NOTE

TAXES V. TORTS: WHICH WILL MAKE FOSSIL FUEL PRODUCERS SHARE CLIMATE CHANGE BURDENS?

BRIDGET PALS*

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INTRODUCTION

Despite clear evidence of climate change and its devastating effects, the United States still lacks a comprehensive plan to adapt to current climate effects and mitigate future climate change damages. Perhaps due to this regulatory failure, state and local governments, as well as public interest groups, have taken matters into their own hands by using tort litigation to hold fossil fuel producers, utilities, and car companies accountable for their contributions to carbon-dioxide (CO_2) emissions. This approach offers both pros and cons. On the one hand, tort litigation is a patchwork approach to an expansive problem and, thus far, has focused nearly exclusively on oil producers—it is unclear whether tort litigation could, on its own, create large, necessary shifts in fossil fuel use. On the other hand, unlike regulation, tort litigation does not require political buy-in at the federal level and may reflect a societal desire to hold fossil fuel producers accountable for their role in driving climate change. These tradeoffs raise two related questions. First, is tort litigation useful in deterring emissions? Put more specifically, in the unique context of oil production, can tort litigation create the necessary *ex ante*[1] incentives to reduce greenhouse gas emissions to a socially optimal level? Second, if not, what role can tort litigation still play? In a hypothetical universe, where the United States has an effective regulatory regime to reduce CO_2 emissions, what, if anything, can tort litigation accomplish that a regulatory regime cannot?

[1] *Ex ante* here refers to forward-looking incentives—what is the impact of the threat of a future lawsuit?

To answer the first question, I will examine the structure—namely the defendants joined—in all seventeen tort liability climate change cases that have been brought in the United States.[2] This Note represents the first comprehensive analysis of the defendants in these cases. This analysis calls into question an important aspect of the typical deterrence model of tort liability. The standard deterrence model suggests that the threat of potential future litigation creates *ex ante* incentives for firms to either modify their behavior to avoid tortious behavior or to price the likely cost of their future torts into the goods or services they provide. In contrast, because of the severe procedural and legal limitations on tort litigation in the oil production context, I argue that the deterrent signal is heavily dampened, resulting in underdeterrence. Indeed, a large portion of oil producers are impracticable or impossible to join in climate change litigation and thereby evade any possibility of liability. Consequently, I posit that tort litigation will struggle to promote the necessary *ex ante* incentives for future abatement or price-signaling for most oil producers. Still, I find that tort litigation can have an important compensatory role to play. Because the oil production industry is global in scope with very high profit margins, while only a small portion of the industry is joined in these lawsuits, I argue that it is unlikely that tort litigation costs—realized or expected—will be passed on to consumers. This means that, unlike in regulatory frameworks, costs placed on oil producers will be borne by producers, thereby serving as an effective punishment without penalizing customers.

After examining the theoretical and practical trade-offs between regulatory and tort approaches and considering the unique confines of the global oil market, I conclude that regulatory approaches should be used to address mitigation costs, while tort liability is best suited to recuperate backward-looking adaptation costs. This Note proceeds as follows. First, Part I describes the costs associated with climate change and, in so doing, lays the groundwork for my argument that mitigation and adaptation costs should be addressed with different strategies. Part II investigates who should pay those costs—the fossil fuel industry or consumers—and concludes that, as a normative matter, industry should bear at least some portion of the costs incurred by climate change, without passing the

[2] The universe of cases, described in more detail below, contains only cases filed before October 15, 2020. *See infra* Part IV; *see also infra* Appendix A.

costs on to consumers. Part III discusses the general economic theory of pollution abatement and the theoretical models of mitigating climate change under regulatory and tort schemes, in order to better understand—in theory—how costs are borne by consumers and producers. Parts IV and V push beyond the theoretical ideals of tort law and regulatory schemes to ask, "how will this work in practice?" Part VI applies these practical models to the unique context of the global oil market, leading to my conclusion that regulatory mechanisms are best suited to mitigation costs, while tort liability, because of its imperfect deterrence, is best used to cover adaptation costs.

I. THE TYPES OF COSTS ASSOCIATED WITH CLIMATE CHANGE

Before considering tort and regulatory approaches to combating climate change, it is important to lay out the different costs associated with this looming threat. These distinctions will become important later, when considering the comparative strengths of tort litigation and regulatory approaches.

The monetary and non-monetary costs of climate change are enormous. By 2050, Chicago's average temperatures will approximate current-day St. Louis, and St. Louis will feel like Dallas.[3] In Europe, London can expect to face the temperatures faced by current-day Barcelona.[4] These increased temperatures pose severe threats to human health and safety, a non-monetary cost of climate change. By 2100, India will likely face an additional 1.5 million deaths/year due to increased heat mortality,[5] while Hurricane Sandy level flooding may occur biannually in New York City.[6] All the same, marginal changes to our climate matter. The difference between 2.7ºF (1.5ºC) and 3.6ºF (2.0ºC) in warming, for example, amounts to an additional 61 million people living under conditions

[3] *See Future Cities*, CROWTHER LAB, https://hooge104.shinyapps.io/future_cities_app/ (last visited Oct. 24, 2020).

[4] *See id.*

[5] *See* Maya Earls, *If Emissions Continue, India Could See 1 Million Heat Deaths a Year*, SCI. AM. (Nov. 2, 2019), https://www.scientificamerican.com/article/if-emissions-continue-india-could-see-1-million-heat-deaths-a-year/.

[6] *See* William Sweet et al., *6. Hurricane Sandy Inundation Probabilities Today and Tomorrow*, BULL. OF THE AM. METEOROLOGICAL SOC'Y, Sept. 2013, at S17, S19.

of extreme drought,[7] and an additional 23 percent of the world's population exposed to severe heatwaves at least once every five years.[8] Reducing the severity of climate change matters, even if it cannot be eliminated entirely.

For the purpose of this Note, I consider two buckets of climate change costs: mitigation costs and adaptation costs. Mitigation costs are the costs necessary to reduce greenhouse gas emissions to limit warming potential, while adaptation costs are the costs associated with adjusting to life with climate change. To put it another way, mitigation costs are an upfront payment to reduce future damage, while adaptation costs are the bill coming due from failure to reduce emissions in the past. Since the Industrial Revolution, people have used cheap fossil fuels to gain access to additional warmth, food, shelter, and convenience. Because of this past behavior, even if the world had collectively decided to stop emitting *any* greenhouse gases in 2017, humanity would have still expected to face nearly 2ºF (1.1ºC) of warming, relative to pre-industrial temperatures.[9] For context, the most recent international treaty on climate change, the Paris Agreement, sought to limit total warming to just 2.7ºF (1.5ºC).[10]

A. Mitigation Costs

Mitigation costs are incurred by reducing greenhouse gas emissions in order to reduce the total future burden of climate change. These costs can be framed as a trade-off between reduced wealth today in exchange for increased utility tomorrow. Mitigation costs can be subdivided into two groups: the technological costs of changing our existing systems to reduce greenhouse gas emissions, and the costs of society changing its behavior to decrease greenhouse gas emissions. Technological costs may include, for example,

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[7] *See* Brad Plumer & Nadja Popovich, *Why Half a Degree of Global Warming Is a Big Deal*, N.Y. TIMES (Oct. 7, 2018), https://www.nytimes.com/interactive/2018/10/07/climate/ipcc-report-half-degree.html.

[8] *See* Alan Buis, *A Degree of Concern: Why Global Temperatures Matter*, NAT'L AERONAUTIC & SPACE ADMIN. (June 19, 2019), https://climate.nasa.gov/news/2865/a-degree-of-concern-why-global-temperatures-matter/.

[9] *See* Thorsten Mauritsen & Robert Pincus, *Committed Warming Inferred from Observations*, 7 NATURE CLIMATE CHANGE 652, 652 (2017).

[10] *See* Paris Agreement to the United Nations Framework Convention on Climate Change, at art. 2, Dec. 12, 2015, T.I.A.S. No. 16,1104.

electrifying transportation systems, decarbonizing electricity grids, or changing agricultural practices to reduce greenhouse gas emissions.

In addition to technological costs, a proper accounting of mitigation costs also includes behavioral costs—the utility[11] cost of people changing the way they act. These costs may be driven by society shifting towards plant-based diets, rather than carbon-intensive meat-based diets, or reducing air travel.[12] While there is generally not a monetary cost to switching to vegetarianism—in fact, vegetarians save hundreds of dollars each year on groceries[13]—there is a *utility* cost to changing one's diet. Quite simply put, some people enjoy eating meat. Similarly, air travel accounts for 12 percent of greenhouse gas emissions in the United States.[14] To reduce air travel and related emissions, individuals might, for example, travel less for pleasure, refrain from attending out-of-state weddings, or—trading emissions for speed—take interstate trains or buses. While these choices may not carry a monetary cost, they carry a clear utility cost.

The above examples illustrate that when individuals change their behavior, that change often comes with a utility cost, even if

[11] In economics, "Marginal utility . . . [is] the additional satisfaction or benefit . . . that a consumer derives from buying an additional unit of a commodity or service." *Marginal Utility*, ENCYC. BRITANNICA (Mar. 20, 2016), https://www.britannica.com/topic/marginal-utility.

[12] The Food and Agriculture Organization of the United Nations (FAO) traces 14.5% of anthropogenic greenhouse gas emissions to livestock. *See Tackling Climate Change Through Livestock*, FAO, http://www.fao.org/ag/againfo/resources/en/publications/tackling_climate_change/index.htm (last updated Oct. 21, 2013). Some researchers estimate that more widespread adoption of plant-based diets could decrease food-related greenhouse gas emissions by 29-70%, in addition to saving the world economy trillions of dollars in reduced health care costs. *See* Marco Springmann et al., *Analysis and Valuation of the Health and Climate Change Cobenefits of Dietary Change*, PROC. OF THE NAT'L ACAD. OF SCI., Apr. 12, 2016, at 1.

[13] *See* Mary Flynn & Andrew Schiff, *Economical Healthy Diets (2012): Including Lean Animal Protein Costs More Than Using Extra Virgin Olive Oil*, 10 J. OF HUNGER & ENV'T NUTRITION 467, 467 (Sept. 23, 2015).

[14] *See Regulations for Emissions from Vehicles and Engines*, EPA, https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-greenhouse-gas-emissions-aircraft (last visited Oct. 21, 2020). Notably, while half of Americans do not regularly fly, the 12% that take more than six round-trip flights per year are responsible for two-thirds of all aviation emissions. *See* Hiroko Tabuchi & Nadja Popovich, *How Guilty Should You Feel About Flying?* N.Y. TIMES (Oct. 17, 2019), https://www.nytimes.com/interactive/2019/10/17/climate/flying-shame-emissions.html.

there is no dollar amount attached.[15] When considering wholesale changes to fundamental elements of society—what people eat, how often and how fast people travel—these large shifts in behavior will not be costless. Whether through infrastructure investments in new technology, behavioral changes, or a combination of the two, mitigation costs, borne by present-day individuals, are not trivial.

B. Adaptation Costs

Adaptation costs are the costs of living with climate change. Such costs include both the monetary costs required to limit the effect the negative impacts, as well as the non-monetary costs of human health and suffering. For example, many coastal cities are already spending money developing resiliency plans to reduce flooding from anticipated sea level rise.[16] Additionally, populations facing large temperature increases may need to install air conditioning more broadly. The need for air conditioning is underscored by a 2003 heat wave across Europe that led to the deaths of over 70,000 people.[17] Even today, less than two percent of German households

[15] An important caveat is that, in some cases, individuals may be indifferent between behaviors and require only a small "nudge" to change from one behavior to another. See RICHARD H. THALER & CASS R. SUNSTEIN, NUDGE (Penguin Books 2009) for a general discussion of nudges in both public policy and private sector contexts. The power of defaults, for example, is well-documented in economic literature. Economists have found that under an opt-in organ donation scheme, only 42% of participants register as organ donors, while if the participants are instead automatically registered as donors with an option to opt out, 82% of the population registers. *See id.* at 180. In a more mundane context, a randomized evaluation found that switching the default setting on a printer to double-sided resulted in a persistent 15% drop in paper use. *See* Johan Egebark & Mathais Ekström, *Can Indifference Make the World Greener?*, 76 J. OF ENV'T ECON. & MGMT. 1 (2016).

[16] *See, e.g.*, *East Side Coastal Resiliency*, N.Y.C. PARKS, https://www.nycgovparks.org/planning-and-building/planning/neighborhood-development/east-side-coastal-resiliency (last visited Oct. 20, 2020) (describing the city's expected investment of $1.5 billion to build a coastal flood protection system along Manhattan); *Transformative Plan to Create Resilient, Open Boston Harbor Unveiled,* CITY OF BOS. ENV'T DEP'T (Oct. 17, 2018) https://www.boston.gov/news/transformative-plan-create-resilient-open-boston-harbor-unveiled (laying out a plan including, "elevated landscapes, enhanced waterfront parks, flood resilient buildings, and revitalized and increased connections and access to the waterfront" to protect Boston from increased flooding from rising sea levels).

[17] *See* Stephen Leahy, *Europe Has Had Five 500-Year Summers in 15 Years. And Now This*, NAT. GEO. (June 28, 2019), https://www.nationalgeographic.com/environment/2019/06/europe-has-had-five-500-year-summers-in-15-years/#close.

have air conditioners.[18] Climate migration will require another large set of adaptation costs, both monetary and non-monetary. Estimates for anticipated migration resulting from climate change range between 25 million and 1 billion climate migrants by 2050,[19] carrying unfathomable psychological, economic, and cultural costs. These estimates are not idle speculation. As of 2016, half of households in the island nation of Kiribati had been affected by sea level rise.[20]

Tort litigation is often motivated by a desire to recuperate a portion of these adaptation costs. For example, states and cities have sought abatement funds to help pay for climate adaptation generally, in addition to seeking damages for increased wildfire costs and damages for hurricane destruction.[21]

C. Comparing the Role of Deterrence in Mitigation and Adaptation Costs

Mitigation costs and adaptation costs are arguably two sides of the same coin. By taking action to mitigate climate change, less adaptation will ultimately be necessary. Nonetheless, I argue that the differences between these types of costs—in particular, the forward-looking nature of mitigation costs as compared to the more backward-looking nature of adaptation costs—mean that cost bearing by consumers can be desirable in the case of mitigation costs, while it does not serve a purpose when accounting for adaptation costs.

Mitigation costs are forward-looking. In considering how to pay these forward-looking costs, it is instructive to consider the general economic model of pollution abatement, which is described in more detail in Part III.A. Greenhouse gas emissions are generally

[18] *See* Iliana Magra et al., *A Heat Wave Bakes Europe, Where Air-Conditioning Is Scarce*, N.Y. TIMES (July 25, 2019), https://www.nytimes.com/2019/07/25/world/europe/heatwave-record-temperatures.html.

[19] *See* INT'L ORG. FOR MIGRATION, IOM OUTLOOK ON MIGRATION, ENVIRONMENT AND CLIMATE CHANGE 38 (2014).

[20] *See* Becky Alexis-Martin et al., *How to Save a Sinking Island Nation*, BBC (Aug. 15, 2019), https://www.bbc.com/future/article/20190813-how-to-save-a-sinking-island-nation.

[21] *See* First Amended Complaint at 94–95, King County v. BP p.l.c., No. 2:18-cv-00758-RSL (W.D. Wa. 2018); *see also* Amended Complaint at 66, City of Oakland v. BP p.l.c., No. 3:17-cv-06011-WHA (N.D. Cal. 2018). To see this trend among other cases, please refer to Appendix A.

considered a negative externality.[22] This externality is internalized if producers are required to account for the social damage incurred by the greenhouse gases in their product, which could happen, for example, through a tort liability or regulatory scheme.[23] Imposing the cost of the externality on producers encourages them to reduce their emissions where it is easy to do so and, through a heightened price signal, encourages consumers in the market to move towards non-polluting alternatives. This double-deterrent signal, where both producers and consumers are encouraged to reduce greenhouse gas emissions, helps organize the market around reduced emissions. Thus, in considering mitigation costs, allowing costs to be passed on to consumers is arguably desirable, as consumers will reduce their emissions in the face of higher costs.

Unlike mitigation costs, adaptation costs are generally backward-looking, but can create forward-looking incentives. As noted above, more strident steps towards mitigation will reduce adaptation costs in the future. In choosing the optimal level of mitigation, it is necessary to weigh the cost of abatement against the future costs of failing to abate.[24] The costs of failing to abate are future adaptation costs incurred because of the failure to pay mitigation costs. Therefore, for society, knowledge about expected future adaptation costs can create forward-looking incentives to pay mitigation costs in the present. For a defendant, the understanding that they will be liable for future adaptation costs should, in theory, cause behavior change in the present. For the sake of clarity, in the context of this Note, I consider only *backward-looking* adaptation costs. Essentially, I will

[22] A negative externality is a "consequence or side effect of one's economic activity causing another . . . to suffer without compensation." *Externality*, BLACK'S LAW DICTIONARY (11th ed. 2019). *See* Reuven Avi-Yonah & David Uhlmann, *Combating Global Climate Change: Why a Carbon Tax Is a Better Response to Global Warming than Cap and Trade*, 28 STAN. ENV'T L.J. 3, 30 ("From an economic standpoint . . . carbon dioxide emissions are the classic externality: emissions occur at no cost to the emitting facility, but at an enormous cost to society as a whole.").

