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Combatting Climate Change Through Conservation Easements

Claire Wright

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Combatting Climate Change Through Conservation Easements

Claire Wright*

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I. INTRODUCTION

In 2007, Rafael Correa, then-President of Ecuador, offered not to extract the oil located underneath Ecuador's Yasuni National Park, in exchange for the international community paying Ecuador \$3.6 billion, which was one-half of the estimated value of those oil fields.¹ He stated that he thought his offer was

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1. See, e.g., Lisa Friedman, *Ecuador Asks World To Pay To Keep Yasuni Oil Underground*, SCI. AM. (May 1, 2012), <https://www.scientificamerican.com/article/ecuador-asks-world-to-pay-to-keep-yasuni-oil-underground/>; David Kestenbaum, *Ecuador to World: Pay up To Save the Rainforest. World to Ecuador: Meh.*, NPR (Sept. 2, 2013, 3:21 AM), <https://www.npr.org/sections>

“an elegant way to help tackle climate change.”² He was referring to the fact that destroying part of the Yasuní National Park would release 800 million tons of carbon dioxide into the atmosphere while also abolishing a valuable “carbon sink” that otherwise would have absorbed millions of tons of carbon dioxide.³ A carbon sink is a plot of land or body of water that absorbs more carbon than it emits.⁴ In addition, extracting the oil from underneath the Yasuní and then burning those barrels of oil would release another 410 million tons of carbon dioxide into the atmosphere, according to Ecuador’s sources.⁵ Moreover, development of the Yasuní would threaten the viability of numerous plant and animal species, as Yasuní National Park is one of the most biologically diverse ecosystems on earth.⁶

/money/2013/09/02/216878935/ecuador-to-world-pay-up-to-save-the-rainforest-world-to-ecuador-meh.

2. Brad Plumer, *Ecuador Asked the World To Pay It Not To Drill for Oil. The World Said No.*, WASH. POST, (Aug. 16, 2013), <https://www.washingtonpost.com/news/wonk/wp/2013/08/16/ecuador-asked-the-world-to-pay-it-not-to-drill-for-oil-the-world-said-no/>; Ryan Haddad, *An Un-Conventional Approach: Ecuador’s Yasuni-ITT Initiative Is in Discord with the UNFCCC*, 12 SUSTAINABLE DEV. L. & POL’Y 15 (2012) (citing Press Release, Min. of Foreign Affairs, Republic of Ecuador, Ecuador Takes Leadership Role on Climate Change (Sept. 24, 2007), <http://www.prnewswire.com/cgi-bin/stories.pl?ACCT=104&STORY=/www/story/09-24-2007/0004668939&EDATE=>), <https://digitalcommons.wcl.american.edu/cgi/viewcontent.cgi?article=1509&context=sdlp>).

3. See Haddad, *supra* note 2, at 15 (referencing the effects of the carbon sink).

4. See, e.g., N.C. State Univ., *Carbon Sink or Carbon Source? Aerosols Play Significant Role in Shifts*, SCI. DAILY (Dec. 9, 2004), <https://www.sciencedaily.com/releases/2004/12/041208225316.htm> (“Researchers at North Carolina State University have shown that the amount of aerosols – dust particles, soot from automobile emissions and factories, and other airborne particles – in the atmosphere has a significant impact on whether the surface area below either absorbs or emits more carbon dioxide (CO₂).”).

5. See Plumer, *supra* note 2; Juan Fernando Villa-Romero, *Ecuador’s Yasuni National Park in the Age of Synthetic Biology*, LATIN AM. SCI. (Sept. 2013), <http://latinamericanscience.org/2013/09/ecuadors-yasuni-national-park-in-the-age-of-synthetic-biology/> (placing the estimated amount of carbon dioxide from barrels of oil burned at 400 million tons).

6. See, e.g., Friedman, *supra* note 1 (“There is little doubt that the Yasuni Reserve contains remarkable biodiversity . . .”); Jeremy Hance, *Photos: Park in Ecuador Likely Contains World’s Highest Biodiversity, but Threatened by Oil*, MONGABAY (Jan. 19, 2010), <https://news.mongabay.com/2010/01/photos-park-in-ecuador-likely-contains-worlds-highest-biodiversity-but-threatened-by-oil/> (“Yasuni is the most biologically diverse place on Earth.”); Kelly Hearn, *Deep in Ecuador’s Rainforest, A Plan to Forego an Oil Bonanza*, YALE SCH. ENV’T.: YALEENVIRONMENT360 (Sept. 13, 2010), https://e360.yale.edu/features/deep_in-ecuadors_rainforest_a_plan_to_forego_an_oil_bonanza (“In addition to its remarkable biodiversity, Yasuni sits atop a fortune of oil, making the park an

Essentially, President Correa was offering a conservation easement (an agreement not to develop) to the international community in exchange for payment by the international community of \$3.6 billion. President Correa's proposal was indeed an elegant and responsible approach to reducing carbon dioxide emissions, as then-Secretary General of the United Nations, Ban Ki-moon, acknowledged in a 2011 press conference.⁷ Secretary General Ki-moon stated that President Correa's proposal was an "innovative concept to combat global warming [and] strikes at the root of the problem by preventing the release of CO₂ in the first place"⁸ After Ecuador received funding commitments from the international community totaling only \$13 million, however, President Correa withdrew this offer in August 2013,⁹ and various entities, including "Andes Petroleum Ecuador, a consortium of two Chinese state-owned firms" commenced extracting oil from the Yasuní National Park in 2016.¹⁰

Correa's "conservation easement" idea apparently had gained some traction by the September 29, 2020 U.S. Presidential debate. During the climate portion of that debate, then-U.S. Presidential candidate Joe Biden denounced the deforestation of the Brazilian Amazon in general and specifically the thousands of major fires that generally had been started by people clearing the Amazon for development and then had

emblem of a development crisis bearing down on the entire western headwaters of the Amazon basin.").

7. See Haddad, *supra* note 2, at 15 (quoting Press Release, Ban Ki-Moon, Secretary-General, Secretary-General's Remarks at Joint Press Encounter With President Rafael Correa of Ecuador, UN.ORG (Feb. 14, 2011), <http://www.un.org/sg/offthecuff/?nid=1723>).

8. *Id.*

9. Juan Falconi Puig, *The World Failed Ecuador on Its Yasuní Initiative*, GUARDIAN (Sept. 19, 2013, 9:08 AM), <https://www.theguardian.com/global-development/poverty-matters/2013/sep/19/world-failed-ecuador-yasuni-initiative>; Jonathan Watts, *Ecuador Approves Yasuni National Park Oil Drilling in Amazon Rainforest*, GUARDIAN (Aug. 16, 2013, 10:38 AM), <https://www.theguardian.com/world/2013/aug/16/ecuador-approves-yasuni-amazon-oil-drilling>.

10. Jonathan Kaiman, *Controversial Ecuador Oil Deal Lets China Stake an \$80-Million Claim to Pristine Amazon Rainforest*, L.A. TIMES (Jan. 29, 2016, 9:37 AM), <https://www.latimes.com/world/mexico-americas/la-fg-ecuador-china-oil-20160129-story.html>; see *Yasuní: A Silent Investment*, DIÁLOGO CHINO (Jan. 7, 2015), <https://dialogochino.net/en/extractive-industries/1152-yasuni-a-silent-investment/> (explaining how the drilling will be for over 846 million barrels of oil); Jose Llangari, *Ecuador Begins Drilling Oil in a Pristine Corner of the Amazon*, SCI. AM. (Sept. 8, 2016), <https://www.scientificamerican.com/article/ecuador-begins-drilling-oil-in-a-pristine-corner-of-the-amazon/>.

burned out of control in the summers of 2019 and 2020.¹¹ For many years, the undeveloped Brazilian Amazon has served as a large “carbon sink” that absorbs much of the carbon dioxide emitted around the world.¹² Accordingly, destruction of the Brazilian Amazon rainforest is concerning to people all over the world.¹³ In reference to those fires, Biden stated that, if elected, he would be “gathering up and making sure we had the countries of the world coming up with \$20 billion to say ‘here’s \$20 billion, stop tearing down the forest and if you don’t, you are going to have significant economic consequences.’”¹⁴

In response to Biden’s comments, Brazilian President Bolsonaro, a right-wing proponent of economic development of

11. See Ryan Richards & Mikyla Reta, *Charting a New Course for U.S.-Brazil Action on the Amazon*, CTR. FOR AM. PROGRESS (Apr. 13, 2021, 5:00 AM), <https://www.americanprogress.org/issues/green/reports/2021/04/13/498006/charting-new-course-u-s-brazil-action-amazon/> (“During the 2020 presidential debate, then-candidate Biden affirmed the urgency of addressing the threat that President Bolsonaro’s policies posed to the Amazon and to the global climate, proposing to work with global partners to create a \$20 billion fund that would incentivize Bolsonaro to change his approach to the Amazon.”).

12. See Anna Jean Kaiser, ASSOCIATED PRESS, *Is the Amazon Really ‘the Lungs’ of Planet Earth? No, It’s More Like Our Sink*, CHI. TRIB. (Aug. 27, 2019, 12:13 PM), <https://www.chicagotribune.com/nation-world/ct-nw-cb-amazon-fire-s-explainer-20190827-oneqsy6c6nfuxb33bictnewnbm-story.html> (“[A] better way to picture the Amazon’s role is as a sink, draining heat-trapping carbon dioxide from the atmosphere.”); Frances Lopez, *Is the Amazon Forest Really ‘the Lungs of the Planet?’*, EURONEWS, <https://www.euronews.com/2019/09/02/is-the-amazon-forest-really-the-the-lungs-of-the-planet> (last updated Mar. 9, 2019).

13. See Ernesto Londoño & Leticia Casado, *Under Pressure, Brazil’s Bolsonaro Forced to Fight Deforestation*, N.Y. TIMES (Aug. 28, 2021), <https://www.nytimes.com/2020/08/01/world/americas/Brazil-amazon-deforestation-bolsonaro.html> (describing how Bolsonaro’s environmental policies are causing Brazil to become “an environmental pariah on the global stage, destroying a positive reputation that took decades to build”); Robert Kessler, *The Amazon Is Burning*, ECOHEALTH ALL. (Aug. 2019), <https://www.ecohealthalliance.org/2019/08/the-amazon-is-burning> (“The Amazon rainforest is one of the greatest natural treasures of our Earth. Its health, in many ways, is our entire planet’s health.”).

14. Flora Charner & Ivana Kottasová, *Brazil’s Bolsonaro Rejects Biden’s Offer of \$20 Billion to Protect the Amazon*, CNN (Sept. 30, 2020, 3:31 PM), <https://www.cnn.com/2020/09/30/americas/brazil-bolsonaro-biden-amazon-intl/index.html>; see also *‘Disastrous’: Brazil’s Bolsonaro Slams Biden Over Amazon Comments*, AL JAZEERA (Sept. 30, 2020), <https://www.aljazeera.com/news/2020/9/30/disastrous-brazils-bolsonaro-slams-biden-over-amazon-comments> [hereinafter AL JAZEERA, SEPT. 30, 2020] (including Bolsonaro’s response that Brazil “would not accept ‘coward threats towards our territorial and economic integrity’”).

the Brazilian Amazon,¹⁵ angrily accused Biden of threatening Brazil's sovereignty and stated that Brazil actually had done more than any other country to preserve its undeveloped lands.¹⁶ Bolsonaro's claim that "Brazil is a model of conservation because of the size of forest land still standing"¹⁷ is belied by the fact that, since he took office in January 2019, destruction of the Brazilian Amazon accelerated at an eleven-year high, with forest clearances up 34.5% and an area the size of Lebanon destroyed.¹⁸ President Bolsonaro has been widely criticized for his pro-development stance on the Amazon in general and his handling of the 2019 and 2020 Amazon fires in particular.¹⁹

Still, Bolsonaro's response raised some legitimate questions regarding Biden's comments. The first part of Biden's statement was fine; he was merely touting Correa's idea of a country offering a conservation easement in exchange for compensation, and numerous Brazilian leaders in recent years have argued that "the world should pay up if it wants more forest to be preserved."²⁰ However, Biden's subsequent reference to imposition of economic sanctions on Brazil should Brazil decline to grant a conservation easement to the international community was mysterious. A conservation easement is a voluntary measure; how could Brazil's declination of such an easement proposal justify imposition of economic sanctions on

15. See AL JAZEERA, SEPT. 30, 2020, *supra* note 14 (explaining how Bolsonaro "has insisted on economic development of the region"); *Brazil to Create 'Amazon Council' to Protect and Develop the Rainforest*, REUTERS (Jan. 21, 2020, 10:38 AM), <https://www.reuters.com/article/us-brazil-environment/brazil-to-create-amazon-council-to-protect-and-develop-the-rainforest-idUSKBN1ZK237> (explaining how Bolsonaro "wants economic development in the Amazon to improve the lives of its 30 million inhabitants, including its indigenous tribes"); Ishaan Tharoor, *How Brazil's Bolsonaro Threatens the Planet*, WASH. POST (Oct. 19, 2018), <https://www.washingtonpost.com/world/2018/10/19/how-brazils-bolsonaro-threatens-planet/> (explaining how Bolsonaro "has long supported opening up indigenous areas, currently protected by the government, to agricultural and commercial use").

16. See AL JAZEERA SEPT. 30, 2020, *supra* note 14; Charner & Kottasová, *supra* note 14 ("Bolsonaro told the UN General Assembly that no other country protected as much wild territory as Brazil.").

17. AL JAZEERA SEPT. 30, 2020, *supra* note 14.

18. *Id.*

19. See *id.* ("The Brazilian leader has insisted on economic development of the region, drawing condemnation from environmentalists, climate scientists and foreign leaders . . ."); Charner & Kottasová, *supra* note 14 (explaining that, in 2019, "the G7 group which includes Canada, France, Germany, Italy, Japan, the United Kingdom and the United States used its summit in France to call on Bolsonaro to step up efforts to protect the Amazon.").

20. AL JAZEERA SEPT. 30, 2020, *supra* note 14.

Brazil? Furthermore, is it fair for developed nations to focus on developing countries' destruction of carbon sinks, when there would be no need for developing countries to preserve their carbon sinks if the developed nations did not emit so many tons of carbon dioxide in the first place?²¹ Following Biden's comments, Brazil's Environment Minister, Ricardo Salles, was more pragmatic. He tweeted: "Just one question: Biden's \$20bn in aid, is that yearly?"²²

The overwhelming majority of climate scientists around the world maintain that climate change (used interchangeably in this article with "global warming") is caused by humans.²³ Primarily, climate change is caused by the burning of fossil fuels, which releases CO₂ (a greenhouse gas), which is then trapped in the earth's atmosphere and raises the average annual

21. See, e.g., Dawn Stover, *You Pay or We Drill*, ANTHROPOCENE MAG. (Dec. 2013), <https://www.anthropocenemagazine.org/2013/12/how-do-we-not-drill> (including former Ecuadorian President Rafael Correa's argument that it is hypocritical for other nations to expect Ecuador to leave its resources untouched when "they are the polluters"). China is the largest emitter of carbon dioxide. See Ian Tiseo, *Largest Global Emitters of Carbon Dioxide by Country 2019*, STATISTA (Sept. 24, 2021), <https://www.statista.com/statistics/271748/the-largest-emitters-of-co2-in-the-world> (stating that China has "a share of almost 30 percent of the world's total CO₂ emissions that year"). Therefore, it is questionable whether China should be considered a developed nation today. See Philippe Benoit & Kevin Tu, *Is China Still a Developing Country? And Why It Matters for Energy and Climate*, COLUM. U.: CTR. ON GLOB. ENERGY POL'Y (July 23, 2020), <https://www.energypolicy.columbia.edu/research/report/china-still-developing-country-and-why-it-matters-energy-and-climate> ("While China's economic might makes it a superpower alongside the United States, it still faces many of the major challenges of a typical developing country, such as widespread energy poverty, including 400 million people without access to clean cooking, significant air pollution, and dependence on increasing energy use to fuel future economic growth."). However, the U.S. is the second largest emitter, and many of the other large emitters of carbon dioxide are developed countries as well. See Tiseo, *supra*. Moreover, "[a]lthough China currently emits the highest levels of CO₂ annually, it has emitted far less than the United States over the past three centuries. Cumulative carbon dioxide emissions in the U.S. reached 367 billion metric tons by 2018. Since the birth of the Industrial Revolution more than 200 years ago, cumulative global CO₂ emissions have increased dramatically. However, emissions started to increase more rapidly as of the 1960's." *Id.*

22. AL JAZEERA SEPT. 30, 2020, *supra* note 14.

23. Robert Lee Hotz & Timothy Puko, *Some Climate Change Effects May Be Irreversible, U.N. Panel Says*, WALL ST. J. (Aug. 9, 2021, 6:00 PM), <https://www.wsj.com/articles/some-climate-change-effects-may-be-irreversible-u-n-panel-report-says-11628496000>; *Causes of Climate Change*, EUR. COMM'N, https://ec.europa.eu/clima/climate-change_en (last visited Nov. 5, 2020) [hereinafter *Causes of Climate Change*]. The full 3949-page IPCC Sixth Assessment report can be accessed at <https://www.ipcc.ch/report/ar6/wg1/>.

temperature of the globe.²⁴ At a minimum, this warming of the globe is changing marine animals' feeding locations, shrinking polar ice caps, raising sea levels, and flooding low-lying lands.²⁵ Moreover, many scientists have concluded that global warming is also responsible for much longer and more severe droughts, numerous and more dangerous wildfires, and many more catastrophic hurricanes and other storms.²⁶

Several climate scientists have warned that, if greenhouse gas emissions are not significantly reduced by 2030, that date may very well be a "tipping point," meaning that self-perpetuating processes may then make reversal of a continually warming world impossible.²⁷ In fact, according to a report issued by the United Nations-affiliated Intergovernmental Panel on Climate Change (IPCC) on August 9, 2021, "[r]ising seas, melting ice caps and other effects of a warming climate may [already] be irreversible for centuries"²⁸ The catastrophe that we are facing may have been best summarized by Ko Barrett, vice chair of the IPCC and the senior adviser for climate at the Office of Oceanic and Atmospheric Research at the National Oceanic and Atmospheric Administration. He stated that "[w]e've known for decades that the world is warming, but this report tells us that recent changes in the climate are widespread, rapid and intensifying, unprecedented in thousands of years."²⁹ In short, climate change is the most grave environmental phenomenon threatening humanity today.

24. *Causes of Climate Change*, *supra* note 23.

25. See *AR6 Climate Change 2021: The Physical Science Basis*, IPCC, <https://www.ipcc.ch/report/ar6/wg1/#SPM> (last visited Oct. 26, 2021) ("[A]ddresses the most up-to-date physical understanding of the climate system and climate change . . .").

26. Hotz & Puko, *supra* note 23.

27. See Stephen Leahy, *Climate Change Driving Entire Planet to Dangerous "Tipping Point"*, NAT'L GEOGRAPHIC (Nov. 27, 2019), <https://www.nationalgeographic.com/science/article/earth-tipping-point> ("The idea of tipping points was introduced 20 years ago by the [IPCC]. The loss of the West Antarctic ice sheet and the Amazon rainforest, or extensive thawing of permafrost, as well as other key components of the climate system, are considered 'tipping points' because they can cross critical thresholds, and then abruptly and irreversibly change."). Tipping points can be triggered between a warming of 1.0° and 2.0 ° Celsius. *Id.* Without a drastic decline in greenhouse gas emissions by 2030, global warming will increase by 1.6° Celsius in the following decades. *Id.*

28. Hotz & Puko, *supra* note 23.

29. *Id.*

For this reason, 192 nations have joined the Paris Agreement³⁰ to slow global warming to 2° Celsius and preferably 1.5° Celsius above the pre-industrial average global temperature and committed to specific, country-by-country greenhouse gas emission reductions called “Nationally Determined Contributions” or NDCs.³¹ Unfortunately, early in former U.S. President Trump’s Administration, he terminated the U.S.’s membership in the Paris Agreement, few countries are meeting their NDCs, and countries’ NDCs were not nearly aggressive enough to slow global warming significantly in any case.³² Accordingly, the world has become increasingly warmer since the Paris Agreement was signed in 2015.³³

The looming global warming crisis has generated numerous reactions and proposed solutions, including a suggestion that the U.S. military could invade Brazil someday if Brazil continues to permit the destruction of its Amazon carbon sink.³⁴ Shortly after U.S. President Biden’s inauguration on January 20, 2021, his new Special Climate Envoy, John Kerry, announced that the U.S. was rejoining the Paris Agreement.³⁵ In addition, President Biden suspended new fossil fuel mining leases on federal lands and waters, and instructed his Cabinet members to terminate any subsidies that their agencies provided to the fossil fuel industry.³⁶ It should be noted, however, that many fossil fuel

30. Paris Agreement to the United Nations Framework Convention on Climate Change, Dec. 12, 2015, T.I.A.S. No. 16-1104, http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf [hereinafter Paris Agreement].

31. See *infra* notes 192–98 and accompanying text.

32. See *infra* note 183 and accompanying text; *infra* notes 223–25 and accompanying text.

33. *Infra* notes 226, 413.

34. Stephen M. Walt, *Who Will Invade Brazil to Save the Amazon*, FOREIGN POLY (Aug. 5, 2019, 5:31 PM), <https://foreignpolicy.com/2019/08/05/who-will-invade-brazil-to-save-the-amazon/> (arguing that, if Brazil continues to destroy the Amazon rainforest, other countries, including the U.S., someday could feel forced to invade Brazil to save the Amazon rainforest and ameliorate the effects of global climate change); see also Aaron Gell, *People Are Seriously Talking About Invading Brazil to Save the Planet*, MEDIUM: GEN (Sept. 24, 2019), <https://gen.medium.com/people-are-seriously-talking-about-invading-brazil-to-save-the-planet-dd94bc5bdf65>.

35. *Kerry Says US ‘Proud to be Back’ in Paris Climate Agreement*, VOICE AM.: NEWS (Jan. 25, 2021, 8:40 PM), <https://www.voanews.com/usa/kerry-says-us-proud-be-back-paris-climate-agreement>.

36. See Joe Khalil, Elyse Russo & Char’Nese Turner, *Biden Pauses Oil and Gas Leases, Cuts Subsidies in ‘Bold’ Climate Steps*, NEWS NATION (Jan. 27, 2021, 9:35 PM), <https://www.newsnationnow.com/politics/biden-100days/biden->

subsidies are provided in the form of federal tax breaks,³⁷ and the U.S. Congress, not the U.S. Executive Branch, would have to amend the Internal Revenue Code (IRC) to abolish such subsidies.³⁸

“Cap and trade” programs—in which an overall cap on emissions is implemented and then the companies and individuals affected can trade emissions among themselves—have been successful in lowering carbon emissions in certain locales,³⁹ and several writers have proposed, as an alternative to a cap and trade program, the imposition of a carbon tax so that those developing and selling fossil fuels are forced to internalize the true cost of fossil fuels.⁴⁰ Some have advocated that

to-pause-oil-and-gas-sales-on-public-lands/ (discussing the executive actions President Biden signed to combat climate change).

37. See, e.g., *Fact Sheet: Fossil Fuel Subsidies: A Closer Look at Tax Breaks and Societal Costs*, ENV'T & ENERGY STUDY INST. (July 29, 2019), https://www.eesi.org/files/FactSheet_Fossil_Fuel_Subsidies_0719.pdf [hereinafter *Fact Sheet*] (“Numerous energy subsidies exist in the U.S. tax code to promote or subsidize the production of cheap and abundant fossil energy.”); Timothy Gardner, *Biden Tax Plan Replaces U.S. Fossil Fuel Subsidies with Clean Energy Incentives*, REUTERS (Apr. 7, 2021, 10:58 AM), <https://www.reuters.com/article/us-usa-treasury-tax-energy/biden-tax-plan-replaces-u-s-fossil-fuel-subsidies-with-clean-energy-incentives-idUSKBN2BU2HL> (“Unwinding tax breaks on fossil fuel companies could face opposition from Biden’s fellow Democrats in the U.S. Congress from energy-producing states.”).

38. See Lili Pike, *Fossil Fuels Get Too Many Government Handouts. Biden Wants to Cut Them Off.*, VOX (Apr. 5, 2021, 1:40 PM), <https://www.vox.com/22363539/oil-gas-subsidies-biden-solar-wind-tax-reform-infrastructure-bill> (explaining how many of the biggest reforms require congressional support); see Shannon Osaka, *Biden is Canceling Fossil Fuel Subsidies. But He Can’t End Them All.*, GRIST (Jan. 28, 2021), <https://grist.org/politics/biden-is-eliminating-fossil-fuel-subsidies-but-he-cant-end-them-all/> (explaining how “only a fraction of those subsidies are within Biden’s purview as president”).

39. See Benjamin Goldstein, *Learning from Europe: Designing Cap-and-Trade Programs that Work*, CTR. FOR AM. PROGRESS (June 1, 2007, 9:00 AM), <https://www.americanprogress.org/issues/green/news/2007/06/01/3173/learning-from-europe-designing-cap-and-trade-programs-that-work/> (discussing the cap-and-trade system in the EU); Richard Schmalensee & Robert Stavins, *Learning from Thirty Years of Cap and Trade*, RESOURCES (May 16, 2019), <https://www.resources.org/archives/learning-thirty-years-cap-trade/> (looking back on the history of cap-and-trade programs as more jurisdictions adopt the policy); Bob Sussman, *The Return of Cap and Trade is Good News for U.S. Climate Policy*, BROOKINGS INST. (Oct. 21, 2015), <https://www.brookings.edu/blog/planetpolicy/2015/10/21/the-return-of-cap-and-trade-is-good-news-for-u-s-climate-policy/> (discussing the comeback of cap-and-trade policies in the U.S. and internationally).

