As the reefs are forced to increasing depths, the amount of sunlight available to them decreases,²²⁶ causing the reefs more stress, which causes more coral bleaching.²²⁷ As coral reefs are adversely affected, the effects stretch up and down the food stream.²²⁸ So, what may seem to be a relatively isolated phenomenon could have major implications for all aquatic life.²²⁹

4. THE NEXT ICE AGE?

In the short term, if global warming does occur, this will mean that the Earth's stock of ice mass will be depleted.²³⁰ As this stock of ice mass is depleted, the (primarily) freshwater tied up in the global ice melt will be added to the Earth's oceans.²³¹ As a result, the salinity of the Earth's oceans will be reduced, causing fundamental changes to the circulation of water throughout them.²³² When this occurs, underwater currents such as the Gulf Stream may be slowed—or stopped altogether.²³³

Located at the top of the Gulf Stream is the massive country of Greenland.²³⁴ Composed primarily of ice, Greenland is slowly melting due to the Earth's rising temperatures.²³⁵ In recent years, Greenland's ice sheet has melted at unprecedented rates, with ninety-seven percent of the ice sheet showing signs of ice melt in July of 2012.²³⁶ Scientists have

222. *Id.*

223. *Id.*

224. *Id.*

225. *Id.*

226. Smith & Buddemeier, *supra* note 182, at 96–98.

227. NAT'L OCEANIC AND ATMOSPHERIC ADMIN., WHAT IS CAUSING CORAL BLEACHING?, *supra* note 219.

228. Smith & Buddemeier, *supra* note 182, at 94–96.

229. *Id.*

230. Hartmann, *supra* note 184.

231. *Id.*

232. *Id.*

233. *Id.*

234. *Id.*

235. *Id.*

236. Goldenberg, *Greenland Ice Sheet Melted at Unprecedented Rate During July*, *supra* note 184.

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gone so far as to predict that the entire ice mass of Greenland will disappear if temperatures rise as little as two degrees Celsius.²³⁷ If this occurs, not only could global sea levels rise up to twenty-three feet,²³⁸ but this massive amount of freshwater would also enter the Atlantic Ocean at the direct peak of the Gulf Stream.²³⁹

The Gulf Stream carries water that has been warmed in the Gulf of Mexico along the East Coast of the United States and Canada and across the Atlantic Ocean towards Ireland and the United Kingdom angling southward towards Africa.²⁴⁰ Effectively, the Gulf Stream is what keeps winters along the East Coast of the United States and Canada and Northern Europe relatively mild.²⁴¹ If the Gulf Stream were to be stopped, or even disrupted, it is possible that these regions could have a drastic shift in climates.²⁴²

According to a small, relatively fringe group of scientists, this massive ice melt could cause all of the areas currently warmed by the Gulf Stream to revert to the climate common at similar latitudes, such as Alaska, Siberia, and permafrost-locked portions of northern Canada.²⁴³

B. *Political Reasons for Regulating Greenhouse Gas Emissions*

Because air is a highly mobile substance, no single country's regulations of greenhouse gas emissions could reign in the steadily increasing growth of atmospheric greenhouse gas levels. This is best evidenced by the eruption of the Icelandic volcano Eyjafjallajökull in 2010, referenced above.²⁴⁴ Recall that when Eyjafjallajökull erupted, an ash cloud was spewed into the air, and this ash cloud wrought havoc over Europe for a week before dissipating.²⁴⁵ Over the course of that week, Europe's

237. Goldenberg, *Greenland Ice Sheet Faces 'Tipping Point in 10 Years,' supra* note 184. This "two degree scenario" is a worst-case scenario where mitigation of future increases in carbon levels cannot be avoided and we as a society have already passed the point of no return. It is worth noting that projections for the actual increase in temperature range from slightly less than two degrees Celsius to up to four degrees Celsius. See Howard Schneider, *World Bank Warns of "4-Degree" Threshold of Global Temperature Increase*, WASH. POST (Nov. 19, 2013), http://articles.washingtonpost.com/2012-11-19/business/35506100_1_celsius-climate-change-temperature.

238. Goldenberg, *Greenland Ice Sheet Faces 'Tipping Point in 10 Years,' supra* note 184.

239. Hartmann, *supra* note 184.

240. *Id.*

241. *Id.*

242. *Id.*

243. See *id.*; see also *Ice Age Beckons: Greenland Ice Sheet Melted at Unprecedented Rate During July*, SIGN OF THE TIMES (July 24, 2012, 1:40 PM), <http://www.sott.net/article/248668-Ice-Age-Beckons-Greenland-ice-sheet-melted-at-unprecedented-rate-during-July>. While this doomsday scenario is only being predicted by a small group of scientists, a similar idea was a box-office success in the 2004 film, *The Day After Tomorrow*. THE DAY AFTER TOMORROW (Lions Gate Entertainment 2004).

244. Erlanger & Ewing, *supra* note 30.

245. *Id.*

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airline industry experienced an economic loss estimated at \$1.7 billion.²⁴⁶

As Eyjafjallajökull's eruption exhibited, substances emitted into the air quickly dissipated from the area in which it entered the atmosphere to reach a steady volume in the entire atmosphere. Therefore, even if the United States—or another major emitter of greenhouse gases—was to stop emitting greenhouse gases for a year, the amount of greenhouse gases in the air would continue to rise, as the rest of the world would continue to emit billions of tons of greenhouse gases.²⁴⁷ So, no single country can act alone in promulgating regulations to reign in the emission of greenhouse gases; countries must work together to help stem the rising tide of global emissions with no end in sight.

