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Climate Change, Presidential Power, and Leadership: "We Can't Wait"

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A stylized world map in shades of blue and white, overlaid on a grid of latitude and longitude lines. The map is centered on the Atlantic Ocean.

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CLIMATE CHANGE,
PRESIDENTIAL POWER,
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*Chris Wold**

The United States now has a climate change policy focused on reducing carbon dioxide and other greenhouse gases (GHGs). Most of this policy has been generated by the Obama Administration through executive action, primarily within the Environmental Protection Agency. To meet U.S. pledges to reduce GHG emissions by 17% by 2020 and 83% by 2050, President Obama must do more because it is clear that Congress will not address climate change. As described in this Article, there is much more the president can do. Using his treaty-making authority, he can take a more positive, constructive approach to reducing GHG emissions in the climate change negotiations. He also has a number of tools available within the World Trade Organization for encouraging fuel efficiency, disseminating technologies that would mitigate GHG emissions, and eliminating fossil fuel subsidies. Domestically, he can direct agencies to impose higher standards on existing sources of GHG emissions rather focusing solely on new and modified sources. He can also do much more to reduce emissions of powerful but short-lived climate forcers, such as methane and black carbon. For example, 99% of black carbon emissions could be eliminated from existing trucks by requiring the use of regenerative filters. Lastly, the president could redirect funding to climate prizes that reward innovation in developing transformative technologies to reduce GHG emissions. In this political climate, and with climate science pointing to ever greater climate impacts, President Obama must use the presidency to act. We can't wait.

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I. INTRODUCTION

In 2007, then-Senator Barack Obama wrote, “As the world’s largest producer of greenhouse gases, America has the responsibility to lead.”¹ As President, he has led. At the domestic level, working primarily through the Environmental Protection Agency, President Obama has increased fuel economy standards,² imposed new limits on

1. Barack Obama, *Renewing American Leadership*, FOREIGN AFF., July–Aug. 2007, at 13.

2. Most recently, the Environmental Protection Agency promulgated regulations to increase fuel efficiency of model year 2017 to 2025 light duty vehicles to 54.5 miles per gallon. 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards, 77 Fed. Reg. 62,624, 62,627 (Oct. 15, 2012).

greenhouse gas emissions from “major emitting facilities,”³ and imposed limits on emissions relating to the development of oil and gas,⁴ among many other things.⁵ As he has said, he must use his executive power because “We Can’t Wait” for Congress to act on climate change.⁶

Nonetheless, he must do more. President Obama has pledged to the international community that the United States will reduce its greenhouse gases by 17% of 2005 levels by 2020 and by 83% by 2050.⁷

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3. Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule, 75 Fed. Reg. 31,514, 31,6547 (June 3, 2010).
 4. Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews, 77 Fed. Reg. 49490 (Aug. 16, 2012).
 5. See *infra* Section III.
 6. President Obama has adopted a “We Can’t Wait” initiative as a means to bypass the inaction of Congress on a range of issues, including climate change. See *We Can’t Wait*, THE WHITE HOUSE, <http://www.whitehouse.gov/economy/jobs/we-cant-wait> (last visited Dec. 20, 2012) (“President Obama is not letting congressional gridlock slow our economic growth.”). See also Charlie Savage, *Shift on Executive Power Lets Obama Bypass Rivals*, N.Y. TIMES, Apr. 23, 2012, at A1 (describing the ways in which President Obama has implemented his “We Can’t Wait” initiative).
 7. In the Copenhagen Accord, the United States first pledged to reduce its GHG emissions “[i]n the range of 17 per cent . . . in conformity with anticipated United States energy and climate legislation, recognizing that the final target will be reported to the secretariat in light of enacted legislation.” Copenhagen Accord, Decision 2/CP.15, Appendix I, U.N. Doc. FCCC/CP/2009/11/Add.1 (Mar. 30, 2010). In a footnote in an appendix, the pledge continued: “The pathway set forth in pending legislation would entail a 30% reduction in 2025 and a 42% reduction in 2030, in line with the goal to reduce emissions 83% by 2050. *Id.* ¶ 26. The United States affirmed its pledge the following year in the Cancun Agreements. See UN Convention on Climate Change (UNFCCC), The Cancun Agreements: Outcome of the Work of the Ad Hoc Working Group on Long-term Cooperative Action Under the Convention Decision, Decision 1/CP.16, U.N. Doc. FCCC/CP/2010/7/Add.1 (Mar. 15, 2011). The actual pledge is found in Compilation of Economy-wide Emission Reduction Targets to Be Implemented by Parties Included in Annex I to the Convention, U.N. Doc. FCCC/SB/2011/INF.1/Rev.1 (June 7, 2011) [hereinafter *Compilation of Economy-wide Emission Reduction Targets*]:

The United States communicated a target in the range of a 17 per cent emission reduction by 2020 compared with 2005 levels, in conformity with anticipated United States energy and climate legislation, recognizing that the final target will be reported to the secretariat in the light of the enacted legislation. In addition, the pathway set forth in pending legislation would entail a 30 per cent emission reduction by 2025 and a 42 per cent emission reduction by 2030, in line with the goal to reduce emissions by

The President has also set a goal of ensuring that “[b]y 2035 we will generate 80 percent of our electricity from a diverse set of clean energy sources—including renewable energy sources like wind, solar, biomass, and hydropower; nuclear power; efficient natural gas; and clean coal.”⁸ None of his actions come close to meeting these goals.

Moreover, he must do more to help the international community reach its goal of keeping average global temperatures from increasing 2°C above pre-industrial levels.⁹ Many scientists argue that the 2°C goal can be met, and the worst impacts of climate change avoided, if we keep carbon dioxide concentrations below 350 parts per million (ppm).¹⁰ As of July 2012, atmospheric concentrations of carbon dioxide exceeded 394 ppm.¹¹ The United States is by far the largest historic contributor to these high levels of atmospheric carbon dioxide, having contributed 28.52% of carbon dioxide from energy.¹² As such, the United States must do much more to ensure that the world’s largest historic emitter of greenhouse gases fulfills its moral and perhaps legal obligation to reduce greenhouse gases before we reach climate change tipping points beyond which climate change will be irreversible for millennia to come.

83 per cent by 2050. The submission of the target by the United States was made on the assumption that other Annex I Parties, as well as more advanced non-Annex I Parties, would, by 31 January 2010, associate with the Copenhagen Accord and submit mitigation actions for compilation into an information document in accordance with paragraph 4 or 5 of the Accord, as the case may be.

Id. ¶ 26.

8. THE WHITE HOUSE, BLUEPRINT FOR A SECURE ENERGY FUTURE 6–7 (Mar. 30, 2011) [hereinafter BLUEPRINT FOR A SECURE ENERGY FUTURE], available at http://www.whitehouse.gov/sites/default/files/blueprint_secure_energy_future.pdf.
9. UNFCCC, Decision 2/CP.17, Outcome of the Work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention, § II(A), U.N. Doc. FCCC/CP/2011/9/Add.1 (Mar. 15, 2012).
10. *See Is It Too Late to Avoid the Worst Impacts of Climate Change?*, SCI. AM. (Aug. 19, 2012), <http://www.scientificamerican.com/article.cfm?id=reducing-atmospheric-co2> (“Prior to 2007 scientists weren’t sure what emissions reduction goal to shoot for, but new evidence led researchers to reach consensus on 350 ppm if we wished to have a planet, in the words of NASA climatologist James Hansen, ‘similar to the one on which civilization developed and to which life on earth is adapted.’”).
11. *See Trends in Atmospheric Carbon Dioxide*, EARTH SYS. RES. LAB., <http://www.esrl.noaa.gov/gmd/ccgg/trends/> (last visited Dec. 20, 2012).
12. *See Climate Analysis Indicators Tool (CAIT)*, WORLD RESOURCES INST., <http://www.wri.org/project/cait/> (last updated May 2012).

And indeed, President Obama can do much more. As described below, the president can use his foreign affairs power to take a more positive role on the international stage, whether that stage is the climate change negotiations, the negotiations concerning other international treaties, or within the World Trade Organization. He can also do more with his executive power, not only by increasing existing standards but also by applying them to existing sources of greenhouse gases, not just new sources. Further, President Obama has so far failed to take advantage of strategies to mitigate emissions of short-term climate forcers such as black carbon that could provide significant climate benefits. Lastly, the approaches adopted so far have not pushed regulated entities or others to develop the transformative technologies that will be needed to deliver sufficient climate change benefits to avert the environmental and economic crisis that lies ahead if we fail to take more aggressive action.

Section II of this article summarizes the climate change challenges facing humanity. Section III reviews the major climate-related actions supported and adopted by President Obama. Section IV describes how these actions fall short of what is needed and the additional steps that the President can take. Section V concludes that, while congressional action is preferable to presidential action, the President has many more climate change mitigation opportunities available to him. His failure to pursue them will have grave consequences for the United States and the world.

II. THE CHALLENGE AHEAD

Scientists estimate that the atmospheric concentration of carbon dioxide (CO₂) prior to the industrial revolution was 280 ppm.¹³ In its last report, the Intergovernmental Panel on Climate Change (IPCC) reported that the atmospheric concentration of CO₂ had reached 379 ppm in 2005.¹⁴ As of July 2012, the atmospheric concentration of CO₂ had topped 394 ppm.¹⁵ When all six greenhouse gases (GHGs) covered by the Kyoto Protocol are added to the mix, concentrations have exceeded 439 ppm CO₂ equivalent (CO₂eq) since 2009.¹⁶

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13. See *Causes of Climate Change*, EPA, <http://www.epa.gov/climatechange/science/causes.html> (last updated June 28, 2012).
 14. Richard B. Alley et al., *Summary for Policymakers*, in CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS 2 (Susan Solomon et al. eds., 2007).
 15. See *Trends in Atmospheric Carbon Dioxide*, *supra* note 11.
 16. See *Atmospheric Greenhouse Gas Concentrations (CSI 013)*, EURO. ENVTL. AGENCY (Jan. 25, 2012, 1:20 PM), http://www.eea.europa.eu/data-and-maps/indicators/atmospheric-greenhouse-gas-concentrations-2/ds_resolveuid/c24c43db-cf40-4db1-a211-1dd38e949669. When including other long-lived GHGs, except water vapor, ozone and

Many scientists argue that CO₂ concentrations above 350 ppm and CO₂eq concentrations above 450 ppm must be avoided to achieve the current goal of the climate change regime to keep temperatures from increasing 2°C above pre-industrial levels.¹⁷ According to the UN Environment Programme, “[e]mission pathways consistent with a ‘likely’ [greater than 66%] chance of meeting the 2°C target” must peak before 2020 at emission levels around 44 GtCO₂eq, with global emissions declining steeply thereafter—on average 2.6% per year.¹⁸ As part of the climate change regime, eighty six countries have pledged to reduce emissions, but these pledges, at best, are 8 GtCO₂eq short of meeting that goal.¹⁹ In fact, the gap between pledges and the 2°C goal are certain to be much higher because many of the pledges are conditional,²⁰ and the United States is not close to meeting its pledge, weak as it is, of reducing 2005 emissions by 17% by 2020.

According to the International Energy Agency (IEA), any chance of meeting the 2°C goal must begin now and include a significant technological component. In the IEA’s “450 Scenario,” strong policy actions must be taken now to peak global energy-related CO₂ emissions before 2020, with those emissions declining to 21.6 Gt by 2035. However, the 450 Scenario requires investment in and consumer spending on energy-related equipment totaling \$15.2 trillion relative to an emissions pathway that takes us to a long-term rise in the average global temperature in excess of 3.5°C.²¹ The IEA emphasizes that action must happen now due to the long economic life spans of energy-related infrastructure—power stations, buildings and factories. Already, 80% of global CO₂ emissions emitted between 2009 and 2035 in the 450 Scenario are “locked-in” by existing infrastructure or infrastructure that is under construction and will still be operational by 2035.²² If the global community waits until 2017 to take coordinated action, the IEA estimates that “all permissible emissions in the 450 Scenario would come from the infrastructure then existing,

aerosols, the total atmospheric concentration of the long-lived GHGs was 461 CO₂eq in 2009, an increase from 278 in pre-industrial times. *Id.*

17. See, e.g., UN ENVIR. PROG., BRIDGING THE EMISSIONS GAP: A UNEP SYNTHESIS REPORT 17 (2011).
18. *Id.* at 9.
19. UN ENVIR. PROG., THE EMISSIONS GAP REPORT 2012: A UNEP SYNTHESIS REPORT 1 (2012).
20. See Compilation of Economy-wide Emission Reduction Targets, *supra* note 7, ¶ 26.
21. Even under these circumstances, IEA estimates this scenario has only a 50% probability of limiting temperature increase to 2°C by keeping total GHG concentrations to 450 ppm CO₂eq. IEA, *World Energy Outlook 2011 Factsheet 2* (2011).
22. *Id.*

so that all new infrastructure from then until 2035 would need to be zero-carbon, unless emitting infrastructure is retired before the end of its economic lifetime to make headroom for new investment.”²³ If action is delayed until 2015, approximately 45% of the global fossil fuel capacity installed by then would have to be retired early or refurbished by 2035.²⁴ Moreover, delayed action will be expensive: “for every \$1 of investment in the power sector avoided before 2020, an additional \$4.3 would need to be spent after 2020 to compensate for the higher emissions.”²⁵

The stark implications of a business-as-usual emissions future have led many political leaders to call for dramatic cuts in GHG emissions and a need for a collective effort to retool the energy base of our modern economies to achieve a low-carbon or carbon-free economy. Not only will developed countries have to reduce their emissions drastically, but developing and even least-developed countries will need to increase energy access in a climate-friendly way. Meeting this challenge will require a “transformative technological revolution.”²⁶

The IEA report reinforces the view that this technological change must be transformative and revolutionary rather than incremental. If not, then we risk locking in technologies for decades, different from the ones we need in a carbon-free future. For example, even “[b]illion-dollar investments in hybrid auto engines . . . would still leave future motor vehicles dependent on harmful fossil fuel combustion and would retain little market value when polluting nations must eventually convert their automotive transportation systems to GHG-free methods.”²⁷ Similarly, a new state-of-the-art coal-fired power plant in India may reduce GHG emissions by 10% compared to traditional

23. *Id.*

24. *Id.*

25. *Id.*

26. According to the International Climate Change Task Force:

Climate change, energy security, and the urgent need to increase access to modern energy services for the world’s poor create an enormous need for more efficient low-carbon and no-carbon energy-supply options. We need a transformative technological revolution in the twenty-first century involving the development and rapid deployment of cleaner energy and transportation technologies. By reducing greenhouse emissions and deploying new climate-friendly technologies, companies can create jobs and launch a new era of economic prosperity.

INT’L CLIMATE CHANGE TASK FORCE, MEETING THE CLIMATE CHALLENGE: RECOMMENDATIONS OF THE INTERNATIONAL CLIMATE CHANGE TASK FORCE 1 (2005).

27. HOWARD A. LATIN, CLIMATE CHANGE POLICY FAILURES 157 (2012).

power plants, but the new plant will still emit more than 20 million tons of GHGs per year for decades.²⁸

So the question is not whether the president is doing something. The question is whether the president is doing the right thing. Are the policies being put in place the ones that will encourage the development of technologies that can help us reach a carbon-free future?

III. PRESIDENTIAL EFFORTS TO MITIGATE CLIMATE CHANGE

The president has a variety of tools available to take action. These include regulations, litigation, prosecutorial discretion, waivers, signing statements, executive orders, and treaty-making authority, among others.²⁹ To combat climate change, the President has used all of these tools, although clearly he has relied primarily on the establishment of new regulations to reduce CO₂.

After years of litigation over the EPA's authority to regulate CO₂ and three other GHGs (methane, nitrous oxide, and hydrofluorocarbons) as pollutants in motor vehicle emissions, the U.S. Supreme Court in *Massachusetts v. EPA* ruled that GHGs are "air pollutants" that "unambiguous[ly]" may be regulated under the Clean Air Act.³⁰ The Court did not direct the EPA to conclude that CO₂ from new motor vehicles may "cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare"³¹—a precondition for regulating motor vehicle pollutants.³² However, any other finding was implausible given the near-universal scientific consensus, including multiple reports from the U.S. National Academy of Sciences,³³ that "[m]ost of the observed increase in

28. *Id.* at 158.

29. See ALAINE GINOCCHI & KEVIN DORAN, CTR. FOR ENERGY & EXEC. AUTH., *THE BOUNDARIES OF EXECUTIVE AUTHORITY: USING EXECUTIVE ORDERS TO IMPLEMENT FEDERAL CLIMATE CHANGE POLICY* 5–13 (2008).

30. *Massachusetts v. EPA*, 549 U.S. 497, 529, 533 (2007) ("Under the clear terms of the Clean Air Act, EPA can avoid taking further action only if it determines that greenhouse gases do not contribute to climate change or if it provides some reasonable explanation as to why it cannot or will not exercise its discretion to determine whether they do.").

31. 42 U.S.C. § 7521(a)(1) (2006).

32. Under the Clean Air Act, the EPA is required to regulate motor vehicle emissions of any "air pollutant" that in the "judgment" of the Administrator "cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare." 42 U.S.C. § 7408(a)(1)(A) (2006).

