

Climate Change

2020-2021 Topic Proposal



Proposed to
The NFHS Debate Topic Selection Committee
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Introduction

In 2002, the phenom from St. Louis, Nelly noted “It’s getting hot in herre.” While it is clear that he was probably not talking about climate change, seventeen years later he very much could be. According to Julia Hollingsworth in a 2019 CNN article “that if global temperatures rise 3 degrees Celsius by 2050, 55% of the world’s population across 35% of its land area would experience more than 20 days of lethal heat per year, “beyond the threshold of human survivability.”” Clearly, time is not on our side and we need to use the research and argumentation abilities of the next generation of leaders to help save our planet.

As a community, we have not taken the opportunity to directly debate climate change or greenhouse gas emissions as the sole focus of a resolution. While we have debated areas that include climate like: Alternative Energy (1997 and 2008) or environmental pollution (1971, 1993) we have not made emissions reductions the sole focus. The Trump administration has taken an activist role is rolling back domestic climate policy and United States participation in international agreements. There is a broad consensus in the academic and scientific communities that the United States needs to do something to either mitigate or adapt to climate change, yet they are doing nothing.

Under this topic, affirmatives could take a variety of approaches to change the course of current climate policy. Affirmatives could set hard targets to reduce emissions to, enact a cap and trade or carbon tax system, eliminate subsidies of fossil fuels, or potentially increase alternative energy production to reduce emissions. Negative teams will have access to a wide range of economic sectors for disadvantages and private agency counterplans in addition to a very legitimate debate about whether the states or the national government is the more credible actor on climate policy. Critical and non-traditional debaters could discuss why regulations are inherently neoliberal, why we should reject environmental managerialism in addition to arguments like settler colonialism or identity politics-based critiques that have a growing literature base focusing on climate change studies.

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Section 1: The State of Climate Policy

1A. The Trump Effect

It would be an understatement to note that US Climate Policy is a mess. From debates on whether or not climate change is anthropogenic or natural, to whether or not it is real or a hoax to who exactly is responsible for taking action, the US has no clear vision on how to tackle climate change. The Trump administration has taken an active role in disrupting any past actions taken by the US. On Trump's watch we have withdrawn from the Paris Climate Agreement, are rolling back CAFÉ standards, eliminating Obama's Clean Power Plan etc. Several states have attempted to institute agreements to bind their states to the Paris Agreement, while other states have doubled down on oil and gas production. Phillip Wallach from the Brookings institute highlights the current nightmare of American climate policy:

Philip A. **Wallach, 3-22-2019**, (Senior Fellow - R Street Institute Former Expert - Brookings Institution) "Where does US climate policy stand in 2019?," Brookings, <https://www.brookings.edu/2019/03/22/where-does-u-s-climate-policy-stand-in-2019///IC>

To think about federal climate policy these days is to think about the future. Will we see Democrats embrace a radical program like the Green New Deal? Or will elites of both parties come to see a carbon tax as an attractive means of raising revenue, as a diverse group of former heads of the Council of Economic Advisors and Nobel Prize winners recently urged? Focusing on 2021 and beyond is quite reasonable. The Trump administration has clearly opposed the climate policies of its predecessor, and there is no reason to expect legislative action of any kind during the 116th Congress. It would seem there is not much to know about American climate policy in the present. At the highest level, that's fair. But when we think about where American climate policy can go in the future, it matters quite a lot just how the Trump administration has gone about trying to reverse the Obama administration's policies, and where American law actually stands today. Keeping track of the administration's legal maneuvers—and their opponents' counters—can be challenging, and so this brief report attempts to offer a comprehensive snapshot of where the nation's climate policies stand today. It stands as a climate-focused supplement to the Brookings Deregulation Tracker.

PARIS CLIMATE AGREEMENT The Paris Climate Agreement came out of the 21st session of the United Nations Climate Change Conference in December 2015, and went into force on November 4, 2016. The United States was one of the principal drivers of the compromise, and President Obama hailed it as "a tribute to American leadership." As a candidate for president, Donald Trump criticized the agreement as a bad deal for the American people and pledged to withdraw the United States if elected. In June 2017, he announced he would be following through with that promise, though he also (confusingly) said he would immediately start negotiations to reenter the climate accord on better terms. Legally, however, Article 28 of the Paris Agreement specifies that a country cannot initiate a withdrawal until three years after the agreement has gone into force—i.e., for the United States, November 4, 2019. That decision would go into effect another year later. As it happens, that would put the expected official U.S. exit from the agreement one day after the next presidential election. If a Democrat were to defeat Trump in November 2020, it then seems likely that the U.S. might leave the agreement and then reenter within a matter of months. If Trump is reelected, we would have to see whether his initial insistence that he would be negotiating a new deal for the United States actually signaled an intention to remain engaged with international climate politics, or whether it was simply bluster. In more practical terms, the effects of the U.S. hokey-pokey on the Paris Agreement (put your left foot in, take your right foot out) aren't entirely clear. Many U.S. states and cities

responded to Trump's withdrawal announcement by putting in place their own commitments. The non-binding nature of countries' commitments under the agreement means that, throughout the world, other actions must ultimately drive emissions below what unguided market behavior would dictate. But, in the longer term, most experts agree that the orientation of the U.S. toward the Paris Agreement will be an important factor in determining whether the compact leads to a virtuous cycle of ambitious emissions reduction strategies around the globe. **MOBILE SOURCES** The two largest sources of carbon emissions in the U.S. are the power and transportation sectors, which the Clean Air Act treats as stationary sources and mobile sources, respectively. According to the Environmental Protection Agency (EPA), light-duty vehicles are responsible for 60 percent of transportation emissions, followed by medium- and heavy-duty trucks at 23 percent, and aircraft at 9 percent. The main regulatory program for automobiles is the Corporate Average Fuel Economy (CAFE) program, which has been in place since 1975. The Energy Independence and Security Act of 2007 dictated that vehicle fleets for model years 2021-2030 would have to achieve "the maximum feasible average fuel economy standard" to be defined by the Department of Transportation as in cooperation with the EPA. Early in the Obama administration, CAFE was selected as the primary means of limiting mobile source carbon emissions. Rules finalized in October 2012 put in place binding standards through Model Year 2021 and offered estimated standards through 2025. Before leaving office in January 2017, the Obama administration issued a final determination making its previous estimates binding, provoking angry criticisms from automakers who felt that the review process leading up to the termination had been rushed and had arrived at an unrealistic conclusion about what was really feasible. The Trump administration vowed to reverse the determination and ultimately did so in April 2018, immediately provoking lawsuits by a coalition of blue state attorneys general. They proposed a new, less-stringent set of determinations, dubbed the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule, in August 2018 that has yet to be finalized. An attempt to defuse litigation through negotiations with the California Air Resources Board recently failed. The Trump administration's actions on CAFE standards are likely to remain consequential even if they are eventually overturned by courts or by a Democratic administration in 2021. Because auto manufacturers need considerable lead time to be able to make decisions about the compositions of their fleets, it seems hard to imagine that they could end up being held to the standards dictated by the outgoing Obama administration after a years-long interregnum of legal uncertainty. Suppose that the Trump standards survive legal scrutiny but a Democrat becomes president in 2021. Pivoting once again toward more stringent carbon emission standards for cars is likely to take at least a year, likely more. It is worth briefly noting other mobile source rules in play. In 2016, the Obama administration put carbon emissions standards for heavy-duty trucks in place through model year 2027. Although former EPA Administrator Scott Pruitt indicated a willingness to reconsider those rules, they are still currently in place. Under the Obama administration, the EPA issued an Endangerment Finding for carbon emissions from aircrafts in 2016. Given the terms of the Clean Air Act, that means the agency is obligated to regulate those emissions. However, no action was taken by the end of the Obama administration, and none has yet been taken by the Trump administration. The centerpiece of the Obama administration's climate policy was the ambitious and highly controversial Clean Power Plan, the rule for emissions from already existing power plants. It was proposed in 2014 and finalized in October 2015. Although the administration made major changes to the rule in an attempt to ensure that courts would view it favorably, it always rested on an awkward legal foundation. That was because the Clean Air Act regulates each source of emissions individually, but the Clean Power Plan essentially sought to regulate the power sector as a coherent whole, all but requiring that fossil-fuel-fired plants subsidize renewable energy. In an extraordinary action taken just before the death of Associate Justice Antonin Scalia in February 2016, a 5-4 majority of the Supreme Court issued a stay on the Clean Power Plan effective until all legal challenges to it were completely exhausted. In other words, the court put the Obama administration's most ambitious action to combat global warming on ice. The election returns in November 2016 ensured that it would not be resuscitated immediately. Courts backed off to give the Trump administration room to work its will, knowing that issuing a final ruling on the Obama administration's policy was probably moot. And, indeed, the Trump administration proposed a rescission of the rule in October 2017 and proposed a replacement, dubbed the Affordable Clean Energy Rule, in August 2018. At present, neither of these rules have been finalized; both are certain to face legal challenges. That leaves the old Clean Power Plan in a state of legal limbo, clearly inactive but not yet technically off the books. Some critics of the president's policies seem to think that the Clean Power Plan might simply be unfrozen in the future and set back upon its way. For example, the Natural Resources Defense Council has opposed what it calls the Trump administration's "Dirty Power Plan" and features a web page appealing to potential donors to "Save the Clean Power Plan." Senator Dianne Feinstein, meanwhile, recently

put forward an alternative to the much-touted Green New Deal, which included a call to restore the Clean Power Plan and its 2030 goals. But does such an objective make any sense in 2019, three years after the original stay was issued? The final Clean Power Plan was to impose its first binding emissions limits as of January 1, 2022, which may seem to give time to see it reinvigorated by a Democratic president in 2021. But any return to the Obama administration's policy would, at least, require a continuation of the legal battle put on hold in 2017; supposing (as is likely) the Trump administration does eventually finalize its rescission of the rule, returning to the old rule would require its own rulemaking process that would take at least a year. Just as importantly, as in the case of CAFE standards, long lead times are necessary for compliance, making it unlikely that any plant could be put on a compliance schedule as short as a year. One might plausibly imagine a modified Clean Power Plan with a later starting date, but, once again, because particular standards for particular dates are the very essence of the rule, such a shift would entail an entirely new rulemaking effort. A new administration might choose to pursue a path of continuity with its last Democratic predecessor, but, then again, they might want to craft their own signature climate policy from scratch—especially since the Clean Power Plan's impact at this point is predicted to be so modest when compared to market forces, as Howard Gruenspecht explains in a recent Brookings analysis. Rules for existing power plants are not the only stationary source rule at issue. The Trump administration proposed to replace the Obama EPA's rule for new and modified power plants in December 2018, putting in place a much less stringent standard for coal plants. Rules for oil refiners are also required by the Clean Air Act, but the Obama administration never got any in place. Other potential areas for regulation include cement production and the agricultural sector. **LITIGATION** While the legal challenges to the Clean Power Plan were frozen much like the rule itself, other legal developments have been progressing, with the potential to reshape the whole regulatory landscape for climate change issues. It is fairly unlikely that these developments will ultimately dictate the shape of climate policy to come—but it seems more likely today than it did just a few years ago. Several types of lawsuits are worth tracking—with the Sabin Center for Climate Change Law providing excellent resources for doing so. First, there are lawsuits that seek to force the United States government to take aggressive action, at least partly in the form of regulation, to combat climate change. Plaintiffs in these lawsuits bring various theories of why courts should listen to them. In the most prominent case, Juliana v. United States, young plaintiffs alleged that the U.S. government has violated their constitutional rights to life, liberty, and property through its own climate-change-causing acts. Much to the surprise of most legal observers, that case survived a motion to dismiss in November 2016, when a District Court judge in Oregon found that the case could proceed to trial. It has since become entangled in a thicket of dueling motions, with a scheduled trial postponed. If plaintiffs can win at trial and withstand appeals in the Ninth Circuit, it is all-but impossible to imagine them winning in the Supreme Court. Nevertheless, the case has become a major rallying point for climate activists (and an object of fascination for mainstream media), and any additional victories in lower courts could have the effect of amplifying dissatisfaction with the status quo. Another case in the Eastern District of Pennsylvania, pursuing a similar theory, was recently dismissed, with the judge declaring: "Because I have neither the authority nor the inclination to assume control of the Executive Branch, I will grant defendants' motion." Other lawsuits allege specific harms and seek compensatory monetary damages, to be paid by the largest fossil fuel extraction companies, rather than asking courts to guide policy. For example, California's San Mateo County has sued Chevron, alleging that sea level rise caused by the burning of fossil fuels is destroying its citizens' property, and that the oil company intentionally concealed evidence and misled the public of these harms. Such cases bear a resemblance to the cases brought against tobacco companies by states' attorneys general, which eventually led to the Master Settlement Agreement; plaintiffs likely seek to duplicate that kind of high-dollar negotiated settlement, even if it requires fundamentally reshaping the limits of tort law. Non-governmental plaintiffs have also begun testing the waters of damage suits against fossil fuel companies. Pacific coast fishermen allege that oil companies have created a public nuisance that resulted in "prolonged closures" of crab fisheries. None of these cases have yet to break through, and many have been dismissed. But if a single jury were to assess monetary damages, the oil companies' willingness to tolerate the current fragmented legal status quo might quickly end, making them enthusiastic proponents of any legislative bargain that barred such claims. Yet another set of cases seeks to use securities law as the means of holding fossil fuel companies accountable, by alleging that they defrauded their investors by failing to disclose the known risks of climate change. It may seem odd to say that the oil

company shareholders' interests are the ones in need of vindication, but this is part of a larger phenomenon in which (as Bloomberg's Matt Levine often says) "everything is securities fraud." In other words, securities law has become the mechanism used to punish public corporations for their sins whenever other means of doing so are inconvenient. By far the most important of these cases is the one filed by the Attorney General of New York against Exxon Mobil in October 2018, after a three-year long investigation led by former state Attorney General Eric Schneiderman. Brought under New York law and now overseen by Schneiderman's successor, Letitia James, the case contends that Exxon's public predictions of future regulatory costs related to climate change diverged from those that it relied on privately, thereby deceiving its investors. A trial is set for late 2019. One of the most important questions for future efforts to address climate change will be their orientation toward all of this pre-existing legal action. Promising to end it (at least at the federal level) would be a major inducement for industry support. **STATE ACTIONS** As the regulatory landscape for climate is shaped by developments at the EPA and in federal courts, it is also important to remember that state and local legislatures have been active even if Congress has not. As Barry Rabe describes, climate action in the states is clearly polarized, with some blue states deeply committed to cutting emissions within their borders. Their efforts include California's cap-and-trade system as well as the Regional Greenhouse Gas Initiative (RGGI) in the northeast, which now has 9 member states. But, looking more broadly, states that have not traditionally made cutting carbon emissions a priority don't seem to be rushing to do so lately. So the parts of the country with the highest emissions rates are often those doing the least—which may be politically unsurprising, but is nevertheless quite unfortunate from an economic efficiency standpoint. **LOOKING TO THE FUTURE** So what is the bottom line, when we consider how U.S. climate policymaking will proceed after the 2020 election? If President Trump wins reelection, the policy landscape will remain fragmented and mired in litigation, with every administration attempt to reduce the stringency of emissions controls fought out in courts. Barring some dramatic reversal on the part of the president or Republicans in Congress, we would expect four more years of federal policy stagnation. This might well make judges more likely to allow aggressive legal actions in court; in any case, it would not bode well for a coherent national climate policy. If a Democrat defeats Trump, his or her administration would probably take a two-track approach to climate policy. First, the Department of Transportation, EPA, and other agencies would use their powers to pick up where Obama administration policies left off. Because this path allows for action without figuring out congressional politics, it seems like the "easy" way of moving forward, but as the Obama administration's struggles showed, it can be a long slog, even as it fails to put to rest legal uncertainty. That makes the second path, through congressional legislation, more urgent. There is no question that putting together a comprehensive climate policy will be a difficult political feat—even if Democrats control the House and Senate, as they did in 2009-2010. But, with talk of a Green New Deal unlikely to disappear, a Democratic president would feel tremendous pressure to deliver a significant deal. He or she would probably be willing to use the executive-centered actions as bargaining chips (in addition to providing clearer limits on liability), even if environmentalists might object to relinquishing any potential tool. In either scenario, the developments during the remaining two years of President Trump's first term will significantly shape each side's leverage. The Brookings Center on Regulation and Markets will continue to cover these developments closely.

The Trump administration has been violently anti-environmental regulation. On his watch, 83 regulations have been rolled back, which, if left unchecked, will turn back the clock on any progress in the name of fighting climate change.

NADJA POPOVICH, LIVIA ALBECK-RIPKA and KENDRA PIERRE-LOUIS , **6-7-2019**, "83 Environmental Rules Being Rolled Back Under Trump," <https://www.nytimes.com/interactive/2019/climate/trump-environment-rollbacks.html?mtrref=www.google.com//IC>

83 Environmental Rules Being Rolled Back Under Trump President Trump has made eliminating federal regulations a priority. His administration, with help from Republicans in Congress, has often targeted environmental rules it sees as burdensome to the fossil fuel industry and other big businesses. [A New York Times analysis, based on research from Harvard Law School, Columbia Law School and other sources, counts more than 80 environmental rules and regulations on the way out under Mr. Trump. Our list represents two types of policy changes: rules that were officially reversed and rollbacks still in progress. The Trump administration has released an aggressive schedule to try to finalize many of these rollbacks this year.](#)

49 34 83 ROLLBACKS COMPLETED ROLLBACKS IN PROCESS TOTAL ROLLBACKS Air pollution and emissions 10 12 22 Drilling and extraction 9 9 18 Infrastructure and planning 12 1 13 Animals 8 2 10 Toxic substances and safety 3 2 5 Water pollution 4 3 7 Other 3 5 8 The Trump administration has often used a “one-two punch” when rolling back environmental rules, said Caitlin McCoy, a fellow in the Environmental and Energy Law Program at Harvard Law School who tracks regulatory rollbacks. “First a delay rule to buy some time, and then a final substantive rule.” But the process of rolling back regulations has not always been smooth. [In some cases, the administration has failed to provide a strong legal argument in favor of proposed changes or agencies have skipped key steps in the rulemaking process,](#) like notifying the public and asking for comment. In several cases, courts have ordered agencies to enforce their own rules. Several environmental rules — summarized at the bottom of this page — were rolled back and then later reinstated, often following legal challenges. Other rollbacks remain mired in court. **ADVERTISEMENT** All told, [the Trump administration’s environmental rollbacks could significantly increase greenhouse gas emissions and lead to thousands of extra deaths from poor air quality every year, according to a recent report prepared by New York University Law School’s State Energy and Environmental Impact Center.](#)

Here are the details for each of the policies targeted by the administration so far. Are there rollbacks we missed? Email climateteam@nytimes.com or tweet [@nyclimate](https://twitter.com/nyclimate). **Air pollution and emissions** COMPLETED 1. Canceled a requirement for oil and gas companies to report methane emissions.Environmental Protection Agency | Read more 2. Revised and partially repealed an Obama-era rule limiting methane emissions on public lands, including intentional venting and flaring from drilling operations.Interior Department | Read more 3. Loosened a Clinton-era rule designed to limit toxic emissions from major industrial polluters.E.P.A. | Read more 4. Stopped enforcing a 2015 rule that prohibited the use of hydrofluorocarbons, powerful greenhouse gases, in air-conditioners and refrigerators.E.P.A. | Read more 5. Repealed a requirement that state and regional authorities track tailpipe emissions from vehicles traveling on federal highways.Transportation Department | Read more 6. Reverted to a weaker 2009 pollution permitting program for new power plants and expansions.E.P.A. | Read more 7. Amended rules that govern how refineries monitor pollution in surrounding communities.E.P.A. | Read more 8. Directed agencies to stop using an Obama-era calculation of the “social cost of carbon” that rulemakers used to estimate the long-term economic benefits of reducing carbon dioxide emissions.Executive Order | Read more 9. Withdrew guidance that federal agencies include greenhouse gas emissions in environmental reviews. But several district courts have ruled that emissions must be included in such reviews.Executive Order; Council on Environmental Quality | Read more 10. Lifted a summertime ban on the use of E15, a gasoline blend made of 15 percent ethanol. (Burning gasoline with a higher concentration of ethanol in hot conditions increases smog.)E.P.A. | Read more IN PROCESS 11. Proposed weakening Obama-era fuel-economy standards for cars and light trucks. The proposal also challenges California’s right to set its own more stringent standards, which other states can choose to follow.E.P.A. and Transportation Department | Read more 12. Announced intent to withdraw the United States from the Paris climate agreement. (The process of withdrawing cannot be completed until 2020.)Executive Order | Read more 13. Proposed repeal of the Clean Power Plan, which would have set strict limits on carbon emissions from coal- and gas-fired power plants. In April 2019, the E.P.A. sent a replacement plan, which would let states set their own rules, to the White House for budget review.Executive Order; E.P.A. | Read more 14. Proposed eliminating Obama-era restrictions that in effect required newly built coal power plants to capture carbon dioxide emissions.E.P.A. | Read more 15. Proposed a legal justification for weakening an Obama-era rule that limited mercury emissions from coal power plants.E.P.A. | Read more 16. Proposed revisions to standards for carbon dioxide emissions from new, modified and reconstructed power plants.Executive Order; E.P.A. | Read more 17. Began review of emissions rules for power plant start-ups, shutdowns and malfunctions. In April, the E.P.A. filed an order reversing a requirement that 36 states follow the emissions rule.E.P.A. | Read more 18. Proposed relaxing Obama-era requirements that companies monitor and repair methane leaks at oil and gas facilities.E.P.A. | Read more 19. Proposed changing rules aimed at cutting methane emissions from landfills. In May, 2019, a federal judge ruled against the E.P.A. for failing to enforce the existing law and gave the agency a fall deadline for finalizing state and federal rules. E.P.A. said it is reviewing the decision.E.P.A. | Read more 20. Announced a rewrite of an Obama-era rule meant to reduce air pollution in national parks and wilderness areas.E.P.A. | Read more 21. Weakened oversight of some state plans for reducing air pollution in national parks. (In Texas, the E.P.A. rejected an Obama-era plan that would have required the installation of equipment at some coal-burning power plants to reduce sulfur dioxide emissions.)E.P.A. | Read more 22. Proposed repealing leak-repair, maintenance and reporting requirements for large refrigeration and air conditioning systems containing hydrofluorocarbons.E.P.A. |

Read more **Drilling and extraction** COMPLETED 23. Made significant cuts to the borders of two national monuments in Utah and recommended border and resource management changes to several more. Presidential Proclamation; Interior Department | Read more 24. Rescinded water pollution regulations for fracking on federal and Indian lands. Interior Department | Read more 25. Scrapped a proposed rule that required mines to prove they could pay to clean up future pollution. E.P.A. | Read more 26. Withdrew a requirement that Gulf oil rig owners prove they could cover the costs of removing rigs once they have stopped producing. Interior Department | Read more 27. Approved construction of the Dakota Access pipeline less than a mile from the Standing Rock Sioux reservation. Under the Obama administration, the Army Corps of Engineers had said it would explore alternative routes. Executive Order; Army | Read more 28. Revoked an Obama-era executive order designed to preserve ocean, coastal and Great Lakes waters in favor of a policy focused on energy production and economic growth. Executive Order | Read more 29. Changed how the Federal Energy Regulatory Commission considers the indirect effects of greenhouse gas emissions in environmental reviews of pipelines. Federal Energy Regulatory Commission | Read more 30. Permitted the use of seismic air guns for gas and oil exploration in the Atlantic Ocean. The practice, which can kill marine life and disrupt fisheries, was blocked under the Obama administration. National Oceanic and Atmospheric Administration | Read more 31. Loosened offshore drilling safety regulations implemented by the Obama administration following the 2010 Deepwater Horizon explosion and oil spill. The revised rules include reduced testing requirements for blowout prevention systems. Interior Department | Read more IN PROCESS 32. Completed preliminary environmental reviews to clear the way for drilling in the Arctic National Wildlife Refuge. Congress; Interior Department | Read more 33. Proposed opening most of America's coastal waters to offshore oil and gas drilling, but delayed the plan after a federal judge ruled that Mr. Trump's reversal of an Obama-era ban on drilling in the Arctic Ocean was unlawful. Interior Department | Read more 34. Lifted an Obama-era freeze on new coal leases on public lands. But, in April 2019, a judge ruled that the Interior Department could not begin selling new leases without completing an environmental review. A month later, the agency published a draft assessment that concluded restarting federal coal leasing would have little environmental impact. Executive Order; Interior Department | Read more 35. Repealed an Obama-era rule governing royalties for oil, gas and coal leases on federal lands, which replaced a 1980s rule that critics said allowed companies to underpay the federal government. A federal judge struck down the Trump administration's repeal. The Interior Department is reviewing the decision. Interior Department | Read more 36. Proposed "streamlining" the approval process for drilling for oil and gas in national forests. Agriculture Department; Interior Department | Read more 37. Ordered review of regulations on oil and gas drilling in national parks where mineral rights are privately owned. Executive Order; Interior Department | Read more 38. Recommended shrinking three marine protected areas, or opening them to commercial fishing. Executive Order; National Oceanic and Atmospheric Administration | Read more 39. Ordered review of regulations on offshore oil and gas exploration by floating vessels in the Arctic that were developed after a 2013 accident. The Interior Department said it was "considering full rescission or revision of this rule." Executive Order; Interior Department | Read more 40. Approved the Keystone XL pipeline rejected by President Barack Obama, but a federal judge blocked the project from going forward without an adequate environmental review process. Mr. Trump later attempted to side-step the ruling by issuing a presidential permit, but the project remains tied up in court. Executive Order; State Department | Read more **Infrastructure and planning** COMPLETED 41. Revoked Obama-era flood standards for federal infrastructure projects, like roads and bridges. The standards required the government to account for sea-level rise and other climate change effects. Executive Order | Read more 42. Relaxed the environmental review process for federal infrastructure projects. Executive Order | Read more 43. Revoked a directive for federal agencies to minimize impacts on water, wildlife, land and other natural resources when approving development projects. Executive Order | Read more 44. Revoked an Obama executive order promoting "climate resilience" in the northern Bering Sea region of Alaska, which withdrew local waters from oil and gas leasing and established a tribal advisory council to consult on local environmental issues. Executive Order | Read more 45. Revoked an Obama executive order that set a goal of cutting the federal government's greenhouse gas emissions by 40 percent over 10 years. Executive Order | Read more 46. Reversed an update to the Bureau of Land Management's public land use planning process. Congress | Read more 47. Withdrew an Obama-era order to consider climate change in managing natural resources in national parks. National Park Service | Read more 48. Restricted most Interior Department environmental studies to one year in length and a maximum of 150 pages, citing a need to reduce paperwork. Interior Department | Read more 49. Withdrew a number of Obama-era Interior Department climate change and conservation policies that the agency said could "burden the development or utilization of domestically produced energy resources." Interior Department | Read more 50. Eliminated the use of an Obama-era planning system designed to minimize harm from oil and gas activity on sensitive landscapes, such as national parks. Interior Department | Read more 51. Eased the environmental review processes for small wireless infrastructure projects with the goal of expanding 5G wireless networks. Federal Communications Commission | Read more 52. Withdrew Obama-era policies designed to maintain or, ideally improve, natural resources affected by federal projects. Interior Department | Read more IN PROCESS 53. Proposed plans to streamline the environmental review process for Forest Service projects. Agriculture Department | Read more **Animals** COMPLETED 54. Opened nine million acres of Western land to oil and gas drilling by weakening habitat protections for the sage grouse, an imperiled bird with an elaborate mating dance. Interior Department | Read more 55. Overturned a ban on the use of lead ammunition and fishing tackle on federal lands. Interior Department | Read more 56. Overturned a ban on the hunting of predators in Alaskan wildlife refuges. Congress | Read more 57. Ended an Obama-era rule barring hunters on some Alaska public lands from using bait to lure and kill grizzly bears. National Park Service; Interior Department | Read more 58. Withdrew proposed limits on the number of endangered marine mammals and sea turtles that people who fish could unintentionally kill or injure with sword-fishing nets on the West Coast. In 2018, California issued a state rule prohibiting the use of the nets the rule was intending to regulate. National Oceanic

and Atmospheric Administration | Read more 59. Amended fishing regulations for a number of species to allow for longer seasons and higher catch rates. National Oceanic and Atmospheric Administration | Read more 60. Rolled back a roughly 40-year-old interpretation of a policy aimed at protecting migratory birds, potentially running afoul of treaties with Canada and Mexico. Interior Department | Read more 61. Overturned a ban on using parts of migratory birds in handicrafts made by Alaskan Natives. Interior Department | Read more IN PROCESS 62. Proposed stripping the Endangered Species Act of key provisions. Interior Department | Read more 63. Proposed relaxing environmental protections for salmon and smelt in California's Central Valley in order to free up water for farmers. Executive Order; Interior Department | Read more **Toxic substances and safety** COMPLETED 64. Narrowed the scope of a 2016 law mandating safety assessments for potentially toxic chemicals, like dry-cleaning solvents and paint strippers. The E.P.A. will focus on direct exposure and exclude air, water and ground contamination. E.P.A. | Read more 65. Reversed an Obama-era rule that required braking system upgrades for "high hazard" trains hauling flammable liquids, like oil and ethanol. Transportation Department | Read more 66. Removed copper filter cake, an electronics manufacturing byproduct comprised of heavy metals, from the "hazardous waste" list. E.P.A. | Read more IN PROCESS 67. Rejected a proposed ban on chlorpyrifos, a potentially neurotoxic pesticide. In August 2018, a federal court ordered the E.P.A. to ban the pesticide, but the agency is appealing the ruling. E.P.A. | Read more 68. Announced a review of an Obama-era rule lowering coal dust limits in mines. The head of the Mine Safety and Health Administration said there were no immediate plans to change the dust limit, but the review is continuing. Labor Department | Read more **Water pollution** COMPLETED 69. Revoked a rule that prevented coal companies from dumping mining debris into local streams. Congress | Read more 70. Withdrew a proposed rule aimed at reducing pollutants, including air pollution, at sewage treatment plants. E.P.A. | Read more 71. Withdrew a proposed rule requiring groundwater protections for certain uranium mines. E.P.A. | Read more 72. Weakened federal rules regulating the disposal and storage of coal ash waste from power plants. (A second phase of this rollback is still under way.) E.P.A. | Read more IN PROCESS 73. Proposed rolling back protections for certain tributaries and wetlands that the Obama administration wanted covered by the Clean Water Act. E.P.A.; Army | Read more 74. Delayed by two years an E.P.A. rule regulating limits on toxic discharge, which can include mercury, from power plants into public waterways. E.P.A. | Read more 75. Ordered the E.P.A. to re-evaluate a section of the Clean Water Act and related guidance that allows states to reject or delay federal projects – including pipelines and other fossil fuel facilities – if they don't meet local water quality goals. Executive Order; E.P.A. | Read more **Other** COMPLETED 76. Prohibited funding environmental and community development projects through corporate settlements of federal lawsuits. Justice Department | Read more 77. Announced intent to stop payments to the Green Climate Fund, a United Nations program to help poorer countries reduce carbon emissions. Executive Order | Read more 78. Reversed restrictions on the sale of plastic water bottles in national parks designed to cut down on litter, despite a Park Service report that the effort worked. Interior Department | Read more IN PROCESS 79. Proposed limiting the studies used by the E.P.A. for rulemaking to only those that make data publicly available. (The move was widely criticized by scientists, who said it would effectively block the agency from considering landmark research that relies on confidential health data.) E.P.A. | Read more 80. Proposed repealing an Obama-era regulation that nearly doubled the number of light bulbs subject to energy-efficiency standards set to go into effect next year. Energy Department | Read more 81. Proposed changes to the way cost-benefit analyses are conducted under the Clean Air Act, Clean Water Act and other environmental statutes. E.P.A. | Read more 82. Proposed withdrawing efficiency standards for residential furnaces and commercial water heaters designed to reduce energy use. Energy Department | Read more 83. Initially withdrew then delayed a proposed rule that would inform car owners about fuel-efficient replacement tires. (The Transportation Department has scheduled a new rulemaking notice for 2020.) **10 rules were reinstated, often following lawsuits and other challenges** 1. Reinstated a rule aimed at improving safety at facilities that use hazardous chemicals following a federal court order. E.P.A. | Read more 2. Reversed course on repealing emissions standards for "glider" trucks — vehicles retrofitted with older, often dirtier engines — after Andrew Wheeler took over as head of the E.P.A. E.P.A. | Read more 3. Delayed a compliance deadline for new national ozone pollution standards by one year, but later reversed course. E.P.A. | Read more 4. Suspended an effort to lift restrictions on mining in Bristol Bay, Alaska. But the Army Corps of Engineers is performing an environmental review of an application for mining in the area. E.P.A.; Army | Read more 5. Delayed implementation of a rule regulating the certification and training of pesticide applicators, but a judge ruled that the E.P.A. had done so illegally and declared the rule in effect. E.P.A. | Read more 6. Initially delayed publishing efficiency standards for household appliances, but later published them after multiple states and environmental groups sued. Energy Department | Read more 7. Delayed federal building efficiency standards until Sept. 30, 2017, at which time the rules went into effect. Energy Department | Read more 8. Reissued a rule limiting the discharge of mercury by dental offices into municipal sewers after a lawsuit by the Natural Resources Defense Council, an advocacy group. E.P.A. | Read more 9. Re-posted a proposed rule limiting greenhouse gas emissions from aircraft, after initially changing its status to "inactive" on the E.P.A. website. In May 2019, the agency confirmed it would issue the rule. E.P.A. | Read more 10. Removed the Yellowstone grizzly bear from the Endangered Species List, but the protections were later reinstated by a federal judge. (The Trump administration appealed the ruling in May 2019.) Interior Department | Read more Note: This list does not include new rules proposed by the Trump administration that do not roll back previous policies, nor does it include court actions that have affected environmental policies independent of executive or legislative action. Sources: Harvard Law School's Environmental Regulation Rollback Tracker; Columbia Law School's Climate Deregulation Tracker; Brookings Institution; Federal Register; Environmental Protection Agency; Interior Department; U.S. Chamber of Commerce; White House.