In 1997, the United States was part of the United Nations Framework Convention on Climate Change which convened in Kyoto, Japan, and whose environmental treaty is best known as the Kyoto Protocol or as the Kyoto Accords.²⁴⁸ These protocols were ratified on December 11, 1997, and went into force in 2005.²⁴⁹ The United States signed on to the Kyoto Protocol under President Bill Clinton in November of 1998,²⁵⁰ but the United States Senate never was willing to ratify the treaty.²⁵¹ Because the United States was never truly committed to the Kyoto Protocol, which called for reductions of eight percent below 1990 emissions levels by the year 2012, the Protocol never gained any real footing outside of the European Union.²⁵²

Following the election of President Barack Obama and a seeming willingness by the United States to reengage in climate change discussions and negotiations, the 2009 United Nations Climate Change Conference was held in Copenhagen, Denmark.²⁵³ However, this conference was declared to be in “disarray” in December of 2009,²⁵⁴ and the confer-

246. INT'L AIR TRANSP. ASS'N, ECONOMIC BRIEFING: THE IMPACT OF EYJAFJALLAJÖKULL'S VOLCANIC ASH PLUME 3 (2010), available at <http://www.iata.org/whatwedo/Documents/economics/Volcanic-Ash-Plume-May2010.pdf>.

247. *Carbon Dioxide Emissions*, supra note 148.

248. Bryan Walsh, *The Kyoto Accords—and Hope—Are Expiring*, TIME (Nov. 8, 2011), <http://www.time.com/time/health/article/0,8599,2098887,00.html>.

249. UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, STATUS OF RATIFICATION OF THE KYOTO PROTOCOL (2013), available at http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php.

250. *Id.*

251. Eric Pianin, *U.S. Won't Have New Plan for Global Warming Talks*, WASH. POST, July 14, 2001, at A12.

252. Walsh, supra note 248.

253. *Id.*

254. John Vidal, *Copenhagen Climate Summit in Disarray After 'Danish Text' Leak*, GUARDIAN (Dec. 8, 2009), <http://www.guardian.co.uk/environment/2009/dec/08/copenhagen-climate-summit-disarray-danish-text>.

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ence would never truly recover. Although a Copenhagen Accord was established under which the United States and other nations agreed to drastically cut emissions, this deal was never approved, only “recognized” and, therefore, is not binding on any of the countries to the summit.²⁵⁵ Although Copenhagen marked an important step forward, showing that the conversation is not dead and that most other nations have agreed that there is a problem, the end result shows just how far away an international solution to this global crisis is. This has only been further confirmed by additional U.N. conferences since Copenhagen, such as Cancun and Doha.

Without a country with the financial means and the political wherewithal to take the lead on the next climate change negotiations, summits will continue to be held every couple of years where every member of the United Nations attends, but where no binding deal is put in place. At both the Kyoto summit and the Copenhagen summit, the world was looking for a major polluter to take the lead. For the United States, however, this leadership was meaningless, as the rest of the world knew that it was highly unlikely that the United States Senate would ratify any self-executing treaty that allowed outside influences to control the environmental regulations in the United States. If Congress or the E.P.A. is willing to take a step and establish meaningful regulations inside the United States, which could be bandied about abroad, there may be a new movement in support of an international agreement relating to air pollution. The United States is the largest *per capita* emitter of carbon dioxide and other greenhouse gases in the world,²⁵⁶ and the rest of the world, rightfully, will not agree to any sort of emissions standards that the largest polluter will not subject itself to.²⁵⁷ Until the United States does so, there simply is not enough incentive for any single country to attempt to take the lead in the international effort economically or politically.²⁵⁸

255. *Copenhagen Deal: Key Points*, BBC NEWS (Dec. 19, 2009), <http://news.bbc.co.uk/2/hi/science/nature/8422307.stm>.

256. *Carbon Dioxide Emissions*, *supra* note 148.

257. The problem is not solely one of a lack of leadership by any single nation. It also exhibits a public good problem that is susceptible to free riding. Even if the E.U. or the United States were to commit to stringent regulations to help reduce their own carbon emissions, there is no guarantee that the developing nations and growing economies of countries like Brazil, China, and India would do the same. The incentive would be greater for these countries to attempt to undercut the policies of lowering regulations to gain an economic advantage for their own economies and to boost exports. In a globally connected world, developed nations such as the United States reducing their demand for fossil fuels will actually lower the global prices, which will increase the demand in developing nations, pushing the price back into equilibrium and simply shifting the delivery point of the oil from the United States and the E.U. to developing nations.

258. This is also a struggle between developed nations, such as the United States and Europe, and developing nations, such as Brazil, China, and India.