40. See Int’l Monetary Fund Fiscal Affairs Dep’t, *Fiscal Policies for Paris Climate Strategies—From Principle to Practice*, INT’L MONETARY FUND (May 1, 2019), <https://www.imf.org/en/Publications/Policy-Papers/Issues/2019/05/01/Fiscal-Policies-for-Paris-Climate-Strategies-from-Principle-to-Practice-46826>

governments simply outlaw the extraction, refinement, and sale of fossil fuels (and not compensate people and entities engaging in such activities) on the ground that these activities cause global warming and consequently constitute a public nuisance.⁴¹ In addition, numerous civil liability lawsuits have been filed against major fossil fuel companies, such as Exxon Mobil Corp., for causing global warming and misleading investors and the public about the dangers of global warming caused by fossil fuels,⁴² and Senators and former U.S. Presidential candidates Elizabeth Warren and Bernie Sanders have even gone so far as to argue that oil company executives should be prosecuted criminally for hiding the fact that their products were destroying the planet.⁴³

At the same time, the U.S. provides pre-tax subsidies (meaning subsidies that don't take into account negative externalities,⁴⁴ or costs imposed on society by a party that does

(presenting a “spreadsheet tool for judging the likely impact on emissions, fiscal revenues, local air pollution mortality, and economic welfare impacts of a range of instruments including comprehensive carbon taxes.”); see Gilbert Metcalf, *New (Republican) Support for a Carbon Tax*, ECONOFACT (Feb. 10, 2017), <https://econofact.org/new-republican-support-for-a-carbon-tax> (discussing the details and potential consequences of a carbon tax proposal); Kyle Pomerleau & Elke Asen, *Carbon Tax and Revenue Recycling: Revenue, Economic, and Distributional Implications*, TAX FOUND. (Nov. 6, 2019), <https://taxfoundation.org/carbon-tax/> (discussing some of the benefits for businesses of a carbon tax); *Why Put a Price on Carbon*, CITIZENS' CLIMATE LOBBY, https://citizensclimatelobby.org/price-on-carbon/?gclid=Cj0KCCQjw5auGBhDEARIsAFyNm9FZ6NzGyeK06zYqWx_WM_gdYPZqR1WZkaeOwFl_xLK4zE-DiX80EIMaAiMwEALw_wcB (last visited Oct. 26, 2021) (discussing the benefits of a general carbon tax scheme).

41. *Fossil Fuel-Based Vehicle Bans Across the World*, REUTERS (Nov. 18, 2020), <https://www.reuters.com/article/climate-change-britain-factbox/fossil-fuel-based-vehicle-bans-across-the-world-idINKBN27Y19F>; Roland Geyer, *It's Unavoidable: We Must Ban Fossil Fuels to Save Our Planet. Here's How We Do It*, GUARDIAN (Mar. 9, 2021), <https://www.theguardian.com/commentisfree/2021/mar/09/its-unavoidable-we-must-ban-fossil-fuels-to-save-our-planet-heres-how-we-do-it> (using past bans on leaded gasoline and chlorofluorocarbons (CFCs) as examples of how bans can mitigate environmental disaster).

42. See Umair Irfan, *Bernie Sanders Wants to Take Fossil Fuel Companies to Criminal Court*, VOX, (Nov. 20, 2019) <https://www.vox.com/2019/11/12/20959293/bernie-sanders-climate-lawsuit-exxon-juliana-sinnok> (“Several climate change lawsuits against fossil fuel companies and governments are now proceeding to trial and one suit may even yield a verdict soon.”).

43. *Id.*

44. See David Coady et al., *Global Fossil Fuel Subsidies Remain Large: An Update Based on Country-Level Estimates* 7–8 (Int'l Monetary Fund (IMF), Working Paper No. WP/19/89, May 2019), <https://www.imf.org/en/Publications/WP/Issues/2019/05/02/Global-Fossil-Fuel-Subsidies-Remain-Large-An-Update-Based-on-Country-Level-Estimates-46509>.

not pay for those costs),⁴⁵ such as local air pollution and global warming,⁴⁶ to fossil fuel companies in the amount of approximately \$118.1 billion per year.⁴⁷ Such subsidies make it difficult politically and legally to establish that extracting and selling fossil fuels constitutes a public nuisance.⁴⁸ Of course, numerous individuals and companies around the world are also developing a wide range of greenhouse gas-reducing technologies and alternative energy sources.⁴⁹ Most of the world agrees that global warming is a serious problem,⁵⁰ but governments' responses are uncoordinated and inconsistent,⁵¹ and ultimately little progress is being made to slow global warming.⁵²

The world's atmosphere is a natural resource owned by all people and it is understandable that no country wants to do the lion's share of the work to protect it for everyone.⁵³ However, if human beings wish to survive, they must find a way to work

45. See *Externalities – The Economic Lowdown Podcast Series*, FED. RSRV. BANK OF ST. LOUIS (Sept. 2012), <https://www.stlouisfed.org/education/economic-lowdown-podcast-series/episode-11-externalities> [hereinafter *Externalities*].

46. Nghia-Piotr Trong Le et al., *IMF Energy Subsidies Template*, IMF, <https://www.imf.org/-/media/Files/Topics/Environment/energy-subsidies/fuel-subsidies-template.ashx> (last updated Mar. 2019).

47. See *infra* Figure 8.

48. See RESTATEMENT (SECOND) OF TORTS § 821B (AM. LAW INST. 1979).

49. See, e.g., Mary Beth O'Leary, *Tackling Greenhouse Gases*, MIT NEWS (Jan. 7, 2019), <https://news.mit.edu/2019/tackling-greenhouse-gases-mechanical-engineering-0107> (discussing how faculty in the Department of Mechanical Engineering are developing technologies that store, capture, convert, and minimize greenhouse gas emissions); Anca Gagiuc, *New Power Source: Neutrinovoltaic Energy*, COM. PROP. EXECUTIVE (Aug. 23, 2020), <https://www.commercialsearch.com/news/new-power-source-neutrinovoltaic-energy/> (revealing that scientists at the Neutrino Energy Group, a research institute in Berlin, are developing a new source of renewable energy called neutrinovoltaic energy).

50. Hotz & Puko, *supra* note 23.

51. See, e.g., Mary Robinson, *Climate Catastrophe Can Be Averted If Leaders Act Now*, IRISH TIMES (Aug. 14, 2021, 12:55 AM), <https://www.irishtimes.com/opinion/mary-robinson-climate-catastrophe-can-be-averted-if-leaders-act-now-1.4646354> (stating that national responses to climate change have been “fitful, inconsistent and uncoordinated”).

52. Press Release, Nat'l Aeronautics & Space Admin., 2020 Tied for Warmest Year on Record, NASA Analysis Shows (Jan. 14, 2021), <https://www.nasa.gov/press-release/2020-tied-for-warmest-year-on-record-nasa-analysis-shows> [hereinafter 2020 Tied for Warmest Year on Record].

53. See, e.g., *infra* note 178.

together to slow climate change.⁵⁴ Moreover, it is clear that the international community needs to take drastic action now to slow global warming,⁵⁵ and all possible strategies for reaching that goal should be considered.⁵⁶

This article considers whether the international community, and whether the U.S. in particular, should promote the execution of conservation easements in which owners of fossil fuels agree not to extract, refine, sell or distribute those fossil fuels, in exchange for a public financial benefit. Again, this is the agreement that former President Rafael Correa was offering to make with the international community on behalf of Ecuador back in 2007.⁵⁷ Furthermore, this article views this question from the perspective of U.S. land use law and the economic theory of property rights, which is discussed further below.⁵⁸ Accordingly, the ultimate question addressed in this article is whether the execution of such conservation easements could be an economically efficient method of slowing global warming,⁵⁹ and the analysis presented in this article suggests that the answer to this question is “yes.”⁶⁰

In considering this question, it should be kept in mind that an owner of fossil fuels could be a private person/entity or a government. Furthermore, a wealthier government typically can simply prohibit the exploitation of government-owned fossil fuels.⁶¹ In contrast, a poorer government typically would need to

54. See, e.g., *Our Planet, Our Future: Fighting Climate Change Together*, EUR. COMM’N (Sept. 19 2018), https://ec.europa.eu/clima/sites/clima/files/youth/docs/youth_magazine_en.pdf (stating that slowing climate change is “going to need huge efforts from all of us individuals, governments, businesses, schools and other organizations, working together”).

55. See, e.g., *Global Issues: Climate Change*, UNITED NATIONS, <https://www.un.org/en/global-issues/climate-change> (last visited June 17, 2021); Timothy Puko, *U.N. Panel Warns Drastic Action Needed to Stave Off Climate Change*, WALL ST. J. (Oct. 7, 2018), <https://www.wsj.com/articles/u-n-panel-warns-drastic-action-needed-to-stave-off-climate-change-1538960400>.

56. See, e.g., Isabella Suarez, *5 Strategies That Achieve Climate Mitigation and Adaptation Simultaneously*, WORLD RES. INST. (Feb. 10, 2010), <https://www.wri.org/insights/5-strategies-achieve-climate-mitigation-and-adaptation-simultaneously> (stating that governments should pursue any reasonable method of mitigating climate change and adjusting to it).

57. See *supra* text accompanying notes 1–10.

58. See *infra* text accompanying notes 88–115.

59. See *infra* text accompanying notes 250–406.

60. *Id.*

61. For example, as stated above, immediately upon being elected the U.S. President, President Biden suspended all new fossil fuel leases on federal lands and waters. See, e.g., Juliet Eilperin & Dino Grandoni, *Biden Poised to Halt*

be compensated for implementing such a prohibition, as it otherwise typically would need to exploit its fossil fuels to lift its population out of poverty.⁶²

In Section II, I explain the basic mechanics of how a conservation easement works in the U.S. In Section III, I discuss the property law framework through which I am approaching the problem of global warming. In Section IV, I review the science of climate change, and in Section V, I review the major legal commitments that the international community has made regarding global warming. In Section VI, I set forth the specific amendments to the Internal Revenue Code (IRC) that I propose the U.S. Congress adopt to implement the conservation easements discussed here. In Section VII, I discuss whether prohibiting fossil fuel owners' extraction, refinement, sale, and distribution of fossil fuels through conservation easements is an economically efficient method of slowing global warming, and, in Section VIII, I conclude.

II. CONSERVATION EASEMENTS

A conservation easement is a voluntary agreement, typically between a governmental entity or conservation land trust, in which the landowner agrees to use or refrain from using the land in a particular manner (e.g., maintain it as an open space or as a refuge for an endangered species), typically in exchange for a tax benefit.⁶³ A conservation land trust is a non-profit corporation that acquires and manages donated lands and conservation easements for the purpose of limiting the

New Fossil Fuel Leasing on Federal Land and Water Wednesday, WASH. POST (Jan. 26, 2021), <https://www.washingtonpost.com/climate-environment/2021/01/25/biden-drilling-moratorium/>.

62. See, e.g., Kestenbaum, *supra* note 1 (statement of former Ecuadorian President Rafael Correa) (discussing the need to exploit the Yasuni oil fields to help the poor of Ecuador since the international community would not pay Ecuador not to drill in the Yasuni).

63. *What You Can Do*, LAND TR. ALL., <https://www.landtrustalliance.org/what-you-can-do> (last visited June 17, 2021); Elizabeth Hughes, *Terrain, Taxes, and Land Trusts: Saving the Florida Panther Through the Use of Conservation Easements*, 94 FLA. BAR J. 53 (2020), <https://www.floridabar.org/the-florida-bar-journal/terrain-taxes-and-land-trusts-saving-the-florida-panther-through-the-use-of-conservation-easements/>. A conservation easement may not only lower the donor's federal and state income taxes, but it may also lower the donor's federal estate taxes and state property taxes. *Id.*; see also *Estate Tax Incentives for Land Conservation: Keeping Land in the Family*, LAND TR. ALL., <https://www.landtrustalliance.org/topics/taxes/estate-tax-incentives-land-conservation> (last visited June 18, 2021).

development of the lands in question.⁶⁴ In the U.S., for example, under Section 170(h) of the Internal Revenue Code (IRC), a landowner generally can take a charitable deduction on the taxpayer's federal tax return for the diminution in the value of the land concerned attributable to an agreement to dedicate all or a portion of the land to one of the following uses:

- (1) preserving land for outdoor recreational use by, or education of, the general public;
- (2) protecting relatively natural habitats of fish, wildlife or plants;
- (3) preserving open space (including farmland or forest space) for scenic enjoyment of the general public or under a governmental conservation policy yielding significant public benefit; or
- (4) preserving a historically important land area or certified historic structure.⁶⁵

Generally speaking, a tax deduction under Section 170(h) of the IRC is available only if the land restriction is perpetual⁶⁶ and “[t]he value of a conservation easement is the fair market value of the easement at the time of contribution.”⁶⁷ Further, the date that the deed of easement is recorded pursuant to state law is the date of contribution for federal tax purposes.⁶⁸ A “qualified appraiser” (as defined in IRC 170(f)(11)(E)) must be used to calculate the value of the easement,⁶⁹ and an appraiser should investigate whether there have been sales of comparable easements as such sale prices typically would constitute the best evidence of the value of the easement.⁷⁰ However, if the appraiser cannot find a record of comparable sales (which often is the case), the appraiser should calculate the value of the easement as the difference between the value of the land without the restriction and the value of the land with the restriction, taking into account all relevant information.⁷¹ If an individual or corporate taxpayer takes a conservation deduction and then violates the easement, the deduction previously granted to the

64. Richard Brewer, *CONSERVANCY: THE LAND TRUST MOVEMENT IN AMERICA 1* (Univ. Press of New Engl. 2003); Andrew Loza, *What is a Land Trust*, WECONSERVEPA, <https://conservationtools.org/guides/150-what-is-a-land-trust> (last visited June 18, 2021).

65. 26 U.S.C. § 170(h)(4)(A).

66. 26 U.S.C. § 170(h)(5)(A).

67. *Conservation Easement Audit Techniques Guide*, INTERNAL REVENUE SERV. 43 (Jan. 24, 2018), https://www.irs.gov/pub/irs-utl/conservation_easement.pdf [hereinafter *Conservation Easement Audit Techniques Guide*] (citing Treas. Reg. §1.170A-14(h)(3)(i)).

68. *Id.* (citing Treas. Reg. § 1.170A-13(C)(3)(ii)(C)).

69. *Id.* at 41.

70. *Id.* at 43.

71. *Id.* at 43–44 (citing Treas. Reg. §1.170A-14(h)(3)(ii)).

landowner is denied and the landowner must pay the taxes owed without the deduction as well as penalties.⁷²

At the same time, for an individual taxpayer, partnership, S corporation, or other pass-through entity (in which the entity's tax benefits and liabilities are passed down to the individual owners), the total amount of the deduction cannot exceed 50% of the taxpayer's contribution base⁷³ (which, in most cases, means the taxpayer's adjusted gross income (AGI) for the year in which the easement was granted),⁷⁴ although any excess value of the easement not claimed in the first year may be carried over to the taxpayer's federal returns for each of the fifteen succeeding years.⁷⁵ If an individual taxpayer is a rancher or farmer, the total amount of the deduction cannot exceed 100% of the taxpayer's contribution base,⁷⁶ and again any excess value of the easement not claimed in the first year may be carried over to the taxpayer's fifteen subsequent tax returns.⁷⁷ If the property in question appreciated during the period in which the taxpayer owned it, lower percentages of the taxpayer's contribution basis would apply.⁷⁸

For a corporation (other than a farmer or rancher), the total amount of the deduction in general cannot exceed 10% of the corporation's taxable income for the year,⁷⁹ and for a farmer or rancher, the total amount of the deduction cannot exceed 100% of the farmer or rancher's taxable income for the year.⁸⁰ For any type of corporate taxpayer, any excess value of the easement not claimed in the first year may be carried over to the corporation's fifteen subsequent tax returns.⁸¹

While the fifteen-year carryover provision in the IRC suggests that many taxpayers ultimately can deduct 100% of the value of a conservation easement on their federal income tax return, it should be kept in mind that the deduction still only

72. 26 U.S.C. § 6662.

73. 26 U.S.C. § 170(b)(1)(E)(i).

74. 26 U.S.C. § 170(b)(1)(E)(i).

75. 26 U.S.C. § 170(b)(1)(E)(ii).

76. 26 U.S.C. § 170(b)(1)(E)(iv)(I).

77. *Id.*

78. *Conservation Easement Audit Techniques Guide*, *supra* note 67, at 35–36.

79. 26 U.S.C. § 170(b)(2)(D).

80. 26 U.S.C. § 170(b)(2)(A); *see also Conservation Easement Audit Techniques Guide*, *supra* note 67, at 36.

81. *Conservation Easement Audit Techniques Guide*, *supra* note 67, at 36–37.

reduces the taxpayer's taxes by an amount equal to the value of the easement multiplied by the taxpayer's tax rate. For example, assuming that the total value of a conservation easement was \$100,000, that the taxpayer was able to deduct that total value over a number of years, and that the taxpayer's tax rate was 20%, the taxpayer's taxes would only have been reduced by \$20,000. Several U.S. states today provide a tax credit, rather than a tax deduction, for a conservation easement,⁸² and as discussed further below in Section VII, the U.S. Congress may need to provide a tax credit for 100% of the value of the conservation easement (100% of the value of the taxpayer's fossil fuel operation) to entice fossil fuel owners to grant conservation easements in which they agree not to extract, refine, sell or distribute those fuels.⁸³ In addition, while a taxpayer in the U.S. can itemize the taxpayer's deductions and take advantage of the IRC Section 170(h) conservation easement charitable deduction provision to maintain the land as a carbon sink today,⁸⁴ the U.S. Congress would have to amend the IRC to allow a tax deduction or credit specifically for an agreement not to extract, refine, sell, or distribute fossil fuels owned by the taxpayer.⁸⁵ At the same time, such legislation should not face significant opposition

82. *State Tax Credits for Donation of a Conservation Easement*, LAND CONSERVATION ASSISTANCE NETWORK, <https://www.landcan.org/article/state-tax-credits-for-donation-of-a-conservation-easement/1616> (last visited June 18, 2021). Most such states impose a significant cap on such a credit, but several states permit the taxpayer to transfer his or her credit to another taxpayer. *Id.* For example, Colorado provides a tax credit of 50% of the first \$100,000 of the value of the conservation easement, and then 50% of the remainder of the value, up to a cap of \$1.5 million. Russell Shay, *State Land Conservation Tax Incentives as of April, 2019*, LAND TR. ALL., <http://s3.amazonaws.com/landtrustalliance.org/State-Land-Conservation-Tax-Incentives-April-2019.pdf> (last visited June 18, 2021). Georgia provides a tax credit of 25% of the value of the donation up to a maximum of \$250,000. *Id.* New Mexico provides a tax credit of 50% of the value of a conservation easement donation, up to a cap of \$250,000 per year, for a total of 20 years. *Id.* All three of these tax credits are transferable, i.e., they can be sold to other taxpayers. *Id.*

83. See *infra* text accompanying notes 233–38.

84. 26 U.S.C. § 170(h)(4)(i)–(iv).

85. See, e.g., Devon Ryan, *New Analysis Suggests Ways for Landowners to Limit Fracking and Mineral Extraction Without Regulations*, STAN. NEWS (Feb. 1, 2017), <https://news.stanford.edu/2017/02/01/stanford-analysis-suggests-ways-landowners-limit-fracking-mineral-extraction-without-regulations/> (“For states where [mineral estate conservation easement (MECEs)] might not be legally supported, the analysis proposes amendments to state laws and the Internal Revenue Code that would allow MECEs to reach parity with the current use of conservation easements and be eligible for tax deductions.”).

because a conservation easement is voluntary,⁸⁶ and the income tax laws in a few states already provide for a deduction or credit for conservation easements.⁸⁷

The specific amendments to the IRC that I propose the U.S. Congress adopt to implement the conservation easements advocated for in this article are discussed below, in Section VI.

III. PROPERTY LAW FRAMEWORK

Most nations around the world recognize private property ownership,⁸⁸ and most economists and development experts agree that private property regimes experience greater economic growth than communal property regimes.⁸⁹ Most property law scholars likewise agree that a private property regime is preferable to a common property regime in general.⁹⁰ What distinguishes most property law scholars around the world is whether they maintain that the private property rights that are recognized today are “natural” and “morally-justified”⁹¹ or, in contrast, are utilitarian in nature, meaning that they are “a mere artifact – a human invention, a social institution.”⁹² Most

86. *See id.* (“A conservation easement is a contract (usually between a landowner and a land trust) whereby a landowner voluntarily agrees to sell or donate the right to use a piece of property in a certain way, commonly agreeing not to develop it.”).

87. Legislation in Alaska, Louisiana, Oklahoma, Texas, North Dakota, Pennsylvania, West Virginia, and Wyoming already provides for a deduction or a credit for such a conservation easement. Ryan, *supra* note 85.

88. *See, e.g., Property rights - Country Rankings*, GLOBAL ECON., https://www.theglobaleconomy.com/rankings/herit_property_rights/ (last visited Dec. 30, 2020).

89. *See, e.g.,* Laura Tuck & Wael Zakout, *7 Reasons for Land and Property Rights to be at the Top of the Global Agenda*, WORLD BANK BLOGS (Mar. 25, 2019), <https://blogs.worldbank.org/voices/7-reasons-land-and-property-rights-be-top-global-agenda>; Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347 (1967) (setting forth a spirited economic defense of private property and, in particular, arguing that the “primary function of property rights is that of guiding incentives to achieve a greater internalization of externalities”).

90. *See, e.g.,* James E. Krier, *Of Property Rights and Rights to Property*, 41 OHIO N. U. L. REV. 589, 591 (2015) <https://repository.law.umich.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=2781&context=articles>.

91. Sukhninder Panesar, *Theories of Private Property in Modern Property Law*, 15 DENNING L.J. 113 (2012), <https://web.nmsu.edu/~jvessel/PrivateProperty-SP.pdf>.

92. JESSE DUKEMINIER ET AL., *PROPERTY: CONCISE EDITION* 36 (Wolters Kluwer 2d ed. 2017).

property law scholars around the world today subscribe to the utilitarian theory of property rights.⁹³

Those utilitarian scholars who more specifically believe that the primary purpose of property rights is to “enhance social welfare by maximizing the value of scarce resources” or distributing scarce resources as efficiently as possible are adherents of the economic theory of property rights.⁹⁴ Efficiency here means “Pareto efficiency,” named after the Italian economist and engineer Vilfredo Pareto, meaning that no change to the distribution scheme can be made to make anyone better off without making someone else worse off.⁹⁵ In the economic theory of property rights, “[p]roperty rights are thought to perform this value-maximizing function by ‘internalizing externalities’ . . . i.e., bringing the costs of the resource’s use to bear on the user.”⁹⁶ As indicated above, this statement is referring to a negative externality, which is a cost of a use imposed on others for which the user does not have to pay.⁹⁷ A positive externality is a benefit of a use bestowed on others for which the user is not paid.⁹⁸ This paper addresses how the Paris Agreement parties could increase the chance that they achieve the goal of the Paris Agreement to limit the increase in the average global temperature to 2° Celsius and preferably 1.5° Celsius and thereby slow global warming, through the lens of the economic theory of property rights.

Climate change, of course, is caused by damage to a very unusual type of property—the earth’s atmosphere—which, as stated above, is a natural resource that is owned by all of humanity.⁹⁹ Some would go so far as to argue that the

93. *Id.* at 36; *see, e.g.*, Richard A. Epstein, *The Utilitarian Foundations of Natural Law*, 12 HARV. J.L. & PUB. POL’Y 711, 714 (1989).

94. DUKEMINIER ET AL., *supra* note 92, at 35.

95. *See, e.g.*, William B.T. Mock, *Pareto Optimality*, in ENCYCLOPEDIA OF GLOBAL JUSTICE. (Chatterjee D.K. eds., 2011), https://doi.org/10.1007/978-1-4020-9160-5_341.

96. DUKEMINIER ET AL., *supra* note 92, at 36.

97. *See, e.g.*, *Externalities*, *supra* note 45.

98. *Id.*

99. Some writers argue that the earth’s atmosphere is not part of the “common heritage of mankind” (CHM) which all nations have explicitly agreed to protect. *See, e.g.*, United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 3; Declaration on the Responsibilities of the Present Generations Towards Future Generations, (Nov. 12, 1997) United Nations Educational, Scientific and Cultural Organization. arts. 4, 8. The CHM as a principle in international law is most “commonly attributed to then-Maltese Ambassador Arvid Pardo who stated in a memorandum dated 17 August 1967

atmosphere is not actually property at all, as no one has the right to exclude anyone else from utilizing it.¹⁰⁰ As a commonly-owned natural resource, it is subject to the economic phenomenon known as “the tragedy of the commons,” which is most associated with Garrett Hardin, who popularized this phenomenon in his 1968 essay of the same name.¹⁰¹ By this phrase, Hardin (and others before him) meant that, with a communally-owned natural resource, each individual will use the resource as much as possible because the costs that he or she imposes will be spread across all users, and ultimately, as a result, the commonly-owned natural resource typically is ruined.¹⁰² Again, in the economics field, those costs which a user imposes on others but for which the user does not have to pay are referred to as “negative externalities.”¹⁰³

Hardin posited that the tragedy of the commons can be averted in only one of two different ways: adoption of “private property, or something formally like it,” or “mutual coercion, mutually agreed upon.”¹⁰⁴ Hardin’s proposition that a commonly-owned natural resource could be protected through adoption of “private property, or something formally like it”¹⁰⁵ is

to the U.N. Secretary General that ‘the time has come to declare the seabed and the ocean-floor a common heritage of mankind.’” Seokwoo Lee & Jeong Woo Kim, *Applying the Principle of the Common Heritage of Mankind: An East-Asian Perspective*, in GLOBAL COMMONS AND THE LAW OF THE SEA (Kenuuan Zou, ed., 2018). Given the linkage of the CHM with the seabed and ocean floor, it is not clear that all nations would consider the earth’s atmosphere to be part of the CHM. *Id.*; *The Common Heritage of Mankind and Four Other Problem Areas*, UNITED NATIONS UNIV. (Dec. 30, 2020), <https://archive.unu.edu/unupress/unupbooks/uu15oe/uu15oe0q.htm>. Some writers have argued that the earth’s atmosphere is a part of the CHM. *See, e.g.*, Prue Taylor, AN ECOLOGICAL APPROACH TO INTERNATIONAL LAW: RESPONDING TO CHALLENGES OF CLIMATE CHANGE 275 (1998). In any case, the earth’s atmosphere unquestionably is a commonly-owned natural resource, as it is not the private property of any single human being, group of human beings, or country, and, in the Paris Agreement, the nations of the world recognized that they must work together to protect this resource. Paris Agreement, *supra* note 30, arts. 3, 4. For this reason, protecting the world’s atmosphere is considered at least a “common concern of humankind.” *See, e.g.*, Nico Schrijver, *Managing the Global Commons: Common Good or Common Sink?*, 37(7) THIRD WORLD Q. 1252, 1263 (2016), <https://doi.org/10.1080/01436597.2016.1154441>.