In addition to eliminating a majority of national policies, the Trump administration has also gutted the very institutions created to monitor climate and pollution regulations. In addition to these actions, the very entities who are crafting climate policies cannot guarantee what to target or how to act.

Frank **Jotzo**, Joanna Depledge, Harald Winkler, 7-1-**2018**, "US and international climate policy under President Trump," Taylor & Francis, <https://www.tandfonline.com/doi/full/10.1080/14693062.2018.1490051//IC>

The election in November 2016 of Donald Trump as a populist, nationalist and unpredictable US President has upended many aspects of international relations and policy, and of American national policies, regulations and practices. Climate change is an ideological issue for Trump's administration and political base, and so climate policy is under assault. US federal climate policies and institutions are being dismantled, climate science is questioned and its funding threatened, and the President has announced that the United States "will withdraw from" the Paris Agreement (White House, 2017 White House (The White House Office of the Press Secretary). (2017). Statement by President Trump on the Paris Climate Accord. United States government. Retrieved from <https://www.whitehouse.gov/the-press-office/2017/06/01/statement-president-trump-paris-climate-accord> [Google Scholar]), a signature achievement of his predecessor Barack Obama. A year and a half into Trump's presidency, Climate Policy has published several papers on current US climate policy and its possible effects and trajectories, some of which are collated in a thematic section in this issue of the journal. More papers will no doubt follow in coming months and years. Contemporaneous, research-based analysis of this nature is one of the strengths of this journal. This editorial takes stock and introduces key themes discussed in the papers. US President Donald Trump opposes efforts to limit climate change, in the United States as well as internationally. This stance apparently is rooted in his administration's electoral populism and economic nationalism, a particular interpretation of individual liberty and a conviction that humanity has a right to exploit nature. Such convictions are shared by key players such as the head of the Environmental Protection Agency (EPA) Scott Pruitt. They are also echoed in deep traditions of US isolationism and rejection of multilateral institutions that could influence or constrain US actions, especially on economically important issues such as climate change. The latter was already evident in the US Senate's unanimous rejection of the 1997 Kyoto Protocol before it was even finalized – on the basis that it might harm the American economy and that developing countries would be exempt from any new commitments. In the era of 'making America great again' as per Trump's election slogan, collective action is not a favoured solution. As a challenge of the global commons, climate change thus sits uneasily with the Trump Administration's worldview. During his election campaign, Trump said he would 'cancel the Paris Climate Agreement'.¹ 1. New York Times (2016 New York Times. (2016). Donald Trump's energy plan: More fossil fuels and fewer rules. Retrieved from <https://www.nytimes.com/2016/05/27/us/politics/donald-trump-global-warming-energy-policy.html> [Google Scholar]). View all notes Consistent with this pledge, in a 1 June 2017 speech in the White House Rose Garden, he announced that the US would withdraw from the Paris Agreement and 'cease all implementation' of it (White House, 2017 White House (The White House Office of the Press Secretary). (2017). Statement by President Trump on the Paris Climate Accord. United States government. Retrieved from <https://www.whitehouse.gov/the-press-office/2017/06/01/statement-president-trump-paris-climate-accord> [Google Scholar]). The US Ambassador to the UN later confirmed this intent to withdraw 'unless the US identifies suitable terms for re-engagement' (USA, 2017a USA. (2017a). United States of America: Communication. Retrieved from <https://treaties.un.org/doc/Publication/CN/2017/CN.464.2017-Eng.pdf> [Google Scholar]). The rules of the Paris Agreement mean that the US cannot formally notify its withdrawal until 4 November 2019, and the withdrawal would only take effect a year later, ironically the day after the next US presidential election. As Kemp (2017a Kemp, L. (2017a). US-proofing the Paris climate agreement. Climate Policy, 17(1), 86–101. doi: 10.1080/14693062.2016.1176007 [Taylor & Francis Online], [Web of Science ®], , [Google Scholar]) points out, the Paris Agreement was designed for a US administration to be able to join by presidential executive action only, bypassing the need for Congressional approval, which has so often stymied US ratification of international treaties (Bang, Hovi, & Sprinz, 2012 Bang, G., Hovi, J., & Sprinz, D. F. (2012). US presidents and the failure to ratify multilateral environmental agreements. Climate Policy, 12(6), 755–763. doi: 10.1080/14693062.2012.699788 [Taylor & Francis Online], [Web of Science ®], , [Google Scholar] ; Kemp, 2016 Kemp, L. (2016). Bypassing the 'ratification straitjacket': Reviewing US legal participation in a climate agreement. Climate Policy, 16(8),

1011–1028. doi: 10.1080/14693062.2015.1061472 [Taylor & Francis Online], [Web of Science®], , [Google Scholar]). Although this legal device has made it easier for Trump to withdraw from the treaty, it would also make it easier for a post-Trump President to rejoin by administrative decision. A key question is whether the US will indeed seek to identify ‘suitable terms for re-engagement’, and what this would mean in practice. Re-negotiation of the Paris Agreement itself is not a realistic prospect now that it has entered into force. However, the US Administration statement could be interpreted to say that the US may attempt to weaken its own Nationally Determined Contribution (NDC) under the Agreement. Although the Paris Agreement provides that parties ‘may at any time adjust’ their NDC, this should be ‘with a view to enhancing its level of ambition’ (Article 4.11), not to weaken it. Analysis by legal scholars indicates that, while not strictly violating its legal obligations, a Party would contravene the spirit of the Paris Agreement if it downgraded an existing NDC or presented a subsequent weaker NDC (e.g. see analysis in Center for Climate and Energy Solutions, 2017 Center for Climate and Energy Solutions. Legal issues related to the Paris Agreement. Retrieved from <https://www.c2es.org/site/assets/uploads/2017/05/legal-issues-related-paris-agreement.pdf> accessed 8 June 2018. [Google Scholar] ; Rajamani & Brunnée, 2017 Rajamani, L., & Brunnée, J. (2017). The legality of downgrading nationally determined contributions under the Paris Agreement: Lessons from the US disengagement. *Journal of Environmental Law Online*. doi: 10.1093/jel/eqx024 [Crossref], , [Google Scholar]). Any downward adjustment would go against normative expectations established by the Agreement and is liable to draw criticism. The question for many then becomes, what price is too high to pay for the US to be on board the multilateral climate effort? A year on, however, there are no signs that the US Administration is seeking to either renegotiate the Paris Agreement, nor has it put forward an alternative, weaker NDC. The President’s attention is evidently focussed on geopolitics and trade, while international climate change policy has taken a back seat. There are also few signs that other countries will follow the US lead, and themselves withdraw – or fail to ratify – the Paris Agreement. That the Russian Federation, a top emitter and longtime climate laggard (Martus, 2018 Martus, E. (2018). Russian industry responses to climate change: The case of the metals and mining sector. *Climate Policy*. doi: 10.1080/14693062.2018.1448254 [Taylor & Francis Online], , [Google Scholar]), has not yet ratified the Agreement may ring some alarm bells. However, many more national leaders reacted to President Trump’s 1 June announcement by reaffirming their determination to implement the Paris Agreement (e.g. see Carbonbrief, 2017 Carbon Brief. (2017). Global reaction: Trump pulls US out of Paris Agreement on climate change. Retrieved from <https://www.carbonbrief.org/global-reaction-trump-pulls-us-out-paris-agreement-climate-change> [Google Scholar]). In an unusually strong diplomatic move, all other G7 Environment Ministers meeting in Bologna soon after the US announcement expressed strong support for the Paris Agreement, with the lone opposing US view registered in a footnote to their communiqué (G7, 2017 G7. (2017). G7 Bologna Environment Ministers’ Meeting Bologna, Italy 11–12 June 2017. Communiqué, Retrieved from <http://www.g7italy.it/sites/default/files/documents/Communiqué%20G7%20Environment%20-%20Bologna.pdf> [Google Scholar]). At the June 2018 G7 meeting, the leaders of the G7 nations, excluding the US, re-affirmed their commitment to the Paris Agreement (G7, 2018 G7. (2018). The Charlevoix G7 Summit Communiqué. Retrieved from <http://www.consilium.europa.eu/en/press/press-releases/2018/06/09/the-charlevoix-g7-summit-communique/> [Google Scholar]). The horror scenario of the Paris Agreement unravelling as a result of US withdrawal now seems unlikely. But Trump’s rhetoric and actions clearly provide backing for opponents of climate change action in any country, and may have a ‘chilling’ effect on global climate action. For the international climate negotiations, uncertainty over whether the US is ‘in or out’ of the Paris Agreement (see Kemp 2017b Kemp, L. (2017b). Limiting the climate impact of the Trump administration. *Palgrave Communications*, 3, 520. doi: 10.1057/s41599-017-0003-6 [Crossref], , [Google Scholar]) poses a major challenge. For now, the US remains ‘in’, and can therefore participate fully in the negotiations on the Paris Agreement’s implementation details. There are fears that this could allow the US delegation to block the negotiations, or else impose unpopular options, before withdrawing altogether in 2020. So far, however, the US delegation has largely maintained long-held positions in the negotiations rather than seeking to obstruct or adopt any dramatically new stance. The US delegation appears to have a mandate to engage constructively on technical issues, with a strong focus on transparency that may well be beneficial for the implementation of the Paris Agreement. However, it is constrained by overarching Presidential political imperatives. These constraints were evident in its closing statement at the 23rd Conference of the Parties (COP 23) in November 2017 (USA, 2017b USA. (2017b). Statement of the United States of America upon the closing of the 23rd session of the conference of the parties to the United Nations framework convention on climate change. Retrieved from http://www4.unfccc.int/Submissions/Lists/OSPSubmissionUpload/69_375_131556034539617911-Statement%20of%20the%20USA%20at%20COP%2023%20Closing.pdf [Google Scholar]), which indicated that the US might not be bound by decisions taken, casting doubt on any technical progress achieved. Many are concluding that the door to US participation needs to remain open, but that the Paris Agreement rulebook cannot be weakened to suit the US. This is different from the Paris Agreement itself, which was very significantly determined by what the US and China could agree. It stands to reason that Trump’s impact on climate policy will remain strongest domestically. Although the US legally remains a party to the Paris Agreement, it has ceased all implementation of the treaty. Already, federal incentives for low-carbon investments have been scrapped, regulations changed to allow more high carbon developments especially in coal and

oil production, motor vehicle emission standards are being rolled back, and the Clean Power Plan – the centre piece of the Obama Administration’s domestic climate policy – is being repealed (see Berardo & Holm, 2018 Berardo, R., & Holm, F. (2018). The participation of core stakeholders in the design of, and challenges to, the US clean power plan. *Climate Policy*. doi: 10.1080/14693062.2018.1478792 [Taylor & Francis Online], , [Google Scholar]). **The most lasting domestic damage of a Trump Administration may be in the erosion of institutions – both regulatory** (e.g. the US EPA under Scott Pruitt) **and those supporting climate science** (National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA)), **with funding to climate-change-related programmes cut. These actions could damage US institutions and capacity on climate policy and regulation for a long time to come. What difference will this bonfire of climate regulations and institutions make to US greenhouse gas emissions?** Galik, DeCarolis, and Fell (2017 Galik, C. S., DeCarolis, J. F., & Fell, H. (2017). Evaluating the US mid-century strategy for deep decarbonization amidst early century uncertainty. *Climate Policy*, 17(8), 1046–1056. doi: 10.1080/14693062.2017.1340257 [Taylor & Francis Online], [Web of Science ®], , [Google Scholar]) provide quantitative estimates of potential emission pathways under the Trump Administration, in contrast to the Mid-Century Strategy for Deep Decarbonization (an 80% reduction in emissions by 2050) released under the Obama Administration. They find that **federal US policy is unlikely to strongly influence continued reductions in emissions in the electricity sector**. They estimate **that near-term emissions trends will remain flat, no matter what the current US Administration does or does not do, and that President Trump’s impact on cumulative US emissions will be small if a subsequent administration gets back onto a trajectory towards an 80% reduction**. However, Galik et al. find that **there could be material and lasting impacts in the built environment and land use sectors, where investments have particularly long-term consequences and so may affect mid-century emissions outcomes**. Decisions with large ‘lock-in potential’ (Kemp, 2017b Kemp, L. (2017b). Limiting the climate impact of the Trump administration. *Palgrave Communications*, 3, 520. doi: 10.1057/s41599-017-0003-6 [Crossref], , [Google Scholar]) for future emissions also include the Keystone XL oil pipeline between the US and the oil sands in Alberta, Canada. As pointed out by several authors, the negative impact of one term of a Trump Presidency may be manageable and reversible, but two terms would be far more damaging. **Chen et al.** (2018 Chen, H., Wang, L., Chen, W., Luo, Y., Wang, Y., & Zhou, S. (2018). The global impacts of US climate policy: A model simulation using GCAM-TU and MAGICC. *Climate Policy*, 18(7), 852–862. doi: 10.1080/14693062.2018.1465390 [Taylor & Francis Online], , [Google Scholar]) **undertake an analysis of the effect of current US climate policy on global emissions and costs of emissions reductions, as well as temperature outcomes, using a global model**. They examine scenarios of US emissions levels staying constant for some time before declining, and also an extreme scenario where US emissions remain at their present level until the end of the century. Chen et al.’s simulations indicate that, **if the US were to step outside of the global effort and remain a high emitting economy for a long time, then others – including developing countries – would need to mitigate significantly more to achieve the same temperature outcomes, at a significantly higher cost to the world economy overall**. The equity implications of such a scenario would be profound. The decisive assumption in Chen et al.’s paper is that the US does not get back on track toward deep emissions reductions once Trump leaves office, as Galik et al. assume in their analysis. In announcing withdrawal from the Paris Agreement, **Trump also made it plain that all financial contributions to the Green Climate Fund (GCF) would stop**. Before leaving office, Obama fast-tracked a \$1 billion donation to the GCF, but the remaining \$2 billion of the US pledge has now been scrapped. For Urpelainen and Van de Graaf (2018 Urpelainen, J., & Van de Graaf, T. (2018). United States noncooperation and the Paris Agreement. *Climate Policy*, 18(7), 839–851. doi: 10.1080/14693062.2017.1406843 [Taylor & Francis Online], , [Google Scholar]), **climate finance is a key vulnerability for future climate cooperation: with the US pulling out of its commitments to provide funding for climate action in developing countries, trust in the UN-based multilateral system could be eroded**. As Sharma (2017 Sharma, A. (2017). Precaution and post-caution in the Paris Agreement: Adaptation, loss and damage and finance. *Climate Policy*, 17(1), 33–47. doi: 10.1080/14693062.2016.1213697 [Taylor & Francis Online], [Web of Science ®], , [Google Scholar]) points out, key provisions in the Paris Agreement on dealing with climate impacts – adaptation, loss and damage and finance – are already weak, even with full US participation. Under a Trump withdrawal, there is likely to be even less support – politically and financially – for adaptation, and loss and damage. **Perhaps the greatest threat presented by US disengagement with the Paris Agreement**

is that of demotivation, a danger cited by Pickering, McGee, Stephens, and Karlsson Vinkhuyzen (2018 Pickering, J., McGee, J. S., Stephens, T., & Karlsson Vinkhuyzen, S. I. (2018). The impact of the US retreat from the Paris Agreement: Kyoto revisited? *Climate Policy*, 18(7), 818–827. doi: 10.1080/14693062.2017.1412934 [Taylor & Francis Online], , [Google Scholar]). Using an agent-based model, Sprinz, Sælen, Underdal, and Hovi (2018 Sprinz, D. F., Sælen, H., Underdal, A., & Hovi, J. (2018). The effectiveness of climate clubs under Donald Trump. *Climate Policy*, 18(7), 828–838. doi: 10.1080/14693062.2017.1410090 [Taylor & Francis Online], , [Google Scholar]) also conclude that, if the US was an outsider to an international agreement, this may reduce participation by other countries in climate mitigation ‘clubs’, compared to a situation where the US is within a global agreement, but not leading the way (a ‘follower’). The next round of NDCs is to be adopted in 2020, and researchers are unanimous that these must significantly scale-up ambition if the window of opportunity of avoiding a 2-degree temperature rise (let alone 1.5) is not to be closed forever (Höhne et al., 2017 Höhne, N., Kuramochi, T., Warnecke, C., Röser, F., Fekete, H., Hagemann, M., ... Gonzales, S. (2017). The Paris Agreement: Resolving the inconsistency between global goals and national contributions. *Climate Policy*, 17(1), 16–32. doi: 10.1080/14693062.2016.1218320 [Taylor & Francis Online], [Web of Science ®], , [Google Scholar]). A US administration that is at best disinterested, at worst hostile, is the last thing the regime needs when ambition needs to be dramatically ramped up. As Pickering et al. point out, the greater urgency of global emissions reductions makes US non-participation relatively more problematic than it was during the 2000s under the Kyoto Protocol. There is, however, room for cautious optimism, as several papers in this collection express. Sprinz et al.’s analysis shows that only in some scenarios does US recalcitrance lead to widespread defection, while in some other constellations it can lead to others joining the ‘club’. Both Pickering et al., and Urpelainen and Van de Graaf, find that the flexible design of the Paris Agreement, with its system of national pledges and actions, should be more resilient than that of the Kyoto Protocol. The economic and technological landscape is also very different from what it was in the 2000s. Urpelainen and Van de Graaf observe that cutting emissions is becoming easier with the cost of low-carbon technologies falling. The Trump Administration’s support for the coal and oil industry, as well as gas production, will not stop the transition to clean energy that is underway. The US coal industry has been in decline mostly because natural gas is the preferred fuel for new installations on economic grounds. Wind and solar power in many instances are already cheaper than fossil fuel alternatives, and they keep getting cheaper (Galik et al., 2017 Galik, C. S., DeCarolis, J. F., & Fell, H. (2017). Evaluating the US mid-century strategy for deep decarbonization amidst early century uncertainty. *Climate Policy*, 17(8), 1046–1056. doi: 10.1080/14693062.2017.1340257 [Taylor & Francis Online], [Web of Science ®], , [Google Scholar]). The US Administration simply does not have the power to stem this tide, and if it did, it would impose economic damage on the country. All this leads Urpelainen and Van de Graaf to agree with Galik et al. that US domestic emissions levels are unlikely to rise, even without favourable federal climate policies. Flatlining emissions, however, are not enough. The yardstick should, instead, be the targeted emissions reductions under the US NDC, and the far stronger reductions necessary to achieve the Paris Agreement’s long-term goals. Sub-national actors, such as US states, cities, businesses and other stakeholders – many of which have long been leaders on clean energy policy – now have an even more important role to play in compensating for federal inaction (Chen et al., 2018 Chen, H., Wang, L., Chen, W., Luo, Y., Wang, Y., & Zhou, S. (2018). The global impacts of US climate policy: A model simulation using GCAM-TU and MAGICC. *Climate Policy*, 18(7), 852–862. doi: 10.1080/14693062.2018.1465390 [Taylor & Francis Online], , [Google Scholar] ; Galik et al., 2017 Galik, C. S., DeCarolis, J. F., & Fell, H. (2017). Evaluating the US mid-century strategy for deep decarbonization amidst early century uncertainty. *Climate Policy*, 17(8), 1046–1056. doi: 10.1080/14693062.2017.1340257 [Taylor & Francis Online], [Web of Science ®], , [Google Scholar] ; Pickering et al., 2018 Pickering, J., McGee, J. S., Stephens, T., & Karlsson Vinkhuyzen, S. I. (2018). The impact of the US retreat from the Paris Agreement: Kyoto revisited? *Climate Policy*, 18(7), 818–827. doi: 10.1080/14693062.2017.1412934 [Taylor & Francis Online], , [Google Scholar]). Many US states already have instruments such as renewable portfolio standards in place, and several states have made strong commitments and achieved recent progress – for example California’s extension of its cap-and-trade programme, and the tightening of the cap under the North-Eastern Regional Greenhouse Gas Initiative carbon trading programme (Arroyo, 2017 Arroyo, V. (2017). State and local climate leadership in the Trumpocene. *CCLRL*, (4). doi: 10.21552/cclrl/2017/4/6 [Crossref], , [Google Scholar] ; Narassimhan, Gallagher, Koester, & Alejo, 2018 Narassimhan, E., Gallagher, K. S., Koester, S., & Alejo, J. R. (2018). Carbon pricing in practice: A review of existing emissions trading systems. *Climate Policy*. doi: 10.1080/14693062.2018.1467827 [Taylor & Francis Online], , [Google Scholar]). Many US States, cities and other stakeholders have also pledged to uphold the US NDC under the Paris Agreement within their own jurisdictions.2 2. For example, see

<https://www.wearestillin.com/> and <https://www.americaspledgeonclimate.com/>. View all notes At the international level, US abdication of any leadership role has opened up new opportunities for plurilateral collaboration. Urpelainen and Van de Graaf see scope for deeper engagement by Europe with China and India, emphasizing the co-benefits of national and internationally co-ordinated climate action. Some closer EU–China–India engagement is taking place, although European leaders' attention has been predominantly on European issues including Brexit and other manifestations of the rise of populism. China meanwhile is pushing ahead with its transition to cleaner technologies, motivated by domestic environmental concerns and the prospect of industrial leadership in new technologies. India has begun implementing ambitious plans for rapid and large deployment of renewable energy. However, it remains to be seen to what extent individual countries or new coalitions proactively take on a leadership role in the international climate policy regime. If the world is to achieve the Paris Agreement's goal of remaining 'well below' a 2-degree temperature increase, and pursuing efforts to 1.5 degrees, there is no room for any country or region of the world to remain a high-carbon reservation. The remaining future global carbon budget is already small (Le Quéré et al., 2017 Le Quéré, C., Andrew, R. M., Friedlingstein, P., Sitch, S., Pongratz, J., Manning, A. C., ... Dan, Z. (2017). Global carbon budget. Earth System Science Data Discussions. Retrieved from <https://www.earth-syst-sci-data-discuss.net/essd-2017-123/essd-2017-123.pdf> [Google Scholar]), and any one nation spending it with profligacy would impose disproportionate – and most probably unacceptable – constraints on the others. Thankfully, such a scenario remains unlikely, even under the climate-sceptic Trump Presidency. Technological progress with low carbon energy technologies has been such that the economic and business case for them is becoming ever stronger. The calls by President Trump and like-minded politicians anywhere in the world to perpetuate a twentieth-century high polluting energy and industrial system now ring increasingly hollow in the face of mega-trends in the other direction. And whoever becomes the next President of the US will have a splendid opportunity to differentiate her or his climate policy from Trump's backpedalling.

The US could take on a variety of approaches, from focusing on carbon capture to alternative energy, there are several approaches that Congress can and should engage.

Center for Climate and Energy Solutions, 2-12-2017, "Congress and Climate Change,"
<https://www.c2es.org/content/congress-and-climate-change///IC>

Federal efforts to address climate change are undertaken under laws, and with funding, approved by Congress. Like other complex economy-wide challenges, climate change touches on a wide array of interests. The stakes vary from sector to sector and region to region. An effective, lasting climate solution requires a careful balancing of those interests, which typically is achieved through the legislative process. Present federal climate efforts are proceeding largely under the 1970 Clean Air Act, which was not initially designed to address climate change. The most cost-effective way to reduce greenhouse gas emissions and avoid the worst consequences of climate change is a comprehensive market-based approach that puts a price on carbon. Despite support from the business and environmental communities, Congress has not seriously debated such an approach since the failure of cap-and-trade legislation in 2009. Short of comprehensive climate change legislation, there are opportunities for interim or complementary steps that can win bipartisan support in Congress.

Incentivizing carbon capture, use, and storage. Congressional action can help unleash private capital to scale up the number of carbon capture projects, including by expanding and reforming the existing 45Q tax credit and expanding the use of private activity bonds. This can bring down capture costs, create new markets for products containing manmade carbon dioxide, and reduce emissions from power and industrial facilities. (Learn about our coalition to accelerate carbon capture deployment.)

Advancing nuclear energy. Congressional action can help maintain the existing nuclear fleet while also spurring research and development that will lead to the next generation of nuclear energy. Nuclear energy is the largest source of zero-carbon energy in the United States and will have to play a role in any long-term decarbonization strategy. Improving energy efficiency.

Energy efficiency reduces emissions from power plants, improves grid resilience during periods of peak electricity demand, saves consumers money, and creates jobs in the building and energy sectors. Federal energy efficiency standards are a main driver of energy efficiency in the United States. Further federal leadership can produce stronger environmental and economic benefits.

Modernizing infrastructure. Congress will be instrumental in designing and funding any new federal infrastructure package. Infrastructure investments can reduce emissions and improve resilience to the climate impacts we're already experiencing. For instance, a modernized grid can better distribute renewable power and make communities more resilient to extreme weather. Any new infrastructure should be built to last, with impacts like rising sea levels and increasingly frequent heat waves in mind.

Maintaining America's scientific edge. Congress appropriates funding for scientific and technology research across the federal government. Congress should continue to support research on climate impacts and how they affect the economy. Federal research is critical to basic and applied research on next-generation energy technologies that will reduce emissions and keep America's economy strong.

Building community resilience. Congress can improve communities' resilience to climate impacts. Legislation should take climate change into consideration to ensure taxpayer dollars are being wisely invested in long-term assets affected by climate change. Programs that help the private sector and individuals make long-term decisions about climate risks, like the National Flood Insurance Program, should be authorized. When Congress appropriates funding to respond to natural disasters, it should help communities build back stronger and prepared for climate impacts.

International support. The United States, in keeping with its obligations under the U.N. Framework Convention on Climate Change (UNFCCC), provides important support to other countries to help them reduce emissions, develop clean energy, and cope with climate impacts. Congress can help demonstrate international leadership on climate change by funding bilateral assistance and multilateral programs such as the Green Climate Fund.

1B. Divisions on What to Target

In terms of focusing on “reducing” emissions, the process is somewhat simple. Records are kept to the amount of greenhouse gas emissions by nations by yearly metrics. The scientific and policymaking communities, however, are divided on what annual target we should attempt to dial back to. For example, the Union of Concerned Scientists would like to use the target created by the IPCC which is 80% below 2000’s levels by 2050.

UCS 07 (Union of Concerned Scientists <http://www.usclimatenetwork.org/resource-database/WEB%20emissions-target-fact-sheet.pdf>)

Defining the U.S. Share of Global Emissions Reductions

There are several ways to determine the United States’ share of the industrialized nations’ emissions budget, including allocations based on the current U.S. share (among industrialized countries) of population, gross domestic product (GDP), and heattrapping emissions. Using these criteria, the U.S. cumulative emissions budget ranges from 160 to 265 GtCO₂eq for the period 2000–2050, of which approximately 45 GtCO₂eq has already been emitted (Figure 1). Given our aggressive assumptions about reductions by other nations and the fact that 450 ppm CO₂eq represents the upper limit needed to avoid a potentially dangerous temperature increase, the United States should reduce its emissions at least 80 percent below 2000 levels by 2050. The costs of delay are high. To meet this minimum target, the United States must reduce its emissions an average of 4 percent per year starting in 2010.[†] If, however, U.S. emissions continue to increase until 2020— even on a “low-growth” path projected by the Energy Information Administration (EIA)—the United States would have to make much sharper cuts later: approximately 8 percent per year on average from 2020 to 2050, or about double the annual reductions that would be required if we started promptly. The earlier we start, the more flexibility we will have later (Figure 2).

Whereas the International Energy Agency and several pre-Trump US policies focus on 80% below 2005 levels by 2050.

International Energy Agency 15 (Energy and Climate Change, World Energy Outlook Special Report, <https://www.iea.org/publications/freepublications/publication/WEO2015SpecialReportonEnergyandClimateChange.pdf>)

Within its INDC, the United States declares its intention to reduce its net GHG emissions⁴ to 26% to 28% below 2005 levels in 2025 and to make best efforts to achieve the upper end of this range. This builds on its commitment in the Copenhagen Accord to reduce emissions to 17% below 2005 levels by 2020. The US INDC sets the 2025 target in the context of a longer range, collective intention to move to a low-carbon global economy as rapidly as possible, and keep the United States on a path to achieving 80% reductions or more by 2050. Energy and climate policies introduced in recent years are already having a material

impact on the projected emissions trajectory for the United States and the INDC target builds on a number of existing and proposed plans and policies, such as the Climate Action Plan, the Clean Power Plan,⁵ tax credits for wind and solar, state-level renewable portfolio standards, a goal to reduce methane emissions from the oil and gas sector, vehicle fuel-economy standards, energy conservation standards and targets to reduce hydrofluorocarbons. There have also been important market developments, most notably the emergence of largescale shale gas production. As of 2013, the United States was around 35% of the way towards the lower-end (26%) of its 2025 emissions reduction target, while seeing its economy grow by around 10% since 2005. Between 2005 and 2013, net GHG emissions were reduced by 547 million tonnes of carbon-dioxide equivalent (Mt CO₂-eq), at a pace of around 60 Mt CO₂-eq per year. Energy-related CO₂ emissions accounted for all of the net reductions, with around 60% coming from the power sector, mainly as a result of lower natural gas prices encouraging coal-to-gas switching, increasing contributions from renewables and, to a much lesser extent, coal plants being retired in anticipation of the Mercury and Air Toxics Standards (in effect as of April 2015) and other environmental regulations. In end-use sectors, the transport sector delivered by far the largest emissions reductions, achieved by tightening fuel-economy standards, followed by industry and buildings. Meeting the target set by the United States requires further cuts in energy sector emissions; but these can be achieved under existing authorities (Figure 2.6). In the INDC Scenario, net GHG emissions fall by nearly an additional 1.1 Gt from 2013 to 2025, to meet the lower end of the overall reductions target (a 26% reduction), with the pace of these reductions projected to increase over time. Based on current INDCs, the United States is projected to deliver the largest absolute reduction in energy-related CO₂ emissions of any country in the world from 2013 to 2025. However, even with a 20% reduction, average CO₂ emissions per capita remain among the highest levels in the world. At the same time, primary energy demand in the United States remains broadly flat, while the population increases by 30 million and the economy grows by around \$6 trillion (\$2013, purchasing power parity [PPP] terms).

The White House, March 31, 2015 (Office of the Press Secretary,
<https://www.whitehouse.gov/the-press-office/2015/03/31/fact-sheet-us-reports-its-2025-emissions-target-unfccc>

Building on the strong progress made under President Obama to curb the emissions that are driving climate change and lead on the international stage, today the United States submitted its target to cut net greenhouse gas emissions to the United Nations Framework Convention on Climate Change (UNFCCC). The submission, referred to as an Intended Nationally Determined Contribution (INDC), is a formal statement of the U.S. target, announced in China last year, to reduce our emissions by 26-28% below 2005 levels by 2025, and to make best efforts to reduce by 28%. Last November, President Obama and President Xi – leaders of the largest economies and largest polluters – made the historic announcement of the respective post-2020 climate targets for the United States and China. For the first time, China committed to limit its greenhouse gas emissions, with a commitment to peak emissions around 2030 and to make best efforts to peak early, and to increase its share of non-fossil energy consumption to around 20 percent by 2030. Following that historic announcement, the European Union put forward an ambitious and achievable INDC to cut their emissions 40% by 2030. And just last week, Mexico announced that it would peak its overall net greenhouse gases by 2026, backed by strong unconditional policies and a new bilateral task force to drive climate policy harmonization with the United States. With these actions, as well as strong INDCs submitted by Norway and Switzerland, countries representing over 50% of global CO₂ emissions have either announced or formally reported their targets. Today's action by the United States further demonstrates real momentum on the road to reaching a successful climate agreement this December in Paris and shows President Obama is committed to leading on the international stage. The U.S. target will roughly double the pace of carbon pollution reduction in the United States from 1.2 percent per year on average during the 2005-2020 period to 2.3-2.8 percent per year on average between 2020 and 2025. This ambitious target is grounded in intensive analysis of cost-effective carbon pollution reductions achievable under existing law and will keep the United States on the pathway to achieve deep economy-wide reductions of 80 percent or more by 2050. The Administration's steady efforts to reduce emissions will deliver ever-larger carbon pollution reductions, public health improvements, and consumer savings over time and provide a firm foundation to meet the new U.S. target.

However, some states and cities are aiming to be at 80% of 1990 levels by 2050:

California Environmental Protection Agency, Air Resources Board 16

(<http://www.arb.ca.gov/cc/cc.htm>)

Background California's major initiatives for reducing climate change or GHG emissions are outlined in Assembly Bill 32 (signed into law 2006), 2005 Executive Order and a regulation to reduce passenger car GHG emissions. These efforts aim at reducing GHG emissions to 1990 levels by 2020 - a reduction of approximately 30 percent, and then an 80 percent reduction below 1990 levels by 2050. The main strategies for making these reductions are outlined in the Scoping Plan. Also provided here are links to state agencies and other groups working on climate issues which are being coordinated by the state's Climate Action Team.