33. See, e.g., NAT'L RES. COUNCIL NAT'L ACADEMY OF SCI., *CLIMATE STABILIZATION TARGETS: EMISSIONS, CONCENTRATIONS, AND IMPACTS OVER DECADES TO MILLENNIA* (2010).

globally averaged temperatures since the mid-20th century is *very likely* [i.e., 90–95% likely] due to the observed increase in anthropogenic greenhouse gas concentrations.”³⁴ Inevitably, the EPA made its “endangerment finding”³⁵ and began regulating GHGs from motor vehicles.³⁶ The finding, upheld by the DC Circuit,³⁷ also opened the door for regulation under other parts of the Clean Air Act.³⁸

With this newly clarified regulatory authority, President Obama, through the EPA and other agencies, has begun to regulate CO₂ and other GHGs from a variety of sources.³⁹ The most significant actions include the following:

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34. Richard B. Alley et al., *supra* note 14, at 10. The most recent assessment of climate change science can be found in a report of the National Oceanic and Atmospheric Administration. AM. METEOROLOGICAL SOC’Y, STATE OF THE CLIMATE IN 2011 (Jessica Blunden & Derek S. Arndt eds., 2012).
 35. *See* Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496 (Dec. 15, 2009).
 36. *See* Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, 75 Fed. Reg. 25,324 (May 7, 2010).
 37. *Coalition for Responsible Regulation, Inc. v. EPA*, 684 F.3d 102, 117 (D.C. Cir. 2012).
 38. Other provisions of the Clean Air Act contain endangerment language identical or almost identical to the language relating to motor vehicles under § 7521(a)(1). *See, e.g.*, 42 U.S.C. § 7547(a)(4) (allowing the EPA to regulate emissions from new non-road engines and vehicles if those emissions “contribute to air pollution which may reasonably be anticipated to endanger public health or welfare”); 42 U.S.C. § 7411(b)(1)(A) (2006) (requiring the EPA to set emission performance standards for any stationary source that “causes, or contributes significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare”).
 39. Other articles treat the specific regulatory acts in more detail than this article. *See, e.g.*, Jonathan H. Adler, *Heat Expands All Things: The Proliferation of Greenhouse Gas Regulation Under the Obama Administration*, 34 HARV. J.L. & PUB. POL’Y 421 (2011); Jody Freeman, *The Obama Administration’s National Auto Policy: Lessons from the Car Deal*, 35 HARV. ENVTL. L. REV. 343 (2011) (examining vehicle emission regulation and the expansion of regulatory authority under the Clean Air Act, and describing lessons for future regulatory action); Hari M. Osofsky, *Diagonal Federalism and Climate Change Implications for the Obama Administration*, 62 ALA. L. REV. 237 (2011) (assessing the Obama Administration’s approach to climate change and energy law and suggesting how future strategies must be developed to combat climate change); U.S. DEP’T OF STATE, U.S. CLIMATE ACTION REPORT 2010, at 40 (2010) (providing a list and description of each policy involving climate change mitigation or adaptation in the United States created by the American Recovery and Reinvestment Act of 2009).

1. On June 30, 2009, the Obama Administration's EPA granted California a waiver of preemption under the Clean Air Act to enforce its GHG standards for model year 2009 vehicles and later models of new motor vehicles.⁴⁰ The decision, taken after President Obama specifically instructed the EPA to reconsider its prior decision,⁴¹ reversed the EPA's decision under the Bush Administration.⁴² The waiver authorizes California and other states wishing to follow California's standards to adopt more stringent GHG controls for motor vehicles than applicable federal standards.⁴³
2. On April 1, 2010, the EPA and the National Highway Traffic Safety Administration (NHTSA) promulgated regulations increasing fuel economy standards and requiring reductions in GHG emissions from cars and light-duty trucks covering model years 2012 through 2016 (the Tailpipe Rule).⁴⁴ These rules effectively require automakers to produce vehicles with an average fuel efficiency of 34.1 miles per gallon by 2016,⁴⁵

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40. California State Motor Vehicle Pollution Control Standards; Notice of Decision Granting a Waiver of Clean Air Act Preemption for California's 2009 and Subsequent Model Year Greenhouse Gas Emission Standards for New Motor Vehicles, 74 Fed. Reg. 32,744 (July 8, 2009).
 41. See Memorandum from President Barack Obama to Administrator of the EPA, Lisa Jackson (Jan. 26, 2009), available at <http://www.whitehouse.gov/the-press-office/Presidential-Memorandum-EPA-Waiver/>.
 42. California State Motor Vehicle Pollution Control Standards; Notice of Decision Denying a Waiver of Clean Air Act Preemption for California's 2009 and Subsequent Model Year Greenhouse Gas Emission Standards for New Motor Vehicles, 73 Fed. Reg. 12,156 (Mar. 6, 2008).
 43. 42 U.S.C. § 7543(b) (2006). That provision requires EPA to grant a waiver unless it finds that California:
 - was arbitrary and capricious in its finding that its standards are in the aggregate at least as protective of public health and welfare as applicable federal standards;
 - does not need such standards to meet compelling and extraordinary conditions; or
 - has proposed standards not consistent with Section 202(a) of the Clean Air Act.

For more on California's waiver request, see *California Greenhouse Gas Waiver Request*, EPA, <http://epa.gov/oms/climate/ca-waiver.htm> (last updated July 31, 2012).

44. Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, 75 Fed. Reg. 25,324 (May 7, 2010). This rule was applied in *Coalition for Responsible Regulation, Inc. v. EPA*, 684 F.3d. 102, 115 (D.C. Cir. 2012).
45. Light-Duty Vehicle Greenhouse Gas Emission Standards, 75 Fed. Reg. at 25,330.

which the EPA and the NHTSA estimate will reduce GHG emissions from these vehicles by approximately 21% by 2030.⁴⁶

3. On August 28, 2012, the EPA and NHTSA jointly proposed rules setting GHG emission standards and fuel economy standards for 2017 to 2025 model year light-duty vehicles.⁴⁷ The standards will increase emissions and fuel economy standards for passenger cars, light-duty trucks, and medium-duty passenger vehicles from 2017 to 2025, achieving an industry fleet-wide average of 54.5 miles per gallon by 2025, reduce fuel consumption by 4 billion barrels of oil, and decrease GHG emissions by 2 billion metric tons.⁴⁸
4. On September 15, 2011, the EPA and the NHTSA published regulations to increase fuel economy and reduce GHG emissions (CO₂, CH₄, and N₂O) from medium- and heavy-duty vehicles, including larger trucks, vans, buses, and tractors.⁴⁹ The agencies estimate that the new standards will reduce CO₂ emissions from these vehicles by “approximately 270 million metric tons and save 530 million barrels of oil over the life of vehicles sold during the 2014 through 2018 model years, providing over \$7 billion in net societal benefits, and \$49 billion in net societal benefits when private fuel savings are considered.”⁵⁰
5. As a consequence of the Tailpipe Rule, the EPA must regulate stationary sources under the Prevention of Significant Deterioration of Air Quality (PSD) program.⁵¹

46. *Id.* at 25,328.

47. *See Regulations and Standards: Light-Duty*, EPA, <http://www.epa.gov/oms/climate/regs-light-duty.htm> (last updated Oct. 15, 2012); 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards, 76 Fed. Reg. 74,854 (Dec. 1, 2011) [hereinafter 2017–2025 Final Rule].

48. 2017–2025 Final Rule, 76 Fed. Reg. at 74,859. Due to a variety of factors, NHTSA’s Corporate Average Fuel Economy standards will increase to an industry fleet-wide average of 48.7–49.7 mpg by 2025. *Id.* at 11.

49. Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles; Final Rules, 76 Fed. Reg. 57,106 (Sept. 15, 2011).

50. *Id.*

51. *See Requirements for Preparation, Adoption, and Submittal of Implementation Plans; Approval and Promulgation of Implementation Plans* 45 Fed. Reg. 52,676, 52,711 (Aug. 7, 1980); Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule, 75 Fed. Reg. 31,514, 31,553–54 (June 3, 2010) [hereinafter Tailoring Rule].

The PSD program requires state-issued construction permits for certain types of stationary sources (iron, steel, and mill plants, for example) that emit more than 100 tons per year of any “air pollutant.”⁵² All other stationary sources emitting more than 250 tons per year of any air pollutant are also covered.⁵³ As a consequence, the EPA now requires these “major emitting facilities” covered by the PSD program to install best-available control technology for GHGs.⁵⁴ However, because immediate regulation of greenhouse gas-emitting sources exceeding the 100 and 250 tons per year benchmarks would result in “overwhelming permitting burdens that would . . . fall on permitting authorities and sources,”⁵⁵ the EPA has limited the meaning of “major emitting facility” to those facilities emitting more than 75,000 and 100,000 tons per year CO₂ equivalent,⁵⁶ depending on the program and project.⁵⁷

52. See 42 U.S.C. §§ 7475, 7479(1) (2006).

53. 42 U.S.C. § 7479(1).

54. See Reconsideration of Interpretation of Regulations That Determine Pollutants Covered by Clean Air Act Permitting Program, 75 Fed. Reg. 17,004 (Apr. 2, 2010).

55. Tailoring Rule, 75 Fed. Reg. at 31,516.

56. CO₂ equivalent, usually abbreviated as CO₂eq or CO₂e, is defined by the IPCC as:

The amount of CO₂ emission that would cause the same integrated radiative forcing as an emitted amount of a greenhouse gas or of a mixture of well mixed greenhouse gases, all multiplied by their respective global warming potentials, which take into account the differing times they remain in the atmosphere.

Annex I: Glossary, Acronyms, Chemical Symbols and Prefixes (Aviel Verbruggen et al. eds.), in IPCC SPECIAL REPORT ON RENEWABLE ENERGY SOURCES AND CLIMATE CHANGE MITIGATION 956 (O. Edenhofer et al. eds., 2011), available at http://www.ipcc.ch/pdf/special-reports/srren/SRREN_Annex_Glossary.pdf.

57. Tailoring Rule, 75 Fed. Reg. at 31,523–524. “Modification” projects must exceed 75,000 tons per year CO₂ eq and “construction” projects must exceed 100,000 tons per year CO₂ eq. Significantly, the Clean Air Act only requires PSD permits for stationary sources that meet the definition of “major emitting facility” and are located in an area designated as “attainment” or “unclassifiable” for any pollutant subject to a national ambient air quality standard (NAAQS). 42 U.S.C. § 7407(d)(1)(A). EPA has set NAAQS for only six substances: carbon monoxide, lead, nitrogen dioxide, ozone, particle pollution, and sulfur dioxide. See *National Ambient Air Quality Standards*, EPA <http://www.epa.gov/air/criteria.html> (last updated Dec. 14, 2012).

The PSD Rule for GHGs is, in fact, more complicated than indicated. The rule established thresholds that may be modified in the future. For

6. On March 27, 2012, the EPA proposed a “standard of performance,”⁵⁸ more commonly referred to as “new source performance standards” (NSPS), for new⁵⁹ fossil fuel fired power plants that are greater than 25 megawatts of electricity. These plants must meet an output-based standard of 1,000 pounds of CO₂ per megawatt hour.⁶⁰ This rule will push power plants to use natural gas or renewables. While it does not prohibit the use of coal, a coal-fired power plant would need to use carbon capture and sequestration technologies to capture at least 50% of its CO₂ to keep CO₂ emissions below the new threshold.⁶¹ These plants represent the greatest source of GHGs in the United States—40% of all U.S. CO₂ emissions and 34% in 2010.⁶² If the facilities use

the first six months of 2011, GHG-permitting requirements applied only to those stationary sources already subject to the PSD program, and best available control technology was required for those already-regulated facilities that increase their GHG emissions by 75,000 tons per year or more. From July 2011 through June 2013, the PSD permitting requirements apply to new construction projects that emit 100,000 tons or more of GHGs per year and to modifications that increase GHG emissions by 75,000 tons or more per year. The EPA may also decide at a later date to initiate another rulemaking in order to apply the PSD permitting requirements to facilities emitting 50,000 tons or more of GHGs per year. *See* Tailoring Rule, 75 Fed. Reg. at 31,516.

58. *See* Standards of Performance for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units, 77 Fed. Reg. 22,392 (Apr. 13, 2012) [hereinafter Proposed NSPS Rule]. The Clean Air Act defines a “standard of performance” as:

[A] standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated.

42 U.S.C. § 7411(a)(1).

59. The Clean Air Act defines a “new source” as “any stationary source, the construction or modification of which is commenced after publication of regulations (or, if earlier, proposed regulations) prescribing a standard of performance under [CAA section 111] which will be applicable to such source.” 42 U.S.C. § 7411(a)(2).

60. Proposed NSPS Rule, 77 Fed. Reg. at 22,394. The NSPS does not apply to fossil fuel fired power plants that have been issued a PSD permit by the date of the proposed rule and that commence construction within twelve months of the date of publication of this proposal. *Id.* at 22,395.

61. *See* EPA, Fact Sheet: Proposed Carbon Pollution Standard for New Power Plants 1–3, *available at* <http://www.epa.gov/carbonpollutionstandard/pdfs/20120327factsheet.pdf> (Mar. 27, 2012).

natural gas rather than coal, the proposed rule could reduce direct emissions from this sector by roughly 50% because natural gas emits about half as much CO₂ as coal.⁶³

7. The United States has contributed \$5 million towards the reduction of black carbon in the Russian Arctic.⁶⁴
8. The United States has committed \$12 million of new funding to the Climate and Clean Air Coalition to reduce short-lived climate forcers, such as methane and black carbon (soot), as well as hydrofluorocarbons.⁶⁵ The United States has also committed \$10 million annually to support the Global Methane Initiative and the Global Alliance for Clean Cookstoves.⁶⁶
9. In December 2009, the EPA began requiring any facility emitting GHGs in excess of 25,000 tons per year, as well as firms in certain specified industries, to report their GHG emissions.⁶⁷ The EPA estimates that the rule covers

62. Proposed NSPS Rule, 77 Fed. Reg. at 22,395; *Sources of Greenhouse Gas Emissions*, EPA, <http://www.epa.gov/climatechange/ghgemissions/sources.html> (last updated June 14, 2012).

63. Proposed NSPS Rule, 77 Fed. Reg. at 22,398. Methane emissions from production of natural gas, however, may significantly reduce the positive climate impacts of switching from coal to natural gas. J. DAVID HUGHES, POST-CARBON INSTITUTE, LIFECYCLE GREENHOUSE GAS EMISSIONS FROM SHALE GAS COMPARED TO COAL: AN ANALYSIS OF TWO CONFLICTING STUDIES 18 (July 2011) (concluding that “[w]hen compared on the basis of the average efficiency of the U.S. gas- and coal-fired electricity generation fleets, and on the basis of most-efficient-technology gas and coal, shale gas clearly has higher emissions over a 20-year timeframe and lower emissions over a 100-year timeframe.”).

64. See Maria Otero, Under Secretary for Democracy and Global Aff., How the UN Can Contribute to International Cooperation on Climate Change, Remarks at the New York-Alesund Symposium in Svalbard, Norway (June 23, 2010), *available at* <http://www.state.gov/j/143563.htm>.

65. Hillary Clinton, Sec’y of State, Remarks at the Climate and Clean Air Coalition To Reduce Short-Lived Climate Pollutants Initiative in Washington, DC (Feb. 16, 2012), *available at* <http://www.state.gov/secretary/rm/2012/02/184061.htm>. Foundation partners, however, have committed more than \$15 million to get the coalition started. *Id.*

66. *Id.*

67. Mandatory Reporting of Greenhouse Gases, 74 Fed. Reg. 56,260, 56,265 (Oct. 30, 2009). While implemented under President Obama, President Bush is responsible for signing the law that authorized the reporting requirement—the FY2008 Consolidated Appropriations Act, H.R. 2764, Pub. L. No. 110-161, 121 Stat. 1844, 2128 (2007).

approximately 10,000 facilities responsible for 85 to 90% of total U.S. greenhouse gas emissions.⁶⁸

10. In November 2010, the EPA “reaffirmed” that states must list marine waters not meeting water quality standards due to ocean acidification and provided guidance to states on monitoring ocean acidification.⁶⁹ The EPA had earlier declined to revise its water quality criterion for marine pH.⁷⁰ These actions were the Obama Administration’s response to petitions from the Center for Biological Diversity (CBD) requesting the EPA to establish Total Maximum Daily Loads (TMDLs) for CO₂⁷¹ and a lawsuit challenging the EPA’s approval of Washington State’s list of water bodies identified as water quality limited under Section 303(d) of the Clean Water Act.⁷² As discussed in the CBD’s petitions, the oceans are rapidly acidifying as marine waters absorb atmospheric CO₂, which is having a profound impact on marine life.
11. In October 2009, President Obama issued Executive Order 13,514, requiring all federal agencies to set goals for reducing GHG emissions directly or indirectly emitted by federal

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68. *Hearing on EPA Regulation of Greenhouse Gases Before the Subcomm. on Energy & Power and Before the H. Comm. on Energy & Commerce*, 112th Cong. 8 (2012) (statement of Regina McCarthy, Asst. Administrator for Air and Radiation, Environmental Protection Agency).
 69. Memorandum from Denise Keehner, Director, Off. of Wetlands, Oceans and Watersheds, EPA, to the Water Division Directors, Regions 1–10, at 6–9 (Nov. 15, 2010), *available at* http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/oa_memo_nov2010.pdf.
 70. See Letter from Peter S. Silva, Asst. EPA Adm’r, to Ms. Miyoko Sakashita, Ctr. for Biological Diversity (Apr. 15, 2010), *available at* <http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/Memorandum-Detailing-EPA-Decision-on-Re-evaluation-and-or-Revision-of-the-Water-Quality-Criterion-for-Marine-pH-for-the-Protection-of-Aquatic-Life.pdf>. The EPA had earlier declined to revise its water quality criterion for marine pH, which is currently set at “PH range of 6. 5 to 8.5 for marine aquatic life (but not varying more than 0.2 units outside of the normally occurring range). This criterion applies to open-ocean waters within 3 miles of a State or Territory’s shoreline where the depth is substantially greater than the euphotic zone.” *Id.*
 71. See, e.g., Letter from Miyoko Sakashita, Ocean Prog. Att’y, Ctr. for Biological Diversity, to Bruce Gwynne, North Coast Water Quality Control Board (Feb. 27, 2007), *available at* http://www.biologicaldiversity.org/campaigns/ocean_acidification/pdfs/acidification-cwa-petition.pdf.
 72. See *Ctr. Biological Diversity v. EPA*, No. 2:09-cv-00670-JCC, ¶¶ 2, 26, 29 (W.D. Wash. May 14, 2009).