[23] *See* ROBERT COOTER & THOMAS ULEN, LAW AND ECONOMICS 45 (5th ed. 2008) ("The key to achieving the social optimum where there are externalities is to induce private profit-maximizers to restrict their output to the socially, and not privately, optimal point. This is done by adopting policies that cause the firm to operate along the social marginal cost curve rather than along the private marginal cost curve. When this is accomplished, the externality is said to have been *internalized* in the sense that the private firm now takes it into consideration.").

[24] *See infra* Part III.

assume that if a socially optimal deterrent strategy is put in place in the future at Time X, the adaptation costs are those resulting from emissions *prior to* Time X. With this careful construction, unlike mitigation costs, it is not necessary for consumers to bear adaptation costs in order to optimize the market. Rather, in considering adaptation costs, I ask, as a normative matter, who *should* pay and, as a descriptive matter given the parameters of the mechanism in question, who realistically *will* pay.

In the next Part, I will discuss the normative question, by considering the justifications for fossil fuel producers to bear at least a portion of the costs of climate change. Again, because consumers are likely to reduce consumption in response to price increases, a price signal passing through to consumers can be helpful in organizing the market in the face of mitigation costs. As such, if fossil fuel producers should compensate the public for climate change, it may be preferable for that burden to be borne through their payment of adaptation costs. In weighing tort liability and regulatory approaches to manage adaptation costs, it is important to ask which approach will place costs on fossil fuel producers.

II. DIVIDING THE BURDEN OF CLIMATE CHANGE IMPACTS

The predicted effects of climate change are catastrophic and mitigating and adapting to them will be expensive. For example, decarbonizing the United States' electricity grid by switching to renewable energy sources would cost about $4.5 trillion.[25] Who should pay—producers or consumers? Both corrective justice and economic frameworks of tort law suggest that producers should bear at least some costs.

A. Cost Distribution Under a Corrective Justice Framework

Under an Aristotelian corrective justice framework, "the duty to rectify is based . . . on the conjunction of injury and wrongdoing," while more modern interpretations of corrective justice instead focus on "eliminating undeserved or otherwise unjustifiable gains and

[25] *See Deep Decarbonisation: The Multi-Trillion-Dollar Question*, WOOD MACKENZIE, https://www.woodmac.com/news/feature/deep-decarbonisation-the-multi-trillion-dollar-question/?utm_source=gtmarticle&utm_medium=web&utm_campaign=wmpr_griddecarb (last visited Oct. 25, 2020).

losses."[26] A brief history of fossil fuel producer behavior demonstrates clear moral culpability for and unjustifiable gains from continued greenhouse gas emissions and, consequently, climate change damages. That said, the partial culpability of consumers complicates this narrative.

Fossil fuel producers have known for decades that the use of fossil fuels would cause irreparable harm to the environment and, in response to that knowledge, led a massive misinformation campaign to prevent the public from understanding the full expected scope of damages.[27] Prior to 1988, Exxon and other fossil fuel producers contributed to climate change research, however, when Congress began taking testimony and considering policy solutions to climate change, "oil-and-gas executives beg[an] to consider the issue's potential to hurt their profits."[28] Indeed, within six weeks of important congressional testimony, Exxon passed around an internal memo encouraging the company to "emphasize the uncertainty in scientific conclusions," a strategy that has continued to the present day.[29]

Between 2000 and 2016, over $2 billion was spent on climate change lobbying, with fossil fuel producers, electric utilities, and the transportation industry outspending pro-environmental lobbying groups by a factor of ten.[30] This misinformation campaign has been wildly successful. While the American public increasingly

[26] Richard Posner, *The Concept of Corrective Justice in Recent Theories of Tort Law*, 10 J. LEGAL STUD. 187, 190, 197 (1981); *see also* Jules Coleman, *Tort Law and the Demands of Corrective Justice*, 67 IND. L.J. 349, 370–71 (1992) ("The central concern of the principle of corrective justice is the consequences of various sorts of doings, not the character or culpability of the doers." (emphasis omitted)).

[27] *See, e.g.*, Shannon Hall, *Exxon Knew about Climate Change Almost 40 Years Ago*, SCI. AM. (Oct. 26, 2015), https://www.scientificamerican.com/article/exxon-knew-about-climate-change-almost-40-years-ago/ ("Exxon didn't just understand the science, the company actively engaged with it. In the 1970s and 1980s it employed top scientists to look into the issue and launched its own ambitious research program that empirically sampled carbon dioxide and built rigorous climate models.").

[28] Nathaniel Rich, *Losing Earth: The Decade We Almost Stopped Climate Change*, N.Y. TIMES (Aug. 1, 2018), https://www.nytimes.com/interactive/2018/08/01/magazine/climate-change-losing-earth.html.

[29] *Id.*

[30] *See Fossil Fuel Interests Have Outspent Environmental Advocates 10:1 on Climate Lobbying*, YALE ENV'T 360 (July 19, 2018), https://e360.yale.edu/digest/fossil-fuel-interests-have-outspent-environmental-advocates-101-on-climate-lobbying.

understands the risks of climate change,[31] even today, climate denialism percolates through the highest levels of government. In 2015, a U.S. Senator famously threw a snowball on the Senate floor to demonstrate that, given the presence of snow in Washington, D.C. in February, climate change was a hoax.[32] This misinformation campaign by fossil fuel producers, perpetrated to secure their own future financial stability with little to no regard for the immense costs imposed on the rest of the world, is morally repugnant. To quote one of the climate change tort litigation complaints, "[a]ccounting for their wrongful promotion and marketing activities, Defendants bear a dominant responsibility for global warming generally."[33] Arguably, if fossil fuel producers had not fought, tooth and nail, to cloud society's understanding of the damages associated with carbon emissions, a policy response may have been developed earlier.

At the same time, however, it is important to note the role that consumers have played in driving climate change. Consumers provided an insatiable demand for energy and fossil fuel producers delivered. Given the efforts of the fossil fuel industry to conceal the harms of greenhouse gas emissions, however, the mere continued purchase of fossil fuels throughout this period is not terribly convincing when assessing moral blame as between producers and consumers.[34] Still, perhaps consumers were comparatively negligent and should bear some portion of costs.

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[31] *See New Poll: Nearly Half of Americans Are More Convinced Than They Were Five Years Ago That Climate Change Is Happening, With Extreme Weather Driving Their Views*, ENERGY POL'Y INST. AT THE UNIV. OF CHI. (Jan. 22, 2019), https://epic.uchicago.edu/news/new-poll-nearly-half-of-americans-are-more-convinced-than-they-were-five-years-ago-that-climate-change-is-happening-with-extreme-weather-driving-their-views/.

[32] *See* Ted Barrett, *Inhofe Brings Snowball on Senate Floor as Evidence Globe Is Not Warming*, CNN (Feb. 27, 2015), https://www.cnn.com/2015/02/26/politics/james-inhofe-snowball-climate-change/index.html.

[33] Complaint at 7, Mayor and City Council of Baltimore v. BP p.l.c., 388 F. Supp. 3d 538 (Md. Cir. Ct. 2018) (No. 24-C-18-004219).

[34] As an aside, it is important to note that this distinction is murkier when comparing consumers in developed countries to those in developing countries. Energy use has historically been tightly correlated with Gross Domestic Product (GDP), although, developed countries are bucking that trend today, as they move from manufacturing to service-based economies. *See Link Between Growth in Economic Activity and Energy Use is Changing Around the World,* ENERGY INFO. ADMIN. (Nov. 20, 2017), https://www.eia.gov/todayinenergy/detail.php?id=33812. The relationship between energy use and GDP supports the notion that developed countries (and their populations) benefitted from cheap

Applying an Aristotelian corrective justice framework to the facts above, fossil fuel industries should bear the costs of their wrongdoing from, at the very least, the moment they became aware of the harmful effects of that wrongdoing. Under a more modern interpretation of corrective justice, industry was unjustifiably enriched by selling climate change-causing products throughout its entire history. Rather than investigating when fossil fuel producers behaved in a morally culpable manner, the modern approach would ask at what point they began interfering with the rights of consumers or breached a duty of care. Given how long the science of climate change has been settled and publicized, this could reach an even earlier period.[35] Therefore, even if economic incentives were put in place to manage forward-looking mitigation costs, corrective justice suggests the adaptation costs already incurred should be paid, at least in part, by producers.

B. Cost Distribution Under an Economic Incentive Framework

Using an economic framework, which maximizes total social welfare by "correcting externalities and other distortions," is worth considering alongside a corrective justice framework.[36] In other words, this perspective asks which party should bear costs in order to promote socially optimal behavior. Applied here, it supports cost-bearing by fossil fuel producers.

First, fossil fuel producers are often the cheapest cost avoider.[37] There are several areas where cost-effective actions by fossil fuel

industrialization using fossil fuels. This historical benefit is sometimes recognized in international climate negotiations in the context of "common but differentiated responsibilities"—the idea that developed countries are better positioned to reduce emissions and owe a duty to assist developing countries. For a brief discussion of common but differentiated responsibilities, *see* Edward Cameron, *What Is Equity in the Context of Climate Negotiations?*, WORLD RES. INST. (Dec. 14, 2012), https://www.wri.org/blog/2012/12/what-equity-context-climate-negotiations. As between developed and developing countries, it is clear that developed countries should bear more of the costs of global emission reduction efforts.

[35] *See, e.g.*, Adam Frank, *The Forgotten History of Climate-Change Science*, NPR (May 13, 2014), https://www.npr.org/sections/13.7/2014/05/13/312128173/the-forgotten-history-of-climate-change-science (noting that scientists have warned that human emissions could drive climate change for nearly a hundred years, with the idea entering public policy in the late 1950s).

[36] Posner, *supra* note 26, at 201.

[37] *See, e.g.*, Brief of Catherine M. Sharkey as Amicus Curiae Supporting Plaintiff-Appellant at 10, City of New York v. B.P. p.l.c., (No. 18-2188) (filed Nov. 11,

producers could have substantial emissions impacts. The natural gas industry illustrates this effectively. When burned, natural gas releases about 40 percent less CO_2 per unit of energy produced, as compared to coal.[38] For this reason, it is often heralded as a "bridge fuel."[39] Unfortunately, natural gas has a leakage problem. Over a twenty-year time horizon, the CO_2 released from burning natural gas to produce energy represents only *half* of the natural gas impact on climate change.[40] This is due to methane—a very potent greenhouse gas—leaking across the U.S. oil and gas supply chain.[41] In fact, researchers estimate that over a twenty-year time horizon, the methane leakage from the oil and gas supply chain has a climate impact equivalent to "the annual CO_2 emissions from *all U.S. coal-fired power plants* operating in 2015."[42] That escaped gas has value, and recapturing it is theoretically cost-justified,[43] but leaks still continue. If the fossil fuel industry were responsible for its greenhouse gas emissions, it would be further incentivized to reduce these emissions.

2019) ("[F]ossil fuel companies are better positioned to internalize the accident costs produced as a result of fossil fuel use, by incorporating the costs of expected accidents into the price of fossil fuels") (quoting Eduardo M. Peñalver, *Acts of God or Toxic Torts—Applying Tort Principles to the Problem of Climate Change*, 38 NAT. RES. J. 563, 573 (1998)).

[38] *See How Much Carbon Dioxide Is Produced When Different Fuels Are Burned?*, ENERGY INFO. ADMIN. (last updated June 17, 2020), https://www.eia.gov/tools/faqs/faq.php?id=73&t=11 (noting natural gas emits about 117 pounds of CO_2 per million British thermal units (Btu) of energy produced, as compared to coal emitting between 205 to 220 pounds of CO_2 per million Btu, depending on the type of coal).

[39] *See* David Roberts, *More Natural Gas Isn't a "Middle Ground" – It's a Climate Disaster*, VOX (May 30, 2019), https://www.vox.com/energy-and-environment/2019/5/30/18643819/climate-change-natural-gas-middle-ground ("It was en vogue during the Obama years to refer to natural gas as a 'bridge fuel,' a fossil fuel that could help reduce emissions while truly clean alternatives were developed.").

[40] *See* Ramón Alvarez et al., *Assessment of Methane Emissions from the U.S. Oil and Gas Supply Chain*, 361 SCI. 186, 188 (July 13, 2018) (estimating that the methane—another potent greenhouse gas—leaked across the U.S. oil and gas supply chain, over a twenty-year time horizon, has a radiative forcing effect equivalent to the CO_2 emitted by converting the natural gas to energy).

[41] *See id.*

[42] *Id.* (emphasis added).

[43] *See* John Schwartz & Brad Plumer, *The Natural Gas Industry Has a Leak Problem*, N.Y. TIMES (June 21, 2018), https://www.nytimes.com/2018/06/21/climate/methane-leaks.html.

Similarly, petroleum refining is one of the most significant carbon-emitting sources in the United States.[44] In 2010, EPA identified a number of best practices for this industry to reduce greenhouse gas emissions, some of which estimated emissions savings of up to 10 percent and many of which had payoff times of only one or two years.[45] These practices included regular maintenance, "implement[ing] energy management systems to improve energy efficiency," and changing equipment—for example, replacing the treatment system used in boiler feed water preparation has a payback horizon of between two and five years and is expected to reduce greenhouse gas emissions by up to ten percent.[46] Increasingly, fossil fuel producers are setting voluntary emission reduction goals—for example, ExxonMobil has pledged to reduce its upstream emissions by at least 15 percent by 2025[47]—suggesting that such reductions are reasonably attainable. If fossil fuel producers were held accountable for their emissions, however, they would be incentivized to act more quickly.

The role of industry as the cheapest cost avoider, however, is not an open and shut case. Consumers can also be cheap cost avoiders. Imagine a consumer who forgets to turn off the lights in the morning on their way to work or fully heats an empty house rather than making use of their programmable thermostat—such a consumer can reduce emissions at low, zero, or even negative[48] personal cost with a very small behavioral change. Today, certain programs capitalize on this notion by allowing electricity grids to purchase *non-use* of electricity from consumers; consumers agree to limit their electricity use during certain hours in exchange for monetary

[44] *See* EPA OFF. OF AIR AND RADIATION, AVAILABLE AND EMERGING TECHNOLOGIES REDUCING GREENHOUSE GAS EMISSIONS FROM THE PETROLEUM REFINING INDUSTRY 9 (2010), https://www.epa.gov/sites/production/files/2015-12/documents/refineries.pdf.

[45] *See id.* at 11–16.

[46] *Id.*

[47] *See ExxonMobil Announces Emission Reduction Plans; Expects to Meet 2020 Goals*, EXXONMOBIL (Dec. 14, 2020), https://corporate.exxonmobil.com/News/Newsroom/News-releases/2020/1214_ExxonMobil-announces-2025-emissions-reductions_expects-to-meet-2020-plan.

[48] Due to electricity cost savings.

compensation.[49] Such programs are called demand response programs and offer a cheap way to balance the electricity grid.[50]

Given the role of consumer behavior in energy use, ultimately, one of the strongest economic arguments in favor of initially placing costs on producers derives from the resulting downstream incentives. If a fossil fuel producer bears the cost of its pollution, its marginal cost of production will increase to account for the internalization of that externality. This, in turn, should lead to increased prices and decreased consumer demand, creating a secondary deterrent effect in consumer behavior. It is well established, for example, that higher gas prices are linked to fewer vehicle miles travelled.[51] This theoretical model depends on an increased cost of production leading to an increased sale price. In Part IV of this Note, I posit that tort liability creates only patchwork deterrence, which will not result in these costs being passed on to consumers, and which thus reduces the efficacy of this double-deterrent effect. This makes tort liability undesirable for forward-looking mitigation costs.[52] Regulatory approaches, however, apply equally across the market and therefore can create these desirable secondary deterrence effects.[53]

By contrast, placing the costs of climate change on consumers will result in sub-optimal deterrence. As above, if taxpayers face higher prices for fossil fuels, they will be deterred from energy consumption. But there are two downsides to this, as compared to placing the burden on fossil fuel producers. First, while some consumers can choose their electric supplier, consumers generally purchase electricity from their utility and do not choose their electricity mix.[54]

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[49] *See* Justin Gundlach & Burcin Unel, *Getting the Value of Distributed Energy Resources Right: Using a Societal Value Stack*, INST. FOR POL'Y INTEGRITY (Dec. 2019), https://policyintegrity.org/files/publications/Getting_the_Value_of_Distributed_Energy_Resources_Right.pdf.

[50] *See id.*

[51] *See Fact #906: January 4, 2016 VMT and the Price of Gasoline Typically Move in Opposition*, OFF. OF ENERGY AND RENEWABLE RES. (Jan. 4, 2016), https://www.energy.gov/eere/vehicles/fact-906-january-4-2016-vmt-and-price-gasoline-typically-move-opposition.

[52] *See supra* Part III.C.

[53] To be discussed more thoroughly in Part V.