Chicago Climate Action Plan no date

(http://www.chicagoclimateaction.org/pages/climate_change_101/25.php)

What are Chicago's greenhouse gas emission reductions goals? The Task Force agreed that Chicago needs to achieve an 80 percent reduction below its 1990 GHG emissions by the year 2050 in order to do its part to avoid the worst global impacts of climate change. To achieve the desired 80 percent reduction, the Task Force proposed an initial goal of a 25 percent reduction below 1990 levels by 2020, a mid-term goal that was far enough in the future to allow time for major infrastructure and behavioral changes, but soon enough to ensure we are on the right course. In 2005, 36.2 million metric tons (MMT) of greenhouse gases in carbon dioxide equivalent units (MMTCO₂e) were emitted in Chicago, averaging 12.7 tons per year for each of Chicago's 2.8 million residents. The 1990 baseline level of emissions is 32.3 MMT (1990 is specified by the Kyoto Protocol). If Chicago continues on its current path, which assumes continued population growth, its emissions would grow to 39.3 MMTCO₂e by 2020. To achieve the Task Force's targeted 2020 goal of 24.2 MMTCO₂e, projected emissions will need to be cut by 15.1 MMTCO₂e by 2020.

Does the year/decade to target ultimately matter in terms of a resolution? Probably not.

However, given there are several focal points from scientists and policymakers it could create some interesting and intricate solvency debates. Where there is overwhelming consensus that action needs to be taken sooner rather than later, or it is game over for civilization.

1C. Climate Change is an Existential Threat

Climate change is the greatest challenge facing humanity today. There is no way to sugarcoat the real challenges of continuing to drag our feet on climate change. Everyone reading this paper has probably seen a wild variety of impact claims regarding the problems presented by inaction. Here is the author's favorite impact card:

Climate Change causes the Planet to EXPLODE

Chalko 4 [Tom J. Chalko , MSc, PhD, 30 October, (<http://nujournal.net/core.pdf>)]

The heat generated inside our planet is predominantly of radionic (nuclear) origin. Hence, Earth in its entirety can be considered a slow nuclear reactor with its solid "inner core" providing a major contribution to the total energy output. Since radionic heat is generated in the entire volume and cooling can only occur at the surface, the highest temperature inside Earth occurs at the center of the inner core. Overheating the center of the inner core reactor due to the so-called greenhouse effect on the surface of Earth may cause a meltdown condition, an enrichment of nuclear fuel and a gigantic atomic explosion.

Summary: Consequences of global warming are far more serious than previously imagined. The REAL danger for our entire civilization comes not from slow climate changes, but from overheating of the planetary interior. Life on Earth is possible only because of the efficient cooling of the planetary interior - a process that is limited primarily by the atmosphere. This cooling is responsible for a thermal balance between the heat from the core reactor, the heat from the Sun and the radiation of heat into space, so that the average temperature on Earth's surface is about 13 degrees Celsius. This article examines the possibility of overheating and the "meltdown" of the solid planetary core due to the atmospheric pollution trapping progressively more solar heat (the so-called greenhouse effect) and reducing the cooling rate of the planetary interior. The most serious consequence of such a "meltdown" could be centrifugal segregation of unstable isotopes in the molten part of the spinning planetary core. Such segregation can "enrich" the nuclear fuel in the core to the point of creating conditions for a chain reaction and a gigantic atomic explosion. Will Earth become another "asteroid belt" in the Solar system? It is common knowledge (experiencing seasons) that solar heat is the dominant factor that determines temperatures on the surface of Earth. Under the polar ice however, the contribution of solar heat is minimal and this is where the increasing contribution of the heat from the planetary interior can be seen best. Rising polar ocean temperatures and melting polar ice caps should therefore be the first symptoms of overheating of the inner core reactor. While politicians and businessmen debate the need for reducing greenhouse emissions and take pride to evade accepting any responsibility, the process of overheating the inner core reactor has already begun - polar oceans have become warmer and polar caps have begun to melt. Do we have enough imagination, intelligence and integrity to comprehend the danger before the situation becomes irreversible? There will be NO SECOND CHANCE...

Realistically, we have until 2050 to act, or climate change will wreak the greatest havoc. A recent Australian study highlights some more reasonable impacts

Julia Hollingsworth, Cnn, 6-4-2019, "Global warming could devastate civilization by 2050: report," CNN, <https://www.cnn.com/2019/06/04/health/climate-change-existential-threat-report-intl/index.html>

(CNN)**Twenty days of lethal heat per year. Collapsed ecosystems. And more than 1 billion people displaced. Those are all probable scenarios that could devastate societies by 2050 if swift and dramatic action isn't taken to curb climate change, according to a think tank report backed by a former Australian military chief.** The paper, by the Melbourne-based Breakthrough National Center for Climate Restoration, is not a scientific study, but an attempt to model future scenarios based on existing research. **It paints a bleak future in which more than a billion people are displaced, food production drops off and some of the world's most populous cities are left partially abandoned.** Its foreword is written by Chris Barrie, a retired admiral and former head of the Australian Defense Force, who said that "**after nuclear war, human-induced global warming is the greatest threat to human life on the planet.**"

Governments need to do whatever possible to prevent a rise in temperature of 3 degrees Celsius.

Julia Hollingsworth, Cnn, 6-4-2019, "Global warming could devastate civilization by 2050: report," CNN, <https://www.cnn.com/2019/06/04/health/climate-change-existential-threat-report-intl/index.html>

The future predicted by the report is one of potential global catastrophe. Authors David Spratt and Ian Dunlop, both longtime climate researchers, warn that **climate change at present poses a "near-to-mid-term existential threat to human civilization."** **They drew on existing scientific research and "scenario planning" to forecast that if global temperatures rise 3 degrees Celsius by 2050, 55% of the world's population across 35% of its land area would experience more than 20 days of lethal heat per year, "beyond the threshold of human survivability."**

Section 2: Solvency Mechanisms

There is a large variety of approaches that can be taken to either reverse the course of climate change and/or mitigate the impacts of climate change. The following subsections will focus on a variety of mechanism umbrellas to address the climate issue that may place limits on what affirmatives can actually do.

2A. Climate Mitigation

The first approach is climate mitigation. Mitigation is a strategy that is very broad and if used could make a resolution very, very large. However, many see mitigation as the best approach to both reduce emissions, remove existing carbon from the atmosphere, and create networks of adaptation to the impacts of climate change.

CSIS 2016 “International Climate Negotiations Glossary”

<https://www.csis.org/programs/energy-and-national-security-program/analysis/international-climate-negotiations-glossary>

Mitigation: Reducing the emissions of greenhouse gases, either through sinks or by curtailing emissions at the source. Most people consider mitigation to be the only long-term solution to climate change, and is therefore central to all international climate negotiations and to achieving the goal of stabilizing greenhouse gas concentrations in the atmosphere. Mitigation is one pillar of climate change action within the UNFCCC and to date has heretofore received the most attention. The Convention requires all countries to formulate and implement mitigation measures. Over the years, the relative attention given to mitigation and adaptation has been the subject of much debate.

Climate mitigation strategies could be efficiency, alternative energy, consumer management, or bicycle paths....

UN Environment, No Date, "Mitigation," <https://www.unenvironment.org/explore-topics/climate-change/what-we-do/mitigation>

UN Environment takes a multifaceted approach towards climate change mitigation in its efforts to help countries move towards climate-resilient and low emissions strategies. Climate Change Mitigation refers to efforts to reduce or prevent emission of greenhouse gases. Mitigation can mean using new technologies and renewable energies, making older equipment more energy efficient, or changing management practices or consumer behavior. It can be as complex as a plan for a new city, or as a simple as improvements to a cook stove design. Efforts underway around the world range from high-tech subway systems to bicycling paths and walkways.

NASA shows that our current mitigation approach is to stabilize current levels of emission so civilizational networks can adapt to changing ecosystems.

Nasa's Global Climate Change Website, No Date, "Climate Change Adaptation and Mitigation," Climate Change: Vital Signs of the Planet,
<https://climate.nasa.gov/solutions/adaptation-mitigation/>

Mitigation – reducing climate change – **involves reducing the flow of heat-trapping greenhouse gases into the atmosphere, either by reducing sources of these gases** (for example, the burning of fossil fuels for electricity, heat or transport) **or enhancing the “sinks” that accumulate and store these gases** (such as the oceans, forests and soil). **The goal of mitigation is to avoid significant human interference with the climate system, and “stabilize greenhouse gas levels in a timeframe sufficient to allow ecosystems to adapt naturally to climate change, ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner”** (from the 2014 report on Mitigation of Climate Change from the United Nations Intergovernmental Panel on Climate Change, page 4).

2B. Regulations to Restrict/Reduce Emissions

The second approach to combatting climate change would be to solely regulate or reduce the amount of emissions. This has been the largest strategy typically used by the United States to tackle climate change. However, sometimes regulations may be ineffective if baselines for emissions are not appropriately set.

Fountain, New York Times, 4-16-16

[Henry, 4-16-16, New York Times, “Calls for Shipping and Aviation to Do More to Cut Emissions”, http://www.nytimes.com/2016/04/17/science/calls-for-shipping-and-aviation-to-do-more-to-cut-emissions.html?_r=0, accessed 6-11-16, AFB]

Both industries are expected to grow over the next few decades, and their percentages of worldwide emissions may increase significantly as emissions are reduced elsewhere. Environmental groups say steps the industries have already taken, including regulations to reduce emissions from new aircraft and ships, will not help much because they are tied to baselines for improvement that are too low.

For the most part, however, a regulatory approach has been successful. For example, looking into California’s LEV program shows how a regulatory approach helped reduce emissions from vehicles.

National Academies of Science, 8

[March, 2006, “State and Federal Standards for Mobile Source Emissions”, http://dels.nas.edu/resources/static-assets/materials-based-on-reports/reports-in-brief/mobile_source_final.pdf, accessed 6-11-16, AFB]

California’s low-emission-vehicle (LEV) program, adopted in 1990, was an important milestone that helped define California and federal on-road emissions standards. It is the primary California mobile-source emissions standard adopted by non-California states. The program consisted of several regulations to reduce emissions from light- and medium-duty vehicles beginning in model year 1994 and continuing through model year 2003. Many Northeastern states actively pursued adoption of California’s LEV program in the 1990s to achieve emissions reductions above those provided by federal emissions standards that would help them meet

their air quality goals. As a result of the states' efforts, manufacturers proposed in 1993 that they would voluntarily provide low-emitting vehicles that exceeded the federal standards to the entire country if the Northeastern states abandoned the California LEV program. This led to the National Low Emissions Vehicle (NLEV) program that introduced California low emissions cars and light-duty trucks into the Northeast beginning with model year 1999 and the rest of the country for model year 2001. This was a major achievement since these vehicles meet voluntary low emissions tailpipe standards that were more stringent than can be mandated by EPA.

The EPA has also been successful in using regulations to reduce Methane emissions from Oil and Gas facilities throughout the US.

Dentons (global law firm), 5-13-16

["Obama methane regulations come into focus: EPA finalizes methane standards for new O&G sources; requests information for existing sources",
<http://www.dentons.com/en/insights/alerts/2016/may/13/obama-methane-regulations-come-into-focus>, accessed 6-11-16, AFB]

Noting that oil and gas facilities are the largest industrial emitters of methane in the United States, EPA's ICR will require companies to gather and submit information that EPA indicates will enable the agency to "develop comprehensive regulations to reduce emissions from existing sources" in the oil and gas sector. Covered industry sources will include methane emissions that occur during the production, gathering, processing, transmission and storage aspects of the oil and gas sector. EPA's ICR also seeks information on innovative, accurate and cost-efficient strategies that members of the industry are using to monitor and mitigate methane emissions.

Restrictions could also include market-based solutions like a Cap and Trade system.

JUSTIN GILLIS MAY 30, 2014, A Price Tag on Carbon as a Climate Rescue Plan, The New York, http://www.nytimes.com/2014/05/30/science/a-price-tag-on-carbon-as-a-climate-rescue-plan.html?_r=0

Cap and trade: A government-created system to restrict emissions by imposing a limit, or cap, on the amount of pollution that can be spewed into the atmosphere by certain industries. The government issues permits or carbon allowances to industries for the amount of greenhouse gases they are allowed to emit, then gradually reduces the cap and the number of permits, providing a financial incentive for those companies to pollute less. Companies that need fewer permits can trade with those that need more permits on a financial commodities market, with the price driven by supply and demand. The higher the price of the permits, the greater the incentive to reduce emissions.

Restrictions might also exclude tax-schemes like a carbon tax.

Frances B. **Smith in 1997**, The Global Warming Treaty: For U.S. Consumers - All Pain, No Gain, National Center for Policy Analysis, <http://www.ncpa.org/pub/ba238>

Delivering Third-World Gains. The Kyoto treaty would exempt developing countries including China and Indonesia from complying with greenhouse gas limits, while imposing heavy restrictions on industrialized countries.

The big losers would be U.S. consumers. That's because any plan that made energy less abundant would significantly lower American living standards. Consumers are direct users of oil, natural gas and electricity in their homes and for transportation. They are the end users of products - food, home building materials, appliances, furniture, cleaning and personal care products - whose manufacture and transport require energy. Analysts estimate that reducing or eliminating this heavy reliance on energy would be devastating: Electricity costs would increase 52 percent. Household fuel prices would jump 50 percent.

Gasoline prices would rise 60 cents per gallon to meet 1990 emissions levels. Energy taxes and greenhouse gas emissions restrictions would affect all Americans to some degree in virtually every aspect of their lives: Homes would be smaller and more expensive, since fewer houses would be built and "sealed" buildings would trap indoor air pollution and increase respiratory problems. People would reset their thermostats and would be colder in the winter and hotter in the summer. The costs of fresh and prepared foods would rise. Families might face drive-time restrictions and gasoline rationing that would cause long lines and waiting times at service stations. Poor and middle-income families would be forced to restrict their recreational activities. Special energy taxes would increase the cost and decrease the convenience of air travel. Costs of nursing home, day care center and hospital services would rise along with energy costs. Costs of police, fire departments, schools and other municipal services would rise, leading to tax increases or service cutbacks at the local level. - See more at: <http://www.ncpa.org/pub/ba238#sthash.MfHu5pwV.dpuf>

2C. Market-Based

Market based approaches seem to be a broader mechanism than solely restricting emissions.

Market based approaches include affixing costs to current emissions. This would be inclusive of both cap and trade and carbon tax-based systems.

CBO in 2009, The Costs of Reducing Greenhouse-Gas Emissions,
http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/104xx/doc10458/11-23-greenhousegasemissions_brief.pdf

The costs of reducing emissions would depend critically on the approach that policymakers adopted to achieve that goal. In particular, costs would depend on whether the policy worked primarily through **conventional regulation or market-based approaches**, on the stringency of emission reductions, and on other policy choices. Conventional Regulation Versus Market-Based Approaches. A basic choice facing policymakers is whether to adopt conventional regulatory approaches, such as setting standards for machinery, equipment, and appliances, **or to employ market-based approaches, such as imposing taxes on emissions or establishing cap-and trade programs**. Experts generally conclude that marketbased approaches would reduce emissions to a specified level at significantly lower cost than conventional regulations.⁵ **Whereas conventional regulatory approaches impose specific requirements that may not be the least costly means of reducing emissions, market-based approaches would provide much more latitude for firms and households to determine the most cost-effective means of accomplishing that goal.**

Market based approaches can accomplish two ends either quantity-based supports which focus on an amount of electricity to be produced by alternative sources or price-based supports which will fix the price for consuming alternative energy.

C. Batlle, I. J. Pérez-Arriaga and P. Zambrano-Barragán in 2011, Regulatory Design for RES-E Support Mechanisms: Learning Curves, Market Structure, and Burden-Sharing, MIT center for environmental and policy research, <https://ceepr.mit.edu/files/papers/2011-011.pdf>

Drawing from relevant experiences in power systems around the world, this paper offers a critical overview of existing policy supports for RES-E, with a focus on direct methods. We provide a detailed review of the different schemes and design features implemented to date, keeping an analytical distinction between the two categories for direct methods: price-based supports, which fix the price to be paid for renewable electricity, and quantity-based supports, which determine a specific amount of electricity to be produced by RES-E. While recent studies provide an account of current RES-E support systems, in this paper we focus on the impacts that these mechanisms have on the overall energy market structure and its

performance in the short- and long-term. Given the rising importance of RES-E in systems everywhere, these impacts can no longer be overlooked.

Specific supports could either be feed-in tariffs or a renewable portfolio standard.

Erik Johnson and Matthew Oliver, Georgia Institute of Technology in **2015** Panel Paper: Feed-in Tariffs Versus Renewable Portfolio Standards: An Estimation of Policy Risk in the Electricity Sector, Association for Public Policy Analysis & Management, <https://appam.confex.com/appam/2015/webprogram/Paper13574.html>

The transition to a low-carbon global energy economy is among the most pressing and challenging issues of our time. In the electricity sector, most renewable energy technologies are not competitive with conventional fossil fuels due to higher generation costs per kilowatt-hour (kWh). This cost premium means investments in renewable generation capacity generally require additional incentives to make them profitable. Many governments have implemented economic support policies to stimulate investment in renewable generation. Two dominant policies have emerged. Feed-in tariffs (FIT)—a price-based scheme—guarantee all eligible producers receive a fixed price per kWh generated. By contrast, a renewable portfolio standard (RPS) is a quantity-based scheme in which the regulator requires a specific proportion of electricity to come from renewable sources. Electric utilities can meet RPS requirements by purchasing renewable electricity from independent generators, or through the installation and operation of their own facilities. In most cases, successful implementation of RPS policy also includes a complementary market mechanism in the form of tradable renewable energy certificates (RECs).

Cap and trade and carbon tax systems would also be topical under a market-based approach.

Gayer and Horowitz 05 (Ted, Georgetown, and John, Department of Agricultural and Resource Economics, U of Maryland, Market-based Approaches to Environmental Regulation, p. 300-303, http://www.aei.org/wp-content/uploads/2011/10/20060720_publishedarticleMIC0104.pdf

4.12.1 Market-based regulation of greenhouse gases Because greenhouse gas emissions are near-perfectly proportional to the quantity of fossil fuels combusted, a carbon cap-and-trade or carbon tax can be based on the quantity of fossil fuels used as energy sources, with equivalence ratios based on the carbon content of each fuel. Thus, while 4.12. Greenhouse gas emissions 301 emissions may not be able to be directly monitored, they can be inferred by the fuel inputs used by various sources. This approach requires that fuel use be monitored, either on the demand or on the supply side. Noncombustion uses of fossil fuels such as fugitive methane or non-fossilfuel sources such as carbon from deforestation or di-nitrogen oxide from soils are less easily accommodated in a market approach, although the market approach might be extended even to these sources. Consider first the design of a domestic carbon cap-and-trade system for fossil fuels. Economists recognize two types of carbon cap-and-trade which differ according to who is required to hold the allowances.¹⁹ Under an upstream trading system, producers and importers would be required to hold allowances for the quantity of fuel they produce or import, based on the carbon emissions of their fuel when it is eventually combusted by a user. Under this system, individual consumers and businesses would not hold allowances and would, in essence, have no contact with the allowance system. Those consumers would nonetheless have an incentive to reduce fuel use because the allowance cap, which would be set below the current level of carbon emissions, would lead the prices of fuels to rise above their non-capped levels. Consumers and businesses and other downstream energy users would

then have an incentive to reduce energy use when that energy came from fossil fuels. As with other market instruments, consumers would have complete flexibility to choose how best to respond to higher prices. This flexibility would lead to carbon emission reductions being achieved at the lowest cost to the economy. The alternative is a downstream trading system, under which energy

consumers would be required to hold the allowances. One possibility is a system in which individual households and businesses would be required to hold allowances that they would submit when paying electric and gas bills or buying gasoline at the pump.

Downstream trading systems are instead usually proposed to cover a more manageable number of “large” sources of emissions, such as electric utilities, large manufacturers, government facilities, commercial transportation fleets. ¹⁹ This section draws heavily on CBO (2001). ³⁰² Policies in Practice and some large

employers. This latter approach would therefore not cover all sources of greenhouse gas emissions. Under an upstream system, approximately 2,000 sources would need to be monitored for fuel use and allowance holdings (CBO, 2001, Cramton and Kerr, 1997). The number of sources that would need to be monitored under a downstream system depends on the coverage. A downstream trading system that covered all users, including individual households, would require monitoring the fuel consumption of many millions of agents; such monitoring could be made simpler through debit cards and electronic tracking of transactions but administration would still be a substantial and intrusive undertaking. A downstream system that covered all users would have identical economic effects to an upstream trading system but would be more costly to implement due to the higher administrative costs. A downstream trading system that covered only “large” users would be less expensive to implement than a full downstream system but would not achieve emission cuts at lowest cost. It would also present the potential problem of emissions “leaking” from regulated to unregulated sources. An upstream system therefore is clearly superior to any form of downstream system. These issues apply equally to a carbon tax, although existing rules for taxation of fossil fuels (unrelated to carbon emissions) would likely dictate at which level the tax would be levied. The U.S. Congress has considered two major cap-and-trade proposals for greenhouse gases. The proposed Clean Air Planning Act of 2003 would have

imposed a carbon cap on electric utilities, a form of downstream trading system that would cover roughly 37 percent of U.S. emissions. The proposed Climate Stewardship Act of 2003 would have imposed a downstream trading system on the “electricity, transportation, industry, and commercial sectors.” Thus, the precise coverage has not been spelled out, although it is clear that a downstream system is

envisioned that would be larger than that covered by the Clean Air Planning Act but still short of a full system. A true upstream system has not yet been seriously considered by Congress. California has also recently discussed its own statewide cap-and-trade. ^{4.12.} Greenhouse gas emissions ³⁰³ It is worth noting that these legislative proposals have not been accompanied by proposed removal of CAFE standards, energy efficiency standards, or other energy efficiency regulations. Estimated costs of proposed systems often do not make clear the assumptions about other energy regulations and do not estimate the added cost from such regulations. Many of the existing energy-efficiency regulations may be presumed to become non-binding under a carbon cap or carbon tax. However, it is also possible that cap-and-trade would be accompanied by, say, a tightening of CAFE or other energy efficiency standards; in this situation, these regulations would add additional costs but no additional benefits. As discussed in Section 3, there are many design features that can reduce the cost or otherwise improve the performance or appeal of a cap-and-trade system. An upstream cap-and-trade program for greenhouse gas emissions should include provisions for: (i) banking and borrowing, which are clearly warranted due to the stock pollutant nature of greenhouse gases; (ii) a safety valve to hedge against the potentially high cost of regulation; and (iii) auctioning rather than grandfathering of the allowances. The auctioning of allowances, with the revenues used to offset other inefficient taxes or to decrease the federal deficit, could be particularly valuable due to the high aggregate value of the allowances. Although fossil fuels account for a large proportion of U.S. greenhouse gas emissions, increased carbon sequestration in soils and plant cover represents another option for reducing emissions. The costs of carbon sequestration are predicted to be low (on the margin); thus, this issue is similar to water quality trading, although with the difference that non-point sources of carbon emissions are a smaller proportion of overall emissions. As with non-point water quality trading, opt-in problems would arise. A carbon cap-and-trade program could incorporate sequestration more readily than a carbon tax approach. A domestic cap-and-trade system would also mesh with an international market for carbon credits in a way that a carbon tax would not.

But a market-based approach would exclude hardline command and control schemes like hard caps.

Mastisoff 2010 (Daniel,

<http://www.environmentmagazine.org/Archives/Back%20Issues/January-February%202010/making-cap-full.html>)

With a new administration in Washington and a new consensus that carbon dioxide emissions are causing catastrophic climate change, it is becoming clear that the United States will soon adopt some form of market-based regulation scheme. Though many would argue that the United States should have instituted a regulatory scheme years ago, the country will reap one distinct advantage from having a late start: the ability to learn from the European Union's ambitious efforts to tackle the problem of industrial carbon emissions for nearly five years. There are many ways that governments and other regulating bodies can regulate and control industrial carbon emissions, but two of the main methods are the traditional “command

and control” strategy in which government sets unwavering limits on how much carbon each business can emit, and a system of **“tradable emissions permits”**—sometimes called cap and trade—in which a government sets an emissions limit, or cap, for each business or industry and issues permits that correspond to the allowed emissions amounts. Businesses within the system can buy and sell emissions permits to each other, enabling those who need and can afford to emit more carbon to do so without the overall limit being exceeded. Under most circumstances, the cap and trade system is considered superior to the command and control approach because cap and trade, in theory, is more cost-effective for businesses and society. Cap and trade encourages businesses to develop more efficient technologies and allow businesses that can most cheaply reduce their emissions to do so, while businesses with high costs of emission reduction do not have to reduce emissions and can instead purchase permits on the market. Carbon dioxide is generally considered an ideal pollutant to be addressed by cap and trade, because it does not matter where the emissions reductions occur.

At the end of the day, as long as there is a financial incentive to regulate a specific behavior, it would be classified as a market-based climate policy

Center for Climate and Energy Solutions in 2015, MARKET MECHANISMS: UNDERSTANDING THE OPTIONS, <http://www.c2es.org/publications/market-mechanisms-understanding-options>

Market-based environmental policies work by creating an incentive to reduce or eliminate emissions. Under this structure, each regulated business chooses independently how to most cost-effectively achieve the required pollution abatement. Notably, some companies can reduce pollution more cheaply than others (because of the age of their equipment or the technology they are using), allowing them to reduce their pollution more, to compensate for those facing higher costs doing less. Taken together, the overall environmental objective will be achieved at the lowest possible total costs. **The key criterion in determining if a policy is ‘market-based’ is that it provides a financial incentive designed to elicit a specific behavior from those responsible for the pollution.** Some policy options are applicable as economy-wide solutions where greater efficiencies can be achieved, while others are more generally targeted to a particular market segment or sector. The following section explores seven major market-based policy options. (Appendix A provides a quick reference for the market-based options described here.)

2D. Capture Technology

A final strategy used to mitigate climate change would be to increase carbon capture technology. Carbon capture does fall under the umbrella of mitigation however, it would also be topical under a broad resolution aiming to solely reduce emissions. Carbon capture or sinks can happen in a variety of ways. Like the soil, algae beds, or the ocean.

Stout et al 16 – PhD, Professor Emeritus, Biosystems and Agricultural Engineering, Michigan State University and Texas A&M University [Stout, Bill, Rattan Lal, and Curtis Monger. "Carbon capture and sequestration: The roles of agriculture and soils." *International Journal of Agricultural and Biological Engineering* 9.1 (2016): 1] 4 – 20 – 16

Abstract: Renewable energy as a replacement for fossil fuels is highly desirable, but the reality is that fossil fuels (especially coal and petroleum) will be major sources of global energy for many decades to come. Therefore, carbon capture is vital to reduce release of carbon emissions and other GHG's to the atmosphere thereby mitigating global warming. This presentation is a review of the role of agriculture and soils in carbon capture. Carbon sequestration in soils is the process of transferring CO₂ from the atmosphere into soils through crop residues. Soil carbon sequestration increases with practices long recommended to increase yields, such as no-till, manure application, agroforestry and cover cropping. It is a Win-Win strategy—advancing food security, improving the environment, and mitigating global warming. Carbon enrichment in greenhouse culture is in widespread use and has been adopted by many commercial producers. It results in remarkable increases in yields of flowers and vegetables. Research has shown the same increase in yields of trees and field crops with higher CO₂ concentrations. The question is, how can CO₂ be applied to field crops to increase yields? Restoration of desertified lands would improve soil quality, increase the pool of C in soils and forests, reduce CO₂ emission to the atmosphere, and improve soil quality. Sequestration of additional carbon in soils would reduce CO₂ emissions to the atmosphere thus mitigating global warming. Reforestation of forests is important, but real trees have ecological limits. Artificial trees could be used to absorb CO₂ from the air any place on the planet, from any source—power plants, vehicles, and all industrial applications. Addition of CO₂ in irrigation water could reduce the pH and help restore alkaline soils. Research is needed to further clarify the cost and benefit of many agriculture technologies for capturing and storing carbon.

Moreira & Pires 16 - CBQF – Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Universidade Católica Portuguesa/Porto, Rua Arquiteto Lobão Vital [Moreira, Diana, and José CM Pires. "Atmospheric CO₂ capture by algae: Negative carbon dioxide emission path." *Bioresource Technology* (2016).] 4-20-16

Abstract

Carbon dioxide is one of the most important greenhouse gas, which concentration increase in the atmosphere is associated to climate change and global warming. Besides CO₂ capture in large emission point sources, the capture of this pollutant from atmosphere may be required due to significant contribution of diffuse sources. The technologies that remove CO₂ from atmosphere (creating a negative balance of CO₂) are called negative emission technologies. Bioenergy with Carbon Capture and Storage may play an important role for CO₂ mitigation. It represents the combination of bioenergy production and carbon capture and storage, keeping carbon dioxide in geological reservoirs. Algae have a high potential as the source of biomass, as they present high photosynthetic efficiencies and high biomass yields. Their biomass has a wide range of applications, which can improve the economic viability of the process. Thus, this paper aims to assess the atmospheric CO₂ capture by algal cultures.

Regardless of which type of capture method is used, the governments should act to incentivize capture which could also create the incentive to produce a variety of alternative fuels.

Morgana 16, M. Granger Morgana,¹ Hamerschlag University Professor of Engineering—Carnegie Mellon U, Opinion: Climate policy needs more than muddling, Proceedings of the National Academy of Sciences of the USA, vol. 113 no. 9, <http://www.pnas.org/content/113/9/2322.full>

Develop Ways to Remove Carbon Dioxide from the Atmosphere. Although the Paris accord (2) calls on the world to hold “the increase in the global average temperature to well below 2 °C” and to pursue efforts “to limit the temperature increase to 1.5 °C” above preindustrial levels, virtually every serious scenario designed to achieve such an outcome requires negative emissions: that is, removing carbon dioxide from the atmosphere. Some of this can be done through the use of biomass energy (BE) combined with CCS (BECCS), because growing biomass takes CO₂ out of the atmosphere, and sequestration would keep it out. However, for biomass systems in which life cycle costs and reduced emissions are attractive (for example, those using cane or switchgrass), logistics and land use constraints will almost certainly limit BECCS to less than what is needed. Of course, advanced biological methods might be developed. Strategies to directly scrub CO₂ from the atmosphere (DAC) will likely be needed. There has been only limited private development of DAC technology (see for example, carbonengineering.com). Governments around the world need to add the aggressive development of advanced BECCS and DAC to their existing climate abatement research portfolios.

2E. Increase Alternative Energy

In addition to any of the regulatory or mitigation policies would naturally be to increase the usage of alternative energy. Lower emissions, lower fuel prices and the reduction of pollution are all advantages that the use of alternative fuels can often provide. Currently, states are leading in alternative energy initiatives because of lack of action by the federal government.

Union of Concerned Scientists, ND, "Smart Energy Solutions: Increase Renewable Energy," Union of Concerned Scientists, <https://www.ucsusa.org/clean-energy/increase-renewable-energy//IC>

Renewable energy is a practical, affordable solution to our electricity needs. By ramping up renewable energy, we can: Reduce air pollution Cut global warming emissions Create new jobs and industries Diversify our power supply Decrease dependence on coal and other fossil fuels Move America toward a cleaner, healthier energy future We have the technologies and resources to reliably produce at least 40 percent of our electricity from renewable energy sources within the next 20 years, and 80 percent by 2050.

The United States has the ability to implement increase levels of alternative energy. It is just not doing so. Currently our capacity to produce renewable energy is higher than that of coal, but that doesn't mean that we are actually using what we are capable of.

Good News Network, 6-17-2019, "For the First Time in History, America's Renewable Energy Capacity is Now Greater Than Coal," <https://www.goodnewsnetwork.org/americas-renewable-energy-capacity-is-now-greater-than-coal///IC>

Despite how the United States has endured ongoing political tensions in the face of climate change, this exciting new report says that the nation is actually becoming greener than ever. According to an analysis by the conservation group SUN DAY Campaign, newly-added electrical generating capacity from renewable energy sources – such as biomass, geothermal, hydropower, solar, and wind – has now surpassed that of coal for the first time in history. The analysis, which was based on the latest monthly “Energy Infrastructure Update” report from the Federal Energy Regulatory Commission (FERC), notes that 18 “units” of new wind capacity (1,545 MW) and 102 units of new solar capacity (1,473 MW) were added during the first four months of this year. Coupled with four new units of hydropower, the renewable energy’s share of all available U.S. generating capacity was pushed up to 21.56%. By comparison, coal’s share dropped to 21.55% (down from 23.04% a year ago). MORE: Just Add Water – New Salt Battery Could Help Spell the End of Fossil Fuels **This all being said, capacity is not the same as actual generation.** Capacity factors for nuclear power and fossil fuels tend to be higher than those for most renewables. For calendar year 2018, the U.S. Energy Information Administration (EIA) reports that renewables accounted for a little more than 17.6% of the nation’s total electrical generation – that is, a bit less than their share of

installed generating capacity in 2018 (over 21.2%). Coal's share of electrical generation in 2018 was 27.2%. FERC's data also reveals that the nation's renewable energy capacity has been adding, on average, one percentage point each year. That is, a year ago, it was 20.66%; three years ago, it was 18.16%. The share of the nation's generating capacity provided by utility-scale solar alone has more than doubled during the past three years from 1.42% to 3.23%. Meanwhile, wind's share has increased from 6.43% to 8.25% and is now on track to surpass hydropower (8.41%) within the next few months. Moreover, the same report indicates that by May 2022, proposed "high probability" generation additions and retirements could result in a net increase in renewable energy capacity of 40,993 MW. By comparison, net capacity by nuclear, coal, oil, and natural gas combined could actually decline by 24 MW; that is, retirements would exceed additions. CHECK OUT: Nation's First 'Hempwood' Factory Could Be Sustainable Lifesaver for Endangered Oak Trees in the US While net growth by just natural gas is projected to be 18,530 MW, that is more than offset by net losses for coal (12,409 MW), nuclear (5,106 MW), and oil (1,039 MW). And even natural gas' projected net growth will be dwarfed by that of wind (25,117 MW) and almost equaled by that of utility-scale solar (14,846 MW). Further, if FERC's projections prove accurate, in three years, renewable energy sources will provide nearly one-quarter (i.e., 24.15%) of the nation's total available installed generating capacity with wind alone accounting for over a tenth (10.01%) and solar at 4.32%. The balance will be provided by hydropower (8.16%), biomass (1.33%), and geothermal (0.33%). The report is an exciting follow-up to an international report that was released in April showing that renewable energy now accounts for one-third of all global power capacity.