C. *Economic Reasons for Greenhouse Gas Emissions Regulations*

Emissions amounts are intricately linked to a country's *per capita* gross domestic product.²⁵⁹ As one author put it, "as long as most of our energy comes from fossil fuels, economic growth will generally be linked to emissions growth."²⁶⁰ The fossil fuel market has become a global one, where the United States has to compete with other nations, such as Brazil, China, and India for the scarce supply of fossil fuels.²⁶¹ Because of this, the United States has great economic incentives to lessen its dependence on fossil fuels. Up until the last decade, if the United States or the European Union were able to reduce its demand for fossil fuels, this would lead to a surplus of international oil and cause the price to drop. With the continued growth of other developing nations, however, if there is a drop in demand from one country, another country will seize on the opportunity for slightly lower prices and more oil.²⁶²

If the United States were to promulgate new regulations targeting the emissions of greenhouse gases, these emissions could encourage technological innovation. Because the price of fossil fuels has been relatively low over the past century, industries in the United States have had little incentive to create new technologies or to improve the efficiency of existing standards.²⁶³ This is because there was little demand from the American consumer for them to do so.²⁶⁴ Until the price rises to a point where consumers begin to substitute other forms of energy generation or transportation for their current consumption of hydrocarbons, the United States will not retake the lead as a technological innovator in the field of energy policy and regulations.²⁶⁵ That is why the United States would do well to continue to incentivize alternatives to fossil fuels now—so that these innovations will be made before the price hits the tipping point.

The problem is that the demand for fossil fuels has been nearly inelastic, if not perfectly inelastic, for the better part of the last century.²⁶⁶ Elasticity is an economic term that reflects the response of

259. Walsh, *supra* note 248.

260. *Id.*

261. *See generally* FRIEDMAN, *supra* note 28. This is not even to mention that O.P.E.C. places artificial limits on the supply of oil in order to keep the price stable.

262. *See id.*

263. *See, e.g.*, R. Darryl Banks & George R. Heaton, Jr., *An Innovation-Driven Environmental Policy*, 12 *ISSUES SCI. & TECH.* 43, 44 (1995). There are, of course, exceptions to this general rule, such as the Corporate Average Fuel Economy (CAFE) standards that were initially enacted in the wake of the oil embargo of the early 1970s. However, even after this temporary spike in the price of fuel in the United States, the prices remained rather stable until the late 1990s and early 2000s.

264. *Id.*

265. *Id.*

266. *US Gasoline Demand Becomes More Inelastic*, *OIL DAILY*, Dec. 28, 2007, at 1.

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demand to the shifts in price of a given product.²⁶⁷ To be perfectly inelastic means that the demand for a given product will be constant, regardless of the price.²⁶⁸ When a good is perfectly inelastic, the demand curve on a standard supply-and-demand graph is a vertical line.²⁶⁹ In contrast, the demand curve for a perfectly elastic good is a horizontal line, where any upward change in prices will result in the complete loss of quantity demanded.²⁷⁰

The demand for carbon-laden fossil fuels in the United States has been nearly perfectly inelastic up to this point in our history.²⁷¹ To a large extent, this is because there is always going to be a demand for fuel for transportation and electricity for homes. But when the price of fossil fuels has been relatively inexpensive in the United States, there has been little incentive to develop a green alternative. But that is where strategic investment in our environment's future can come in can pay off.

The basic tenet of economic theory is the fact that all goods are scarce.²⁷² To a certain extent, the United States has not faced a genuine scarcity of fossil fuels in the past few decades.²⁷³ As other countries with populations much larger than the United States, such as China and India,²⁷⁴ increase their own economic development and demand for fossil fuels, the United States will be forced to pay higher and higher prices for the fossil fuels that it necessarily needs. However, if stringent regulations are put in place regulating the emissions of greenhouse gases, which force manufacturers, such as automobile manufacturers, to innovate and increase efficiency and electricity companies to reduce the emissions of electricity generation, the amount of fossil fuels demanded will be lessened. This will not only make the United States less dependent on fossil fuels, it will also protect future United States families from the uncertainties in fossil fuel prices that will occur as China and India's demand for fossil fuels grows.

The shift in demand of fossil fuels in Europe over the last decade shows that this truly can happen. From 2001 to 2011, Europe's daily

267. RICHARD H. LEFTWICH, *INTRODUCTION TO MICROECONOMICS* 62–68 (1970).

268. *Id.*

269. *Id.*

270. *Id.*

271. *US Gasoline Demand Becomes More Inelastic*, *supra* note 266.

272. Ian Byatt, *Ten Tenets: Politics and the Market Economy*, 5 *TEACHING BUS. & ECON.* 3, 3 (Autumn 2001).

273. David W. Chen et al., *Behind New York Gas Lines, Warnings and Crossed Fingers*, *N.Y. TIMES*, Nov. 9, 2012, at A1, <http://www.nytimes.com/2012/11/10/nyregion/in-new-york-gas-shortage-missed-opportunities-and-diverted-focus.html>.