activities or from activities related to agency activities, such as vendor supply chains and delivery services.⁷³

12. In February 2009, President Obama directed the Department of Energy to meet its statutory obligations under the Energy Policy and Conservation Act of 1975 and the Energy Policy Act of 2005 to set energy efficiency standards for appliances.⁷⁴ Since that time, the Department of Energy has proposed or adopted a number of new or higher energy efficiency standards for an array of products.⁷⁵
13. In February 2010, the Council on Environmental Quality issued three guidance documents that describe how federal agencies can evaluate and consider the potential climate change impacts of and resulting GHG emissions from federal actions subject to the National Environmental Policy Act (NEPA).⁷⁶ The three guidance documents explain when and how an agency should analyze GHG emissions and climate change impacts;⁷⁷ promote implementation and monitoring of mitigation commitments, including when mitigation supports Findings of No Significant Impact;⁷⁸ and clarify how agencies adopt and use categorical exclusions.⁷⁹

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73. See Exec. Order No. 13,514, 74 Fed. Reg. 52,117, § 2(a) (Oct. 8, 2009).
 74. Memorandum from President Barack Obama to the Sec'y of Energy, Appliance Efficiency Standards (Feb. 5, 2009), *available at* http://www.whitehouse.gov/the_press_office/ApplianceEfficiencyStandards/.
 75. See *Notices and Rules*, U.S. DEP'T OF ENERGY, http://www1.eere.energy.gov/buildings/appliance_standards/current_rulemakings-notice.html (last visited Dec. 20, 2012) (including a list of notices and rules adapted from February 2009 through October 2012).
 76. See 42 U.S.C. §§ 4321–4370h (2006). NEPA requires the preparation of an environmental impact statement for major federal actions that may affect the quality of the human environment." *Id.* at § 4332(C).
 77. National Environmental Policy Act (NEPA) Draft Guidance, Consideration of the Effects of Climate Change and Greenhouse Gas Emissions, 75 Fed. Reg. 8,046 (Feb. 23, 2010).
 78. National Environmental Policy Act (NEPA) Draft Guidance, NEPA Mitigation and Monitoring; Notice of Availability, 75 Fed. Reg. 8,046 (Feb. 23, 2010).
 79. National Environmental Policy Act (NEPA) Draft Guidance, Establishing, Applying, and Revising Categorical Exclusions under the National Environmental Policy Act, 75 Fed. Reg. 8,045 (Feb. 23, 2010). For an analysis of these guidance documents, see Fred R. Wagner et al., *CEQ NEPA Guidance Documents Available for Public Comment* (Beveridge & Diamond, P.C., Client Alert, Feb. 23, 2010), *available at* <http://www.bdlaw.com/news-812.html>.

14. On September 14, 2009, the Department of Interior (DoI) coordinated a Department-wide strategy “to increase scientific understanding of and development of effective adaptive management tools.”⁸⁰ The strategy directs each bureau within the DoI to consider and analyze climate change impacts of its activities, policies, and plans. The strategy also establishes a “Climate Change Response Council” to coordinate climate change related activities within the department as well as with other agencies.⁸¹
15. After the Fish and Wildlife Service classified the polar bear as a threatened species under the Endangered Species Act,⁸² it designated more than 187,000 square miles of sea-ice, terrestrial denning habitat and barrier island habitat as “critical habitat” for polar bears.⁸³ The decision, which the Fish & Wildlife Service declined to make under the Bush Administration,⁸⁴ now requires federal agencies to consult with the Service to ensure that any action authorized, funded, or carried out by a federal agency does not cause destruction or adverse modification to this habitat.⁸⁵
16. On February 8, 2010, the Securities and Exchange Commission (SEC) published interpretive guidance to public companies regarding the Commission’s existing disclosure requirements as they apply to climate change matters.⁸⁶ The SEC concluded that climate change may trigger disclosure requirements for public companies under certain circumstances. For example, various SEC regulations may

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80. DEP’T OF INTERIOR, SECRETARIAL ORDER NO. 3285, RENEWABLE ENERGY DEVELOPMENT BY THE DEPARTMENT OF THE INTERIOR § 3 (Mar. 11, 2009).
 81. *Id.* § 5.
 82. Determination of Threatened Status for the Polar Bear (*Ursus maritimus*) Throughout Its Range, 73 Fed. Reg. 28,212 (May 15, 2008).
 83. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Polar Bear (*Ursus maritimus*) in the United States; Final Rule, 75 Fed. Reg. 76,086 (Dec. 7, 2010).
 84. Determination of Threatened Status for the Polar Bear (*Ursus maritimus*) Throughout Its Range, 73 Fed. Reg. at 28,298.
 85. See Endangered Species Act, 16 U.S.C. §§1531–1599, § 1536(a)(2). A federal district court, however, recently vacated the rule designating critical habitat because the Fish and Wildlife Service failed to follow the procedural requirements of the Endangered Species Act. *Alaska Oil & Gas Ass’n v. Salazar*, No. 3:11-cv-0036-RRB (D. Alaska, Jan. 10, 2013) (order granting plaintiffs’ motions for summary judgment).
 86. Commission Guidance Regarding Disclosure Related to Climate Change, 75 Fed. Reg. 6,290 (Feb. 8, 2010).

impose on public companies a duty to disclose risks associated with climate change legislation and regulations, international agreements, the indirect consequences of such regulation (such as increased demand for goods that result in lower emissions than competing products), and the potential impacts of climate change (such as extreme weather events) on their operations.⁸⁷

17. The American Recovery and Reinvestment Act of 2009 (ARRA) included \$50 billion for cleaner U.S. energy, greater energy efficiency, and domestic sources of renewable energy.⁸⁸ Better known as the Stimulus Package, ARRA included \$5 billion for the Weatherization Assistance Program, \$3.2 billion for Energy Efficiency and Conservation Block Grants, \$300 million for the Energy Efficient Appliance Rebate Program and the Energy Star Program, and clean energy tax credits for homeowners.⁸⁹
18. In January 2012, the EPA published new rules to implement the Renewable Fuel Standard (RFS) program,⁹⁰ which establishes minimum volumes of renewable fuels in transportation fuels sold in the United States.⁹¹ The EPA estimates that by 2022, the standards will reduce GHG emissions “by 138 million metric tons, about the annual emissions of 27 million passenger vehicles, replacing about seven percent of expected annual diesel consumption and decreasing oil imports by \$41.5 billion.”⁹²
19. In August 2012, the EPA promulgated new rules for emissions of volatile organic compounds (VOCs) from gas wells and other aspects of oil and gas development,

87. *See id.* at 6,291–97.

88. American Recovery and Reinvestment Act of 2009, Pub. L. 111–5, 123 Stat. 115, 138–40.

89. This summary of climate change benefits derives from Natural Resources Defense Council, *An Assessment of the Obama Administration’s First-Year Environmental Record* 1 (Jan. 2010) available at <http://www.nrdc.org/legislation/obamarecord/files/obamarecord.pdf>.

90. *See* Energy Independence and Security Act of 2007, Pub. L. 110-140, 121 Stat. 1492, 1519.

91. Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards, 77 Fed. Reg. 1,320 (Jan. 9, 2012).

92. *Climate Change: Regulatory Initiatives*, EPA, <http://epa.gov/climatechange/EPAactivities/regulatory-initiatives.html> (last visited Dec. 20, 2012).

including natural gas and shale development.⁹³ The rules will limit the release of VOCs and other air pollutants that contribute to tropospheric ozone, a significant GHG precursor gas. They will also indirectly reduce methane emissions, a more potent GHG than CO₂. The EPA estimates that these rules will result in an annual reduction of between 1 and 1.7 million tons of methane, equivalent to 19 to 33 million metric tons of CO₂.⁹⁴ This translates into removing 4 to 8 million cars from the road each year.⁹⁵ With natural gas systems accounting for 32% of all methane emissions in 2009⁹⁶ and 11,400 new hydraulically fractured wells drilled each year, these new rules are an important first step for regulating emissions from oil and gas development.⁹⁷

Agencies have taken a number of other smaller actions to support mitigation of and adaptation to climate change. These include activities such as launching an online “waste to biogas mapping tool”

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93. See Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews, 77 Fed. Reg. 49,490 (Aug. 16, 2012).
94. *Id.* at 49,533–34. The new standards require that most fractured and refractured gas wells undertake “green completions” to reduce VOC emissions. As the EPA explains, “[i]n a green completion, special equipment separates gas and liquid hydrocarbons from the flowback that comes from the well as it is being prepared for production. The gas and hydrocarbons can then be treated and used or sold, avoiding the waste of natural resources that cannot be renewed.” EPA, EPA Fact Sheet: Overview of the Final Amendments to Air Regulations for the Oil and Natural Gas Industry 1 (Apr. 17, 2012) [hereinafter EPA Fact Sheet: Air Regulations for the Oil and Natural Gas Industry], available at <http://www.epa.gov/airquality/oilandgas/pdfs/20120417fs.pdf>. Because developers can capture the methane and sell it as natural gas that would otherwise be leaked, vented or flared, the new rules should be cost-effective, perhaps even profitable: EPA’s estimates that the rules will save producers \$11 to \$19 million when the rules are fully implemented in 2015. *Id.*
95. Michael Obeiter, WRI INSIGHTS, *How the EPA’s New Oil and Gas Standards Will Reduce Greenhouse Gas Emissions* (May 9, 2012), <http://insights.wri.org/news/2012/05/how-epas-new-oil-and-gas-standards-will-reduce-greenhouse-gas-emissions>.
96. EPA, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990–2010, at 2–3, Table 2-1 (2012) [hereinafter EPA, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS].
97. EPA Fact Sheet: Air Regulations for the Oil and Natural Gas Industry, *supra* note 94, at 1.

to support the use of organic waste for energy projects,⁹⁸ establishing a Green Power Partnership to promote the use of renewable energy,⁹⁹ and identifying ways that indigenous peoples can increase their ability to adapt to climate change impacts.¹⁰⁰

IV. OPTIONS FOR THE PRESIDENT'S FUTURE CLIMATE CHANGE AGENDA

The president's initiatives, undertaken pursuant to the Clean Air Act and other statutes, are a significant step forward for the United States. Considering previous policies of the Bush and Clinton Administrations alike, these steps indicate a real policy to address climate change across a broad spectrum of economic activities and actors.

These initiatives of the President are all good. The problem, however, is that they are not good enough. Nobody anticipates that these measures alone will allow the United States to reach its pledges to reduce its emissions by 17% by 2020 or 83% by 2050. (These pledges are enshrined in the Copenhagen Accord¹⁰¹ and iterated in the Cancun Agreements¹⁰² to the UN Framework Convention on Climate Change.¹⁰³) For example, the EPA and the NHTSA estimate that the two new standards for light duty vehicles will reduce GHG emissions by approximately 35% by 2035.¹⁰⁴ While these rules may help us get to the 2020 goal of reducing emissions by 17%—at least from this one economic sector—they will not help the United States reach an 83% reduction without significantly higher emissions standards or a structural change in the way we power automobiles. Similarly, the two agencies estimate the new standards for medium- and heavy-duty vehicles will reduce CO₂ emissions by approximately 270 million

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98. Press Release, EPA, EPA Launches First Waste to Biogas Mapping Tool (June 7, 2012), *available at* <http://yosemite.epa.gov/opa/admpress.nsf/0/6CB45E4A9E7EA92C85257A16005838BE>.
99. *See Green Power Partnership*, EPA, <http://www.epa.gov/greenpower/> (last visited Dec. 20, 2012).
100. Press Release, NOAA, NOAA Partners Meet to Explore Climate Change and Coastal Tribes (July 17, 2012), *available at* http://www.noaa.gov/stories2012/20120717_firststewardssymposium.html.
101. *See* Copenhagen Accord, *supra* note 7; *see also* BLUEPRINT FOR A SECURE ENERGY FUTURE, *supra* note 8, at 24.
102. *See* UNFCCC, Cancun Agreements, *supra* note 7.
103. UN Framework Convention on Climate Change, *entered into force* Mar. 21, 1994, S. TREATY DOC NO. 102-38, 1771 U.N.T.S. 107.
104. 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards, Proposed Rule, 76 Fed. Reg. 74,854, 74,964 (Dec. 1, 2011).

metric tons over the life of vehicles sold during the 2014 through 2018 model years¹⁰⁵—a small fraction of emissions from this rapidly growing sector.¹⁰⁶ Similarly, the GHG reductions resulting from the NSPS standards for coal-fired power plants are even less encouraging: research indicates that the new standards, even if improved, would reduce total U.S. CO₂ emission by roughly 2 to 5%.¹⁰⁷ Under current policies, no sector will come close to achieving 83% reductions by 2050.¹⁰⁸

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105. Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium-and-Heavy Duty Engines and Vehicles, 76 Fed. Reg. 57,106 (Sept. 15, 2011).
106. Total emissions from medium- and heavy-duty vehicles was 402.3 Teragram CO₂ Eq. in 2010. EPA, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS, *supra* note 96, at 22-2, Table 2-15. 1 Teragram equals 1 million metric tons. The percentage reduction in GHGs differs for each class of vehicles. For example, the final standards for heavy-duty vehicles for 2018 (including a separate standard to control air conditioning system leakage) represent an average per-vehicle reduction in GHGs of 17 percent for diesel vehicles and 12 percent for gasoline vehicles, compared to a common baseline, while for other classes of vehicles. Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, 76 Fed. Reg. at 57,119. For a 2017 model “Class 2b–8 vocational vehicle,” however, the new standards represent only a 6 to 9% reduction in CO₂ emissions over a 2010 model year vehicle.” *Id.* at 57,121.
107. See NATHAN RICHARDSON ET AL., GREENHOUSE GAS REGULATION UNDER THE CLEAN AIR ACT: STRUCTURE, EFFECTS, AND IMPLICATIONS OF A KNOWABLE PATHWAY 36 (2010), (citing EPA, TECHNICAL SUPPORTING DOCUMENT FOR THE ANPRM: STATIONARY SOURCES 16–17 (1997)). The paper notes that EPA’s estimates show potential reductions of 4 to 10%, but that actual reductions are dependent on certain variables, such as the configuration of the plant’s boiler and the availability of local, low-cost biomass. In contrast, “[a] flexible efficiency standard calibrated to reduce coal heat input by 10 percent per unit of electricity generated by coal could capture potential improvements in efficiency and from biomass cofiring.” *Id.* at 43–44. One report does conclude that the United States may achieve reductions of 16.3% from 2005 levels in 2020. Dallas Burtraw & Matt Woerman, U.S. Status on Climate Change Mitigation 1 (Resources for the Future, Discussion Paper, Oct. 2012). However, the U.S. Energy Information Administration estimates that U.S. CO₂ will be only 9% below 2005 levels by 2020. U.S. ENERGY INFO. ADMIN., ANNUAL ENERGY OUTLOOK 2013 EARLY RELEASE OVERVIEW 12 n.6 (2012). Burtraw and Woerman reach more optimistic conclusions because they assume full implementation of regulations that have not yet been promulgated.
108. See, e.g., NICHOLAS M. BIANCO & FRANK T. LITZ, WORLD RESOURCES INST., REDUCING GREENHOUSE GAS EMISSIONS IN THE UNITED STATES USING EXISTING FEDERAL AUTHORITIES AND STATE ACTION 2 (2010) (stating that even under the most aggressive scenario contemplated by their report, the actions will “fall short of President Obama’s Copenhagen pledge to reduce emissions 17 percent below 2005 levels by

So where does this leave us? While Congressional action is clearly desirable, and in some circumstances necessary, the executive can do much more to put us closer to the U.S. pledge of a 17% reduction by 2020 based on 2005 GHG emissions levels and 83% by 2050. First, the Obama Administration has relied on a purely domestic strategy. It must take a much more positive leadership role in international negotiations—the kind of leadership that is needed to sharply reduce GHG emissions. Second, efforts to reduce CO₂ emissions must be strengthened, particularly with respect to existing fossil fuel fired power plants. Third, while CO₂ is at the heart of any long-term strategy to abate climate change, the mitigation of short-lived climate forcers such as black carbon, methane, and tropospheric ozone could bring substantial short-term climate benefits. Fourth, none of the approaches adopted so far force radical changes in technology—the kind of changes needed to transform the United States to a low-carbon economy. Through climate change technology prizes and other fiscal policies, the president can foster the growth of alternative energy supplies that can end our reliance on fossil fuels.

A. *International Leadership*

The president has several opportunities to flex his treaty-making authority to strengthen the climate change efforts across a range of international agreements. These include the climate change regime itself, as well as the International Civil Aviation Organization and the World Trade Organization.

1. UNFCCC Climate Negotiations

The negotiations within the climate change regime are complex, and are currently addressing a wide variety of economic activities and socio-economic considerations. Yet, it is clear that the United States is a major stumbling block to achieving meaningful mitigation commitments. To be sure, the United States is not alone. Canada, Japan, and Russia, among developed countries, and large-emitting developing countries like China, India, and South Korea, have shown little interest in making meaningful commitments. Long-time observers of the climate process, however, lay most of the blame at the feet of the United States, not because the United States is the biggest historic emitter of GHGs or because it is the world's largest economy, but rather because it has done more to slow progress on a package of international commitments than other countries.¹⁰⁹

2020.”); Adler, *supra* note 39, at 444 (stating that the regulatory changes made under the Clean Air Act are “unlikely to come anywhere close to the aspirational goal of reducing emissions 80% by 2050.”).