Despite all of this promise of alternative energy capacity, coal is still king. 80% of all electricity generated in the United States is still derived from fossil fuel production, while only a small fraction comes from renewable sources.

Center for Sustainable Systems, University of Michigan. August 2018. "U.S. Renewable Energy Factsheet." Pub. No. CSS03-12./IC

Patterns of Use While energy is essential to modern society, most primary sources are unsustainable. The current fuel mix is associated with a multitude of environmental impacts, including global climate change, acid rain, freshwater consumption, hazardous air pollution, and radioactive waste. Renewable energy has the potential to meet demand with a much smaller environmental footprint and can help to alleviate other pressing problems, such as energy security, by contributing to a distributed and diversified energy infrastructure. About 80% of the nation's energy comes from fossil fuels, 8.6% from nuclear, and 11% from renewable SOURCES. Wind is the fastest growing renewable source but contributes only 2.4% of total energy used in the United States.¹ The examples below illustrate the progress and potential of U.S. renewable energy.

While we live in this era of climate alarmism, the UCS delivers a ray of hope. It is possible to meet the 2050 emissions goals, the technology exists and is feasible, but the political will must also exist to slay the climate dragon. If the US strengthened the market for alternative energy while also regulating carbon emissions, it may be possible to find a way to avoid this existential crisis.

Union of Concerned Scientists, ND, "Renewable Energy Can Provide 80 Percent of U.S. Electricity by 2050," Union of Concerned Scientists,
https://www.ucsusa.org/clean_energy/smart-energy-solutions/increase-renewables/renewable-energy-80-percent-us-electricity.html//IC

A comprehensive study by the Department of Energy's National Renewable Energy Laboratory (NREL) shows that the U.S. can generate most of its electricity from renewable energy by 2050. The Renewable Electricity Futures Study found that an 80 percent renewables future is feasible with currently available technologies, including wind turbines, solar photovoltaics, concentrating solar power, biopower, geothermal, and hydropower. The study also demonstrates that a high renewables scenario can meet electricity demand across the country every hour of every day, year-round. Variable resources such as wind and solar power can provide up to about half of U.S. electricity, with the remaining 30 percent from other renewable sources. Increasing renewables to supply 80 percent of U.S. electricity does not, however, limit energy choices to one specific pathway. Rather, the NREL study shows that a range of renewable energy scenarios provide the nation with multiple pathways to reach this goal. Ramping up renewable energy provides significant benefits... Renewable energy provides substantial benefits for our climate, our health, and our economy. It dramatically reduces global warming emissions, improves public health, and provides jobs and other economic benefits. And since most renewables don't require water for cooling, they dramatically reduce the water requirements for power production compared to fossil-fueled power plants. In an 80 percent renewables future, carbon emissions from the power sector would be reduced by 80 percent, and water use would be reduced by 50 percent. ...but we need the right policies to make it happen The NREL study makes it clear that the 80 percent renewables future is technically feasible and affordable, but can only be achieved with the right policies and measures in place. We already have the tools to start significantly ramping up renewable energy today. But we must also work to improve the electricity grid with increased transmission infrastructure to integrate a high amount of renewable generation, and incorporate more advanced grid planning to maintain reliability. Ultimately, the U.S. needs a long-term clean energy policy that create a long-term market for renewable energy, encourages and supports the integration of renewable energy, puts a price on carbon emissions, and increases funding for research and development. More about the Renewable Electricity Futures Study The Renewable Electricity Futures Study is arguably the most comprehensive analysis of a high renewable electricity future to date. The study was assessed by 140 peer reviewers, used state-of-the-art modeling to achieve the results, and includes detailed assessments of costs, challenges, and opportunities for each renewable energy technology. It serves as an accurate, realistic portrayal of what can be achieved in the coming decades. Since the study was performed at a very fine geographic and time scale (looking at 134 regions across the U.S. on an hourly basis) the results are robust and closely detail how renewable energy sources and potential vary by region. Some parts of the country have substantial wind resources. Other areas have more solar potential. Still others have extensive biomass or geothermal resources. To show these variations across the country, NREL created interactive visualizations that show differences for several metrics, including: Transformation of the Electric Sector Hourly Operation in 2050 Power Flows in 2050

There are several policies that could be implemented to increase the use of renewable energy.

Union of Concerned Scientists, April 2013, " RAMPING UP RENEWABLES," Union of Concerned Scientists,
https://www.ucsusa.org/sites/default/files/legacy/assets/documents/clean_energy/Ramping-Up-Renewables-Energy-You-Can-Count-On.pdf//IC

MANY TOOLS ARE AVAILABLE

TO RAMP UP RENEWABLE ENERGY AND MAINTAIN RELIABILITY Several new approaches to operating electricity grids can help integrate variable renewable energy resources while lowering costs, reducing emissions, and maintaining reliability. Many of these approaches are being evaluated at the state and regional levels. The Federal Energy Regulatory Commission (FERC) and © UCAR/Carlye Calvin Xcel Energy's Cedar Creek Wind Farm near Grover, CO, helped the utility generate 57 percent of its electricity from wind one night in spring 2012—a U.S. record. Source: National Center for Atmospheric Research 2011. Ramping Up Renewables 7 the North American Electricity Reliability Corporation (NERC) are also changing planning and operating procedures at the national level to remove barriers to integrating renewable energy (Wiser and Bolinger 2011). FERC is an independent federal agency that regulates interstate transmission and wholesale sales of electricity, natural gas, and oil. NERC develops and enforces electricity reliability standards, assesses whether different regions have enough resources to meet demand over a 10-year period, and monitors the bulk power system. The new approaches that FERC, NERC, regional grid operators, and utilities are implementing include: Geographic dispersion. In a large interconnected power system, the wind does not blow everywhere, although it is usually blowing somewhere. The amount of sunshine also often varies within a region. Integrating wind and solar projects over larger areas helps smooth out an uneven supply of power from individual projects (Figure 3). Aggregating several wind forecasts and operating data from multiple projects across a larger area improves the accuracy of forecasts. In some regions, wind and solar have complementary availability for meeting electricity demand. Sharing energy reserves to balance electricity supply and demand over larger areas also greatly reduces the cost and amount of reserves needed to support wind and solar facilities. Combining more than 75 smaller “balancing areas”—regions with authorities designated by FERC to monitor, coordinate, and control the electricity system—in the eastern half of the country into seven larger areas would make attaining 30 percent wind power easier and less costly, according to one study (EnerNex 2010). The problem is even KY Alaska Hawaii MI NY MA RI CT PA VT WI WV NH ME NJ MD DE CA CO IA OH KS OK TX AR MN MT NE NM ND OR TN NV MO IN NC VA GA MS AL LA FL ID WY WA SD IL UT AZ SC Projects Completed 1Q 2012 Projects Completed 3Q 2012 • 0.1 MW to 9.9 MW • 10 MW to 99.9 MW • 100 MW and greater Projects Completed Prior to 2012 Projects Completed 2Q 2012 Puerto Rico Projects Completed 4Q 2012 Figure 3. Wind energy facilities in the United States. Wind projects throughout the West, Plains, Midwest, and Northeast help smooth out uneven power from individual facilities. Aggregating several wind forecasts and operating data from multiple projects across a larger area improves the accuracy of forecasts. (Where the density of wind projects is high, their location is not precise; to allow the map to show multiple projects, their location is based on counties.) Source: AWEA 2013a. 8 Union of Concerned Scientists more acute in the West, which has many very small grid balancing areas that do not coordinate operations with their neighbors (Olsen and Lehr 2012). Integrating wind and utility-scale solar facilities over larger areas will require investments in more transmission capacity and changes to grid operating procedures, including more coordination between balancing areas. In some regions and states, including the Midwest, New England, mid-Atlantic, New York, and California, FERC has designated an independent system operator (ISO) to control all power plants and transmission lines. In those areas, ISOs can adopt new operating procedures and invest in new transmission capacity to facilitate integration over larger areas. In regions where individual utilities operate plants with little coordination, utilities and states will need to cooperate to integrate wind and solar into the grid. **Better forecasting.** All grid operators use forecasting to understand how the weather will affect electricity demand. With growing reliance on wind and solar energy, some larger utilities and regional grid operators are using weather observations, meteorological data, computer models, and statistical analysis to project wind and solar output, and to reduce power and reserves from fossil fuels, cutting costs in the process (see Box 2). Wider use of that approach could save \$1 billion to \$4 billion annually, according to a study by the National Oceanic and Atmospheric Administration and the U.S. Department of Energy (Haugen 2011). **Improved scheduling.** In much of the western United States, operators of wind and solar facilities must schedule power deliveries to the grid on an hourly or day-ahead basis. If actual generation does not match what they have promised, they often face significant cost penalties. When they produce much more power than expected, they are forced to curtail output. Because wind and sunlight can fluctuate over relatively short periods of time, allowing operators to schedule power delivery on a sub-hourly basis can make the grid more efficient, save money, and reduce emissions. Better wind forecasting can also greatly improve the accuracy of such scheduling. FERC has issued new rules that would require grid operators to offer intra-hour scheduling as an option by 2014, and allow operators of variable facilities to provide weather and operating data to improve grid forecasting (Wiser and Bolinger 2011). The implementation of these rules will improve scheduling in the West and between ISOs and their neighbors. Because these reforms make the grid more efficient, several regions have begun to implement new scheduling rules. For example, the Bonneville Power Administration (BPA) in the Northwest and the California ISO have launched a pilot program that allows wind owners to schedule electricity provided to California every 30 minutes instead of only once per hour. This measure is expected to cut costs, as well as reliance on federal hydroelectric dams now used to balance changes in wind power output over an entire hour. The measure will also reduce the need to curtail wind power when the system does not have enough This new forecasting system will enable us to harness wind far more effectively while saving millions of dollars for our customers. We are very pleased to use this as a key tool toward building a diverse portfolio. —Eric Pierce, Xcel Energy (NCAR 2011) © Fresh Energy Ramping Up Renewables 9 hydroelectric power for balancing (Business Wire 2011). According to BPA Administrator

Steve Wright, “We can continue to modernize the Northwest grid in new ways that will help lower the costs of wind power while protecting reliability.” All ISOs and regional transmission organizations in the United States already schedule the electricity supply in their regions on a five-minute basis, except the Southwest Power Pool, which will have that approach by 2014. In June 2011, the Midwest ISO required operators of variable renewable facilities to participate fully in the region’s real-time (five-minute) energy market. The new approach allows wind to compete with other generators on a more level playing field, reduces the need to curtail renewable facilities, improves system efficiency, and lowers costs and emissions (Paulman 2011; PR Newswire 2011). **Making**

power plants more flexible. Moving toward more flexible fossil fuel power plants is a relatively easy way to integrate more variable renewable sources into an electricity grid. Most natural gas plants can provide this flexibility, because operators can increase or decrease their output very quickly. Even when natural gas and other fossil fuel facilities provide reserves for short-term balancing, adding wind and solar to a system significantly reduces emissions (Lew 2012; Milligan et al. 2009). Operators of hydroelectric plants can also make a system more flexible by adjusting water flows to match fluctuations in demand and supply. A large surplus of natural gas capacity exists today because of a surge of new plants built over the past decade. As a result, many natural gas plants are operating well below their design capacity, according to several studies (MIT 2011; Swisher 2011; Kaplan 2010). Replacing less-flexible coal plants with underused natural gas capacity—and adding new gas plants that can start up quickly—could allow operators to integrate renewable energy more easily and cheaply while reducing air pollution and water use. However, a significant increase in the nation’s dependence on natural gas has many economic, environmental, public health, and safety risks. Scaling up renewable energy and energy-saving technologies now (see below) is critical to reducing these risks while lowering costs

and transitioning rapidly to a low-carbon energy system. **Building new transmission lines.** Adding large amounts of renewable energy (or conventional sources) to the electricity system—and delivering high-quality wind and large-scale solar from remote areas to cities—will require new transmission lines. New lines will also be needed to make the grid more reliable, and to integrate wind and solar over larger areas. New lines would make the electricity system more efficient, and enable wind power to displace facilities that cost more to operate. Some studies have shown that the money saved from operating coal and natural gas plants less often would offset most or all of the costs of adding more transmission capacity (EnerNex 2010). And these studies did not consider making homes and businesses more energy efficient or using small-scale wind and solar, combined heat and power, and other technologies close to where electricity is consumed, which could also reduce costs as well as the need for new transmission lines. Investment in new transmission capacity—which can take up to a decade to plan, approve, and build—has not kept pace with the rapid growth of wind power in the United States. However, notable progress has been made over the past few years to correct this problem. Transmission projects now being developed could support a near-doubling of wind power capacity over the next eight years (AWEA 2012a). Texas alone is investing \$6.5 billion to build 2,300 miles of new high-voltage transmission by 2013 that will support up to 18,500 MW of wind energy (O’Grady 2011). We can continue to modernize the Northwest grid in new ways that will help lower the costs of wind power while protecting reliability. —Steve Wright, Bonneville Power Administration (Business Wire 2011) 10 Union of Concerned Scientists In December 2011, the Midwest ISO approved 17 new “multi-value” transmission lines that will support 14,000 MW of wind capacity, help utilities meet state renewable electricity standards, improve system reliability, and provide up to \$49 billion in net economic benefits (MISO 2011). Other transmission projects are moving ahead in California and Northwest, Southwest, Mountain, Midwest, and Plains states (AWEA 2012a; Wiser and Bolinger 2012).

Managing customer demand. The least-expensive way to manage variability on the grid is often not to add more power sources but to better manage customer demand. Many utilities already offer “demandresponse” programs, which pay large customers to reduce their electricity use when demand is high. For example, ISOs in New England, New York, and the mid-Atlantic region allow demand-response programs to meet future electricity needs if they are less costly than generating the electricity (ISO-NE 2012). These regions use such programs to help balance supply and demand on a minute-by-minute basis, providing more flexibility for integrating wind and solar energy. **Using smart grid technologies.** According to analysts at the

Massachusetts Institute of Technology, new technologies in sensing, communications, control, and power electronics can make the grid more efficient and reliable, improve the use of existing capacity, and provide greater flexibility in controlling power flows. And those benefits, in turn, would enable operators to integrate large volumes of renewable and distributed power (MIT 2011). For example, the first threshold for allowing more distributed solar on a distribution line is to determine if added supplies exceed demand on that line. By measuring the least amount of power used on a distribution line, instead of only the most, a utility could

allow more distributed solar on that line without adding control equipment. **Storage.** Several storage technologies are now available to manage variability on the grid over short time frames, as well as to store electricity when demand is low and use it when demand is higher. Many of these technologies have been used for decades to accommodate other sources of variability and uncertainty on the power system, and to help integrate inflexible coal and nuclear power plants. These storage technologies include:

- **Pumped hydroelectric.** These plants store energy by pumping water to a higher elevation when electricity supply exceeds demand, and then allowing that water to run downhill through a turbine to produce electricity when demand exceeds supply. With 22 gigawatts (GW) of installed capacity in the United States—much of it built a generation ago to help accommodate inflexible nuclear power plants—pumped hydro is the largest source of storage in the power system today. However, the potential for more pumped hydroelectric storage is limited, as the long permitting process and high costs make financing new hydro facilities difficult.
- **Thermal storage.** Heat from the sun captured by concentrating solar plants can be stored in water, molten salts, or other fluids, and used to generate electricity for hours after sunset. Several such plants are operating or proposed in Our goal is to provide environmentally sound, safe, and reliable energy at a reasonable cost. Adding wind to our portfolio helps us achieve our goals. What’s more, adding

wind to our energy portfolio has not driven up rates. In fact, it has helped us to continue to reduce costs. Simply put, having a variety of energy options gives us the ability to make the smartest choices for our customers. —Tim Laughlin, Xcel Energy (Laughlin 2012) Ramping Up Renewables 11 California, Arizona, and Nevada. The Bonneville Power Administration is also conducting a pilot program in the Northwest to store excess power from wind facilities in residential water heaters (Mason County PUD 2012). • Compressed air energy storage. These systems use excess electricity to compress air and store it in underground caverns, like those used to store natural gas. The compressed air is then heated and used to generate electricity in a natural gas combustion turbine. Such facilities have been operating in Alabama and Europe for many years, and developers have proposed several new projects in Texas and California (Copelin 2012; Kessler 2012). • Batteries. Batteries can also store renewable electricity, adding flexibility to the grid. AES Corp. is using 1.3 million batteries to store power at a wind project in West Virginia (Wald 2011). Batteries in plug-in electric vehicles can also store wind and solar energy, and then power the vehicles or provide electricity and stability to the grid when the vehicles are idle. A pilot project with the University of Delaware and utilities in the mid-Atlantic region showed that such vehicles could provide significant payoffs to both the grid and owners of electric vehicles, who would be paid for the use of their batteries (Tomic and Kempton 2007). • Hydrogen. Excess electricity can also be used to split water molecules to produce hydrogen, which would be stored for later use. The hydrogen can then be used in a fuel cell, engine, or gas turbine to produce electricity without emissions. The National Renewable Energy Laboratory (NREL) has also researched the possibility of storing hydrogen produced from wind power in wind towers, for use in generating electricity when demand is high and the wind is not blowing (Kottenstette and Cottrell 2003). **POWERING THE FUTURE WITH RENEWABLE ENERGY With these tools in hand, we can ramp up renewable energy to much higher levels. Leading countries and states have set strong targets for**

renewable energy to realize this future. At least 18 countries have binding renewable electricity standards (REN21 2012). Denmark is aiming to produce 50 percent of its electricity from wind by 2025—and 100 percent of its electricity from renewable energy by 2050. Germany has a binding target to produce at least 35 percent of its With new tools and experience, our operators have learned how to harness every megawatt of power they can when the wind is blowing at high levels like this. — Kent Saathoff, ERCOT (ERCOT 2012) © NREL 12 Union of Concerned Scientists electricity from renewable sources by 2020—with the target rising to 50 percent by 2030, and 80 percent by 2050. China also has a near-term target of producing 100 GW annually from wind, and is considering doubling its solar target to 40 GW by 2015. These targets are 40 percent higher than installed U.S. wind capacity, and more than five times U.S. solar capacity, as of the end of 2012. **The United States does not have a national target or other long-term policy to expand the use of renewable energy.** However, 29 states and the District of Columbia (DC) have adopted renewable electricity standards, which require utilities to supply a growing share of power from renewable sources. DC and 17 states require at least 20 percent renewables by 2025. Hawaii and Maine have the highest renewable standards in percentage terms (40 percent by 2030), followed by California (33 percent by 2020), Colorado (30 percent by 2020), and Minnesota (27.5 percent by 2025) (UCS 2011). **Numerous studies show that we could transition to a low-carbon electricity system based on large shares of renewables within two decades, given the right policies and infrastructure.** For example, detailed simulations by U.S. grid operators, utilities, and other experts have found that electricity systems in the eastern and western halves of the country could work by sourcing at least 30 percent of total electricity from wind—and that the West could work with another 5 percent from solar (EnerNex 2010; GE Energy 2010). Using energy storage technologies to balance out fluctuations in these resources would be helpful but not necessary, and not always economical, according to these analysts. These simulations did show that such gains would require significant investments in new transmission capacity, along with changes in how the grid is operated (as noted above). Expanding transmission lines to allow wind power to supply 20 percent to 30 percent of the electricity used in the eastern United States in 2024 would require just 2 to 5 percent of the system’s total costs (EnerNex 2010). However, as noted, reductions in the cost of operating coal and natural gas plants would offset most or all of these new costs. Other studies have shown that the United States can achieve even higher levels of renewable power while significantly reducing reliance on coal plants and maintaining a reliable, affordable, and much cleaner electricity system. For example, NREL has found that renewable energy technologies available now could supply 80 percent of U.S. electricity in 2050, while meeting demand every hour of the year in every region of the country (Figure 4) (NREL 2012). Under this scenario, wind and solar facilities provide nearly half of U.S. electricity in 2050. NREL also found that an electricity future based on high shares of renewables would deeply cut carbon emissions and water use. Needed investments in new transmission infrastructure would average \$6.5 billion per year, according to NREL—within the recent range of such costs for investor-owned utilities. In Climate 2030, the Union of Concerned Scientists analyzed a scenario consistent with targets set by states that are leaders in clean energy investments (Cleatus et al. 2009). The analysis set a national target to cut U.S. carbon emissions 57 percent by 2030, and at least 80 percent by 2050. When combined with improvements in energy efficiency, renewable energy could reliably supply at least half of U.S. electricity needs by 2030, according to this analysis. To achieve these targets, more than half of the renewable power would come from bioenergy, geothermal, hydro, and concentrating solar plants with thermal storage—technologies that can produce electricity around the clock, and during periods of high demand. Wind represents one of the fuel choices that helps us manage congestion on the system and ultimately helps keep prices low for our customers. —Joe Gardner, Midwest Independent Transmission System Operator (Reuters 2012) Ramping Up Renewables 13 Variable power from wind and solar PV would provide 22 percent of total U.S. electricity by 2030. Another study found that investing in energy efficiency and renewable energy could allow the nation to phase out coal entirely, and significantly reduce reliance on nuclear power (Synapse

2011). A 2011 study by the Intergovernmental Panel on Climate Change concluded that renewable energy could reliably supply up to 77 percent of world energy needs by 2050 (IPCC 2011). And several studies have found that renewables could provide 100 percent of the world's energy needs by 2050 (DeLuchhi and Jacobson 2011; WWF 2011; Jacobson and Delucchi 2010).

It is highly unlikely that alternative energy sources alone will get the job done. While the capacity is there, market will is not. The government must offer some sort of intervention to decarbonize the energy system. Therefore, a successful resolution for debates to address climate change must include a regulatory or market option while also making room for the alternative energy debate.

Morgana 16. M. Granger Morgana,¹ Hamerschlag University Professor of Engineering—Carnegie Mellon U, Opinion: Climate policy needs more than muddling, Proceedings of the National Academy of Sciences of the USA, vol. 113 no. 9, <http://www.pnas.org/content/113/9/2322.full>

Sustain and Grow All Energy Sources That Do Not Emit Carbon. Successfully **decarbonizing the energy system** will require a portfolio of everything we've got. Although **wind and solar** can make important contributions, especially if undertaken at continental scale combined with long-distance transmission (11), it is most unlikely that they alone will ever be sufficient. Two other technologies will be essential: **carbon capture** with deep geological sequestration (CCS) on both coal and gas plants, and a new generation of safer and more cost-effective **nuclear plants** that can be deployed in both the developed and developing world (12, 13). We have spent decades talking about CCS (14), but because fossil fuel power plants have been able to freely emit carbon dioxide to the atmosphere, progress in the development of commercial scale CCS has moved at a snail's pace. Through strategies such as a **direct or indirect price on emissions of CO2, tax breaks, or direct subsidies**, legislators and regulations should find ways to make it attractive for private firms to invest in commercial scale CCS. Today in the United States, just under 20% of all electricity comes from carbon-free nuclear plants (amounting to 60% of our power that involves no CO2 emissions). However, in parts of the United States, nuclear plants are being closed because they are not cost-competitive with cheap natural gas. This may make short-term economic sense, but from a longer-term societal perspective, shutting down reliable base-load power plants that emit no CO2 is counterproductive. Legislators and regulations should find ways to **continue the operation of nuclear plants** that are otherwise viable. In the long run, if nuclear is to play a serious role, existing light-water nuclear plant designs will need to be **replaced by more advanced designs** that are safer, more cost-effective, and limit the generation of long-lived waste. In the United States, the **advanced reactor research program** of the Department of Energy should be revitalized and expanded. National and international nuclear regulatory bodies need the flexibility and increased technical ability to **evaluate and efficiently license** factory-produced small modular reactors and advanced reactor designs.

There is also plenty of room for the government to potentially incentivize alternative energy development. This is what was done during the Obama administration; however a lot of the work was rolled back by the Trump administration. With the anti-regulatory push of the status quo, Caperton's strategy may not be fully effective.

Richard W. **Caperton, 1-10-2012**, (Director of Clean Energy Investment at the Center for American Progress), "Good Government Investments in Renewable Energy," Center for American Progress,

<https://www.americanprogress.org/issues/green/reports/2012/01/10/10956/good-government-investments-in-renewable-energy///IC>

Budget deficits drove the conversation in Washington in 2011 with the daily news dominated by government shutdown threats, the "super committee," continuing resolutions, and arcane budgeting practices. Unfortunately, this left Americans convinced that government investments in the future are off the table because of large federal budget deficits that need to be reduced. Americans were misled. As the Center for American Progress points out, the United States can balance our budget, reduce our long-term debt, and make key investments in our future all at the same time. CAP's plan works toward a more vibrant economy where all Americans are better off and clean energy is an integral part of this future. Best of all, the investments that government needs to make are relatively modest and can be paid for by ending wasteful spending in the same energy sector. There is no doubt that Americans need clean energy because it's vital to our nation's economic competitiveness, security, and health. There is also no doubt that government will play an important role in making the transition to clean energy. Why? Because the federal government always has been—and always will be—a player in energy markets. The federal government has made investments in energy for more than a century, by granting access to resources on public lands, helping build railroads and waterways to transport fuels, building dams to provide electricity, subsidizing exploration and extraction of fossil fuels, providing financing to electrify rural America, taking on risk in nuclear power, and conducting research and development in virtually all energy sources. There's no reason that Washington should stop making new investments. Considering the history, government investment has led to amazing developments, including universal access to reliable and affordable electricity, lasting economic development, and industrial growth. This success story alone could justify continued government engagement of vibrant energy markets. When we consider that investments in clean energy are investments in America's future, it's clear that the smart choice is to make these investments to meet the next generation of energy challenges and to produce a foundation of affordable, reliable, and clean energy alternatives for future waves of investment and opportunity. At the same time we can no longer afford indiscriminate or wasteful subsidies. It is essential that government's investments in energy be fair, effective, and efficient. This issue brief examines how the government currently invests in renewable energy, when those investments are effective, and how those investments should work in the future. **Energy and the tax code** The federal government has a suite of tools at its disposal to make investments, including cash grants, regulatory incentives, tax expenditures, and financing supports. When properly designed and targeted, each of these tools plays an important role. In the energy sector most government investment happens through the tax code. Indeed, for energy companies that receive federal support, the most important day of the year is Tax Day, when they receive a large amount of their government benefits. In fact, 44 percent of energy spending in 2010 was through the tax system, with the remainder through other tools. There are both good and bad reasons for this. Both companies and the government have an established system for paying and processing taxes, so providing investments through the tax code provides for efficient delivery of incentives by tapping existing infrastructure and rules. More cynically, however, tax expenditures are an expedient that may be at cross-purposes with good government practice because they are held to different budget standards than direct spending. This means that working through the tax code is less transparent and therefore far easier to pass through Congress with reduced budget scrutiny. These issues are discussed in detail in the CAP report "Government Spending Undercover: Spending Programs Administered by the IRS" by Lily Batchelder and Eric Toder. Tax expenditures are government spending programs that deliver subsidies through the tax code via special tax credits, deductions, exclusions, exemptions, and preferential rates. While the actual implementation can be complicated, tax expenditures are economically the same as direct spending both for the government

and for beneficiaries. With direct spending, the government brings in tax money and then spends it, while with tax expenditures the government simply reduces the taxes that a company owes. Either way, the company has more money and the federal government has less. **Tax expenditures should be held accountable for achieving results** The underlying reasons for so much energy spending being done through the tax code are unlikely to change, at least in the short term. Therefore **it's important that energy tax expenditures work well**. In previous CAP work we've called for regular reviews of all tax expenditures to ensure this spending is effective, efficient, and necessary. There are some energy tax expenditures that clearly do not meet this standard. Sima Gandhi and I wrote in depth about this issue in "America's Hidden Power Bill," where we described obscure tax credits for the oil-and-gas industry that have existed for more than 80 years and have no demonstrable benefits for Americans. Such tax breaks simply provide windfall benefits to these mature industries at taxpayer expense. We also discussed several tax credits for clean energy that are much better designed. This issue brief calls for Congress to take action on some of the most important clean energy tax issues in today's policy and political debates: the production tax credit, the investment tax credit, and the Treasury Cash Grant Program. Each of these can be extended in a way that both leads to powerful incentives for investment in our energy future and represents good tax policy. Finally, it's important to note that each of the three primary issues is significant for a different reason. Because renewable energy sources have different characteristics they require different treatments within the tax code. Simply extending the production tax credit is not sufficient. Neither is extending the Treasury Cash Grant Program nor improving the investment tax credit. Congress needs to do all of these things. If Congress only takes action on one of these, they will in effect be "picking winners" across technologies. Congress should instead focus on a comprehensive investment package that creates paths for all technologies so that American businesses will invest in the technologies that make the most sense for our country. **Three ways to invest efficiently and effectively** Fortunately, we already know some of the best ways for the federal government to make meaningful investments. Through effective and efficient use of the tax code, the government can continue to help drive deployment of the energy technologies that will be critical to our future. This section describes the three most important tax issues for the government to consider in encouraging the next wave of strategic energy investment in the United States. They are: The production tax credit The investment tax credit The Treasury Cash Grant Let's look at each in turn. **The production tax credit** The renewable electricity production tax credit, or PTC, is the most critical tax incentive for renewable energy projects using wind, geothermal, biomass, and hydroelectric power technologies, among others. I'll focus on wind here because it's the most prominent, but investment in all of these resources is important. **The PTC is linked to electricity generation from a project**. That is, for each kilowatt-hour of electricity produced, the owner of a project gets a tax credit. "Tax credit" means that the owner of the project gets to reduce their tax bill by a certain amount—currently 2.2 cents per kilowatt hour, or kWh—at the end of the year. Let's look at an example. A typical large wind farm has several dozen turbines that can generate 100 megawatts of electricity. Because the wind conditions are only favorable for part of the year, it won't produce that much power all of the time. Instead, the wind turbines will only spin about 30 percent of the time. This wind farm will generate 262,800,000 kWh each year, which will earn \$5,781,600 in tax credits from the PTC. Let's be clear: This is a \$5 million government investment, but it just happens to have gone through the tax code. This tax credit is economically the same as government spending: The government has less money than they would have without the investment, and the project is more profitable. It is also true that the incentive helped stimulate the investment that made both the income and the tax expenditure possible. In short, this investment helped directly create economic activity and growth. Since its creation in 1993, the government has invested several billion dollars in wind power through the PTC. These have been smart investments. The PTC is intended to incentivize the deployment of energy sources that are more expensive than fossil-fuel sources and whose cost will come down as more of the technology is deployed. This is also known as driving a technology down its cost curve. Since 1980 the cost of wind power has declined by 90 percent. Declining costs are critical because they allow for more clean energy to be built, which will improve our environment and diversify our power mix. Indeed, the PTC has led to massive amounts of new growth in the wind industry. Since 1993 more than 40 gigawatts of new capacity have come online. We know this growth is attributable to the PTC. (see Figure 1) Since its creation the PTC has only been extended for two years at a time. When it's not in effect, there's virtually zero investment. When it is in effect, investment is tremendous. There are also more formal economic studies suggesting the positive outcome of the PTC: Economist Gilbert Metcalf, for example, finds that "[T]he data suggest that much of the current investment in wind can be explained by the production tax credit for wind." (For more information on how we know the PTC works, see the CAP report, "America's Hidden Power Bill.") The PTC also has real benefits for American workers. At least 85,000 people work in the wind industry. These workers are spread all across our country and throughout the industry. We have people making turbines, installing them, and operating them, all in good-paying jobs. Unfortunately, we don't have as many people working in the wind industry as we could. While the wind-manufacturing sector has grown in recent years, it has historically been crippled by the PTC expiring every two years. Manufacturers know that this on-again, off-again cycle for the industry would leave them with virtually no business every other year, so American wind farms use some imported parts. Indeed, we have more demand for certain turbine parts than we have domestic manufacturing capacity. In particular, U.S. manufacturing capacity is insufficient for gearboxes, generators, bearings, and castings. The lack of consistent policy is clearly contributing to U.S. underinvestment in domestic production of these strategic technologies. Our economic competitors have simultaneously developed robust manufacturing capacity to serve both their growing domestic demand and meet global demand through technology exports. (see Figure 2) Over the past three years, however, the United States experienced tremendous growth in wind manufacturing, partly

because of the relatively stable PTC, which was most recently extended for four years as part of the 2009 American Recovery and Reinvestment Act, known as the stimulus. In that time new manufacturers set up shop across the country and the composition of domestic parts that each turbine made has steadily increased while our wind energy imports declined. This should be a lesson to Congress: A long-term PTC is more valuable than a short-term extension when we look at the overall impact on jobs and growth. Instead of allowing the PTC to expire this year, it should be extended for at least four more years to give confidence and stability to investors throughout the supply chain. This doesn't mean, however, that the PTC should be extended indefinitely without review. This is exactly one of the biggest problems with many of the deeply flawed fossil-fuel subsidies. If Congress wants to extend it beyond that timeframe, they should build in a review process to evaluate whether or not the credit should be adjusted in any way. Congress should review the size of the credit and review whether or not it should be linked to inflation. Ultimately as the industry matures and markets expand, the PTC—like other subsidies that have done their work and grown strong domestic industries—should be allowed to sunset, taking taxpayers off the hook for payments.