274. See *WORLD BANK, DATA: CHINA*, *supra* note 151; *WORLD BANK, DATA: INDIA*, *supra* note 154.

consumption of oil *dropped* from over 16,000 barrels daily to less than 15,000 barrels daily.²⁷⁵ On the whole, Europe's share of world consumption of oil dropped from 21% to 17% in the same period.²⁷⁶ And the results were not just limited to oil consumption. During the same period, Europe's consumption of coal dropped from 22% of the world's consumption to less than 13%.²⁷⁷ All of this has happened while individual European nations have taken a stance towards promoting green forms of energy and incentivizing innovation.²⁷⁸ This has been coupled with stringent environmental regulations going into place.²⁷⁹

Balanced with environmental regulation and the rising prices of fossil fuels, economic incentivization would help fuel the continued growth of green energy in the United States, which would go further to reducing our addiction to foreign fossil fuels and our emissions into the atmosphere. Whether it is nuclear, solar, wind, or hydroelectricity, a host of low-greenhouse-gas-emitting options currently exist. As these alternatives are strategically incentivized, the U.S. will slowly move away from its consumption of fossil fuels and, hopefully, reduce the amount of greenhouse gases put into the air.²⁸⁰ But until these options come with a substantially lower cost than the current alternative, greenhouse gas emissions will continue to rise.²⁸¹

V. PROPOSED GREENHOUSE GAS EMISSIONS REGULATIONS

To this point, three major plans have emerged for the regulation of greenhouse gas emissions that the author thinks should be noted. The first is a cap-and-trade program.²⁸² The second is the continued regulation of greenhouse gas emissions through the regulation of the input of fossil fuels and the corresponding emissions.²⁸³ The third is a tax struc-

275. Slawomir Smiech & Monika Papiez, *Fossil Fuel Prices, Exchange Rate, and Stock Market: A Dynamic Causality Analysis on the European Market*, 118 *ECON. LETTERS* 199, 199 (2013).

276. *Id.*

277. *Id.*

278. *Europe's Dirty Secret: The Unwelcome Renaissance*, *ECONOMIST* (Jan. 5, 2013), <http://www.economist.com/news/briefing/21569039-europes-energy-policy-delivers-worst-all-possible-worlds-unwelcome-renaissance>.

279. *Id.* For example, the European Union has a strict directive going into force in 2016 in regards to coal-fired power plants. This directive will force the plants to update their facilities to reduce emissions or face huge fines.

280. Elizabeth Douglass, *First U.S. Nuclear Power Closures in 15 Years Signal Wider Industry Problems*, *GUARDIAN* (Sept. 24, 2013), <http://www.theguardian.com/environment/2013/sep/24/us-nuclear-power-closures>.

281. *Id.*

282. See generally Timothy J. Mulls & M. Rhead Enlon, *(If) Things Fall Apart: Searching for Optimal Regulatory Solutions to Combating Climate Change Under Title I of the Existing CAA if Congressional Action Fails*, 40 *ENVTL. L. REP. NEWS & ANALYSIS* 10864 (2010).

283. *Id.*

ture that would increase the price of fossil fuels, such as gasoline, in a way that would encourage the substitution of like goods, with the balance of increased tax revenues being channeled into the innovation investment programs.²⁸⁴

A. *Cap-and-Trade Systems*

Cap-and-trade systems are relatively straightforward. Although there are many different types of cap-and-trade systems, the basic premise of all of them is the same.²⁸⁵ The idea is that a country sets a maximum amount of emissions that it is comfortable with and then creates a system in which market economics leads the actual regulation.²⁸⁶ Although the country, through its regulator, sets the initial limit of pollutants, it allows the market to define which parts of the industry innovate and which parts of the industry pay to continue to pollute.²⁸⁷

In the United States, the E.P.A. would determine the maximum amount of greenhouse gases that could be emitted each year, i.e., the “cap.”²⁸⁸ Once this cap was established, vouchers—or credits—would be distributed between all of the different polluters.²⁸⁹ If a polluter emits less than they were allowed to emit through their vouchers, that polluter can bank the credits for future years or sell the credits to other polluters.²⁹⁰ This allows the market to establish the price of carbon credits.

From there, the E.P.A. could simply allow the market to regulate itself, or the E.P.A. could institute gradual decreases in the total number of vouchers available. If the E.P.A. instituted gradual decreases in the number of vouchers available, the system would eventually reduce the actual emission of greenhouse gas. Other proposed systems, though, would simply set an initial cap and then let the market drive itself.²⁹¹

In this way, a cap-and-trade system provides financial incentive to make investments to lessen pollution.²⁹² If the price of credits is relatively low, there will be little innovation to reduce regulation.²⁹³ If the price of credits rises and is mixed with looming decreases in the total number of credits, however, then suddenly the value of innovation

284. See, e.g., Dirk J. Wolfson & Carl C. Koopmans, *Regulatory Taxation of Fossil Fuels: Theory and Policy*, 19 *ECOLOGICAL ECON.* 55, 55–65 (1996).

285. Jean-Louis Chica, *Cap-and-Trade*, 21 *J. INT’L TAX.* 44, 44–54 (2010).

286. *Id.*

287. *Id.*

288. Rachel Cleetus, *Finding Common Ground in the Debate Between Carbon Tax and Cap-and-Trade Policies*, 67 *BULL. ATOMIC SCI.* 19, 20 (2011).

289. *Id.*

290. *Id.*

291. Amy Harder, *Cap and Trade Lives On*, *NAT’L J. DAILY*, Oct. 16, 2012.

292. *Id.* at 20–21.

293. *Id.*

increases.²⁹⁴ Additionally, the cost to continue to pollute becomes higher and higher.²⁹⁵ Even though cap-and-trade systems function as individual market economies, they are not perfect.