109. Tom Athanasiou of Ecoequity sums up the views of many climate negotiation observers:

The stated reasons for the U.S. positions are well known. In 1997, the Senate made clear that it would not give its consent to ratification unless developing countries also made commitments to reduce GHG emissions.¹¹⁰ These concerns arise from fears that U.S. businesses would be at a competitive disadvantage if they must pay the cost of CO₂ abatement while their competitors in developing countries do not.¹¹¹

Much time has passed since 1997. Research indicates that fears of a competitiveness effect are overstated, except for those industries with the highest energy use, or that studies finding a competitiveness effect failed to take into account the cost of climate change adaptation.¹¹² But more to the point, this is a crisis of leadership, both in the White House and in the Senate. The United States remains the largest historic emitter of GHGs by far: 28.52% of CO₂

It's the US, after all, that reduced the Kyoto Protocol to a non-starter, and the US that led the Copenhagen charge to abandon top-down emissions targets in favor of bottom-up "pledge and review." It's the US that, in the words of chief negotiator Todd Stern, is looking for a "new paradigm for climate diplomacy" that asserts a world in which the developed countries are no longer presumed to bear the overarching, if inconvenient, obligations of the rich and the responsible.

Tom Athanasiou, *Who's to Blame for the Impasse in Global Climate Talks?*, EARTH ISLAND J. (Winter 2011), http://www.earthisland.org/journal/index.php/eij/article/whos_to_blame_for_the_impasse_in_global_climate_talks/.

110. S. Res. 98, 105th Cong. (1997) (enacted).

111. See TREVOR HOUSER ET AL., PETERSON INST. FOR INT'L ECON. & WORLD RESOURCES INST., *LEVELING THE CARBON PLAYING FIELD 2* (2008).

112. See, e.g., *id.* at 10–12 (arguing past energy regulations have given companies competitive advantages abroad, thus improving profits). Another analysis concluded:

We find that higher energy prices, of the sort associated with pricing CO₂ at \$15 per ton, would lead to an average production decline of 1.3 percent across U.S. manufacturing, but also a 0.6 percent decline in consumption (defined as production plus net imports). This suggests only a 0.7 percent shift in production overseas. There is no statistically discernible effect on employment for the manufacturing sector as a whole.

JOSEPH E. ALDY & WILLIAM A. PIZER, *THE COMPETITIVENESS IMPACTS OF CLIMATE CHANGE MITIGATION POLICIES* iv (2009). See also Corrado Di Maria & Edwin van der Werf, *Carbon Leakage Revisited: Unilateral Change Policy with Directed Technical Change*, 39 ENVTL. RES. ECON. 55, 57, 69–70 (2008) (concluding that a shift to greater carbon efficiency will give rise to new industry standards where technological improvements are disbursed even to countries without restrictions on carbon emissions).

from energy, whereas eighty seven developing countries have historic emissions of 0.90% of the world's total.¹¹³ China does have relatively high historic emissions of 9.36%, but India, another country frequently mentioned as an industrial competitor, has historic emissions of just 2.52%.¹¹⁴

In addition, the United States has one of the highest per capita emissions rates: 17.3 tons in per capita emissions in 2011,¹¹⁵ although this is a steep recession-caused decline from 22.9 tons per person in 2005.¹¹⁶ China, in comparison, has per capita emissions less than half that at 7.2 tons per capita.¹¹⁷ India has emissions of just 1.6 tons per capita.¹¹⁸

In other words, the emissions of India in particular, but also China to a lesser extent, must increase dramatically before they reach U.S. levels. To honor the commitment to “take the lead” to abate climate change,¹¹⁹ the United States must show real leadership—leadership it has so far been unwilling to demonstrate. The U.S. executive branch has been all too willing to hide behind the Senate's stated refusal to provide its advice to ratification. In the same way that President Obama showed leadership to get a version of a national health care system adopted—something presidents since Franklin Delano Roosevelt have failed to achieve—President Obama can and should lead the United States at the international climate change negotiations.

2. International Aviation

Under the European Union's Emissions Trading Scheme (ETS), any airline, regardless of country of origin, must reduce its emissions from flights departing and arriving from cities within the EU by 3% of 2006 levels by 2013 and 5% by 2020.¹²⁰ Airlines may achieve these

113. *See Climate Analysis Indicators Tool (CAIT)*, *supra* note 12.

114. *Id.*

115. JOS G.J. OLIVIER ET AL., TRENDS IN GLOBAL CO₂ EMISSIONS 6 (2012).

116. *Climate Analysis Indicators Tool*, *supra* note 12.

117. OLIVIER ET AL., *supra* note 115, at 29, Table A1.3.

118. *Id.*

119. Article 3.1 of the UNFCCC provides that “the developed country Parties should take the lead in combating climate change and the adverse effects thereof.” UNFCCC, *supra* note 9, art. 3.1.

120. *See* Keith Laing, *Enviros Argue Emissions Trading is Working in Europe*, THE HILL (Oct. 17, 2012, 12:49 PM), <http://thehill.com/blogs/transportation-report/aviation/262539-enviros-argue-emissions-trading-is-working-in-europe>; *see also* Council Directive 2003/87 2003 O.J. (L 275) 32, 32 (EU). For more on the EU ETS, *see generally* *European Commission, Emissions Trading System (EU ETS)*, EURO.COMM'N (Nov. 15, 2010), *available at* <http://ec.europa.eu/clima/polic>

targets by purchasing credits for pollution. This is a fairly modest plan. First, a recent study concluded that the U.S. airline industry could collectively receive a windfall gain of \$2.6 billion from the ETS requirements.¹²¹ Second, despite improvements in jet engines that have made new engines 70% more fuel efficient than those produced 40 years ago, and 20% more fuel efficient than 10 years ago, CO₂ emissions from airplanes nearly doubled between 1990 and 2006, and they are expected to grow by 2% to 3% per year unless further action is taken.¹²²

Despite this modest plan and potential profit to the industry, the United States and other countries have asked the European Union to suspend or delay its plans to include U.S. and other non-EU airlines in the European Trading Scheme.¹²³ Transportation Secretary Ray LaHood has decried “the EU’s go-it-alone approach” as “impeding

ies/ets/index_en.htm (explaining the EU ETS’s “cap and trade” principle of carbon emissions).

121. Robert Malina et al., *The Impact of the European Union Emissions Trading Scheme on US Aviation*, 19 J. AIR TRANSP. MGMT. 36, 40 (2012). The authors made the following conclusions:

We forecast the potential impact of the EU-ETS on US airlines from 2012 to 2020. Reflecting current market behavior, we modeled an emissions price of €15/tCO₂ in 2010 that increased by 4% per year. We considered three cost pass-through assumptions. In our modeling framework, CO₂ emissions from US airlines between 2011 and 2020 increased by 35% in the reference scenario and 32% under the EU-ETS when there is full cost pass-through. The small reduction in aviation emissions reflects high abatement costs in aviation relative to abatement costs in other industries. When there is full cost pass-through, airlines received windfall gains of \$2.6 billion from the grandfathering of allowances.

Id.

122. Int’l Civil Aviation Org. [ICAO], *Group on International Aviation and Climate Change (GIACC) Report*, ¶¶ 1.1.2–1.1.3, (June 1, 2009) [hereinafter ICAO, *GIACC Report*]; UNFCC, *Information Relevant to Emissions from Fuel Used for International Aviation and Maritime Transport*, ¶ 4.4, FCCC/SBSTA/2010/MISC.5 (May 20, 2010).
123. In February 2012, more than 20 countries, including the United, China, India, and Russia, met in Moscow to agree on a basket of possible countermeasures against the inclusion of aviation in the EU scheme. Joint Declaration of the Moscow Meeting on Inclusion of International Civil Aviation in the EU-ETS, Feb. 22, 2012, *available at* www.greaironline.com/photos/Moscow_Declaration.pdf. The aviation industry also opposes the application the EU ETS to it, recently issuing a declaration “urging governments to reach agreement at the International Civil Aviation Organization (ICAO) for a global framework for reduction of emissions from aircraft operations using technology development.” *Toward Sustainable Aviation*, 6th Aviation & Environment Summit, ¶ 6, Mar. 22, 2012.

international progress on a multilateral agreement for international aviation.”¹²⁴ The irony of the statement is stunning, given the United States’ “go-it-alone” approach to the entire issue of climate change. Moreover, President Obama has not ruled out using international dispute settlement to resolve the issue,¹²⁵ and, in a remarkable departure from respect for the rule of law, President Obama signed legislation “exempting” U.S. airlines from compliance with the EU ETS.¹²⁶ This is not climate leadership.

Instead, the United States suggests that the EU should negotiate through the International Civil Aviation Organization (ICAO), an international organization that has failed to proscribe any emissions reductions. ICAO, which was established under the 1944 Convention on International Civil Aviation,¹²⁷ has the authority to regulate, among other things, emissions from international aviation. ICAO’s governing Council has not imposed mandatory obligations on ICAO parties to mitigate CO₂ emissions from aircraft. It has, however, approved an annual improvement in fuel efficiency of 2% between 2013 and 2020 and an aspirational global fuel efficiency improvement rate of 2% per year from 2021 to 2050.¹²⁸ If these goals are met, cumulative fuel efficiency from aviation would improve approximately 60% from 2005 levels.¹²⁹ Still, ICAO does not appear to be an institution that will establish any requirements unless pushed. Leadership from the EU with corresponding leadership from President Obama could provide the impetus ICAO needs to finally take GHG mitigation seriously.

124. Ray LaHood, Sec’y of Transp., Statement at Senate Committee on Commerce, Science, and Transportation 3 (June 6, 2012), *available at* http://commerce.senate.gov/public/?a=Files.Serve&File_id=9f35bb3b-c8bd-4ee0-87aa-57819b7b914f.

125. *See* Letter from Aerospace Industries Association et al. to Hillary Rodham Clinton, Sec’y of State, & Raymond H. LaHood, Sec’y of Transp. (July 30, 2012), *available at* <http://www.nbaa.org/ops/environment/eu-ets/20120731-coalition-letter-us-hosted-aviation-climate-meeting.pdf>; Special Briefing, *Preview of the EU Emissions Trading System Meeting*, U.S. DEPT. OF STATE (July 30, 2012), *available at* <http://www.state.gov/r/pa/prs/ps/2012/07/195781.htm>.

126. Senator John Thune, for example, has introduced a Senate bill that would prohibit U.S. airlines from participating in the EU ETS. European Union Emissions Trading Scheme Prohibition Act of 2011, S.1956, 112th Cong., § 2 (Dec. 7, 2011). President Obama signed the legislation on November 27, 2012.

127. Convention on International Civil Aviation, Dec. 7, 1944, T.I.A.S. No. 1591, 15 U.N.T.S. 295.

128. ICAO, *Declaration by the High-level Meeting on International Aviation and Climate Change*, ¶ 2.2, HLM-ENV/09-WP/7 (Oct. 8, 2009).

129. IACO, *GIACC Report*, *supra* note 122, para. 3.7.1.

President Obama should send a clear, positive message: The United States will not litigate this issue before an international tribunal as the airline industry wishes, and he will veto any legislation that seeks to exempt U.S. airlines from compliance with the EU ETS. He should also negotiate standards similar to those of the EU ETS within ICAO.

3. International Trade

The rules of international trade, particularly those administered by the World Trade Organization, provide many opportunities for pursuing climate change benefits. In fact, international trade policy is an area that has much unfilled potential to encourage the dissemination of climate change technologies worldwide, thus lowering the cost of climate mitigation.

a. Climate Change Friendly Goods and Services

A central goal of the General Agreement on Tariffs and Trade (GATT)¹³⁰ is the negotiation and application of nondiscriminatory tariffs—the tax imposed on goods as a condition of importation. As part of the current Doha Round of negotiations, World Trade Organization (WTO) members have agreed to reduce or eliminate tariffs on environmental goods and services.¹³¹ The negotiations, however, have been slowed by the inability of WTO members to agree on a list of qualified environmental goods and services. Defining what are “environmental” goods and services has also proven more challenging than it appears.

Consider two approaches in the climate change context. Under the first approach, climate change mitigation technologies (and services) would be defined in relation to a specific good or end-use.¹³² Thus, goods such as solar photovoltaic panels and wind turbines would be slated for tariff reduction or elimination. The second approach would cast a wider net and include “environmentally preferable products” from a climate change perspective.¹³³ Under this approach, a product that causes less harm to the climate than alternative products would be subject to tariff reduction or

130. General Agreement on Tariffs and Trade, Oct. 30, 1947, 61 Stat. A-11, 55 U.N.T.S. 194, arts. I, II:1(a) [hereinafter GATT].

131. World Trade Organization, Ministerial Declaration of 14 November 2001, ¶ 31(iii), WT/MIN(01)/DEC/1, 41 I.L.M. 746 (Nov. 14, 2001). When citing WTO sources, this article utilizes the date adopted and the date published, as available.

132. Mahesh Sugathan, Int’l Ctr. for Trade and Sustainable Dev., *Climate Change Benefits from Liberalisation of Environment Goods and Services*, in LINKING TRADE, CLIMATE CHANGE AND ENERGY 8 (2006).

133. *Id.*

elimination.¹³⁴ The trouble with this second approach is determining exactly when a product is more climate change friendly than an alternative product. For example, corn-based ethanol may or may not result in lower greenhouse gas emissions than fossil fuels; it depends on how much of the production lifecycle is included in the calculation, how the corn was grown, and how the ethanol was produced.¹³⁵ In addition, use of corn-based ethanol results in much higher emissions than sugarcane-based ethanol.¹³⁶ Moreover, technology developments may make both products substantially inferior to cellulosic ethanol.¹³⁷ If current technologies receive preferential treatment such as a zero tariff, then it will be difficult, if not impossible, to provide more beneficial trade advantages to future, superior technologies. The same problems hold true for attempts to reduce tariffs for appliances and other products that are energy efficient. In addition, the establishment of separate tariffs for specific products, such as energy efficient dishwashers, would require governments to establish a new tariff classification,¹³⁸ a process that may not be as straightforward as it might seem.¹³⁹

Nonetheless, focusing on climate change related technologies could help narrow these concerns and forge an agreement. A wide range of climate change related technologies, including wind turbines, solar panels, geothermal energy sensors, and fuel cells, could be considered environmental goods. Reducing or eliminating tariffs of these technologies would reduce their cost and encourage their use and

134. *Id.*

135. See Bruce A. Babcock et al., *Is Corn Ethanol a Low-Carbon Fuel?*, IOWA AG. REV., Fall 2007, at 1–3, 10.

136. See Suani Teixeira Coelho et al., São Paulo State Secretariat for the Environment, *The Brazilian Experience with Sugarcane Ethanol*, in LINKING TRADE, CLIMATE CHANGE AND ENERGY 28 (2006).

137. See Ohio Env't Council, Fact Sheet: Ethanol, Options for Sustainable Energy Future, available at http://www.theoec.org/PDFs/FactSheets/FactSheet_Ethanol.pdf (discussing the advantages of cellulosic ethanol).

138. Sugathan, *supra* note 132, at 8–9.

139. See WORLD BANK, INTERNATIONAL TRADE AND CLIMATE CHANGE 45–72 (2008). Because many industries vigorously defend their tariff preferences and protections, this option may be politically difficult to achieve. Another concern with both approaches for many countries is that a reduction in the tariffs to benefit a specific technology may lead to a tariff reduction for other technologies unrelated to climate change. For example, India classifies solar photovoltaic panels as “Other” under the subclassification of light emitting diodes (LEDs). An effort to reduce tariffs for solar photovoltaic panels may thus lead to a tariff reduction in all “Other” LEDs. While India could always reclassify photovoltaic panels, the example highlights why the negotiations are not straightforward.

dissemination. A World Bank report concluded that removing tariffs for four basic clean energy technologies (wind, solar, clean coal, and efficient lighting) in eighteen of the high-GHG-emitting developing countries could result in trade gains of up to 7% (and up to 14% if nontariff barriers are also removed).¹⁴⁰ If translated into emissions reductions, these trade gains suggest that—even within a small subset of clean energy technologies for a select group of countries—the impact of trade liberalization on GHG emissions could be significant.

President Obama should take the lead by encouraging the Office of the United States Trade Representative (USTR) to negotiate an agreement on climate change friendly goods and services, even if the list begins as a very short list. Even a short list would show that trade policy can in fact be climate-friendly. It could also help promote the diffusion of climate change technologies around the world.

The Asia-Pacific Economic Cooperation forum (APEC), whose twenty one members include the United States,¹⁴¹ has recently shown the way forward. The members of APEC agreed to reduce applied tariff rates to 5% or less by the end of 2015 on a range of environmental goods.¹⁴² Many of these goods will benefit climate change, including biomass boilers, parts that are integral components to wind turbines, and solar water heaters, among other products.¹⁴³ If obstacles to negotiating a similar agreement in the WTO become insurmountable, alternate forums, such as bilateral and regional free trade agreements, may provide opportunities for agreements similar to the APEC agreement.

b. Climate Change and “Like Product”

The GATT imposes a number of obligations on WTO members to prevent them from using nontariff barriers, including taxes, administrative procedures, and other laws and regulations, to protect domestic industries from foreign competition. Three of these obligations are at the center of trade-environment disputes as well as the design of climate change policies.¹⁴⁴

140. *Id.* at 72.

141. *See Member Economies*, ASIA-PACIFIC ECONOMIC COOPERATION (APEC), <http://www.apec.org/About-Us/About-APEC/Member-Economies.aspx> (last visited Dec. 20, 2012).

142. APEC, 20th Economic Leaders’ Declaration, APEC List of Environmental Goods, at Annex C, Sept. 8–9, 2012, *available at* http://www.apec.org/meeting-papers/leaders-declarations/2012/2012_aelm/2012_aelm_annexC.aspx.

143. *Id.*

144. For more on “trade-environment” disputes, *see generally* CHRIS WOLD, SANFORD GAINES & GREG BLOCK, *TRADE AND THE ENVIRONMENT: LAW AND POLICY* (2d ed. 2011).