100. Krier, *supra* note 90, at 591 n.8.

101. Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243, 1243–48 (1968).

102. *Id.* at 1244.

103. *Id.*

104. *Id.* at 1245, 1247.

105. *Id.*

supported by the Coase theorem in economics, named after Ronald Coase, who first posited it in 1960.¹⁰⁶ The Coase theorem maintains that the parties involved in a dispute over use of a resource will be able to bargain to an efficient outcome, regardless of which party is awarded the property rights, if there is a competitive economy with complete information, zero transaction costs, and a clear definition of property rights.¹⁰⁷ Coase's theorem is especially widely applied to activities (such as the emission of greenhouse gases) that impose a negative externality on others.¹⁰⁸

Land use law, environmental law, and the major international agreements on climate change are all based to an extent on Hardin's and Coase's theories.¹⁰⁹ For example, once the parties to the United Nations Framework Convention on Climate Change (UNFCCC) agreed that people around the globe are entitled to an atmosphere that does not cause severe effects due to global warming, the developed countries to date are largely responsible for greenhouse gas emissions and hence global warming, and the developing countries to date have suffered the most severe effects of global warming, the parties could then establish the Green Climate Fund (funded by the developed countries for the developing countries to use to reduce their greenhouse gas emissions and adjust to climate change)¹¹⁰ and negotiate the Paris Agreement, in accordance with Coase's

106. R. H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960), <http://www.jstor.org/stable/724810>.

107. *Id.* at 8.

108. See, e.g., Robert S. Pindyck, *Coase Lecture—Taxes, Targets and the Social Cost of Carbon*, 84 *ECONOMICA* 345 (2017), <https://doi.org/10.1111/ecca.12243>.

109. See, e.g., John Burrit McArthur, *International Environmental Law: Can it Overcome its Weaknesses to Create an Effective Remedy for Global Warming?*, 10 *SANTA CLARA J. INT'L L.* 253, 256 n.12, 266 n.71 (2013), <http://digitalcommons.law.scu.edu/scujil/vol10/iss2/9>; Jouni Paavola, *Climate Change: The Ultimate Tragedy of the Commons?* 9–18 (Ctr. for Climate Change Econ. & Pol'y, Sustainability Rsch. Inst., Working Paper 53, 2011), https://www.cccep.ac.uk/wp-content/uploads/2015/10/WP53_climate-change-tragedy-commons.pdf.

110. *About GCF*, GREEN CLIMATE FUND. (Apr. 3, 2021) <https://www.greenclimate.fund/about>; *Green Climate Fund*, UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, <https://unfccc.int/process/bodies/funds-and-financial-entities/green-climate-fund> (last updated July 16, 2021); *Green Climate Fund Directors Warn It Faces Staffing Crisis*, CLIMATE CHANGE NEWS, <https://www.climatechangenews.com/2015/10/16/green-climate-fund-directors-warn-it-faces-staffing-crisis/> (Oct. 16, 2015); Paris Agreement, *supra* note 30, at arts. 2.2, 4.5, 9.

theorem.¹¹¹ Furthermore, given that the Paris Agreement parties were unwilling to adopt a system of “mutual coercion,” each party instead agreed to publish non-binding, evolving “nationally determined [greenhouse gas reduction] contributions” (NDCs) and utilize a wide range of public and “private property” or marketing measures to meet those NDCs, in accordance with Hardin’s theory.¹¹² The Paris Agreement parties, through their NDCs, have agreed how the burden of decreasing greenhouse emissions and slowing global warming should be distributed.¹¹³

Unfortunately, to date, the global climate change agreements have failed to slow global warming.¹¹⁴ An economic analysis of how the parties may increase the likelihood of achieving the goal of the Paris Agreement involves determining how the parties can decrease their greenhouse gas emissions at the lowest possible cost.¹¹⁵ As mentioned above, this article more specifically considers whether the execution of conservation easements in which fossil fuel owners agree not to extract, refine, sell, or distribute their fuels could be an economically efficient method of slowing global warming.

IV. THE SCIENCE OF CLIMATE CHANGE

“Climate change” refers to any long-term change in weather patterns,¹¹⁶ and global warming “is the long-term heating of Earth’s climate system . . . due to human activities, primarily fossil fuel burning”¹¹⁷ However, as the biggest change in our weather patterns for a number of years has been caused by global warming, climate scientists and the public often use the terms “climate change” and “global warming”

111. Pindyck, *supra* note 108.

112. See, e.g., Paris Agreement, *supra* note 30, at art. 6; JANE A. LEGGETT & RICHARD K. LATTANZIO, CONG. RSCH. SERV. R44609, CLIMATE CHANGE: FREQUENTLY ASKED QUESTIONS ABOUT THE 2015 PARIS AGREEMENT, 6–12 (2017), <https://fas.org/sgp/crs/misc/R44609.pdf>.

113. Paris Agreement, *supra* note 30, at art. 4.

114. *Infra* text accompanying note 407.

115. *Supra* text accompanying note 95.

116. See, e.g., *What is Climate Change?*, DAVID SUZUKI FOUND. (Nov. 3, 2020), <https://davidsuzuki.org/what-you-can-do/what-is-climate-change/> [hereinafter DAVIDSUZUKI.ORG]; *Overview: Weather, Global Warming and Climate Change*, NASA JET PROPULSION LAB, <https://climate.nasa.gov/resources/global-warming-vs-climate-change/> (last updated Nov. 17, 2020) [hereinafter NASA JET PROPULSION LAB].

117. NASA JET PROPULSION LAB, *supra* note 116.

interchangeably.¹¹⁸ Accordingly, in this paper, the terms are used interchangeably as well.

Global warming is caused by a great increase in the concentration of greenhouse gases in the earth's atmosphere.¹¹⁹ Greenhouse gases are "those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds."¹²⁰ The greenhouse gases cause global warming by reflecting back to the earth energy from the sun which has bounced off of the earth, just as a giant greenhouse surrounding the globe would do (and hence these gases have come to be referred to as "greenhouse gases").¹²¹

The major greenhouse gases are water vapor, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and various fluorinated gases (hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆), and nitrogen trifluoride (NF₃)).¹²² Some of these gases are naturally present in the earth's atmosphere.¹²³ For example, human beings breathe in oxygen and expel CO₂,¹²⁴ and cows and other large livestock expel significant amounts of methane.¹²⁵ However, humans have significantly increased the emissions of these natural greenhouse gases.¹²⁶ Furthermore, the fluorinated gases are

118. *Id.*; DAVIDSUZUKI.ORG, *supra* note 116.

119. *See, e.g., Climate Change Indicators: Greenhouse Gases*, ENV'T PROT. AGENCY, <https://www.epa.gov/climate-indicators/greenhouse-gases> (last visited Nov. 3, 2020).

120. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY, (Martin Parry et al. eds, 2007), https://www.ipcc.ch/site/assets/uploads/2018/03/ar4_wg2_full_report.pdf.

121. *See, e.g., Global Climate Change: The Causes of Climate Change*, NASA, <https://climate.nasa.gov/causes/> (last visited Nov. 4, 2020) [hereinafter *Global Climate Change*]; *ClimateKids: Meet the Greenhouse Gases*, NASA, <https://climatekids.nasa.gov/greenhouse-cards/> (last updated Oct. 6, 2021).

122. *See, e.g., Melissa Denchak, Greenhouse Effect 101*, NAT'L RESOURCES DEFENSE COUNCIL (July 16, 2019), <https://www.nrdc.org/stories/greenhouse-effect-101>.

123. *Id.*

124. Sabine De Brabandere, *How Do We Breathe?*, SCI. AM. (May 16, 2019), <https://www.scientificamerican.com/article/how-do-we-breathe>.

125. *Global Climate Change: Which is a Bigger Methane Source: Cow Belching or Cow Flatulence?*, NASA, <https://climate.nasa.gov/faq/33/which-is-a-bigger-methane-source-cow-belching-or-cow-flatulence/> (last visited Nov. 4, 2020).

126. *Global Climate Change, supra* note 121.

manmade.¹²⁷ In sum, since the commencement of the Industrial Revolution in the 1750's, there has been a significant increase in the concentration of greenhouse gases in the atmosphere, and the rate of this increase has itself increased exponentially in recent decades.¹²⁸

For example, the rate of growth of CO₂, the gas responsible for 81% of the increased warming of the earth's atmosphere, "averaged about 1.6 ppm per year in the 1980s and 1.5 ppm per year in the 1990s . . ." ¹²⁹ Then, the mean growth rate increased to 2.3 ppm per year on average from 2009 to 2018, and in 2018, carbon dioxide increased by 2.5 ppm.¹³⁰ The concentration of methane in the atmosphere has also been accelerating.¹³¹ For example, it increased 50% between 2007 and 2013.¹³² Climate scientists have warned for years that there likely will be a tipping point, "when the planet reaches a threshold of irreversible climate change and the worse effects—extreme drought, sea level rise, monster wildfires and hurricanes—become not the exception but the norm[,] "¹³³ and they estimate today that this tipping point could be reached by 2030 in general¹³⁴ and may have already been reached with respect to some aspects of global warming.¹³⁵ When a tipping point has been reached, scientists maintain, the earth's ability to absorb additional CO₂ will decline, "creat[ing] a destructive land-atmosphere feedback loop that could dramatically accelerate the worst effects of global warming."¹³⁶

127. Denchak, *supra* note 122.

128. *What Are the Greenhouse Gas Changes Since the Industrial Revolution?*, AM. CHEMICAL SOC'Y, <https://www.acs.org/content/acs/en/climate-science/greenhousegases/industrialrevolution.html>. (last visited Nov. 4, 2020) ("CO₂, for instance, never increased more than 30 ppm [parts per million] during any previous 1,000-year period . . . but has already risen by 30 ppm in the past two decades.").

129. *Rising Emissions Drive Greenhouse Gas Index increase*, NAT'L OCEANIC AND ATMOSPHERIC ADMIN. (May 21, 2019), <https://research.noaa.gov/article/ArtMID/587/ArticleID/2455/RISING-EMISSIONS-DRIVE-GREENHOUSE-GAS-INDEX-INCREASER>.

130. *Id.*

131. *Id.*

132. *Id.*

133. Jonathan Hahn, *Climate Could Hit a Tipping Point Sooner Than You Think*, SIERRA CLUB (Jan. 26, 2019), <https://www.sierraclub.org/sierra/climate-could-hit-tipping-point-sooner-you-think>.

134. *Id.*

135. Hotz & Puko, *supra* note 23.

136. Hahn, *supra* note 133.

In sum, climate scientists have concluded that the buildup of greenhouse gases in the earth's atmosphere is primarily caused by man,¹³⁷ and, in particular, is primarily caused by (1) man's burning of fossil fuels, including coal, gasoline, and oil, which releases CO₂; and (2) man's destruction or dissipation of many of the natural carbon sinks that exist around the world.¹³⁸ Again, a "carbon sink" is an area, such as an ocean or a forest, that absorbs more CO₂ than it emits.¹³⁹

V. SUCCESSES AND FAILURES OF INTERNATIONAL AGREEMENTS REGARDING CLIMATE CHANGE

The first major multilateral agreement regarding climate change was the U.N. General Assembly's endorsement of the establishment of the Intergovernmental Panel on Climate Change (IPCC) by the World Meteorological Organization (WMO) and the U.N. Environment Program (UNEP).¹⁴⁰ The WMO and the UNEP established the IPCC in 1988, and the U.N. General Assembly endorsed this joint action in the same year.¹⁴¹ The IPCC is completely apolitical and exists solely to provide the U.N. members with accurate information regarding the causes and effects of climate change and suggest methods of adaptation and mitigation.¹⁴² It produces regular reports, referred to as "Assessments," but it does not conduct its own research.¹⁴³ Rather, it synthesizes data and reports produced by scientists all around the world regarding numerous aspects of climate

137. See, e.g., *Causes of Climate Change*, *supra* note 23 ("Humans are increasingly influencing the climate and the earth's temperature by burning fossil fuels, cutting down forests and farming livestock.").

138. *Deforestation and Climate Change*, CLIMATE COUNCIL (Aug. 21, 2019), <https://www.climatecouncil.org.au/deforestation/#:~:text=Burning%20fossil%20fuels%2C%20in%20combination,carbon%20sinks%20such%20as%20forests.>

139. *Carbon Sink or Carbon Source? Aerosols Play Significant Role in Shifts*, SCI. DAILY (Dec. 9, 2004), <https://www.sciencedaily.com/releases/2004/12/041208225316.htm>.

140. Laurence Boisson de Chazournes, *United Nations Framework Convention on Climate Change*, UNITED NATIONS AUDIOVISUAL LIBR. INT'L L. (2008), https://legal.un.org/avl/pdf/ha/ccf/ccc_e.pdf.

141. *The Intergovernmental Panel on Climate Change*, IPCC, <https://www.ipcc.ch/> (last visited Nov. 26, 2020); *History of the IPCC*, IPCC, <https://www.ipcc.ch/about/history/#:~:text=The%20establishment%20of%20the%20IPCC,UN%20General%20Assembly%20in%201988.&text=Since%201988%2C%20the%20IPCC%20has,about%20climate%20change%20produced%20worldwide> (last visited Nov. 26, 2020).

142. *Id.*

143. *Id.*

change.¹⁴⁴ Although the IPCC is sometimes criticized as not being alarmist enough,¹⁴⁵ the IPCC is considered the most credible authority on the science of climate change.¹⁴⁶ At present, the IPCC is working on its Sixth Assessment Report, which will be released in 2022.¹⁴⁷

Shortly after the establishment of the IPCC in 1988, the UNFCCC¹⁴⁸ was adopted at U.N. headquarters in New York on May 9, 1992.¹⁴⁹ President George H.W. Bush (Sr.) signed the UNFCCC on behalf of the U.S. at the Earth Summit held in Rio De Janeiro in June of 1992,¹⁵⁰ and the U.S. Senate then ratified the UNFCCC on October 15, 1992.¹⁵¹ The UNFCCC entered into force on March 21, 1994.¹⁵² As its name suggests, this Convention essentially provides a framework through which the international community can continue to negotiate multilateral agreements designed to remediate climate change.¹⁵³ Both the Kyoto Protocol on Climate Change and the Paris Agreement were negotiated under the auspices of the UNFCCC.¹⁵⁴ This

144. *Id.*

145. Glenn Scherer, *Report: IPCC Underestimates Climate Risks*, CLIMATE CENT. (Dec. 10, 2012), <https://www.climatecentral.org/news/report-ipcc-under-estimate-assessing-climate-risks-15338>.

146. David Herring, *Isn't There a lot of Disagreement Among Climate Scientists About Global Warming?*, CLIMATE.GOV (Feb. 3, 2020), <https://www.climate.gov/news-features/climate-qa/isnt-there-lot-disagreement-among-climate-scientists-about-global-warming> (“Probably the most definitive assessments of global climate science come from the Intergovernmental Panel on Climate Change (IPCC).”).

147. *Sixth Assessment Report*, IPCC, <https://www.ipcc.ch/assessment-report/ar6/> (last visited Nov. 26, 2020) [hereinafter *Sixth Assessment Report*].

148. United Nations Framework Convention on Climate Change, *adopted* May 9, 1992, S. TREATY DOC No. 102-38, 1771 U.N.T.S. 107 (entered into force Mar. 21, 1994)

149. *Status of the Ratification of the Convention*, UNFCCC, <https://unfccc.int/process-and-meetings/the-convention/status-of-ratification/status-of-ratification-of-the-convention> (last visited Nov. 26, 2020).

150. *Sixth Assessment Report*, *supra* note 148; John Parnell, *Countdown to Rio+20: George Bush Senior Starts 20 Years of Stalemate*, CLIMATE HOME NEWS (Aug. 5, 2012, 4:46 PM), <https://www.climatechangenews.com/2012/05/08/count-down-to-rio20-george-bush-senior-starts-20-years-of-stalemate/>.

151. *Sixth Assessment Report*, *supra* note 147.

152. *Id.*

153. *Climate Get the Big Picture*, UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, <https://unfccc.int/resource/bigpicture/> (last visited Nov. 26, 2020).

154. *Id.*; see also Jane Leggett, *The United Nations Framework Convention on Climate Change, the Kyoto Protocol, and the Paris Agreement: A Summary*, CONG. RSCH. SERV. (JAN. 29, 2020), <https://fas.org/sgp/crs/misc/R46204.pdf>.

Convention remains operational today, and it currently has 197 parties.¹⁵⁵

The first agreement negotiated under the UCFCCC was the Kyoto Protocol to the United Nations Framework on Climate Change (Kyoto Protocol), which was adopted on December 10, 1997, and entered into force in 2005.¹⁵⁶ On behalf of the United States, U.S. Ambassador to the U.N. Peter Burleigh signed the Kyoto Protocol on December 11, 1998,¹⁵⁷ but because it was never ratified by the U.S. Senate, the United States was not a party to the Kyoto Protocol.¹⁵⁸ In addition, Canada withdrew from the Kyoto Protocol on December 12, 2011, stating that the Protocol's "goals were unworkable because the United States and China never agreed to Kyoto . . .,"¹⁵⁹ and the United States and China were the two largest emitters of greenhouse gases by 2018.¹⁶⁰

Under the Kyoto Protocol, the thirty-eight most developed nations, as well as the European Union (together known as the Annex 1 Parties) initially made commitments to reduce their greenhouse gas emissions by 5% below their 1990 levels during the 2009 to 2012 time period.¹⁶¹ Developing countries (at the time, including China and India) were encouraged to reduce their greenhouse gas emissions but were not obligated to do so.¹⁶² Theoretically, the developed nations' commitments were legally binding, but if one of these nations failed to meet its stated greenhouse gas emission commitment, it was granted 100 days to fix or "true up" the situation,¹⁶³ and it could do so by acquiring emission reduction credits through three different market mechanisms or investing in various land use, land use change, and forestry (LULUCF) projects (essentially designed to

155. *Sixth Assessment Report*, *supra* note 147.

156. Kyoto Protocol to the United Nations Framework Convention on Climate Change, *opened for signature* 16 Mar. 1998, 2303 U.N.T.S. 162 (entered into force Feb. 16, 2005) [hereinafter U.N. Status Report on the Kyoto Protocol].

157. *United States Signs the Kyoto Protocol*, U.S. DEP'T STATE ARCHIVE (Nov. 12, 1998), https://1997-2001.state.gov/global/global_issues/climate/fs-us_sign_kyoto_981112.html.

158. U.N. Status Report on the Kyoto Protocol, *supra* note 156.

159. *Id.*

160. *Kyoto Protocol Fast Facts*, CNN, <https://www.cnn.com/2013/07/26/world/kyoto-protocol-fast-facts/index.html> (last updated Mar. 18, 2021).

161. Leggett, *supra* note 154, at 4.

162. *Id.*

163. Paulina Poplawski-Stephens, *What Would Be the Consequences of Not Meeting Kyoto Carbon Targets?*, INST. ENV'T SCI. (Feb. 2014), <https://www.theies.org/analysis/what-would-be-consequences-not>.

protect carbon sinks).¹⁶⁴ The three market mechanisms are the Clean Development Mechanism (investing in a carbon emission reduction project in a developing country),¹⁶⁵ Joint Implementation (entering into an agreement with a group of parties which, when combined, met their overall commitments), and Emissions Trading.¹⁶⁶ Moreover, if a nation was still non-compliant at the end of that 100-day period, it was simply required to add its shortfall during the 2009 to 2012 compliance period to its new commitment for the second compliance Kyoto Protocol period of 2013 to 2020, plus commit to an additional 30% reduction in greenhouse gas emissions during that second period.¹⁶⁷ Such a noncompliant party furthermore was required to submit a compliance action plan and its eligibility to make transfers under Emissions Trading was suspended until it was once again in compliance with its commitment.¹⁶⁸ As the environmental lawyer for ClientEarth, Josh Roberts, stated when Canada withdrew from the Kyoto Protocol, the Kyoto Protocol had “very few teeth beyond international diplomatic censure.”¹⁶⁹

If one assesses the success of the Kyoto Protocol based solely on whether the remaining thirty-six developed parties (following the United States’ failure to ratify the Protocol and Canada’s withdrawal from it) met their greenhouse gas emission reduction commitments, the Protocol was an unmitigated success. All thirty-six of these parties met their individual commitments under the Protocol during the 2009 to 2012 period.¹⁷⁰ (Whether these nations met their additional

164. *Id.*; see also Leggett, *supra* note 154, at 5.

165. *The Clean Development Mechanism*, UNITED NATIONS CLIMATE CHANGE, <https://unfccc.int/process-and-meetings/the-kyoto-protocol/mechanisms-under-the-kyoto-protocol/the-clean-development-mechanism> (last visited Dec. 14, 2020) (“Such projects can earn saleable certified emission reduction (CER) credits, each equivalent to one tonne of [CO₂], which can be counted towards meeting Kyoto targets.”).

166. Leggett, *supra* note 154, at 5.

167. Poplawski-Stephens, *supra* note 163; see also *An Introduction to the Kyoto Protocol Compliance Mechanism*, UNITED NATIONS CLIMATE CHANGE, <https://unfccc.int/process/the-kyoto-protocol/compliance-under-the-kyoto-protocol/introduction> (last visited Dec. 14, 2020) [hereinafter *Kyoto Compliance Mechanism*].

168. *Kyoto Compliance Mechanism*, *supra* note 167.

169. *Canada Condemned at Home and Abroad for Pulling out of Kyoto Treaty*, GUARDIAN, <https://www.theguardian.com/environment/2011/dec/13/canada-condemned-kyoto-climate-treaty> (last visited Nov. 10, 2021).

170. See, e.g., Alan Martin, *Climate Change: Figures Show Kyoto Protocol Was a Success – Or Do They?*, ALPHR (June 15, 2016), <https://www.alphr.com>

greenhouse gas emission reduction commitments with respect to the 2013 to 2020 period has not yet been assessed.)¹⁷¹ To be sure, these nations are to be congratulated for having met their initial commitments under the Kyoto Protocol, and their 100% compliance rate suggests that international peer pressure can be an effective mode of enforcement.¹⁷²

Still, if one measures the success of the Kyoto Protocol based on whether it actually slowed global warming, there is little to celebrate. To begin with, nine of the thirty-six remaining developed parties to the Kyoto Protocol actually met their commitments only by purchasing the right to emit more CO₂ from nations that were not emitting as much.¹⁷³ In addition, the most severe economic recession since the 1930s occurred during 2008 to 2012, and experts estimate that carbon emissions during these years were one to two gigatons lower than they otherwise would have been as a result.¹⁷⁴ Most important, most nations in the world (including the United States and Canada) did not reduce their greenhouse gas emissions during the 2009 to 2012 period, despite the recession in effect during those years, and global greenhouse gas emissions, in fact, rose significantly during those years.¹⁷⁵

As indicated above by Canada's spokesperson at the time Canada withdrew from the Kyoto Protocol, the major flaw in the Kyoto Protocol was that it did not require most nations in the world, including the major greenhouse gas-emitting nations such as China and India, to make greenhouse gas emission reduction commitments.¹⁷⁶ The continued warming of the earth simply cannot be halted or slowed until all or at least most nations on earth significantly reduce their greenhouse

/environment/1003699/climate-change-figures-show-kyoto-protocol-was-a-success-or-do-they/.

171. Leggett, *supra* note 154, at 5 (discussing these nations' progress toward their contributions as of November 2018).

172. Martin, *supra* note 170.

173. *Id.*

174. *Id.*

175. *Total Greenhouse Gas Emissions (kt of CO₂ Equivalent)*, THE WORLD BANK, <https://data.worldbank.org/indicator/EN.ATM.GHGT.KT.CE> (last visited Dec. 15, 2020).

176. *Kyoto Protocol Fast Facts*, *supra* note 160; see also Julian Borger, *Bush Kills Global Warming Treaty*, GUARDIAN (Mar. 29, 2001), <https://www.theguardian.com/environment/2001/mar/29/globalwarming.usnews> ("Mr. Bush said he opposed the Kyoto deal . . . because it exempted developing countries and would harm the U.S. economy.").

emissions.¹⁷⁷ In addition, those nations which had been required under the Protocol to reduce their greenhouse gas emissions understandably felt that the Protocol unfairly placed the burden of solving the climate change crisis solely on them.¹⁷⁸ While negotiating a second round of Kyoto Protocol commitments for the 2013 to 2020 period, Australia, Japan, and a few other parties proposed the adoption of an agreement that included commitments on the same terms from all parties to the Protocol.¹⁷⁹ This then led to a mandate, negotiated in 2011 in Durban, South Africa, to develop a protocol or legal instrument under the UNFCCC applicable to all participant nations no later than 2015.¹⁸⁰ This mandate resulted in the adoption of the Paris Agreement.¹⁸¹

The Paris Agreement was the second major agreement negotiated under the UNFCCC.¹⁸² It was adopted at the twenty-first session of the Conference of the Parties (COP) to the UNFCCC, opened for signature on April 22, 2016, and entered into force on November 4, 2016.¹⁸³ At present, there are 192 parties to the Paris Agreement,¹⁸⁴ constituting almost the entire 193 members of the United Nations.¹⁸⁵ The U.S. signed the Paris Agreement on April 22, 2016, and it accepted the Agreement by Executive Order on September 3, 2016,¹⁸⁶ but former U.S. President Trump officially withdrew the U.S. from the Paris Agreement and that withdrawal became effective as of

177. See, e.g., *Global Climate Change Regime*, COUNCIL ON FOREIGN RELS. (June 19, 2013), <https://www.cfr.org/report/global-climate-change-regime> (“Fifteen to twenty countries are responsible for roughly 75 percent of global emissions, but no one country accounts for more than about 26 percent. Efforts to cut emissions—*mitigation*—must therefore be global.” (emphasis in original)).