[54] *See* Kathryne Cleary & Karen Palmer, US ELECTRICITY MARKETS 101, RES. FOR THE FUTURE (Mar. 3, 2020), https://media.rff.org/documents/US_Electricity_Markets_101.pdf (explaining that consumers must purchase from their utility in regulated markets, and that in deregulated markets consumers have the

Most consumers primarily choose whether to consume or not to consume. As such, while consumers might reduce overall demand for electricity, it is not necessarily the case that they can selectively reduce demand only for non-renewable electricity.[55] In contrast, placing the burden on fossil fuel producers should ensure that downstream purchasers—including utilities—face the increased price *of fossil fuels*. Second, if the burden is initially placed on consumers, the costs are no longer on the cheapest cost avoider in terms of decreasing methane leakage or improving efficiency of petroleum refining; those benefits may no longer be realized.

On balance, recognizing that many costs will ultimately be handed down to consumers, optimal deterrence and corrective justice arguments favor placing the burden on producers first and keeping it there. It is important to bear in mind, however, that the status quo—limited climate change mitigation—places the *entire* burden on the general public, who will bear the severe costs of climate change in the future. The relevant trade-off is whether society bears costs today, through mitigation, or tomorrow, through increased adaptation.[56]

III. THE THEORETICAL MODEL OF CLIMATE CHANGE ABATEMENT

Having laid out the costs associated with climate change—both mitigation and adaptation—and set forth why it is desirable for fossil fuel producers to bear those costs, I now ask how regulatory and tort approaches can best be levied to achieve an optimal level of greenhouse gas emissions without consumers bearing the full cost. First, I will discuss the general economic theory of pollution abatement. Second, I will discuss the theoretical models of mitigating climate change under regulatory and tort schemes.

option to purchase from other sources, but that the terms of those offers are often undesirable).

[55] An important caveat—at least half of U.S. electricity customers currently have the option to purchase solely renewable energy from their utility at a premium. *See Buying Clean Electricity*, U.S. DEP'T OF ENERGY (last visited Feb. 15, 2021), https://www.energy.gov/energysaver/buying-and-making-electricity/buying-clean-electricity.

[56] See Part I for a discussion of mitigation and adaptation costs.

A. The General Economic Model of Pollution Abatement

The economic model for pollution abatement aims to maximize social welfare by calling for abatement up to the point where the marginal cost of mitigation exceeds the marginal benefit of abatement. In other words, trading-off increased mitigation costs today for decreased adaptation costs in the future, should cost up to, but not exceed, a certain dollar value, which is contingent on the expected benefits of abatement.

It is fairly intuitive to show that the correct timeframe for abatement is not total abatement beginning tomorrow. The repercussions from immediately suspending all fossil fuel use would be catastrophic. Today, fossil fuels are used to keep people warm in the winter and cool in the summer, to clean drinking water, to produce and transport food, and to provide medical care. On the other hand, the correct level of abatement is certainly not zero either, given that fossil fuel emissions drive climate change and, therefore, there are externalities that are not being internalized. As always, the limit cases are easy. The correct level of abatement is greater than zero and less than infinity.

In order to create a useful metric to determine the correct level of abatement, economists estimate the value of reduced climate harms—adaptation costs—for each marginal ton of CO_2 equivalent emissions.[57] This value is then discounted to account for the fact that a dollar today is worth more than a dollar tomorrow, both due to time preferences and economic growth.[58] The resulting number is

[57] There are many different greenhouse gases that contribute to climate change. For example, methane causes warming at a strength 28-87 times greater than CO_2; however, it has a much shorter atmospheric lifespan. *See* Peter Howard & Jason Schwartz, *Think Global: Reciprocity & Global SCC*, 42 COLUM. J. OF ENV'T L. 203, 217 (2017). Because CO_2 is the primary driver of climate change, the field will convert other greenhouse gases into CO_2-equivalent emissions as a common unit. *See id*.

[58] The Office for Budget and Management (OMB) puts forth the following rationales for discounting:

> (a) Resources that are invested will normally earn a positive return, so current consumption is more expensive than future consumption, since you are giving up that expected return on investment when you consume today.
>
> (b) Postponed benefits also have a cost because people generally prefer present to future consumption. They are said to have positive time preference.

called the Social Cost of Carbon, described as "the most important figure you've never heard of."[59] In 2013, an Interagency Working Group (IWG) under the Obama administration estimated the Social Cost of Carbon at $37/ton of CO_2 ($46 in 2020 dollars).[60] Today, regulators use the Social Cost of Carbon in cost benefit analyses to account for the true costs of emissions.[61]

That said, the Social Cost of Carbon is an imperfect metric. There are unavoidable challenges to estimating it, and as such, the IWG's number "should be treated as a lower bound."[62] These challenges include, among others: (1) high unquantifiable costs, such as the psychological, emotional, and cultural harm of forced mass migration due to severe drought; (2) the complexity of our climate and the constantly evolving nature of the understanding of climate impacts;[63] and (3) uncertainty within and between climate models.[64] Evidence that the IWG's value is underestimated is reflected in the much higher estimates of other countries. Sweden, Germany, and

> (c) Also, if consumption continues to increase over time, as it has for most of U.S. history, an increment of consumption will be less valuable in the future than it would be today, because the principle of diminishing marginal utility implies that as total consumption increases, the value of a marginal unit of consumption tends to decline.

OFF. OF MGMT. & BUDGET, EXEC. OFF. OF THE PRESIDENT, OMB CIRCULAR A-4, at 32 (Sept. 17, 2003).

[59] *The EPA is Rewriting the Most Important Number in Climate Economics*, ECONOMIST, Nov. 16, 2017, https://www.economist.com/united-states/2017/11/16/the-epa-is-rewriting-the-most-important-number-in-climate-economics.

[60] *See* Howard Shelanski, *Refining Estimates of the Social Cost of Carbon*, OBAMA WHITE HOUSE ARCHIVES (Nov. 1, 2013), https://obamawhitehouse.archives.gov/blog/2013/11/01/refining-estimates-social-cost-carbon.

[61] For a thorough overview of the role of the Social Cost of Carbon as it pertains to the National Environmental Policy Act (NEPA), refer to Zoe Palenik, *The Social Cost of Carbon in the Courts*, 28 N.Y.U. ENV'T L.J. 393 (2020).

[62] *Are the Federal IWG Numbers Still the Best?*, COST OF CARBON POLLUTION, https://costofcarbon.org/faq/are-the-federal-iwg-numbers-still-the-best (last visited Apr. 3, 2020).

[63] *See* NAT'L ACAD. OF THE SCIS., VALUING CLIMATE DAMAGES, UPDATING ESTIMATION OF THE SOCIAL COST OF CARBON DIOXIDE 153 (2017) (discussing current limitations in the IWG process).

[64] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014 SYNTHESIS REPORT: SUMMARY FOR POLICYMAKERS 20 (R.K. Pachauri & L.A. Meyer eds., 2014), https://www.ipcc.ch/site/assets/uploads/2018/02/AR5_SYR_FINAL_SPM.pdf (providing a range of surface temperature increases from 3.7°C to 4.8°C in 2100, absent additional mitigation—nearly a one degree range).

the UK estimate $168/ton, $171/ton, and $118/ton, respectively.[65] Even corporations use a higher value, estimating the Social Cost of Carbon at up to $82, which is 60 percent higher than the IWG's estimated value.[66]

For the purposes of the theoretical models of tort and regulatory approaches, it is only necessary to know that some accurately estimated Social Cost of Carbon could feasibly exist. Later, when I discuss the practical realities of cost-bearing, I rely on the U.S. government's conservative estimate for the Social Cost of Carbon for illustrative purposes, however, I believe that my argument is robust to higher values for the Social Cost of Carbon.

B. The Theoretical Model of Regulatory Deterrence

In the last section, I discussed the theoretical model of abatement, and how the Social Cost of Carbon can be used to estimate the social damages from each ton of carbon emitted. Now, I will discuss how the Social Cost of Carbon fits into a regulatory scheme. Economic approaches to climate change regulation place an additional cost on all greenhouse gas emissions, causing the emitters to internalize the externalities of their production.[67] Popular discourse has centered around two mechanisms for internalizing these externalities: carbon taxes and cap-and-trade.[68]

A Pigouvian carbon tax—a tax levied for each ton of CO_2 emitted—set equal to the Social Cost of Carbon would result in perfect internalization.[69] Under a cap-and-trade scheme, a regulator determines how many total tons of CO_2 polluters can emit, and then auctions off permits to them.[70] A polluter may only emit up to the

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65 *See Are the Federal IWG Numbers Still the Best?*, *supra* note 62.

66 *See id.*

67 *See* COOTER & ULEN, *supra* note 23 at 45.

68 *See generally* Avi-Yonah & Uhlmann, *supra* note 22.

69 *See, e.g.*, Jonathan Masur & Eric A. Posner, *Toward a Pigouvian State*, 164 U. PA. L. REV. 93, 95–96 (2015) ("A Pigouvian tax is a tax equal to the harm that the firm imposes on third parties. For example, if a manufacturer pollutes, and the pollution causes a harm of $100 per unit of pollution to people who live in the area, then the firm should pay a tax of $100 per unit of pollution. . . . It would be an understatement to say that economists endorse Pigouvian taxes over command-and-control regulation.").

70 *See* ROBERT N. STAVINS, *Experience With Market-Based Environmental Policy Instruments*, *in* HANDBOOK OF ENV'T ECON. 355, 392–93 (Mäler & Vincent eds., 2003).

amount their permit allows, but may sell or purchase permits from other polluters.[71] Assuming that a carbon tax is set at the Social Cost of Carbon, and that the number of permits in a cap-and-trade scheme is set at a level that optimally trades off increased costs today for decreased costs tomorrow, the price of a permit to emit a ton of CO_2 and the carbon tax should be the same. That is to say, if regulators know which price to pick or how many permits to sell, they can get to the exact same amount of emissions, at the same price, with either a Pigouvian tax or a cap-and-trade scheme.[72]

Whether accomplished through a cap-and-trade scheme or a carbon tax, internalizing the cost of emissions renders fossil fuels comparatively more expensive to produce and sell than they would be absent the additional cost. Fossil fuel producers have two avenues to respond to these increased prices. First, they may choose to pass the cost in whole, or in part, on to consumers. Second, they may choose to bear the extra cost burden themselves, through reduced profits.

If the producers respond by increasing prices, non-emitting sources of energy, such as wind and solar, will become more competitive, making it more worthwhile to invest in research and development and to build more projects.[73] The increase in price necessary to spur more renewable development may not need to be very large. Onshore wind is currently price-competitive with combined-cycle natural gas electricity generation, even without government

[71] *See id.*

[72] *See cf. id.* at 102 (noting that Pigouvian taxes and cap-and-trade schemes both impose per-unit costs equal to the social cost of the activity and discussing the challenges of uncertainty in cap-and-trade scheme designs). In practice, a permit scheme provides greater control over the total emissions, while a tax provides greater control over the economic incentives at play. The European carbon markets have been quite volatile, for example. *See EU Carbon Price Crashes to Record Low*, GUARDIAN (Jan. 24, 2013), https://www.theguardian.com/environment/2013/jan/24/eu-carbon-price-crash-record-low#:~:text=The%20European%20Union's%20flagship%20climate,to%20support%20the%20struggling%20market.

[73] *See* Robert N. Stavins, *A Meaningful U.S. Cap-and-Trade System to Address Climate Change*, 32 HARV. ENV'T L. REV. 293, 305 (2008) ("As a policy positively or negatively affects the profitability of firms, investors experience changes in the value of investments in those firms. Finally, workers experience changes in employment and wages.").

subsidies.[74] With subsidies, both onshore wind and solar are price-competitive with combined-cycle natural gas.[75] In fact, in January 2020, the Energy Information Administration (EIA) expected solar and wind to represent 76 percent of additional capacity built over the course of the year.[76] If fossil fuel producers were held accountable for the climate externalities[77] of coal and natural gas, renewable energy sources would be even more competitive, such that investment might happen on a faster timescale.

In addition, consumers faced with higher energy costs reduce energy consumption in order to save money.[78] For example, vehicle miles travelled and gasoline prices have historically moved in opposite directions, showing that consumers have a tendency to change their behavior in the face of increased prices.[79] This creates a second level of deterrence—consumers decrease *demand* which mitigates some of the underlying costs of shifting energy systems.

To illustrate the costs of shifting energy systems, consider the following example. Imagine a world where I can buy up to 10 Megawatt-hours (MWh) of energy from Source A at $40/MWh and up to 5 MWh of energy from Source B at $60/MWh, and I would like to purchase 10 MWh of energy. Absent a tax, I would choose to purchase from Source A and pay a total of $400. If the government

[74] *See* U.S. ENERGY INFO. ADMIN., LEVELIZED COST AND LEVELIZED AVOIDED COST OF NEW GENERATION RESOURCES IN THE ANNUAL ENERGY OUTLOOK 2020, at 7 (Feb. 2020) (comparing the total LCOE, including tax credits, for "wind, onshore" and "Solar photovoltaic" with "Combined cycle" and "Advanced nuclear").

[75] *See id.* (comparing the total LCOE, including tax credits, for "wind, onshore" and "Solar photovoltaic" with "Combined cycle" and "Advanced nuclear").

[76] *See New Electric Generating Capacity in 2020 Will Come Primarily from Wind and Solar*, ENERGY INFO. ADMIN. (Jan. 14, 2020), https://www.eia.gov/todayinenergy/detail.php?id=42495.

[77] It is necessary to point out that the climate externalities of fossil fuels do not account for nearly all of the social externalities. The particulate matter emissions from coal plants in the United States lead to thousands of deaths per year, for example. *See* Jay Apt, *The Other Reason to Shift Away from Coal: Air Pollution That Kills Thousands Every Year*, SCI. AM. BLOG (June 7, 2017), https://www.scientificamerican.com/article/the-other-reason-to-shift-away-from-coal-air-pollution-that-kills-thousands-every-year/. For the purposes of this Note, however, I focus on climate impacts only.

[78] *See* Stavins, *supra* note 73, at 305 ("As producers pass through increased costs, consumers experience increased prices of energy and non-energy goods, as well as reduced consumption.").

[79] *See Fact #906: January 4, 2016 VMT and the Price of Gasoline Typically Move in Opposition*, *supra* note 51.

places a $30 tax on energy from Source A, I will buy my first 5 MWh from Source B, for a total cost of $300, and my next 5 MWh from Source A, which now costs $40 + $30 = $70/MWh, meaning 5 MWh costs $350. My energy costs are now $650 instead of $400.

When a consumer pays an additional tax that is funneled towards investments in energy efficiency or clean technology, those dollars are simply being traded across time: an extra dollar spent today for a dollar less in climate damage tomorrow. If a tax or permit scheme is revenue neutral, that money returns to the consumer—or, at least, to consumers in aggregate—via rebates or decreased taxes.[80] While consumers still shift their behavior in response to the heightened price, the amount they pay in the present is simply the difference in electricity costs, as compared to the counterfactual where there is no tax. Applying this to the example above, I paid $30/MWh x 5MWh = $150 in taxes. Returning that $150 in taxes from my $650 in energy costs, the final cost is still $500 for 10 MWh of energy instead of $400. This example demonstrates that even if a tax is revenue-neutral, there may still be costs to changing energy systems until technology adapts or, in this case, Source B builds more capacity and decreases in cost.

A second possibility is that, instead of increasing prices and passing on costs to consumers, producers simply internalize the costs and reduce profits. As will be discussed below, tort litigation rather than regulation is more likely to create this result. This could still potentially drive investment in other energy resources, as shareholders may see greater profit opportunities elsewhere.

Requiring fossil fuel producers to internalize the climate externalities of their products renders emission-free energy sources more competitive than in the absence of any tax or permit scheme, making them more worthwhile investments and leading to an increase in pollution abatement. Assuming the policy is well-designed, greenhouse gas emissions should reduce to a level that maximizes social welfare.

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[80] *See, e.g.*, Brian Murray & Nicholas Rivers, *British Columbia's Revenue-Neutral Carbon Tax: A Review of the Latest "Grand Experiment" in Environmental Policy*, 86 ENERGY POL'Y 674, 677 (2015) (discussing the implementation of British Columbia's revenue neutral tax).

C. The Theoretical Model of Tort Liability

Under a tort liability framework, defendants have an *ex ante* incentive to internalize the future costs of their externalities equal to the likely costs that they will face in litigation, multiplied by the likelihood that they will be sued. In some cases, this internalization is diluted because tortfeasors are not regularly apprehended, either because victims lack access to the legal system or because the tortfeasor goes undetected.[81] Punitive damages creates an opportunity to magnify the deterrent effect, as the increased expected cost of a lawsuit can balance out the probability that a given defendant evades liability. In such a case, punitive damages allow for a fuller internalization of societal damages, which aids with creating proper economic deterrence.[82]

If all potential plaintiffs sue all potential defendants for all harms, or if a subset of plaintiffs sue a proportion of defendants paired with a multiplier to account for the defendants not being sued,[83] tort litigation could result in a socially optimal level of deterrence. The full internalization of harms would impose the Social Cost of Carbon on each ton of emissions. In theory, therefore, tort liability imposes the same economic incentives as either a cap-and-trade or carbon tax scheme. But, given procedural and practical limitations on tort litigation, does this theory work in practice?