The investment tax credit While the production tax credit primarily benefits wind, the solar industry is the primary beneficiary of the investment tax credit, or ITC. The ITC works a little differently, in a way that makes more economic sense for the type of capital investment required for developing solar energy projects. Instead of the tax credit being spread over 10 years and only awarded as energy is produced, **renewable energy developers get an upfront tax credit based on the initial investment in the project.** For solar power the credit is worth 30 percent of the initial investment. So if a building owner spends \$6 million to put a 1 megawatt solar energy system on a building's rooftop, the building owner is then awarded a \$1.8 million tax credit—but the owner is not allowed to claim any other tax credits over the life of the project. The upfront, one-time nature of the ITC has some real benefits for solar power. First, solar is a more expensive technology to initially install, so investors have a special need for the investment-based incentive. Second, solar is a younger industry than wind, and the technology isn't quite as proven over the long term. This means that future energy production is slightly less certain with solar power than with wind power, so a production-based incentive would be less valuable. Just like the PTC, the ITC has been a tremendous success. The solar industry has experienced extremely impressive cost improvements. (see Figure 3) Not surprisingly, as costs fall and demand rises, the solar industry now employs more than 100,000 people, up from 20,000 just five years ago. The ITC was extended until 2016 as part of the stimulus bill. The extension provided very valuable certainty to the solar market, but when it expires Congress should also review the size and effectiveness of this credit.

The Treasury Cash Grant in lieu of tax credits Despite their incredible successes, the PTC and ITC aren't perfect, and they don't provide a complete offering to meet the full range of project-financing needs faced in the emerging renewable energy market. The biggest problem is that most renewable energy projects are structured in such a way that they don't earn profits for the first several years of the project's life. The developer only owes taxes on profits (not revenues), so they may not owe any taxes for years after building the project. At the same time, tax credits are used to reduce the amount of taxes owed. Thus, if the developer doesn't owe any taxes, the associated credits are worthless. This is a structural limitation of using the tax code to support strategically valuable public investments. Traditionally, project developers have worked around this problem by bringing in so-called "tax equity investors." These investors—typically large financial institutions—essentially buy the tax credits from a project. This cash from the tax equity investor is extremely valuable and allows developers to monetize the tax benefits without actually owing taxes. This system worked fairly well before the financial crisis. There was more than \$6 billion in tax equity available in 2007. The pool of tax equity capital shrank dramatically, though, when large financial institutions no longer owed taxes, as they lost money in 2008 and 2009. This shortfall was fixed with something called the Treasury Cash Grant Program. **This program**, also known as the Section 1603 program because of where it's included in the stimulus bill, **does two things: It makes the PTC-eligible technologies also eligible for the ITC. It allows developers to get a cash grant instead of the ITC.** This means that all renewable developers are able to get a cash grant from the Treasury Department for 30 percent of the initial investment in their project. This solved the tax equity market shortfall problem, and allowed renewable investments to continue. Instead of shrinking, the wind and solar industries grew during the recent recession, largely because the Section 1603 program helped with financing. Unfortunately, this program drew to a close at the end of 2011. After creating the program in 2009, Congress extended it for one year at the end of 2010. Now they should extend the program for at least one more year, and ideally change it to run concurrently with the underlying PTC and ITC, always matching their expiration dates. This is especially important because there's not expected to be enough tax equity available to meet the demand. In 2011 the U.S. Partnership for Renewable Energy Finance estimated that there was a total of \$7.5 billion available through tax equity and the Treasury Cash Grant. They project that there will only be \$3.6 billion in tax equity available in 2012, which is far less than recent history suggests will be needed. (see Figure 4) The cash grant program makes the PTC and ITC more effective, more efficient, and more transparent. It makes absolutely no sense to have this beneficial program on a different schedule than the tax credits it improves. In addition to overcoming a simple shortfall in investment capital from the tax equity market, the cash grant program has several benefits that make it superior to a tax credit. First, the cash grant is more economically efficient. In a best-case scenario, the tax equity investor is going to buy tax credits at a slight discount (it makes no sense to pay full price because then there's no possible profit for the investor). In real life, however, there's evidence that tax equity investors buy tax credits at a much deeper discount. The Bipartisan Policy Center finds that even though a tax credit and cash grant may have the same face value to the government, the tax credit is only half as valuable as the cash grant to the project developer and thus is dramatically less effective at producing clean energy outcomes. Second, the cash grant is much more transparent. When a developer claims the ITC, all they do is

check a box and write in a number on a tax form. When they claim the cash grant, however, they submit much more information, such as details on the project and the number of jobs that will be created with the investment. And while tax information is strictly confidential, the Treasury publishes a list of every project that has received a Section 1603 cash grant. If Congress does choose to extend the cash grant program to always match the PTC and ITC extensions, thus making this public spending more efficient for taxpayers, they should also evaluate the size of the tax credits. The overwhelming popularity and the evidence of the cash grant's economic efficiency seem to indicate that the ITC could be made smaller if it is always offered as a cash grant.

2F. Eliminate “Dirty” Subsidies

One of the biggest barriers towards investment in alternative energy is government subsidization of dirty energy.

Lui 16 – MA Economics University of Victoria [Lui, Chui Ying. "Keeping the Carbon Buried: Cap-and-Trade Is More Efficient Than A World Carbon Tax." (2016).]

Indeed, many governments heavily subsidize dirty energy which creates a barrier for clean energy investments. In 2013, the world subsidized dirty energy by \$548 billions and clean energy by \$121 billions only.⁵ The dirty energy subsidies are in the forms of direct spending or tax breaks, investments by state-owned enterprises, and public financing. These subsidies drive investments away from clean energy by reinforcing dirty energy's incumbent advantage and reducing the competitiveness of clean energy.⁶ The barrier effect is evident by the much higher new investments in dirty energy than clean energy, despite the cost competitiveness of clean energy.⁷

Dirty energy subsidies prevail even though they are widely considered inefficient. It would be challenging to explain why dirty energy subsidies persist with an economic model. This paper does not attempt to provide such explanations, rather, I ask which of a carbon tax or a quota is more effective in reducing emissions given that these barriers exist. The existence of barriers to clean energy investments has implications on whether a tax or a quota is more efficient in curbing global carbon emissions. Curbing emissions through a world carbon tax assumes that investments would divert to clean energy when the costs of dirty energy increase. However, this requires that investments can flow freely between dirty and clean energy. My model is the first that captures the reality that political barriers to clean energy investments are prominent, and it confirms that a tax is ineffective in this case.

I first start with a model similar to Ren et al. (2011) except that energy (E) is an intermediate input to the consumption good (X). Dirty energy (D) is produced along with emissions that cause 'Hurt' to all countries while clean energy (C) does not cause Hurt. The world has two countries that are endowed with mobile capital, which is the only input to produce energy. The mobile capital mimics financial investments which flow freely in the world market. Energy (D + C) is immobile and is one of the two inputs to the mobile consumption good X. As expected I find that a world quota is equivalent to a world tax. Then, I remove the possibility of investing in clean energy and find that a world tax always performs worse than asymmetric taxes, because imposing asymmetric taxes or subsidies between the countries shifts more capital from one country to another as the spread in the demands for capital widen. With a decreasing return to scale production function, the extreme allocations of capital decrease energy production efficiency and thus Hurt. But a world quota is more efficient in decreasing Hurt because the decrease in energy production is directly from the decrease in capital rather than a decrease in energy production efficiency. These results apply to both symmetric and asymmetric countries.

My model also sheds light on why countries continue to build oil plants and subsidize oil explorations despite the big drop in oil prices. My model shows that a carbon tax decreases the rents from dirty energy investments but dirty energy production stays the same because capital cannot be invested elsewhere. When virtually no other option is available, countries' welfare maximizing behaviour ensures that all capital available would be invested in producing dirty energy with resources like coal and tar sands. This paper therefore provides further evidence that removing subsidies on dirty energy which removes barrier to clean energy investments is critical.

The united states continues to spend billions subsidizing dirty energy. Eliminating this would allow for increased renewable energy.

David **Coady**, Ian Parry, Nghia-Piotr Le, Baoping Shang, **5-2-2019**, "Global Fossil Fuel Subsidies Remain Large: An Update Based on Country-Level Estimates," IMF, <https://www.imf.org/en/Publications/WP/Issues/2019/05/02/Global-Fossil-Fuel-Subsidies-Remain-Large-An-Update-Based-on-Country-Level-Estimates-46509//IC>

This paper updates estimates of fossil fuel subsidies, defined as fuel consumption times the gap between existing and efficient prices (i.e., prices warranted by supply costs, environmental costs, and revenue considerations), for 191 countries. Globally, subsidies remained large at \$4.7 trillion (6.3 percent of global GDP) in 2015 and are projected at \$5.2 trillion (6.5 percent of GDP) in 2017. The largest subsidizers in 2015 were China (\$1.4 trillion), United States (\$649 billion), Russia (\$551 billion), European Union (\$289 billion), and India (\$209 billion). About three quarters of global subsidies are due to domestic factors—energy pricing reform thus remains largely in countries' own national interest—while coal and petroleum together account for 85 percent of global subsidies. Efficient fossil fuel pricing in 2015 would have lowered global carbon emissions by 28 percent and fossil fuel air pollution deaths by 46 percent, and increased government revenue by 3.8 percent of GDP.

Section 3: Definitions/Topicality

Climate Policy

Climate policy includes one or more of the following: tech standards, market measures, governmental industry development, and fiscal incentives.

Boasson senior researcher at the CICERO Centre for International Climate and Environmental Research in Oslo, Norway **2014** Elin Lerum National Climate Policy: A Multi-field Approach page 7-10

I argue that most national climate-policy outcomes can be characterized along two central dimensions of state steering: technological vs. economic steering, and indirect vs. direct state steering. By combining the two categories, we get a typology of four climate-policy outcomes that captures a broad variety of policy outcomes. We begin with the dimension concerning the directness of state steering: whether the government should steer directly or indirectly (see Sala-i-Martin 2002). On the lowest end of state engagement we find policies that leave the actual choices and specific decisions on practice and the use of technology to non-state actors. Such policies provide fairly general technical or economic steering signals, so it is up to private actors to translate these into action. At the opposite, high, end of state engagement are policies that strictly require certain practices or technologies or the state itself may engage in, say, carbon mitigation, through state owned corporations or involvement in joint ventures with private actors.

The second dimension concerns the 'condensed form of knowledge about social control and ways of exercising it' on which policy outcomes are based (Lascombes and Le Gales 2007). The technical-economic aspect here has two extremes. At the technical end, climate measures are designed to diffuse specific technologies or practices, and the policy relies on technical specifications (see discussion in Metz et al. 2007). The policy will set technical performance standards, Whereas the societal costs involved will result from the technical requirements. And at the economic end, governmental regulations create or regulate economic incentives, whereas the actual technologies and techniques applied will be those that lie below certain economic thresholds.

Combinations of the two dimensions create the four categories presented in Table 1.1: technology standards, market measures, governmental industry development and fiscal incentives.

Technology standards are policies that give clear guidance but leave the more detailed decisions to private actors. This category includes regulations and standards that give private actors guidance on which practices, technologies or emissions levels are deemed acceptable. Pollution permits is a classic example of this kind of measure it gives a cap on emissions, while leaving it to the private actor to decide which technology or practice to apply in order to keep emissions below a certain threshold. Many land-use planning regulations also belong in this category. The technology standards category includes some measures that are often categorized as voluntary or information measures in the environmental policy literature. For instance, agreements between state and industry that create a cap on emissions will fit here. Voluntary agreements of a very loose nature, without any clear guidance on practice and technology, are not regarded as policy measures, however, technical and practical advice on specific issues, for instance on home insulation, are regarded as under "technology standards". General information campaigns, for instance aimed at promoting awareness of climate change, are not specific measures and do not fit here.

Market measures are governmental regulations aimed at creating economic incentives that can stimulate shifts in practices and technologies so as ultimately to reduce greenhouse gas (GHG) emissions. These measures create new markets or change the functioning of existing markets. This definition is broader than the traditional definitions of market instruments applied in environmental economics. For instances, the OECD defines market instruments thus:

Market-based instruments seek to address the market failure of ‘environmental externalities’ either by incorporating the external cost of production or consumption activities through taxes or charges on processes or products, or by creating property rights and facilitating the establishment of a proxy market for the use of environmental services. (OECD 2007)

Both the classic understanding of market instruments and the definition of market measures presented above include energy and carbon taxation, emissions trading and market-based support schemes, such as green certificates: these measures leave it to private actors to select and develop the technologies and practices that are most profitable, given the new price signals introduced by government measures. With respect to emissions trading and green certificate schemes, the government does not set the economic incentives: these are set by market forces. In addition, governments may influence markets by launching product-labelling schemes (like energy labelling of electric appliance and buildings) and information campaigns (targeting a particular kind of producers and customers). The latter measures are not normally taken into account by environmental economists. Because they are designed with the objective of influencing behaviour through creating of market changes, they fit in this broader understanding of market measures.

With governmental industry development, the government engages specifically in industrial decisions concerning the choice of technology and practices. The government first determines that a certain technology or industry practice is to have priority, and then regulates technology choices directly, rather than regulating the acceptable costs of the various choices of technology. This may occur through strict regulations, where failure to meet the technological requirements will trigger some sort of punitive action. Alternatively, state-owned companies or agencies may be directly involved in the development of new technologies and practices. Traditional feed-in schemes for renewable energy will also fall under this category: here the government interferes directly by setting the price on specific technologies (Commission 2005a, 2008a).

Fiscal incentives refer to state aid schemes where support is granted on the basis of economic, not technical, criteria. In such schemes, the government determine the economic criteria for selecting the projects eligible for support, and the state then undertakes the actual selection. Such support will be granted for the least costly, or most cost-efficient, renewable energy projects, energy efficiency measures or direct emission-reduction efforts.

This fourfold typology gives us a basis for categorizing policy outcomes in different policy areas. Whereas some policy areas are dominated by measures that fit within one of the categories, other areas may involve a combination of different policy categories. Further, the climate policies of some countries may be dominated by one type of measure, whereas we may see more variation elsewhere.

Climate policy is about food and fuel – includes tech, finance, market mechanisms and efficiency

CPI 2013 “The Policy Climate” Climate Policy Initiative <http://climatepolicyinitiative.org/wp-content/uploads/2013/04/The-Policy-Climate.pdf>

At its heart, climate policy is about resources, especially food and fuel. How we produce and combust fossil fuels for energy and how agriculture displaces stored carbon in our soils and forests are the key drivers of emissions. We need to increase the productivity of our stocks of

natural resources, through innovative technology, organization, finance, market designs and policy to improve the yields from each unit of land we farm and energy that powers our industry, buildings, and transport. Our ability to maintain the ecosystems we value, including the stability of the climate, will come from getting more growth out of what we have been given. We can regulate and protect the physical world most effectively when we create the economic space in which to do so.

Climate policy includes a mix of regulations and market based policies

CPI 2013 “The Policy Climate” Climate Policy Initiative <http://climatepolicyinitiative.org/wp-content/uploads/2013/04/The-Policy-Climate.pdf>

What European countries have learned through many years of climate policy is that no single policy can do everything; rather, a mix of regulation, market-based instruments, and targeted, information-driven policies has proven most effective at addressing climate and energy issues.

But there are other lessons to learn from Europe. These include the challenges of developing and implementing an integrated climate policy across several states; the challenge of implementing policy within the constraints of the EU’s enshrined principle of “subsidiarity,” or devolving power to the lowest level of government possible; the important role of finance; and lessons on how countries and regions can cooperate with their neighbors to improve climate policy abroad.

Climate policy includes comprehensive energy strategies and regulations

CPI 2013 “The Policy Climate” Climate Policy Initiative <http://climatepolicyinitiative.org/wp-content/uploads/2013/04/The-Policy-Climate.pdf>

National climate policy seems to be on the horizon, although its shape is not yet clear. Some members of Congress continue to support a comprehensive option such as an economy-wide cap-and-trade system or carbon tax. These comprehensive policies could lead to more cost-effective approaches to reducing emissions. A nationwide approach would allow the U.S. to capture the most cost-effective emissions reductions wherever they are available, enabling greater climate gains at lower cost. A nationwide, market-based mechanism would encourage renewable energy investment in the areas richest in renewable resources, provide an economy-wide incentive for energy efficiency, and incentivize greater investment in low-carbon technologies with the promise of a nationwide market. A nationwide clean energy standard, which would limit emissions from the power sector, has also been proposed.

Alternatively, without further legislative action, the Clean Air Act provides a regulatory framework for limiting greenhouse gas emissions nationwide, with the federal government setting guidelines for state implementation. If regulation is the approach, the challenge for both federal and state governments will be to harness efficient and effective state programs to meet federal standards. The Clean Air Act provides for some flexibility in implementation, so state implementation of greenhouse gas limits would not necessarily look like traditional command-and-control regulation. For example, the United States already uses an emissions trading system to limit sulfur dioxide emissions under the Clean Air Act, and states may be able to use similar state- or regional-level mechanisms to limit greenhouse gas emissions.

Climate policy is political action designed to reduce GHG emissions through strategies of mitigation and adaptation

JoMkristian Stræte Røttereng, 2011 [Carbon Capture and Storage in a Climate Policy Perspective: The Case of Norway, <http://ntnu.diva-portal.org/smash/get/diva2:440226/FULLTEXT01.pdf>]

2.2 Climate Policy Identified The term policy aims at the substantial content of political decisions, pointing at its characteristics like the choice means to achieve set targets - the selection of policy tools and instruments to fulfill political objectives. Political decisions to guide policies, result from politics, which are understood as

the interaction among constellations of actors and interests within a decision-making structure and process (or lack of such) (Fermann 2001: 193). Climate policy measures are in this text understood as substantive action taken to manage GHG emissions – like switching fuel types in a production system, improving energy efficiency by applying restrictive policies or investing in insulation products, or even deciding to build a CO2 capture facility at a fossil power plant. More broadly, the term climate policy instruments also include manipulating strategic macro scale system structures, like changing political, economic, and technical framework conditions to sanction certain behavior among actors affected by the policy. Relevant framework conditions in a Norwegian CCS perspective are elaborated on in chapter 3. Figure 1 outlines a model to overview the generic process leading to applied climate policy as described above. This illustration is borrowed and modified from a study of political space of maneuvering in foreign policy. It demonstrates how policy outcomes follow from politics and policy objectives, decided within a structure that limits the means available (Fermann 2010: 34). Although presented as a system where executed policies have feedback effects on the “contextual circumstances” for new policy decision, the present model represents a rather linear understanding of the policy cycle. An environmental policy process rarely follows these stages chronologically (Vig and Kraft 2009). This model serves, however, to demonstrate how a policy intention may be independent from the policy behavior and outcome. In a political context, where an aim is to create winning coalitions by aligning interests and actors, also successful climate policy measures strive to fulfill other objectives in addition to the climate change agenda: the more interests served, the larger coalition can be mobilized. Here so-called “no regret measures” are the lowest hanging fruit, an example being emission-reducing measures that come at practically no cost and which also benefit other interests. Yet, the main motive for climate policy measures should be to limit GHG releases (IPCC 2001b: 122). If challenging to tell apart in practice, and some might argue of only academic relevancy, distinguishing climate policies from non-climate policies is crucial when understanding the underlying motives behind an action – what is motivated by environmental concerns and what is presented as climate policies but in reality serves other interests. This distinction is also relevant when developing GHG scenarios where it is necessary to foresee what emissions reduction measures will be taken with and without further incentives. Managing human induced climate change can either relate to adaptation to its consequences or mitigation of its causes - namely reducing releases of GHGs to the atmosphere (Verbruggen 2007). Yet both types of action are important and necessary, this text deals with the latter aspect – from now on referred to as climate policy mitigation measures or in similar wordings. Such policies or measures contribute to (i) reduce GHG streams from emission sources like combustion engines, households, industrial sites, cities, countries and other systems or (ii) increase the uptake of GHGs in natural or artificial sinks (like forests), as figure 2 illustrates (Metz et al. 2007). From now on I focus on climate change emissions reduction mitigation strategies. Although both may lead to lowered CO2-emissions, the literature distinguishes between climate policies and non-climate policies. A climate policy strategy is taken with the primary objective of lowering GHG releases to the atmosphere. Non-climate policies might have the same effect in terms of GHG emissions but are taken due to other reasons. This has for example been demonstrated by the virtual stabilization of Japanese energy-related CO2 emissions from 1973 to 1986 prior to the introduction of an expressed Japanese climate change policy (Fermann 1995). Metz et al. (2007) find that climate change mitigation activities should reduce GHG emissions by a) changing behavioral patterns, b) developing and implementing new technologies, c) capturing GHGs before they are emitted to the atmosphere or by d) enhancing natural sinks to sequester more GHGs. Stern (2007: 214-215) argues that a climate policy measure may have either of two fundamental objectives: ! To reduce emissions from non-fossil fuel based sources: ! Reduction of emissions from land use change, agriculture or fugitive processes.⁹ ! To reduce emissions from fossil fuel combustion by: ! Reducing demand for emission-intensive goods and services ! Improving energy efficiency - fewer input, more output ! Switching to technologies which produce fewer emissions and lower the carbon intensity of production The Klimakur 2020 report (Klif 2010a) examines possible climate policy measures in a

Norwegian context. This report bases its inquiry on achieving the previously mentioned Norwegian governments 2020 target, by cutting GHG emissions by 15-17 million tons CO₂-equivalents in 2020 as compared to a Business As Usual (BAU) baseline scenario. 10 A host of mitigation activities are presented along two types of analyses. Both sector wise approaches to substantial actions (like improvement of industrial process, switching to new fuels) and possible effects from manipulating macro economic framework conditions through taxation and subsidies are assessed in various action menus or scenarios. Still, also when taking this background into account, defining climate policy instruments merely as “deliberate” actions, as Stern’s 1) or 2) or IPCC’s a)-d), leading to lower GHG emissions than a Business As Usual scenario (BAU) is imprecise. I emphasize the importance of maintaining consistency between strategic ambitions and conducted policy instruments, which when turning back to figure 1 refers to harmonizing climate policy as behavior and climate policy as intention. In this regard, BAU scenarios may constitute a weak comparative basis for assessing behavior-intention-compliance or means-goal efficiency in climate policy outcomes. The more ambitious the strategic policy objectives are, the higher the risk becomes of loosing the link between policy intention and behavior in cases where policy outcomes are compared to a BAU reference only. This goes in particular where a policy field serves an overarching ambition, as is the case for climate policy – which in Norwegian policy making serves to underpin the sustainable development strategy. The relationship between climate change and sustainable development has been identified as follows: “Decision making related to climate change is a crucial aspect of making decisions about sustainable development, simply because climate change is one of the most important symptoms of “unsustainability”” (IPCC 2001a). The statement suggests that current GHG emissions are one of several drivers of an unsustainable development. New questions now arise. What is sustainable development and how does it relate to climate change in particular? What does reducing GHG emissions imply in this regard? What kind of actions do such activities require? What is the ideal climate policy instrument? The following sections address these questions. In the following section, the evolution of strategies of environmental management and the link to sustainable development is accounted for.

Climate policies are aimed at climate change mitigation and adaptation

Mickwitz et al, 2009 [Climate Policy Integration, Coherence and Governance, http://www.peer.eu/fileadmin/user_upload/publications/PEER_Report2.pdf, JRL]

The study’s aims are: • To assess the degree of climate policy integration in different countries and policy sectors (energy, traffic, spatial planning, education, etc.), in some cases at the local level, and to determine key coherence problems between climate policies and other policies at different levels. • To suggest means – such as institutions, processes (e.g. EIA) or measures – to enhance climate policy integration and improve policy coherence, within the context of multi-level governance. The study is based on the view that analysing and comparing experiences across time, sectors and countries is beneficial and instructive. Oversimplified, straightforward comparisons may be seriously misleading, however; and case-specific characteristics should be borne in mind. By undertaking broad comparative studies with in-depth involvement by researchers with national knowledge and different disciplinary backgrounds, the country – and context – specific understanding can be maintained at the same time as all the new perspectives that emerge as a result of comparison using common concepts and questions are introduced. Put bluntly, none of the research institutes involved could have undertaken the study in isolation – such a task requires a network. The study deals with both climate change mitigation and adaptation policies. The Intergovernmental Panel on Climate Change (IPCC 2007, 878) defines mitigation thus: “An anthropogenic intervention to reduce the anthropogenic forcing of the climate system; it includes strategies to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks.” Mitigation policies thus refer to policies that are intended to enhance mitigation, i.e. to reduce greenhouse gas emissions or to promote sinks. IPCC (2007, 869) defines adaptation as, “Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, autonomous and planned adaptation.” Adaptation policies are therefore policies that intend to enhance adaptation.

Other actions are part of a strategy of climate policy integration

Mickwitz et al, 2009 [Climate Policy Integration, Coherence and Governance, http://www.peer.eu/fileadmin/user_upload/publications/PEER_Report2.pdf, JRL]

Based on the definition of policy integration made by Underdal (1980), and environmental policy integration by Lafferty and Hovden (2003), we define climate policy integration as: • the incorporation of the aims of climate change mitigation and adaptation into all stages of policy-making in other policy sectors (non-environmental as well as environmental); • complemented by an attempt to aggregate expected consequences for climate change mitigation and adaptation into an overall evaluation of policy, and a commitment to minimise contradictions between climate policies and other policies. In order to evaluate the degree of climate policy integration, one has to focus the evaluation by asking where policy integration should be found. Assuming that there is a political commitment that a policy objective should be integrated into other policies, this needs to be reflected in policy strategies – in general strategies such as government programmes, and in sector-specific ones – as well as in the policy instruments (e.g. laws, taxes, support schemes, information material etc.) by which the strategies are implemented. Since policy integration is designed not just to change bureaucracies but to result in actual climate change mitigation and adaptation, it is essential to extend the examination to include policy outputs² and outcomes³ (Figure 1). If climate change is integrated into educational policies, it should be incorporated into the materials used in schools, into lessons and ultimately into the knowledge and the daily habits of pupils. If policy integration proves to be a good way in which to promote climate change mitigation and adaptation, the more knowledgeable pupils will behave differently as adults. Furthermore, strategies and policy instruments may be formed at any governmental level, from the global to the local. The conceptual model in Figure 1 is thus not bound to any particular governmental level.

Climate policy is short-hand for climate change policy

Mickwitz et al, 2009 [Climate Policy Integration, Coherence and Governance, http://www.peer.eu/fileadmin/user_upload/publications/PEER_Report2.pdf, JRL]

Throughout this study we use the term "climate policy integration" and "climate policy" although the terms "climate change policy integration" and "climate change policy" would be more precise. The reason is that "climate policy integration" and "climate policy" are the terms that have become established in the literature and are also more communicative.

Climate policy includes: carbon pricing (cap & trade, tax on emissions), regs on transportation, buildings, appliances and smart growth

Kevin Doran and Alaine Ginnocchio, 2008 [* Kevin Doran is a Senior Research Fellow at the Energy and Environmental Security Initiative, University of Colorado Law School. ** Alaine Ginnocchio is Research Associate at the Energy and Environmental Security Initiative, University of Colorado Law School, 3 Env'tl & Energy L. & Pol'y J. 31, ARTICLE: UNITED STATES CLIMATE POLICY: USING MARKET-BASED STRATEGIES TO ACHIEVE GREENHOUSE GAS EMISSION REDUCTIONS, lexis]

A. Climate Policy: A Comprehensive Portfolio Human activity, resulting in the emission of greenhouse gases ("GHGs") into the atmosphere, is producing unwanted global climate change. To avoid the serious and potentially catastrophic environmental, economic, and health consequences associated with an increasing global temperature, global emissions of GHGs must be slowed, reduced, and stopped. There is no silver bullet for achieving the reduction of GHG emissions. It will require changes in energy policy and sustainable development, as well as market-based policies for reducing GHG emissions. Therefore, a climate change policy is more accurately defined as a portfolio of policies largely aimed at reducing GHG emissions. Some proposals can be implemented immediately at little or no cost, while others will require structural changes to

our economic and energy systems and to the way we think and live. n1 [*33] Carbon pricing through measures such as a cap-and-trade program or a tax on emissions is thought to be one of the most effective and efficient mechanisms for reducing GHG emissions. n2 The prevailing wisdom is that there is no other single policy that promises to deliver as steep a curve in emissions for as large a part of the total emission inventory as pricing emissions. n3 Pricing is the way to get both short-term gains through efficiency and long-term gains from investments in research and switching to cleaner fuels. n4 The significance of this component of climate policy should not be understated. Without the ability to price carbon, it is unlikely that we will be able to contain global temperature changes within an acceptable range. n5 However, emission pricing is not a silver bullet; and in fact, emissions pricing is only one part of a climate change policy which should include a portfolio of policies. Historically, it has taken an average of ten to twelve years for the federal government to implement a rule or policy of such scope and magnitude. n6 It could take a decade or more for a cap-and-trade system to start having a profound impact on emissions, but it would be wise to simultaneously adopt a portfolio of policies that would have more of an immediate impact. n7 Further, we must also accept that a pricing policy can take us only part of the way. As currently conceived, it would be difficult to make an emissions pricing policy reach individual motorists, much less impact every sector of the economy. n8 Companion measures would need to be part of a comprehensive climate change policy--regulations concerning transport, [*34] buildings, appliance efficiency, and smart growth. n9 Such a comprehensive climate change policy would capture low hanging fruit, which can impact emissions sooner and at a much lower cost. For example, energy efficiency measures can help slow the pace at which the risk from global warming increases, but it cannot reverse the trend alone. In the long-term, the world's economy needs a technological transformation, moving from the status quo, in which 90% of global energy comes from fossil fuels, to being largely free of emissions from fossil fuels by 2100. n10

Emissions Targets

Targets are emissions reduction levels that include specific timeline for achievement

C2ES No date “Greenhouse Gas Emissions Targets” <http://www.c2es.org/us-states-regions/policy-maps/emissions-targets>

A greenhouse gas emissions target refers to the emission reduction levels that states set out to achieve by a specified time. For example, a state may set a target of reducing emissions to 1990 levels by 2020, and to 50 percent below 1990 levels by 2050.

GHG emission reduction targets- either expressed in parts per million, percentage reduction from baseline year, or limiting climate change to specific temperature

Center for Media and Democracy in 2009, SourceWatch,
http://www.sourcewatch.org/index.php/Greenhouse_gas_emission_reduction_targets

Greenhouse gas emission reduction targets are commonly expressed in either parts per million of carbon dioxide equivalent, parts per million of carbon dioxide equivalent concentration, a percentage reduction from a specified baseline year or by a nominated year, or in terms of limiting global climate change to below a specific temperature, such as a 2 degree increase over pre-industrial temperatures.

Greenhouse Gases (6 Gases)

GHGs are the following 6 things

Steinmiller '00 – Senior Vice President and General Counsel for Conner Strong & Buckelew

Heather A., COMMENT: STEEL INDUSTRY WATCH OUT! THE KYOTO PROTOCOL IS LURKING,
Villanova Environmental Law Journal, 2000, 11 Vill. Env'tl. L.J. 161

II. Background A. Greenhouse Effect Generally The greenhouse effect is a natural phenomenon that occurs in the troposphere. n11 It begins when ultraviolet radiation travels from [*163] the sun, through the atmosphere, to the Earth. n12 The Earth absorbs some of this ultraviolet radiation and releases the remaining radiation back into space in the form of infrared energy. n13 Greenhouse gases absorb much of this infrared energy. n14 This entire process is called the greenhouse effect. n15 The greenhouse effect prevents too much infrared energy from escaping into space and keeps the Earth's temperature warm enough to sustain life. n16 Many scientists warn that excess emissions of greenhouse gases into the atmosphere accelerates the greenhouse effect. n17 The excess emission of greenhouse gases decreases the amount of infrared energy released into space and traps more infrared energy in the Earth's troposphere. n18 The trapping of infrared energy increases [*164] the Earth's temperature and causes abrupt changes in the weather, such as floods, hurricanes, droughts, and higher sea levels. n19 The gases contributing to the greenhouse effect are: (1) carbon dioxide, (2) methane, (3) nitrous oxide, (4) hydrofluorocarbons, (5) perfluorocarbons, and (6) sulfur hexafluoride. n20 While both human activity and natural causes can create the first [*165] three of these gases, only human activity creates the last three. n21 Carbon dioxide is the most pervasive among the gases and, therefore, will be the major focus of the discussion.