Of all the cap-and-trade systems proposed to this point, none have targeted the entire colossus that is greenhouse gas emissions. Most have included blanket exemptions for agriculture and for mobile sources.²⁹⁶ The fear is that requiring agricultural actors to limit their greenhouse gas emissions will increase food prices, adversely affecting the families that can least afford it.²⁹⁷ Similarly, the administration of a cap-and-trade system for mobile sources has implementation problems, as the E.P.A. may be required to collect vouchers from individuals as they fill their tanks with gas.²⁹⁸

B. *Piecemeal Regulation of Greenhouse Gas Emissions*

Another solution is to target greenhouse gas emissions through the regulation of the inputted fuel. This has become the preferred solution of the Obama Administration and his E.P.A. and has actually led to new rules.²⁹⁹ The idea is that if you reduce the amount of pollutants in fuel, you reduce the output of those emissions as that fuel is burned.³⁰⁰ However, as this note has attempted to lay out for the reader, the only way to cut greenhouse gas emissions is to actually reduce the consumption of fossil fuels.³⁰¹ In recent years, the E.P.A. has promulgated new rules that target some of the greenhouse gas emissions of fossil fuels while simultaneously imposing new efficiency regulations with regards to mobile sources.³⁰²

In the biggest initial step to regulate greenhouse gas emissions following *Massachusetts v. E.P.A.*, the Administrator of the E.P.A. issued an endangerment finding at the end of 2009.³⁰³ This finding brought the E.P.A. into compliance with the Court's holding in *Massachusetts v. E.P.A.*—that the E.P.A. must at least make a determination of whether

294. *Id.*

295. *Id.*

296. David Bennett, *Cap and Trade Politics*, PENTON INSIGHT, Jan. 22, 2010.

297. *Id.*

298. John Gallagher, *Truckers Pan Cap-and-Trade*, J. COMMERCE, June 10, 2009.

299. Dina Cappiello, *Tailpipe Pollution Rule: EPA to Unveil Proposal to Clean Up Gas, Automobile Emissions*, HUFFINGTON POST (March 28, 2013), http://www.huffingtonpost.com/2013/03/28/tailpipe-pollution-rule-epa_n_2976057.html.

300. *Id.*

301. See discussion *supra* Part III.

302. See, e.g., Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, *supra* note 20.

303. Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, *supra* note 91.

greenhouse gas emissions endanger society under the definition of the C.A.A.³⁰⁴ What the E.P.A. Administrator found was “that greenhouse gases in the atmosphere may reasonably be anticipated both to endanger public health and to endanger public welfare.”³⁰⁵ Further, the Administrator found that the mix of carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride endangered the public because of “the risks associated with changes in air quality, increases in temperatures, changes in extreme weather events, increases in food- and water-borne pathogens, and changes in aeroallergens.”³⁰⁶ Even with this endangerment finding, however, the E.P.A. has left much to be desired in regards to the regulation of these compounds—particularly carbon dioxide. This endangerment finding was upheld by the D.C. Circuit, and the Supreme Court of the United States denied *certiorari* with regards to that issue.³⁰⁷

Following the endangerment finding, the E.P.A. issued three particular final rules of interest. The first is the Timing Rule.³⁰⁸ The second is the Tailpipe Rule.³⁰⁹ The last is the Tailoring Rule.³¹⁰

The E.P.A. issued the Timing Rule in April of 2010. At the time of the Timing Rule’s promulgation, it was of little effect, however. This is because the Timing Rule clarified when an air pollutant “becomes ‘subject to regulation’ under the Clean Air Act.”³¹¹ The E.P.A. concluded that an air pollutant comes within the jurisdiction of the E.P.A. once a regulation requiring control of that pollutant goes into effect.³¹² For purposes of prevention of significant deterioration permitting under the C.A.A.,³¹³ therefore, stationary sources will be subject to regulation for greenhouse gas emissions when a specific regulation governing the same

304. *Massachusetts v. E.P.A.*, 549 U.S. 497, 531–32 (2007).

305. Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, *supra* note 91.

306. *Id.*

307. *Coal. for Responsible Regulation, Inc. v. E.P.A.*, 684 F.3d 102, 122–123 (D.C. Cir. 2012) (per curiam), *cert. granted in part and denied in part sub nom.*, *Chamber of Commerce v. E.P.A.*, 81 U.S.L.W. 3621 (U.S. Oct. 15, 2013) (No. 12-1272).

308. Reconsideration of Interpretation of Regulations That Determine Pollutants Covered by Clean Air Act Permitting Programs, *supra* note 19.

309. Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, *supra* note 20.

310. Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule, *supra* note 21.

311. *Coal. for Responsible Regulation, Inc.*, 684 F.3d at 115 (quoting Reconsideration of Interpretation of Regulations That Determine Pollutants Covered by Clean Air Act Permitting Programs, *supra* note 19).

312. Reconsideration of Interpretation of Regulations That Determine Pollutants Covered by Clean Air Act Permitting Programs, *supra* note 19.