IV. THE REALITY OF TORT LIABILITY

In this Part, I examine how climate change tort litigation has worked in practice. To this point, I have discussed the culpability of fossil fuel producers, generally, and theoretical framework for regulatory and tort approaches to climate change, broadly. Mirroring the focus of tort litigation on oil producers, I now shift to a narrower discussion of oil producer liability. I conclude that, thus far, multiple factors lead to a systemic underestimation of liability, dampening any resultant price signal and reducing the ability of tort liability to

[81] For a discussion of various examples of underdeterrence and potential solutions, refer to Saul Levmore, *Probabilistic Recoveries, Restitution, and Recurring Wrongs*, 19 J. LEGAL STUD. 691–92 (1990).

[82] *See, e.g.*, Catherine M. Sharkey, *Punitive Damages as Societal Damages*, 113 YALE L.J. 347, 369 (2003).

[83] *See* Catherine M. Sharkey, *The BP Oil Spill Settlements, Classwide Punitive Damages, and Societal Deterrence*, 64 DEPAUL L. REV. 681, 682 (2015).

deter future emissions. These factors fall into the following general camps: (1) the defendant tortfeasors are mostly large, national oil producers—smaller producers or large state-owned foreign producers are not joined, creating no incentive for them to internalize costs; (2) certain sources of emissions, such as agricultural emissions and, in many cases, coal emissions, escape liability nearly entirely because these lawsuits focus heavily on oil producers; (3) lack of a federal common law claim may create uncertainty and non-uniformity in adjudication; and (4) the current U.S. tort litigation model, by its structure, cannot consider international harms. These deficiencies stem from both procedural and doctrinal challenges that curtail expected and actual liability for emitters, ultimately calling into question whether tort liability can create effective *ex ante* incentives.

Before diving into my results, a quick note on my methodology. As of October 2020, the Sabin Center for Climate Change Law's Climate Change Litigation Tracker listed twenty-six climate change lawsuits rooted in common law claims.[84] Of these, six were outside the scope of my analysis, for example, contract disputes over potential carbon sequestration and storage projects.[85] The remaining twenty were brought with an aim to hold emitters responsible for climate change impacts and, of those, seventeen were aimed at fossil fuel producers or power producers. Again, because these suits focus most heavily on oil producers—all seventeen cases included oil producers, often to the exclusion of other emitters—I have focused my analysis on the impacts of tort liability on the oil industry.

Procedurally, these cases are brought by joining a number of large emitters or producers of greenhouse gases who, when taken together, represent the source of a substantial portion of all greenhouse gas emissions throughout history.[86] Of the seventeen cases referenced above, seven joined fewer than ten defendants, one joined sixteen defendants, five joined between twenty and twenty-

[84] For an overview of each case, see Appendix A. For a breakdown of the defendants joined in each case, see Appendix B.

[85] *See, e.g.*, Complaint, Savoy Energy, LLC v. N.M. Inst. of Mining & Tech., No. 2:10-cv-10-DB (D. Utah Jan. 10, 2010).

[86] *See, e.g.*, Am. Elec. Power Co. v. Connecticut, 564 U.S. 410, 418 (2011) (noting that five defendants constitute 25% of emissions in the domestic electric power sector); City of Oakland v. BP p.l.c., 325 F. Supp. 3d 1017, 1021 (N.D. Cal. 2018) (noting that five defendants were responsible for 11% of all emissions since the Industrial Revolution).

nine defendants, and three joined thirty or more defendants. Many of the joined defendants were different subsidiaries within the same corporation, as in *County of San Manteo v. Chevron Corp.*, in which the following pairs were joined:[87]

- Chevron and Chevron USA
- BP p.l.c. and BP America
- Devon Energy Corp. and Devon Energy Production Co.
- ENI SPA and ENI Oil & Gas Inc.
- ConocoPhillips, ConocoPhillips Co., Phillips 66, and Phillips 66 Co.
- Occidental Petroleum Corp., Occidental Chemical Corp.
- Repsol SA, Repsol Energy North America Corp., and Repsol Trading USA Corp.
- Rio Tinto PLC, Rio Tinto Ltd., Rio Tinto Energy America, Inc., Rio Tinto Minerals Inc., and Rio Tinto Service Inc.
- Marathon Oil Co., Marathon Oil Corp., and Marathon Petroleum Corp.

This practice is common across the lawsuits I reviewed, meaning that as a practical matter, fewer unique emitters are being joined than the raw numbers might suggest.

A. Certain Oil Producers Systemically Avoid Liability

In analyzing these seventeen tort-based climate change lawsuits, I find that medium and small-scale producers are only very rarely joined in these cases and that foreign state-owned oil producers almost never are. I propose theories for why such entities are not joined, how they might be joined, and the repercussions of failing to join them.

1. Producers That Are Not Large, Vertically Integrated Operators Are Rarely Included in Litigation

Overwhelmingly, large vertically integrated operators are joined in litigation, while other producers are not. As will be shown, this near exclusive joining of the nation's largest emitters without inclusion of smaller producers lets almost all producers off the hook, save for the very largest.

[87] *See* Complaint at 1–2, County of San Mateo v. Chevron Corp., No. 17 Civ. 03222 (Cal. Super. Ct. July 17, 2017).

To better understand the distribution of producers, I rely on designations by the Independent Petroleum Association of America (IPAA). According to the IPAA, approximately 90 percent of oil and natural gas produced in the United States is produced by independent operators, defined as operators that do not conduct their own refining.[88] Producers like Chevron, Shell, and BP are not independent operators, but are "fully integrated" Global Operators.[89] Global Operators account for 18.7 percent of U.S. oil production.[90] Of the eight producers that the IPAA classifies as Global Operators, seven have been joined in at least one of the cases in my sample. Both ExxonMobil and Chevron were joined in fifteen out of seventeen cases, while BP and Shell (or their subsidiaries) were each joined in thirteen cases.[91] ENI and Total (or their subsidiaries) were joined only in three cases, and Statoil was joined only once.[92] This analysis demonstrates that a clear group of defendants are present in nearly every case, but also suggests that there are other Global Operators—ENI and Total—which, for whatever reason, have largely escaped prosecution.

Moving away from the Global Operator category, the rate at which producers are joined drops precipitously. The next largest group of producers are Large Independent producers, defined by the IPAA as those that produce over 200,000 barrels of oil/day but are not vertically integrated.[93] These producers represent 34.4 percent of U.S. oil production,[94] but are joined as defendants much less frequently than Global Operators. Of the eighteen Large Independent oil producers, only half are joined in any of the cases in my sample and, of those that are joined, they are joined less often than the Global Operators.[95] The median Large Independent oil producer that appears at least once as a defendant is joined in only four cases. Recall that, in contrast, ExxonMobil and Chevron were joined in

88 *See* BOB FRYKLUND ET AL., INDEP. PETROLEUM ASSOC. OF AM., THE ECONOMIC CONTRIBUTION OF INDEPENDENT OPERATORS IN THE UNITED STATES 3 (2019), https://www.ipaa.org/wp-content/uploads/2019/05/IPAA-Economic-Contribution-Final-Report.pdf.

89 *Id.*

90 *See id.* at 8.

91 *See infra* Appendix B.

92 *See id.*

93 *See* FRYKLUND ET AL. *supra* note 88, at 3.

94 *See id.* at 6, 8.

95 *Compare id.* at 19, *with* Appendix B.

fifteen out of seventeen cases. Large Independent producers are receiving comparatively little attention from plaintiffs.

Given that Large Independent producers represent over a third of U.S. oil production, it is surprising that they are joined in comparatively few cases. There are a few potential explanations for this discrepancy. First, and seemingly most likely, plaintiffs are targeting the producers with the deepest pockets. Of the five most frequently joined defendants,[96] four were listed in the Top 15 of S&P Global Platts 2019 Top 250 Global Energy Company Rankings, which "recognize[s] the top financial performers in energy" based on a company's "asset worth, revenues, profits and return on invested capital."[97] Second, it is possible that Global Operators are more attractive to the plaintiffs bringing these lawsuits because they are vertically integrated,[98] eliminating any arguments that liability should be targeted further down the production line. Finally, Global Operators have long histories of fossil fuel production, which may assist with proving causality, a required element in a tort claim. For example, BP was founded in 1908,[99] Chevron in 1879,[100] Shell began oil production in the 1880s,[101] and Standard Oil, the predecessor to ExxonMobil, was founded in 1870.[102] ConocoPhillips, the most commonly joined Large Independent producer, has a similarly long history, with its predecessor Continental Oil founded in 1875.[103] As such, in addition to being household names, it may be the case that the Global Operators are more likely to be joined in these lawsuits

[96] The five most commonly joined defendants are Chevron, ConocoPhillips, ExxonMobil, BP, and Shell (and their respective subsidiaries). *See* Appendix B.

[97] *See 2019 Top 250 Companies*, S&P GLOBAL PLATTS, https://www.spglobal.com/platts/top250/rankings/2019 (last visited Dec. 13, 2020); *History of Top 250*, S&P GLOBAL PLATTS, https://top250.platts.com/HistoryOfTop250 (last visited Dec. 13, 2020).

[98] *See* FRYKLUND, *supra* note 88, at 3.

[99] *See Our History*, BP, https://www.bp.com/en/global/corporate/who-we-are/our-history/first-oil.html (last visited Oct. 21, 2020).

[100] *See History*, CHEVRON, https://www.chevron.com/about/history (last visited Oct. 21, 2020).

[101] *See Company History*, SHELL, https://www.shell.com/about-us/our-heritage/our-company-history.html (last visited Oct. 21, 2020).

[102] *See Our History*, EXXONMOBIL (Sept. 4, 2018), https://corporate.exxonmobil.com/Company/Who-we-are/Our-history.

[103] *See 1909-1875*, CONOCOPHILLIPS, http://www.conocophillips.com/about-us/our-history/1909-1875/ (last visited Oct. 21, 2020).

because their longstanding history means that they represent a larger share of total cumulative emissions.

In line with the fact that Large Independent oil producers receive little attention from plaintiffs, procedural practicality and shallower pockets shield the smallest operators from being joined in these suits. This will likely eliminate any deterrent signal aimed at smaller producers. The remaining operators—not Global or Large Independent—represent nearly half of the oil production in the United States.[104] There are an estimated 2,189 producers in this universe, only a small fraction of which are represented in any of these cases. Of those that are joined, it is overwhelmingly the case that they appear as a defendant in only one case.[105]

It seems that the choice to include a small producer is often driven by plaintiffs' interest in a procedural advantage. In particular, based on the procedural histories of the cases I analyzed, defendants frequently seek to remove their case to federal court,[106] presumably due to a perceived benefit from a more neutral forum. Adding a non-diverse defendant can keep the case in state court, giving plaintiffs––who want to remain in state court—an incentive to join a small, local defendant. To illustrate this point, consider the following two cases. First, in *Board of County Commissioners and City of Boulder v. Suncor*, the plaintiffs joined Suncor Energy Sales (U.S.A.) as a defendant;[107] this is the only case in which Suncor appears.[108] Suncor Energy Sales (U.S.A.) is headquartered in Denver, Colorado,[109] which prevents removal to federal court on diversity grounds.[110] For context, Suncor is responsible for two billion tons of global

104 *See* FRYKLUND, *supra* note 88, at 6.

105 *See* Appendix B. In eight of seventeen cases, "Entities 1-100" or "Does 1-10" are joined, leaving open the possibility that some of these other producers may later be added to the case, after more discovery has been conducted. Given that the names of the top fuel producers are readily available, however, it is unclear what additional information may come through discovery that would allow for further identification of defendants.

106 *See generally* Appendix A (demonstrating the frequency with which defendants seek to remove the case to federal court).

107 *See* Amended Complaint at 1, Bd. of Cnty. Comm'rs of Boulder County v. Suncor Energy, Inc., No. 2018CV030349 (Colo. Dist. Ct. 2d Div. 2018).

108 *See* Appendix B.

109 *See Contact Us*, SUNCOR CONNECTIONS, https://connections.suncor.com/contact-us (last visited Nov. 7, 2020).

110 *See* 28 U.S.C. § 1441(b)(2) (2018) (prohibiting removal of a case based on diversity jurisdiction if a defendant is a citizen of that state).

greenhouse gas emissions since 1988, approximately an eighth of Exxon's production.[111] Lacking diversity jurisdiction, Suncor and Exxon put forth six alternative arguments for federal subject matter jurisdiction, which the United States District Court for the District of Colorado rejected, remanding the case to state court.[112] The Tenth Circuit affirmed.[113] Similarly, in *City and County of Honolulu v. Sunoco*, Aloha Petroleum—a local convenience store and gas station chain headquartered in Hawaii[114]—was included in the litigation.[115] The above suggests that adding small producers or other defendants to prevent complete diversity is a worthwhile tactic that plaintiffs are employing. Outside of this exception, however, small producers are rarely included in cases.

To the extent that plaintiffs' choice to join primarily Global Operators is driven by procedural challenges in joining all possible defendants, plaintiffs could consider creating a defendant class if they wanted to include smaller oil producers.[116] In practice, however, defendant class actions are very rare and, just as in plaintiff class actions, there are limits on how the class can be structured. For example, courts are more likely to join defendants in a class when there is a "juridical link as some [independent] legal relationship which relates all defendants in a way such that single resolution of the dispute is preferred to a multiplicity of similar actions" with examples including "partnerships or joint enterprises, conspiracy, and aiding and abetting."[117] Still, in *United States v. Trucking Employers, Inc.*, an employment discrimination case, the United States District Court for the District of Columbia certified a sprawling class of "those common carriers of general commodity freight by motor

111 *See* Amended Complaint, *supra* note 107, at 15–16, 20.

112 *See* Bd. of Cnty. Comm'rs of Boulder Cnty. v. Suncor Energy, Inc., 405 F. Supp. 3d 947, 955, 981 (D. Colo. 2019) (*aff'd by* 965 F.3d 792 (10th Cir. 2020)).

113 *See* Bd. of Cnty. Comm'rs of Boulder Cnty. v. Suncor Energy, Inc., 965 F.3d 792, 798 (10th Cir. 2020).

114 *See* Complaint at 8, City and County of Honolulu v. Sunoco LP, No. 1CCV-20-0000380 (Haw. Cir. Ct. 2020).

115 *See id*. at i, 8.

116 This idea was suggested by early commentators in the context of bringing climate change tort suits against power plants. *See* David Grossman, *Warming Up to a Not-So-Radical Idea: Tort-Based Climate Change Litigation*, 28 COLUM. J. ENV'T L. 1, 30 (2003).

117 Francis X. Shen, *The Overlooked Utility of the Defendant Class Action*, 88 DENV. UNIV. L. REV. 73, 84 (2010) (internal quotations omitted).

vehicle which employ over-the-road drivers, and which are parties to or are bound by the National Master Freight Agreement" with at least one hundred employees and annual revenues of over one million dollars.[118]

That said, the class in *Trucking Employers* was an injunctive class under Rule 23(b)(2) of the Federal Rules of Civil Procedure,[119] while a climate change suit seeking damages would be a damages class certified under Rule 23(b)(3). Due process commands that plaintiffs have the ability to opt-out of damages classes.[120] Logically, due process would require at least those same minimal protections for defendant classes. This would severely diminish the efficacy of the class, if one were to be certified. Consequently, defendant classes are not necessarily a panacea to the challenge of joining smaller fossil fuel producers. While eight of seventeen cases left space to join additional defendants that might become known to plaintiffs at a later date,[121] only one case has sought certification of a defendant class.[122]

Given the above, it is clear that non-Global Operator producers are unlikely to face liability for their emissions under a tort liability scheme because plaintiffs are systemically choosing to not sue them. If only the very largest producers face liability, smaller producers will be able to produce oil at a lower marginal cost per unit, as they will forego expected liability costs. Depending on market share, this could prevent the producers subjected to liability from passing damages to consumers at risk of losing their market-competitiveness. This dynamic suggests costs will be borne by some producers, but

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[118] United States v. Trucking Emps., Inc., No. 74-453, 1975 U.S. Dist. LEXIS 11594, at *1 (D.D.C. July 2, 1975).

[119] *Compare id.* at *1 (certifying the class under 23(b)(2)), *with* FED. R. CIV. P. 23(b)(2) (describing classes for injunctive or declaratory relief).

[120] *See* Phillips Petroleum v. Shutts, 472 U.S. 797, 811–12 (1985) (holding that "due process requires at a minimum that an absent plaintiff be provided with an opportunity to remove himself from the class" if an absent plaintiff is being bound "concerning a claim for money damages or similar relief at law").

[121] For example, these cases name as defendants, "Entities 1-100." *See infra* Appendix B. *See, e.g.*, Complaint, Pac. Coast Fed. of Fishermen's Ass'ns v. Chevron, No. CGC-18-571285 (Cal. Super. Ct. 2017); First Amended Complaint, King County v. BP p.l.c., No. 2:18-cv-00758-RSL (W.D. Wash. 2018); Complaint, Rhode Island v. Chevron Corp., No. PC-2018-4716 (Providence Cnty. Super. Ct. 2018).