178. See, e.g., Martin, *supra* note 170 (“George W. Bush stated that . . . ‘I’m not going to let the U.S. carry the burden for cleaning up the world’s air, like the Kyoto treaty would have done’ . . .”).

179. Leggett, *supra* note 154, at 5.

180. *Id.*

181. *Id.*

182. *Id.*

183. Chapter XXVII Environment: 7.d Paris Agreement (Dec. 12, 2015), https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=XXVII-7-d&chapter=27&clang=_en [hereinafter U.N. Status Report on the Paris Agreement].

184. *Id.*

185. See *About Us*, UNITED NATIONS, <https://www.un.org/en/about-us> (last visited Jan. 20, 2022) (stating that the U.N. comprises 193 member states).

186. See U.N. Status Report on the Paris Agreement, *supra* note 183.

November 4, 2020.¹⁸⁷ Then, U.S. President Joe Biden, shortly after his election, announced that the U.S. was rejoining the Paris Agreement.¹⁸⁸

The overall goal of the Paris Agreement is to “[h]old[] the increase in the global average temperature to well below 2° Celsius above pre-industrial levels and pursu[e] efforts to limit the temperature increase to 1.5° Celsius above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change.”¹⁸⁹ If the nations of the world do not make any effort to reduce their greenhouse gas emissions, the average global temperature is expected to rise between 3° and 5° Celsius above pre-industrial levels by the end of the century with catastrophic results.¹⁹⁰ A subsidiary goal of the Paris Agreement is to achieve net zero emissions by mid-century (2050) by balancing anthropogenic greenhouse gas emissions against removals of greenhouse gases from the atmosphere.¹⁹¹

In order to achieve these goals, each party, prior to convening in Paris in 2015, was encouraged to publish its intended individual greenhouse gas emission reduction contribution or “Intended Nationally Determined Contribution” (INDC).¹⁹² When each party formally joined the Paris Agreement through ratification or accession, its INDC was treated as its initial “Nationally Determined Contribution” or NDC, unless it had altered its INDC prior to its accession to, or ratification of, the Paris Agreement.¹⁹³ Each party has furthermore agreed to communicate a second, more aggressive NDC by 2020 and at least every five years thereafter.¹⁹⁴ Of course, a party may adjust

187. See *id.* at n.4.

188. Fiona Harvey, *US To Hold World Climate Summit Early Next Year and Seek to Rejoin Paris Accord*, GUARDIAN (Dec. 14, 2020), <https://www.theguardian.com/environment/2020/dec/14/us-to-hold-world-climate-summit-early-next-year-and-seek-to-rejoin-paris-accord>.

189. Paris Agreement, *supra* note 30, art. 2.1(a), at 3.

190. Maxime Pontoire, *The Race to Zero Emissions, and Why the World Depends on It*, UN NEWS (Dec. 2, 2020), <https://news.un.org/en/story/2020/12/1078612>.

191. See Paris Agreement, *supra* note 30, art. 4.1, at 4.

192. *Paris Climate Agreement Q&A*, CTR. FOR CLIMATE & ENERGY SOLUTIONS, <https://www.c2es.org/content/paris-climate-agreement-qa> (last visited Oct. 28, 2021) [hereinafter *Paris Climate Agreement Q&A*]; *Intended Nationally Determined Contributions*, UNFCCC, <https://unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs/indcs> (last visited Oct. 28, 2021).

193. See *Paris Climate Agreement Q&A*, *supra* note 192.

194. Paris Agreement, *supra* note 30, arts. 4.3, 4.9, at 4–5.

its existing NDC at any time “with a view to enhancing its level of ambition.”¹⁹⁵ No party is required to commit to any particular greenhouse gas emission reduction level,¹⁹⁶ but every party agrees to communicate each of its NDCs to the other parties and allow a panel of experts to review and comment on them.¹⁹⁷ Furthermore, the Conference of the Parties to the UNFCCC is committed to undertake a “Global Stocktake” in 2023 and every five years thereafter to assess overall progress toward the Paris Agreement’s goals.¹⁹⁸

All of the NDCs which the parties have submitted to date are maintained by the Secretariat of the UNFCCC and can be accessed there.¹⁹⁹ For example, in its initial NDC, the EU (including at that time the United Kingdom of Great Britain and Northern Ireland) committed to reduce greenhouse gas emissions by at least 40% compared to 1990 by 2030.²⁰⁰ In an updated NDC submitted on December 17, 2020, the EU committed to reduce its greenhouse gas emissions by 55% compared to 1990 by 2030.²⁰¹ Furthermore, on December 11, 2020, the United Kingdom of Great Britain and Northern Ireland (the UK) submitted a NDC just for the UK, in which it stipulated that “the UK is committing to reduce economy-wide greenhouse gas emissions by at least 68% by 2030, compared to

195. Paris Agreement, *supra* note 30, art. 4.11, at 5.

196. CLIMATE FOCUS, THE PARIS AGREEMENT: SUMMARY 1 (Dec. 28, 2015), <https://www.climatefocus.com/sites/default/files/20151228%20COP%2021%20briefing%20FIN.pdf> [hereinafter PARIS AGREEMENT SUMMARY].

197. Paris Agreement, *supra* note 30, arts. 4.2, 4.8, 4.9, 13.7(b), 13.11, at 4–5, 17–18; *see also* PARIS AGREEMENT SUMMARY, *supra* note 196, at 3–4.

198. Paris Agreement, *supra* note 30, arts. 1, 14.1, 14.2, at 3, 18–19.

199. *Id.*, art. 4.12, at 5. *See generally* INDCs as Communicated by Parties, UNFCCC, <https://www4.unfccc.int/sites/submissions/INDC/Submission%20Pages/submissions.aspx> (last visited Oct. 28, 2021) (UNFCCC Secretariat’s registry of parties’ INDC submissions).

200. EUROPEAN COMM’N & LATVIAN PRESIDENCY OF THE COUNCIL OF THE EUROPEAN UNION, SUBMISSION BY LATVIA AND THE EUROPEAN COMMISSION ON BEHALF OF THE EUROPEAN UNION AND ITS MEMBER STATES 1 (Mar. 6, 2015), <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Sweden%20First/EU%20First%20NDC.pdf>; *see Climate Action: Paris Agreement*, EUROPEAN COMM’N, https://ec.europa.eu/clima/policies/international/negotiations/paris_en#:~:text=The%20EU's%20initial%20nationally%20determined,by%20the%20end%20of%202018 (last visited Oct. 28, 2021) [hereinafter *Climate Action: Paris Agreement*].

201. GERMANY & EUROPEAN COMM’N, UPDATE OF THE NDC OF THE EUROPEAN UNION AND ITS MEMBER STATES 6 ¶ 27 (Dec. 17, 2020), https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Sweden%20First/EU_NDC_Submission_December%202020.pdf.

1990 levels.”²⁰² This is a significant increase in the commitment of the UK compared to when it was a member of the EU,²⁰³ and the UK is the seventeenth largest emitter of greenhouse gases.²⁰⁴ Angola, in its first NDC, stated that it “plans to reduce GHG emissions up to 35% unconditionally by 2030 as compared to the Business As Usual (BAU) scenario (base year 2005). In addition, it is expected that through a conditional mitigation scenario the country could reduce an additional 15% below BAU emission levels by 2030.”²⁰⁵ In an updated first NDC submitted on May 30, 2021, Angola then committed to achieve a 14% reduction in greenhouse gas emissions (unconditionally) by 2025.²⁰⁶ When the U.S. initially joined the Paris Agreement, its first NDC provided that “the United States intends to achieve an economy-wide target of reducing its greenhouse emissions by 26-28 per cent below its 2005 level in 2025 and to make best efforts to reduce its emissions by 28%.”²⁰⁷ Then, when the U.S. rejoined the Paris Agreement on February 19, 2021,²⁰⁸ it submitted an updated first NDC, which stated that it was “setting an economy-wide target of reducing its net greenhouse gas emissions by 50-52 percent below 2005 levels in 2030.”²⁰⁹

202. UK GOV'T, UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND'S NATIONALLY DETERMINED CONTRIBUTION 1 (2020), <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/United%20Kingdom%20of%20Great%20Britain%20and%20Northern%20Ireland%20First/UK%20Nationally%20Determined%20Contribution.pdf> (emphasis omitted).

203. See *Climate Action: Paris Agreement*, *supra* note 200.

204. Paul Bolton, *UK and Global Emissions and Temperature Trends*, UK PARLIAMENT (June 2, 2021), <https://commonslibrary.parliament.uk/uk-and-global-emissions-and-temperature-trends/>.

205. REPUBLIC OF ANGOLA, INTENDED NATIONALLY DETERMINED CONTRIBUTION (INDC) OF THE REPUBLIC OF ANGOLA 4 (Nov. 2015), <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Angola%20First/INDC%20Angola%20deposito.pdf> (emphasis omitted).

206. REPUBLIC OF ANGOLA, NATIONALLY DETERMINED CONTRIBUTION OF ANGOLA 9 (May 2021), <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Angola%20First/NDC%20Angola.pdf>.

207. UNITED STATES OF AMERICA, U.S. COVER NOTE, INDC AND ACCOMPANYING INFORMATION 1 (2015), <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/United%20States%20of%20America%20First/U.S.A.%20First%20NDC%20Submission.pdf>.

208. *Paris Climate Agreement Q&A*, *supra* note 192.

209. UNITED STATES OF AMERICA, THE UNITED STATES OF AMERICA NATIONALLY DETERMINED CONTRIBUTION: REDUCING GREENHOUSE GASES IN THE UNITED STATES: A 2030 EMISSIONS TARGET 1 (2021), <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/United%20States%20of%20America%20First/United%20States%20NDC%20April%202021%20Final.pdf> (emphasis omitted).

The Paris Agreement was an extraordinary achievement in that almost every nation on earth joined the Agreement and each of those nations committed to reducing its greenhouse gas emissions.²¹⁰ Further cause for celebration was the developed nations' agreement to continue to fund a "Green Climate Fund" (GCF) in the amount of at least \$100 billion annually by 2020, to assist the developing and least developed nations to reduce their own greenhouse gas emissions and adapt to climate change (which disproportionately affects these nations).²¹¹ In essence, the developed nations agreed that they owed these funds to the developing nations as it was the developed nations' economic development activities, especially their reliance on fossil fuels, that was primarily responsible for global warming to date.²¹² The developing nations, for their part, agreed to use the GCF "reparation funds" to wean themselves from fossil fuels, follow a more sustainable economic development model, and adapt to climate change.²¹³ This funding commitment was critical to consummation of the Paris Agreement.²¹⁴ As indicated above, the establishment of the GCF is an example of the above-mentioned Coase theorem in action: once the global community agreed that the developing nations had a property right to a

210. *The Paris Agreement*, UNFCCC, <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement> (last visited Nov. 19, 2021).

211. *Climate Finance in the Negotiations*, UNFCCC, <https://unfccc.int/topic/s/climate-finance/the-big-picture/climate-finance-in-the-negotiations> (last visited Oct. 29, 2021); *Resource Mobilization*, GREEN CLIMATE FUND, <https://www.greenclimate.fund/about/resource-mobilisation#> (last visited Oct. 29, 2021); see Paris Agreement, *supra* note 30, art. 9, at 13–14.

212. *Climate Funds Update*, CLIMATE FUNDS UPDATE, <https://climatefundsupdate.org/> (last visited Oct. 29, 2021); see also *The \$3 Billion U.S. Pledge for the Green Climate Fund: Is It a Lot?*, BROOKINGS (Nov. 17, 2014), <https://www.brookings.edu/blog/planetpolicy/2014/11/17/the-3-billion-u-s-pledge-for-the-green-climate-fund-is-it-a-lot/> (breaking down the financial contributions).

213. *About GCF*, GREEN CLIMATE FUND, <https://www.greenclimate.fund/about> (last visited Oct. 29, 2021).

214. See DELIVERING ON THE \$100 BILLION CLIMATE FINANCE COMMITMENT AND TRANSFORMING CLIMATE FINANCE, INDEP. EXPERT GRP. ON CLIMATE FIN. 6 (Dec. 2020), https://www.un.org/sites/un2.un.org/files/100_billion_climate_finance_report.pdf; see also Tucker Davey, *Developing Countries Can't Afford Climate Change*, FUTURE LIFE INST. (Aug. 5, 2016), <https://futureoflife.org/2016/08/05/developing-countries-cant-afford-climate-change/>; Benoit Mayer, *Climate Change Reparations and the Law and Practice of State Responsibility*, 7 ASIAN J. INT'L L. 185, 187, 194–95 (2016), <https://www.cambri-dge.org/core/journals/asian-journal-of-international-law/article/climate-change-reparations-and-the-law-and-practice-of-state-responsibility/59BEEB3F2AE39E8A2DA15815B25D3270>.

clean atmosphere and that furthermore the developed nations had violated that right, the parties could negotiate a payment from the developed nations to the developing nations to rectify this property right violation.²¹⁵

The Paris Agreement is a groundbreaking agreement that has the potential to solve the global warming crisis,²¹⁶ and arguably it is premature to assess the success of the Paris Agreement as the UNFCCC won't complete its first "Global Stocktake" of greenhouse gas emissions until 2023.²¹⁷ However, climate scientists have warned that aggregation of all of the parties' initial NDC ambitions would need to be tripled to prevent the average global temperature from exceeding 2° Celsius above the pre-industrial average global temperature and would need to be increased fivefold to prevent the average global temperature from exceeding 1.5° Celsius.²¹⁸ In other words, the average global temperature is predicted to rise between 2.9° Celsius and 3.4° Celsius above the pre-industrial average global temperature even if all of the Paris Agreement parties meet their stated NDCs.²¹⁹ In addition, numerous authorities have reported that the great majority of Paris Agreement parties are

215. Pindyck, *supra* note 108, at 345.

216. Katie Regan, *195 Nations Reach Groundbreaking Climate Change Agreement*, NACCHO (Dec. 18, 2015), <https://www.naccho.org/blog/articles/195-nations-reach-groundbreaking-climate-change-agreement>.

217. *Global Stocktake*, UNFCCC, <https://unfccc.int/topics/science/workstreams/global-stocktake#eq-1> (last visited Oct. 29, 2021).

218. Joeri Rogelj et al., *The Emissions Gap*, in UNITED NATIONS ENV'T PROGRAMME, EMISSIONS GAP REPORT 2020, at 25, 28 (2020), <https://www.unep.org/emissions-gap-report-2020>; see also Stephen Leahy, *Most Countries Aren't Hitting 2030 Climate Goals, and Everyone Will Pay the Price*, NAT'L GEOGRAPHIC (Nov. 5, 2019), <https://www.nationalgeographic.com/science/article/nations-miss-paris-targets-climate-driven-weather-events-cost-billions> (referring to a study conducted by climate scientists entitled "The Truth Behind the Paris Agreement Climate Pledges" and stating, in part, that "[c]ountries need to double and triple their 2030 reduction commitments to be aligned with the Paris target").

219. *National Climate Action Under the Paris Agreement*, WORLD RESOURCES INST., <https://www.wri.org/ndcs> (last visited Oct. 29, 2021) [hereinafter *National Climate Action*]; see also Shyam Saran, *Paris Climate Talks: Developed Countries Must Do More Than Reduce Emissions*, GUARDIAN (Nov. 23, 2015), <https://www.theguardian.com/environment/2015/nov/23/paris-climate-talks-developed-countries-must-do-more-than-reduce-emissions>; Warren Cornwall, *The Paris Climate Pact Is 5 Years Old. Is It Working?*, SCIENCE (Dec. 11, 2020), <https://www.sciencemag.org/news/2020/12/paris-climate-pact-5-years-old-it-working>.

failing to meet even their very modest NDCs.²²⁰ In short, the Paris Agreement is doomed to fail unless the parties, especially the biggest greenhouse gas emitters, establish and adhere to much more aggressive NDCs within just the next few years.²²¹ Specifically, according to climate scientists, the parties must reduce their greenhouse gas emissions by at least 45% as compared to 2010 emission levels by 2030, less than eight short years from now, if they want to have a realistic chance of meeting the temperature goals stated in the Paris Agreement.²²²

Unfortunately, as of late October 2021, only thirteen parties to the Paris Agreement had submitted their second NDC, which was due in 2020.²²³ These countries are Argentina, Bhutan, Gambia, Grenada, Marshall Islands, Nepal, Oman, Papua New Guinea, Samoa, South Sudan, Suriname, Tonga, and United

220. See, e.g., Leahy, *supra* note 218; Nsikan Akpan, *Only 2 Countries Are Meeting Their Climate Pledges. Here's How the 10 Worst Could Improve*, PBS (Sept. 26, 2019), <https://www.pbs.org/newshour/science/only-2-countries-are-meeting-their-climate-pledges-heres-how-the-10-worst-could-improve>.

Furthermore, experts predict that the average global temperature will rise more than 4° Celsius above the pre-industrial average global temperature if nations ignore their Paris Agreement commitments and continue to increase their greenhouse gas emissions. See *National Climate Action*, *supra* note 219; Carmen Singer et al., *The 7 Countries Actually Living Up to the Paris Climate Agreement*, GLOBAL CITIZEN (Oct. 12, 2018), <https://www.globalcitizen.org/en/content/7-countries-paris-climate-agreement/>.

221. See David Roberts, *The Paris Climate Agreement is at Risk of Falling Apart in the 2020s*, VOX (Nov. 5, 2019), <https://www.vox.com/energy-and-environment/2019/11/5/20947289/paris-climate-agreement-2020s-breakdown-trump>; Fiona Harvey, *World Is in Danger of Missing Paris Climate Target, Summit Is Warned*, GUARDIAN (Dec. 12, 2020), <https://www.theguardian.com/environment/2020/dec/12/world-is-in-danger-of-missing-paris-climate-target-summit-is-warned>.

222. Myles Allen et al., *Summary for Policymakers, in* GLOBAL WARMING OF 1.5°C. AN IPCC SPECIAL REPORT ON THE IMPACTS OF GLOBAL WARMING OF 1.5°C ABOVE PRE-INDUSTRIAL LEVELS AND RELATED GLOBAL GREENHOUSE GAS EMISSION PATHWAYS, IN THE CONTEXT OF STRENGTHENING THE GLOBAL RESPONSE TO THE THREAT OF CLIMATE CHANGE, SUSTAINABLE DEVELOPMENT, AND EFFORTS TO ERADICATE POVERTY 3, 12 (Valerie Masson-Delmotte et al. eds., 2018), https://www.ipcc.ch/site/assets/uploads/site/s/2/2019/05/SR15_SPM_version_report_LR.pdf; see “*Climate Commitments Not on Track to Meet Paris Agreement Goals*” as NDC Synthesis Report Is Published, UNFCCC (Feb. 26, 2021), <https://unfccc.int/news/climate-commitments-not-on-track-to-meet-paris-agreement-goals-as-ndc-synthesis-report-is-published>; Akpan, *supra* note 220.

223. *NDC Registry*, UNFCCC, <https://www4.unfccc.int/sites/ndcstaging/Pages/Home.aspx> (last visited Oct. 29, 2021) (“13 Parties have submitted their second NDCs.”).

Arab Emirates,²²⁴ and none of the thirteen is in the group of the top ten emitters of carbon dioxide (based on 2018 data).²²⁵ Not surprisingly, greenhouse gas emissions have continued to increase, rather than decrease, since the 2015 adoption of the Paris Agreement.²²⁶

To be sure, the U.S.' rejoining of the Paris Agreement in 2021²²⁷ as well as the distribution of vaccines throughout the world to protect against the COVID-19 pandemic²²⁸ are likely to reenergize the Paris Agreement parties and cause them to focus more on their commitments to reduce greenhouse gas emissions.²²⁹ In addition, the twenty-sixth Conference of Parties (COP) of the UNFCCC, which was rescheduled from November 2020 to November 2021 because of the COVID-19 crisis,²³⁰

224. *NDC Registry (Interim)*, UNFCCC, <https://www4.unfccc.int/sites/NDCStaging/Pages/All.aspx> (last visited Oct. 29, 2021) (listing all parties' first and, where applicable, second NDCs).

225. See Robert Rapier, *The World's Top 10 Carbon Dioxide Emitters*, FORBES (Dec. 4, 2019), <https://www.forbes.com/sites/rrapier/2019/12/04/the-worlds-top-10-carbon-dioxide-emitters/?sh=532d045d2d04>; *Each Country's Share of CO₂ Emissions*, UNION OF CONCERNED SCIENTISTS, <https://www.ucsusa.org/resources/each-countrys-share-co2-emissions> (last updated Aug. 12, 2020).

226. Rebecca Lindsey, *Climate Change: Annual Greenhouse Gas Index*, CLIMATE.GOV (Aug. 14, 2020), <https://www.climate.gov/news-features/understanding-climate/climate-change-annual-greenhouse-gas-index>.

227. Press Statement, U.S. Sec'y of State Antony J. Blinken, The United States Officially Rejoins the Paris Agreement (Feb. 19, 2021), <https://www.state.gov/the-united-states-officially-rejoins-the-paris-agreement>.

228. See Josh Holder, *Tracking Coronavirus Vaccinations Around the World*, N.Y. TIMES, <https://www.nytimes.com/interactive/2021/world/covid-vaccinations-tracker.html> (last visited Oct. 29, 2021); see also António Guterres, U.N. Sec'y-Gen., Remarks to the Nordic Council (Oct. 27, 2020), <https://www.un.org/sg/en/content/sg/speeches/2020-10-27/remarks-the-nordic-council> (stating that "the world is way off track" in its efforts to combat climate change and develop the world's economies in a sustainable manner, on account of the COVID-19 pandemic).

229. See *Schroders Climate Progress Dashboard: Despite COP26 Delay Biden Election Win May Reenergise Global Climate Change Action*, SCHRODERS (Feb. 12, 2020), https://www.schroders.com/en/media-relations/newsroom/all_news_releases/schroders-climate-progress-dashboard-despite-cop26-delay-biden-election-win-may-reenergise-global-climate-change-action/ (stating that President Biden's election and the U.S. rejoining the Paris Agreement could reenergize Paris Agreement parties' commitments); Justin Rowlett, *Why 2021 Could Be Turning Point for Tackling Climate Change*, BBC (Jan. 1, 2021), <https://www.bbc.com/news/science-environment-55498657> (stating that, by the end of 2021, the COVID-19 vaccines should kick in and the world can turn its attention to solving the climate change crisis).

230. Press Release, UNFCCC, COP26 Postponed (Apr. 1, 2020), <https://unfccc.int/news/cop26-postponed> [hereinafter COP26 Postponed];

should encourage the parties to negotiate much more aggressive second NDCs.²³¹ Still, if global warming was a crisis in 2015, it is an impending catastrophe today.

Bold, innovative approaches must be employed by the Paris Agreement parties to assist them to reduce their greenhouse gas emissions. The remainder of this paper proposes one such approach.

VI. PROPOSED AMENDMENTS TO THE IRC

This short section describes the specific amendments to Section 170²³² of the IRC that I propose the U.S. Congress adopt. As indicated above, I recommend that Section 170 of the IRC be amended to permit an owner of fossil fuels to take a credit on the owner's federal tax return for the entire value of his or her current fossil fuel operation, in the event that the owner grants a conservation easement prohibiting any further extraction, refinement, sale or distribution of those fuels.²³³ At present, the IRC does not even permit an owner of fossil fuels to take a deduction on the owner's federal tax return for the value of his or her fossil fuel operation, should the owner grant such a conservation easement.²³⁴ I am proposing that a fossil fuel owner

Glasgow Climate Change Conference – October-November 2021, UNFCCC, <https://unfccc.int/conference/glasgow-climate-change-conference-october-november-2021> (last visited Oct. 29, 2021).

231. See COP26 Postponed, *supra* note 230; John F. Kerry, *U.S. Special Presidential Envoy for Climate, Transcript of Remarks to UNA-USA's Global Engagement Summit, Marking the United States Rejoining the Paris Agreement - With Q&A* (Feb. 19, 2021), <https://www.un.org/sg/en/content/sg/statement/2021-02-19/transcript-of-remarks-una-usa%E2%80%99s-global-engagement-summit-marking-the-united-states-rejoining-the-paris-agreement-qa> (stating that, at the COP26 in Glasgow in November 2021, “all nations must raise our sights, must raise ambition together”).

232. See generally 26 U.S.C. § 170.

233. See *supra* text accompanying notes 82–87.

234. 26 U.S.C. § 170(h)(4)(A)(i)–(iv). Earth scientists at Stanford University and environmental law professors at the University of Buffalo and University of California at Los Angeles have advocated for fossil fuel owners to grant conservation easements prohibiting fracking (otherwise known as hydraulic fracturing) and other subsurface activities on their land and they have dubbed such conservation easements “mineral estate conservation easements” (MECEs). Robert B. Jackson et al., *Mineral Estate Conservation Easements: A New Policy Instrument to Address Hydraulic Fracturing and Resource Extraction*, 47 ENV'T L. REP. 10112, 10113–15 (2017). They furthermore have proposed that the IRC (and state income tax laws, if necessary) be amended to recognize a MECE as a conservation easement. *Id.* at 10119–20; see also Devon Ryan, *New Analysis Suggests Ways for Landowners to Limit Fracking and Mineral Extraction Without Regulations*, STANFORD U. NEWS (Feb. 1, 201

who grants such a conservation easement be entitled to take a credit, rather than a deduction,²³⁵ because the economic analysis below demonstrates that paying fossil fuel owners for the full value of their operations is economically efficient,²³⁶ most fossil fuel owners probably would not grant such a conservation easement simply for a deduction of the value of their operation on their federal tax return, and society desperately needs these owners to close their operations.

As Subsection “a” of Section 170 of the IRC is entitled “Allowance of Deduction,” it most likely would be easiest for the U.S. Congress to amend Section 170 as advocated here by adding a new subsection “r” to Section 170 of the IRC entitled “Allowance of Credit.” As in the case of a conservation easement generally, the value of any fossil fuel owner’s operation should be valued at the time that the deed of easement is recorded and all relevant information should be considered in the determination of that value.²³⁷ Although such conservation easements would be voluntary, it would behoove any fossil fuel owner to grant such an easement sooner rather than later, as the value of any owner’s operation can be expected to decline in the future.²³⁸ As the value of some such operations could be very high, the U.S. Congress could provide that the credit is limited

7), <https://news.stanford.edu/2017/02/01/Stanford-analysis-suggests-ways-land-owners-limit-fracking-mineral-extraction-without-regulations/> (discussing MECEs and the approach advocated by Professors Jackson, Owley, and Salzman).