First, the most favored nation (MFN) obligation of GATT Article I requires each WTO member to tax and regulate imported “like products” from all other WTO members the same.¹⁴⁵ For example, Mexico cannot tax solar panels from Germany less than solar panels from Japan. Second, the national treatment principle of GATT Article III requires a country to tax and regulate imported products “no less favourably” than “like” domestic products.¹⁴⁶ Thus, the United States may impose a tax on imports of HFC-23, a powerful greenhouse gas, provided that the tax rate is no more than the tax imposed on domestically-produced HFC-23. Third, GATT Article XI prohibits members from applying any restrictions, such as quotas and licensing schemes, other than tariffs on the importation or exportation of products.¹⁴⁷ Thus, as explored below, the U.S. embargo on Mexican tuna in the *Tuna/Dolphin I* dispute violated Article XI.¹⁴⁸

A central question for both the MFN and national treatment nondiscrimination obligations is whether a trade measure relates to “like products.” Quite obviously, governments may tax and regulate wind turbines differently from automobiles and coal differently from solar panels. At some point, however, products become so similar that trade rules demand equal tax and regulatory treatment to ensure fair competition in the global marketplace. The issue of “like products” raises difficult questions. Is electricity from coal the same as electricity from wind power? Are hybrid, electric, and traditional gas-powered automobiles like products that require equivalent tax and regulatory treatment?

WTO dispute settlement panels make “like products” determinations by assessing, on a case-by-case basis, the following four factors: 1) the products’ end-uses in a given market; 2) consumers’ tastes and habits, which change from country to country; 3) the products’ properties, nature, and quality; and 4) tariff classification of the products in question.¹⁴⁹ The simplicity of this four-part test masks the complexities of the national treatment obligation, which alters the meaning of “likeness” depending on the circumstances. For example, panels have defined “like products” narrowly with respect to taxes, provided they are not imposed to

145. GATT, *supra* note 130, art. I.

146. *Id.* art. III.

147. *Id.* art. IX.

148. Panel Report, *United States—Restrictions on Imports of Tuna*, ¶ 5.18, WT/DS21/R (Sept. 3, 1991) (*unadopted*) [hereinafter *Tuna/Dolphin I*].

149. Appellate Body Report, *Japan—Taxes on Alcoholic Beverages*, WT/DS8/AB/R, WT/DS10/AB/R, WT/DS11/AB/R, at 20 (*published* Oct. 4, 1996) (*adopted* Nov. 1, 1996) [hereinafter *Japan-Alcoholic Beverages II*].

protect domestic production.¹⁵⁰ If that condition is met, then natural gas and coal, because of their different physical characteristics, are probably not like products despite their similar end uses; they could be taxed differently. However, taxes designed to afford protection to domestic production expand the concept of like products to include “directly competitive and substitutable products.”¹⁵¹ Under this expanded concept of likeness, the WTO’s Appellate Body has found shochu, whisky, brandy, rum, gin, genever, and liqueurs to be “directly competitive and substitutable.”¹⁵² For regulatory measures, the definition of “like product” fits somewhere between these two points but significantly closer to the broader reading of “directly competitive and substitutable products.”

Whatever ambiguity exists in the interpretation of “like products,” trade panels have been absolutely clear that factors unrelated to the product as a product cannot be used as the basis for taxing or regulating products differently. Thus, in the *Tuna/Dolphin* disputes, dispute settlement panels found U.S. import restrictions on tuna to be impermissible because the basis for barring imports into the United States related to the way the fish were caught, not some physical characteristic of the tuna itself.¹⁵³ Processes and production methods (PPMs), such as fish harvesting techniques that do not affect the product as a product (non-product related PPMs), cannot be used to distinguish otherwise like products for tax and regulatory purposes.¹⁵⁴ Similarly, a dispute settlement panel found U.S. rules that imposed different requirements on foreign gasoline than domestic gasoline impermissible because those rules related to data held by a foreign company, not the gasoline itself.¹⁵⁵ On the other hand,

150. See *id.* (“How narrowly is a matter that should be determined separately for each tax measure in each case.”).

151. See *id.* at 26 (asserting that “like products” and “directly competitive or substitutable products” mean “one and the same thing.”).

152. *Id.*

153. See *Tuna/Dolphin I*, *supra* note 148, at ¶¶ 5.17–5.18 (finding that U.S. quantitative restriction on tuna importation was impermissible, as it dealt more with dolphin conservation than physical characteristics of the fish).

154. See *id.* at ¶¶ 3.17–3.18, 5.14–5.16; see also Report of the Panel, *United States—Restrictions on Imports of Tuna*, ¶¶ 3.5–3.6, DS29/R (published June 16, 1994) (*unadopted*); Appellate Body Report, *United States—Import Prohibition of Certain Shrimp and Shrimp Products*, ¶ 42, WT/DS58/AB/R (published Oct. 12, 1998) (*adopted* Nov. 6, 1998) (concluding that the United States restrictions on shrimp imports violated the GATT because the restrictions were based on whether a country protected sea turtles).

155. Panel Report, *United States—Standards for Reformulated and Conventional Gasoline*, ¶ 6.13, WT/DS2/R (published Jan. 29, 1996) (*adopted as modified by the Appellate Body* May 20, 1996).

product-related PPMs, such as irradiation and pasteurization, may be used to distinguish products for tax and regulatory purposes (that is, pasteurized milk may be taxed and regulated differently from non-pasteurized milk). These rulings complicate efforts to tax or regulate climate-friendly technologies more favorably than other products.

To remove ambiguity concerning the meaning of “like product,” the president, through USTR, could seek a binding interpretation¹⁵⁶ of WTO members on the meaning of “like product” for a range of climate-related products and technologies. For example, the interpretation of “like product” could specify that electric cars are not “like” fossil fuel powered cars and that electricity from renewable sources is not “like” electricity produced from fossil fuels. Even among fossil fuel powered automobiles, the interpretation could make clear that vehicles with high fuel economy are not like vehicles with low fuel economy, even if they are in other respects very similar. Similarly, an energy efficient appliance could be defined as not “like” a less energy efficient appliance of the same kind.

c. A Climate Subsidies Agreement

The WTO’s Agreement on Subsidies and Countervailing Measures (SCM Agreement)¹⁵⁷ does not judge subsidies based on their policy objective. Rather, it prohibits subsidies that distort trade by causing material injury or serious prejudice to industries in other countries (for example, by suppressing prices or displacing imports of nonsubsidized products).¹⁵⁸ Subsidies that promote climate change mitigation, such as subsidies for solar panels, may result in trade distortions just like any other subsidy, including fossil fuel subsidies, by providing an unfair advantage for the country’s solar panels in the marketplace.¹⁵⁹ In fact, some U.S. producers of solar panels successfully challenged imports of solar panels from China, claiming

156. See GATT, *supra* note 130, art. IX. Article IX(2) of the WTO Agreement provides that WTO Members have the authority to adopt “interpretations” by a three-fourths majority vote. The WTO members could also use a waiver, as provided by Article IX(3) of the WTO Agreement. Waivers are to be used only in exceptional circumstances, subject to approval by at least three-fourths of the WTO membership. Unlike an interpretation, however, a waiver is time-limited and must be renewed periodically. *Id.*

157. Agreement on Subsidies and Countervailing Measures, Apr. 15, 1994, 1867 U.N.T.S. 14 [hereinafter SCM Agreement].

158. *Id.* art. 3.

159. For more on fossil fuel subsidies, and in particular the role of international trade policy, see Chris Wold, Grant Wilson & Sara Foroshani, *Leveraging Climate Change Benefits through the World Trade Organization: Are Fossil Fuel Subsidies Actionable?*, 43 GEO. J. INT’L L. 635 (2012).

those panels were subsidized and causing material injury to the U.S. solar panel industry.¹⁶⁰ Where a subsidy distorts trade by causing material injury or serious prejudice to another country's industry, the harmed country may retaliate with countervailing duties or countermeasures.¹⁶¹

To fall within the scope of the SCM Agreement, a government must provide a financial contribution, such as the transfer of funds or the provision of goods or services that confers a benefit on the recipient.¹⁶² The subsidy must also be "specific" to a limited group of enterprises.¹⁶³ For example, a subsidy limited to producers of renewable energy or certain types of climate change mitigation technologies might be deemed a specific subsidy because it is available in fact or in law only to certain enterprises or industries. The WTO panel's decision in *United States-Cotton* suggests that even a relatively large number of recipients may lead to a "specificity" finding. In that case, the Panel concluded that crop insurance subsidies available for about 100 different crops were available to "a sufficiently discrete segment of the United States economy to qualify

160. In a related action, the Department of Commerce also imposed anti-dumping duties on imports of Chinese of solar cells from certain manufacturers from 31.14% to 249.96%. For determinations relating to both the subsidies determination and the dumping determination, see *Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled Into Modules, From the People's Republic of China: Final Affirmative Countervailing Duty Determination and Final Affirmative Critical Circumstances Determination*, 77 Fed. Reg. 63,788 (Oct. 17, 2012); *Crystalline Silicon Photovoltaic Cells and Modules from China, Investigation Nos. 701-TA-481 and 731-TA-1190 (Final)*, USITC Publication 4360 (Nov. 2012).

161. Countervailing duties arise from "material injury" actions initiative through a WTO member's administrative processes. Countervailing duties are increased duties to offset the harm caused by the subsidy. See SCM Agreement, *supra* note 157, arts. 10–23. Countermeasures arise from either "material injury" or "serious prejudice" actions initiated in the WTO Dispute Settlement Body. *Id.* arts. 7.1, 7.9. Countermeasures may include increased duties on products but they may also include the suspension of other WTO-related rights, including intellectual property rights arising under the Agreement on Trade-related Aspects of Intellectual Property Rights.

162. *Id.* art. 1.1.

163. *Id.* art. 2.

as ‘specific.’”¹⁶⁴ If subsidies distort trade and are considered specific, they are subject to retaliatory trade sanctions.¹⁶⁵

The executive has several options for using the SCM Agreement for climate change purposes. First, the United States could challenge the fossil fuel subsidies of other WTO members. This option is unlikely as it would probably invoke a retaliatory trade dispute concerning U.S. fossil fuel subsidies, which may be as high as \$52 billion annually.¹⁶⁶ Of course, the United States could use the SCM Agreement as a reason to eliminate its own fossil fuel subsidies or its subsidies for corn production,¹⁶⁷ which are used to make ethanol. WTO panels have concluded that U.S. cotton subsidies¹⁶⁸ and EU sugar¹⁶⁹ subsidies are inconsistent with the SCM Agreement, and it is highly likely that they would draw the same conclusions with respect to U.S. corn subsidies.¹⁷⁰ If the United States fails to act unilaterally, perhaps the WTO will direct it to remove corn subsidies; Canada and Brazil have lodged a WTO dispute,¹⁷¹ although the case appears moribund.

164. See Panel Report, *United States—Subsidies on Upland Cotton*, ¶ 7.1150, WT/DS267/R (published Sept. 8, 2004) (adopted Mar. 21, 2005); *aff’d* Appellate Body Report, *United States—Subsidies on Upland Cotton*, ¶ 543, WT/DS267/AB/R (published Mar. 3, 2005) [hereinafter *U.S. Subsidies on Upland Cotton*].

165. SCM Agreement, *supra* note 157, arts. 7, 19.

166. Mark Clayton, *Budget Hawks: Does US Need to Give Gas and Oil Companies \$41 Billion a Year?*, CHRISTIAN SCI. MONITOR, Mar. 9, 2011, <http://www.csmonitor.com/USA/Politics/2011/0309/Budget-hawks-Does-US-need-to-give-gas-and-oil-companies-41-billion-a-year>.

167. Corn and soybean producers collectively receive about 80% of total subsidy payments of \$8 to \$14 billion annually. See Vincent Smith et al., *Field of Schemes: The Taxpayer and Economic Welfare Costs of Shallow-Loss Farming Programs* 26 (Am. Enter. Inst. of Pub. Pol’y Res., Working Paper No. 2012-01), available at http://www.aei.org/files/2012/05/29/-field-of-schemes-the-taxpayer-and-economic-welfare-costs-of-shallowloss-farming-programs_173428924992.pdf.

168. *U.S. Subsidies on Upland Cotton*, *supra* note 164, ¶ 7.1150.

169. See Appellate Body Report, *European Communities—Export Subsidies on Sugar*, ¶¶ 340–41, WT/DS265/AB/R, WT/DS266/AB/R, WT/DS283/AB/R (published April 28, 2005) (adopted May 19, 2005).

170. That U.S. corn subsidies distort the world market for corn is plain. For example, Mexican farmers are actually reducing their corn prices below costs of production to compete with U.S. corn. Timothy A. Wise, *The Paradox of Agricultural Subsidies: Measurement Issues, Agricultural Dumping and Policy Reform* 14–15 (Global Dev. and Env’t Inst. Working Paper No. 04-02, 2004), available at <http://ase.tufts.edu/gdae/Pubs/wp/04-02AgSubsidies.pdf>.

171. See Request for Consultations by Canada, *United States—Subsidies and Other Domestic Support for Corn and Other Agricultural Products*, WT/DS357/1 (Jan. 11, 2007).

More positively, the USTR, could seek to negotiate a “Climate Change Subsidies Agreement” similar to the one WTO members have been negotiating for fisheries subsidies.¹⁷² In the fisheries agreement, which is not yet completed, WTO members have found common ground on a range of permissible and prohibited fisheries subsidies. For example, subsidies for artisanal fishing and for the construction of water and sanitary waste systems serving fish processing facilities, among many others, have been proposed as permissible under the SCM Agreement.¹⁷³ Similarly, the WTO members could agree on the types of climate change subsidies, such as those for certain types of renewable energy, that would be allowable. Such agreement may not be easy, of course. For example, the United States provides enormous subsidies for corn production, much of which is turned into ethanol.¹⁷⁴ Sugarcane-based ethanol, however, has an energy balance—the ratio of energy contained in the final biofuel product to the energy used to produce it—about 5.33 times higher than corn-based ethanol.¹⁷⁵ Thus, the WTO members would need to determine whether subsidies for all kinds of ethanol or just some kinds would be allowable.

B. The Carbon Agenda

As noted above, the majority of the Obama Administration’s efforts have targeted CO₂. When thinking of a long-term approach to climate change, this is not only sensible, but necessary. Nonetheless, the Obama Administration could do more to mitigate CO₂. Many of these actions would not be new, but rather close exemptions to current rules or increase existing standards.

1. An NSPS Rule for Existing Fossil Fuel Fired Power Plants

The NSPS rule for fossil fuel fired power plants is an essential step towards reducing emissions in the United States. However, that rule only applies to new plants; it does not apply to existing power plants that are the greatest source of GHGs in the United States—40% of all U.S. CO₂ emissions and 34% of all U.S. GHG emissions in 2010.¹⁷⁶ Moreover, less than 7% of electricity generation built in the

172. Draft Consolidated Chair Texts of the AD and SCM Agreements, Annex VIII, TN/RL/W/213 (Nov. 30, 2007).

173. *See id.* Annex VIII, arts. I, II; *see also* Paper from New Zealand, *Fisheries Subsidies: Exhaustive List of Non-Prohibited Fisheries Subsidies*, TN/RL/GEN/141 (June 6, 2006).

174. *See* U.S. CONG. BUDGET OFFICE, *THE IMPACT OF ETHANOL USE ON FOOD PRICES AND GREENHOUSE-GAS EMISSIONS 2* (2009).

175. *See* INT’L AIR TRANSP. ASS’N, *2nd Generation Biomass Conversion Efficiency 24* (undated), <http://www.iata.org/SiteCollectionDocuments/Documents/IATAConversionTechnologiesFinalv2.pdf>.

176. Proposed NSPS Rule, 77 Fed. Reg. at 22,395; *Sources of Greenhouse Gas Emissions*, *supra* note 62.

United States since 1990 derives from coal-fired power plants.¹⁷⁷ Industry has already made the shift to natural gas and renewables, which will meet the new NSPS without making any modifications. In fact, the EPA estimates that 95% of natural gas combined cycle (NGCC) power plants built since 2005 will meet the standard.¹⁷⁸ While NGCC plants produce roughly half as much CO₂ as coal-fired power plants, they still produce, on a U.S. scale, massive amounts of CO₂ and methane. In fact, natural gas is defined, in part, as comprising at least 70% methane by volume as well as minor amounts of other GHGs.¹⁷⁹

As a result, the EPA should establish emission standards for existing facilities. This will clearly have important economic consequences for these facilities, no doubt the reason the EPA has so far refused to impose GHG restrictions on these facilities. Nonetheless, imposing standards on existing power plants will likely cause the early retirement of the most inefficient existing power plants as well as the modification of others. Failure to do so will no doubt extend the life of these inefficient facilities as operators seek to avoid meeting the standards established for new or modified power plants.

Similarly, the EPA could set an NSPS for other industries. The production of cement requires vast amounts of energy—5% globally¹⁸⁰—and constitutes the largest source of U.S. CO₂ emissions

177. Letter from Kevin M. Kennedy, U.S. Climate Initiative, World Resources Inst., to Lisa Jackson, EPA, *available at* <http://www.wri.org/stories/2012/04/summary-epa-proposed-performancestandards-power-plant-ghg-emissions>.

178. EPA, Fact Sheet: Proposed Carbon Pollution Standard for New Power Plants, *supra* note 61, at 2.

179. The proposed rule defines “natural gas” as:

[A] fluid mixture of hydrocarbons (e.g., methane, ethane, or propane), composed of at least 70 percent methane by volume or that has a gross calorific value between 35 and 41 megajoules (MJ) per dry standard cubic meter (950 and 1,100 Btu per dry standard cubic foot), that maintains a gaseous state under ISO conditions. In addition, natural gas contains 20.0 grains or less of total sulfur per 100 standard cubic feet. Finally, natural gas does not include the following gaseous fuels: landfill gas, digester gas, refinery gas, sour gas, blast furnace gas, coal-derived gas, producer gas, coke oven gas, or any gaseous fuel produced in a process which might result in highly variable sulfur content or heating value.