[122] *See* Amended Complaint, Comer v. Nationwide Mut. Ins. Co., No. 1:05-cv-00436, 2006 U.S. Dist. LEXIS 33123 (S.D. Miss. Feb. 23, 2006).

at the same time, the price signal to consumers will be diminished, reducing the likelihood that tort liability can drive meaningful reductions in carbon emissions.

2. State-Owned Foreign Oil Companies Are Excluded from Tort Litigation

In the prior section, I discussed how smaller producers escape liability. On the opposite end of the spectrum, many of the world's *largest* oil producers have not been joined in any climate change lawsuits either and are therefore escaping liability as well. Although the United States is the world's largest oil producing country, approximately 81 percent of oil production occurs outside the United States, posing a challenge to the efficacy of tort litigation.[123] Many of the world's largest oil producers are state-owned, such as Kuwait Petroleum Company, China National Petroleum Corp., Abu Dhabi National Oil Company, Pemex, and, until its recent IPO, Saudi Aramco.[124] Saudi Aramco, the world's largest oil producing company, accounts for approximately ten percent of global oil production.[125] While Motiva, a subsidiary of Saudi Aramco, was joined in one of the lawsuits I reviewed,[126] it has otherwise not been included as a defendant in these cases.[127]

The reasons for this notable absence in tort litigation are not entirely clear. One possibility is that the interest groups bringing these cases are seeking a proof of concept prior to engaging in more complex international litigation, but it is also possible that plaintiffs lack confidence that joining these state-owned parties would be

[123] *See Frequently Asked Questions: Which Countries Are the Top Producers and Consumers of Oil?*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/tools/faqs/faq.php?id=709&t=6 (last updated Apr. 1, 2020).

[124] *See* Umar Ali, *Top Ten Companies by Oil Production*, OFFSHORE TECH. (May 14, 2019), https://www.offshore-technology.com/features/companies-by-oil-production/ (listing top state-owned oil companies); Massoud A. Derhally, *Saudi Aramco Surges in Trading Debut After World Record IPO*, NAT'L (Dec. 14, 2019), https://www.thenational.ae/business/markets/saudi-aramco-surges-in-trading-debut-after-world-record-ipo-1.949756 (discussing Saudi Aramco's initial public offering).

[125] *See* Dahlia Nehme, *Saudi Aramco: The Oil Colossus*, REUTERS (Nov. 3, 2019), https://www.reuters.com/article/us-saudi-aramco-ipo-factbox/saudi-aramco-the-oil-colossus-idUSKBN1XD03T.

[126] *See* Complaint, State v. Chevron Corp., No. PC-2018-4716 (R.I. Super. Ct. July 2, 2018).

[127] *See infra* Appendix B, Table 2.

possible, given the shield of sovereign immunity.[128] The Foreign Sovereignty Immunity Act (FSIA) does create some exceptions to sovereign immunity, notably cases:

> [I]n which the action is based upon a commercial activity carried on in the United States by the foreign state; or upon an act performed in the United States in connection with a commercial activity of the foreign state elsewhere; or upon an act outside the territory of the United States in connection with a commercial activity of the foreign state elsewhere *and that act causes a direct effect in the United States*.[129]

If climate change were considered a direct effect, this exception could possibly create an opening to join state-owned producers in climate change lawsuits. However, case law on the Foreign Sovereign Immunity Act mandates that "[a] direct effect . . . is one that has no intervening element, but, rather, flows in a straight line without deviation or interruption."[130] The steps between extraction, sale, burning, emissions, and the resultant climate change impacts could be too attenuated. There is little academic literature on point and ultimately, whether or not climate change litigation could be an exception to foreign sovereign immunity is unclear.

Even if climate change impacts count as an exception under the Foreign Sovereign Immunity Act, there are additional barriers to bringing claims against large state-owned oil producers. In general, a forum state only has personal jurisdiction over a defendant if the defendant has minimum contacts demonstrating that the defendant has purposefully availed itself of the forum.[131] *J. McIntyre Machine, LTD v. Nicastro* demonstrates why this may be challenging with foreign defendants. In *McIntyre*, although a British manufacturer's defective product had been purchased in New Jersey and caused injury in New Jersey, the Supreme Court ruled that those facts were

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[128] *See* 28 U.S.C. § 1604 ("Subject to existing international agreements to which the United States is a party at the time of enactment of this Act a foreign state shall be immune from the jurisdiction of the courts of the United States and of the States except as provided in sections 1605 to 1607 of this chapter."); *see also* Opati v. Republic of Sudan, 140 S. Ct. 1601, 1604 (2020) ("As a baseline rule, the FSIA holds foreign states and their instrumentalities immune from the jurisdiction of federal and state courts.").

[129] 28 U.S.C. § 1605(a)(2) (emphasis added).

[130] Princz v. Federal Republic of Germany, 26 F.3d 1166, 1172 (D.C. Cir. 1994) (internal citations omitted).

[131] *See* Int'l Shoe Co. v. Washington, 326 U.S. 310, 316 (1945).

not sufficient to establish minimum contacts for specific jurisdiction because the manufacturer "did not have a single contact with the State apart from the fact that the machine in question ended up there."[132] Indeed, it did not matter that there may have been sufficient contacts with the United States as a whole because when considering whether a given state has personal jurisdiction, only the contacts with the sovereign state are considered.[133] As a result, it is possible that a court could find that a company that sold oil only within a particular state—even if that oil later reached other states—could only be sued in that state. Even more disconcerting, in *City of Oakland v. ExxonMobil*, the U.S. District Court for the Northern District of California found it lacked personal jurisdiction over four out of five defendants, including U.S.-based defendants, because plaintiffs failed to pass a "but-for" causal test for personal jurisdiction: "nowhere do plaintiffs contend that sea level rise would not occur absent defendants' California contacts."[134] On appeal, the Ninth Circuit did not reach this question, having decided to vacate and remand the case to District Court to determine whether there was a basis for subject matter jurisdiction.[135] That said, if the District Court's reasoning were to bear out, it would have chilling implications for plaintiffs' ability to join any defendants in this type of case, whether domestic or international.

Finally, there may be a presumption against holding defendants liable for damages that stem from emissions that took place outside of the United States, which could pose problems for plaintiffs regarding both foreign and non-foreign defendants. In *City of New York v. BP*, the U.S. District Court for the Southern District of New

[132] J. McIntyre Mach., Ltd. v. Nicastro, 564 U.S. 873, 875 (2011).

[133] *Compare id.* at 874 ("The principal inquiry in cases of this sort is whether the defendant's activities manifest an intention to submit to the power of a sovereign"), *with id.* at 898 (Ginsburg, J., dissenting) (arguing that the defendant's contacts with "the United States market as a whole" meant that the forum was "entirely appropriate").

[134] City of Oakland v. BP p.l.c., No. C 17-06011 WHA, 2018 U.S. Dist. LEXIS 126258, at *12 (N.D. Cal. July 17, 2018), *vacated and remanded*, 969 F.3d 895 (9th Cir. 2020), *superseding*, 960 F.3d 570 (9th Cir. 2020).

[135] *See* City of Oakland v. BP p.l.c., 969 F.3d 895, 911 n.13 (9th Cir. 2020) ("We do not reach the question whether the district court lacked personal jurisdiction over four of the defendants. If, on remand, the district court determines that the cases must proceed in state court, the Cities are free to move the district court to vacate its personal-jurisdiction ruling.").

York held that, "to the extent that the City seeks to hold Defendants liable for damages stemming from foreign greenhouse gas emissions, the City's claims are barred by the presumption against extraterritoriality and the need for judicial caution in the face of 'serious foreign policy consequences.'"[136] This case is under appeal, but the inability to hold defendants accountable for foreign greenhouse gas emissions, even if it were possible to overcome issues of sovereign immunity and personal jurisdiction, would eliminate from potential liability approximately 85 percent of all CO_2 emissions from fossil fuel combustion.[137] This would cripple plaintiffs' ability to join the full oil market, or even a majority of the oil market.

The potential limitations on joining foreign defendants or holding defendants liable for foreign emissions may result in severe underdeterrence, as the parties responsible for the majority of the harms caused by climate change are not being held accountable.

B. Non-Oil Sources of Emissions Are Not Considered

Of the seventeen common law cases I reviewed, there was a heavy focus on oil and gas giants. Other sources of greenhouse gas emissions were rarely included, meaning that many culpable actors are not being held to account. This means that tort liability cannot create socially optimal deterrence with regards to climate change.

The failure to include coal producers as defendants is one of the most glaring omissions in these lawsuits. Coal is responsible for roughly 20 percent of all emissions in the United States[138] and the top five coal producers in the United States are responsible for *half*

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[136] *See* New York City v. BP p.l.c., 325 F. Supp. 3d 466, 475 (S.D.N.Y. 2018). *But see* Brief for State of New York et al. as Amicus Curiae Supporting Appellant, New York City v. BP p.l.c., No. 18-cv-182 (filed Nov. 15, 2018) http://blogs2.law.columbia.edu/climate-change-litigation/wp-content/uploads/sites/16/case-documents/2018/20181115_docket-18-2188_amicus-brief-3.pdf (arguing that the district court misapplied the canon of presumption against extraterritoriality).

[137] *See Global Greenhouse Gas Emissions Data*, EPA, https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data (last updated Sept. 10, 2020).

[138] *See How Much of U.S. Carbon Dioxide Emissions Are Associated With Electricity Generation?*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/tools/faqs/faq.php?id=77&t=11 (last updated May 26, 2020) (noting that coal represents 60% of CO_2 emissions from the electricity sector and that the electricity sector accounts for 32% of total U.S. CO_2 emissions).

of all domestic coal production.[139] Peabody Energy and Arch Coal, which are responsible for 19.6 percent and 12.4 percent of all coal production in the United States, respectively,[140] were each joined in only two cases. Both were joined in *County of San Mateo*.[141] In addition, Arch Coal was also joined in *City of New York*, and Peabody Energy was joined in *Native Village of Kivalina*.[142] Aside from these exceptions, none of the top five coal producers were joined in these cases.[143] One potential explanation for this lack of representation is that market pressures have forced many coal companies, including Arch Coal and Peabody Energy, to declare bankruptcy.[144] Given that coal is a dying industry,[145] perhaps litigants did not want to expend the resources to join coal companies, knowing that they may be bankrupt before trial or judgment-proof by the time litigation concludes. All the same, even as it wanes, coal continues to account for roughly 20 percent of U.S. emissions.[146] By omitting this sector from liability, coal producers are underdeterred and the burden of their externalities is borne entirely by consumers.

Another example of an elusive greenhouse gas culprit is the agricultural sector. A quarter of global greenhouse gas emissions can be tied to the agricultural sector, both through soil and livestock management, as well as land cover change (e.g. deforestation).[147] Improving tilling techniques and other soil management practices

139 *See Top 10 Major Coal Producers, 2019*, U.S. ENERGY INFO. ADMIN. (2019), https://www.eia.gov/coal/annual/pdf/table10.pdf (summing the "percent of total production" column for the top five producer yields 50.9%).

140 *See id.*

141 *See infra* Appendix B.

142 *See id.*

143 *Compare Top 10 Major Coal Producers, supra* note 139 (listing the top five producers as Peabody Energy Corp, Arch Resources Inc., Navajo Nation, Murray Energy Corp, and Alliance Resource Partners LP), *with infra* Appendix B (showing only Peabody Energy Corp. and Arch Resources as joined in any of these cases).

144 *See, e.g.*, Arathy S. Nair, *Peabody Chapter 11 Tops String of U.S. Coal Bankruptcies*, REUTERS (Apr. 15, 2016), https://www.reuters.com/article/us-usa-coal-bankruptcy/peabody-chapter-11-tops-string-of-u-s-coal-bankruptcies-idUSKCN0XC2KQ.

145 *See, e.g.*, Samantha Gross, *Why There's No Bringing Coal Back*, BROOKINGS INST. (Jan. 16, 2019), https://www.brookings.edu/blog/planetpolicy/2019/01/16/why-theres-no-bringing-coal-back/.

146 *See* U.S. ENERGY INFO ADMIN., *supra* note 138.

147 *See* Keith Paustian et al., *Climate-Smart Soils*, 532 NATURE 49, 49 (2016).

could result in carbon emissions reductions equivalent to 1.5 petagrams (1.6 billion tons) of greenhouse gas emissions each year.[148] These emissions reductions in the United States alone could be equivalent to removing 42 million passenger cars from the road.[149] Joining enough farmers to constitute a substantial portion of emissions and demonstrate causality, however, would be extraordinarily challenging. This is at least one reason why the agricultural sector will likely avoid ever being held accountable for their greenhouse gas emissions in court.

In contrast, by joining just five major oil producers, a plaintiff can account for 11 percent of total emissions since the Industrial Revolution.[150] It is easy to see why the oil and gas industry makes a more desirable target. The problem, of course, is that this singular focus on one subset of one industry minimizes tort law's effectiveness as a deterrence mechanism.

C. State-by-State Adjudication Creates a Patchwork System

In addition to the structural deficiencies of these tort litigation cases, there are additional substantive legal barriers preventing tort liability from creating sufficient deterrence. The first is U.S. Supreme Court precedent holding that there is no federal common law public nuisance claim for climate change impacts.[151] This means climate change litigation can only be pursued at the state level.[152] This may cause a lack of uniformity in how damages are assessed, as state-level judiciaries may vary in how they choose to calculate damages.[153] Further, we might expect systemic underestimations

148 *See id.* at 52.

149 *See Carbon Farming - Global Carbon Storage*, CLIMATE CENT. (Nov. 20, 2019), https://www.climatecentral.org/gallery/graphics/carbon-farming-global-carbon-storage.

150 *See, e.g.*, City of Oakland v. B.P. p.l.c., 325 F. Supp. 3d 1017, 1021 (N.D. Cal. 2018).

151 *See* Am. Elec. Power Co. v. Connecticut, 564 U.S. 410, 424 (2011) ("We hold that the Clean Air Act and the EPA actions it authorizes displace any federal common-law right to seek abatement of carbon-dioxide emissions from fossil-fuel fired powerplants.").

152 *See id.*

153 In *Amer. Elec. Power Co.*, for example, the U.S. Supreme Court noted the challenges of case-by-case injunctions by individual district judges. *See id.* at 428. ("The expert agency is surely better equipped to do the job than individual district judges issuing ad hoc, case-by-case injunctions."). Individual state courts, each

due to how climate harms disproportionately impact certain parts of the country. The American South, for example, is particularly vulnerable to climate change impacts, but it is also, oddly, a place where "people today seem least worried about the phenomenon."[154] Because the states that are most likely to be impacted by climate change are also the states most opposed to addressing it,[155] a tort-based system may fail to award damages to the plaintiffs most in need if a judiciary's predilections follow the political sentiment in their state, which is likely.[156] This could mean that plaintiffs in the communities most impacted by climate change will bear a disproportionately large burden of the adaptation costs, as compared to plaintiffs in communities that are able to recover damages through tort suits. Unless these weakened deterrence signals in some states are balanced by excessive deterrence signals elsewhere, defendants will face a diminished deterrent signal overall.

D. Tort Litigation Does Not Include International Harms

Finally, by suing for concrete harms felt in the United States, tort litigation fails to internalize the externalities of harms felt outside the country. In theory, there could be tort suits in other countries to internalize those harms. For example, *Lliuya v. RWE AG* is an ongoing suit between a Peruvian farmer and a German utility company, in which the farmer is seeking to recover for damages due to glacial flooding in his home.[157] Still, the challenges with nation-by-nation litigation mirror those inherent in state-by-state adjudication.

acting within its own body of common law and its own understanding of climate change, would presumably lead to great inconsistency.

[154] *See* Robinson Meyer, *Climate Change Will Intensify Inequality in the U.S.*, ATL. (June 30, 2017), https://www.theatlantic.com/science/archive/2017/06/global-warming-american-south/532200/ (explaining how the American South will suffer some of the highest costs of climate change and noting that, "climate change is going to be terrible for Trump country."); *see also* Solomon Hsiang et al., *Estimating Economic Damage from Climate Change in the United States*, 356 SCI. 1362 (2017).

[155] *See id.*

[156] Given that the bulk of the American South elects judges, it is reasonable to infer that the judiciary may reflect the partisan lean in those states. *See Judicial Selection: An Interactive Map*, BRENNAN CTR. FOR JUST. http://judicialselectionmap.brennancenter.org/?court=Supreme (last visited Nov. 8, 2020).

[157] *See Luciano Lliuya v. RWE AG*, SABIN CTR. FOR CLIMATE CHANGE L., http://climatecasechart.com/non-us-case/lliuya-v-rwe-ag/ (last visited Nov. 7, 2020).

Moreover, varying climate polices and varying expectations for the appropriate damages make it unlikely that the full externalities will ever be internalized by tort litigation.

V. THE REALITY OF REGULATORY APPROACHES

Having considered how tort litigation varies in practice, as compared to theory, I will now do the same for the regulatory model. Over the past several years, a number of carbon taxes and permit schemes have been implemented, both inside and outside of the United States, which shed light on how these systems work in practice. Many of these programs have been implemented at the utility-level. In particular, I examine the Regional Greenhouse Gas Initiative (RGGI, pronounced "Reggie"), British Columbia's Carbon Tax, and the European Union's cap and trade scheme. While the relatively weak RGGI scheme does not result in increased costs being passed on to customers, industry does appear to pass costs on to consumers in schemes with more aggressive targets.