235. Several states already permit a taxpayer to take a credit, rather than a deduction, on the taxpayer’s state income tax return for the value of an approved conservation easement, although many such states impose an upper limit on the credit that can be claimed. See Land Trust Alliance, *State Tax Credits for Donation of a Conservation Easement*, LAND CONSERVATION ASSISTANCE NETWORK, <https://www.landcan.org/article/state-tax-credits-for-donation-of-a-conservation-easement/1616> (last visited Oct. 29, 2021) (discussing various state tax code provisions that permit a taxpayer to take a credit for donation of a conservation easement).

236. See *infra* text accompanying notes 350–406.

237. See *supra* text accompanying notes 66–71.

238. Value may be adversely impacted and thus expected to decline due to the organized movement to divest in fossil fuels. See, e.g., *Fossil Fuel Divestment: A \$5 Trillion Challenge*, BLOOMBERGNEF (BNEF) (Aug. 26, 2014), <https://about.bnef.com/blog/fossil-fuel-divestment-5-trillion-challenge/>; Joe Ryan, *Fossil Fuel Industry Risks Losing \$33 Trillion to Climate Change*, BLOOMBERG (July 11, 2016), <https://www.bloomberg.com/news/articles/2016-07-11/fossil-fuel-industry-risks-losing-33-trillion-to-climate-change>; Akshat Rathi, *Bill Gates Shows How Hard It Can Be to Divest From Fossil Fuel*, BLOOMBERG (Feb. 15, 2021), <https://www.bloombergquint.com/wealth/bill-gates-in-new-climate-book-talks-about-finally-divesting-from-oil>.

to a stated amount on the owner's tax return for any particular year but could be carried over on future tax returns for a stated number of years until the full credit has been claimed. Section 170 of the IRC already establishes such yearly limits for conservation easement deductions and provides in general for the value of a conservation easement to be carried over on future tax returns for up to fifteen years.²³⁹

The U.S. Congress in this new subsection of Section 170 of the IRC should provide that any such credit is conditioned on the taxpayer's agreement that any further federal or state subsidies promoting the use of the taxpayer's fossil fuels will cease. To be sure, a fossil fuel owner's use of state or federal subsidies to exploit the owner's fuels would violate the terms of such a conservation easement in any case. However, to avoid confusion on this point, it would be best to explicitly state that a fossil fuel owner that grants such a conservation easement and claims the credit proposed here forfeits the right to receive any further state or federal subsidies intended to promote the exploitation of the taxpayer's fossil fuels.

Furthermore, the amendment to Section 170 of the IRC should include a rigorous program of monitoring and enforcement by the Internal Revenue Service (IRS) together with the owners of such conservation easements (the land trust or government agency receiving the easement in each case). The new conservation easements proposed in this article cannot assist in the critically important goal of slowing global warming if the easements are not enforced. To date, violations of a conservation easement by the landowner that granted the easement have been rare, but they do occur.²⁴⁰ In addition, a conservation easement owner (again, the land trust or government agency entrusted to enforce the easement) occasionally has knowingly permitted the conservation easement to be violated.²⁴¹ Given the fossil fuel industry's

239. See *supra* text accompanying notes 73–81.

240. See, e.g., Ann Harris Smith, *Conservation Easement Violated: What Next? A Discussion of Remedies*, 20 FORDHAM ENV'T L. REV. 597, 598 (2017) (citing J. Breting Engel, *The Development, Status, and Viability of the Conservation Easement as a Private Land Conservation Tool in the Western United States*, 39 URB. L. 19, 35 (2007)).

241. E.g., Randy Schultz, *Water District Gets Tough on All the Wrong People*, S. FLA. SUN SENTINEL (Dec. 13, 2016), <https://www.sun-sentinel.com/opinion/fl-rsscol-water-district-20161213-story.html> (explaining that although sale of acreage in Palm Beach Agricultural Preserve to GL Homes initially would be subject to a conservation easement restricting it to agricultural use, a majority

tremendous political power today,²⁴² it is not difficult to imagine a situation in which a fossil fuel owner grants a conservation easement agreeing not to extract, refine, sell, or distribute the owner's fossil fuels, receives a full credit for the value of the owner's fossil fuel operation on the owner's federal tax return, and then somehow continues to exploit those fossil fuels.

If a violation of such a conservation easement is established, the IRS, of course, could obtain back taxes²⁴³ and possibly penalties²⁴⁴ from the fossil fuel owner/taxpayer. In addition, judges in at least some state courts possess the power to issue injunctive relief and award damages for breach of a conservation easement.²⁴⁵ The final recommended amendment to Section 170 of the IRC is that it include a requirement that a fossil fuel owner must agree, in the easement agreement, that a proper remedy for the owner's violation of the easement would be to transfer ownership of the owner's fossil fuels to the easement owner or another appropriate entity if that easement owner no longer exists, was complicit in the easement violation, or does not possess the capacity to ensure that the fossil fuels will not be extracted, refined, sold, or distributed in the future. As indicated, the fossil fuels should be subject to the same restrictions in the hands of the transferee.²⁴⁶ In light of society's desperate need for such conservation easements and taxpayers' very generous payment to fossil fuel owners of the full value of their operations pursuant to the amended IRC Section 170 discussed here, the remedies for violations of such easements need to be severe enough to ensure that the great majority of

vote of the seven-member Palm Beach County Commission could grant a land-use change that would permit GL Homes to build homes on the land); see Wells Dusenbury, *Timeline: As Thousands of New Homes Rise, Farmland Vanishes in Palm Beach Country*, S. FLA. SUN SENTINEL (June 1, 2021), <https://www.sun-sentinel.com/local/palm-beach/fl-ne-pbc-ag-reservedevelopment-2021-0601-4k5ydquvczeerdetpkrqtqko3e-story.html> (discussing sales by Palm Beach County and the Lake Worth Drainage District of numerous acres to GL Homes for construction of thousands of homes on land that had been given the above-mentioned land-use change).

242. See *infra* text accompanying note 287.

243. *Conservation Easement Audit Techniques Guide*, *supra* note 67.

244. *Id.*

245. Smith, *supra* note 240, at 605–07.

246. Related state legislation may need to be enacted to ensure that civil judges possess the power to transfer title of the fossil fuels in question to the easement owner or other appropriate entity as a remedy for a fossil fuel owner's violation of the easement terms and provide for third-party enforcement of such a conservation easement when the easement owner is not enforcing the easement. Such legislation, however, is beyond the scope of this article.

fossil fuel owners granting such easements will comply with the terms of their easements.

The next section demonstrates that it would be economically efficient for the U.S. to pay fossil fuel owners the full value of their operations in exchange for their agreement to cease extracting, refining, selling, and distributing their fuels.

VII. ECONOMIC ANALYSIS

A. IT APPEARS THAT THE MOST ECONOMICALLY EFFICIENT METHOD OF SLOWING GLOBAL WARMING IS TO LEAVE FOSSIL FUELS IN THE GROUND.

As stated above, Garrett Hardin, the author of *The Tragedy of the Commons*, concluded that, in order to save a commonly-owned natural resource such as the world's atmosphere, a government must either embrace "mutual coercion, mutually agreed upon" or employ "private property, or something formally like it."²⁴⁷ If a government could impose "mutual coercion, mutually agreed upon," it should order that fossil fuels stay in the ground, as that can be the most economically efficient method of slowing climate change.²⁴⁸ This conclusion is based, at least in part, on the common-sense notion that "prevention is better than the cure." In other words, if a society pays to keep fossil fuels in the ground and therefore no carbon dioxide is emitted in the first place, it does not need to pay the much higher costs of remedying local air pollution and slowing global warming that are imposed by the burning of fossil fuels. The adage "prevention is better than the cure" is generally attributable to the Dutch philosopher Desiderius Erasmus in approximately 1500²⁴⁹ and is applicable in many contexts.²⁵⁰ For

247. Hardin, *supra* note 101, at 1245, 1247.

248. Bård Harstad, *Buy Coal! A Case for Supply-Side Environmental Policy*, 120 J. POL'Y ECON. 77, 79, 106 (2012) [hereinafter Harstad 2012]; *see also* Bård Harstad, *Pay Countries to Keep Their Fossil Fuels in the Ground*, FIN. TIMES (July 4, 2013), <https://www.ft.com/content/f9496782-e491-11e2-875b-00144feabdc0> [hereinafter Harstad, Financial Times] (summarizing the main points of the above paper).

249. *See Prevention Is Better Than Cure*, ROYAL COLL. NURSING, <https://www.rcn.org.uk/get-involved/campaign-with-us/prevention-is-better-than-cure> (last visited Oct. 21, 2021).

250. *See, e.g.,* Leszek Borysiewicz, *Prevention Is Better Than Cure*, 9 CLINICAL MED. 572 (2009) (preventing acquisition of an illness through vaccination); Amer Ridzuan, *Prevention is Better Than Cure (MUET ESSAY)*, AMERZING (Aug. 4, 2017), <https://ameridzuan.blogspot.com/2017/08/prevention-is-better-than-cure-muet.html> (healthy living to prevent illness, safe driving to

example, one of the main rationales for implementation of a national health care system is that generally it is much less expensive to ensure that an individual does not contract a particular illness in the first place than it is to treat that person in the emergency room of a hospital or cure the person of that illness.²⁵¹

However, today neither the Paris Agreement coalition of parties nor the U.S. as an individual country is able to impose “mutual coercion, mutually agreed upon” to slow global warming.²⁵² In the U.S., states and local governments possess the primary authority to regulate land use,²⁵³ and there are states (e.g., California) that have implemented various innovative and aggressive measures to reduce greenhouse gas emissions²⁵⁴ and conceivably could ban the exploration and extraction of fossil fuels within their territories. Unfortunately, other states that possess large stores of fossil fuels appear to have very little interest in reducing their production of fossil fuels and would be very unlikely to prohibit the exploration and extraction of fossil fuels in their territories within the next several years.²⁵⁵ The U.S. Congress, pursuant to the Commerce Clause of the U.S. Constitution,²⁵⁶ and primarily through the Environmental Protection Agency which Congress endorsed,²⁵⁷ can and does regulate carbon dioxide emissions throughout the

prevent automobile accidents, and financial planning and vigilance to avoid financial fraud and bankruptcy).

251. See Kimberly Amadeo, *How Preventive Care Lowers Health Care Costs: National Health Care Plans Must Cover Preventive Care*, BALANCE (Jan. 28, 2021), <https://www.thebalance.com/preventive-care-how-it-lowers-aca-costs-3306074>.

252. See Melissa Denchak, *Paris Climate Agreement: Everything You Need to Know*, NRDC (Feb. 19, 2021), <https://www.nrdc.org/stories/paris-climate-agreement-everything-you-need-know> (pointing out that emissions reductions targets and financial contributions goals have no enforcement mechanisms to compel countries to comply with the targets).

253. *Lake Cty. Estates v. Tahoe Reg'l Planning Agency*, 440 U.S. 391, 402 (1979).

254. See, e.g., *Climate Change*, CAL. AIR RES. BD., <https://ww2.arb.ca.gov/our-work/topics/climate-change> (last visited Oct. 29, 2021) (detailing the work of the California Air Resources Board in response to climate change).

255. See *Major Fossil Fuel-Producing States Rely Heavily on Severance Taxes*, U.S. ENERGY INFO. ADMIN. (Aug. 21, 2015), <https://www.eia.gov/todayinenergy/detail.php?id=22612> (showing that states producing fossil fuels rely disproportionately on severance taxes on extracted resources, meaning the states financially benefit from increased extraction).

256. U.S. CONST. art. I, § 8, cl. 3.

257. *The Origins of EPA*, ENV'T PROT. AGENCY, <https://www.epa.gov/history/origins-epa> (last visited Oct. 29, 2021).

U.S.²⁵⁸ Still, given the fifty-fifty split between Democrats and Republicans in the U.S. Senate today, there is very little chance that the current U.S. Congress would be able to ban the extraction, refinement, sale, and distribution of fossil fuels throughout the U.S.²⁵⁹

Furthermore, just like U.S. states that possess large reserves of fossil fuels tend to promote rather than restrict production of their fossil fuels, none of the Paris Agreement parties that possess large fossil fuel reserves (e.g., Saudi Arabia, India, Venezuela, the Russian Federation, Indonesia, Australia, and Nigeria) made a significant commitment to restrict its supply of fossil fuels in its initial NDC.²⁶⁰ For example, India is the only nation in the top ten fossil fuel producers that mentioned restraining the supply of fossil fuels at all²⁶¹ (and that restraint consists solely of a coal tax).²⁶² Also, there simply is no international legislature that could prohibit the extraction, refinement, sale, and distribution of fossil fuels around the world.²⁶³ In addition, China and the Russian Federation almost

258. *Am. Elec. Power Co. v. Connecticut*, 564 U.S. 410, 416 (2011) (“[T]his Court held that the Clean Air Act authorizes federal regulation of emissions of carbon dioxide and other greenhouse gases.” (internal citation omitted) (citing *Massachusetts v. EPA*, 549 U.S. 497, 528–30 (2007))); *Hodel v. Virginia Surface Mining & Reclamation Ass’n*, 452 U.S. 264, 282 (1981) (holding that “the power conferred by the Commerce Clause [is] broad enough to permit congressional regulation of activities causing air or water pollution, or other environmental hazards that may have effects in more than one State.”). *See generally* Robinson Meyer, *How the U.S. Protects the Environment, From Nixon to Trump*, ATLANTIC (Mar. 29, 2017), <https://www.theatlantic.com/science/archive/2017/03/how-the-epa-and-us-environmental-law-works-a-civics-guide-pruitt-trump/521001/> (“Every major post-1970 environment law relies on this Constitutional power—the Commerce Clause in Article I, Section 8—to restrict air and water pollution and protect endangered species.”).

259. *See* Coral Davenport, *This Powerful Democrat Linked to Fossil Fuels Will Craft the U.S. Climate Plan*, N.Y. TIMES (Sept. 19, 2021), <https://www.nytimes.com/2021/09/19/climate/manchin-climate-biden.html> (discussing how Senator Joe Manchin, a West Virginia Democrat with deep ties to coal and natural gas interests, will be the key swing vote on climate legislation and thus sweeping reductions in extraction are extremely unlikely with the current composition of the Senate).

260. *See, e.g.*, Georgia Piggot et al., *Addressing Fossil Fuel Production Under the UNFCCC: Paris and Beyond* 10–11 (Stockholm Env’t Inst., Working Paper No. 2017-09, 2017).

261. *Id.* at 11–12, Tbl. 1.

262. *Id.* at 11.

263. *See* N.N. Singh, *The Absence of a Sovereign Legislature and Its Consequences for International Law*, 12 MALAYA L. REV. 277, 277 (1970); Stephen M. Schwebel, *The Effect of Resolutions of the U.N. General Assembly*

certainly would veto any U.N. Security Council action interfering in the affairs of individual nations to slow global warming, including a worldwide ban on the extraction, refinement, sale, and distribution of fossil fuels, unless numerous imminent deaths were threatened in both China and the Russian Federation.²⁶⁴

Accordingly, per Hardin's conclusion, both the Paris Agreement coalition and the U.S. must employ "private property" concepts, or, in other words, private market mechanisms, to slow global warming.²⁶⁵ In this context, "[m]arket-based environmental policies work by creating an incentive to reduce or eliminate emissions,"²⁶⁶ primarily by affecting the demand or supply (and therefore the price) of a particular fossil fuel or alternative energy source.²⁶⁷ Figure 1 below demonstrates how price and demand for gasoline are inversely related.²⁶⁸ In other words, it shows that, "as [the] price of [gasoline] rises, quantity demanded decreases, and vice versa. These points are then graphed, and the line connecting them is the demand curve (D)."²⁶⁹ The provision of subsidies for the production or use of alternative energy forms, the imposition of a carbon tax, the implementation of a cap-and-trade program (which serves the same function as a carbon tax), and conservation easements preserving carbon sinks and prohibiting

on *Customary International Law*, 73 PROC. ANN. MEETING (AM. SOC'Y INT'L L.) 301, 301 (1979).

264. See Ed King, *China and Russia Block UN Security Council Climate Change Action*, CLIMATE HOME NEWS (Feb. 18, 2013), <https://www.climatechangenews.com/2013/02/18/china-and-russia-block-un-security-council-climate-change-action/> (showing that China and Russia have used their seats on the UN Security Council to block climate action in the past and will likely do so again).

265. See Hardin, *supra* note 101, at 1245, 1247.

266. Janet Peace & Jason Ye, *Market Mechanisms: Options for Climate Policy*, CTR. FOR CLIMATE ENERGY SOLS., at 1, 2 (Apr. 2020).

267. See JONATHAN L. RAMSEUR & LARRY PARKER, CONG. RESEARCH SERV., R40242, CARBON TAX AND GREENHOUSE GAS CONTROL: OPTIONS AND CONSIDERATIONS FOR CONGRESS 44 (2009) (stating that both a carbon tax and a cap-and-trade program are intended "to increase the price of fossil fuels"); U.N. Env't Programme, *Reforming Energy Subsidies: Opportunities to Contribute to the Climate Change Agenda* (2008), <https://wedocs.unep.org/bitstream/handle/20.500.11822/7754/-Reforming%20Energy%20Subsidies-2002150.pdf?sequence=3&isAllowed=y>.

268. See *Reading: Demand, Supply, and Equilibrium in Markets for Goods and Services*, LUMEN LEARNING, <https://courses.lumenlearning.com/baycollege-introbusiness/chapter/reading-demand-supply-and-equilibrium-in-markets-for-goods-and-services/> (last visited Oct. 29, 2021).

269. *Id.*

the extraction of fossil fuels are all examples of such private market measures.²⁷⁰

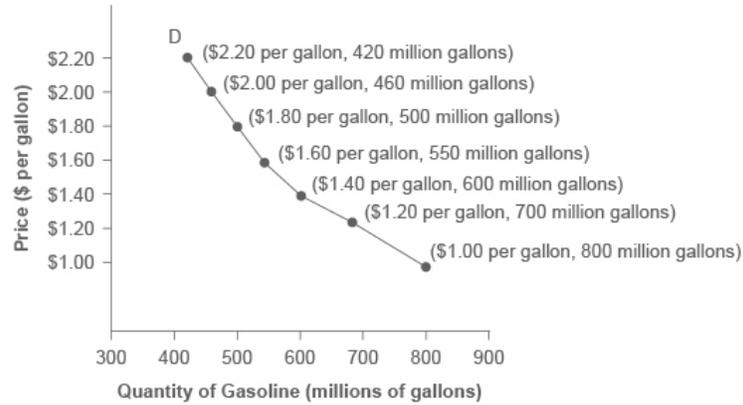


FIGURE 1: RELATIONSHIP BETWEEN THE DEMAND AND PRICE OF OIL²⁷¹

However, in any coalition of governments where some have committed to reducing CO₂ emissions and some have not, if an individual government reduces its consumption of fossil fuels (i.e., pursues demand-side policies), the coalition price of fossil fuels will decline and those members of the coalition that have not committed to reduce CO₂ emissions will simply consume more fossil fuels.²⁷² In economics terminology, this is known as

270. See, e.g., RAMSEUR & PARKER, *supra* note 267, at 2 (comparing the market mechanisms of a carbon tax and a cap-and-trade program); NAT'L ACAD. OF ENG'G ET AL., *THE POWER OF RENEWABLES: OPPORTUNITIES AND CHALLENGES FOR CHINA AND THE UNITED STATES* 8 (2010) ("The most prominent national policy approach for renewable energy in both China and the United States has been price support, both direct and indirect. U.S. subsidies have been primarily in the form of tax breaks for producers and consumers, and have been effective in driving specific market and technology development.").

271. *Reading: Demand, Supply, and Equilibrium in Markets for Goods and Services*, LUMEN LEARNING, <https://courses.lumenlearning.com/baycollege-introbusiness/chapter/reading-demand-supply-and-equilibrium-in-markets-for-goods-and-services/> (last visited Oct. 29, 2021).

272. Harstad 2012, *supra* note 248, at 78.

“carbon leakage,”²⁷³ and Figure 2 below demonstrates this phenomenon.²⁷⁴

Alternatively, if an individual government in such a coalition reduces its supply of fossil fuels (i.e., pursues supply-side policies), the coalition price will increase and fossil fuel producers that have not committed to reduce CO₂ emissions will simply produce more fossil fuels.²⁷⁵ This is known as “supply-side leakage,”²⁷⁶ and Figure 3 below demonstrates this phenomenon.²⁷⁷

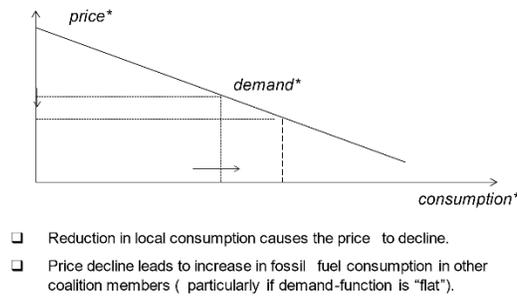


FIGURE 2: DEMAND-SIDE LEAKAGE²⁷⁸

273. *Id.* (citing the IPCC’s definition of carbon leakage as “the increase in CO₂ emissions outside the countries taking domestic mitigation action divided by the reduction in the emissions of these countries”).

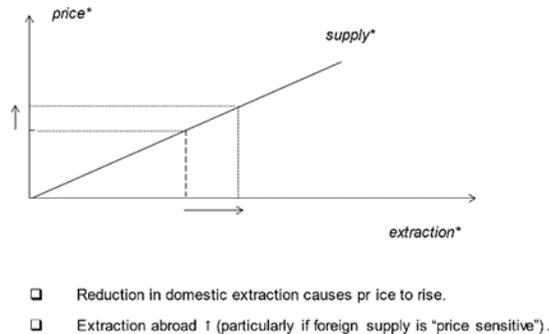
274. See Bård Harstad, *Buy Coal! A Case for Supply-Side Environment Policies*, at 7, <https://www.eaere.org/wp-content/uploads/2018/12/PRESENTATION-Erik-Kempe-Award-2013.pdf> [hereinafter Harstad Presentation] (last visited Oct. 29, 2021) (slide deck presentation by Harstad).

275. Harstad 2012, *supra* note 248, at 78–79.

276. *See id.*

277. Harstad Presentation, *supra* note 274, at 8.

278. *Id.* at 7 (figure has a few adjustments approved by Harstad).

FIGURE 3: SUPPLY-SIDE LEAKAGE²⁷⁹

Therefore, both the Paris Agreement coalition and the U.S. should, at a minimum, pursue both demand-side policies and supply-side policies to balance demand-side leakage and supply-side leakage.²⁸⁰ Furthermore, they should do whatever they can to keep fossil fuels in the ground, as doing so can be the most economically efficient strategy for slowing global warming.²⁸¹

Unfortunately, most climate change agreements among nations, including the Paris Agreement, and most individual governments promote demand-side climate policies.²⁸² In other words, they generally encourage imposing limits on greenhouse gas emissions (e.g., through a carbon tax or a cap-and-trade program) rather than imposing limits on greenhouse gas production.²⁸³ As saturation of the atmosphere with CO₂ is the ultimate cause of global warming, national policymakers logically may conclude that fossil fuel consumption is the

279. *Id.* at 8.

280. See G.B. Asheim et al., *The Case for a Supply-Side Climate Treaty: The Paris Agreement can be Strengthened by a Treaty Limiting Global Fossil Fuel Supply*, 365 *SCIENCE* 325, 325 (2019).

281. See Harstad 2012, *supra* note 248, at 77, 79, 106.

282. See Michael Lazarus et al., *Supply-Side Climate Policy: The Road Less Taken* 3, 7 (Stockholm Env't Inst., Working Paper No. 2015-13, 2015), <https://mediamanager.sei.org/documents/Publications/Climate/SEI-WP-2015-13-Supply-side-climate-policy.pdf> (discussing the prevalence of demand-side climate policies and the opportunities to implement supply-side policies to complement or substitute the current policies in place).

283. See Harstad 2012, *supra* note 248, at 77–79 (discussing the prevalence of demand-side climate policies and the issues that arise from them).

“problem” that needs to be attacked.²⁸⁴ In addition, lawmakers may find it much more difficult to adopt supply-side policies and directly attack a few fossil fuel producers than to adopt demand-side policies and ask the much larger group of consumers to reduce their consumption of fossil fuels.²⁸⁵ This is especially the case, given that many governments rely on fossil fuel profits as an important component of their own coffers²⁸⁶ and fossil fuel producers tend to be very powerful politically.²⁸⁷ This does not bode well for the battle against global warming.²⁸⁸

Again, the Paris Agreement is a tremendous success in that it includes almost the entire community of nations in one, all-encompassing climate change agreement.²⁸⁹ Also, as mentioned above, the Paris Agreement arguably is an example of Coase’s

284. See Lazarus et al., *supra* note 282, at 3 (stating that the “combustion of fossil fuels is by far the largest human source of global greenhouse gas emissions” and laying out some of the ways that policymakers are attempting to lessen the amount of fossil fuel consumption).

285. *Id.* at 4, 7 (stating that supply-side climate policies are less common for three general reasons: “1) the greater political attractiveness of demand as compared with supply measures; 2) standard GHG accounting rules that undervalue supply-side relative to demand-side measures; and 3) common perceptions of the nature of fuel markets,” and discussing how supply-side policies “target a narrower set of actors”).

286. See, e.g., ADELE C. MORRIS, *THE CHALLENGE OF STATE RELIANCE ON REVENUE FROM FOSSIL FUEL PRODUCTION 2* (2016), <https://www.brookings.edu/wp-content/uploads/2016/08/state-fiscal-implications-of-fossil-fuel-production-0809216-morris.pdf> (analyzing U.S. states’ reliance on fossil fuels to generate state revenue); James Landale, *What Will the End of Oil Dependence Mean for Geopolitics?*, BBC (Jan. 3, 2020), <https://www.bbc.com/news/world-50974609> (“Russia is one of the biggest exporters of oil and gas in the world. Its economy and its government depend hugely on the revenues this brings in. Little wonder that President Putin describes the development of ‘green technologies’ as . . . one of the ‘main challenges and threats’ to Russia’s economic security.” (emphasis omitted)); James Cust et al., *Unburnable Wealth of Nations: Successful Action to Address Climate Change Would Diminish the Value of Fossil Fuel Resources in Many of the World’s Poorest Countries*, 54 *FIN. & DEV.* 46 (2017) (explaining how it is difficult for many developing countries to embrace climate change treaties because their governments are highly dependent on fossil fuel sales and tax revenues).