Kyoto stipulates 6 GHGs

Dernbach 4 - Professor, Widener University Law School

John C., INTRODUCTION: Toward A Climate Change Strategy For Pennsylvania, Penn State Environmental Law Review, Winter, 2004, 12 Penn St. Env'tl. L. Rev. 181, Lexis

A variety of gases can contribute to climate change. The six gases subject to control under the Kyoto Protocol are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride. n96 Carbon dioxide is the most commonly discussed greenhouse gas and makes the largest contribution to climate change, but it is not the most potent greenhouse gas. The other gases are emitted in smaller amounts but have, on a ton-for-ton basis, more global warming potential than carbon dioxide. Over a 100-year time horizon, for instance, one ton of nitrous oxide has 296 times the global warming potential of a ton of carbon dioxide, and a ton of methane has 23 times [*197] the global warming potential of a ton of carbon dioxide. n97 Pennsylvania's operating and abandoned underground coal mines are a significant source of methane emissions. An effort that focused only on carbon dioxide would not be as effective as an effort that focused on all relevant gases. A focus on all gases, moreover, provides more opportunities to create opportunities (including opportunities for the coal industry) and reduce costs.

There are 6

UK Department of Energy & Climate Change 14

3-27, 2013 UK Greenhouse Gas Emissions, Provisional Figures and 2012 UK Greenhouse Gas Emissions, Final Figures by Fuel Type and End-User,

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/295968/2014_0327_2013_UK_Greenhouse_Gas_Emissions_Provisional_Figures.pdf

The basket of greenhouse gases covered by the Kyoto Protocol consists of six gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride. The last three gases are collectively referred to as fluorinated gases or F-gases. In accordance with international reporting and carbon trading protocols, each of these gases is weighted by its global warming potential (GWP), so that total greenhouse gas emissions can be reported on a consistent basis. The GWP for each gas is defined as its warming influence relative to that of carbon dioxide. Greenhouse gas emissions are then presented in carbon dioxide equivalent units.

Chart outlining makeup of US emissions

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*John C., **Seema, ARTICLE: CLIMATE CHANGE LAW: AN INTRODUCTION, Energy Law Journal, 29 Energy L. J. 1, Lexis

[*6] Like other countries, the United States publishes annually a profile of U.S. greenhouse gas emissions and sinks. Table 1 provides a summary of that profile:

Type of Gas	1990	2005	Total Growth 1990-2005	Total Growth (Percentage Increase)
Carbon Dioxide	5,061.6	6,089.5	1027.9	20.3
Methane	609.1	539.3	(69.8)	(11.5)
Nitrous Oxide	482.0	468.6	4.6	(1.0)
HFCs,PFCs, SF6	89.3	163.0	73.7	82.5
TOTAL	6,242.0	7,260.4	1036.4	16.6
Net Carbon Dioxide Flux from Land Use, Land-Use Change, & Forestry	(712.8)	(828.5)	(130.3)	(18.3)
Net Emissions (Sources and Sinks)	5,529.2	6,431.9	902.7	16.3

Table 1: Net Greenhouse Gas Emissions (Teragrams of carbon dioxide equivalent) n29

Table 1 provides data for six greenhouse gases. n30 Because these gases have different global warming potential (a ton of methane represent twenty-one times the warming potential of a ton of carbon dioxide), the numbers in Table 1 are all expressed in carbon dioxide equivalents. Carbon dioxide is the dominant greenhouse gas, contributing 6,089.5 of the 7,260.4 teragrams, or 83.9% of the equivalent emissions in 2005. The overwhelming majority of carbon dioxide emissions, in turn (5751.2 of the 6089.5 teragrams emitted in 2005, or 94.4 %), were from fossil fuel combustion. n31 Dominant sources of methane emissions are landfills, the digestive systems of animal livestock (particularly cows and sheep), and natural gas pipeline systems. The overwhelming majority of nitrous oxide emissions are from agricultural soil management, although mobile source combustion (primarily automobiles) plays a small role. The remaining pollutants (hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride) are [*7] manufacturing byproducts, although electrical transmission and distribution also contribute to emissions. n32

Quotes Kyoto text

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Eric, COMMENT: REPUDIATION AND REGRET: IS THE UNITED STATES SITTING OUT THE KYOTO PROTOCOL TO ITS ECONOMIC DETRIMENT?, Environmental Law, Spring, 2007, 37 Env'tl. L. 441, Lexis

The Kyoto Protocol, n31 an addition to the UNFCCC, was adopted in 1997 and came into force in February 2005 after Russia added itself to the list of 141 ratifying countries. n32 The stated aim of the parties to the UNFCCC was to stabilize "greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate [*447] system." n33 Those gases include: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride. n34 The Kyoto Protocol's plan to achieve that goal involves specific emissions reduction targets within a specific timeframe for most of the developed countries among its parties. n35 For example, if the United States became a Party it would be required to reduce its GHG emissions seven percent below the amount of its 1990 emissions n36 between 2008 and 2012. n37 Iceland, by contrast, is allowed to increase its emissions by ten percent. n38 Such a surplus of emissions capacity is known as "hot air." Russia is probably the biggest winner in terms of hot air. Its target under the Kyoto Protocol is zero percent (i.e., it needs to be at or below its 1990 levels by 2012), n39 but the collapse of its economy after the 1990 benchmark left it with a thirty-percent emissions surplus. n40

Greenhouse Gases (Broad)

A GHG is any gas that absorbs and releases radiation in the atmosphere

Seafish 14 - Non-Departmental Public Body (NDPB) set up by the Fisheries Act 1981 to improve efficiency and raise standards across the seafood industry

The Seafish Guide to Greenhouse Gas Emissions in Seafood,
http://www.seafish.org/media/publications/SeafishGuidetoGHGEmissionsinSeafood_201409.pdf

A greenhouse gas (GHG) is any gas, both natural and anthropogenic, that absorb and release infrared radiation in the atmosphere⁵. Many GHG's occur naturally in the atmosphere, such as carbon dioxide (CO₂), methane (which is around 25 times more potent than CO₂ 5a), nitrous oxide (300 times more potent^{5a}), and water vapour, while others are man-made, such as the chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), as well as sulphur hexafluoride (SF₆). Atmospheric concentrations of both the natural and man-made gases have been rising over the last few centuries. As the global population has increased and our reliance on fossil fuels (such as coal, oil and natural gas) has intensified, so emissions of these gases have risen. While gases such as carbon dioxide occur naturally in the atmosphere, our interference with the carbon cycle (through burning forest lands, or mining and burning coal), artificially moves carbon from solid state to its gaseous state, thereby increasing atmospheric concentrations⁶.

GHG = gas that traps heat in the atmosphere

B-Corporation 8 - companies using the power of business to solve social and environmental problems

B Resource Guide: Calculating Greenhouse Gas Emissions,
http://www.bcorporation.net/sites/default/files/documents/portal/BCorp_Calculating_Greenhouse_Gas_Emissions.pdf

I. Definition: What are Greenhouse Gas (GHG) Emissions?

Gases that trap heat in the atmosphere are often called greenhouse gases (GHGs). Some GHGs such as carbon dioxide occur naturally and are emitted to the atmosphere through natural processes and human activities. Other greenhouse gases (e.g., fluorinated gases) are created and emitted solely through human activities. The principal greenhouse gases that enter the atmosphere because of human activities are: Carbon dioxide, methane, nitrous oxide and fluorinated gases. 2

[skips to footnote #2]

2 Greenhouse Gases in more detail:

Carbon Dioxide (CO₂): Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). Carbon dioxide is also removed from the atmosphere (or “sequestered”) when it is absorbed by plants as part of the biological carbon cycle.

Methane (CH₄): Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.

Nitrous Oxide (N₂O): Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.

Fluorinated Gases: Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for ozone-depleting substances (i.e., CFCs, HCFCs, and halons). These gases are typically emitted in smaller quantities, but because they are potent greenhouse gases, they are sometimes referred to as High Global Warming Potential gases (“High GWP gases”).

Greenhouse Gases (Direct vs. Indirect)

Direct vs. indirect GHGs – climate effects of indirect GHGs are less certain

Kim et al. 9 – Wyle Laboratories, Inc.

*Brian, **Ian A. Waitz – consultant, ***Mary Vigilante – Synergy Consultants Inc., ****Royce Bassarab - WYLE LABORATORIES, INC, AIRPORT COOPERATIVE RESEARCH PROGRAM Report #11, Guidebook on Preparing

Airport Greenhouse Gas Emissions Inventories,

http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_011.pdf

1.3 Overview of Greenhouse Gas Emissions This Guidebook focuses on the development of inventories for the following GHGs: 1. Carbon dioxide (CO₂), 2. Methane (CH₄), 3. Nitrous oxide (N₂O), 4. Sulfur hexafluoride (SF₆), 5. Hydrofluorocarbons (HFC), and 6. Perfluorocarbons (PFC). This list mirrors the gases regulated under the Kyoto Protocol. These gases are typically covered in most GHG emissions reporting protocols including the guidelines from the Intergovernmental Panel on Climate Change (IPCC) and the recent protocol from TCR (IPCC 1999 and TCR 2008a). For U.S. economic sectors as a whole, these gases generally represent the most notable GHGs based on a combination of the quantity of pollutant emitted and potential for exerting climate change effects. For aviation, emissions of the fluorinated compounds (including HFC and PFC) are less significant because these compounds are generally emitted from industrial activities. They can be emitted from airport activities associated with the use of refrigeration and fire extinguishers, but these emissions are not well documented. Of the three remaining gases, emissions of CO₂ at an airport tend to be better understood than N₂O and CH₄. In addition to the direct emissions, consideration can often be given to the other following pollutants that have the potential to exert climate change effects: water vapor (H₂O), particulate matter (PM), sulfur oxides (SO_x), oxides of nitrogen (NO_x), carbon monoxide (CO), and nonmethane volatile organic compounds (NMVOC). These pollutants can produce some direct effects, but their main contributions are as precursors for indirect effects. The direct effects that H₂O exert tend to be dominated by the normal, natural hydrologic cycle (rainfall, evaporation, etc.). However, water vapor still may have an important effect, especially for direct emissions into the stratosphere as occur for some aircraft flights. Similarly, the effects produced by PM species (i.e., black carbon or soot and sulfate aerosols) can be important. SO_x adds to this effect since it can react in the atmosphere and form sulfate aerosols. Both H₂O and PM also have indirect effects through contrail formation. Ozone (O₃) also has a climate change effect but is not directly emitted. Rather, O₃ is produced in the troposphere through reactions involving NO_x or CO and NMVOCs. In the stratosphere, it is produced through a reaction involving oxygen molecules (O₂) and ultraviolet (UV) radiation. Since O₃ is not directly emitted, it cannot be included in an airport emissions inventory. However, its precursors, NO_x, CO, and NMVOC can be included. NO_x can also produce nitrate aerosols, thus further complicating the assessment of indirect effects. Although the indirect effects are generally considered important, they also have the largest uncertainties associated with their climate impacts. Inclusion of these precursor emissions within a GHG inventory arguably helps to comprehensively capture all of the emissions related to climate change, consistent with the general guidelines specified by the IPCC in promoting the need to quantify even indirect emissions as part of the overall GHG inventory (IPCC 2006). However, since there are technical issues for these precursors, such as no well-established CO₂ equivalencies for these precursors, these emissions cannot be directly compared to each other at this time using simple multipliers. More complex climate models are required for this purpose.

This distinction is borne out in Kyoto

NAEI 15

National Atmospheric Emissions Inventory, Overview of greenhouse gases, <http://naei.defra.gov.uk/overview/ghg-overview> The GHG inventory covers the seven direct greenhouse gases under the Kyoto Protocol: Carbon dioxide (CO₂) Methane (CH₄) Nitrous oxide (N₂O) Hydrofluorocarbons (HFCs) Perfluorocarbons (PFCs) Sulphur hexafluoride (SF₆) Nitrogen trifluoride (NF₃) These gases contribute directly to climate change owing to their positive radiative forcing effect. HFCs, PFCs, SF₆ and NF₃ are collectively known as the 'F-gases'. In general terms, the largest contributor to global warming is carbon dioxide which makes it the focus of many climate change initiatives. Methane and nitrous oxide contribute to a smaller proportion, typically <10%, and the contribution of F-gases is even smaller (in spite of their high Global Warming Potentials) at <5% of the total. Also reported are four indirect greenhouse gases: Nitrogen oxides Carbon monoxide Non-methane volatile organic compounds (NMVOC) Sulphur dioxide Nitrogen oxides, carbon monoxide and NMVOCs are included in the inventory because they can produce increases in tropospheric ozone concentrations and this increases radiative forcing (warming of the atmosphere). Sulphur dioxide is included because it contributes to aerosol formation which can either warm (through absorption of solar radiation on dark particles) or cool (from forming cloud droplets and reflecting radiation) the atmosphere.

IPCC recognizes this distinction

IPCC, no date

FAQ, <http://www.ipcc-nggip.iges.or.jp/faq/faq.html>

A: Scientific aspects of greenhouse gases are dealt with by Working Group 1 of the IPCC. See <http://www.ipcc.ch/>. The NGGIP deals with the following anthropogenic emissions by sources and removals by sinks of greenhouse gases (GHG).

Those covered in the Revised 1996 Guidelines;

Carbon dioxide (CO₂)

Methane (CH₄)

Nitrous oxide (N₂O)

Hydrofluorocarbons (HFCs - this is really a family of gases, there are many individual gases)

Perfluorocarbons (PFCs - this is also a family of gases)

Sulphur hexafluoride (SF₆)

Other direct GHG covered in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 Guidelines);

Nitrogen trifluoride (NF₃)

Trifluoromethyl sulphur pentafluoride (SF₅CF₃)

Halogenated ethers

Other halocarbons

The NGGIP inventory guidelines do not include gases covered by the Montreal Protocol, such as;

Chlorofluorocarbons (CFCs - this is also a family of gases)

Hydrochlorofluorocarbons (HCFCs - this is also a family of gases)

There are also the “indirect” GHGs that do not directly contribute to the greenhouse effect, but once they are released into the atmosphere they form substances (e.g. tropospheric ozone O₃, aerosols) which contribute to the greenhouse effect. Indirect anthropogenic greenhouse gases are, amongst others, carbon monoxide (CO), non-methane volatile organic compounds (NMVOC), nitrogen oxides (NO_x), ammonia (NH₃) and sulphur dioxide (SO₂). 2006 Guidelines contain links to information on methods used under other agreements and conventions, for the estimation of emissions of tropospheric precursors which may be used to supplement the reporting of emissions and removals of greenhouse gases for which methods are provided.

Market-Based Regulations/Incentives

Market mechanism

CSIS 2016 “International Climate Negotiations Glossary”

<https://www.csis.org/programs/energy-and-national-security-program/analysis/international-climate-negotiations-glossary>

Market mechanism: A market mechanism is an approach to reducing greenhouse gas emissions using market frameworks, including a price on emissions (e.g., a cap or a tax), trading schemes, and various pollution taxes. Some Parties favor market mechanisms to reduce the costs of mitigation, increase environmental effectiveness, and spur technological innovation. The Bali Action Plan acknowledges opportunities for both market and non-market approaches (e.g., mandates). Research indicates that several factors are necessary for market mechanisms to be successful, including accurate measurement, transparency, accountability, fungibility, and consistency. The Kyoto Protocol included three market mechanisms: the Clean Development Mechanism (CDM), the Joint Implementation (JI), and international emissions trading. Any agreement reached in Paris is not expected to create a new market mechanism, and some countries are opposed to the inclusion of a market mechanism within the agreement. An overarching market mechanism—such as a global emissions trading platform—is unlikely to emerge under the auspices of the UNFCCC in the near future, although existing and future market mechanisms are likely to benefit from many of the ideas, processes, and methodologies created in the UNFCCC.

Market based incentives

IPIECA 2012 (The global oil and gas industry association for environmental and social issues) “Climate change: a glossary of terms” 5th edition <http://www.ipieca.org/publication/climate-change-glossary-terms-5th-edition>

Market-based Incentives

Measures intended to use price mechanisms (e.g. taxes and tradable permits) to reduce greenhouse gas emissions.

Market based regulation

Union of Concerned Scientists 2011 “Global Warming Glossary”

<http://www.climatehotmap.org/global-warming-glossary/m.html>

Market-based regulation - Regulatory approaches using price mechanisms (e.g., taxes and auctioned tradable permits), among other instruments, to reduce heat-trapping gas (greenhouse gas) emissions.

Market-based regulation is distinct from command and control, liability rules, and social media campaigns

Meade 15 (Richard, Cognitus Advisory Services Limited, Regulation 2025 Spectrum of Regulatory Responses, Ministry of Transport New Zealand, p. 18-20)

4.3. Tools Applied Particularly in Social Regulation

4.3.1. Liability Rules

Establishing legal liability for adverse events (e.g. environmental damage, passenger transportation accidents, workplace accidents) is a clear and strong, though blunt, regulatory tool. It represents a strategy of deterrence rather than compliance (Gunningham (2010)). The approach has adversarial features, in that it rests on detection, prosecution and penalties. In its pure form, it assumes that regulated parties are fully aware of their liability from taking certain actions, and respond rationally to the associated incentives. It also assumes that the probability of detecting breaches, and breach sanctions, are sufficient to induce desired behaviours. Where deterrence is adversarial rather than cooperative, it can undermine cooperative behaviour that might otherwise be forthcoming from regulated parties. Being adversarial can also induce minimal compliance, and resistance to enforcement.³⁵ However, the adversarial use of liability rules remains a useful strategy as implemented by public or private agencies where cooperative behaviour cannot be assumed, and/or if the risks of non-cooperative behaviour by even a few are severe.

4.3.2. Market-Based Regulation – Cap-and-Trade

Market-based regulation such as cap-and-trade emissions permit schemes can provide a greater degree of certainty as to quantity outcomes than taxes or subsidies. This is because cap-and-trade schemes fix a cap on the allowed level of regulated activity. However, they introduce uncertainty as to permit price, which adjusts to equate permit supply and demand. Instead of requiring knowledge of individual agents' marginal benefits and costs of the activity to be regulated, in setting the desired quantity outcome the regulator instead must determine the overall socially desirable level (e.g. of emissions, or number of vehicles driving in the central city). Ensuring compliance still requires some means of measuring individual agents' output of the regulated activity. Taxes and cap-and-trade schemes can be equivalent, but this equivalence fails under uncertainty (Weitzman (1974)).

Provided the traded property rights are well-defined and enforceable, and trading costs are low, in principle cap-and-trade schemes should be efficient. That is, despite initial allocations of permits, trading will occur until marginal compliance costs are equated to permit price across regulated parties. However, whether permits are auctioned or gifted raises equity considerations, as well as dynamic efficiency issues such as stranding sunk investments made prior to scheme introduction.³⁶ Moreover, political uncertainty as to cap levels and the levels of any free allowances, particularly across compliance periods, can undermine cap-and-trade effectiveness, as was experienced in the EU emissions trading scheme.³⁷

[³⁵ Additionally, it might encourage self-selection into the regulated activity by parties with expertise in evading detection or contesting enforcement, just as strong extrinsic incentives can reduce intrinsic motivation (Bénabou and Tirole (2013)). ³⁶ Parties that made long-term investments prior to cap-and-trade scheme introduction might object if such schemes result in an uncompensated reduction in the value of their investments. This can deter them from making further investments, reducing dynamic efficiency. Gifting permit allocations to such investors is one means to reduce such impacts. However, where technology changes make long-term investments redundant, these impacts may be less critical. ³⁷ Political commitment issues

arise here as they do under incentive regulation, and monetary policy. Some form of credible “independent central bank” governing caps and allowances is yet to be developed.]

4.3.3. Self-Regulation and Meta-Regulation

In contrast to deterrence strategies involving legal liability rules administered privately or by public agencies, self-regulation and meta-regulation are founded on assuming either inherent or selfinterested cooperative behaviour on behalf of regulated parties. Self-regulation involves a group engaged in a particular sphere of activity agreeing on their own objectives, and how best to achieve them. Meta-regulation, including co-regulation, adds an element of actual or threatened direct regulatory involvement, such as in setting the objectives or methods of self-regulation if voluntary selfregulation fails to achieve regulatory objectives. The latter can involve a focus on regulatory riskmanagement, with the regulator monitoring how (would-be) regulated parties devise systems to achieve the regulator’s aims, rather than directly monitoring the achievement of those aims (Black (2010), Baldwin et al. (2010)).

Self- and meta-regulation are forms of compliance strategies (Gunningham (2010)), and build on an increasing understanding of what motivates cooperative behaviour in collective action situations (Ostrom (2000)).³⁸ An important contributor to cooperative behaviour is the development of norms such as trust and reciprocity. This can result where the relevant group has effective leadership, controls its membership, and shapes and enforces its own rules – as has been common in selfregulating professions (Rostain (2010)).³⁹ Such norms – and hence effective self-regulation – are more likely to emerge in situations where members have shared interests, and are homogeneous and hence face low collective decision making costs. However, if these conditions do not arise, or the group’s interests diverge sufficiently from the regulator’s, then an added element of compulsion under meta-regulation may be needed.

Each approach is founded on directly assisting the regulated party to achieve the regulator’s desired aims, including by way of education and creation of compliance expertise (as opposed to indirectly, via threat of ex post punishment for non-compliance under deterrence strategies). Both self- and meta-regulation can be effective ways of harnessing the regulated group’s superior information (e.g. technical expertise), as well as any intrinsic motivation for good performance (such as professional ethics, and peer review). Meta-regulation further relies on the group’s members fearing negative repercussions for all, due to the misconduct of one or more “rogue” members, to induce peer monitoring and control. Self-regulation can become more viable when users of the self-regulated activity gain access to better information regarding service quality, such as is increasingly the case with the rise of platforms for consumers to rate their service experiences.

38 See Appendix F.3 of New Zealand Productivity Commission (2015) for a wider discussion of collective action as an alternative to government organisation. 39 Tirole (1988) shows why parties such as professions can favour advertising bans – a form of information non-disclosure. This is because bans enable them to differentiate their services and thereby enhance their market power. Rostain (2006) argues that such market power can be useful to reduce any tension between professional’s pursuit of income and output quality.

4.3.4. Standards

Standards represent a form of command and control, with the regulator specifying standards against which they monitor compliance.⁴⁰ However, they can include little more than information disclosure requirements backed up by general competition/antitrust law, as was initially the case in electricity distribution in New Zealand (i.e. being more command than regulatory control).⁴¹ In New Zealand's case such disclosures were intended to enable informal yardstick competition via customer and third party performance benchmarking.

More commonly, standards include tools such as process standards dictating how regulated parties are to undertake their activities. Alternatively they include performance standards, dictating what those activities must achieve. Examples include specifying the use of certain technologies for safety or environmental protection (process), or the attainment of certain levels of each (performance). Process standards are informationally less demanding than either taxes and subsidies, cap-and-trade schemes, or performance standards. This is because the regulator simply needs to know what input processes to mandate. Hence outputs need not be monitored, and compliance is relatively easy to verify. They also provide greater certainty to regulated parties when making investment choices, since likely compliance with process standards is easier to determine. The cost of this approach is that it typically involves imposing uniform or "one-size-fits-all" obligations on possibly very diverse parties (including as to production technologies). This leads to inefficiency, since marginal compliance costs will not be equal across regulated parties, and without opportunities to trade obligations this can force costly exit by those with high compliance costs. Also, the costs of mandating inappropriate processes are potentially large. So are the costs of inducing compliance with the letter of detailed, rule-based standards, instead of with the spirit of principles-based standards (Scott (2010)).⁴²

Performance standards are more informationally demanding than process standards because they require the regulator to monitor the outputs (e.g. safety outcomes, or environmental impacts) of possibly diverse and numerous regulated parties. They also require greater judgement on the part of the regulator and regulated parties as to compliance. This can complicate investment choices where performance standard compliance is difficult to ascertain ex ante, and increases scope for mechanisms such as third-party performance certification. However, performance standards have the important efficiency advantage over process standards of allowing regulated parties to choose the least-cost way in which to achieve compliance. This can also encourage technological innovations to achieve compliance (OECD (1996)), although not always successfully.⁴³

40 Criminal law, and prohibitions of undesirable conduct, also fall within this category or regulation. 41 Bolton and Dewatripont (2005) discuss situations in which mandatory information disclosures can be superfluous, and lead to excessive disclosure when parties have incentives to disclose voluntarily. Good parties may wish to disclose to distinguish themselves from bad parties, which induces bad parties to disclose also (for fear of being assumed worse than they really are). However, mandatory disclosure can remove incentives for excessive disclosures when parties are uncertain about their own types. 42 The Global Financial Crisis has as much

been attributed to regulatory failings as it has to finance sector misconduct. For example, over-reliance on prescriptive capital adequacy rules – a form of process standard – has been blamed for finance sector firms being free to find innovative ways of creating off-balance sheet financing structures (Scott (2010), Baldwin et al. (2010), Rose (2014), Kroszner and Strahan (2014)). Such structures contributed to the resulting systemic financial problems. 43 Mumford (2011) describes how failures in performance-based regulation contributed to the “leaky buildings” saga in the New Zealand building industry.

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4.3.5. Influencing Preferences

Similar to the use of behavioural theories in regulation, directly influencing preferences is also a relatively new approach, aided in particular by the rise of social media and other platforms for mass information exchange. Many regulatory approaches such as taxes, incentive regulation and liability rules take the objectives of the regulated parties as given (i.e. possibly non-conforming and selfinterested, as well as rational). Instead they seek to modify those objectives through the use of additional incentives (e.g. penalties or rewards that modify regulated firm’s profits). By contrast, regulators are increasingly seeking to change the objectives – i.e. preferences – of regulated parties directly. Social marketing campaigns are an example, such as those in New Zealand to change attitudes towards drink-driving. Like compliance strategies, they seek to assist regulated parties to achieve desired outcomes, rather than punish failure to do so as under more traditional deterrence strategies. They are a natural alternative to try when deterrence strategies are ineffective, such as with repeat drink-drivers, and aim to elicit cooperation rather than to punish

Liability rules and command and control are distinct from market-based regulation

Olmstead and Richardson 14 (Sheila, visiting fellow at Resources for the Future and an associate professor at the Lyndon B. Johnson School of Public Affairs, The University of Texas at Austin, and Nathan, resident scholar at Resources for the Future, Managing the Risks of Shale Gas Development Using Innovative Legal and Regulatory Approaches, <http://www.rff.org/files/sharepoint/WorkImages/Download/RFF-DP-14-15.pdf>)

1. Introduction Shale gas development is increasing rapidly in the United States; natural gas extracted from deep shale reached about one-quarter of US production by 2010 and may comprise half or more of US production by 2040. Operators now can exploit these resources cost-effectively due to advances in two critical technologies: hydraulic fracturing and horizontal drilling. The use of these technologies to extract gas from deep shale formations has generated significant economic benefits, but it also has raised concerns about associated risks to the environment and human health.¹ The wide distribution of shale plays means that many are being developed in states such as Texas and Oklahoma with rich histories of oil and gas exploitation and regulation and others in states such as Ohio and Pennsylvania with little such history. States have long been the primary regulators of oil and gas development and have retained that role as production has expanded, though both federal and local authorities play

some role. The regulatory framework for managing risks from shale gas development is highly dynamic. Flexible, innovative legal and regulatory approaches hold great promise as cost-effective alternatives to prescriptive regulation, but it remains to be seen whether they are appropriate for managing shale gas risks. This paper examines two main categories of innovative approaches that can be used to regulate environmental risks: liability rules and market-based regulations. For each approach, we discuss theoretical advantages and disadvantages, and we explore actual and potential applications to the regulation of risks from shale gas development.

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2. Liability Rules Virtually all public discussion of the risks of shale development centers on the proper role for regulation: which risks need to be regulated, and how stringent should that regulation be? Nevertheless, liability, not regulation, is probably the most important driver of operator practices aimed at reducing risks—and this likely would remain the case under even the most ambitious proposals for more extensive regulation. Large areas of drilling-related activity are unregulated or only lightly regulated, like drilling equipment and, in most states, fracking fluids. Even when state drilling regulations are quite detailed, such as those aimed at ensuring well integrity, operators retain significant discretion. But operators always face the threat of lawsuit if their activity results in harms to others or to the environment. Lawsuits over drilling and related activities, such as truck accidents, are common. Operators therefore have a strong incentive to exercise due care in almost all activities, regardless of regulation. This is not to suggest that regulation is not useful and in many cases necessary, but rather that the two systems—regulation and liability—work together to shape patterns of behavior and thereby reduce risks. Much work has been done on the effects of liability rules in the environmental context, especially on Superfund and related state laws (Kornhauser and Revesz 1994; Sigman 1998; Chang and Sigman 2000, 2007; Alberini and Austin 2002). But debates over how best to manage new risks imposed by expanding shale development have largely been missing a consideration of the liability system—and of options available for improving its ability to manage new risks.

2.1 Regulation versus Liability in General But how do the two systems work together? When is liability appropriate and adequate, and when is regulation needed instead? Law and economics scholar Steven Shavell (1984, 357) addressed these questions in a landmark article, identifying four criteria on which to base an evaluation of which tool is superior for a particular situation: ① Information asymmetry. Where private parties have greater knowledge about risky activities than prospective regulators do, liability is favored over regulation. Regulation without good

information is likely to be too lax or too strict, and courts are usually better able to determine the required level of care (and whether it was met) in a particular situation than regulators can do across all actual and possible situations. Resources for the Future Olmstead and Richardson 3

□ Ability to pay. If those responsible for harms can escape liability because they are unable to pay to remedy those harms, liability will give inadequate incentives to change behavior. □ Threat of suit. Similarly, if those responsible for harms can escape liability because they are never sued at all, liability once again will give inadequate incentives. The best and most relevant example is activity that creates widely dispersed harms. Victims may lack standing to sue, ability to organize a class action, or ability to connect the harm suffered to the party responsible, for example. □ Costs. Both liability and regulation have costs—litigation costs on the one hand, and administrative and enforcement costs on the other. Litigation costs can be very high but are only incurred in the case of harm, while regulation requires the ongoing “public expense of maintaining the regulatory establishment” and private compliance costs (Shavell 1984, 364). Shavell observes that in most real-world settings, a mix of liability and regulation is used. He argues that as a general rule, the choice between the two in a given area seems to reflect these criteria: society generally, if not always, gets the regulation/liability decision right.

2.2 Regulation versus Liability in Shale Development This is probably true in the oil and gas context as well. For most risks, private parties have better information than regulators, even sophisticated state-level agencies. This points in favor of a liability system, and, indeed, most operator decisions are made in the shadow of liability risk. But other factors point toward regulation. In many cases, operators have excellent information but potential victims do not, and it is hard for courts to determine if operators exercised due care. An important reason is the simple fact that activity occurs underground, where only equipment under the control of operators can observe it. Another challenge is that many operators are small independents whose resources may be inadequate to cover large damage awards. And the strongest factor in favor of regulating some oil and gas activities is that they may lead to significant but widely dispersed harms. Liability is likely to be an inefficient and impractical means of addressing, for example, fugitive methane emissions or contamination of rivers and streams with flowback fluids. This is of course not unique to oil and gas drilling—most environmental regulation can point to dispersed harms as its *raison d’être*, and in fact one way of describing the growth of environmental regulation is a response to an inability of the Resources for the Future Olmstead and Richardson 4 traditional liability system to address widespread environmental harms associated with industrial society. Whether regulation or liability is superior in cost terms for shale gas risks—or any others—is harder to determine. Shavell struggled somewhat to come up with general principles in his 1984 article, concluding that, on balance, liability is likely to be less costly. This may be true for many one-off, small scale events but is almost certainly not true when harms are dispersed because class actions are notoriously complex. Even allowing for class-action lawsuits, costs of a pure liability approach may be extremely high (Menell 1991). In fact, Shavell’s third criteria—threat of suit—could be viewed as a special case of his cost pillar. When potential plaintiffs find it difficult to sue, the cause is often the high cost of legal action in the face of collective action problems or procedural barriers that courts erect to protect against difficult-to-resolve suits. In other cases, inadequate threat of suit might arise from information asymmetries. If you don’t know who is polluting your water, you can’t sue. On the other hand,

where information is readily available to private parties and instances of harm are relatively rare compared to the level of activity, liability is likely to be much less costly than detailed regulation. Good examples are truck accidents and aboveground damage to landowners' property, both of which are generally handled by (or negotiated in the shadow of) the tort system. Therefore the intuition that the division of labor, as it were, between liability and regulation follows Shavell's principles seems to hold in the oil and gas context just as Shavell asserts it does generally. This is not to say that some activities currently regulated might not be better handled through liability, or that there is no need for additional regulation because the current liability system is adequate. Either claim requires far more evidence than the above anecdotal review could provide. Nor is it to say that this division of regulatory labor arose by design. In most cases, regulation is imposed when the liability system comes to be viewed as inadequately addressing a given risk (usually in circumstances poorly suited to liability under Shavell's criteria), not de novo creation of a new regulatory regime based on a theoretical framework. One of the liability system's great virtues is that it is the default—new activities and technologies are “regulated” by it even if they outpace top-down regulation. Resources for the Future Olmstead and Richardson 5

2.3 Policy Options for the Shale Liability System We therefore have a legal system for addressing risks of shale development in which regulation and liability operate in symbiotic parallel, addressing different risks and harms. And within this system, good principles exist for deciding whether a given activity is best left to be controlled by liability or regulated, though decisions in individual cases may be difficult. In broad terms, the current balance between liability and regulation appears to follow those principles. Therefore, rather than fueling already-contentious debates about whether additional regulation is needed, it is useful to discuss how the existing system for reducing risks can be made more efficient and effective. Policy options for improving regulation of shale development are widely discussed, but options for improving the liability system are relatively underexamined. Given the significance of liability in managing development risks and encouraging exercise of care by operators, this is unfortunate. This section explores some such options, organized broadly around Shavell's principles.