RGGI is a permit scheme spanning eleven states in the Northeastern United States.[158] This permit scheme imposes a cap on emissions among electricity generators and, since 2014, has decreased that cap by 2.5 percent each year.[159] At the start of each fiscal year, RGGI distributes permits to electricity generators, primarily through

[158] As of 2019, nine states were participating in RGGI. *See* JONATHAN L. RAMSEUR, CONG. RSCH. SERV., R41836, THE REGIONAL GREENHOUSE GAS INITIATIVE: BACKGROUNDS, IMPACTS, AND SELECTED ISSUES 1 (2019), https://fas.org/sgp/crs/misc/R41836.pdf. Since then, New Jersey has rejoined RGGI after a period of non-participation, Virginia has become a new participant, and Pennsylvania is now considering whether to participate. *See Materials on New Participation*, REG'L GREENHOUSE GAS INITIATIVE (last visited Feb. 14, 2021), https://www.rggi.org/program-overview-and-design/new-participation; *see also* Tohan et al., *The Regional Greenhouse Gas Initiative (RGGI): The Mid-Atlantic Expansion is Underway . . . Or is It?* X NAT'L L.R. 282 (Oct. 8, 2020), https://www.natlawreview.com/article/regional-greenhouse-gas-initiative-rggi-mid-atlantic-expansion-underway-or-it.

[159] *See* JONATHAN L. RAMSEUR, CONG. RSCH. SERV., R41836, THE REGIONAL GREENHOUSE GAS INITIATIVE: BACKGROUNDS, IMPACTS, AND SELECTED ISSUES 6 (2019), https://fas.org/sgp/crs/misc/R41836.pdf (noting also that the remaining 80% of emissions derive from the "transportation, industrial, commercial, and residential sectors").

an auction which generates revenue for the member states.[160] An electricity generator is only allowed to emit emissions equal to or less than the number of permits it has purchased. As of 2019, RGGI covered 165 power plants, representing nearly 20 percent of all greenhouse gas emissions in participating states.[161]

Since its implementation in 2009, carbon emissions from electricity generation in the RGGI region have dropped 35 percent.[162] At the same time, electricity prices have actually decreased by two percent, and the permit auctions have raised over $2.5 billion in revenue, of which two-thirds was reinvested in "efficiency, GHG abatement, or electricity bill assistance."[163] Given that electricity prices have fallen, even with RGGI's cap-and-trade system, one might argue that regulatory actions are well-positioned to deter emissions, without costing consumers. On the other hand, RGGI's low permit prices are well below the Social Cost of Carbon, hovering around $5 per ton, for the last year.[164] This means that the market price of a permit is clearing far too low to internalize the externalities of emissions, which in turn implies that RGGI's targets may not be sufficiently aggressive as to reach a socially optimal level of emissions. At the same time, the decreased emissions from RGGI, despite these low prices, suggest that even very low carbon prices can be effective at pushing consumers and utilities towards renewables. As the cost to install new renewable and non-renewable energy sources is essentially at parity, this would make sense.[165]

Setting the above aside, it is important to note that RGGI is not the sole reason for these declining emissions. RGGI states also have their own renewable portfolio standards.[166] For example, in 2016,

160 *See id.* at 8–9 (explaining that 80% of permits are sold via auction, the unsold permits are either sold later at a fixed price, "distributed to various entities," or retired permanently).

161 *See id.* at 6.

162 *See The Regional Greenhouse Gas Initiative: A Fact Sheet*, CERES 2, https://www.ceres.org/sites/default/files/Fact%20Sheets%20or%20misc%20files/RGGI%20Fact%20Sheet.pdf (last visited Oct. 30, 2020).

163 *Id.* at 1.

164 *See Auction Results*, REG'L GREENHOUSE GAS INITIATIVE, https://www.rggi.org/auctions/auction-results (last visited Oct. 30, 2020).

165 *See supra* text accompanying notes 74–76.

166 *See* Jackson Morris, *State Clean Energy Policies Make Stronger RGGI a No-Brainer*, NRDC (Sept. 27, 2016), https://www.nrdc.org/experts/jackson-morris/state-clean-energy-policies-make-stronger-rggi-no-brainer.

New York established a clean energy standard that requires that half of the state's energy come from renewable sources by 2030, which would represent a 40 percent reduction in emissions, relative to 1990 levels.[167] In 2006, Vermont required a 50 percent reduction in GHG emissions, relative to 1990 levels, by 2028, although this was relaxed to require only a 40 percent reduction in 2016.[168] For comparison, RGGI's 2.5 percent annual cap reduction, carried from 2016 to 2030, would amount to a 30 percent reduction, relative to 2016 emission levels.[169] Given these increasingly strong renewable portfolio standards, it is possible that individual state-level policies, such as the clean energy standards in New York and Vermont, are doing the heavy lifting in driving emission reductions, not RGGI.

In emission reduction programs with more aggressive targets, there is evidence that prices are passed on to customers, whether by program design or by industry behavior. For example, in 2008, British Columbia began imposing a carbon tax that applied to 70 percent of all emissions.[170] This tax is estimated to have reduced emissions by up to 15 percent.[171] The tax began at C$10/ton, in 2008, and climbed in C$5 increments until it reached C$30/ton in 2018.[172] The tax is nearly six times the cost of a permit under RGGI.[173] The tax

167 *See Governor Cuomo Announces Establishment of Clean Energy Standard that Mandates 50 Percent Renewables by 2030*, N.Y. STATE (Aug. 1, 2016), https://www.governor.ny.gov/news/governor-cuomo-announces-establishment-clean-energy-standard-mandates-50-percent-renewables.

168 *See Climate Change in Vermont: Vermont's Goals*, STATE OF VT., https://climatechange.vermont.gov/vermonts-goals (last visited Nov. 7, 2020).

169 Reducing emissions by 2.5% yields 97.5% remaining. A further 2.5% reduction is 97.5% of 97.5%, etc., yielding $(1\text{-}0.025)^{14} = 0.702 = 70\%$, which is equivalent to approximately a 30% reduction.

170 *See Revenue-Neutral Carbon Tax | Canada*, U.N. FRAMEWORK CONVENTION ON CLIMATE CHANGE, https://unfccc.int/climate-action/momentum-for-change/financing-for-climate-friendly/revenue-neutral-carbon-tax (last visited Nov. 7, 2020).

171 *See id.*

172 *See id.*

173 *Compare Allowance Price and Volumes*, REG'L GREENHOUSE GAS INITIATIVE, https://www.rggi.org/Auctions/Auction-Results/Prices-Volumes (last visited Feb. 3, 2021) (showing a permit price of $5.35/ton of in December 2018) *with Revenue-Neutral Carbon Tax | Canada*, *supra* note 170 (noting a price of $30/ton in 2018).

is assessed at the point of sale of the carbon-emitting fuel.[174] For example, the tax has increased the cost of gas by 19 cents per gallon.[175] Researchers have tied the carbon tax to decreased gasoline sales and decreased residential natural gas demand, showing the power of pricing on consumer behavior.[176] Still, because the tax is revenue neutral, much of that money returns to consumers through "personal and business tax measures, such as reductions in personal income tax rates, the Low Income Climate Action Tax Credit and corporate income tax reductions."[177] In 2018, Canada required all other provinces to follow suit and adopt their own carbon taxes.[178]

Similarly, evidence from the European Union Cap and Trade system supports the idea that industry passes on tax costs to consumers. The European Cap and Trade system covers 45 percent of energy use and has resulted in a 21 percent reduction in emissions across those sectors between 2005 and 2020.[179] In 2015, the European Commission conducted a study on the degree to which increased energy prices were passed on to consumers, through a variety of different sectors. Refinery products, such as diesel and petroleum, passed on the full cost.[180] In contrast, the cement industry passed on only 20 to 50 percent of costs, the lowest rate of the industries studied.[181] Passing on costs creates a price signal for consumers that may encourage them to purchase from less energy-intensive—and therefore cheaper—sources.

When a sufficiently high tax is passed, or a cap-and-trade program with sufficient scarcity in permits is implemented, consumers

174 *See* Brian Murray & Nicholas Rivers, *British Columbia's Revenue-Neutral Carbon Tax: A Review of the Latest "Great Experiment" in Environmental Policy*, 86 ENERGY POL'Y 674, 676 (2015).

175 *See* Eduardo Porter, *Does a Carbon Tax Work? Ask British Columbia*, N.Y. TIMES (Mar. 1, 2016), https://www.nytimes.com/2016/03/02/business/does-a-carbon-tax-work-ask-british-columbia.html.

176 *See* Murray & Rivers, *supra* note 174 at 678.

177 U.N. FRAMEWORK CONVENTION ON CLIMATE CHANGE, *supra* note 170.

178 *See* Kathleen Harris, *Justin Trudeau Gives Provinces Until 2018 to Adopt Carbon Price Plan*, CBC (Oct. 3, 2016), https://www.cbc.ca/news/politics/canada-trudeau-climate-change-1.3788825.

179 *See EU Emissions Trading System (EU ETS)*, EUR. COMM'N, https://ec.europa.eu/clima/policies/ets_en (last visited May 20, 2020).

180 *See* CE DELFT, OEKO-INSTITUT, EUR. COMM'N, EX-POST INVESTIGATION OF COST PASS-THROUGH IN THE EU ETS, 166 (2015), https://ec.europa.eu/clima/sites/clima/files/ets/revision/docs/cost_pass_through_en.pdf.

181 *See id.*

are likely to bear at least a portion of the increased energy costs. This provides a deterrent signal to consumers, but also implies that fossil fuel producers are not bearing the costs of mitigation.

VI. COST-BEARING IN THE CONTEXT OF OIL PRODUCTION

I have now discussed, at length, what costs need to be paid, who should pay them, how they might be distributed in theory, and how tort and regulatory frameworks are likely to effectuate deterrence in practice. I mentioned at the start of this piece that I was motivated by two questions—can tort litigation serve as a sufficient deterrent for emissions, and if not, what seat can tort litigation have at the table? In Part III.C, I described how the current structure of tort litigation allows huge swaths of the oil production market—both small producers inside the United States and large state-owned non-United States producers—to escape liability, and how additional procedural and legal hurdles make it unlikely that all costs will be internalized through tort litigation. Regulation, on the other hand, can be evenly applied to an entire market and results in costs being passed on to consumers, deterring further consumption. This would seem to tip the balance in favor of a regulatory approach, raising the questions: Does tort law still have a role to play? What, if anything, can tort law accomplish that regulations cannot? The answer lies in one of the features of tort law that may make it seem undesirable at first: the deterrent effect is weak due to the structural challenges in climate change litigation against oil producer defendants. Because the deterrent effect that it creates is dampened it is unlikely to impact prices in the oil market. This means that tort litigation places the cost burden squarely on oil producers, without passing the cost on to consumers. To fully understand this final piece, it is necessary to examine the peculiarities of the global oil market.

A huge challenge with using any type of economic policy—whether tort-based or regulatory—to reduce greenhouse gas emissions from oil and natural gas is that oil prices bear little relationship to the marginal cost of production. Instead, oil prices are largely a function of supply, potentially due to cartel behavior.[182]

[182] *See What Drives Crude Oil Prices: Supply OPEC*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/finance/markets/crudeoil/supply-opec.php (last updated Oct. 6, 2020) (noting that OPEC's supply plays a substantial role in driving

In a perfectly competitive market, goods are sold at close to the cost of production with profits tending towards zero.[183] The cost of the good, in such cases, is set by market forces and both producers and consumers act as "price-takers" and do not control the price of the good.[184] But when producers act as part of a cartel, they coordinate with their peers to, "agree on price, output, and other decisions aimed at achieving monopoly profits"—in other words, such producers act as price-setters, rather than price-takers.[185] A cartel, for example, may reduce production in order to manufacture scarcity, relative to demand, and thereby increase prices.[186] The Organization of the Petroleum Exporting Countries (OPEC) is often used as a textbook example of a cartel, although there is some debate about whether OPEC is a true cartel.[187] Either way, OPEC has previously artificially constrained production of oil to drive up prices.[188] Because oil is traded on a global market, this behavior affects oil prices

prices); *see also* Andrew Chatzky & Anshu Siripurapu, *OPEC in a Changing World*, COUNCIL ON FOREIGN REL., https://www.cfr.org/backgrounder/opec-changing-world (last updated Apr. 9, 2020) (discussing how OPEC has frequently behaved as a cartel in the past).

183 PRINCIPLES OF ECONOMICS 319 (Univ. of Minn. Libraries Publishing Ed. 2016) available at: https://open.lib.umn.edu/principleseconomics/ ("[T]he model of perfect competition predicts that, at a long-run equilibrium, production takes place at the lowest possible cost per unit and that all economic profits and losses are eliminated.").

184 *See id.* at 298 ("The assumptions of the model of perfect competition, taken together, imply that individual buyers and sellers in a perfectly competitive market accept the market price as given. No one buyer or seller has any influence over that price. Individuals or firms who must take the market price as given are called price takers.").

185 *See id.* at 377–79 (discussing how, in an imperfect market, firms may collude to raise the price of a good, thereby setting the price).

186 *See id.*

187 *See* A.F. Alhajji & David Huettner, *OPEC and Other Commodity Cartels: A Comparison*, 28 ENERGY POL'Y 1151, 1151 n.2 (1998) (finding "over 250 economics textbooks . . . that use OPEC as a cartel example" but arguing that the actual behavior of OPEC members is better described by a more complex model than merely a cartel).

188 *See* Chatzky & Siripurapu, *supra* note 182 ("The Organization of the Petroleum Exporting Countries (OPEC) is a bloc of fourteen oil-rich member states spanning the Middle East, Africa, and South America. Combined, the group controls close to forty percent of world oil production. This dominant market position has at times allowed OPEC to act as a cartel, coordinating production levels among members to manipulate global oil prices.").

around the world.[189] From an environmental perspective, this is not necessarily a bad thing—after all, high oil prices deter energy use—but for this discussion it is important to consider the distortions caused by this cartel behavior on the global oil market.

The ability of OPEC to set prices is best exemplified by Saudi Arabia's single-handed ability to cause fluctuations in the oil market. Within OPEC, Saudi Arabia long held the role of a "swing producer," impacting prices by decreasing production.[190] In the past, however, Saudi Arabia has become frustrated with the expectation that it should bear the burden of reduced production on its own.[191] Uncontrolled production can have profound impacts on the global oil market. In 2014, for example, OPEC negotiations broke down and the cost of oil—which had remained, on average, between $110/barrel and $120/barrel for the prior five years—plummeted to $80/barrel.[192] While some countries argued that Saudi Arabia should shoulder increased production cuts, Saudi Arabia was comfortable reducing prices.[193] In part, this may have been motivated by a desire to limit competition from U.S. shale-oil, which carries a higher cost of production.[194] Similarly, in March 2020, Saudi Arabia entered

189 *See What Drives Crude Oil Prices: Spot Prices,* U.S. ENERGY INFO. ADMIN., https://www.eia.gov/finance/markets/crudeoil/spot_prices.php (last visited Sept. 12, 2020) ("Many types of crude oil are produced around the world. Variations in quality and location result in price differentials, but because oil markets are integrated globally, prices tend to move together.").

190 *See* John Kemp, *Saudi Arabia Resumes Familiar Role as Swing Producer*, REUTERS (Feb. 21, 2019), https://www.reuters.com/article/uk-oil-prices-kemp-idUKKCN1QA1AO.

191 In 2016, for example, Saudi Arabia refused to enter production cut negotiations unless Iran also agreed to cut production. *See* Benoit Faucon et al., *No Agreement on Oil Freeze at Doha Meeting*, WALL ST. J. (Apr. 17, 2016), https://www.wsj.com/articles/doha-draft-calls-for-oil-output-freeze-at-january-levels-until-october-1460872822. In 2019, Saudi Arabia threatened to increase production if other OPEC nations continued to ignore agreed-upon production cuts. *See* Nayla Razzouk et. al., *Saudis Pledge to Cut Production, But Only If Other OPEC Members Stop Cheating*, WORLD OIL (Dec. 5, 2019), https://www.worldoil.com/news/2019/12/5/saudis-pledge-to-cut-production-but-only-if-other-opec-members-stop-cheating.

192 *See* Brad Plumer, *Oil Prices Keep Plummeting as OPEC Starts a Price War with the US*, VOX (Nov. 28, 2014), https://www.vox.com/2014/11/28/7302827/oil-prices-opec.