Proposed NSPS Rule, 77 Fed. Reg. at 22,440.

180. Madeleine Rubenstein, *Emissions from the Cement Industry*, EARTH INST., COLUMBIA UNIV. BLOG (May 9, 2012, 11:00 AM), <http://blogs.ei.columbia.edu/2012/05/09/emissions-from-the-cement-industry/>. Producing one ton of cement requires 4.7 million BTU of energy, equivalent to about 400 pounds of coal, and generates almost one ton of CO₂. *Id.* During the cement production process, calcium carbonate

other than fossil fuel consumption.¹⁸¹ The manufacture of limestone, pulp mills, and other industrial facilities also contributes substantial emissions of GHGs.¹⁸² If the EPA determines that these sources contribute “significantly” to the accumulation of GHGs in the atmosphere, the EPA is required to establish an NSPS that represents the best-demonstrated technology for reducing emissions from that category of sources, taking into account the costs of imposing such controls.¹⁸³

2. Aircraft Emissions

The Federal Aviation Administration, or perhaps the EPA,¹⁸⁴ has authority to make operational improvements, such as idle times, flight speeds, taxiing, use of reverse thrust, and other practices reducing fuel use, that could reduce GHG emissions from 0.7 to 1.4% annually, or roughly 10 to 20% by 2030.¹⁸⁵ In addition, the EPA has authority under the Clean Air Act to promulgate emissions standards for aircraft.¹⁸⁶ The EPA recently adopted new NO_x emissions standards

(CaCO₃) is heated in a cement kiln at a temperature of about 1,450°C (2,400°F) to form lime and CO₂. The lime is then combined with silica-containing materials to produce clinker (an intermediate product), with the earlier byproduct CO₂ released to the atmosphere. GHG emissions. EPA, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS, *supra* note 96, at 4-4 to 4-5.

181. U.S. ENERGY INFO. AGENCY, EMISSION OF GREENHOUSE GASES IN THE UNITED STATES 2008, at 28 (2009), *available at* <http://www.eia.gov/oiaf/1605/ggrpt/carbon.html#industrial>. Cement production accounts for 0.4% of U.S. GHG emissions. EPA, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS, *supra* note 96, at 2-17, Table 2-12.
182. *See* EPA, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS, *supra* note 96, Section 4 (discussing limestone, pulp mill, and other industrial facility emissions).
183. 42 U.S.C. § 7411(f) (2012).
184. Some disagreement exists regarding EPA’s authority to regulate operational improvements. For a discussion of this debate, *See, e.g.*, Nathan Richardson, *Aviation, Carbon, and the Clean Air Act* 16–19 (Resources for the Future, Discussion Paper, 2012), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2129370.
185. BIANCO & LITZ, *supra* note 108, at 14.
186. 42 U.S.C. § 7571 (1996). As with mobile sources, the Administrator may propose emissions standards for aircraft only after finding that an “air pollutant” emitted by an aircraft engine “in his judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare.” § 7571(a)(2)(A). The regulations are to take effect “after such period as the Administrator finds necessary . . . to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance” § 7571(b).

for aircraft engines.¹⁸⁷ As aircraft engines contribute about 1% of the total U.S. mobile source NO_x emissions,¹⁸⁸ promulgating new standards could provide significant climate change benefits, particularly if CO₂ standards are set as well. Significantly, the EPA's authority to regulate existing aircraft engines is relatively clear. Unlike the provisions for NSPS, which refer to "new" and "modified" sources, Section 231 allows the EPA to impose emissions standards on "any class or classes of aircraft engines."¹⁸⁹

3. Marine Vessel Emissions

The International Maritime Organization (IMO) estimates that ships emitted 1,046 million tons of CO₂ in 2007, 3.3% of global emissions that year.¹⁹⁰ To put this in perspective, only five countries—the United States, China, Russia, India, and Japan—currently have a higher percentage of the world's total CO₂ emissions than the global shipping industry. Emissions from shipping are expected to grow. Mid-range emissions scenarios indicate that these emissions could grow, in the absence of policies, by 200 to 300% by 2050 as a result of the growth in world trade.¹⁹¹

CO₂ emitted from low quality bunker fuel is the most important GHG emitted by ships, but ships also emit CH₄, NO_x, and HFCs (from refrigeration), as well as black carbon and ozone precursor gases such as carbon monoxide and non-methane VOCs.

Table 1: Summary of GHG Emissions from Shipping during 2007¹⁹²

	International shipping (million tonnes)	Total Shipping	
		Million tonnes	CO ₂ equivalent
CO ₂	870	1050	1050
CH ₄	Not determined*	0.24	6
N ₂ O	0.02	0.03	9
HFC	Not determined*	0.0004	≤ 6

* A split into domestic and international emissions is not possible.

187. Control of Air Pollution From Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 77 Fed. Reg. 36,342 (June 18, 2012).

188. *Regulatory Announcement: New Emission Standards for New Commercial Aircraft Engines*, EPA (Nov. 2005), <http://www.epa.gov/nonroad/aviation/420f05015.htm>.

189. 42 U.S.C. § 7571(a)(2)(A) .

190. INT'L MARITIME ORG., SECOND IMO GHG STUDY 2009, at 1 (2009).

191. *Id.*

192. *Id.* at 3, Table 1.1.

The EPA could also adopt emissions standards for marine vessels. Section 213(a)(4) of the Clean Air Act provides the EPA with the authority to promulgate standards for emissions other than CO, NO_x, and VOCs from “non-road engines and vehicles,” a category that includes ships, provided that the Administrator determines that emissions of GHGs from ships are “significant contributors” to air pollution which may reasonably be anticipated to endanger public health or welfare.¹⁹³ According to the EPA’s own analysis, new standards could reduce GHG emissions by 20 to 40 million metric tons.¹⁹⁴ These reductions would result from efficiency improvements from technology retrofits on existing ships, technology or design concepts for both new ships and retrofits, and operational improvements for all ships.¹⁹⁵ Reducing vessel speed by 5 to 10%, while increasing time at sea, could reduce CO₂ emissions by more than 15%.¹⁹⁶ Whether the EPA can require a variety of fuel-switching or technology-based improvements that reduce GHGs could be the subject of debate, because 95% of the fleet calling on U.S. ports is foreign-flagged and these vessels will emit many of the CO₂ emissions on the high seas.¹⁹⁷ As several states and environmental organizations have petitioned to regulate vessel emissions,¹⁹⁸ the EPA will likely need to address this issue soon.¹⁹⁹

193. 42 U.S.C. § 7547(a)(4).

194. EPA, *EPA Analysis of the Transportation Sector: Greenhouse Gas and Oil Reduction Scenarios* 46 (Mar. 18, 2010).

195. *Id.* at 43.

196. A.P. MOLLER-MAERSK GROUP, HEALTH, SAFETY, SECURITY AND ENVIRONMENT REPORT 2008, at 30 (2008).

197. JAMES E. MCCARTHY, CONG. RESEARCH SERV., R40506, CARS AND CLIMATE: WHAT CAN EPA DO TO CONTROL GREENHOUSE GASES FROM MOBILE SOURCES? 12 (2009).

198. *See, e.g.*, Petition for Rule Making Seeking the Regulation of Greenhouse Gas Emissions from Ocean-Going Vessels, People of the State of California Acting by and Through Attorney General Edmund G. Brown, Jr. v. Stephen Johnson (Oct. 3, 2007).

199. The Supreme Court has held that the Americans with Disabilities Act (ADA) could be applied to foreign-flagged cruise ships so long as the ADA-required accommodations did not interfere with the ships’ internal affairs or require major, permanent modifications to the ships. *Spector v. Norwegian Cruiseline*, 545 U.S. 119, 120 (2005). The United States also enforces pollution standards on ships in its territorial waters. *See, e.g.*, 36 C.F.R. 13.65(b)(4) (2012). As one author notes, “it might be that a distinction needs to be made between operational factors (speed, fuel type, etc.), that are easily amenable to control, and permanent modifications of the vessel.” MCCARTHY, *supra* note 197, at 12.

4. Other Non-Road Engines and Vehicles

The same authority that gives the EPA authority to regulate vessel emissions also grants it authority to regulate emissions from other non-road engines—construction equipment, farm equipment, forklifts, outdoor power equipment, lawn and garden equipment, and recreational vehicles.²⁰⁰ In 2007, this sector accounted for 199.7 million metric tons of CO₂ emissions, 3.3% of U.S. 2007 CO₂ emissions.²⁰¹ The EPA should ascertain the feasibility of reducing emissions from this sector.

C. Short-lived Climate Forcers

Perhaps the greatest opportunity for addressing climate change in the short term is for the United States and other governments to act aggressively on short-lived climate forcers—black carbon, methane (CH₄), and tropospheric ozone (O₃). Short-lived climate forcers are frequently considered together because of their chemical links. For example, measures to reduce methane have a large impact on global and regional warming because methane is a GHG itself and a precursor to tropospheric ozone, a powerful GHG.²⁰² Measures to reduce black carbon will also reduce concentrations of tropospheric ozone, largely through reductions in emissions of carbon monoxide, a precursor gas of ozone.²⁰³

The significant role that short-lived climate forcers can play in climate change mitigation is underscored by reviewing the effects of these substances on radiative forcing.²⁰⁴ These three substances, together with industrial gases such as CFCs and HFCs, account for more than half of current climate change.²⁰⁵ Because of their short atmospheric lifetimes, at least for the short-lived climate forcers, efforts to significantly reduce emissions of short-lived climate forcers can move us much closer to the goal of maintaining temperature at no more than 2°C above pre-industrial levels. The 2°C goal translates to radiative forcing of less than or equal to 2.5 watts per meter squared

200. 42 U.S.C. § 7547(a)(4) (2012).

201. MCCARTHY, *supra* note 197, at 13.

202. UN ENVIR. PROG. & WORLD METEOROLOGICAL ORG., INTEGRATED ASSESSMENT OF BLACK CARBON AND TROPOSPHERIC OZONE: SUMMARY FOR DECISION MAKERS 7 (2011) [hereinafter UNEP & WMO].

203. *See id.* at 1–2 (summarizing the effects of reducing carbon monoxide emissions).

204. Absorbed solar energy is exactly balanced by radiation emitted to space by the Earth and atmosphere when the climate system is in equilibrium. Factors that disturb this balance, and thus potentially alter the climate, are called radiative forcing agents. Alley et al. *supra* note 14, at 2 n.2.

205. *See infra* Table 2.

(Wm^{-2})²⁰⁶ and, with no further increases in emissions of other gases, eliminating black carbon, methane, and tropospheric ozone would reduce radiative forcing to 0.427 Wm^{-2} .

Table 2: Radiative Forcing (RF) of Climate Forcers in 2005 (in Wm^{-2})²⁰⁷

Long-lived Climate Forcers	RF
CO ₂	1.66
HFCs, PFCs, SF ₆	0.017
N ₂ O	0.16
CFCs, HCFCs and other Montreal Protocol Gases	0.32
Short-lived Climate Forcers	
Black Carbon	0.90
Tropospheric Ozone (O ₃)	0.35
Methane (CH ₄)	0.48
Subtotal	3.878
Other	
SO ₂ /NO _x mix	- 2.1
Land surface changes due to deforestation	- 0.2
Total	1.578

Of course, the present reality is much more complex than this. CO₂ emissions will increase, absorption of CO₂ by oceans is slowing, and efforts to reduce short-lived climate forcers will also eliminate emissions of substances that cool the earth by reflecting light back into space. Still, the math shows us that significant efforts to reduce short-lived climate forcers provide an important opportunity to meet the 2°C goal in a relevant timeframe to avoid unmanageable climate change impacts.

A joint report by the UN Environment Programme (UNEP) and the World Meteorological Organization (WMO) indicates that a small number of measures relating to black carbon, methane, and tropospheric ozone could pack a significant mitigation punch.²⁰⁸

206. Veerabhadran Ramanathan & Yangyang Xu, *The Copenhagen Accord for Limiting Global Warming: Criteria, Constraints, and Available Avenues*, 107 PROCEEDINGS NAT'L ACAD. SCI. 8055, 8055 (May 4, 2010).

207. P. Forster et al., *Changes in Atmospheric Constituents and in Radiative Forcing*, in CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS 131–32 (Susan Solomon et al., eds., 2007); Ramanathan & Xu, *supra* note 206, at 8056 (for black carbon).

208. UNEP & WMO, *supra* note 202, at 2.

Specifically, the report suggests that projected warming during the 2030s could be halved through implementation of these measures to reduce short-lived climate forcers.²⁰⁹ In contrast, even a fairly aggressive strategy to reduce CO₂ “does little to mitigate warming over the next 20–30 years.”²¹⁰ Significant co-benefits to air quality, human health, and world food supplies would also result from reducing black carbon and tropospheric ozone.²¹¹ UNEP has estimated the value of avoiding premature deaths relating to exposure to tropospheric ozone and PM_{2.5} (essentially black carbon), and premature deaths resulting from measures to reduce methane and black carbon, at a staggering \$1.7 to 10.9 trillion.²¹²

1. Black Carbon

Black carbon, or soot, is a component of fine particle pollution emitted from diesel engines, residential stoves, agricultural and forest fires, and some industrial facilities.²¹³ Black carbon particles are small, typically smaller than a micrometer,²¹⁴ but nonetheless have a large impact on climate change. In the atmosphere, black carbon absorbs solar radiation, which heats the surrounding air.²¹⁵ It also causes warming when it is deposited on snow and ice, again, where it absorbs solar radiation and accelerates the melting of the snow and ice.²¹⁶ It can also alter cloud formation by warming surrounding air and burning off low-level stratus and cumulus clouds, which allows more solar radiation to reach the earth’s surface.²¹⁷ Scientists estimate that the contribution of one gram of black carbon to climate change over a period of 100 years is 100 to 2,000 times greater than one gram of

209. *Id.* at 9–10.

210. *Id.* at 10.

211. *See id.* at 16–18 (including reduction of premature deaths, improved human health, and better crop yields). *See also* EPA, REPORT TO CONGRESS ON BLACK CARBON 148 (2012) (expounding on potential health benefits) [hereinafter EPA, REPORT TO CONGRESS ON BLACK CARBON].

212. EPA, REPORT TO CONGRESS ON BLACK CARBON, *supra* note 211, at 148 (citing UNEP & WMO, *supra* note 202, at 122).

213. Jessica Seddon Wallack & Veerabhadran Ramanathan, *The Other Climate Changers: Why Black Carbon and Ozone Also Matter*, FOREIGN AFF., Sept. 2009, at 105, 106.

214. EPA, REPORT TO CONGRESS ON BLACK CARBON, *supra* note 211, at 20.

215. *Id.* at 17.

216. *Id.*

217. Mario Molina et al., *Reducing Abrupt Climate Change Risk Using the Montreal Protocol and Other Regulatory Actions to Complement Cuts in CO₂ Emissions*, 106 PROCEEDINGS NAT’L ACAD. SCI. 20616, 20618–19 (2009).

CO₂, even though its lifetime is only days to weeks.²¹⁸ When mixed with water soluble aerosols, however, it can create greater cloud cover that reflects more solar radiation back into the atmosphere and cools the earth.²¹⁹ For this reason, the precise global warming impact of black carbon is still uncertain.²²⁰

Black carbon may also indirectly contribute to global warming. For example, because black carbon accelerates the melting of snow and ice in the Arctic by absorbing solar radiation (sunlight), it contributes to longer ice-free Arctic conditions conducive to opening new Arctic navigation routes and new oil production facilities. Both of these activities will increase GHG emissions, including emissions of black carbon.²²¹

Black carbon is the second largest warming agent and, while its effects are felt nearly everywhere, its effects are felt the most in the Arctic and other areas of snow and ice. The Arctic, for example, is warming more than twice as fast as the rest of the planet,²²² and black carbon is a major contributor. By one estimate, black carbon “may be responsible for ~0.5–1.4°C of the 1.9°C warming observed in the Arctic from 1890 to 2007,” with the largest impact deriving from black carbon emissions in northern Eurasia, North America, and Asia.²²³ In the Tibetan Himalayas, black carbon may be responsible for 0.6°C of the 1°C warming since the 1950s.²²⁴

Black carbon derives almost exclusively from two major sources: the use of fossil fuels and biomass burning.²²⁵ Fossil fuels, particularly diesel, contribute about 35% of black carbon emissions worldwide.²²⁶ The remaining black carbon emissions are a result of “burning of

218. UNEP & WMO, *supra* note 202, at 6.

219. Molina et al., *supra* note 217, at 20618–19.

220. *Id.* at 20619. *See also* UNEP & WMO, *supra* note 202 (describing the known effects of black carbon). A just-released study indicates that the climate effects of black carbon are worse than previously thought. T.C. Bond et al., *Bounding the Role of Black Carbon in the Climate System: A Scientific Assessment*, J. GEOPHYSICAL RES. ATMOSPHERES, forthcoming 2013, available at <http://onlinelibrary.wiley.com/doi/10.1002/jgrd.50171/abstract>.

221. *See* Erika Rosenthal & Robert Watson, *Multilateral Efforts to Reduce Black Carbon Emissions: A Lifeline for the Warming Arctic?*, 20 REV. EUR. COMM. & INT. ENV'TL L. 3, 4–5 (2011).

222. Center for Climate and Energy Solutions, *Global Warming and the Arctic FAQs*, <http://www.c2es.org/science-impacts/basics/faqs/arctic> (last visited Dec. 20, 2012).