313. P.S.D., as this standard is known, applies to new major sources or major modifications at existing sources for pollutants located in attainment areas. U.S. ENV’T’L PROT. AGENCY,

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goes into effect.³¹⁴ Without a specific regulation in place at the time, the Timing Rule created uncertainty until the Tailpipe Rule went into effect.³¹⁵

The Tailpipe Rule was issued by the E.P.A. in conjunction with the National Highway Traffic Safety Administration (N.H.T.S.A.) in May of 2010.³¹⁶ This rule was promulgated to regulate the emissions standards of mobile source emitters.³¹⁷ Noting that mobile sources emitted thirty-one percent of all U.S. greenhouse gas emissions,³¹⁸ the E.P.A. and the N.H.T.S.A. targeted the six greenhouse-related air pollutants identified in the 2009 endangerment finding.³¹⁹ By setting tailpipe goals as to how much of each pollutant can be emitted per mile, the E.P.A. and the N.H.T.S.A. amended fuel efficiency standards for automobiles.³²⁰ At the time that the Tailpipe Rule was initially promulgated, these fuel efficiency standards called for an average fuel economy of 35.5 miles per gallon by the model year 2016.³²¹

Finally, the E.P.A. completed its promulgation of the triumvirate of rules with the Tailoring Rule in June of 2010.³²² In response to the Timing Rule's application of the Tailpipe rule's regulation of greenhouse gas emissions, the Tailoring Rule exempted all but the largest stationary sources from regulation for the time being.³²³ The E.P.A., in announcing the rule, stated "that it was 'relieving overwhelming permitting burdens that would, in the absence of this rule, fall on permitting authorities and

PREVENTION OF SIGNIFICANT DETERIORATION (PSD) BASIC INFORMATION (2011), <http://www.epa.gov/NSR/psd.html>.

314. Reconsideration of Interpretation of Regulations That Determine Pollutants Covered by Clean Air Act Permitting Programs, *supra* note 19. R

315. *Coal. for Responsible Reg., Inc.*, 684 F.3d at 115.

316. Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, *supra* note 20. R

317. Dina Cappiello, *Tailpipe Pollution Rule: EPA to Unveil Proposal to Clean Up Gas, Automobile Emissions*, HUFFINGTON POST (Mar. 28, 2013), http://www.huffingtonpost.com/2013/03/28/tailpipe-pollution-rule-epa_n_2976057.html.

318. Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, *supra* note 20. R

319. Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, *supra* note 91. R

320. *New EPA Rules on Tailpipe Emissions Will Save Lives*, WASH. POST (Mar. 31, 2013), http://articles.washingtonpost.com/2013-03-31/opinions/38170903_1_the-epa-public-health-benefits-rule.

321. Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, *supra* note 20. R

322. Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule, *supra* note 21. R

323. *Id.*; see *Coal. for Responsible Reg., Inc. v. E.P.A.*, 684 F.3d 102, 115–16 (D.C. Cir. 2012) (per curiam).

sources.’³²⁴ In essence, the Tailoring Rule largely exempted stationary sources from the application of the Tailpipe Rule via the Timing Rule.³²⁵

Although the Timing, Tailpipe, and Tailoring Rules are the first major steps of the E.P.A. to attempt to regulate greenhouse gas emissions, the rules leave much to be desired. For instance, the rules do little to actually regulate stationary sources. Additionally, the rules fail to account for all of the mobile sources currently on the road, other than dealing with the regulation of other pollutants that can be removed from fossil fuels before they are sold on the market. The problem is that the only way to begin to limit greenhouse gas emissions by mobile sources is to actually decrease the demand for fossil fuels, which all of these rules fail to do in a meaningful way.

Two positives can be drawn from the E.P.A.’s promulgation of the Timing, Tailpipe, and Tailoring Rules. The first is that the E.P.A. has fully set its sights on regulating carbon dioxide and other greenhouse gas emissions. The second comes out of the litigation over the rules, in which the D.C. Circuit held that the Tailpipe Rule was neither arbitrary nor capricious and that the petitioners lacked standing to challenge the Timing and Tailoring Rules, as they were not actually in effect yet.³²⁶ Both of these signs point in the direction of allowing the E.P.A. to move forward with additional, more thorough regulations.³²⁷

324. *Id.* (quoting Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule, *supra* note 21).

325. Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule, *supra* note 21.

326. *Coal. for Responsible Regulation, Inc. v. E.P.A.*, 684 F.3d 102 (D.C. Cir. 2012) (per curiam), *cert. granted in part sub nom.*, *Chamber of Commerce v. E.P.A.*, 81 U.S.L.W. 3621 (U.S. Oct. 15, 2013) (No. 12-1272).