193 *See id.*

194 *See* Jay Solomon, *Why Saudis Decided Not to Prop Up Oil,* WALL. ST. J. (Dec. 21, 2014), https://www.wsj.com/articles/why-saudis-decided-not-to-prop-up-oil-1419219182.

negotiations with Iran and Russia to jointly cut production, but negotiations broke down and Saudi Arabia instead increased production.[195] This breakdown, combined with a decrease in demand due to the coronavirus pandemic, led to oil prices dropping 60 percent between January and the start of April 2020.[196]

The large profit margins in the oil industry further illustrate the effectiveness of OPEC. In 2016, the marginal cost of production for a barrel of oil in Saudi Arabia was approximately $2.50/barrel.[197] In Russia, the cost was $3/barrel, and in the United States, non-shale oil cost $5/barrel to produce and shale cost $6/barrel. Once operational and overhead costs are included, Saudi Arabia's costs increased to just shy of $9/barrel, Russia's to $19/barrel, U.S. non-shale's to $21/barrel, and U.S. shale's to $23/barrel.[198] In contrast, in 2016, the price of crude oil was approximately $40/barrel—two years prior it was $100/barrel.[199] Despite these comparatively low prices, in 2016, oil was still selling at over four times Saudi Arabia's marginal cost of production, and nearly twice the cost of U.S. shale.

Given these massive price swings and producers' large profit margins, it is tempting to think that producers might simply "eat" the costs of regulation and avoid passing on the added costs to consumers, keeping prices low and demand high. Accepting the Social Cost of Carbon at $46 per ton of CO_2 and noting that there are 0.43 metric tons of CO_2 emitted per barrel of crude, a full encapsulation of the producers' externalities would add less than $20/barrel in additional costs.[200] If oil prices return to the $75–$80 range, even U.S.

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195 *See* Natasha Turak, *Whiting Petroleum is Just the "First Domino" to Fall in US Shale Wipeout, Strategist Says*, CNBC (Apr. 2, 2020), https://www.cnbc.com/2020/04/02/coronavirus-whiting-petroleum-is-just-the-first-domino-to-fall-in-us-shale-wipeout-strategist-says.html.

196 *See id.*

197 *See WSJ News Graphics, Barrel Breakdown*, WALL ST. J. (Apr. 15, 2016), http://graphics.wsj.com/oil-barrel-breakdown/.

198 *See id.*

199 *See id.*; *see also* Timothy Puko & Georgi Kantchev, *Oil Prices Slide Ahead of High Stakes Meeting*, WALL ST. J. (Apr. 15, 2016) https://www.wsj.com/articles/oil-prices-waver-in-volatile-trade-1460709588.

200 *See* Howard Shelanski, *Refining Estimates of the Social Cost of Carbon*, OBAMA WHITE HOUSE ARCHIVES (Nov. 1, 2013), https://obamawhitehouse.archives.gov/blog/2013/11/01/refining-estimates-social-cost-carbon; *see also Greenhouse Gases Equivalencies Calculator – Calculations and References*, EPA, https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-

shale—which today claims a breakeven point between $50-$55[201]—could eat the entirety of that social cost out of their profits.

In practice, the costs are often passed on to consumers in the regulatory context, as in the EU's cap-and-trade scheme.[202] So, even though oil producers have enormous profit margins, experience suggests that at least a portion of costs will be passed down to consumers. This makes sense, given that regulatory policies affect all producers selling in the country or state with the policy.

With tort liability, it might be a different story. Certain oil producers are shielded from liability because only very large, vertically integrated United States producers are regularly included in climate change tort lawsuits.[203] Small and mid-sized producers, representing 83 percent of U.S. oil production,[204] are rarely joined and, on the other hand, large state-owned producers are avoiding liability; OPEC alone represents 40 percent of global oil production.[205] These non-defendants will not have to shoulder additional costs of production from tort liability unless plaintiffs dramatically change their approach to these lawsuits.

Today's oil market offers a strong suggestion that tort liability costs will be subsumed by defendants rather than passed on to consumers. As discussed above, it is over twice as expensive to produce a barrel of U.S. shale oil, as compared to Saudi Arabian oil, but barrels of oil are traded globally and are priced globally.[206] U.S. shale does not pass on its higher cost of production to consumers, rather, it reduces profits to continue to be price competitive. Similarly, defendants in these tort suits would essentially face a higher cost of production than non-defendants, but, due to plaintiffs' inability or reluctance to join state-owned defendant fossil fuel producers, the vast majority of the world's oil market will be unaffected by tort liability. This is analogous to how much of the global oil market has production costs below those of shale gas. Because they are

calculations-and-references (last visited Apr. 21, 2020) (estimating emissions of 0.43 metric tons of CO_2/barrel of oil).

201 *See* Turak, *supra* note 195.

202 *See supra* discussion accompanying notes 179–181.

203 *See supra* Part IV.A.

204 *See* FRYKLUND, *supra* note 88, at 3; *see also supra* Part IV.A.

205 *See What Drives Crude Oil Prices: Supply OPEC*, *supra* note 182; *see also supra* Part IV.A.

206 *See What Drives Crude Oil Prices: Spot Prices*, *supra* note 189.

constrained by the global oil market, these defendant oil producers will be unable to raise their prices to cover the costs of tort liability. This is problematic if the goal is to create a deterrence signal in the market; however, this asymmetry allows tort litigation to play out a true compensatory function. Insofar as our goal is for oil producers to shoulder part of the costs of climate change adaptation, this is a positive ramification.

CONCLUSION

Now that I have covered the contours of tort and regulatory schemes and their practical implications, I discuss first, which tools will force fossil fuel producers to bear a portion of the costs of climate change, as demanded by both moral corrective justice and optimal deterrence theories, and second, when that burden-shifting is desirable. Tort and regulatory solutions bring different offerings to the table.

Because climate change tort litigation joins only a small part of the total market and, notably, OPEC countries are thus far unaffected by the litigation, tort litigation is unlikely to generate a deterrence signal large enough to move the needle on mitigation costs. This same feature renders it challenging for a producer to pass on their costs to consumers without losing market competitiveness, particularly in the context of oil, where prices are artificially inflated due to cartel-behavior. The inability to pass additional costs to consumers is evidenced by the fact that shale gas and non-shale gas are sold to consumers at the same price, despite shale gas being vastly more expensive to produce. Under a tort liability scheme, the fossil fuel producer must fully bear the costs of tort litigation and cannot pass the costs through to consumers.

In contrast, a regulatory scheme places costs on all fossil fuel producers equally, making it easier for producers to pass on costs to consumers. There is evidence of this in regulatory approaches in Canada and the EU. This creates a double-deterrent, first to producers, who want to save on costs in order to maximize profits, and second to consumers, who consume less energy in the face of higher prices. This is desirable because it drives mitigation, however, the burden of changing behavior and paying higher energy prices is ultimately borne by consumers, even if the regulatory mechanism is revenue neutral.

Mitigation costs are forward-looking: how do individuals change behavior today, to reduce climate change impacts tomorrow? The theoretical model of climate change abatement is designed to create the correct incentives to reduce greenhouse gas emissions to socially-optimal levels. While identical in their theoretical limit, in practice, regulatory approaches to climate change pass costs through to consumers, while tort liability is unlikely to do so. If our goal is to pay the mitigation costs necessary to reduce climate change impacts, regulatory solutions are best situated to manage this role.

In contrast, adaptation costs look backwards: how does society recuperate costs from yesterday's mistakes? While adaptation costs can create *ex ante* incentives, I prioritize payment over deterrence, where mitigation costs can do forward-looking cost balancing. If regulatory solutions fund adaptation costs—for example, by using revenue from a carbon tax to fund resiliency programs—these costs are fully borne by the public, because the public is already bearing the cost of increased energy prices under a regulatory scheme. Recognizing the imperative to hold fossil fuel producers accountable for their morally reprehensible behavior, adaptation costs should be paid for, in part or in whole, through tort liability. Tort liability will ensure that fossil fuel producers bear costs, because the defendants will be unable to raise prices without risking reduced market-competitiveness, due to small producers and foreign producers evading liability entirely.

Consequently, as a normative matter, tort litigation should be used to manage *ex post* adaptation costs, while regulations are better suited to manage mitigation costs.

APPENDIX A

This Appendix contains all twenty-six cases listed in the Common Law section of the Sabin Center for Climate Change's climate change litigation tracker as of October 15, 2020.[207] Case history is up to date as of early November 2020. For my analysis in Part IV, I focus on the cases in Table 1—cases that join oil producers. The following cases were included in the Sabin Center for Climate Change Law's Common Law tracker but omitted from the tables below, as they were not relevant to my analysis:

- *International Finance Corp. v. Korat Waste to Energy Co.*: In this case, plaintiff alleged that defendant had breached a "covenant of good faith and fair dealing" in negotiating an Emission Reduction Purchase Agreement.[208] The case eventually settled.[209]
- *Savoy Energy, LLC v. New Mexico Institute of Mining & Technology*: This case regards a dispute between an energy company and a university regarding a contract for a carbon sequestration project.[210]
- *Emerick v. Town of Glastonbury*: This case regards damage to plaintiff's property by "upstream development, storm water increase, and water quality degradation."[211] The case is unrelated to climate change except insofar as climate change may have exacerbated the erosion to plaintiff's property.[212]

[207] *See U.S. Climate Change Litigation: Common Law Claims*, SABIN CTR. FOR CLIMATE CHANGE L., http://climatecasechart.com/case-category/common-law-claims/ (last visited Oct. 15, 2020). Please note *Comer v. Murphy Oil* was filed twice.

[208] Complaint at 2, Int'l Fin. Corp. v. Korat Waste to Energy Co., (No. 1:07-cv-05451-SHS-THK) (filed June 8, 2007).

[209] *See International Finance Corp. v. Korat Waste to Energy Co.*, SABIN CTR. FOR CLIMATE CHANGE L., http://climatecasechart.com/case/international-finance-corp-v-korat/ (last visited Oct. 15, 2020).

[210] *See* Complaint at 2–3, Savoy Energy v. N.M. Inst. of Mining & Tech., No. 2:10-cv-10-DB (D. Utah 2009); Stipulation of Dismissal at 1, Savoy Energy v. N.M. Inst. of Mining & Tech., No. 2:10-cv-10-DB (D. Utah 2010).

[211] Emerick v. Town of Glastonbury, No. HHDCV115035304S, 2015 Conn. Super. LEXIS 1246, at *1 (May 14, 2015).

[212] *See id.* at *55–56.

- *Panoche Energy Center, LLC v. Pacific Gas & Electric Co.*: This case is a dispute as to who should pay costs under California's Global Warming Solutions Act of 2006.[213]
- *PAWS Holdings, LLC v. Daikin Industries, Ltd.*: This case is about a manufacturing defect in heating, ventilation, and air conditioning units that led to decreased efficiency (and therefore excessive GHG emissions).[214] The case was not brought with a goal to mitigate climate change.

Table 1: Common Law Cases Brought Primarily Against Fossil Fuel Producers[215]

Case Name	Details
Am. Elec. Power Co. v. Connecticut Filed 2004	**Defendants:** Electric power companies[216] **Emissions joined:** Annually, 2.5% of worldwide emissions; 10% of U.S. emissions[217] **Overview:** Plaintiffs sought an annual cap of emissions from each defendant; however, the Supreme Court remanded the case because the Clean Air Act preempted federal common law.[218]
Comer v. Murphy Oil USA Filed 2005 & 2011	**Emissions joined:** Not specified **Damages sought:** Damages for losses sustained by plaintiffs in Hurricane Katrina and punitive damages[219] **Overview:** Plaintiffs, a putative class harmed by Hurricane Katrina, sued a putative defendant class of fossil fuel companies and a putative defendant class of insurance companies seeking damages.[220] The district court dismissed the case, from the bench, as a non-justiciable political question.[221] The Fifth Circuit partially reversed, but

[213] *See* Panoche Energy Ctr., LLC v. Pac. Gas & Elec. Co., 1 Cal. App. 5th 68, 68 (2016).

[214] *See PAWS Holdings, LLC v. Daikin Industries, Ltd.*, SABIN CTR. FOR CLIMATE CHANGE L., http://climatecasechart.com/case/paws-holdings-llc-v-daikin-industries-ltd/?cn-reloaded=1 (last visited Oct. 15, 2020).

[215] Please note that the damages listed in the table below are not exhaustive, but are rather meant to give a flavor of what types of damages are being sought.

[216] *See* Am. Elec. Power Co. v. Connecticut, 564 U.S. 410, 415 (2011).

[217] *See id.* at 418.

[218] *See id.* at 415, 429.

[219] *See* First Amended Complaint at 17, Comer v. Nationwide Mut. Ins. Co., No. 1:05-cv-00436-LG-RHW, 2006 U.S. Dist. LEXIS 33123 (S.D. Miss. Feb. 23, 2005).

[220] *See* Comer v. Murphy Oil USA, 585 F.3d 855, 859 (5th Cir. 2009).

[221] *See id.* at 860, 860 n.2.

	granted a petition to hear en banc and vacated their decision.[222] Due to a recusal, the en banc review did not occur, leaving the district court's opinion in place. Plaintiffs sought a writ of mandamus from the Supreme Court, but it was denied, meaning the district court's opinion remains in place. In 2011, plaintiffs sought to revive the case, but it was claim precluded.
Native Village of Kivalina v. ExxonMobil Corp. Filed 2008	**Emissions joined:** Not specified **Damages sought:** Monetary damages for climate change harms, including relocation of population; declaratory judgment for future expenses[223] **Overview:** The Village of Kivalina, which was beginning to feel the effects of climate change, brought claims against oil and coal companies under theories of conspiracy, federal public nuisance, state private and public nuisance, and concert of action.[224] The district court did not grant supplemental jurisdiction to plaintiff's state claims and dismissed the federal common law claims.[225] The Ninth Circuit held that federal common law was preempted by the Clean Air Act, but noted that plaintiffs could pursue remedies under state law.[226]
City of Oakland v. BP p.l.c. Filed 2017	**Emissions joined:** 11% of global emissions since the industrial revolution.[227] **Damages sought:** Create an abatement fund remedy for adaptation costs[228] **Overview:** San Francisco and the City of Oakland sued the five largest publicly-traded oil producers under a public nuisance theory.[229] The district court dismissed the claims for failure to state a claim and dismissed four of five defendants, due to lack of personal jurisdiction.[230] On appeal, the Ninth Circuit found that the public nuisance

[222] *See id.* at 879–80; Comer v. Murphy Oil USA, 607 F.3d 1049, 1053 (5th Cir. 2010) (noting that the panel opinion was vacated upon granting en banc review and that en banc review will not occur).
[223] *See* Complaint at 67, Native Village of Kivalina v. ExxonMobil Corp., 696 F.3d 849 (9th Cir. 2012) (No. 4:08-cv-01138-SBA).
[224] *See id.* at ii.
[225] *See* Native Village of Kivalina v. ExxonMobil Corp., 696 F.3d 849, 854–55 (9th Cir. 2012).
[226] *See id.* at 866.
[227] *See* Amended Complaint at 40, City of Oakland v. BP p.l.c., No. 3:17-cv-06011-WHA (N.D. Cal. 2018).
[228] *See id.* at 66.
[229] *See id.* at 2, 62, 64.
[230] *See* City of Oakland v. BP p.l.c., 969 F.3d 895, 903 (9th Cir. 2020).

	claim "does not arise under federal law," remanded to the district court to either find another avenue for subject matter jurisdiction or remand to state court, and declined to reach the question of personal jurisdiction.[231]
County of San Mateo v. Chevron Corp. Filed 2017	**Emissions joined:** 20% of global fossil fuel emissions from 1965–2015[232] **Damages sought:** Compensatory damages for climate change harms, equitable relief to abate the nuisance, and punitive damages[233] **Overview:** Defendants attempted to remove the case to federal court, the district court remanded, and the Ninth Circuit affirmed.[234]
County of Santa Cruz v. Chevron Corp. Filed 2017	**Emissions joined:** About 20% of global fossil fuel emissions from 1965–2015.[235] **Damages sought:** Compensatory damages for climate change harms, equitable relief to abate the nuisance, and punitive damages.[236] **Overview:** Defendants sought to remove to federal court and the appeal for remand was consolidated along with several other municipal cases to be heard by the same Ninth Circuit panel as *City of Oakland*, which remanded those cases to state court.[237]
Pac. Coast Fed. of Fishermen's Ass'ns v. Chevron Corp. Filed 2017	**Emissions joined:** 15% of total global emissions from 1965–2015[238] **Damages sought:** Compensatory damages, equitable relief to abate the nuisance, and punitive damages[239] **Overview:** The complaint brought nuisance claims along with products liability claims (failure to warn, design

[231] *Id.* at 901, 911, 911 n.13.
[232] *See* Complaint at 33, County of San Mateo v. Chevron Corp., No. 17CIV03222 (Cal. Super. Ct. 2017).
[233] *See id.* at 98.
[234] *See* County of San Mateo v. Chevron Corp., 960 F.3d 586, 603 (9th Cir. 2020).
[235] *See* Complaint at 7, County of Santa Cruz v. Chevron, No. 17CV03242 (Cal. Super. Ct. 2017).
[236] *See id.* at 123.
[237] *See County of Santa Cruz v. Chevron Corp.*, SABIN CTR. FOR CLIMATE CHANGE L. http://climatecasechart.com/case/county-santa-cruz-v-chevron-corp/ (last visited Nov. 12, 2020).
[238] *See* Complaint at 5, Pac. Coast Fed. of Fishermen's Ass'ns v. Chevron Corp., No. CGC-18-571285 (Cal. Super. Ct. 2017).
[239] *See id.* at 90.

	defect), but there has been little movement since the complaint was filed.[240]
Mayor and City Council of Baltimore v. BP p.l.c. Filed 2018	**Emissions joined:** About 15% of global emissions from 1965–2015[241] **Damages sought:** Compensatory damages, equitable relief, civil penalties, punitive damages, and disgorgement of profits[242] **Overview:** Plaintiffs—the Mayor and City Council of Baltimore—brought claims under theories of public/private nuisance, failure to warn, design defect, trespass, and a violation of the Consumer Protection Act, alleging climate harms.[243] Defendants attempted to remove to federal court on arising-under jurisdiction, but the case was remanded to state court, with the remand affirmed by the Fourth Circuit.[244] The Supreme Court has granted certiorari as to the scope of review by the Fourth Circuit.[245]
Rhode Island v. Chevron Corp. Filed 2018	**Emissions joined:** 14.81% of global emissions from 1965-2015[246] **Damages sought:** Compensatory damages, equitable relief including abatement, punitive damages, and disgorgement of profits.[247] **Overview:** Rhode Island sued several fossil fuel producers under theories of public nuisance, failure to warn, design defect, trespass, public trust, and violations of the State Environmental Rights Act.[248] Defendants removed to federal court and plaintiffs' motion to remand to state court was granted; the First Circuit has affirmed the remand.[249]

[240] *See id.* at i to ii; *see also Pacific Coast Fed. of Fishermen's Ass'n, Inc. v. Chevron*, SABIN CTR. FOR CLIMATE CHANGE L., http://climatecasechart.com/case/pacific-coast-federation-of-fishermens-associations-inc-v-chevron-corp/ (last visited Nov. 12, 2020).
[241] *See* Complaint at 4, Mayor and City Council of Baltimore v. BP p.l.c., No. 24-C-18-004219 (Md. Cir. Ct. 2018).
[242] *See id.* at 130.
[243] *See id.* at iv to v.
[244] *See* Mayor of Baltimore v. BP p.l.c., 952 F.3d 452, 457 (4th Cir. 2020).
[245] *See* BP p.l.c. v. Mayor of Baltimore, 141 S. Ct. 222 (2020).
[246] *See* Complaint at 4, Rhode Island v. Chevron Corp., No. PC-2018-4716 (Providence Cnty. Super. Ct. 2018).
[247] *See id.* at 140.
[248] *See id.* at ii.
[249] *See* Rhode Island v. Chevron Corp., 979 F.3d 50, 53 (1st Cir. 2020).