287. Lazarus et al., *supra* note 282, at 4 (“[D]irectly addressing fossil fuel production, by taxing or reducing such activities, could be expected to engender strong opposition from powerful coal, oil and gas interests.”); Samantha Gross, *Why Are Fossil Fuels so Hard to Quit*, BROOKINGS INST. (June 2020), <https://www.brookings.edu/essay/why-are-fossil-fuels-so-hard-to-quit/> (stating that “fossil fuel companies are politically powerful” and discussing the challenges of moving away from reliance on fossil fuels).

288. See Harstad 2012, *supra* note 248, at 77, 106.

289. *The Paris Agreement*, *supra* note 210.

economic theory in action.²⁹⁰ That is, once the international community agreed that: (1) everyone deserves to live in a world where the average global temperature is limited to a 2° Celsius increase, and preferably a 1.5° Celsius increase, (2) the developed countries owe the developing countries damages for past greenhouse gas emissions, and (3) the developing countries would utilize their “damage awards” to reduce their own greenhouse emissions and adjust to the effects of climate change, the Paris Agreement parties could proceed to commit to attempting to achieve that temperature goal and each party could commit to an initial NDC.²⁹¹ Still, it is very clear in 2022 that the Paris Agreement is not working to slow global warming.²⁹² As stated above, to reach the more modest goal of preventing the increase in the average global temperature from rising above 2°C, the Paris Agreement parties’ initial NDCs would need to be tripled, and most of the parties are not even reaching their very modest initial NDCs.²⁹³

In 2012, prior to the international community’s negotiation of the Paris Agreement in 2015, Bård Harstad, a Norwegian economist who teaches at the University of Oslo, published a research article which analyzed the possibility that a climate coalition could adopt supply-side policies²⁹⁴ and specifically “buy . . . [fossil fuel] deposits and conserve them.”²⁹⁵ Naturally, Harstad pointed out, the coalition should purchase deposits based on their price, starting with the least expensive deposits, or those that are marginally profitable to exploit.²⁹⁶ Importantly, it is exactly these marginally profitable deposits that will be exploited if and only if the fossil fuel price is high, that will generate the supply-side leakage discussed above.²⁹⁷ When these deposits are locked, the hazard of “supply-side leakage” is reduced, and the coalition can then safely restrict its own

290. Pindyck, *supra* note 108, at 345.

291. *See id.* at 345–46.

292. *See* 2020 Tied for Warmest Year on Record, *supra* note 52 (noting how 2020 “was 1.84 degrees Fahrenheit (1.02 degrees Celsius) warmer than the baseline[,] . . . making [2020 and 2016] effectively tied for the warmest year on record”).

293. *See supra* text accompanying notes 218–20.

294. Harstad 2012, *supra* note 248, at 77–78; *see also* Harstad, *Financial Times*, *supra* note 248.

295. Harstad 2012, *supra* note 248, at 77.

296. *Id.* at 85.

297. *Id.* at 79–80.

production of fossil fuels without engendering supply-side leakage.²⁹⁸

In addition to eliminating supply-side leakage, he noted that such purchases of fossil fuel deposits have two additional advantages.²⁹⁹ First, he explained, in such a situation, coalition members could exclusively implement supply-side measures and avoid implementing demand-side policies that would (in contrast to the supply-side policies) lead to leakage.³⁰⁰ Second, he noted, eliminating supply-side leakage would cause the price of fossil fuels to rise to a high level, which in turn would make needed investments in green technologies (including both alternative energy technologies and carbon capture technologies) much more attractive.³⁰¹ In sum, Harstad concluded, the coalition's purchase and preservation of fossil fuel deposits can be the most economically efficient method of slowing global warming.³⁰² Below, Figure 4 demonstrates the market for the purchase of fossil fuel deposits around the world,³⁰³ and Figure 5 demonstrates secondary effects of the coalition purchasing fossil fuel deposits.³⁰⁴

298. *Id.*

299. *Id.* at 79, 93, 106; Harstad, Financial Times, *supra* note 248.

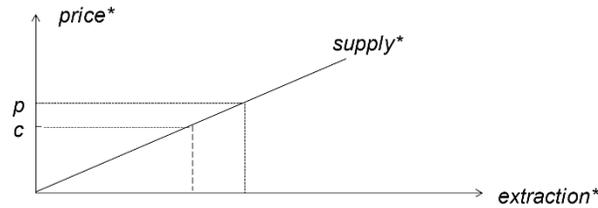
300. Harstad 2012, *supra* note 248, at 79, 93, 106.

301. Harstad, Financial Times, *supra* note 248; *see also* Harstad 2012, *supra* note 248, at 79 (explaining that when the implementation of supply-side policies equalizes consumption prices across countries, investments in technology will become more efficient).

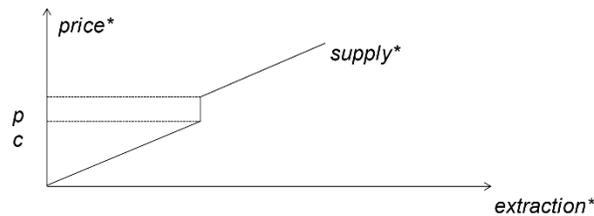
302. Harstad 2012, *supra* note 248, at 77; Harstad, Financial Times, *supra* note 248.

303. Harstad Presentation, *supra* note 274, at 11.

304. *Id.* at 12.



- Profit is $p - c$.
- Gains from buying if $Damage > p - c$.

FIGURE 4: MARKET FOR EXTRACTION RIGHTS³⁰⁵

- Foreign supply becomes less sensitive to the price.
- This reduces carbon leakage on the supply side.
- => optimal to reduce extraction, not consumption.
- Price will be equal at home and abroad.
- This price is high, so all invest more in R&D.
- The "socially optimal" solution is implemented.

FIGURE 5: SECONDARY EFFECTS³⁰⁶

In this same paper, Harstad explained that a similar “leakage” problem occurred regarding the deforestation of tropical forests around the world.³⁰⁷ That is, to preserve carbon sinks, one could boycott timber logged in tropical forests, but that would just cause the timber price to fall and those not

305. *Id.* at 11.

306. *Id.* at 12 (figure has a few adjustments approved by Harstad).

307. Harstad 2012, *supra* note 248, at 83.

participating in the boycott would be able to purchase more timber from those forests.³⁰⁸ Therefore, the international community has learned that, to forestall destruction of those forests, “it is more effective to acquire the land or pay certain countries directly for reducing deforestation.”³⁰⁹ The Reducing Emissions from Deforestation and Forest Degradation (REDD) program is dedicated to obtaining and distributing funds for this specific purpose today.³¹⁰

Harstad received the very prestigious biannual “Erik Kempe prize” for the best paper in the field of environmental and resource economics for his 2012 paper.³¹¹ Naturally, his 2012 paper built on the work of other economists, including Peter Bohm.³¹² In recent years, more and more economists have demonstrated the economic advantages of supply-side climate policies that keep fossil fuels in the ground.³¹³ In addition, some

308. *Id.*

309. Harstad, *Financial Times*, *supra* note 248.

310. Harstad 2012, *supra* note 248, at 83–84, 106–07.

311. *Erik Kempe Award 2013: Bård Harstad*, EUR. ASS’N OF ENV’T & RES. ECONOMISTS, <https://www.eaere.org/erik-kempe-award/erik-kempe-award-2013-bard-harstad/> (last visited Oct. 29, 2021). Harstad, along with Torben K. Mideksa, was awarded the Erik Kempe prize again in 2019, for their paper “Conservation Contracts and Political Regimes.” *Erik Kempe Award 2019: Bård Harstad and Torben Mideksa*, EUR. ASS’N OF ENV’T & RES. ECONOMISTS, <https://www.eaere.org/erik-kempe-award/erik-kempe-award-2019-bard-harstad-and-torben-mideksa/> (last visited Oct. 29, 2021). To read their 2019 paper, see Bård Harstad & Torben K. Mideksa, *Conservation Contracts and Political Regimes*, 84 REV. ECON. STUD. 1708 (2017). Harstad is the only economist who has received the Erik Kempe prize twice. See *The Erik Kempe Award in Environmental and Resource Economics*, EUR. ASS’N OF ENV’T & RES. ECONOMISTS, <https://www.eaere.org/erik-kempe-award/> (last visited Oct. 29, 2021).

312. See Peter Bohm, *Incomplete International Cooperation to Reduce CO₂ Emissions: Alternative Policies*, 24 J. ENV’T ECON. & MGMT. 258 (1993) (discussing “a policy where the price reductions from reduced fuel demand are neutralized by fuel-deposit purchases or leases by signatory countries or an international organization acting on their behalf”).

313. See, e.g., Lazarus et al., *supra* note 282, at 7–10 (discussing the multiple advantages of supply-side policies that economists have examined); Kim Collins & Roman Mendeleevitch, *Leaving Coal Unburned: Options for Demand-Side and Supply-Side Policies*, 87 DIW ROUNDUP: POLITIK IM FOKUS 1 (2015) (comparing demand-side and supply-side policies for reducing emissions from coal consumption); see also Hans-Werner Sinn, *Public Policies Against Global Warming: A Supply Side Approach*, 15 INT. TAX & PUB. FIN. 360 (2008) (discussing potential policy options regarding global warming from a supply-side perspective); HANS-WERNER SINN, *THE GREEN PARADOX: A SUPPLY-SIDE APPROACH TO GLOBAL WARMING* (2012); Fergus Green & Richard Denniss, *Cutting With Both Arms of the Scissors: The Economic and Political Case for Restrictive Supply-Side Climate Policies*, 150 CLIMATIC CHANGE 73 (2018)

have demonstrated the political advantages of supply-side climate policies.³¹⁴ Many environmentalists have long advocated that governments adopt supply-side climate change policies and restrict or ban further extraction of fossil fuels.³¹⁵ Now, they can rely on very reputable economists to support their argument.³¹⁶

Harstad's purchase proposal is essentially equivalent to advocating that the Paris Agreement coalition enter into conservation easements with nations that possess large fossil fuel deposits.³¹⁷ Not surprisingly then, Harstad endorsed former Ecuadorian President Correa's proposed conservation easement for Ecuador's Yasuní National Park.³¹⁸ Specifically, Harstad stated, "[t]he Yasuní-ITT Initiative seems to be a good example of what may constitute an efficient climate policy There exists no better climate policy than not drilling."³¹⁹

(demonstrating that restrictive supply-side policies targeting fossil fuels have numerous economic and political advantages over similar restrictive demand-side instruments); Christophe McGlade & Paul Ekins, *The Geographical Distribution of Fossil Fuels Unused When Limiting Global Warming to 2 °C*, 517 NATURE 187 (2015) (finding that a large amount of fossil fuel reserves need to remain unused from 2010 to 2050 to limit global warming to two degrees Celsius); Asheim et al., *supra* note 280; Damian Carrington, *Leave Fossil Fuels Buried To Prevent Climate Change, Study Urges*, GUARDIAN (Jan. 7, 2015), <https://www.theguardian.com/environment/2015/jan/07/much-worlds-fossil-fuel-reserve-must-stay-buried-prevent-climate-change-study-says> (discussing study conducted by McGlade and Ekins).

314. See, e.g., Green & Denniss, *supra* note 313, at 79–84.

315. See, e.g., David Roberts, *It's Time to Think Seriously About Cutting Off the Supply of Fossil Fuels*, VOX (May 31, 2018), <https://www.vox.com/energy-and-environment/2018/4/3/17187606/fossil-fuel-supply> ("Policies that choke off fossil fuels at their origin . . . have been embraced by climate activists, picking up steam with the Keystone pipeline protests and the recent direct action of the Valve Turners." (emphasis omitted)); *Keep It in the Ground*, CTR. FOR BIOLOGICAL DIVERSITY, https://www.biologicaldiversity.org/campaigns/keep_it_in_the_ground/ (last visited Oct. 29, 2021) ("[O]ur climate can't afford *any* new fossil fuel development. That's why, since 2015, the Center has campaigned to *keep it in the ground* — to stop the expansion of oil, gas and coal development on public lands and oceans by halting new leasing and permitting."); Julian Spector, *To Fight Climate Change, We Need To Go Beyond Burying Fossil Fuels*, BLOOMBERG (Feb. 9, 2016), <https://www.bloomberg.com/news/articles/2016-02-09/environmentalists-must-go-beyond-keep-it-in-the-ground-to-fight-climate-change> ("The explicit language of 'keep it in the ground' appears in a letter written by 400 green advocates A bill with that name sits in the U.S. Senate The websites of leading environmental groups like the Sierra Club and Greenpeace proclaim Keep It in the Ground as a top priority for fighting climate change.").

316. See *supra* text accompanying notes 248–315.

317. See Harstad 2012, *supra* note 248, at 83.

318. Stover, *supra* note 21.

319. *Id.*

Of course, even with the adoption of aggressive conservation easement programs aimed at shutting down the fossil fuel industry around the world or within the U.S., some fossil fuel production would continue, as a conservation easement program is voluntary.³²⁰ Hence, it would be logical for the Paris Agreement coalition or the U.S. to also pursue conservation easement programs aimed at preserving carbon sinks. As prohibiting the extraction or refinement of fossil fuels can be the most efficient method of slowing global warming,³²¹ however, this article focuses on conservation easements prohibiting the extraction, refinement, sale, and distribution of fossil fuels. It also focuses primarily on the situation in the U.S., which, as a federal system, constitutes a coalition of governments, like the Paris Agreement coalition, in which some of the governments are attempting to reduce CO₂ emissions and slow global warming and some are not.³²²

B. IT IS ECONOMICALLY EFFICIENT FOR THE U.S. GOVERNMENT TO PAY U.S. FOSSIL FUEL OWNERS NOT TO EXTRACT THEIR FOSSIL FUELS.

As stated above, the U.S. is a coalition of governments, some of which are attempting to reduce CO₂ emissions and slow global warming and some are not.³²³ Hence, when considering the U.S. as an independent entity, the most economically efficient

320. See, e.g., Phil Willon, *Must Reads: Will Newsom End Drilling in California? Many Environmentalists Are Betting Yes*, L.A. TIMES (Apr. 23, 2019), <https://www.latimes.com/politics/la-pol-ca-gavin-newsom-fracking-oil-drilling-ban-20190423-story.html> (noting that California Democratic Governor Gavin Newsom recognized that, “despite his strong support for putting California on a path to a 100% renewable energy supply, it would be unrealistic to think that California can just stop its dependence on oil and gas”); see also *supra* note 63 and accompanying text.

321. See Harstad 2012, *supra* note 248, at 77; Harstad, Financial Times, *supra* note 248.

322. See, e.g., Sam Ricketts et al., *States Are Laying a Road Map for Climate Leadership*, AM. PROGRESS (Apr. 30, 2020), <https://www.americanprogress.org/issues/green/reports/2020/04/30/484163/states-laying-road-map-climate-leadership> (“[S]tate governments across the United States are taking meaningful action against climate change and toward building a clean energy economy.”); Dan Charles, *North Dakota Officials Block Wind Power In Effort To Save Coal*, NPR (Feb. 25, 2021), <https://www.npr.org/2021/02/25/965775584/north-dakota-officials-block-wind-power-in-effort-to-save-coal> (“Two [North Dakota] counties . . . have enacted drastic restrictions on new wind projects in an attempt to save coal mining jobs, despite protests from landowners who’d like to rent their land to wind energy companies.”).

323. See *supra* note 322 and accompanying text.

method for the U.S. to pursue to slow global warming likewise can be to keep fossil fuels in the ground.³²⁴

Due to the large political support for the fossil fuel industry in several U.S. states which possess significant quantities of fossil fuels, the strong support for the fossil fuel industry in the U.S. Congress, and the heavy subsidization of the fossil fuel industry in the U.S., it is very unlikely that the federal or any state government would simply ban or materially restrict the extraction, refinement, sale, or distribution of fossil fuels within the next few years.³²⁵ This is true regardless of whether a government would be willing to compensate the fossil fuel owners for that action.³²⁶ At the same time, as discussed above, the U.S. Congress could implement a voluntary conservation easement program as a method for keeping much of U.S. fossil fuel reserves in the ground,³²⁷ and the U.S. Government probably would have to pay fossil fuel owners 100% of the value of their operations for such easements.³²⁸ Accordingly, as discussed above in Section VI of this paper, it is recommended

324. See Harstad 2012, *supra* note 248, at 77; Harstad, Financial Times, *supra* note 248.

325. See David Roberts, *Friendly Policies Keep US Oil and Coal Afloat Far More Than We Thought*, VOX (July 26, 2018), <https://www.vox.com/energy-and-environment/2017/10/6/16428458/us-energy-coal-oil-subsidies> (explaining that the fossil fuel industry is heavily subsidized by both the state and federal government).

326. See, e.g., Robinson Meyer, *The Oil Industry Is Quietly Winning Local Climate Fights*, ATLANTIC (Feb. 20, 2020), <https://www.theatlantic.com/science/archive/2020/02/oil-industry-fighting-climate-policy-states/606640> (stating that the American Petroleum Institute (API) does not support a carbon tax or any other policy that would reduce fossil-fuel use).

327. See *supra* text accompanying notes 233–46. Of course, as Harstad explained so well, if the U.S. is the only fossil fuel-producing country that restricts fossil fuel extraction through a conservation easement program, then the other fossil-fuel-producing nations around the world will simply increase their own extractions of fossil fuels. Harstad 2012, *supra* note 248, at 78–80. In other words, such a supply-side policy will lead to supply-side carbon leakage. *Id.* at 80. Still, it makes sense for the U.S. to be the early adopter of such a conservation easement program, as such a program appears to be an economically efficient method for combatting climate change in general and the major international climate change agreements emphasize that the “developed country Parties should take the lead in combatting climate change.” Torben K. Mideksa, *Leadership and Climate Policy* 1 (Munich Soc’y for the Promotion of Econ. Research, CESifo Working Paper No. 9054, 2021), <https://www.cesifo.org/en/publikationen/2021/working-paper/leadership-and-climate-policy> (quoting Article 3.1 of the UNFCCC and stating that “[b]oth the Kyoto Protocol and the Paris Agreement encourage the developed countries to take a lead in reducing emissions”).

328. See *supra* text accompanying note 235.

that the IRC be amended to provide that fossil fuel owners can be compensated for agreeing not to extract, refine, sell, or distribute their fossil fuels and receive a credit (rather than a deduction) for the full value of their fossil fuel operations.³²⁹

This section considers whether it would be economically efficient for the U.S. Government to implement such a program of conservation easements within the U.S. territory. In other words, it considers whether the value of U.S. producers' and refiners' businesses is lower than the costs imposed on society by the burning of those fossil fuels (assuming, for purposes of this section, that the U.S. can afford to pay that value).

As stated above, in valuing any particular conservation easement being granted to the U.S. Government, the U.S. Government should consider valuations of comparable easements.³³⁰ If there are no sale prices for comparable easements, the easement should be valued as the difference between the value of the taxpayer's property with the easement and the value of the taxpayer's property without the easement, taking into account all relevant factors regarding a fossil fuel owner/taxpayer's operation, including, for example, the type of fossil fuel concerned, the quantity of that fuel, the cost of extracting or refining the fuel, the anticipated sales revenue for that fuel, and the fundamental financials of the operation, including cash flow and debt level.³³¹ Those individuals or entities whose operations are or would be borderline profitable, especially those who have not yet incurred "sunk capital costs,"³³² would be most likely to take advantage of such a

329. See *supra* text accompanying notes 232–46.

330. See *supra* text accompanying notes 69–70.

331. See *supra* text accompanying note 71. The U.S. Government could pay fossil fuel owners something like \$5/ton of carbon dioxide emissions avoided, which is what the GCF pays landowners in developing countries who agree to preserve their lands as carbon sinks. See, e.g., Bruno Vander Velde, *New Climate Funding Pays to Protect Forests*, CONSERVATION INT'L (Oct. 4, 2017), <https://www.conservation.org/blog/new-climate-funding-pays-to-protect-forests> ("Countries can apply to sell verified emissions reductions — each one of them representing 1 ton of avoided carbon dioxide emissions — to the GCF, at a price of US\$ 5 per ton."). However, the value paid for conservation easements granted by fossil fuel owners would need to be high enough to entice the owners to grant such easements, as society needs the owners to stop extracting, refining, selling, and distributing their fossil fuels.

332. See RICHARD BARON & DAVID FISCHER, OECD, DIVESTMENT AND STRANDED ASSETS IN THE LOW-CARBON TRANSITION 7 n.1, <https://www.oecd.org/sd-roundtable/papersandpublications/Divestment%20and%20Stranded%20Assets%20in%20the%20Low-carbon%20Economy%2032nd%20OECD%20RTSD.pdf>; Daniel Rosenbloom, *Breaking Carbon Lock-In Through*

conservation easement program, just as Harstad's above-discussed economic analysis predicts.³³³ It should be emphasized, though, that there is an incentive for all fossil fuel owners to enter into such conservation easements sooner rather than later, as the value of each owner's fossil fuels is likely to decrease over the next several years, given the local air pollution and CO₂ emissions caused by the burning of those fossil fuels and the consequent unpopularity of those fuels.³³⁴

Financial experts reported that, in 2020, the value of that segment of the U.S. fossil fuel industry that explores for, extracts, and refines oil, gas, and coal was approximately \$686.83 billion.³³⁵ The \$686.83 billion figure is higher than the

Innovation and Decline, WORLD RESOURCES INST., https://files.wri.org/expert-perspective-rosenbloom_0.pdf (last visited Oct. 29, 2021); *Stranded Assets and Renewables: How the Energy Transition Affects the Value of Energy Reserves, Buildings and Capital Stock* 9, 30 (Int'l Renewable Energy Agency, Working Paper, July 2017), https://www.irena.org/-/media/Files/IRENA/A/Agency/Publication/2017/Jul/IRENA_REmap_Stranded_assets_and_renewables_2017.pdf.

333. See *supra* text accompanying notes 296–97.

334. See, e.g., *supra* note 238 and accompanying text.

335. This figure was calculated by starting with the \$4,677.45 billion value figure for the global oil and gas market in 2020. *Global \$7425.02 Billion Oil and Gas Markets, 2015-2020, 2020-2025F, 2030F*, GLOBENEWSWIRE (Mar. 4, 2021), [https://www.eia.gov/todayinenergy/detail.php?id=43015](https://www.globenewswire.com/news-release/2021/03/04/2187025/0/en/Global-7425-02-Billion-Oil-and-Gas-Markets-2015-2020-2020-2025F-2030F.html#:~:text=filingsmedia%20partners-,Global%20%247425.02%20Billion%20Oil%20and%20Gas%20Markets%2C%202015,2020%2C%202020%2D2025F%2C%202030F&text=The%20global%20oil%20and%20gas,(CAGR)%20of%2025.5%25 [hereinafter GLOBENEWSWIRE] (discussing the data that ResearchAndMarkets had presented in its study entitled “Oil and Gas Global Market Report 2021: COVID-19 Impact and Recovery to 2030”). The $4,677.45 billion figure was then multiplied by 19% to arrive at the figure of $888.7155 billion, as this same article states that North American production is responsible for 19% of the total value figure. <i>Id.</i> Then, actual oil and gas production figures in 2019 for the U.S., Canada, and Mexico were compared to calculate the percentage that the U.S. oil and gas industry contributes to the North American oil and gas industry. Specifically, U.S. oil production figures for 2019 were obtained from the U.S. Energy Information Administration. <i>U.S. Crude Oil Production Grew 11% in 2019, Surpassing 12 Million Barrels Per Day</i>, U.S. ENERGY INFO. ADMIN. (Mar. 2, 2020), <a href=). Canadian oil production figures for 2019 were obtained from Statistics Canada. *Supply and Disposition of Crude Oil and Equivalent*, STATISTICS CAN. (Aug. 10, 2021), <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2510006301&pickMembers%5B0%5D=1.1&cubeTimeFrame.startMonth=01&cubeTimeFrame.startYear=2019&cubeTimeFrame.endMonth=12&cubeTimeFrame.endYear=2019&referencePeriods=20190101%2C20191201>. The Mexican oil production figures for 2019 were obtained from a report by the U.S. Energy Information Administration. *Executive Summary*, U.S. ENERGY INFO. ADMIN. (Nov. 30, 2020), <https://www.eia.gov/international/analy>

value of only the operations of the producers and the refiners,³³⁶ but if it is economically efficient for the U.S. Government to pay the \$686.83 billion, it is economically efficient to pay the smaller figure for just the producers' and refiners' businesses. Alternatively, financial experts project that, in 2021, the value of that segment of the U.S. fossil fuel industry that explores for, extracts, and refines oil, gas, and coal will be approximately \$858.4 billion,³³⁷ and this may be a fairer figure to utilize for the value of the U.S. fossil fuel industry, as the value of the industry was unnaturally suppressed by the COVID-19 virus in 2020.³³⁸

sis/country/MEX. The U.S. and Canadian natural gas production figures for 2019 were obtained from Natural Resources Canada. *Natural Gas Facts*, NAT. RES. CAN., <https://www.nrcan.gc.ca/science-data/data-analysis/energy-data-analysis/energy-facts/natural-gas-facts/20067> (last visited Oct. 29, 2021). Mexican natural gas production figures for 2019 were obtained from Statista in an article written by Bruna Alves. Bruna Alves, *Mexico: Monthly Natural Gas Production 2019-2020*, STATISTA (July 2, 2021), <https://www.statista.com/statistics/751410/mexico-natural-gas-production/>. Cubic feet of natural gas were translated into oil barrel equivalents for comparison at the rate of 5,614 cubic feet of natural gas for each barrel of crude oil. *Reference Tools*, INDEP. PETROLEUM ASS'N OF AM., <https://www.ipaa.org/reference-tools/> (last visited Oct. 29, 2021). These production figures revealed that the U.S. oil and gas industry constitutes 75% of the North American oil and gas industry. Accordingly, the \$888.7155 billion figure was multiplied by 75%, resulting in a figure of \$666.54 billion for the value of the U.S. oil and gas industry in 2020. This figure was added to the \$20.29 billion value of the U.S. coal industry in 2020, as reported by Melissa Garside. Melissa Garside, *U.S. Coal Mining Market Value 2010-2020*, STATISTA (Aug. 6, 2020), <https://www.statista.com/statistics/1137311/market-size-of-coal-mining-in-the-us/>. Together, these figures total \$686.83 billion for the value of the U.S. fossil fuel industry in 2020.