223. Molina et al., *supra* note 217, at 20619.

224. *Id.*

225. UNEP & WMO, *supra* note 202, at 6.

226. Wallack & Ramanathan, *supra* note 213, at 107.

biomass from forest fires, man-made fires for clearing cropland, and the use of organic fuels for cooking, heating, and small-scale industry.”²²⁷

The United States has the world’s highest per capita emissions of black carbon,²²⁸ accounting for 8% of the global total.²²⁹ In the United States, the transport sector is responsible for 52.3% of U.S. black carbon emissions;²³⁰ 35.3% results from biomass burning, including wildlife fires, and 7.8% from stationary sources such as energy production and other industrial sources.²³¹

While the United States has made efforts to reduce black carbon from the transport sector, it can do much more. The EPA estimates black carbon emissions will decline by 86% by 2030 due to regulations that apply to emissions standards for new engines, including requirements resulting in use of diesel particulate filters (DPFs).²³² While this is impressive, there is no need to wait until 2030 or to limit the regulations to new engines.²³³ Because black carbon dissipates quickly and has a GWP 100 to 2000 times that of CO₂,²³⁴ efforts should be made to eliminate black carbon more quickly. For example, regenerative filters for diesel vehicles reduce black carbon emissions by up to 99%.²³⁵ According to one estimate, “retrofitting one million semitrailer trucks with DPFs between 2012 and 2030 would provide the total equivalent carbon dioxide reduction of 96 million metric tons—equivalent to eliminating the annual emissions of 21 million cars or 1.8 million diesel semitrailer trucks.”²³⁶

227. *Id.*

228. Zeke Hausfather, *Black Carbon and Global Warming: A Promising Short-Term Approach?*, THE YALE FORUM ON CLIMATE CHANGE & THE MEDIA (July 9, 2009), <http://www.yaleclimatemediaforum.org/2009/07/black-carbon-and-global-warming/>.

229. EPA, REPORT TO CONGRESS ON BLACK CARBON, *supra* note 211, at 6.

230. *Id.* at 2, fig. A.

231. *Id.*

232. *Id.* at 8.

233. For example, the EPA has already begun the SmartWay Transport Partnership Program, a retrofit program for in-use mobile diesel engines, as part of the National Clean Diesel Campaign. *SmartWay Transport Program*, EPA, <http://www.epa.gov/cleanschoolbus/sw-overview.htm> (last updated Oct. 22, 2012).

234. UNEP & WMO, *supra* note 202, at 6.

235. S. Biswas et al., *Chemical Speciation of PM Emissions from Heavy-Duty Diesel Vehicles Equipped with Diesel Particulate Filter (DPF) and Selective Catalytic Reduction (SCR) Retrofits*, 43 ATMOS. ENV’T 1917, 1921–22 (2009).

236. L. BRUCE HILL, CLEAN AIR TASK FORCE, THE CARBON DIOXIDE-EQUIVALENT BENEFITS OF REDUCING BLACK CARBON EMISSIONS FROM

The EPA could also take more aggressive action to limit black carbon emissions from stationary sources resulting from coal combustion (for example, utilities, industrial and commercial boilers, and other industrial processes) and stationary diesel engines. Existing technologies and strategies exist to abate emissions, including “use of cleaner fuels and direct PM_{2.5} reduction technologies such as fabric filters (baghouses), electrostatic precipitators (ESPs), and DPFs.”²³⁷ While biomass burning provides additional challenges, options do exist,²³⁸ such as banning open field burning of agricultural waste.²³⁹

On the global level, the United States could also do much more. The Global Alliance for Clean Cookstoves is a public-private partnership comprising more than 300 public and private partners and 35 countries that seeks to “save lives, improve livelihoods, empower women, and combat climate change by creating a thriving global market for clean and efficient household cooking solutions.”²⁴⁰ It has set a “goal to foster the adoption of clean cookstoves and fuels in 100 million households by 2020.”²⁴¹ However, U.S. contributions to the partnership have been small, just \$50 million over the first five years.²⁴² Given the significance of black carbon to climate change and the health of hundreds of millions of women and children exposed to black carbon from biomass cooking, more significant U.S.

U.S. CLASS 8 TRUCKS USING DIESEL PARTICULATE FILTERS: A PRELIMINARY ANALYSIS 4 (2009).

237. EPA, REPORT TO CONGRESS ON BLACK CARBON, *supra* note 211, at 8. For more on options for reducing black carbon from trucks, see *Technologies Diesel Retrofit Devices*, EPA, <http://www.epa.gov/cleandiesel/technologies/retrofits.htm> (last updated Sept. 27, 2012).
238. See Molina et al., *supra* note 217, at 20619. Addressing biomass cooking will be challenging. Biomass cooking, which emits black carbon as well as methane and carbon monoxide, both of which produce ozone and thus amplify warming, is used by an estimated three billion people in the developing world. Despite China’s rapid economic growth, approximately 80% of Chinese households rely on solid fuels like wood or dung to meet their energy needs. The benefits of replacing traditional biomass cooking with BC-free stoves in specific regions would be significant: it could reduce BC-caused warming by 70 to 80% over South Asia and by 20 to 40% over East Asia. *Id.*
239. UNEP & WMO, *supra* note 202, at 166.
240. *The Cookstove Story*, GLOBAL ALLIANCE FOR CLEAN COOKSTOVES, <http://cleancookstoves.org> (last visited Dec. 20, 2012).
241. *Id.*; see also *Global Alliance for Clean Cookstoves*, U.S. DEP’T OF STATE, <http://www.state.gov/s/partnerships/cleancookstoves/index.htm> (last visited Dec. 20, 2012).
242. *The United States Commitment to the Global Alliance for Clean Cookstoves: Year One Progress Report*, U.S. DEP’T. STATE (Sept. 22 2011), available at <http://www.state.gov/r/pa/prs/ps/2011/09/173774.htm>.

contributions could create a huge, positive impact on the environment and human health.

2. Methane

Methane is a GHG in its own right with an atmospheric life of 12 years,²⁴³ but it is also a precursor for ozone. Methane has the second largest RF of the GHGs after CO₂.²⁴⁴ Methane is a potent greenhouse gas that has 25 times the global warming potential of CO₂ over a 100-year time frame and 72 times the global warming potential of CO₂ over a 20-year time frame.²⁴⁵ The IPCC has reported that present atmospheric concentrations of methane “are unprecedented in at least the last 650,000 years,” with concentrations rising from 715 parts per billion in 1970 to 1,774 in 2005.²⁴⁶ These increases in methane result from agriculture, including rice cultivation and the keeping of ruminant livestock, coal mining, oil and gas production and distribution, biomass burning, and municipal waste landfills.²⁴⁷

As with reducing emissions of other short-lived climate forcers, reducing emissions of methane will have significant co-benefits for human health and air quality. For some methane sources, emission control measures for methane also reduce other co-emitted substances such as VOCs that contribute to the formation of tropospheric ozone, as well as air toxins, such as benzene, carbon tetrachloride, and chloroform.

a. Methane to Markets Partnership

In 2004, fourteen governments, including the United States, launched the Methane to Markets Partnership to advance cost-effective, near-term methane recovery and the use of methane as a clean energy source.²⁴⁸ “The Initiative has focused on methane recovery and use opportunities in the agriculture (animal waste management), coal mine, landfill, and oil and gas system sectors.”²⁴⁹ The Partnership, renamed the Global Methane Initiative in 2010, now includes thirty eight additional governments, the European

243. Forster et al., *supra* note 207, at 212, Table 2.14.

244. *Id.* at 141, Table 2.1

245. *Id.* at 212, Table 2.14. The United States has recently estimated that methane has a GWP 21 times that of CO₂ over a 100-year period. EPA, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS, *supra* note 96, at ES-3.

246. Forster et al., *supra* note 207, at 140, 143.

247. *Id.* at 142.

248. *Global Methane Initiative: Initiative*, EPA, <http://www.epa.gov/globalmethane/initiative.htm> (last updated Sept. 21, 2012).

249. *Id.*

Commission, the Asian Development Bank, and the Inter-American Development Bank, as well as NGO participants, that have collaborated on more than 300 projects around the world that have reduced methane emissions by approximately 40 million MtCO₂eq.²⁵⁰ When fully implemented, these projects are expected to reduce emissions by more than 60 million MtCO₂eq per year while also providing new sources of clean energy, supporting technology transfer, stimulating local economic growth, and providing public health and environmental benefits.²⁵¹ Participating governments are also asked to develop action plans in order to coordinate methane reduction efforts, and developed countries will provide coordinated assistance to developing country partners.²⁵²

The United States has been a leading participant in the Methane to Markets Partnership, yet its commitment could be greatly expanded. The current U.S. financial commitment to the Partnership is just “\$53 million over a five-year period to facilitate the development and implementation of methane projects in both developing countries and countries with economies in transition.”²⁵³ Even just the fiscal year FY 2006 contribution of \$12.9 million led to methane reductions of 9 MMTCO₂eq.²⁵⁴ Moreover, the \$18.3 million contribution from the United States helped to leverage an additional \$261 million from private and foreign government sources.²⁵⁵ Given methane’s high GWP and short atmospheric lifespan, additional U.S. financial contributions could result in substantial reductions in methane emissions.

b. Natural Gas

Methane typically composes nearly 90% of natural gas, a fuel that is rapidly replacing coal and other fossil fuels to generate electricity and power vehicles.²⁵⁶ However, in the United States in 2009, industry lost 2.4%—623 billion cubic feet—of methane during production and

250. *See id.*

251. *Global Methane Initiative: Accomplishment Report*, EPA, <http://www.epa.gov/globalmethane/accompreport-10.htm> (last updated Sept. 21, 2012).

252. *Terms of Reference*, GLOBAL METHANE INITIATIVE, <http://www.globalmethane.org/about/terms.aspx> (last visited Dec. 20, 2012).

253. EPA, METHANE TO MARKETS, U.S. GOVERNMENT ACCOMPLISHMENTS IN SUPPORT OF THE METHANE TO MARKETS PARTNERSHIP 4 (2007).

254. *Id.* at 4, 6.

255. *Id.* at 7.

256. SUSAN HARVEY ET AL., NAT’L RESOURCES DEFENSE COUNCIL, LEAKING PROFITS: THE U.S. OIL AND GAS INDUSTRY CAN REDUCE POLLUTION, CONSERVE RESOURCES, AND MAKE MONEY BY PREVENTING METHANE WASTE 3 (2012).

distribution.²⁵⁷ This represents about 37% of total U.S. methane emissions in 2009.²⁵⁸

The EPA has introduced a number of voluntary programs, such as the Natural Gas STAR program, which encourages companies “to adopt cost-effective technologies and practices that improve operation efficiency and reduce emissions of methane.”²⁵⁹ Through this program, the EPA offers technical documents covering a wide range of recommended technologies and practices, including implementation costs and anticipated payback periods.²⁶⁰ Despite these resources, it appears that industry has not embraced the methane-reducing technologies and practices recommended by the EPA.²⁶¹

In addition, and as noted above,²⁶² the EPA has, for various aspects of oil and natural gas production, revised new source performance standards for VOCs and sulfur dioxide, revised standards for leak detection and repairs, and established emissions standards for previously uncontrolled emissions sources.²⁶³ While the new standards will significantly reduce methane emissions indirectly, the EPA could do more if it regulated methane directly.²⁶⁴ According to the Natural Resources Defense Council, the EPA leaves approximately 74% of the

257. *Id.* These estimates may significantly undervalue emissions lost due to production and distribution of natural gas. *See id.* at 12 (discussing uncertainty in methane emissions estimates due to EPA’s accounting methods and EPA’s ongoing efforts to improve its estimates).

258. *Id.* at 4. More recent estimates put methane emissions from the oil and gas industry at more than 40 percent of the total U.S. methane emissions—or roughly 5 percent of total U.S. emissions of all GHGs. Proposed NSPS Rule, 77 Fed. Reg. at 49,535.

259. *Natural Gas STAR Program*, EPA, <http://www.epa.gov/gasstar/> (last updated Sept. 27, 2012).

260. *See id.*

261. HARVEY ET AL., *supra* note 256, at 14.

262. *See supra* Section III, No. 19.

263. Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews, 77 Fed. Reg. 49,490 (Aug. 16, 2012).

264. The failure to do so arguably violates the EPA’s duty under Section 111 of the Clean Air Act because the EPA has already determined that methane and other GHGs are “air pollutants” that “in his judgment . . . causes, or contributes significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare.” 42 U.S.C. § 7411(b)(1)(A) (2012). *See also* Endangerment and Cause or Contribute Findings for Greenhouse Gases, 74 Fed. Reg. 66,496 (Dec. 15, 2009).

methane emissions from the oil and gas industry unaffected by the new rules.²⁶⁵

In addition, the EPA has the authority to regulate existing sources of methane emissions, but it has chosen to omit them from the new rule despite substantial emissions from existing sources. Under Section 111(d) of the Clean Air Act, the EPA is required to work with the states to control emissions of pollutants, like methane, from existing sources.²⁶⁶ The Secretary of Energy Advisory Board specifically recommended that the EPA adopt standards for existing sources.²⁶⁷ Without mandated emission limits on existing sources, such as compressors and pneumatic devices, “these outdated devices will continue to spew unchecked pollution for years to come.”²⁶⁸ Moreover, “[b]ecause a large amount of the pollution from existing sources can be controlled using the same or similar technologies that the EPA is proposing for new and modified sources, the EPA could quickly and efficiently develop and implement such standards.”²⁶⁹

3. Tropospheric Ozone

Tropospheric ozone (O₃) is a significant greenhouse gas and human health pollutant. Ozone is not emitted directly but is formed when methane, nitrogen oxides (NO_x—nitric oxide (NO) and nitrogen dioxide (NO₂)), VOCs, and carbon monoxide react with sunlight.²⁷⁰ Large increases in these ozone precursor gases have increased tropospheric ozone concentrations globally by roughly 30% from preindustrial levels; in the northern hemisphere, ozone concentrations have more than doubled.²⁷¹ The contribution of tropospheric ozone to

265. Letter from Berks Gas Truth et al., to Lisa Jackson, EPA Administrator (Nov. 30, 2011), *available at* <http://www.scribd.com/doc/74404768/Environmentalists-Comments-on-EPA-s-Proposed-Oil-and-Gas-Emission-Rules>.

266. *See* 42 U.S.C. § 7411(d).

267. *See* SEC’Y OF ENERGY ADVISORY BOARD, SHALE GAS PRODUCTION, SECOND NINETY DAY REPORT 4–5 (2011) (noting that the proposed rules, which did not change in relevant part in the final rules, “fall short of the recommendations made in the Subcommittee’s Ninety-Day Report because the rules do not directly control methane emissions and the NSPS rules as proposed do not cover existing shale gas sources except for fractured or re-fractured existing gas wells.”).

268. Letter from Berks Gas Truth et al., *supra* note 265.

269. *Id.*

270. UNEP & WMO, *supra* note 202, at 7–8.

271. Royal Society, *Ground-level Ozone in the 21st Century: Future Trends, Impacts and Policy Implications 1* (Sci. Pol’y Report 15/08, Oct. 2008), *available at* http://royalsociety.org/uploadedFiles/Royal_Society_Content/policy/publications/2008/7925.pdf.

global warming, even though its atmospheric lifetime is only 4 to 18 days, is about 20% of that caused by CO₂.²⁷²

Emissions of ozone precursor gases arise from a wide variety of natural and anthropogenic sources: “energy generation, transport, agriculture, industrial processes, biomass burning and land use changes such as deforestation are significant sources of O₃ precursor gases.”²⁷³ Given the nature of these sources, socioeconomic factors such as poverty, urbanization, and population growth will influence the production of natural and anthropogenic O₃ precursor emissions, as transport, industrial infrastructure, and energy use continue to grow.²⁷⁴

Breathing ozone causes a range of human health problems, including chest pain, coughing, throat irritation, and congestion.²⁷⁵ It can worsen bronchitis, emphysema, and asthma, as well as reduce lung function and inflame the linings of the lungs.²⁷⁶ Repeated exposure to ozone may permanently scar lung tissue.²⁷⁷

Ozone is also toxic to plants. UNEP and the WMO estimate that measures to control emissions of methane to reduce tropospheric ozone concentrations could avoid the loss of about 25 million tons of rice, maize, soybean, and wheat annually.²⁷⁸ The Royal Society put this damage from ozone in monetary terms: it estimated that ozone caused \$14 to \$26 billion in 2000 in crop damage, a figure “significantly higher than present day losses to crops projected to occur as a result of climate change.”²⁷⁹

D. *Technology*

As noted in Section II of this paper, the International Energy Agency (IEA) has reported that if internationally coordinated action is not taken by 2017, then all new infrastructure from 2017 to 2035 would need to be zero-carbon in order to meet the IEA’s 450 ppm scenario.²⁸⁰ The way out of this technologically demanding scenario is to retire emitting infrastructure before the end of its economic

272. Molina et al., *supra* note 217, at 20619; Royal Society, *supra* note 281, at 1.

273. Royal Society, *supra* note 271, at 3.

274. *Id.* at 11.

275. *Health Effects*, EPA, <http://epa.gov/glo/health.html> (last updated Nov. 1, 2012).

276. *Id.*

277. *Id.*

278. UNEP & WMO, *supra* note 202, at 16.

279. Royal Society, *supra* note 271, at 77.

280. *See supra* text accompanying notes 21–25.

lifetime. At least in the United States, given the EPA's focus on setting emissions for new and modified sources of GHGs, it seems unlikely that firms will be willing to retire that infrastructure early. The costs of this inaction are steep—for every \$1 of avoided investment in the power sector before 2020, an additional \$4.3 after 2020 must be spent to compensate for the higher emissions.²⁸¹ Also as described earlier, we need a technological revolution. Hybrid engines still run on fossil fuel; they are part of an incremental approach that ultimately continues our dependence on fossil fuels. Even the new emissions standards set for 2017 to 2025 will not require a technological revolution away from fossil fuels, despite requiring an average fuel economy of 54.5 mpg.²⁸²

So how do we achieve this technological revolution? Here are some ideas, none of which are totally new: climate change technology prizes, serious investments in renewable energy infrastructure, and elimination of fossil fuel subsidies.