King County v. BP p.l.c. Filed 2018	**Emissions joined:** 11% of emissions since the industrial revolution[250] **Damages sought:** Creation of an abatement fund for infrastructure and other costs, compensatory damage; costs include, among others, lost property tax revenue, wildfire response, and flood control[251] **Overview:** King County, Washington, sued the five largest investor-owned fossil fuel producers under theories of public nuisance and trespass.[252] The case has been stayed since October 2018.[253]
Bd. of Cnty. Comm'rs of Boulder Cnty v. Suncor Energy, Inc. Filed 2018	**Emissions joined:** 18 billion tons since 1988[254] **Damages sought:** Costs associated with past and future climate impacts, remediation or abatement of nuisance, and costs of climate change public education [255] **Overview:** Three local governments in Colorado sued Exxon and Suncor under public/private nuisance, trespass, unjust enrichment, and state statutory theories, seeking damages for present and future costs that would be incurred as a result of climate change.[256] Defendants' attempt to remove to federal court under seven different theories of federal jurisdiction was refused by the district court.[257] On appeal, the Tenth Circuit declined to review six of the theories and affirmed on the seventh, remanding to state court.[258]
City of New York v. BP p.l.c. Filed 2018.	**Emissions joined:** 11% of all emissions since the industrial revolution[259] **Damages sought:** Compensatory damage for costs already and currently being incurred, and injunction if defendants fail to pay damages

[250] *See* First Amended Complaint at 51, King County v. BP p.l.c., No. 2:18-cv-00758-RSL (W.D. Wa. 2018).
[251] *See id.* at 94–95.
[252] *See id* at i.
[253] *See King County v. BP p.l.c.*, SABIN CTR. FOR CLIMATE CHANGE L., http://climatecasechart.com/case/king-county-v-bp-plc/ (last visited Nov. 12, 2020).
[254] Amended Complaint at 16, 20, Bd. of Cnty. Comm'rs of Boulder Cnty v. Suncor Energy, Inc., No. 2018CV30349 (Colo. Dist. Ct. 2d Div. 2018).
[255] *See id.* at 121–23.
[256] *See id.* at 101, 105, 109, 110, 113, 121–23.
[257] *See* Bd. of Cnty. Comm'rs of Boulder Cnty. v. Suncor Energy, Inc., 965 F.3d 792, 798 (10th Cir. 2020).
[258] *See id*.
[259] *See* Amended Complaint at 2, City of New York v. BP p.l.c., 1:18-cv-00182-JFK (S.D.N.Y. 2018).

	Overview: The City of New York sued the five largest fossil fuel producers under theories of public and private nuisance and trespass.[260] This case was dismissed in July 2018. Oral arguments for the appeal of the dismissal were heard in the Second Circuit in November 2019.[261]
City & County of Honolulu v. Sunoco LP Filed 2020	**Emissions joined:** Not specified **Damages sought:** Compensatory and punitive damages, "equitable relief, including abatement of the nuisances," and disgorgement of profits[262] **Overview:** Defendants moved to remove the case to federal court under federal question jurisdiction[263] and the case was stayed pending outcome of *County of San Mateo*.[264] After *County of San Mateo* was decided, plaintiffs filed for remand to state court, which was granted in February 2021.[265]
State v. Am. Petroleum Inst. Filed 2020	**Emissions joined:** "[A] substantial portion of global atmospheric greenhouse-gas concentrations"[266] **Damages sought:** Disclosure of defendants' climate change research, funding of corrective public education campaign, civil penalties, restitution, and disgorgement of profits[267] **Overview:** Minnesota sought recompense for current and expected damages from climate change. Defendants filed a notice of removal based on federal question jurisdiction and diversity jurisdiction.[268]

[260] *See id.* at 1, 2.

[261] *See City of New York v. BP p.l.c.*, SABIN CTR. FOR CLIMATE CHANGE L., http://climatecasechart.com/case/city-new-york-v-bp-plc/ (last visited Nov. 12, 2020).

[262] Complaint at 113, City & County of Honolulu v. Sunoco, LP, No. 1CCV-20-0000380 (Haw. Cir. Ct. 2020).

[263] *See* Notice of Removal at 2, City & County of Honolulu v. Sunoco, LP, No. 1CCV-20-0000380 (Haw. Cir. Ct. 2020).

[264] *See City and County of Honolulu v. Sunoco LP*, SABIN CTR. ON CLIMATE CHANGE L., http://climatecasechart.com/case/city-county-of-honolulu-v-sunoco-lp/ (last visited Mar. 5, 2021).

[265] *See id.*

[266] Complaint at 71, State v. Am. Petroleum Inst., No. 0:20-cv-01636-JRT-HB (Minn. Dist. Ct. 2020).

[267] *See id.* at 82–83.

[268] *See* Notice of Removal at 11–12, State v. Am. Petroleum Inst., No. 0:20-cv-01636-JRT-HB (D. Minn. 2020).

City of Charleston v. Brabham Oil Filed 2020	**Emissions joined:** Not specified **Damages sought:** Monetary damage, and "equitable relief, including abatement of the nuisances"[269] **Overview:** Filed September 9, 2020. Charleston sued large fossil fuel producers for their role in climate change under public/private nuisance, failure to warn, trespass, and state statutory law.[270]
State v. BP Am. Filed 2020	**Emissions joined:** Not specified **Damages sought:** Monetary and "other relief as the Court may deem proper"[271] **Overview:** Filed September 10, 2020. Delaware sued for damages due to climate change under failure to warn, trespass, nuisance, and fraud theories.[272]
City of Hoboken v. Exxon Mobil Corp. Filed 2020	**Emissions joined:** 12% of global emissions, 1965 to 2017.[273] **Damages sought:** Monetary damages (compensatory and punitive), nuisance abatement, and end of "trespass"[274] **Overview:** Filed September 20, 2020.

[269] Complaint at 136, City of Charleston v. Brabham Oil, No. 2020CP1003975 (S.C. Ct. Comm. 2020).
[270] *See id.* at i to ii.
[271] Complaint at 217, State v. BP Am., N20C-09-097 (Del. Super. Ct. 2020)
[272] *See id.* at ii to iii.
[273] *See* Complaint at 28, City of Hoboken v. Exxon Mobil Corp., HUD-L-003179-20 (N.J. Super. Ct. 2020).
[274] *Id.* at 144–45.

Table 2: Cases Brought Against Other Defendants

Korsinsky v. EPA Filed: 2005	Korsinsky sued EPA and New York State and City environmental agencies for failure to respond adequately to climate change.[275] Case was dismissed for lack of standing because the claim was both too speculative and unlikely to be redressable by the court.[276]
California v. Gen. Motors Corp. Filed 2006	The State of California sued major automobile manufacturers[277] under both state and federal law, seeking monetary damages and declaratory judgment for future costs.[278] The district court dismissed the case as a political question. California initially appealed but dropped the appeal in response to federal policy changes including EPA's endangerment finding.[279]
S.F. Chapter of A. Randolph Inst. v. EPA Filed: 2007	Plaintiffs sued the EPA and local San Francisco governments under state and federal law to prevent construction of two natural gas plants, asserting violations of the APA, procedural due process, and public nuisance.[280] On the nuisance claim, the court found licensing a power plant could not be a nuisance if done pursuant to state law, and that nuisance claims against the operation of the plants were not ripe as the plants had not yet been built.[281]

[275] *See* Korsinksy v. EPA, 192 Fed. App'x 71, 71 (2d Cir. 2006).
[276] *See id.*
[277] *See* Complaint at 9, California v. Gen. Motors Corp., No. 06-cv-05755 MJJ (N.D. Cal. 2006) (noting that the cars defendants sell release 20% of emissions in the U.S. and 30% of California's emissions).
[278] *See id.* at 12–14.
[279] *See* Unopposed Motion to Dismiss Appeal at 1-2, California v. Gen. Motors, No. 06-cv-05755, (9th Cir. June 19, 2009).
[280] *See* S.F. Chapter of A. Randolph Inst. v. EPA, No. 3:07-cv-04936, 2008 U.S. Dist. LEXIS 27794 at *2–3 (N.D. Cal. Mar. 28, 2008).
[281] *See id.* at *8.

APPENDIX B

Table 1: Cases and Defendants

	Am. Elec. Power Co. v. Connecticut	*Comer v. Murphy Oil*[282]	*City of New York v. BP p.l.c.*	*Pac. Coast Fed. of Fisherman's Ass'ns*	*Bd. of Cnty. Commr's of Boulder Cnty.*	*King County v. BP p.l.c.*	*Rhode Island v. Chevron Corp.*	*Mayor & City Council of Baltimore*	*County of San Mateo v. Chevron Corp.*	*City of Oakland v. BP p.l.c.*	*County of Santa Cruz v. Chevron*	*Native Vill. of Kivalina*	*City and County of Honolulu*	*City of Charleston v. Brabham Oil*	*State v. BP Am.*	*City of Hoboken*	*State v. Am. Petrol. Inst.*
Am. Elec. Power[283]	X											X					
Am. Petrol. Inst.															X	X	X
Anadarko Petrol. Corp.				X					X		X						
Apache Corp.				X					X		X				X		
BP[284]			X	X		X	X	X	X	X	X	X	X	X	X	X	
Chevron[285]		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
Citgo Petrol.				X			X	X	X		X				X		
CNX Res. Corp.								X							X		
ConocoPhillips[286]			X	X		X	X	X	X	X	X	X	X	X	X	X	
Consol Energy Inc.[287]								X							X		
Devon Energy[288]				X					X		X				X		
Encana Corp.				X					X		X						
ENI Oil & Gas Inc., ENI SPA				X					X		X						
ExxonMobil[289]		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

[282] For *Comer*, the table reflects the original 2005 filing of the case.
[283] Includes Am. Elec. Power Co. and Am. Elec. Power Co. Service Corp.
[284] Includes BP America, BP p.l.c., and BP Products North America.
[285] Includes Chevron Corp., Chevron USA, Chevron/Texaco Corp.
[286] Includes ConocoPhillips, ConocoPhillips Co, Phillips 66, Phillips 66 Co.
[287] Includes Consol Energy, Inc. and Consol Marine Terminals.
[288] Includes Devon Energy Corp., Devon Energy Production Co.
[289] Includes ExxonMobil Corp., ExxonMobil Oil Corp.

	Am. Elec. Power Co.	*Comer*	*City of New York*	*Pac. Coast*	*Boulder*	*King County*	*Rhode Island*	*Baltimore*	*San Mateo*	*Oakland*	*Santa Cruz*	*Kivalina*	*Honolulu*	*Charleston*	*State v. BP Am.*	*Hoboken*	*State v. Am. Petrol. Inst.*
Hess Corp.				X			X	X	X		X			X	X		
Marathon[290]				X			X	X	X		X		X	X	X		
Murphy Oil, U.S.A., Murphy USA		X												X	X		
Occidental[291]				X					X		X				X		
Peabody Energy Corp.									X			X					
Repsol[292]				X					X		X						
Shell[293]		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
Speedway							X	X						X	X		
The Southern Co.	X											X					
Total[294]				X					X		X				X		
XCEL Energy	X											X					
Does/Entities/Oil and Refining Entities[295]		X		X		X	X		X	X	X		X				

[290] Includes Marathon Oil Co., Marathon Oil Corp., Marathon Petroleum Co. LP, Marathon Petroleum Corp.
[291] Includes Occidental Chemical Corp., Occidental Petroleum Corp.
[292] Includes Repsol Energy North America Corp., Repsol SA, Repsol Trading USA Corp.
[293] Includes Royal Dutch Shell p.l.c., Shell Oil Co., Shell Oil Products Co. LLC.
[294] Includes Total E&P USA Inc., Total SA, Total Specialties USA.
[295] Includes space reserved for additional future defendants.

Table 2: Defendants Joined in Only One Case

Defendants	Case
Aloha Petroleum LLC Aloha Petroleum LTD	City and County of Honolulu v. Sunoco, LP
Arch Coal, Inc.	County of San Mateo v. Chevron Corp.
BHP Group Limited BHP Group PLC BHP Hawaii	City and County of Honolulu v. Sunoco, LP
Brabham Oil Company	City of Charleston v. Brabham Oil
Cinergy Corporation	Am. Elec. Power Co. v. Connecticut
Colonial Group, Inc.	City of Charleston v. Brabham Oil
Colonial Pipeline Company	City of Charleston v. Brabham Oil
Crown Central LLC Crown Central New Holdings LLC Crown Central Petroleum Corp.	Mayor & City Council of Baltimore v. BP p.l.c.
DTE Energy Co.	Native Village of Kivalina v. ExxonMobil Corp.
Duke Energy Corp.	Native Village of Kivalina v. ExxonMobil Corp.
Dynegy Holdings	Native Village of Kivalina v. ExxonMobil Corp.
Edison International	Native Village of Kivalina v. ExxonMobil Corp.
Enmark Stations	City of Charleston v. Brabham Oil
Flint Hills Resources LP Flint Hills Resources Pine Bend	State v. Am. Petroleum Inst.
Getty Petroleum Marketing, Inc.	Rhode Island v. Chevron Corp.
Koch Industries	State v. Am. Petroleum Inst.
Louisiana Land & Exploration Co.	Mayor & City Council of Baltimore v. BP p.l.c.
Lukoil Pan Americas	Rhode Island v. Chevron Corp.
Midamerican Energy Holdings	Native Village of Kivalina v. ExxonMobil
Mirant Corp.	Native Village of Kivalina v. ExxonMobil Corp.
Motiva	Rhode Island v. Chevron Corp.
NRG Energy	Native Village of Kivalina v. ExxonMobil Corp.
Ovintiv, Inc.	State v BP Am.
Piedmont Petroleum Corp.	City of Charleston v. Brabham Oil

Pinnacle West Capital	Native Village of Kivalina v. ExxonMobil Corp.
Reliant Energy	Native Village of Kivalina v. ExxonMobil Corp.
Rio Tinto Energy America, Inc. Rio Tinto, Ltd. Rio Tinto Minerals, Inc. Rio Tinto PLC Rio Tinto Service, Inc.	County of San Mateo v. Chevron Corp.
Statoil ASA	County of San Mateo v. Chevron Corp.
Suncor Energy (USA), Inc. Suncor Energy Inc. Suncor Energy Sales, Inc.	Bd. of Cnty. Comm'rs of Boulder County v. Suncor Energy, Inc.
Sunoco	City and County of Honolulu v. Sunoco, LP
Tennessee Valley Authority	Am. Elec. Power Co. v. Connecticut
The AES Corp.	Native Village of Kivalina v. ExxonMobil Corp.
Universal Oil Products	Comer v. Murphy Oil USA
XTO Energy, Inc.	State v. BP Am.