336. See GLOBENEWSWIRE, *supra* note 335 (“The oil and gas market consists of sales of oil and gas by entities . . . that undertake the exploration for, extraction, drilling, and refining, of oil and gas and some of its derivatives.”).

337. This figure was calculated by multiplying the 2021 global oil and gas industry value of \$5,870.13 billion by 19% to determine the 2021 value for the North American oil and gas industry value of \$1,115.33 billion. GLOBENEWSWIRE, *supra* note 335. Then, the \$1,115.33 billion figure was multiplied by 75%, to determine the U.S. oil and gas industry value of \$836.5 billion, as the U.S. constitutes 75% of the North American oil and gas industry. *Supra* note 335. Then, the 2020 value for the U.S. coal industry was multiplied by 7.8%, as financial experts project that the U.S. coal industry will produce 7.8% more coal in 2021 than it did in 2020. Tyler Godwin, *US 2021 Coal Production Estimated to Rise 7.8% on Year: EIA*, S&P GLOB. (Mar. 9, 2021), <https://www.spglobal.com/platts/es/market-insights/latest-news/coal/030921-us-2021-coal-production-estimated-to-rise-78-on-year-eia>. Finally, the U.S. oil and gas value figure for 2021 was added to the U.S. coal value figure for 2021, for a total of \$858.4 billion.

338. See, e.g., Divy Malik et al., *The Impact of COVID-19 on the Global Petrochemical Industry*, MCKINSEY & CO. (Oct. 28, 2020), <https://www.mckinsey.com/industries/chemicals/our-insights/the-impact-of-covid-19-on-the-global-petrochemical-industry#>; Ivan Penn, *Oil Companies Are Collapsing, but*

Again, the 2021 figure of \$858.4 billion is higher than the value of only the operations of the producers and the refiners,³³⁹ but if it is economically efficient for the U.S. Government to pay the \$858.4 billion figure, it is economically efficient to pay the smaller amount for just the producers' and refiners' businesses.

One accepted method of valuing a business is to multiply a recent annual profit figure (or, sometimes, a recent figure for "Earnings Before Interest, Taxes, Depreciation, and Amortization" or "EBITDA") by the appropriate number of years.³⁴⁰ The appropriate multiplier varies widely depending on the industry or company, from one times the profit level for "a small, personal service business where the new owner will be the only, or one of the only, professional service providers," to eight to ten times the profit level for "[a]n extremely well-established and steady business with a rock-solid market position, whose continued earnings will not be dependent upon a strong management team."³⁴¹ For "middle-market companies with sales of several million dollars up to several hundred million dollars, . . . assuming modest growth of low to high single digits, a common fair valuation range is five to seven times EBITDA."³⁴² Most U.S. fossil fuel owners probably fit into this last category.³⁴³

As illustrated below in Figure 7, the annual profits of the entire U.S. fossil fuel industry in 2017 were approximately \$120.7 billion,³⁴⁴ and five times that figure is \$603.5 billion and seven times that figure is \$844.9 billion. Once again, this profit figure is larger than just the profit figure for the producers and refiners, but if it is economically efficient for the U.S.

Wind and Solar Energy Keep Growing, N.Y. TIMES (Sept. 8, 2021), <https://www.nytimes.com/2020/04/07/business/energy-environment/coronavirus-oil-wind-solar-energy.html>.

339. See *supra* text accompanying notes 335–37.

340. See Armin Laidre, *Business Valuation Methods with Examples*, EXITADVISER, <https://exitadviser.com/business-value.aspx?id=business-valuation-methods> (last visited Oct. 30, 2021); Kison Patel, *A Review of Business Valuation Methods Available to Buyers*, DEALROOM, <https://dealroom.net/blog/company-valuation-methods> (last visited Oct. 30, 2021).

341. Bob Adams, *Fast and Simple Business Valuation*, BUSINESS TOWN, <https://businesstown.com/articles/fast-and-simple-business-valuation/> (last visited Oct. 30, 2021).

342. *Id.*

343. See *Who Are America's Independent Producers*, INDEP. PETROLEUM ASS'N OF AM., <https://www.ipaa.org/independent-producers/> (last visited Oct. 30, 2021).

344. See *infra* text accompanying note 352.

Government to pay the larger amount for the entire industry, it is economically efficient for the U.S. Government to pay the smaller amount for just the producers' and refiners' businesses.

The highest valuation of the U.S. fossil fuel industry, based on the above-discussed valuation figures, is \$858.4 billion. As demonstrated in Figure 6, the local air pollution and global warming costs imposed on society by the burning of U.S. fossil fuels has steadily increased since 2010 and totaled \$454.1 billion in 2017 alone. The 2017 figures for post-tax subsidies (externalities, or, in other words, costs imposed on society by a party that does not pay for those costs)³⁴⁵ reported in Figure 6 are the most recent figures available for the costs imposed on society by the burning of U.S. fossil fuels. However, such costs have continued to rise after 2017, as the burning of U.S. fossil fuels has continued to increase since 2017, with a possible dip in such costs for 2020 due to the disruption of many fossil fuel business operations by the COVID-19 pandemic.³⁴⁶

	2010	2011	2012	2013	2014	2015	2016	2017
Global Warming	163.4	169.6	171.6	179.2	188.3	186.7	201.2	212
Local Air Pollution	174.7	190.5	201.9	217.9	236.7	240.4	245.7	242.1
Vehicle Extern.	152.6	157.2	164.7	171.4	183	186.2	193.3	187.7
Foregone Tax Revenue	35.8	41.6	40.3	41.4	42.1	33.9	31.9	34.7
TOTAL	526.4	558.8	578.5	610	650.1	647.2	672.1	676.6

FIGURE 6: POST-TAX SUBSIDIES PROVIDED TO THE U.S. FOSSIL FUEL INDUSTRY³⁴⁷ (U.S. \$ BILLIONS)

345. See *Externalities*, *supra* note 45.

346. Rebecca Lindsey, *Climate Change: Atmospheric Carbon*, CLIMATE.GOV (Oct. 7, 2021), <https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide>; *Carbon Dioxide Levels Continue at Record Levels, Despite COVID-19 Lockdown*, WORLD METEOROLOGICAL ORG. (Nov. 23, 2020), <https://public.wmo.int/en/media/press-release/carbon-dioxide-levels-continue-record-levels-despite-covid-19-lockdown>.

347. Le et al., *supra* note 46.

Rounding the industry valuation up to \$1 trillion and using the 2017 figure of \$454.1 billion for the local air pollution and global warming costs imposed on society in 2017, it clearly would be economically efficient for the U.S. Government to pay the \$1 trillion in value for the U.S. fossil fuel industry to avoid such costs, as such costs would total \$1 trillion in only 2.2 years.

The fact that it would be economically efficient for the U.S. Government to pay the producers and refiners not to extract, refine, sell or distribute their fossil fuels may be easier to comprehend by considering the relevant figures for just one year, given that a multiple of annual profits or EBITDA is an acceptable method of valuing a business or industry.³⁴⁸ That is, if the costs imposed by the burning of U.S. fossil fuels in a particular year exceed the entire industry's profits for that year, that also would suggest that it would be economically efficient for the U.S. Government to pay the producers and refiners not to extract, refine, sell, or distribute their fossil fuels. The year 2017 is utilized in this analysis, as 2017 figures are available for both U.S. fossil fuel industry profits and the post-tax subsidies provided to the industry. As explained further below, pre-tax subsidies for 2015 to 2016 are used as a proxy for pre-tax subsidies for 2017, as 2017 pre-tax subsidy figures are unavailable and the 2017 figures would be even higher than the 2016 figures.³⁴⁹ Pre-tax subsidies are all subsidies except for externalities,³⁵⁰ or, in other words, costs imposed by a party that are not paid by that party.³⁵¹

As Figure 7 reveals, profits for the entire U.S. fossil fuel industry in 2017 were approximately \$120.7 billion.³⁵²

348. Laidre, *supra* note 340; Patel, *supra* note 340.

349. See *infra* text accompanying note 357.

350. See Coady et al., *supra* note 44, at 7–8.

351. See *Externalities*, *supra* note 45.

352. The profit figures reported in Figure 7 were calculated based on a reported \$257 billion in profits for the fossil fuel industry in North America in 2014 (the height of the industry). *\$257 Billion*, OIL CHANGE INT'L (May 2015), <http://priceofoil.org/profits-oil-gas-coal-companies-operating-u-s-canada/> [hereinafter *Profits for Oil, Gas & Coal*]; Lorne Stockman, *Newsletter: Despite Falling Prices North America's Fossil Fuel Sector Makes Healthy Profits*, OIL CHANGE INT'L (May 5, 2015), <http://priceofoil.org/2015/05/05/despite-falling-prices-north-americas-fossil-fuel-sector-makes-healthy-profits/> (clarifying that the above-referenced Oil Change International article was reporting on profits for all of North America, not just the U.S. and Canada). As the U.S. constitutes 75% of the North American fossil fuel industry, *supra* note 335, this \$257 billion figure for 2014 was multiplied by 75% to obtain the profit figure of \$192.8 billion

YEAR								
2010	2011	2012	2013	2014	2015	2016	2017	2018
128.5	158.5	153.1	171.4	192.8	114.8	91.2	120.7	159.4

FIGURE 7: PROFITS OF THE ENTIRE U.S. FOSSIL FUEL INDUSTRY³⁵³ (U.S. \$ BILLIONS)

The profit level for just the producers and refiners would be lower than this figure. However, if the costs imposed by the burning of fossil fuels in 2017 exceed the entire industry's profits for 2017, those costs certainly would exceed the profits of just the producers and refiners in 2017. In addition, all the costs imposed by local air pollution and global warming resulting from the burning of U.S. fossil fuels in 2017 should be attributed to the producers and refiners.

In contrast, as Figure 6 reveals, global warming and health care costs attributable to local air pollution created by the burning of U.S. fossil fuels in 2017 were \$212 billion and \$242.1 billion, respectively, for a total of \$454.1 billion.³⁵⁴ Just comparing the \$454.1 billion annual cost to the \$120.7 billion annual profit for the entire industry demonstrates that it would be economically efficient for the U.S. Government to pay producers and refiners the value of their businesses, in exchange

for the U.S. fossil fuel industry in 2014. Then, the profit figure for the U.S. fossil fuel industry for each of the years 2010 to 2013 and 2015 to 2018 was determined by using the growth/decline rate of the revenues of the U.S. oil and gas industries during the years 2010 to 2018. The growth/decline rates would be lower if revenues for the U.S. coal industry were included, but this would mean that the profits of the U.S. fossil fuel industry were at least as high as the figures reflected in Figure 7. Note, the profit figures reported in Figure 7 do not include the profits of privately held U.S. fossil fuel companies. Profit figures for these companies are unavailable because these companies do not have to report their financials to the U.S. Securities and Exchange Commission (SEC). *U.S. Private Companies*, LIBRARY OF CONG., <https://guides.loc.gov/company-research/private> (last visited Oct. 30, 2021) ("Unlike public companies, private companies are not required to file with the Securities and Exchange Commission (SEC)."); *Profits for Oil, Gas & Coal*, *supra* note 352 (noting that profits of privately-held fossil fuel companies cannot be ascertained).

353. *Profits for Oil, Gas & Coal*, *supra* note 352.

354. Le et al., *supra* note 46; Coady et al., *supra* note 44.

for their promises not to extract, refine, sell, or distribute any further fossil fuels.³⁵⁵

To add insult to injury, much of the industry's profits of approximately \$120.7 billion for 2017 would disappear in the absence of the substantial pre-tax subsidies that the U.S. federal and state governments provided to producers and consumers in 2017.³⁵⁶ The pre-tax subsidy figures for 2015 to 2016 that are reported in Figure 8 are the most recent pre-tax subsidy figures available. Because the 2017 pre-tax subsidy figures would be even higher due to the Trump Administration significantly increasing pre-tax subsidies to the fossil fuel industry,³⁵⁷ the 2015 to 2016 figures are used as a proxy for 2017 figures. The definition of the term "subsidy" used in this paper is the definition used by the Organization for Economic Cooperation and Development (OECD) and the World Trade Organization (WTO), which is "any government action that lowers the cost of production, lowers the cost of consumption, or raises the price received by producers."³⁵⁸

355. See Joseph E. Aldy, Professor of the Practice of Pub. Policy, Harvard Kennedy Sch., Statement of Joseph E. Aldy, United States House Committee on Oversight and Reform, Subcommittee on Environment, Hearing on "The Role of Fossil Fuel Subsidies in Preventing Action on the Climate Crisis" 1 (Apr. 22, 2021), https://media.rff.org/documents/Joseph_Aldy_-_Testimony_-_April_2021.pdf ("To the extent U.S. production subsidies increase hydrocarbon consumption, the adverse public health, climate change, and labor productivity losses from pollution resulting from fossil fuel combustion could exceed the market value of these fuels.").

356. See *infra* text accompanying notes 358–65.

357. See, e.g., Erin Auel, *The Trump Budget Is Full of Giveaways to Coal and Oil Companies*, CTR. FOR AM. PROGRESS (Feb. 15, 2018), <https://www.americanprogress.org/issues/green/news/2018/02/15/446678/trump-budget-full-giveaways-coal-oil-companies/>; Dana Nuccitelli, *Trump's Plan to Bail Out Failing Fossil Fuels with Taxpayer Subsidies Is Perverse*, GUARDIAN (Oct. 9, 2017), <https://www.theguardian.com/environment/climate-consensus-97-percent/2017/oct/09/trumps-plan-to-bail-out-failing-fossil-fuels-with-taxpayer-subsidies-is-perverse>; Kevin Crowley, *Biden Tax Plan Targets Fossil Fuel Subsidies Worth \$35 Billion*, BLOOMBERG (Apr. 8, 2021), <https://www.bloomberg.com/news/articles/2021-04-07/biden-tax-plan-targets-fossil-fuel-subsidies-worth-35-billion>.

358. JANET REDMAN ET AL., OIL CHANGE INT'L, DIRTY ENERGY DOMINANCE: DEPENDENT ON DENIAL 7 & n.b (Oct. 2017), http://priceofoil.org/content/uploads/2017/10/OCI_US-Fossil-Fuel-Subs-2015-16_Final_Oct2017.pdf [hereinafter OIL CHANGE INTERNATIONAL 2017] (relying on and citing definition used by the OECD and WTO).

PRE-TAX SUBSIDY TYPE	
Producer Subsidies – Federal	14.7
Producer Subsidies – State	5.8
Consumer Subsidies	14.5
Overseas Development	2.1
U.S. Military	81
TOTAL	118.1

FIGURE 8: PRE-TAX SUBSIDIES PROVIDED TO THE U.S. FOSSIL FUEL INDUSTRY IN 2017 (USING 2015-2016 FIGURES AS A PROXY FOR 2017 FIGURES)³⁵⁹ (U.S. \$ BILLIONS)

Conservative estimates of the subsidies that the federal and state governments provided to U.S. fossil fuel producers (on average in 2015 and 2016) are \$14.7 billion and \$5.8 billion, respectively, for a total of \$20.5 billion.³⁶⁰ Consumer subsidies

359. *Id.* at 5, 10, 21–22, 27, 34, app. I (Appendix I contains complete list of state and federal production subsidies, which relies heavily on the OECD's database of fossil fuel subsidies around the world); Tom DiChristopher, *U.S. Spends \$81 Billion a Year to Protect Global Oil Supplies, Report Estimates*, CNBC (Sept. 21, 2018), <https://www.cnbc.com/2018/09/21/us-spends-81-billion-a-year-to-protect-oil-supplies-report-estimates.html> (discussing comprehensive study of U.S. military costs related to fossil fuels conducted by Securing America's Future Energy (SAFE)).

360. OIL CHANGE INTERNATIONAL 2017, *supra* note 358, at 5, 10, 16–19, 27, 34. A list of the major tax break programs through which most of the federal producer subsidies are provided can be found on page eleven of the report. A complete list of the specific federal and state production subsidies is provided in Appendix I. Several commentators have reported that U.S. governments provide approximately \$20 billion per year in subsidies to fossil fuel producers, but most appear to be relying on the Oil Change International 2017 report or the OECD database, upon which the Oil Change International 2017 report heavily relies, for this figure. *See* Nuccitelli, *supra* note 357; *Fact Sheet*, *supra* note 37. At the same time, this \$20 billion annual figure for producer subsidies is not an unusually high figure. In a 2014 study, Oil Change International reported that the federal and state governments provided \$21.6 billion in exploration and production subsidies in 2013. SHAKUNTALA MAKHIJANI, OIL CHANGE INT'L, CASHING IN ON ALL OF THE ABOVE: U.S. FOSSIL FUEL PRODUCTION SUBSIDIES UNDER OBAMA 4, 7 (July 2014), http://priceofoil.org/content/uploads/2014/07/OCI_US_FF_Subsidies_Final_Screen.pdf; *see also* Simon Denyer, *Richest Nations Fail To Agree on Deadline To Phase out Fossil Fuel Subsidies*, WASH. POST (July 1, 2016), https://www.washingtonpost.com/world/richest-nations-fail-to-agree-on-deadline-to-phase-out-fossil-fuel-subsidies/2016/07/01/7db563fb-42f0-46c8-bea4-2fcfc0f48c69_story.html (discussing Oil Change International's 2014 study). In 2018, the National Resources Defense Council (NRDC) published a study concluding that the federal and state governments provided tax breaks totaling \$26 billion and favorable financing totaling \$1.4 billion to fossil fuel producers. Han Chen &

(subsidies provided to consumers to lower their price of fossil fuels) totaled approximately \$14.5 billion annually,³⁶¹ and the

Danielle Droitsch, *Time for the US to End Fossil Fuel Subsidies*, NRDC (June 3, 2018), <https://www.nrdc.org/experts/danielle-droitsch/time-us-end-fossil-fuel-subsidies>; Phil Dzikiy, *Fossil Fuel Subsidies Top \$5 Trillion Worldwide, Fair Pricing Would Have Cut Emissions 28%, Study Says*, ELECTREK (May 9, 2019), <https://electrek.co/2019/05/09/fossil-fuel-subsidies-trillions/>. Another report states that “[o]ther credible estimates of annual United States fossil fuel subsidies range from \$10 billion to \$52 billion annually – yet none of these include[s] costs borne by taxpayers related to the climate, local environmental, and health impacts of the fossil fuel industry.” *Fossil Fuel Subsidies Overview*, OIL CHANGE INT’L, <http://priceofoil.org/fossil-fuel-subsidies/> (last visited Oct. 30, 2021). The OECD database of fossil fuel subsidies indicates that the U.S. federal and state governments provided only \$6,169,088,982 in subsidies to fossil fuel producers in 2017. *OECD Inventory of Support Measures for Fossil Fuels*, OECD, https://stats.oecd.org/index.aspx?DataSetCode=FFS_USA (last visited Oct. 30, 2021) (select “Budgetary Transfer” or “Tax Expenditure” from the “Mechanism” tab and “Federal” or “Sub” or “Both” from the “Level” tab). However, the OECD database was not complete, so Oil Change International supplemented the OECD database in its own 2017 report discussed above. See OIL CHANGE INTERNATIONAL 2017, *supra* note 358, at 19 n.64 (“Our state subsidy estimates benefited from OECD’s 2015 Inventory of Support Measures for Fossil Fuels. Three state subsidies were directly over from their U.S. fossil fuel support inventory, which can be found at http://stats.oecd.org/index.aspx?DataSetCode=FFS_USA.”); see also *Explainer: The Challenge of Defining Fossil Fuel Subsidies*, CARBONBRIEF (June 12, 2017), <https://www.carbonbrief.org/explainer-the-challenge-of-defining-fossil-fuel-subsidies> (explaining that the OECD originally did not track public finance subsidies provided to the fossil fuel industry); *OECD: Fossil Fuel Subsidies Added up to At Least \$373bn in 2015*, CARBONBRIEF (Feb. 28, 2018), <https://www.carbonbrief.org/oecd-fossil-fuel-subsidies-373-billion-2015>. The International Monetary Fund (IMF) reported that the U.S. provided only \$1.09 billion in pre-tax subsidies to its U.S. fossil fuel industry. Le et al., *supra* note 46. The IMF states that it based this figure on the OECD’s Inventory of Support Measures for Fossil Fuels. See Coady et al., *supra* note 44, at 16. However, the OECD’s Inventory of Support Measures for Fossil Fuels reports a much higher figure, as previously noted. An IMF researcher who worked on the IMF’s report replied to an inquiry regarding this \$1.09 billion figure, confirming that the IMF did not include any U.S. military costs and stating that perhaps the IMF only reported the subsidies that the U.S. federal government had provided to producers (see email from IMF Researcher Piotr Le to the author, (on file with the Law Review)), but even the \$1.3 billion figure reported by the OECD for producer subsidies provided by the U.S. federal government is higher than the \$1.09 billion figure reported by the IMF for all pre-tax subsidies. It is possible that the IMF did not include in its pre-tax subsidy figure any subsidies provided by the U.S. federal or state governments to the oil industry. See Le et al., *supra* note 46 (noting that its \$1.09 billion figure comprises \$410 million for the coal industry and \$670 million for the natural gas industry, implying that no subsidies to the oil industry were included).

361. OIL CHANGE INTERNATIONAL 2017, *supra* note 358, at 7, 22 & nn.95–96 (“U.S. federal and state governments provide an estimated \$14.5 billion annually in consumption subsidies that reduce the cost of fossil fuel energy use by end-users. This annual estimate combines a federal annual average for 2015

U.S. federal government also provided approximately \$2.1 billion per year to assist fossil fuel producers to develop fossil fuel deposits outside of the U.S. in 2015 and 2016.³⁶² In addition, the U.S. military incurs costs of approximately \$81 billion per year just to secure oil distribution channels around the world.³⁶³ This is a very conservative figure for U.S. military costs, as it concerns only oil, not gas or coal,³⁶⁴ and no alternative fuel industry, like the solar or wind power industries, is provided with a free global security service.³⁶⁵ The sum of all of these pre-tax subsidies in 2017 is \$118.1 billion, as shown in Figure 8, and the overwhelming majority of these subsidies were provided by the U.S. federal government. Specifically, only the \$5.8 billion that states provided to producers and the \$2.8 billion that states provided to consumers were not provided by the federal government.³⁶⁶ If all of these pre-tax subsidies in 2017, totaling \$118.1 billion, are deducted from the industry's profits of approximately \$120.7 billion in 2017, the industry's 2017 profits decline to only \$2.6 billion.

Furthermore, in 2017, U.S. states lost \$34.7 billion in sales tax revenue (referred to as "foregone tax revenue" in Figure 6 above) on account of the unnaturally low, subsidized price of fossil fuel.³⁶⁷ They also incurred costs of approximately \$187.1 billion for traffic jams and vehicle accidents (referred to as "vehicle externalities" in Figure 6 above) that would not have occurred but for that unnaturally low, subsidized fossil fuel price

to 2016, including LIHEAP (\$3.4 billion) and Highway Trust Fund (\$8.3 billion) spending, and state-level totals for 2014 (\$2.8 billion), which come from OECD's state inventory of direct consumer support subsidies." (footnotes omitted).

362. *See id.* at 21.

363. Tom DiChristopher, *U.S. Spends \$81 Billion a Year to Protect Global Oil Supplies, Report Estimates*, CNBC (Sept. 21, 2018), <https://www.cnbc.com/2018/09/21/us-spends-81-billion-a-year-to-protect-oil-supplies-report-estimates.html> (discussing the conclusions of comprehensive study published by Securing America's Future Energy (SAFE)); *see also The Military Cost of Defending Global Oil Supplies*, SAFE (Sept. 20, 2018), <https://secureenergy.org/military-cost-defending-global-oil-supplies/> [hereinafter *SecureEnergy*]. The full study conducted by SAFE can be found at: <http://secureenergy.org/wp-content/uploads/2020/03/Military-Cost-of-Defending-the-Global-Oil-Supply.-Sep.-18.-2018.pdf>.

364. DiChristopher, *supra* note 363; *see also SecureEnergy*, *supra* note 363.

365. *See* Umair Irfan, *Fossil Fuels Are Underpriced by a Whopping \$5.2 Trillion*, VOX (May 17, 2019), <https://www.vox.com/2019/5/17/18624740/fossil-fuel-subsidies-climate-imf>.

366. OIL CHANGE INTERNATIONAL 2017, *supra* note 358, at 5, 22.

367. *See* Le et al., *supra* note 46 (enter "U.S." and "2017"); Coady et al., *supra* note 44, at 7, 19–21.

(as drivers would have patronized public transportation more).³⁶⁸ These last two figures, along with the figures for the CO₂ emissions added to the atmosphere and the healthcare costs incurred due to local air pollution, typically are considered to be “post-tax subsidies,” and they totaled \$676.6 billion, as shown in Figure 6 above.