1. Climate Change Technology Prizes

The idea of offering prizes for technological and other breakthroughs is not new.²⁸³ After years of failing to find a means to navigate the oceans safely without getting lost, the British Parliament offered a prize to the person who could design such a system.²⁸⁴ Taking up the challenge, John Harrison, a self-educated English carpenter and clockmaker, invented the marine chronometer to establish the longitude of a ship at sea. For his efforts, the British Parliament awarded him £8,750²⁸⁵ in addition to £10,000 in prize money from Britain's Board of Longitude.²⁸⁶

Professor Jonathan Adler has recently summarized the benefits of prizes over grants.²⁸⁷ Grants tend to limit the range of promising

281. IEA, *supra* note 21, at 2.

282. See Bill Vlasic, *U.S. Sets High Long-Term Fuel Efficiency Rules for Automakers*, N.Y. TIMES, Aug. 28, 2012, at B1 (quoting Daniel Becker, Director of the Safe Climate Campaign, a Washington-based environmental advocacy group, as saying “[t]he vast majority of vehicles will be more efficient without using electric or hybrid powertrains”).

283. See, e.g., DEBORAH D. STINE, CONG. RES. SERV., R40677, FEDERALLY FUNDED INNOVATION INDUCEMENT PRIZES I (2009).

284. See generally DAVA SOBEL, LONGITUDE: THE TRUE STORY OF A LONE GENIUS WHO SOLVED THE GREATEST SCIENTIFIC PROBLEM OF HIS TIME (1995).

285. *Id.* at 149.

286. *Id.* at 129–32.

287. See Jonathan H. Adler, *Eyes on Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization*, 35 HARV. ENVTL. L. REV. 1, 28–35 (2011).

ventures because grant recipients must meet specific grant criteria. In addition, the research resulting from a grant may not result in useful technological innovations, but the government must pay for the research regardless of its value or marketability. Moreover, political pressure may influence grant decision-making.²⁸⁸ In contrast, prizes are only paid when the innovation meets specified criteria. Further, prizes may incentivize innovation more than regulatory or market-based mechanisms.²⁸⁹ As the National Academies of Science (NAS) noted, “compared with grant programs, prize programs may be expected to attract more individuals, informal teams, and for-profit firms of various sizes and perhaps not as many academic institutions.”²⁹⁰

The major questions with climate change prizes are the dollar amount of the prizes, the criteria for receiving the prizes, and ownership of the intellectual property rights. While some have suggested prize values of \$100 to \$200 million annually for innovations in zero-energy building design, reductions in urban greenhouse gas emissions, and increased development of fuel-efficient vehicles,²⁹¹ others have suggested much higher dollar amounts, perhaps as much as \$1 billion per year over ten years, representing one third of the \$30 billion the federal government has budgeted for climate-related technologies over the next decade.²⁹² For the kinds of transformative technologies we need to transform energy systems, the transport sector, and industrial processes, prizes towards the higher dollar suggestion may be more appropriate.²⁹³

With respect to intellectual property rights, the NAS counsels that the federal government should not retain ownership of the intellectual property deriving from the invention unless the prizewinner chooses not to put the invention into commercial use or allow others to license the invention.²⁹⁴ It also proposes that the prizewinner not be required to make the invention available at no cost or on concessional terms.²⁹⁵ These stipulations certainly would help

288. *Id.* at 44.

289. *Id.* at 36.

290. NAT'L RES. COUNCIL NAT'L ACAD. OF SCI., INNOVATION INDUCEMENT PRIZES AT THE NATIONAL SCIENCE FOUNDATION 13 (2007).

291. Thomas Kalil, *Prizes for Technological Innovation*, 9 (The Brookings Inst. & The Hamilton Project, Discussion Paper 2006-08, Dec. 2006).

292. Adler, *Eyes on a Climate Prize*, *supra* note 287, at 43.

293. In this regard, the £20,000 offered in 1714 for designing a system to measure longitude would be worth roughly £3 million today (\$4.74 million).

294. NAT'L RES. COUNCIL NAT'L ACAD. OF SCI., *supra* note 290, at 33–34.

295. *Id.* at 33.

encourage inventors to test novel technologies. The one caveat that might be made is that the federal government be allowed to recoup some portion of the prize money, particularly if the prize money tends toward the \$1 billion range.

2. Investments in Renewable Energy Infrastructure

The IEA anticipates that energy consumption will grow by 53% from 2008 to 2035 without policies that bend this trajectory.²⁹⁶ In the absence of such policies, the share of fossil fuels in global primary energy consumption will be around 75% in 2035.²⁹⁷ Moving towards energy sustainability will require policies on a broad range of fronts, including conserving energy, increasing energy efficiency, fuel switching, and improving land use practices to improve carbon storage and prevent CO₂ emissions. As the United Nations Environment Programme succinctly states, “[n]one of these things will happen without any effort. Governments individually and collectively will need to make them happen through strong policies and measures, including a range of regulatory and market-based interventions.”²⁹⁸

Just as with fossil fuel subsidies, accounting for the precise value of subsidies for renewable energy is difficult, largely because subsidies come in a variety of forms, and assessors must determine whether some governmental programs meet their definition of a subsidy.²⁹⁹ In

296. *International Energy Outlook 2011: Highlights*, U.S. ENERGY INFO. ADMIN. (Sept. 19, 2011), <http://www.eia.gov/forecasts/ieo/>.

297. INT’L ENERGY AGENCY, *WORLD ENERGY OUTLOOK: EXECUTIVE SUMMARY 2011*, at 2 (2011).

298. UN ENVIR. PROG., *REFORMING ENERGY SUBSIDIES: OPPORTUNITIES TO CONTRIBUTE TO THE CLIMATE CHANGE AGENDA 10 (2008)* [hereinafter *UNEP REFORMING ENERGY SUBSIDIES*].

299. UNEP synthesizes the various definitions of “subsidy” as follows:

There is enormous confusion about what is meant by an energy subsidy. The narrowest and perhaps most common definition is a direct cash payment by a government to an energy producer or consumer to stimulate production or use of a particular fuel or form of energy. Broader definitions attempt to capture other types of government interventions that affect prices or costs, either directly or indirectly. For example, a recent [Organization for Economic Co-operation and Development] study defined a subsidy in general terms *as any measure that keeps prices for consumers below market levels, or for producers above market levels or that reduces costs for consumers and producers*. The US Energy Information Administration has defined an energy subsidy as *any government action designed to influence energy market outcomes, whether through financial incentives, regulation, research and development or public enterprises*. In a similar way, the IEA defines energy subsidies as *any government action that concerns primarily the energy sector that lowers the*

any event, the U.S. Department of Energy estimates that 2010 subsidies for renewable energy exceeded \$14.67 billion in 2010,³⁰⁰ \$6.19 billion deriving from the American Recovery and Reinvestment Act of 2009.³⁰¹

As another means to encourage technological change, the president should champion a national feed-in tariff program. Feed-in tariff programs for solar and wind power have proven effective in Denmark, Germany, Japan, and elsewhere.³⁰² They have also been effective in parts of the United States, such as Portland and Eugene, Oregon.³⁰³ A national feed-in tariff program could provide the incentive for a renewable energy breakthrough.³⁰⁴

Additional subsidies for the renewable energy sector may also spur the innovation and transition to a low-carbon economy. Identifying an end date or specific target at which time the subsidies end may help signal to producers and consumers that these subsidies are not everlasting. In the case of climate change, perhaps the end date is when the technology is cost-competitive with fossil fuel power or when renewables reach a specific percentage of energy consumption.

3. Eliminate Fossil Fuel Subsidies

Even as CO₂, a byproduct of fossil fuel combustion, warms the planet, the world's nations are subsidizing the consumption of fossil fuels by more than \$312 billion annually³⁰⁵ and the production of fossil

cost of energy production, raises the price received by energy producers or lowers the price paid by energy consumers.

Id. at 11.

300. U.S. ENERGY INFO. ADMIN., DIRECT FEDERAL FINANCIAL INTERVENTIONS AND SUBSIDIES IN ENERGY IN FISCAL YEAR 2010, at xiii, Table ES2 (2011).

301. *See* American Recovery and Reinvestment Act of 2009, Pub. L. 111-5, 123 Stat. 115, 138-40, § 24.

302. UNEP REFORMING ENERGY SUBSIDIES, *supra* note 298, at 25.

303. *See* Lee van der Voo, *New Rates Set for Oregon's Feed-in-Tariff Program*, SUSTAINABLE BUS. OREGON (Sept. 21, 2010), http://www.sustainablebusinessoregon.com/articles/2010/09/new_rates_set_for_oregons_feed-in_tariff_program.html?page=all (demonstrating that the feed-in-tariff program was "so popular with consumers that its capacity was subscribed in just 15 minutes in the first enrollment period July 1.").

304. In 2008, Congressman Jay Inslee introduced a national feed-in tariff bill into the 110th Congress known as the Renewable Energy Jobs and Security Act, H.R.6401. For a discussion of some of the legal and policy issues relating to this bill, *see* WILSON RICKERSON ET AL., FEED-IN TARIFFS AND RENEWABLE ENERGY IN THE USA: A POLICY UPDATE 11-16 (2008).

305. INT'L ENERGY AGENCY, *supra* note 297, at 3.

fuels by perhaps another \$100 billion.³⁰⁶ Clearly these subsidies distort markets around the world, ensuring that petroleum products enter the market far below production costs and inhibit the development of renewable energy supplies. Moreover, they increase emissions of CO₂. Elimination of fossil fuel subsidies could reduce CO₂ emissions from 1.1% to 18%.³⁰⁷ The \$400 to \$500 billion a year in fossil fuel subsidies is roughly 1% of world gross domestic product (GDP); this is the amount that the Stern Review estimated was required to limit global warming to no more than a 2°C rise in temperature.³⁰⁸

Given the complexity of the way subsidies are provided, an exact figure of annual U.S. fossil fuel subsidies is difficult to identify, but U.S. fossil fuel subsidies appear to be in the range of \$10 billion³⁰⁹ to \$52 billion³¹⁰ annually. Three times, President Obama has submitted a budget to Congress that modestly reduces fossil fuel production subsidies—about \$4 billion annually³¹¹—only to have Congress restore them in the approved budget.³¹² The President spoke at Nashua Community College in New Hampshire in March 2012 on the need to

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306. INT'L ENERGY AGENCY ET AL., ANALYSIS OF THE SCOPE OF ENERGY SUBSIDIES AND SUGGESTIONS FOR THE G-20 INITIATIVE 4 (2010). Producer subsidies are estimated to be *at least* \$100 billion, and consumer subsidies to be estimated to be between \$200 and \$600 billion. *See* GLOBAL SUBSIDIES INITIATIVE (GSI) OF THE INTERNATIONAL INST. FOR SUSTAINABLE DEV., GSI-UNEP CONFERENCE REPORT, INCREASING THE MOMENTUM OF FOSSIL FUEL SUBSIDY REFORM: DEVELOPMENT AND OPPORTUNITIES 14–15 (2010).
307. JENNIFER ELLIS, GLOBAL STUD. INITIATIVE, THE UNTOLD BILLIONS: FOSSIL-FUEL SUBSIDIES, THEIR IMPACTS AND THE PATH TO FREEDOM 29 (2010).
308. NICHOLAS STERN, THE ECONOMICS OF CLIMATE CHANGE: THE STERN REVIEW 12–14 (2006).
309. ENVTL. LAW INST., ESTIMATING U.S. GOVERNMENT SUBSIDIES TO ENERGY SOURCES: 2002–2008, at 3 (2009) (concluding that fossil fuel subsidies totaled approximately \$72 billion over the seven-year study period).
310. Clayton, *supra* note 166.
311. *Fossil Fuel Subsidies in the U.S.*, OIL CHANGE INT'L, <http://priceofoil.org/fossil-fuel-subsidies/> (last visited Dec. 20, 2012).
312. *See* OFFICE OF MGMT. & BUDGET, EXEC. OFFICE OF THE PRESIDENT, BUDGET OF THE U.S. GOVERNMENT FISCAL YEAR 2010: TERMINATIONS, REDUCTIONS, AND SAVINGS 7, 69 (2009) [hereinafter 2010 TRS]; OFFICE OF MGMT. & BUDGET, EXEC. OFFICE OF THE PRESIDENT, BUDGET OF THE U.S. GOVERNMENT FISCAL YEAR 2011: TERMINATIONS, REDUCTIONS, AND SAVINGS 7 (2010) [hereinafter 2011 TRS]; OFFICE OF MGMT. & BUDGET, EXEC. OFFICE OF THE PRESIDENT, BUDGET OF THE U.S. GOVERNMENT FISCAL YEAR 2012: TERMINATIONS, REDUCTIONS, AND SAVINGS 81 (2011) [hereinafter 2012 TRS].

eliminate fossil fuel subsidies.³¹³ That is a start. Perhaps his next speech on the subject will be somewhere more visible than a small community college in New Hampshire. The fossil fuel industry is clearly a mature industry, comprising some of the world's most profitable corporations; the five biggest oil companies—BP, Chevron, ConocoPhillips, ExxonMobil, and Shell—made \$137 billion in 2011 alone.³¹⁴ This is hardly an industry that needs public support.³¹⁵ The savings from these subsidies could be diverted either to climate change technology prizes, subsidies for renewable energy, or the cost of building infrastructure to move renewable energy from production areas to the existing grid.

Ending these subsidies will require congressional action. Yet, the president can use his bully pulpit to educate citizens about the cost of these subsidies and identify those who receive them. The harsh spotlight of highly profitable companies receiving the nation's largesse at a time of economic constraint could compel legislators to eliminate such subsidies. This is optimistic, perhaps, based on the knowledge that earlier efforts have failed to eliminate subsidies to BP, Chevron, ConocoPhillips, ExxonMobil, and Shell.³¹⁶

V. CONCLUSION

For the first time since the United States became one of the first ratifiers of the UNFCCC in 1992, the United States has a climate change policy focused on reducing CO₂ and other GHGs. Most of this policy has been generated by the Obama Administration through executive action, primarily within the EPA but also within other agencies.³¹⁷ Unfortunately, this is not enough. To put the United States on a path closer to meeting its pledge to reduce GHG emissions by 17% by 2020 and 83% by 2050, President Obama or any

313. Responding to Climate Change Staff, *Obama Calls on Congress to End Fossil-Fuel Subsidies* (Mar. 2, 2012) <http://www.rtcc.org/energy/obama-calls-on-congress-to-end-fossil-fuel-subsidies/> (reporting that President Obama said, "Right now, \$4 billion of your tax dollars—\$4 billion—subsidise [sic] the oil industry every year.").

314. See Karen Showalter, *Senate Fails to Cut Favors to Big Oil, Once Again*, OIL CHANGE INT'L (Mar. 29, 2012), <http://priceofoil.org/2012/03/29/senate-fails-to-cut-favors-to-big-oil-once-again/>.

315. Moreover, eliminating fossil fuel subsidies would reduce externalized costs of pollution and health care costs. The U.S. National Academy of Sciences reported that fossil fuel use costs the United States \$120 billion in pollution and related health care costs in 2005. See NAT'L RES. COUNCIL NAT'L ACAD. OF SCI., HIDDEN COSTS OF ENERGY: UNPRICED CONSEQUENCES OF ENERGY PRODUCTION AND USE 21 (2010).

316. See *Fossil Fuel Subsidies in the U.S.*, *supra* note 311.

317. See *supra* Section III.

subsequent president must do more. In the short term, it is clear that the action must come from the executive branch as Congress has shown no signs of addressing climate change. As described in Section IV, there is much more the president can do with his treaty-making authority and other powers granted to the executive. Many of these actions can bring significant climate benefits with known technologies, such as eliminating 99% of black carbon emissions on existing trucks by requiring the use of filters. Directly regulating methane from existing and new oil and gas production and transmission operations would reduce emissions of methane, a GHG much more potent than CO₂.

On September 16, 2012, we learned that Arctic sea ice once again hit an all-time low for ice cover.³¹⁸ The six lowest ice extents in the satellite record have now occurred in the last six years (2007 to 2012).³¹⁹ New research shows that Greenland and Antarctica are losing three times as much ice as twenty years ago and contributing significantly to sea level rise.³²⁰ In this political climate, President Obama must use the presidency to act. When Lyndon Johnson was counseled not to try and resuscitate a civil rights bill that seemed doomed as many previous civil rights bills, he famously responded, “Well, what the hell’s the presidency for?”³²¹ This is the question that President Obama must ask. He staked his first term on achieving something many other presidents, including Lyndon Johnson, had failed to do: adopting national health legislation. He must stake his second term on passage of meaningful climate change legislation. With the Senate unwilling to lead, the president must grab the leadership reins and move the United States as close as it can to achieving its pledges. We can’t wait.

318. *Arctic Sea Ice Extent Settles at Record Seasonal Minimum*, NAT’L SNOW & ICE DATA CTR. (Sept. 19, 2012), <http://nsidc.org/arctic/seaiceneWS/2012/09/arctic-sea-ice-extent-settles-at-record-seasonal-minimum/> (“On September 16, Arctic sea ice appeared to have reached its minimum extent for the year of 3.41 million square kilometers (1.32 million square miles). This is the lowest seasonal minimum extent in the satellite record since 1979 and reinforces the long-term downward trend in Arctic ice extent.”).

319. *Id.*

320. See Andrew Shepherd et al., *A Reconciled Estimate of Ice-Sheet Mass Balance*, SCIENCE, Nov. 2012, at 1183–89.

321. ROBERT CARO, *THE PASSAGE OF POWER* 487 (2012).