2.3.1 Information Asymmetry When private actors have better access to information than regulators, liability is more effective, all else equal (Shavell 1984). But information asymmetry between private parties can create problems—wrongdoers may escape liability because victims are not aware they have been injured, cannot determine who is responsible, or cannot acquire sufficient evidence to support their case. Even if this information can be obtained, doing so may be costly. As we already noted, this is particularly true for disparate harms, like air and surface water pollution. But even where harms are relatively localized, as in some cases of groundwater or soil contamination, information is often difficult to come by. Disclosure, burden shifting, and strict liability can improve the function of the liability system in situations of information asymmetry. Such situations are common in shale development, where levels of expertise between operators and potential victims (landowners and citizens) differ greatly. Beneficial changes in firms' behavior often emerge directly from disclosure (Bennear and Olmstead 2008). But disclosure also provides information to prospective plaintiffs in legal action. If groundwater is contaminated by specific compounds, for example, fracking fluid disclosure rules, requirements that firms report spills and other such accidents, and wastewater transportation

tracking and recordkeeping regulations can help victims identify and sue those responsible for environmental damage. Without such disclosure requirements, it might be difficult or impossible for such litigation to succeed. Civil discovery can help plaintiffs uncover information but can be costly for both sides. Another approach in cases of information asymmetry is to shift presumptions or burdens of proof in litigation. For example, most states require testing of water wells near drilling operations to identify groundwater contamination. In contrast, Pennsylvania does not require predrilling water well testing but instead shifts the burden of proof onto defendant operators if such testing is not done. Ordinarily, a plaintiff would have to show an operator caused the injury in question (here, groundwater contamination) to prevail in litigation. But in Pennsylvania, any contamination is presumed to have been caused by drilling unless the defendant operator can rebut this presumption with pre-drilling test evidence. In most cases, the operator will have better information than potential victims about groundwater quality and other geological and hydrological conditions. Placing the burden of proof on operators therefore likely reduces litigation-related costs and decreases the chance that a wrongdoer will escape liability because plaintiffs cannot establish causation. This may be one reason why energy developers in Pennsylvania typically engage in extensive pre-development groundwater testing at significant private cost (though these data are not publicly available, and post-development testing is only performed in the case of a complaint). Such burden-shifting approaches may be useful in other contexts in which litigation would be a better, cheaper alternative to regulation but for information asymmetries. Perhaps the most common approach to information asymmetry in litigation is the imposition of strict liability—that is, liability without regard to whether a defendant has exercised due care. Strict liability is traditionally applied to “ultra-hazardous” activities, on the basis that such activities carry a very high duty of care. In a few states, oil drilling has been classed as ultra-hazardous, but in others courts handle drilling under the general negligence standard. Contrary to the intuition of many, imposing strict liability theoretically should not result in operators taking additional care (Shavell 1980). But it does have one important advantage—it simplifies litigation. Plaintiffs may lack sufficient information to prove a defendant operator failed to exercise due care, but under strict liability they must only prove they were injured and that the defendant caused that injury. However, strict liability also affects activity levels: since those engaged in the activity are subject to greater liability, at the margin, some will simply choose not to engage in it (Shavell 1980). This may be a good thing if other factors, such as lack of information on the part of plaintiffs or the existence of judgment-proof defendants mean that Resources for the Future Olmstead and Richardson 7 activity levels are greater than socially optimal. But if these factors are not present, strict liability carries a hidden cost.

2.3.2 Ability to Pay Policymakers have long been aware of problems created by reliance on the liability system when potential damages exceed the ability of defendants to compensate victims. Oil and gas development is a classic example: damages from spills or contamination can be great, and many independent operators have limited resources. Traditional tools for addressing this problem are financial responsibility, insurance requirements, and bonding. Generally, when an operator applies for a permit to drill a well, it must show evidence of adequate financial resources or insurance to pay related claims. Operators also may be required to post a bond in

association with the permit. For example, Pennsylvania requires operators to file a bond of \$2,500 for each well permit. Operators in Pennsylvania and Colorado alternatively can file a “blanket bond” of \$25,000 covering all wells in the state. Texas requires a similar \$25,000 blanket bond for up to 10 wells. Bonding can reduce the ability of operators with limited resources to escape liability and therefore increase incentives to take due care to avoid harms—but only when funded appropriately. An amount of \$2,500 is certainly insufficient to cover the expected damages from a serious accident at a well, and since it is far less than any firm’s assets, likely provides no incentive to take additional care. A \$25,000 blanket bond is probably even less effective since large operators may have thousands of wells. Stronger financial responsibility requirements can improve the ability of the liability system to generate adequate incentives for operators.

2.3.3 Threat of Suit The primary reason operators might expect to escape suit for harms they cause, and therefore face inadequate incentives to reduce risks, is the disparate nature of many such harms, such as air and surface water pollution. This is the source of the appeal of much oil and gas regulation, and no policy can change the distributed nature of risks from the activity. Nevertheless, some policy changes can increase the effectiveness of the liability system. For example, the cost and complexity of pursuing class-action claims might be reduced for certain kinds of injury related to shale development.. As noted above, information disclosure rules are also useful in that they enable actual and potential victims to find out about harms, identify responsible parties, and establish causation in litigation. Resources for the Future Olmstead and Richardson 8

2.3.4 Costs Almost all of the tools and policy options discussed above for resolving information asymmetries, addressing inability to pay, and preventing operators from escaping liability also help reduce the costs of litigation. Information disclosure regulations lessen the need to rely on expensive discovery to acquire information. Burden shifting rules, in theory, put the burden of evidence gathering on the party able to meet it at least cost. Strict liability can greatly simplify cases by eliminating the need to prove duty of care and breach of that duty. Other measures to reduce cost include expediting litigation, most obviously by appointing (and funding) enough state and federal judges to manage current and future caseloads. In states and districts with large amounts of drilling activity and related litigation, specialist courts or dockets might also improve the ability of courts to efficiently handle such cases.

3. Prescriptive Administrative Regulation (of Shale Gas Development) Until the 1990s, the standard approach to environmental regulation was limited to policy instruments that economists call “command-and-control” or prescriptive approaches, which regulate behavior or performance of individual facilities. While there are many such approaches, they fall into two general classes: technology standards and performance standards. A technology standard requires firms to use a particular pollution abatement technology. For example, the 1977 Clean Air Act Amendments required new power plants to install large flue-gas desulfurization devices (“scrubbers”) to remove sulfur dioxide from stack gases. In the shale context, technology standards may require a particular type of cement in well casing. Other types of command-and-control regulations, such as setback requirements, are similarly uniform across firms, though they do not deal specifically with technology. A performance standard allows polluters more

freedom. Rather than requiring a specific number of feet of setback or a specific casing technology, for example, a performance standard might require that concentrations of specified pollutants in streams near drilling sites not exceed a certain level or that a pressure test on the cement casing not exceed a given reading. In theory, regulators can vary technology or performance standards across regulated firms, though in practice, they have tended to implement uniform standards. Command-and-control policy instruments are not all equal in economic terms. For example, performance standards are generally better than technology standards at minimizing the sum of emissions control costs and pollution damages (Besanko 1987; Benneer and Coglianese 2012). Some performance standards are better than others in effectiveness and cost-effectiveness Resources for the Future Olmstead and Richardson 9 terms (Helfand 1991). For reasons discussed in Section 4, however, economic theory strongly favors market-based over command-and-control policy instruments, even performance standards. A recent analysis suggests that 81 percent of observed shale gas regulations at the state level are prescriptive (Richardson et al. 2013, 14). Prescriptive approaches are common at the federal level, as well. For example, the Bureau of Land Management’s recent proposed rules for hydraulic fracturing on federal lands require operators to maintain specific types of logs and meet particular well construction standards. Of these prescriptive approaches, however, performance standards are practically nonexistent. Even when states do frame shale-related regulations as performance standards, they often appear to be unenforceable. In order to be effective, a performance standard must set a well-defined, measurable standard. For example, requiring firms to limit venting or flaring to circumstances where it is economically necessary or to avoid such practices when they create a risk to public health does not create an enforceable rule, though it might guide regulators’ case-by-case permitting decisions. Conversely, a performance standard that effectively precludes all but a single compliance mechanism is a performance standard in name only. The US Environmental Protection Agency (2012) established updated New Source Performance Standards in 2012 for oil and gas wells, though in practice these are structured so that a single technological approach, “green completion,” will be adequate to meet them. Setting these quasi-performance standards aside, out of 27 states surveyed by Nathan Richardson and colleagues (2013), only Alabama, Montana, Nebraska, and Texas use performance standards, and none of them uses a performance standard for more than one regulatory element in the survey. Since these standards are so rare, drawing conclusions about their rationale would be unwise. Another, even more flexible approach is case-by-case permitting, under which operators must submit a formal permit application that is subject to the regulator’s approval. Unlike performance standards, this form of regulation is widely used for shale gas development activities, accounting for 14 percent of regulations in the 27 states surveyed, and up to 20–25 percent of regulations in some individual states (Richardson et al. 2013). Case-by-case permitting allows both operators and regulators some discretion in the manner in which requirements are satisfied, but the level of performance is not uniformly specified across firms. One benefit of this approach is that operators and regulators can tailor their technologies and practices to local conditions and priorities. It has important drawbacks, however. It is administratively costly, since each permit must be independently reviewed. And it Resources for the Future Olmstead and Richardson 10 frequently lacks transparency because it is difficult for industry, much less the interested public, to know what practices and technologies are required.

4. Market-Based Administrative Regulation (of Shale Gas Development) In contrast to the prescriptive approaches described above, market-based policy instruments are decentralized, focusing on aggregate or market-level outcomes, such as total emissions, rather than the activities of individual facilities. A wide array of policy instruments falls within this category. Taxes, environmental markets (such as tradable pollution permit programs), and information disclosure policies are common examples. The principle that market-based instruments are more cost-effective than command-and-control policies in the short run is well-developed in economic theory (Crocker 1966; Baumol and Oates 1971; Bohm and Russell 1985; Tietenberg 1990; Hahn and Stavins 1992; Stavins 2003). Market-based tools have this advantage because they exploit cost differences across regulated firms. In the context of pollution control, the firms with the lowest abatement costs exercise the most control, and those with the highest costs control less, paying more for permits or higher tax bills. This short-run cost-effectiveness advantage tends to be emphasized in public policy debates, and it is a critical argument in favor of market-based instruments. However, the greatest potential cost savings from these types of environmental policies may be achieved in the long run, when firms' compliance technologies are not fixed. Because they require firms to pay to pollute, market-based tools provide strong incentives for regulated firms to invest in new technologies that reduce pollution abatement costs over time, either creating these innovative technologies themselves or adopting cheaper pollution control technologies developed by other firms (Downing and White 1986; Milliman and Prince 1989).

4.1 Environmental Taxes The classic economic prescription for the management of environmental market failures is to tax negative externalities and subsidize positive externalities, with the efficient tax, or subsidy, equal to the marginal damages, or benefits, at the efficient level of the externality (Pigou 1920; Baumol 1972; Sandmo 1975). To our knowledge, no taxes are being used to regulate negative impacts of shale gas development per se in the United States. But oil and gas production are subject to many local, state, and federal taxes that potentially could be used as tools to mitigate potential risks from shale gas development. Resources for the Future Olmstead and Richardson 11 A severance tax is one candidate. While pollution taxes tend to be charged on the flow of emissions from a particular source to air or water, severance taxes are typically charged on the quantity or market value of a nonrenewable natural resource stock removed from the environment. The severance tax is the most widely adopted state oil and gas tax (Chakravorty et al. 2011). Twenty-six out of 31 states reviewed by Richardson et al. (2013) currently have severance taxes on natural gas (see Figure 1). Figure 1. State Severance Taxes at \$5.40/Mcf Natural Gas Price Source: Richardson et al. (2013), 66, Map 21. State and local governments rely heavily on severance tax revenues to fund public goods (Kunce 2003). They may also be justified in theory as a way to capture the intertemporal external cost related to the depletion of a nonrenewable natural resource ("scarcity rent," in economic terms)—in the case of shale development, the fact that a unit of gas removed from shale today is Resources for the Future Olmstead and Richardson 12 not there to extract tomorrow. Private firms operating in competitive markets do internalize this cost as they make choices about how to allocate their extraction activities over time (Hotelling 1931). However, the public sector—as owner of subsurface minerals in some instances and as steward of such resources more generally—can capture and invest these rents to promote the

economically sustainable use of nonrenewable resources (Hartwick 1977; Solow 1992), remedy environmental harms (Gulley 1982), or simply provide ongoing income that might smooth the boom-and-bust cycle common to resource-based economies. In theory, the optimal severance tax also could account for negative gas production externalities to the extent that those externalities are related to the quantity or value of production from a given well. Methane emissions and emissions of local and regional air pollutants, such as nitrogen oxides (NO_x) and volatile organic compounds, are good examples. Unfortunately, severance taxes at current US levels appear to have little impact on producer behavior. Recent analyses refute older studies comparing state and federal oil and gas taxes in the 1990s that suggested the severance tax had relatively strong impacts on production in comparison to the federal corporate income tax or state property taxes on oil and gas reserves (Deacon 1993). The newer analyses account for tax interaction effects and other complicating factors and show that production is quite inelastic to even large changes in the severance tax, though they may have somewhat more impact on drilling activity than on production (Kunce 2003; Kunce et al. 2004; Chakravorty et al. 2011). A second challenge is that the most significant potential risks related to shale gas development are not necessarily linked to producing wells (Krupnick et al. 2013). In fact, once a shale gas well is in production, many risks from the development process are no longer relevant. Local air pollution and congestion from truck traffic are good examples; so are surface water risks from impoundments used for hydraulic fracturing. Other risks—such as habitat fragmentation from well pads or pipelines—can no longer be affected by a tax on production. Thus, a severance tax will not provide effective incentives on the margin for mitigation of these risks, though the revenues could be used for corrective action or public investments in risk reduction. In 2012, Pennsylvania chose a different option that may avoid these two challenges. The state implemented an impact fee on gas production from the Marcellus Shale, which counties or municipalities may vote to adopt. The fee is imposed on every producer in adopting localities and applies to all spudded unconventional gas wells. The amount of the fee depends on the average annual price of natural gas and is charged on a per-well basis, regardless of production. Resources for the Future Olmstead and Richardson 13 The constitutionality of this fee is currently under review before the Pennsylvania Supreme Court, but to the extent that there are fixed external costs to shale gas well development, the impact fee approach may be economically justifiable. Such a fee could vary spatially—for example, higher fees could be implemented in areas such as sensitive habitat that have higher anticipated social costs of well development. Fees also could increase over time as the land footprint of shale gas development consumes a greater fraction of formerly open space, increasing the marginal value of remaining open space.

4.2 Environmental Markets While environmental taxation had been proposed since the early part of the last century, the rise of environmental trading markets began later, when the Nobel Prize-winning economist Ronald Coase (1960) noted that the mere existence of externalities in a market could, under certain very restrictive conditions, induce private negotiation of efficient outcomes in cleaning up pollution. A key condition was well-defined property rights, which fostered the development of systems of marketable pollution permits, known as “cap-and-trade” systems, though there are other variations on the same theme (Dales 1968; Montgomery 1972). The conceptual framework of emissions trading programs is well described in the

literature (Tietenberg 2006). The regulator sets an aggregate cap on pollution and allocates or auctions the implied number of pollution permits to the regulated community. The pollution permits are transferable, and each firm will buy and sell permits based on a comparison of market permit prices with its own marginal abatement costs. When the permit market clears, each firm will have equated its own marginal pollution abatement cost with the prevailing permit price, resulting in equal marginal costs across firms and the least-cost allocation of control responsibility to meet the aggregate cap. No emissions trading programs have been established specifically to regulate risks from shale gas development, but current and future applications may be relevant, requiring or facilitating the participation of energy developers directly or indirectly. Shale gas operators and service companies are subject to Clean Air Act regulations for local and regional air pollutants, some of which have been implemented through tradable permit policies. For example, the 2003–2008 NO_x Budget Trading Program was designed to reduce aggregate NO_x emissions and their regional transport in the eastern United States, in an effort to increase regional compliance with federal ambient ozone standards. Marcellus shale development is expected to contribute 12 percent of regional NO_x and volatile organic compound emissions responsible for the formation of ground-level ozone by 2020 (Roy et al. 2012). If future trading programs were to emerge, sources in the shale gas production chain could be Resources for the Future Olmstead and Richardson 14 incorporated, even though prior policies focused on coal-fired power plants and other large industrial point sources. Given the significant concerns raised about methane emissions in the shale gas production chain (Allen et al. 2013), participation of shale gas operations in existing markets for greenhouse gas emissions would seem to be an obvious candidate for extending the advantages of market-based regulation to this new sphere. For example, one could imagine operators generating emissions credits from green well completions that could be used as offsets in existing markets (such as California’s new cap-and-trade program, or the European Union’s Emissions Trading System). If shale gas development is responsible for water pollution emissions in watersheds with water quality trading programs, operators may be affected by these programs. The Clean Water Act prevents shale gas operators from discharging effluent directly to rivers and streams, but water quality trading policies could be relevant to shale gas development in watersheds with Total Maximum Daily Loads (TMDLs) under the Clean Water Act that focus on contaminants such as sediment, dissolved solids, and chloride from both point and nonpoint sources. Links between shale gas development, sedimentation, and chloride in rivers and streams have been established in the literature (Olmstead et al. 2013), and flowback and produced water are high in dissolved solids. Together, these contaminants are the focus of 10–15 percent of TMDLs currently being implemented (US Environmental Protection Agency 2013). A handful of current water quality trading programs allow trading in sediment loads, but none focus on chloride or total dissolved solids (Fisher-Vanden and Olmstead 2013). However, use of these flexible policy instruments could reduce the cost of compliance with any new regulations addressing surface water pollution from shale gas development. Risks related to the quantity of water used in hydraulic fracturing are an additional concern and are another area where markets could help. These concerns are more relevant in arid regions than in those with more plentiful water supply (Nicot and Scanlon 2012). In some jurisdictions in the western United States, water users have the ability to lease and transfer water rights to other users. In theory, such markets can result in water moving to its highest-valued uses (Hartman and Seastone 1970;

Brewer et al. 2008). Because irrigation has traditionally dominated water consumption, especially in the West, farmers stand to benefit most from the ability to engage shale gas operators—who need reliable sources of water for hydraulic fracturing—in leases or sales. If withdrawals for energy development pose a risk to agriculture in arid states, water markets could help to mitigate that Resources for the Future Olmstead and Richardson 15 risk, compensating rights holders for any expected decreases in productivity. Water leases and transfers between irrigators and growing western cities (Brewer et al. 2008) may provide a template for such transactions with energy developers. A small number of documented trades already have taken place between agricultural users and energy developers in North Dakota; Colorado and Utah also have seen some participation of energy developers in water rights markets (Western Governors’ Association 2012). Trading is likely occurring on a much larger scale than what is implied by these documented instances, particularly in states such as Texas, where groundwater is private property. For water users, the decision to transfer water depends on the relative impacts of development, the value of agricultural production with less water, and the price that energy developers are willing to pay. While the seller of water benefits from trade, other water users, such as those who share infrastructure maintenance costs, may suffer unexpected consequences from water trading. Downstream junior rights holders who benefit from irrigation return flows may also experience damages if water used for hydraulic fracturing is not returned to rivers and streams, or if water quality is degraded. A careful examination of the distributional consequences of water markets as they relate to shale gas development is needed.

4.3 Information Disclosure Policies Information disclosure policies have been developed to inform consumers about the public and private benefits of their consumption activities, as well as to influence the behavior of polluting firms. Policies aimed at firms’ behavior are most relevant to the regulation of risks from shale gas development, though such policies also can indirectly influence consumers of goods and services produced by these firms. There is growing evidence for the effectiveness of such policies in changing firms’ behavior (Powers et al. 2011; Bennear and Coglianese 2005). An important example of this type of disclosure policy studied by many researchers is the requirement that manufacturing facilities publicly disclose toxic chemical releases under the US Toxics Release Inventory (TRI) program. Though releases have decreased dramatically since the TRI began, it has been difficult to determine whether the TRI is actually responsible for these decreases in toxic emissions because data are not available for releases before the program began or for unregulated facilities (Bennear and Coglianese 2005). Federal and state legislators have implemented information disclosure requirements in an effort to mitigate shale gas development risks. Since 2005, the injection of fracturing fluids other than diesel fuel has been exempt from the disclosure requirements of the Safe Drinking Water Resources for the Future Olmstead and Richardson 16 Act, the federal statute that typically addresses risks to drinking water supplies from deep underground injection. However, the Bureau of Land Management draft rules for hydraulic fracturing operations on public lands, issued in May 2012, include a fracking fluid disclosure requirement, and fifteen states currently require disclosure of this kind (Richardson et al. 2013). Unfortunately, as with the TRI, no data are available on the contents of fracturing fluids before these state and federal policies came into force, and because all hydraulic fracturing operations tend to be covered by these rules, no

data are available on fluids used by firms that do not disclose their contents. Thus, it will be difficult to gauge the impact of disclosure on operators' behavior. A potential method is to exploit the variation in timing of the adoption of disclosure rules by states, controlling carefully for other differences across states (perhaps looking at wells in the same shale play, but within states with different disclosure rules). One possibility is that disclosure results in public attention to operators using toxic chemicals, creating pressure for behavioral change from consumers or shareholders. Such impacts have been measured empirically for the TRI, which is available online (www.scorecard.org) in an easy-to-interpret format. FracFocus has emerged to play a similar role for fracking fluid disclosure requirements, and its website (www.fracfocus.org) allows users to obtain PDFs of fracking fluid chemical lists by well. Since disclosure through FracFocus has occurred for some locations since 2011, an empirical assessment of its effects on shareholder or consumer behavior may now be feasible. Similarly, researchers could compare practices on federal land (under the proposed Bureau of Land Management disclosure rule) to those on nearby private land where disclosure is not required.

Mitigation

Mitigation is consistently defined in nearly every document about climate change policy and by nearly every organization that works in climate change policy. These documents and organizations define mitigation measures as policies that either curtail GHG emissions or enhance GHG sinks. This evidence also provides a definitional response to effects topical affirmatives.

Boucher Laboratoire de Météorologie Dynamique, IPSL/CNRS, Université P. et M. Curie, Paris, **et al 2014** Oliver “Rethinking climate engineering categorization in the context of climate change mitigation and adaptation” Wiley Interdisciplinary Reviews: Climate Change 5.1 Wiley Online

Mitigation is defined by the Intergovernmental Panel on Climate Change (IPCC) Fourth assessment report's glossary[16] as ‘technological change and substitution that reduce resource inputs and emissions per unit of output’. It further specifies that ‘although several social, economic, and technological policies would produce an emission reduction, with respect to climate change, mitigation means implementing policies to reduce greenhouse gas emissions and enhance sinks’. This definition is consistent with that from the IPCC Third assessment report[17] and implies that methods aiming at reducing natural sources or enhancing natural sinks of CO₂ and other greenhouse gases do qualify as mitigation policies. This definition is also consistent with the United Nations Framework Convention on Climate Change[18] (UNFCCC) which stipulates in its Article 4 that Parties ‘shall adopt national policies and take corresponding measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases and protecting and enhancing its greenhouse gas sinks and reservoirs’.

Mitigation offers the affirmative a wide range of mechanisms – includes carbon tax, cap and trade and CO₂ absorption strategies.

Perrings Professor of Environmental Economics and Environmental Management at the University of York **2003** Charles “The Economics of Abrupt Climate Change” Philosophical Transactions: Mathematical, Physical and Engineering Sciences 361.1810 jstor

No country will undertake mitigation actions unless it is believed that those actions will affect the probability of climate change. That is, mitigation presupposes that anthropogenic emissions of GHGs are a significant part of the explanation for abrupt climate change, and that reducing the concentration of GHGs will affect the likelihood of such change taking place. Mitigation includes any actions to reduce emissions of CO₂ (and other GHGs), or to increase carbon sequestration. Examples include carbon and other energy taxes, energy policies to reduce dependence on fossil fuels, multilateral environmental agreements to reduce emissions (FCCC, Kyoto), and actions to increase absorption of CO₂ (afforestation). They also include policies that reduce the cost of mitigation (the Kyoto mechanisms: carbon trading, Joint Implementation, the Clean Development Mechanism and the European Bubble).

Mitigation is limited to anthropogenic impacts on climate change

European Climate Adaptation Platform No date “Glossary” <http://climate-adapt.eea.europa.eu/glossary>

Mitigation

An anthropogenic intervention to reduce the anthropogenic forcing of the climate system; it includes strategies and measures to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks. Examples of mitigation measures are renewable energy technologies, waste minimization processes and public transport commuting practices, etc.

Penalties

Penalty implies the concept of punishment

West's Encyclopedia of American Law 2nd edition **2008** <http://legal-dictionary.thefreedictionary.com/penalty>

Penalty is a comprehensive term with many different meanings. It entails the concept of punishment—either corporal or pecuniary, civil or criminal—although its meaning is usually confined to pecuniary punishment. The law can impose a penalty, and a private contract can provide for its assessment. Pecuniary penalties are frequently negotiated in construction contracts, in the event that the project is not completed by the specified date.

Penalties increase cost of activities through charges, taxes or liability. Penalties can be levied on the pollution, the feedstock or the final product

Salzman Professor of Law and Nicholas Institute Professor of Environmental Policy @ Duke **2013** James “Teaching Policy Instrument Choice in Environmental Law: The Five P’s” Duke Environmental Law & Public Forum <http://scholarship.law.duke.edu/cgi/viewcontent.cgi?article=1250&context=delpf>

Short of banning an activity, the next most effective way to limit the behavior is to make it more expensive, whether through charges, taxes, or liability. By increasing the costs of polluting activities, such penalties discourage pollution and waste and force the polluter to bear the costs of her activities. To use economics language, the polluter internalizes the negative externalities of her behavior. Also known as a Pigouvian tax, this policy instrument ensures that each actor has a direct incentive to regulate her own behavior according to how valuable the polluting activities are.¹⁸ In our commons example, shepherds might be charged a fee per sheep for the right to graze each day. The fee could be shifted up or down, depending on the desired level of grazing. Carbon taxes, much discussed in the press at the moment, are a topical example of this approach.

In theory, financial penalties offer an attractive policy instrument. One could levy the penalty on pollution (whether kilos of emissions or solid waste), on the feedstock (for example, a carbon tax on oil or coal), or on the final product (for example, a gas-guzzling car), but there are two practical obstacles. The first lies in getting the price right. Markets are efficient when the prices for goods accurately reflect their full environmental and social cost. A key aspect in internalizing externalities, then, is valuation. If one agrees that externalities should be internalized—that polluters should pay—the obvious question is “how much”? For example, we might all agree that CFC emissions harm the ozone layer, but how much monetary harm is caused by releasing a kilogram of CFCs? One dollar? One penny? One-hundredth of a penny? Because there is no market for the ozone layer, these values can only be estimated. Or perhaps it may be sufficient to focus, instead, on the level of penalty that changes behavior.

Financial penalties include taxes

Segerson Department of Economics University of Connecticut & **Walker** Oceans Studies Board The National Academies **2002** Kathleen & Dan “Nutrient Pollution An Economic Perspective” Estuaries Springer Link

Empirical evidence suggests that voluntary approaches can be effective if there is sufficient inducement for polluters to participate. There are a number of reasons why a polluter might participate in a voluntary program or voluntarily undertake abatement (Segerson and Miceli 1998; Segerson and Li 1999; Lyon and Maxwell 2002), including a strong commitment to environmental improvement or stewardship; a personal benefit (e.g., when the polluter is also a user of a polluted resource, such as ground water); a perceived payoff in the marketplace (e.g., when a firm feels it will benefit directly or indirectly from having a green image or marketing a green product); a sufficiently large financial inducement or subsidy, and fear that failure to participate will lead to more

stringent mandatory controls in the future. Managers can increase the likelihood of participation by affecting one or more of these motivating factors. Through information or moral persuasion, managers can try to increase the public's environmental stewardship and recognition of the benefits of pollution abatement. Managers can also design financial incentives to encourage participation, or make implicit or explicit threats that, if the voluntary approach is unsuccessful, regulation and/ or financial penalties (such as taxes) would be imposed. Such threats are likely to be more effective when small numbers of polluters are involved, so that there is a more direct link between the individual polluter's actions and the likelihood that the voluntary approach will be successful. If the regulatory threat applies to an entire industry, there is the potential that some firms may avoid taking voluntary action in the hope that others will take action and thereby forestall the imposition of the more costly regulation or tax (Li and Segerson 9000). This free-rider problem may be more pronounced among small and medium-sized enterprises, who might not view their individual pollution contributions as pivotal. While small and medium-sized enterprises are individually insignificant contributors, in the aggregate (e.g., across a drainage basin), they might constitute a significant share of the nutrient load.

Distinct from incentives

Segerson Department of Economics University of Connecticut & **Walker** Oceans Studies Board The National Academies **2002** Kathleen & Dan “Nutrient Pollution An Economic Perspective” Estuaries Springer Link

Economic analysis can also contribute to the debate over how to achieve desired water quality goals. In designing policies to achieve these reductions a fundamental choice must be made between the use of a voluntary approach and the use of mandatory controls or financial penalties. In many instances managers may find that a well-formulated mix of incentives (voluntary approaches) and disincentives (mandatory or punitive approaches) works better than either approach would work alone. In evaluating alternative approaches, a key criterion is cost-effectiveness. Ensuring that policies are cost-effective (i.e., that they achieve water quality goals at the lowest possible cost) ensures that society does not give up more than is necessary to achieve these goals. To the extent that it reduces the burden on industry, cost effectiveness can protect jobs, increase production, and reduce the costs of consumer products, which can in turn increase the political acceptance of the policy.

Penalties on emissions includes taxes

Benjaafar & Chen Department of Industrial and Systems Engineering University of Minnesota **2014** Saif & Xi “On the Effectiveness of Emission Penalties in Decentralized Supply Chains” http://www.isye.umn.edu/faculty/pdf/Saif_ISyE_updated_papers_9_14/bech-08-25-2014.pdf

Imposing penalties on emissions is also a mechanism that an increasing number of firms have adopted voluntarily in their efforts to mitigate their emissions. For example, several firms have committed to becoming carbon-neutral through the purchase of carbon offsets (a carbon-neutral firm is one that is credited with reducing global emissions by an amount equal to the one it produces). In order to pay for these offsets, some firms, such as Microsoft and Disney, are imposing internal taxes on their business units for the carbon emissions for which these business units are directly responsible; see DiCaprio (2013) and Davenport (2013). Other firms are putting a price on emissions in evaluating the attractiveness of new investments or to justify investments in conservation projects or renewable energy. A recent report by CDP found at least 30 companies, ranging from utilities, such as Xcel Energy, to energy companies, such as Exxon, and retailers, such as Walmart, setting an internal price ranging from \$6 to \$60 per metric ton on their carbon pollution (see CDP (2013a)). Firms that are water-intensive, such as Coca Cola, are putting a price on water that is substantially higher than the prevailing price (see Fellow (2013)).

Penalty is a combination of pricing and regulatory measures

Herzog & Katzer M.I.T. Laboratory for Energy and the Environment **2006** Howard & James “The Future of Coal in a Greenhouse Gas Constrained World” presented at the 8th International Conference on Greenhouse Gas Control Technologies http://e40-hjh-server1.mit.edu/pdf/GHGT8_Herzog_Katzer.pdf

To explore the potential effects of carbon policy, three cases are formulated: a reference or Business as Usual (BAU) **Case** with no emissions policy beyond the first Kyoto period, and two cases involving the imposition of a common global price on CO₂ emissions. The two policy cases, a Low and a High CO₂ price path, with the CO₂ penalty stated in terms of 1997 \$US per ton of CO₂. This penalty or emissions price can be thought of as the result of a global cap-and-trade regime, a system of harmonized carbon taxes, or even a combination of price and regulatory measures that combine to impose the marginal penalties on emissions. The Low CO₂ Price profile corresponds to the proposal of the National Commission on Energy Policy [1] which we represent by applying its maximum or “safety valve” cap-and-trade price. It involves a penalty that begins in 2010 with \$7 per ton CO₂ and increases at a rate of 5% per year thereafter. The High CO₂ Price case assumes the imposition of a larger initial charge of \$25 ton CO₂ in the year 2015 with a rate of increase of 4% thereafter.