If the post-tax subsidies totaling \$676.6 billion for 2017 are added to the pre-tax subsidies of \$118.1 billion for 2017, the total of all subsidies is \$794.7 billion, and the U.S. fossil fuel industry actually lost \$674 billion in 2017. Clearly, the U.S. fossil fuel industry is not pursuing a sustainable business model. No private company would spend \$794.7 billion annually to obtain annual profits of only \$120.7 billion. And, of course, the U.S. population should not continue to spend \$794.7 billion annually so that the U.S. fossil fuel industry by itself can enjoy annual profits of \$120.7 billion. To be sure, government entities in the U.S. to date have not spent all of the costs indicated above for the remediation of local air pollution and global warming. Nonetheless, those costs are, in fact, accruing and will have to be paid.³⁶⁹

Within the discipline of liberal economics upon which capitalism is based,³⁷⁰ subsidies are very disfavored.³⁷¹ According to the tenets of liberal economics, demand and supply should determine the range of goods and services available in the marketplace, and subsidies cause goods and services to be provided that otherwise would not be provided and take resources away from goods and services that otherwise would be provided.³⁷² Only when there is a market failure—e.g., an infant

368. Le et al., *supra* note 46 (enter “U.S.” and “2017”); Coady et al., *supra* note 44, at 13–14.

369. See *The Hidden Costs of Fossil Fuels*, UNION OF CONCERNED SCIENTISTS (Aug. 30, 2016), <https://www.ucsusa.org/resources/hidden-costs-fossil-fuels>; see also Jon Heggie, *Making the Change: Breaking Our Fossil Fuel Habit*, NAT'L GEOGRAPHIC (Apr. 13, 2020), <https://www.nationalgeographic.com/science/article/partner-content-breaking-our-fossil-fuel-habit>.

370. See Sarwat Jahan & Ahmed Saber Mahmud, *What is Capitalism?*, 52 FIN. & DEV. 44 (2015).

371. See, e.g., Jehan Sauvage, *Why Government Subsidies Are Bad for Global Competition*, OECD (Apr. 15, 2019), <https://www.oecd.org/trade/why-subsidies-are-bad-global-competition/> (analogizing subsidies to doping in sports by the way they undermine fairness and competition).

372. See MARC BACCHETTA ET AL., WTO, *The Economics of Subsidies*, in WORLD TRADE REPORT 2006, at 55, 55–62 (2007), https://www.wto.org/english/res_e/booksp_e/anrep_e/world_trade_report06_e.pdf (rejecting subsidies in “perfect market” conditions).

industry that society wants but would fail on its own, or a near-monopolist that is driving out all competitors in an industry—would subsidies be justified.³⁷³ There is no market failure that would justify the enormous subsidies that governments in the U.S. provide to the fossil fuel industry.³⁷⁴ This industry is not an infant industry but rather a very mature one, and it has been receiving enormous subsidies for many years.³⁷⁵ At one point, the Organization of Arab Petroleum Exporting Countries (OAPEC) might have been considered at least an oligopolist that the U.S. needed to counter for national security reasons, but the threat of the U.S.’ dependence on a foreign source of energy has long since dissipated.³⁷⁶ Despite the economic disadvantages of government subsidies, subsidies provided to the fossil fuel industry in the U.S. and throughout the world are enormous.³⁷⁷ In fact, the International Monetary Fund estimates that subsidies provided to the fossil fuel industry constitute 85% of all subsidies provided globally.³⁷⁸

For many years now, the enormous subsidies that various U.S. government entities have provided to the U.S. fossil fuel industry have caused all kinds of distortions in the energy marketplace and other harmful results.³⁷⁹ In particular,

373. See *id.* See generally GENE M. GROSSMAN, PROMOTING NEW INDUSTRIAL ACTIVITIES: A SURVEY OF RECENT ARGUMENTS AND EVIDENCE (1989) (discussing a wide range of market failures that could justify provision of a government subsidy to a particular company or industry).

374. See Aldy, *supra* note 355, at 1, 7 (stating that “fossil fuel production subsidies do not correct market failures” and explaining that, to the contrary, such subsidies constitute “a government failure”).

375. *E.g.*, *Fact Sheet*, *supra* note 37, at 1.

376. See Johannes Urpelainen & Elisha George, *Reforming Global Fossil Fuel Subsidies: How the United States Can Restart International Cooperation*, BROOKINGS INST. (July 14, 2021), <https://www.brookings.edu/research/reforming-global-fossil-fuel-subsidies-how-the-united-states-can-restart-international-cooperation/> (“[S]caling up domestic fossil fuel production was part of the United States’ aggressive push for energy security following the OPEC oil embargo in 1973.”); OECD, FOSSIL FUEL SUPPORT COUNTRY NOTE: UNITED STATES OF AMERICA (June 2020), <http://stats.oecd.org/wbos/fileview2.aspx?IDFile=2c7b60cf-dae4-49dd-ac64-b173bd0a403e> (“Exports of crude oil . . . were previously banned until the 40-year-old policy was repealed at the end of 2015.”).

377. See *Fact Sheet*, *supra* note 37, at 2.

378. *Id.*

379. See *id.* at 1–2; Urpelainen & George, *supra* note 376; Hans Biebl, Comment, *Energy Subsidies, Market Distortion, and a Free Market Alternative*, 46 U. MICH. J.L. REFORM CAVEAT 43, 43–44 (2012) (“[M]arket distortions created by fossil fuel subsidies’ have led to inefficient market share ‘allocation within the energy sector.’” (quoting OFFICE OF MGMT. & BUDGET, FISCAL YEAR 2013, CUTS, CONSOLIDATIONS, AND SAVINGS, BUDGET OF THE U.S.

hundreds, if not thousands, of new companies have entered the oil and gas markets in recent years, when neither the U.S. nor the world in general needs any more oil or gas.³⁸⁰ These companies have helped to further pollute the air in local communities and contribute to global warming through the burning of their oil and gas.³⁸¹ In addition, some studies have concluded that approximately one-half of the companies in the U.S. fossil fuel industry would be unprofitable in the absence of the pre-tax subsidies that the federal and state governments are providing to them.³⁸² Furthermore, the subsidies provided to these companies have made it much more difficult for those same government entities to subsidize the development of alternative energy sources.³⁸³

GOVERNMENT 80 (2012), <http://www.whitehouse.gov/sites/default/files/omb/budget/fy2013/assets/ccs.pdf>).

380. See, e.g., Carrington, *supra* note 313 (“[I]t makes literally no sense for the industry to go hunting for more fossil fuel . . . We’ve binged to the edge of our own destruction.”).

381. See, e.g., *id.*; David Roberts, *Friendly Policies Keep US Oil and Coal Afloat Far More Than We Thought*, VOX (July 26, 2018), <https://www.vox.com/energy-and-environment/2017/10/6/16428458/us-energy-coal-oil-subsidies> (“[T]ax preferences and other subsidies push nearly half of new, yet-to-be-developed oil into profitability. This potentially increases US oil production by almost 17 billion barrels over the next few decades, equivalent to 6 billion tonnes (Gt) of CO₂. Almost half of the new oil fields getting drilled would have been left alone if not for subsidies.” (quoting Peter Erickson et al., *Effect of Subsidies to Fossil Fuel Companies on United States Crude Oil Production*, 2 NATURE ENERGY 891 (2017))).

382. See Bart Hawkins Kreps, *Pulling the Plug on Fossil Fuel Production Subsidies*, RESILIENCE (Mar. 25, 2019), <https://www.resilience.org/stories/2019-03-25/pulling-the-plug-on-fossil-fuel-production-subsidies/> (quoting Erickson et al., *supra* note 381). Another study identified which specific oil, gas, and coal reserves around the world are already borderline unprofitable even with the enormous subsidies that their owners receive. McClade & Ekins, *supra* note 313, at 188–90; see also Carrington, *supra* note 313 (discussing the McClade and Ekins study).

383. George Ferns & Marcus Gomes, *G7: Why Major Economies Are Delaying a Break with the Fossil Fuel Industry*, CONVERSATION (June 10, 2021), <https://theconversation.com/g7-why-major-economies-are-delaying-a-break-with-the-fossil-fuel-industry-162281> (“Governmental support for the industry in the form of subsidies or tax breaks artificially inflates the profitability of fossil fuels, in turn making renewables a less attractive investment.”); OCEANA, FACT SHEET: MYTH VS. FACT – OIL & GAS SUBSIDIES 1 (Apr. 5, 2012), https://usa.oceana.org/sites/default/files/MythsFactsheet_JustSubsidies_FINAL_4-5-12.pdf (“[T]he U.S. Government – by eliminating unnecessary subsidies for oil and gas – would be saving on the order of \$10 billion per year that could be invested in other national priorities like defense, transportation, or alternative energy. A Congressional Research Service report corroborates these findings.” (footnotes omitted)).

Perhaps best illustrating the perverse nature of the subsidies that the federal and state governments provide to the fossil fuel industry is the fact that these subsidies make the industry as a whole so wealthy that it then can continue to pressure lawmakers into continuing to grant the industry subsidies year after year.³⁸⁴ Lobbying and campaign contribution costs are a matter of public record.³⁸⁵ For decades, fossil fuel companies have paid hundreds of millions of dollars in lobbying and campaign contribution costs annually to block the U.S. Congress' enactment of any legislation adverse to their interests.³⁸⁶ For example, as Figure 9 reveals, in 2018 and 2020 (campaign years), lobbying costs and campaign contributions by the energy/natural resources sector as a whole totaled \$250,837,518 in 2018 and \$297,803,541 in 2020, with a large majority of those totals coming from oil and gas, natural gas, and coal mining, combined.³⁸⁷

384. See *infra* text accompanying notes 385–80; *infra* Figure 9.

385. See generally Lobbying Disclosure Act of 1995, 2 U.S.C. §§ 1601–14; Federal Election Campaign Act of 1971, 52 U.S.C. §§ 30101–146.

386. See *infra* text accompanying note 388.

387. See *id.*

YEAR	CONTRIBUTIONS
2010	232,475,652
2011	187,126,813*
2012	280,342,904
2013	170,395,925*
2014	251,600,967
2015	154,469,532*
2016	266,983,293
2017	147,789,920*
2018	250,837,518
2019	149,312,359*
2020	297,803,541

FIGURE 9: LOBBYING/CAMPAIGN CONTRIBUTIONS PAID BY THE ENERGY/NATURAL RESOURCES SECTOR, INCLUDING FOSSIL FUEL INDUSTRIES³⁸⁸ (U.S. \$ MILLIONS)

*No campaign contributions are recorded for these years, as they are non-campaign years.

As Joseph Aldy stated in his article “Eliminating Fossil Fuel Subsidies,” fossil fuel subsidies “convey billions of dollars of benefits to the firms claiming them without an identifiable benefit for consumers or for the nation’s energy security.”³⁸⁹ The enormity of the pre-tax and post-tax subsidies provided to the U.S. fossil fuel industry is demonstrated by the fact that it “is more than the country’s defense budget and 10 times the federal

388. *Energy/Natural Resources: Long-Term Contribution Trends*, OPENSECRETS, <https://www.opensecrets.org/industries/totals.php?cycle=2022&ind=E> (last visited Oct. 31, 2021). Considering only campaign contributions, a large majority of campaign contributions by the energy/natural resources sector comes from fossil fuel industries (e.g., oil and gas, natural gas, and coal mining). For example, for 2020 contributions: oil and gas, natural gas, and coal mining combined for a total contribution of approximately \$168.2 million of the sector total of \$221.1 million. *See id.* Similarly, for 2018 contributions: oil and gas, natural gas, and coal mining combined for a total contribution of approximately \$101.2 million of the sector total of \$145.2 million. *See id.* To see the contribution amount for individual industries within the energy/natural resources sector, choose the specific industry (e.g., “Oil & Gas”) from the “Industries in this Sector:” drop-down list.

389. Joseph E. Aldy, *Proposal 5: Eliminating Fossil Fuel Subsidies*, in THE HAMILTON PROJECT: 15 WAYS TO RETHINK THE FEDERAL BUDGET 31, 32 (Michael Greenstone et al. eds., 2013), https://www.hamiltonproject.org/assets/files/fifteen_ways_to_rethink_the_federal_budget_full_book.pdf.

spending for education.”³⁹⁰ And the utter absurdity of the U.S.’ and other countries’ phenomenal subsidization of the fossil fuel industry was succinctly summarized in May 2019 by the U.N. Secretary-General, António Guterres: “What we are doing is using taxpayers’ money – which means our money – to boost hurricanes, to spread droughts, to melt glaciers, to bleach corals. In one [phrase]: to destroy the world.”³⁹¹

For all the above reasons, many economists and environmentalists are steadfastly opposed to the provision of subsidies to the fossil fuel industry. Accordingly, in 2009, former U.S. President Obama, at a meeting of the G20 nations, proposed that the G20 nations end inefficient fossil fuel subsidies.³⁹² Then, in 2012, President Obama particularly urged the end of subsidies to the oil and gas industries, stating that “[y]ou can keep subsidizing a fossil fuel that’s been getting taxpayer dollars for a century, or you can place your bets on a clean-energy future.”³⁹³ To date, though, very little progress has been made toward fulfilling the goal of ending fossil fuel subsidies.³⁹⁴ However, at the 2016 G7 meeting, the leaders of the G7 nations urged “all countries to eliminate inefficient subsidies by no later than 2025 and left the door open to an earlier phase-out for some countries.”³⁹⁵

390. James Ellsmoor, *United States Spend Ten Times More on Fossil Fuel Subsidies Than Education*, FORBES (June 15, 2019), <https://www.forbes.com/sites/jamesellsmoor/2019/06/15/united-states-spend-ten-times-more-on-fossil-fuel-subsidies-than-education/?sh=7ca4c64a4473>.

391. Damian Carrington, *Just 10% of Fossil Fuel Subsidy Cash ‘Could Pay for Green Transition’*, GUARDIAN (Aug. 1, 2019), <https://www.theguardian.com/environment/2019/aug/01/fossil-fuel-subsidy-cash-pay-green-energy-transition>.

392. *Fossil Fuel Subsidies Overview*, OIL CHANGE INT’L, <http://priceofoil.org/fossil-fuel-subsidies/#:~:text=What%20is%20a%20Fossil%20Fuel,price%20paid%20by%20energy%20consumers> (last visited Oct. 31, 2021) (“In 2009, the Obama Administration and the G20 nations proposed that they end “inefficient” fossil fuel subsidies.”).

393. Helene Cooper & Jonathan Weisman, *Obama Seeks to End Subsidies for Oil and Gas Companies*, N.Y. TIMES (Mar. 1, 2012), <https://www.nytimes.com/2012/03/02/us/politics/obama-calls-for-an-end-to-subsidies-for-oil-and-gas-companies.html>.

394. See OIL CHANGE INT’L, *supra* note 392 (noting that although the Obama Administration and G20 proposal generated repeated acknowledgement, “it resulted in very limited progress for many years You can’t really say you’re committed to the fight against climate change if you’re still funding oil, gas, and coal”).

395. *Id.*

To repeat, the subsidies that various U.S. government entities are providing to the fossil fuel industry are causing terrific economic and environmental harm,³⁹⁶ and the U.S. has indicated that it will eliminate these subsidies by 2025.³⁹⁷ Consequently, as stated above, if the current U.S. Congress and other government entities enact any legislation opposed by the fossil fuel industry in the next few years, it most likely will be to abolish or phase out the approximately \$118.1 billion in pre-tax subsidies that they are currently providing to the fossil fuel industry.³⁹⁸

Again, the important point of this section of the paper is that even if the U.S. federal and state governments cannot force the U.S. fossil fuel industry to internalize the negative externalities that the industry imposes on society (as appears to be the case), the analysis presented above demonstrates that it would, in fact, be economically efficient for the U.S. Government to pay producers and refiners not to extract, refine, sell, or distribute their fossil fuels, through the provision of income tax benefits. This is the case even if the U.S. Government had to pay these owners the full value of their businesses, as the costs of local air pollution and global warming imposed on society each year by the burning of fossil fuels is much higher than their annual profits.

C. THE U.S. GOVERNMENT CAN AFFORD TO PAY PRODUCERS AND REFINERS NOT TO EXTRACT AND REFINER THEIR FOSSIL FUELS.

As stated above, the highest estimate of the value of the entire U.S. fossil fuel industry today is \$858.4 billion, or \$1 trillion when rounded up.³⁹⁹ Furthermore, as discussed above, pre-tax subsidies provided to the U.S. fossil fuel industry in 2017 totaled approximately \$118.1 billion,⁴⁰⁰ and most of these pre-tax subsidies were provided by the federal government.⁴⁰¹ If the U.S. Government were to redirect the \$118.1 billion per year in pre-tax subsidies it pays to the U.S. fossil fuel industry to the new conservation easement program, it would take the U.S.

396. See, e.g., Le et al., *supra* note 46 (enter “U.S.” and year desired); Coady et al., *supra* note 44, *passim*.

397. OIL CHANGE INT’L, *supra* note 392.

398. See *supra* text accompanying notes 366–69.

399. *Supra* note 337 and accompanying text.

400. See *supra* text accompanying notes 357–66; *supra* Fig. 8.

401. *Supra* note 366 and accompanying text.

Government approximately 8.5 years to pay the \$1 trillion figure.⁴⁰²

As discussed above, I recommend that the IRC be amended to provide that an owner of fossil fuels can take a credit (rather than a deduction) for the value of a conservation easement prohibiting extraction or refinement of those fuels.⁴⁰³ If the U.S. Government wishes to spread such payments over several years, it could limit the amount a taxpayer can claim for the credit each year and then permit the taxpayer to carry-over any unclaimed value for a specified number of years in the future. There should not be any resistance to adoption of such an annual claim limit and carry-over provision, especially as a carry-over period of fifteen years is already in place for other types of conservation easements.⁴⁰⁴ It is axiomatic that a fossil fuel owner could not receive payment for foregoing extraction or refinement of the owner's fossil fuels pursuant to a conservation easement and at the same time receive subsidies based on the extraction or refinement of those fossil fuels. Still, as stated above, the IRC could also be explicitly amended to condition the U.S. Government's payment for a conservation easement granted by a producer or refiner on the cessation of any further government subsidies to that producer or refiner.

For some period of time after the U.S. Government has commenced a conservation easement program, the U.S. federal and state governments could continue to pay consumer subsidies to consumers and producer subsidies to fossil fuel producers and refiners that are not participating in the conservation easement program. However, as the value of fossil fuel deposits decrease in the future⁴⁰⁵ and conservation easement program becomes more popular, it should become easier and easier for the federal and state governments to abolish all producer and consumer subsidies. In short, the U.S. Government can afford to pay producers and refiners not to extract, refine, sell, or distribute

402. One trillion U.S. dollars divided by \$118.1 billion is 8.467.

403. See *supra* text accompanying notes 232–46.

404. See *supra* text accompanying notes 73–87; see 26 U.S.C. § 170(b)(1)(E)(ii).

405. See Carrington, *supra* note 313 (“Major fossil fuel companies face the risk that significant parts of their reserves will become worthless.”); Adam Barth et al., *The Future of Natural Gas in North America*, MCKINSEY & CO. (Jan. 6, 2020), <https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/the-future-of-natural-gas-in-north-america#> (stating that decarbonization policies and shifting demand for renewable energy are likely to reduce the revenues and profits of natural gas producers).

their fossil fuels. As most pre-tax fossil fuel subsidies are provided by the U.S. Government,⁴⁰⁶ the U.S. Government ultimately should be able to pay for the conservation easements proposed in this paper by redirecting the pre-tax subsidies that it currently provides to the fossil fuel industry to the new conservation easement program.

VIII. CONCLUSION

Despite all the international efforts to slow global warming in the last few decades, the last seven years have been the seven hottest years on record, with “2020 tied with 2016 as the warmest year on record, according to an analysis by NASA.”⁴⁰⁷ Clearly, we need to take very bold actions now to reverse the perverse death spiral that humankind currently is engaged in with the fossil fuel industry. Furthermore, as Garrett Hardin has advised, we must rely on private market measures to reduce CO₂ emissions and slow global warming, as there does not seem to be any way to force independent nations or individual companies within the U.S. to stop extracting, refining, selling, or distributing fossil fuels.⁴⁰⁸

The specific action considered here—private conservation easements prohibiting the extraction, refinement, sale, and distribution of fossil fuels—certainly is novel and may be distasteful to many. To begin with, the idea that it would ever make sense to pay someone to do nothing is difficult to grasp.⁴⁰⁹ However, there is precedent for such payments. For example, in the U.S. and around the world, workers have received incentives not to commute to work during certain hours of the workday,⁴¹⁰ and the U.S. Government pays farmers not to grow certain crops in certain years.⁴¹¹

Moreover, the terrific public largesse that the fossil fuel industry has already enjoyed over the years makes it especially

406. *Supra* note 366 and accompanying text.

407. 2020 Tied for Warmest Year on Record, *supra* note 52.

408. *See* Hardin, *supra* note 101, at 1245–47.

409. *See* Stover, *supra* note 21 (quoting German Minister of Economic Cooperation and Development Dirk Niebel noting, in response to former Ecuadorian President Correa’s Yasuni proposal, that “countries such as Germany did not like the idea of ‘payment for non-action’”).

410. Richard Mudge, *They Pay Farmers Not to Grow Crops, Don’t They?*, ENO CTR. FOR TRANSP. (Sept. 16, 2013), <https://www.enotrans.org/article/pay-farmers-not-grow-crops-dont/>.

411. *Id.*; *see also* Soil Conservation and Domestic Allotment Act of 1936, 16 U.S.C. §§ 590a–q; Agricultural Adjustment Act of 1938, 7 U.S.C. § 1281–393.

difficult to accept that the most economically efficient method of slowing global warming may be to pay fossil fuel owners again, this time not to exploit their fossil fuels. Arguably, the U.S. fossil fuel industry has acted like a bully for decades,⁴¹² but any realistic effort to slow global warming must acknowledge, rather than simply bemoan, the fact that the fossil fuel industry today possesses tremendous political power and may continue to do so for the near future. Furthermore, this article considers the global warming crisis from the perspective of the economic theory of property rights, which treats an economically efficient outcome as a just outcome, and the analysis presented here strongly suggests that paying fossil fuel owners to close their operations and leave their fossil fuels in the ground is an economically efficient method of slowing global warming.

Fossil fuel companies have already located approximately five times more fossil fuel reserves than can be burned and still limit warming to 1.5° Celsius,⁴¹³ so that continuing to explore for more fossil fuels literally is a waste of energy, in addition to a waste of time and money.⁴¹⁴ Scientists have concluded that wind and solar energy alone could provide approximately 80% of the U.S.' energy needs,⁴¹⁵ and the U.S. possesses a very large reserve of oil, referred to as the "strategic petroleum reserve," as well as large reserves of gasoline, from which it can make withdrawals whenever needed.⁴¹⁶ Finally, in order to pay for a new

412. *E.g.*, Emma Searson, *No More Candy for Fossil Fuels*, ENV'T AM. (Aug. 4, 2020), <https://environmentamerica.org/blogs/environment-america-blog/ame/no-more-candy-fossil-fuels> (discussing how the U.S. fossil fuel industry has received billions of dollars of COVID-19 recovery funds, despite receiving billions of dollars in subsidies from the federal and state governments each year, describing the fossil fuel industry as "the big bad bully").

413. Jack Shapiro, *8 Reasons Why We Need to Phase Out the Fossil Fuel Industry*, GREENPEACE (Sept. 11, 2019), <https://www.greenpeace.org/usa/8-reasons-why-we-need-to-phase-out-the-fossil-fuel-industry/> (discussing an IPCC special report). *See generally* Allen et al, *supra* note 222.

414. *See* Carrington, *supra* note 313.

415. *See* Matthew R. Shaner et al., *Geophysical Constraints on the Reliability of Solar and Wind Power in the United States*, 11 ENERGY & ENV'T SCI. 914 (2018); *see also* Ellsmoor, *supra* note 390 (discussing the study published in *Energy & Environmental Science*).

416. *See* Grant Nülle, *New Legislation Affects U.S. Strategic Petroleum Reserve*, EIA (Dec. 9, 2015), <https://www.eia.gov/todayinenergy/detail.php?id=24072> ("As the largest stockpile of government-owned emergency crude oil in the world, the SPR is designed to help alleviate significant disruptions in oil supplies from events such as severe weather; major geopolitical events; and unplanned production, transport, and delivery outages. Located in four storage sites along the Gulf of Mexico, the SPR currently holds more than 695 million barrels of crude oil, or about 96% of its 727 million barrel design capacity

conservation easement program through which fossil fuel owners agree not to further extract, refine, sell, or distribute fossil fuels, the U.S. Government can simply redirect the very large subsidies that it already pays to the U.S. fossil fuel industry to the new conservation easement program.

Essentially, the conservation easement program proposed here accepts the great political power that the fossil fuel industry currently possesses and suggests a method of accomplishing what society otherwise cannot seem to accomplish: outlawing further extraction or trafficking in fossil fuels and at the same time providing a way for the fossil fuel companies to go out of business. Owners of fossil fuels would expect to be compensated for leaving their fossil fuels in the ground, just as developing countries like Ecuador expect to be paid for leaving their fossil fuels in the ground.⁴¹⁷ At the very least, it is hoped that this paper has sparked further interest in novel private market measures that could help combat climate change.

[O]ne million barrels of gasoline are held in the Northeast Gasoline Supply Reserve.”); Chris Baraniuk, *Why the US Hides 700 Million Barrels of Oil Underground*, BBC (Sept. 21, 2015), <https://www.bbc.com/future/article/20150921-why-the-us-hides-700-million-barrels-of-oil-underground> (“The [SPR]’s formidable size makes it a significant deterrent to oil import cutoffs and a key tool of foreign policy.”); HEATHER L. GREENLEY, CONG. RESEARCH SERVICE, *THE STRATEGIC PETROLEUM RESERVE: BACKGROUND, AUTHORITIES, AND CONSIDERATIONS* at Summary, 2 (May 13, 2020), <https://fas.org/sgp/crs/misc/R46355.pdf> (explaining that the U.S. Congress created the SPR in response to the 1973 to 1974 oil embargo imposed by the Organization of Arab Petroleum Exporting Countries (OAPEC) and the consequent tripling in the price of imported crude oil but noting that the SPR’s security role may be diminished now that the U.S. is a net exporter of crude oil and petroleum products).

417. See Kestenbaum, *supra* note 1 (quoting Former Ecuadorian President Rafael Correa’s discussion regarding the need to exploit the Yasuni oil fields to help the poor of Ecuador since the international community would not pay Ecuador not to drill in the Yasuní); Harstad, *Financial Times*, *supra* note 248 (“[Fossil fuel] owners will certainly request compensation for conserving their resources on the world’s behalf.”); Carrington, *supra* note 313 (stating that providing compensation would be key to getting countries (whether rich or poor) to agree to keep their fossil fuels in the ground).