327. It is worth noting that as this note was going to print, the Supreme Court of the United States decided to grant *certiorari* in six consolidated cases on the very issue of this note. All six of these cases had been consolidated in the D.C. Circuit in *C.R.R.*, which was an amalgamation of ninety-four different cases. *See Coal. for Responsible Regulation, Inc. v. E.P.A.*, 684 F.3d 102 (D.C. Cir. 2012) (per curiam), *cert. granted in part sub nom.*, *Util. Air Regulatory Grp. v. E.P.A.*, 81 U.S.L.W. 3560 (U.S. Oct. 15, 2013) (No. 12-1146); *Coal. for Responsible Regulation, Inc. v. E.P.A.*, 684 F.3d 102 (D.C. Cir. 2012) (per curiam), *cert. granted in part sub nom.*, *Am. Chemistry Council v. E.P.A.*, 81 U.S.L.W. 3520 (U.S. Oct. 15, 2013) (No. 12-1148); *Coal. for Responsible Regulation, Inc. v. E.P.A.*, 684 F.3d 102 (D.C. Cir. 2012) (per curiam), *cert. granted in part sub nom.*, *Energy-Intensive Mfrs. v. E.P.A.*, 81 U.S.L.W. 3621 (U.S. Oct. 15, 2013) (No. 12-1254); *Coal. for Responsible Regulation, Inc. v. E.P.A.*, 684 F.3d 102 (D.C. Cir. 2012) (per curiam), *cert. granted in part sub nom.*, *Se. Legal Found. v. E.P.A.*, 81 U.S.L.W. 3621 (U.S. Oct. 15, 2013) (No. 12-1268); *Coal. for Responsible Regulation, Inc. v. E.P.A.*, 684 F.3d 102 (D.C. Cir. 2012) (per curiam), *cert. granted in part sub nom.*, *Texas v. E.P.A.*, 81 U.S.L.W. 3631 (U.S. Oct. 15, 2013) (No. 12-1269); *Coal. for Responsible Regulation, Inc. v. E.P.A.*, 684 F.3d 102 (D.C. Cir. 2012) (per curiam), *cert. granted in part sub nom.*, *Chamber of Commerce v. E.P.A.*, 81 U.S.L.W. 3621 (U.S. Oct. 15, 2013) (No. 12-1272). *Certiorari* was granted in all of these cases to determine “[w]hether [the E.P.A.] permissibly determined that its regulation of greenhouse gas emissions from new motor vehicles triggered permitting requirements under the [C.A.A.] for stationary sources that emit greenhouse gases.” The resulting case could prove to be just as

Simply put, the E.P.A. can effectively regulate the emission of greenhouse gases via a rule that deals with regulating the fossil fuels that go into both mobile and stationary sources, but only for new sources. For existing sources, however, different tactics have to be used.

C. Regulatory Taxation

A last major method of possibly regulating greenhouse gas emissions is through regulatory taxation. Regulatory taxation is a way to incentivize innovation.³²⁸ At its core, a regulatory tax is a tax that is imposed on something simply to regulate its use.³²⁹ From an economic perspective, a regulatory tax simply shifts the supply curve upward, increasing the price of the product and decreasing the amount of the product demanded. This makes it more expensive to continue to use the product and encourages the substitution of like goods.

Most proposals of regulatory taxation with regards to greenhouse gas emissions have centered around hugely increasing the fuel tax.³³⁰ The most recent proposal from the International Monetary Fund was to increase the fuel tax to \$1.40 per gallon.³³¹ At current prices, this would push the price of gasoline to \$5.00 per gallon.³³² This would be a substantial increase from the current federal gas tax, last raised in 1993, of 18.4 cents per gallon.³³³

The regulatory tax would do three things. First, the regulatory tax tests the price elasticity of demand for gasoline.³³⁴ If the price were to increase over one dollar per gallon from current prices, the demand for gasoline would likely fall substantially.³³⁵ This would reduce the amount of fuel being burned and reduce our current emissions of greenhouse gases. Next, the shift in demand from gasoline would have to correspond with an increase in demand for alternative fuels, higher fuel-efficiency vehicles, or public transportation. This would increase the incentive behind all of these, and foster more investment in the industries, which

groundbreaking as *Massachusetts* and could provide the basis through which the E.P.A. is able to set up a national framework regulating greenhouse gas emissions. Or, this case could just as easily set the E.P.A. and environmentalists back in their quest to stem the rising tide of greenhouse gas emissions. Only time—and the Supreme Court—will tell.

328. See Wolfson & Koopmans, *supra* note 284, at 55.

329. *Id.* at 55–65.

330. See, e.g., Gregg Laskowski, *The IMF Wants How Big a Gas Tax Hike?*, U.S. NEWS (Apr. 10, 2013), <http://www.usnews.com/opinion/blogs/on-energy/2013/04/10/imf-bites-the-hand-that-feeds-it>.

331. *Id.*

332. *Id.*

333. *Id.*

334. See Wolfson & Koopmans, *supra* note 284, at 55–65.

335. This is because the increase in cost would shift the supply curve of gasoline up in such a way that it would actually alter the price elasticity of demand of gasoline, encouraging substitutes.

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would lead to more innovation, lower price, and more price competition with conventional fuel. Lastly, the regulatory tax would raise a great deal of money, which could then be funneled back into investments in green energy.³³⁶

The problem with a regulatory tax such as this is that it would disproportionately affect the poor in the United States.³³⁷ While the wealthy would be able to afford to pay for the increased tax on gasoline, the poor would not. The poor also would not be able to afford to buy a more fuel-efficient vehicle.³³⁸ This is a large reason why the federal gas tax has remained constant since 1993.

VI. A COMMON-SENSE SOLUTION TO GREENHOUSE GAS EMISSIONS³³⁹

With a whole host of scientists concluding that greenhouse gas emissions may prove to be a danger to humans, the E.P.A. finally made an endangerment finding on greenhouse gas emissions.³⁴⁰ Following the Supreme Court's holding in *Massachusetts v. E.P.A.*,³⁴¹ the D.C. Circuit had little trouble upholding the finding of endangerment.³⁴² But this is only the first step in fully regulating greenhouse gas emissions.

Now that the E.P.A. has made an endangerment finding with regards to carbon dioxide and other greenhouse gases, it can classify them as criteria pollutants under the C.A.A. Once the E.P.A. has classified each greenhouse gas as a criteria pollutant, the E.P.A. could simply set NAAQSs for that greenhouse gas. Once these NAAQSs had been established, the E.P.A. could rely on the cooperative federalism of the states to implement the specifics that make sense for each state.

Furthermore, deferring implementation to the states would allow for a solution in regards to mobile source regulations. States would be better able to factor mobile sources into their SIPs than the E.P.A. can in any sort of national plan. What may be a problem for California may not necessarily be a problem for Alaska. These differences in the major industries of states, along with the different lifestyles enjoyed by

336. Laskowski, *supra* note 330.

337. *Id.*

338. *Id.*

339. As this note was going to print, the Supreme Court of the United States agreed to hear six challenges to the E.P.A.'s ability to do just this. See *supra* note 327. In these cases, the Court will determine whether the E.P.A. has the power to do this at all under the C.A.A.

340. Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, *supra* note 91.

341. 549 U.S. 497 (2007).

342. *Coal. for Responsible Regulation, Inc. v. E.P.A.*, 684 F.3d 102 (D.C. Cir. 2012) (per curiam), *cert. granted in part and denied in part sub nom.*, *Chamber of Commerce v. E.P.A.*, 81 U.S.L.W. 3621 (U.S. Oct. 15, 2013) (No. 12-1272) (denying *certiorari* on the issue of endangerment finding).

residents would be best addressed by letting the states make decisions inside a larger national framework established by the E.P.A.

A national framework is necessary, however, to ensure that the long-term goals are met. Even if one state is completely in attainment, that does not mean that emissions from a neighboring state—or neighboring country—could not push it in to non-attainment status. But with concerns over the feasibility of a comprehensive cap-and-trade system, there are few full-scale options left to the E.P.A. Regulation of greenhouse gas emissions through the C.A.A. is one of them, and the author believes that it is the best.

In setting the NAAQSs for greenhouse gases, the E.P.A. would face a choice: Should it set the NAAQSs high enough that drastic cuts in greenhouse gas emissions would not be necessary at this time, or should the E.P.A. set the NAAQSs low enough that the world community would see this as a step by the E.P.A. in the right direction? Easy implementation would go a long way to making the plan sustainable over the long-term nationwide. However, a harder plan domestically could help spur international development of a more comprehensive solution.

In his 2013 State of the Union Address, President Obama made it clear that if Congress failed to act, he would take steps through executive power to regulate greenhouse gas emissions.³⁴³ Classifying each greenhouse gas as a criteria pollutant and subjecting it to NAAQSs via the C.A.A. could all be done under current law without having to consult Congress. And with the E.P.A. having already made the endangerment finding and the D.C. Circuit having said that it passes the evidentiary standard of review,³⁴⁴ all signs point to the fact that this plan would succeed and withstand the scrutiny of the courts.

The classification of each greenhouse gas as a criteria pollutant is not the only solution to the problem, however. The recent steps by the E.P.A. with the Timing, Tailpipe, and Tailoring Rules show progress.³⁴⁵ One of the major holes with the Timing, Tailpipe, and Tailoring Rules is that the E.P.A. failed to address stationary sources. On September 20, 2013, however, the E.P.A. proposed a new rule that would regulate new stationary sources.³⁴⁶ Until the E.P.A. receives comments and finalizes the rule, it is too early to judge the substance of the proposal. That being

343. Patrick Rucker & Deborah Zabarenko, *Obama Gives Congress a Climate Change Ultimatum*, REUTERS (Feb. 13, 2013), <http://www.reuters.com/article/2013/02/13/us-obama-speech-climate-idUSBRE91C09T20130213>.

344. *Coal. for Responsible Reg., Inc. v. E.P.A.*, 684 F.3d 102 (D.C. Cir. 2012) (per curiam), cert. granted in part and denied in part sub nom., *Chamber of Commerce v. E.P.A.*, 81 U.S.L.W. 3621 (U.S. Oct. 15, 2013) (No. 12-1272).

345. *New EPA Rules on Tailpipe Emissions Will Save Lives*, supra note 320.

346. *Wendy Koch*, supra note 22.

said, the proposal fails to address existing stationary sources in their entirety—a hole which President Obama has directed the agency to plug with regulations by June of 2014 in hopes that these regulations will be able to go into effect by 2015.³⁴⁷

The C.A.A. provides a sensible vehicle through which to establish a framework for regulating greenhouse gas emissions. Whether it is through a cooperative federalism approach or national rules and standards, this problem can be addressed in the United States. Although a cooperative federalism approach would lead to more flexible rules that may prove more successful, advocates of regulation are happy to see an attempt at national standards for the first time.

VII. CONCLUSION

In conclusion, rising greenhouse gas levels may or may not bring about the end of humanity. But this high degree of uncertainty does not mean that we should sit idly by and do nothing. If anything, this level of uncertainty means that we, as a society, should do everything in our power to stem the rising tide of greenhouse gas emissions before it is too late. The C.A.A. provides a sensible vehicle through which we can do that, if only we can muster the strength to begin to solve the problem in earnest.³⁴⁸ Now, we must take the steps to stem this rising tide before it is too late.

347. *Id.*

348. Again, see *supra* note 327.