Private Sector

Private sector means outside governmental control

Dictionary.com

["private sector", Dictionary.com, <http://www.dictionary.com/browse/private-sector?s=t>, accessed 6-10-16, AFB]

noun 1. **the area of the nation's economy under private rather than governmental control.**

Private sector is for-profit businesses

Investopedia

[Private Sector Definition | Investopedia, www.investopedia.com/terms/p/private-sector.asp, accessed 6-10-16, AFB]

What is the 'Private Sector'

The private sector encompasses all for-profit businesses that are not owned or operated by the government. Companies and corporations that are government run are part of what is known as the public sector, while charities and other nonprofit organizations are part of the voluntary sector.

The Bureau of Labor Statistics tracks and reports both private and public unemployment rates for the United States.

Private sector includes personal sector

BusinessDictionary.com

["private sector", BusinessDictionary.com, <http://www.businessdictionary.com/definition/private-sector.html>, accessed 6-10-16, AFB]

The part of national economy made up of private enterprises. It includes the personal sector (households) and corporate sector (companies), and is responsible for allocating most of the resources within an economy. See also public sector.

Regulations

Regulations can be targeted to reduce emissions

EPA, 16 [2-23-16, “Evaluating Climate Policy Options, Costs and Benefits”,
<https://www3.epa.gov/climatechange/EPAactivities/economics.html>, accessed 6-11-16, AFB]

EPA analyzes the anticipated economic effects of proposed standards and policies to reduce greenhouse gas emissions. These analyses have shown that there are a variety of cost-effective policies available to reduce greenhouse gas emissions. Policy options range from comprehensive market-based legislation to **targeted regulations to reduce emissions** and improve the efficiency of vehicles, power plants and large industrial sources. Underlying these analyses are economic models and detailed studies of technologies to reduce emissions.

EPA, 5-16

[“EPA’s Actions to Reduce Methane Emissions from the Oil and Natural Gas Industry: Draft Information Collection Request for Existing Sources”,
<https://www3.epa.gov/airquality/oilandgas/may2016/icr-fs.pdf>, accessed 6-11-16, AFB]

On May 12, 2016, the U.S. Environmental Protection Agency (EPA) issued a draft Information Collection Request (ICR) to require oil and natural gas companies to provide extensive information needed to develop **regulations to reduce methane emissions** from existing oil and gas sources. In addition, the agency announced plans to issue a Request for Information to seek information on innovative strategies that can accurately and cost-effectively locate, measure and mitigate methane emissions. The draft ICR is a critical step toward meeting the Obama Administration’s commitment to **reduce emissions** from existing oil and gas sources, as part of the President’s Climate Action Plan: Strategy to Reduce Methane Emissions. Also as part of the Strategy, EPA has issued final New Source Performance Standards (NSPS) to reduce methane and smog-forming volatile organic compounds from new, modified and reconstructed sources in the oil and gas industry. EPA announced its plans to issue the ICR on March 10, 2016, as part of a joint commitment between the U.S. and Canadian governments to take new actions to reduce methane pollution from the oil and gas sector, including developing regulations to reduce methane emissions from existing sources. The ICR is the first step in that process; the information that companies will be required to collect and report to EPA will provide the foundation necessary for developing comprehensive **regulations to reduce emissions** from existing sources in the large and complex oil and gas industry.

EPA issues regulations to reduce emissions

EPA

<https://www3.epa.gov/airquality/oilandgas/actions.html>, accessed 6-11-16, AFB]

EPA Issues Final Air Rules for the Oil and Natural Gas Industry On April 17, 2012, the U.S. Environmental Protection Agency (EPA) issued cost-effective **regulations**, required by the Clean Air Act, to **reduce harmful air pollution** from the oil and natural gas industry while allowing continued, responsible growth in U.S. oil and natural gas production. The final rules include the first federal air standards for natural gas wells that are

hydraulically fractured, along with requirements for several other sources of pollution in the oil and gas industry that currently are not regulated at the federal level. Based on public comment, EPA made a number of changes to the proposed rules to increase compliance flexibility while maintaining comparable environmental benefits, streamline notification, recordkeeping and reporting requirements, and strengthen accountability.

Regulations to reduce emissions California EPA Air Resources Board, 8

[4-15-8, “Adoption of Proposed Regulations to Reduce Emissions from Diesel Engines”, accessed 6-11-16, AFB]

Adoption of Proposed Regulations to Reduce Emissions from Diesel Engines This page last reviewed April 15, 2008 **RULEMAKING TO CONSIDER THE ADOPTION OF PROPOSED REGULATIONS TO REDUCE EMISSIONS FROM DIESEL ENGINES ON COMMERCIAL HARBOR CRAFT OPERATED WITHIN CALIFORNIA WATERS AND 24 NAUTICAL MILES OF THE CALIFORNIA BASELINE**

Increasing regulations to reduce emissions – in lit for both sides Appleby, Investment Manager, 15

[Mike, 11-6-15, Alliance Trust Investments, “Tightening regulations to reduce emissions. Who wins?”, <http://www.alliancetrustinvestments.com/sri-hub/posts/2015/November/Tightening-regulations-to-reduce-emissions>, accessed 6-11-16, AFB]

The earth’s climate is changing because of human activity. This will have negative impacts on our economy and the certainty of this is getting stronger¹. The international response to combat the increasing average global temperatures appears to be gaining momentum. Significant progress is being made in the run up to change negotiations in Paris in November 2015². The two largest emitters; the US and China have set more stretching targets, which is an important step forward. The US has set a target of reducing Green House Gas (GHG) Emissions from 26-28% by 2025, versus 2005 levels. This is effectively a doubling of their existing policies. China are aiming to reduce GHG intensity³ 60-65% by 2030 versus 2005 levels. The globally agreed goal is to limit the global average temperature rise to two degrees centigrade⁴. This rise is estimated to have a relatively benign impact on our ability to develop. So what? We think this does have implications for investments. There are some obvious potential losers from these regulations (carbon intensive businesses) and some potential winners (low carbon alternatives and technologies that can be used to reduce our GHG emissions). This trend of increasing regulation to reduce GHG emissions is not new, we have been working on this theme since our funds were launched back in 2002. Identifying potential winners and losers from a given trend is not in itself a reason to own a stock – but it is an important element. We also want companies that have good business fundamentals which mean they can be profitable; as well as undemanding valuations. It is when the sustainability (growth), business fundamentals (profitability) and valuation are all favourable, that we believe investments are most likely to generate the best investment returns. We highlight five companies that we think are well placed to benefit from regulation to reduce Green House Gas (GHG) emissions. These companies are all beneficiaries of our Climate Change and Energy Efficiency investment theme. Kingspan Group PLC (A2*) Kingspan generates approximately 80% of its sales from insulation products and the rest from renewables and other building products. Insulation of buildings is one of the most cost effective energy efficiency strategies and is seeing strong take up, in part driven by increasingly stringent building standards worldwide. Kingspan has succeeded because of its investment in innovation and design, which has allowed them to grow strongly while helping their clients attain ‘outstanding’ BREEAM ratings (BREEAM, BRE Environmental Assessment Method, is the world’s foremost environmental assessment method and rating systems for buildings). Energy efficiency is an important way of reducing GHG emissions by reducing

how much energy is wasted in heating buildings. Sunpower Corp (A2*) Sunpower Corp is a photovoltaic solar module manufacturer, installer and operator of solar energy projects. The company is listed in the US and has one of the most efficient solar modules which improves the amount of power generated and the investment returns. This gives them a competitive advantage over less efficient conversion rates from their competitors. The cost of solar modules has dropped dramatically and the economics of solar power have started to look very compelling. In many areas we are close to solar being competitive with little or no subsidies. Solar power is an obvious beneficiary of regulation to reduce how much carbon dioxide is emitted in generating electricity, as it emits far lower GHG as compared to generating power from fossil fuels. Gamesa Corp Tecnologica (A2*) Gamesa is a Spanish company that manufactures wind turbines for generating electricity as well as developing wind farms. They are an obvious winner of any attempt to reduce the carbon intensity of power generation, as their product produces electricity with significantly lower emissions than conventional fossil fuel power. We like their exposure to power markets that are growing and have good renewable (wind) resources such as Brasil, India and China. Daikin Industries (C2*) Daikin Industries is a Japanese company that is the world largest producer of air conditioners. Air conditioning does contribute to environmental damage (from GHG emissions in their operation) and damage to the ozone layer from refrigerant chemicals. Daikin's products are all geared towards reducing overall energy consumption in a meaningful way, and their chemicals division produces chemical products which reduce the damage to the ozone layer, caused by chemicals used in air conditioners. We believe being the most efficient and proactively managed air conditioning company gives Daikin a significant competitive advantage. Their products will appeal to customers wishing to reduce the electricity bills for cooling buildings as well as the associated emissions, which in turn drives demand for their business. Enel Green Power (A3*) Enel Green Power is an Italian listed company involved in the development and operation of generating electricity from renewable sources. They generate electricity from a variety of renewable resources including wind, hydro, geothermal, biomass and solar. The company is an obvious beneficiary of regulation to reduce how much carbon dioxide is emitted in generating electricity, as it emits far lower GHG from its renewable assets as compared to fossil fuels which are more carbon intensive. * Our comprehensive 'Sustainability Matrix' helps us to pinpoint how well a company responds to our sustainability criteria.

Taxation is regulatory

Avi-Yonah, University of Michigan Irwin I. Cohn Professor of Law and director of the International Tax LLM Program, specializes in corporate and international taxation, 11

[Reuven S., Accounting, Economics, and Law: Vol. 1: Iss. 1, Article 6., "Taxation as Regulation: Carbon Tax, Health Care Tax, Bank Tax and Other Regulatory Taxes", <http://repository.law.umich.edu/cgi/viewcontent.cgi?article=2643&context=articles>, p. 2-3, accessed 6-11-16, AFB]

But taxation has a third goal, which has not been noticed as widely: a regulatory goal. In most developed countries governments use the tax system to change the behavior of actors in the private sector, by incentivizing (subsidizing) activities they wish to promote and by disincentivizing (penalizing) activities they wish to discourage. This is the point of the second quotation above. This regulatory function of the tax system is quite well established. Indeed, it can be argued that some types of taxes, such as Pigouvian taxes (designed to deter certain activities by forcing private actors to internalize their social costs), are entirely regulatory in nature. In other cases, such as the corporate income tax, much of the complexity of the current tax structure stems from the government's attempting to use it to achieve regulatory aims. If the US income tax was purely a revenue raising and redistributive tax, most of the complexity of the current tax code could be eliminated.

Carbon taxation is regulation

Avi-Yonah, University of Michigan Irwin I. Cohn Professor of Law and director of the International Tax LLM Program, specializes in corporate and international taxation, 11

[Reuven S., Accounting, Economics, and Law: Vol. 1: Iss. 1, Article 6., "Taxation as Regulation: Carbon Tax, Health Care Tax, Bank Tax and Other Regulatory Taxes", <http://repository.law.umich.edu/cgi/viewcontent.cgi?article=2643&context=articles>, p. 2-3, accessed 6-11-16, AFB]

This essay will argue that in some cases regulation is a legitimate goal of taxation. In general, the choice between taxation and other forms of regulation, such as command and control regulation or direct subsidies, depends on the particular policy context. In some instances, taxation is the most effective way to achieve a specific regulatory goal. A good example of this is combating global climate change. There are three broad methods that have been advanced for government to reduce greenhouse gas emissions: Command and control regulation, cap and trade, and carbon taxes. Of these, there is a broad consensus among commentators that carbon taxes are the most effective.⁷

Command and control regulation of greenhouse gas emissions has generally been rejected because of a wide consensus that the government does not have the necessary information to ensure that the emissions targets are distributed most effectively among private market actors. The solution to the climate change problem depends on technological innovation in the private sector, and governments are ill-suited to picking winners to develop such technologies. In addition, existing command and control regimes are sector specific while the climate change problem applies to the entire economy. This leaves cap and trade and carbon taxes as the two leading marketbased solutions. However, a carbon tax is much simpler than cap and trade. A tax is imposed at \$x per ton of carbon content on the main sources of carbon dioxide emissions in the economy, namely coal, oil, and natural gas. The tax is imposed "upstream," i.e., at the point of extraction or importation, which means that it can be imposed on only 2,000 taxpayers (500 coal miners and importers, 750 oil producers and importers, and 750 natural gas producers and importers). Credits can be given to carbon sequestration projects and to other projects that reduce greenhouse gas emissions, and exports are exempted. Cap and trade, on the other hand, is inherently more complicated. While the cap can also be imposed "upstream", it has several features that require complexity. First, the proposal needs to determine how allowances will be created and distributed, either for free or by auction. Free distribution requires deciding which industries receive allowances, while an auction requires a complex monitoring system to prevent cheating. Second, the trading in allowances needs to be set up and monitored: a system needs to be devised to prevent the same allowance from being used twice, and penalties need to be established for polluters who exceed their allowances. Third, if allowances are to be traded with other countries, the international trading of allowances would need to be monitored as well. Fourth, to prevent cost uncertainty, cap and trade proposals typically have complex provisions for banking and borrowing allowances, and some of them provide for safety valves. Fifth, offsets are needed for carbon sequestration and similar projects, and those are more complicated than credits against a carbon tax liability. Finally, most cap and trade proposals involve provisions for coordinating with the cap and trade policies of other countries, and for punishing countries that do not have a greenhouse gas emission reduction policy. In addition to its inherent complexity, cap and trade is also more difficult to enforce. An elaborate mechanism needs to be set up to distribute and collect allowances and to ensure that allowances are real (a difficult task, especially if allowances from non-United States programs are permitted) and that polluters are penalized if they emit greenhouse gases without an allowance. A new administrative body needs to be set up for this purpose, or at least a new office within EPA, and new employees with the relevant expertise need to be hired. A carbon tax, on the other hand, can be enforced by the IRS with its existing staff, which has the relevant expertise in enforcing other excise taxes. Cap and trade also raises collateral issues that are not present in a carbon tax, such as the need for the SEC to enforce rules regarding futures trading in allowances. A good example is the tax implications of both policies. A carbon tax, as a federal tax, has no tax implications: it is simply collected and is not deductible. Allowances under cap and trade, on the other hand, raise a multitude of tax issues: What are the tax implications of distributing allowances for free? What are the tax implications of trading in allowances? Should allowance exchanges be permitted to avoid the tax on selling allowances? What amount of the purchase price of a business should be allocated to its allowances? If borrowing and banking occur, what are the tax consequences? Can allowances be amortized? None of these issues arise under a carbon tax. It can in fact be argued that the tax implications of cap and trade are inconsistent with the basic premise of the system. The theory behind cap and trade posits that permits to emit CO₂ will be traded freely among private market participants, so that they end up distributed in the most efficient way (i.e., in the hands of companies whose costs of abating emissions are the highest). This is consistent with the Coase Theorem because in the absence of transaction costs the initial allocation of permits does not matter. However, there are likely to be significant transaction costs, including the application of the

corporate tax. Under current tax rules companies are likely to face a tax burden when they (a) receive permits, (b) sell permits, (c) borrow permits, (d) bank permits, and (e) when a business that has permits is bought or sold. These barriers mean that the Coase Theorem does not apply and the initial allocation matters.⁸ This problem can be mitigated by changing the Code to provide for tax-free trading in permits, but other tax-related transaction costs are likely to persist in any cap and trade regime. Therefore, a carbon tax emerges as the superior price mechanism to restrict carbon emissions. This example illustrates that at least in one important policy context, taxation is not just an acceptable vehicle for regulation, but the regulatory technique that is preferred by most commentators (even though it may be less realistic politically). Another example of a preference for taxation is Pigouvian taxes on items like tobacco and alcohol, which are designed to reduce behavior that has important negative externalities. The experience with Prohibition has clearly demonstrated that taxation is superior to direct regulation in reducing alcohol consumption, and taxation of cigarettes has been the most effective technique in reducing smoking. These taxes are relatively marginal in the tax systems of developed economies. But it is also clear that developed countries also use their main taxes, which are the individual and corporate income taxes and the VAT, to achieve regulatory goals. Given that regulation via taxation is legitimate in some cases, the next section will address which of these taxes is best suited to achieve regulatory goals.

RPS = regulation

National Renewable Energy Laboratory, 15

[7-6-15, “Renewable Portfolio Standards”,
http://www.nrel.gov/tech_deployment/state_local_governments/basics_portfolio_standards.html, accessed 6-11-16, AFB]

A renewable portfolio standard (RPS) is a regulatory mandate to increase production of energy from renewable sources such as wind, solar, biomass and other alternatives to fossil and nuclear electric generation. It's also known as a renewable electricity standard.

Cap & Trade = regulation

California EPA Air Resources Board, 16

[7-10-16, <http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm>, accessed 6-11-16, AFB]

Cap-and-trade is a market based regulation that is designed to reduce greenhouse gases (GHGs) from multiple sources. Cap-and-trade sets a firm limit or cap on GHGs and minimize the compliance costs of achieving AB 32 goals. The cap will decline approximately 3 percent each year beginning in 2013. Trading creates incentives to reduce GHGs below allowable levels through investments in clean technologies. With a carbon market, a price on carbon is established for GHGs. Market forces spur technological innovation and investments in clean energy. Cap-and-trade is an environmentally effective and economically efficient response to climate change.

Renewable Energy

The U.S. Energy Information Administration outlines 5 major types of renewable energy sources:

U.S. Energy Information Administration, 6-27-2019, "Renewable Energy Sources," U.S. Department of Energy,
https://www.eia.gov/energyexplained/index.php?page=renewable_home//IC

What is renewable energy? Renewable energy is energy from sources that are naturally replenishing but flow-limited; renewable resources are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. The major types of renewable energy sources are Biomass Wood and wood waste Municipal solid waste Landfill gas and biogas Ethanol Biodiesel Hydropower Geothermal Wind Solar

In addition to those outlined by the EIA, ocean and hydrogen energy are typically recognized.

SunPower, ND, "A Complete Guide to 7 Renewable Energy Sources," SunPower - United States, <https://us.sunpower.com/complete-guide-7-renewable-energy-sources//IC>

A Complete Guide to 7 Renewable Energy Sources What is Renewable Energy and How Does It Work? Have you been wondering what “renewable energy” really means? Renewable energy sources are literally found in sunlight, in the air, deep underground and in our oceans. They are part of the planet’s physical structure, which means they are constantly being renewed by natural means. They simply cannot run out. These sustainable energy sources are often called “alternative energy” because they’re considered to be an alternative to traditional fossil fuels such as oil and coal. Just because an energy source is renewable doesn’t mean it’s 100 percent environmentally safe. For instance, dams harness the power of moving water, but they can also harm fish and wildlife. Wind turbines use the sun’s energy to generate clean electricity, but there are environmental impacts from the manufacturing process. All told, though, alternative energy resources pack a much lighter environmental footprint than fossil fuels. This is why renewable energy sources are so important – they are our ticket to a less polluted world. Even if we did not face the threat of climate change, minimizing pollution is basic for good health. And what’s good for the environment is increasingly good economically for homeowners and businesses. Solar and wind power in particular are now less expensive than fossil fuels in many parts of the world, and the price keeps decreasing annually. (Learn

all about going solar in our Solar Resource Center.) So how does renewable energy work? [Here’s a look at seven clean energy sources that can be tapped directly or indirectly to help our world go green and fight global](#)

[warming.](#) Aside from geothermal and hydrogen, the sun plays a significant role in each of these types of renewable energy. Green and Clean: Sustainable Energy Sources Five types of alternative energy are generated by harnessing a natural process, like sunlight or waves. They are generally the most sustainable forms of energy. [Solar Energy](#) Sunlight is a renewable resource, and its most direct use is achieved by capturing the sun’s energy. A variety of solar energy technologies are used to convert the sun’s energy and light into heat: illumination, hot water, electricity and (paradoxically) cooling systems for businesses and industry. Photovoltaic (PV) systems use solar cells to convert sunlight into electricity. Solar hot water systems can be used to heat buildings by circulating water through flat-plate solar collectors. Mirrored dishes that are focused to boil water in a conventional steam generator can produce electricity by concentrating the sun’s heat. Commercial and industrial buildings can also leverage the sun’s energy for larger scale needs such as ventilation, heating and cooling. Finally, thoughtful architectural designs can passively take advantage of the sun as a source of light for heating and cooling. Homeowners, businesses and government entities can take advantage of the benefits of solar power in many ways: Install a home solar system or commercial solar panels; construct or retrofit a building to incorporate solar hot water, cooling or ventilation systems; design from scratch structures that take advantage of the sun’s natural attributes for passive heating and lighting. [Capturing the](#)

[Wind](#) Wind can be considered a form of solar energy because the uneven heating and cooling of the atmosphere cause winds (as well as the rotation of the earth and other topographical factors). Wind flow can be captured by wind turbines and converted into electricity. On a smaller scale, windmills are still used today to pump water on farms. Commercial grade wind-powered generating systems are available to meet the renewable energy needs of many organizations. Single-wind turbines can generate electricity to supplement an existing electrical supply. When the wind blows, power generated by the system goes to offset the need for utility supplied electricity. Utility-scale wind farms generate electricity that can be purchased on the wholesale power market, either contractually or through a competitive bid process. Learn more about wind power here.

[Geothermal: Power from the Earth](#) Geothermal energy is derived from the heat of the earth. This heat can be sourced close to the surface or from heated rock and reservoirs of hot water miles beneath our feet. Geothermal power plants harness these heat sources to generate electricity. On a much smaller scale, a geothermal heat pump system can leverage the constant temperature of the ground found just 10 feet under the surface to help supply heat to a nearby building in the winter, or to help cool it in the summer. Geothermal energy can be part of a commercial utility energy solution on a large scale, or can be part of a sustainable practice on a local level. Direct use of geothermal energy may include: Heating office

buildings or manufacturing plants; helping to grow greenhouse plants; heating water at fish farms; and aiding with various industrial processes (e.g., pasteurizing milk). Learn more about geothermal energy at Energy Informative. **From Waterwheels to Hydroelectricity**

Hydropower isn't a new invention, though the waterwheels once used to operate the gristmills and sawmills of early America are now largely functioning as historic sites and museums. Today, the kinetic energy of flowing rivers is captured in a much different way and converted into hydroelectricity. Probably the most familiar type of hydroelectric power is generated by a system where dams are constructed to store water in a reservoir which, when released, flows through turbines to produce electricity. This is known as "pumped-storage hydropower," where water is cycled between lower and upper reservoirs to control electricity generation between times of low and peak demand. Another type, called "run-of-river hydropower," funnels a portion of river flow through a channel and does not require a dam. Hydropower plants can range in size from massive projects such as Hoover Dam to micro-hydroelectric power systems. Direct use of hydroelectric power is naturally dependent on geographic location. Assuming a dependable waterway source is accessible and available, micro-hydroelectric plants can be constructed to supply electricity to farm and ranch operations or small municipalities. Small towns can harness the energy of local waterways by building moderately sized hydroelectric power systems.

Learn more about hydroelectric energy at the U.S. Geological Survey website. **Power from the Ocean** There are two types of energy that can be produced by the ocean: thermal energy from the sun's heat and mechanical energy from the motion of tides and waves. Ocean thermal energy can be converted into electricity using a few different systems that rely on warm surface water temperatures. "Ocean mechanical energy" harnesses the ebbs and flows of tides caused by the rotation of the earth and the gravitational influence of the moon. Energy from wind-driven waves can also be converted and used to help reduce one's electricity costs. There are also lesser developed technologies that leverage ocean currents, ocean winds and salinity gradients as sources of power conversion. Cold ocean water from deep below the surface can be used to cool buildings (with desalinated water often produced as a by-product), and seaside communities can employ the methods to tap natural ocean energy described above to supplement municipal power and energy needs. Ocean energy is an evolving source of alternative energy production, and with more than 70 percent of the surface of our planet covered by ocean, its future looks promising, depending on geographies and regulatory guidelines. Learn more about ocean power on

California's energy web page. **Other Alternative Energy Sources** These two types of renewable energy have to be produced using

mechanical means, rather than by harnessing a natural process. **Bioenergy** is a type of renewable energy derived from biomass to create heat and electricity or to produce liquid fuels such as ethanol and biodiesel used for transportation. Biomass refers to any organic matter coming from recently living plants or animals. Even though bioenergy generates about the same amount of carbon dioxide as fossil fuels, the replacement plants grown as biomass remove an equal amount of CO₂ from the atmosphere, keeping the environmental impact relatively neutral. There are a variety of systems used to generate this type of electricity, ranging from directly burning biomass to capturing and using methane gas produced by the natural decomposition of organic material. How is bioenergy used? Businesses or organizations that transport goods or people can convert their fleets to vehicles that use biofuels such as ethanol or biodiesel. Manufacturing facilities can be equipped to burn biomass directly to produce steam captured by a turbine to generate electricity. In some cases, this process can have a dual purpose by powering the facility as well as heating it. For example, paper mills can use wood waste to produce electricity and steam for heating. Farm operations can convert waste from livestock into electricity using small, modular systems. Towns can tap the methane gas created by the anaerobic digestion of organic waste in landfills and use it as fuel for generating

electricity. Learn more about bioenergy here. **Hydrogen: High Energy/Low Pollution** Hydrogen is the simplest (comprised of one proton and one electron) and most abundant element in the universe, yet it does not occur naturally as a gas on earth. Instead, it is found in organic compounds (hydrocarbons such as gasoline, natural gas, methanol and propane) and water (H₂O). Hydrogen can also be produced under certain conditions by some algae and bacteria using sunlight as an energy source. Hydrogen is high in energy yet produces little or no pollution when burned. Liquid hydrogen has been used to launch space shuttles and other rockets into orbit since the 1950s. Hydrogen fuel cells convert the potential chemical energy of hydrogen into electricity, with pure water and heat as the only byproducts. However, commercialization of these fuel cells as a practical source of green energy will likely be limited until costs come down and durability improves. Almost all the hydrogen used in the United States is used in industry to refine petroleum, treat metals, produce fertilizer and process foods. In addition, hydrogen fuel cells are used as an energy source where hydrogen and oxygen atoms are combined to generate electricity. There are also currently a few hundred hydrogen-powered vehicles operating in the United States, a number that could increase as the cost of fuel cell production drops and the number of refueling stations increases. Other practical applications for this type of renewable energy include large fuel cells providing emergency electricity for buildings and remote locations, electric motor vehicles powered by hydrogen fuel cells and marine vessels powered by hydrogen fuel cells. Learn more about hydrogen power on the Energy Information Agency website.

The U.S. Environmental Protection Agency outlines 7 major types of renewable energy sources:

U.S. Environmental Protection Agency, ND, "Local Renewable Energy Benefits and Resources," US EPA, <https://www.epa.gov/statelocalenergy/local-renewable-energy-benefits-and-resources//IC>

Overview Local governments can dramatically reduce their carbon footprint by purchasing or directly generating electricity from clean, renewable sources. **The most common renewable power technologies include: Solar** (photovoltaic, solar thermal) **Wind Biogas** (e.g., landfill gas/wastewater treatment digester gas) **Geothermal Biomass** Low-impact **hydroelectricity** Emerging technologies - **wave and tidal power**

Renewable Energy Targets

Renewable energy targets establish goals to achieve specific amount of renewable energy production or consumption

International Renewable Energy Agency in 2015, Renewable Energy Target Setting, http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Target_Setting_2015.pdf

In an attempt to clarify these terminology issues, this report sets out a general definition of renewable energy targets. Renewable energy targets are defined as numerical goals established by governments or other actors (such as electric utilities) to achieve a specific amount of renewable energy production or consumption. Renewable energy targets can apply to the electricity, heating/cooling or transport sectors, or to the energy sector as a whole, and often include a specific time period or date by which the target is to be reached. Renewable energy targets that cover the entire primary or final energy mix are referred to as “overarching” renewable energy targets in this report. Furthermore, the report focuses on targets at the national level.

Same as above

International Renewable Energy Agency in 2015, Renewable Energy Target Setting, http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Target_Setting_2015.pdf

This report sets out a general definition of **renewable energy targets**, which **are defined as numerical goals established by governments to achieve a specific amount of renewable energy production or consumption. They can apply to the electricity, heating/cooling or transport sectors, or to the energy sector as a whole. They often include a specific time period or date by which the target is to be reached.**

Renewable energy targets have a variety of implementation mechanisms (see quantity v price based supports above)

International Renewable Energy Agency in 2015, Renewable Energy Target Setting, http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Target_Setting_2015.pdf

The literature tends to blur the lines between renewable energy targets (i.e., the numerical goal to be reached) and the specific tools, such as compliance and enforcement mechanisms required to achieve them. This can be seen in Renewable Energy Standards, which are often referred to as both a target and a policy tool. In fact, **Renewable Energy Standards encompass a numerical target (or targets) as well as additional procurement, primary of final energy mix of a country. Governments that have set a renewable energy target for themselves, or the utilities on whom a renewable energy obligation has been imposed, continue to have a number of different options to reach the target. Auctions are only one such policy tool. A number of jurisdictions around the world have used feed-in tariffs in a similar way in order to achieve their targets in part or in full. Likewise, blending mandates are one among a range of policy instrument to achieve renewable energy targets in the transport sector. monitoring and enforcement mechanisms (see Box 2). While a range of specific policy instruments can be used to achieve a specific target, they do not in themselves represent a renewable energy target. A**

renewable energy target, whether mandatory or aspirational, remains a numerical goal set out for a sector as a whole (electricity, heating/cooling, or transportation), or for the primary of final energy mix of a country. Governments that have set a renewable energy target for themselves, or the utilities on whom a renewable energy obligation has been imposed, continue to have a number of different options to reach the target. Auctions are only one such policy tool. A number of jurisdictions around the world have used feed-in tariffs in a similar way in order to achieve their targets in part or in full. Likewise, blending mandates are one among a range of policy instrument to achieve renewable energy targets in the transport sector.

RPS target – set a quota, timeframe, possible target levels for different renewables

MARK JACCARD in 2004 Simon Fraser University Vancouver, British Columbia, Canada,
Renewable Portfolio Standard,
<http://www.emrg.sfu.ca/media/publications/2004/RPSEncyclopedia.pdf>

Many considerations influence the design of an RPS. Major categories include selection of the target, determining resource eligibility, determining where and to whom the policy is applied, designing flexibility mechanisms, and setting administrative responsibilities. Although these are presented individually here, **they cannot be considered in isolation from each other in the design process.** A clear set of policy objectives is required for navigating these considerations. These include standard policy objectives, such as effectiveness, economic efficiency, equity, political acceptability, and administrative feasibility, but also the specific environmental and perhaps social goals that are the motivation for the RPS in the first place. For example, the RPS has been linked to the greenhouse gas reduction goals of several jurisdictions. The following discussion of design considerations assumes that the policy objectives include the standard list, as well as those environmental objectives that tend to favor renewables relative to fossil fuel and nuclear-generated electricity.

2.1 Target Selection The main challenge of the RPS is determination of the binding target or quota for renewable energy production. There are several aspects to this determination.

2.1.1 Target Size Setting target size requires consideration of impacts on different objectives, including anticipated costs. These impacts will depend in part on the local cost and availability of renewables and the price of conventional electricity sources. From a political acceptability perspective, the target would be large enough to move the industry toward the environmental objective, but not so large that it results in a dramatic increase in electricity prices. The size of the target can also affect the level of competition among fuels or technologies. For example, if targets could be achieved with a relatively small number of large projects, there may be less competition and little pressure to innovate. Some knowledge of the potential costs and quantities of renewables is therefore important in establishing targets.

2.1.2 Target Timing Another consideration in selecting the target is timing. Some lead time may be required to permit cost-effective responses to the RPS target. The length of the lead time will depend on the magnitude of the target and the characteristics of eligible resources. If existing facilities are not eligible for meeting targets, sufficient lead time will be required for investments in new facilities. A phase-in period would enable the government to conduct interim evaluations in order to assess impacts and make target adjustments where necessary, thereby maintaining fairly stable compliance costs. However, duration and stability of targets can also be important so that buyers and sellers can more easily negotiate long-term supply contracts. Long-term commitments that guarantee a revenue stream are important for securing low-cost project financing, especially for capital-intensive technologies such as renewables.

2.1.3 One or Multiple Renewables Targets An issue in target setting is **whether there should be one target for which all renewables compete, or a separate target for different classes of renewables.** Under the first approach, the lowest cost options would be developed to meet the aggregate target. This approach should advance environmental goals more cost-effectively, but it might do less well in furthering other objectives, such as greater supply diversity or increased support for newly emerging, but still expensive, types of renewables. Perhaps one renewable (e.g., wind) will capture the entire RPS market even though other renewables would eventually become competitive were they assisted in achieving commercialization and production thresholds. The state of Connecticut designed its RPS with separate targets for Class 1 renewables (solar, wind, landfill gas, and sustainable biomass) and Class 2 renewables (hydropower and municipal solid waste), the intent being to limit the share of hydropower and municipal solid waste within the RPS.

Restrictions

Taxing and quantity restrictions are the implementation of emissions restrictions

Babiker & Eckaus MIT, Joint Program on the Science and Policy of Global Change **2000**

Mustafa J. & Richard S. "Rethinking the Kyoto Emissions Targets" MIT Joint Program on the Science and Policy of Global Change Report No 65

http://web.mit.edu/globalchange/www/MITJPSPGC_Rpt65.pdf

Rather than placing a tax on carbon dioxide emissions, the Kyoto agreement would impose an emissions constraint on each country. A rational approach to setting this constraint would start with an agreement on an allowable level of global warming, perhaps even zero. That would imply a specific level of radiative forcing. This, in conjunction with the estimation of current atmospheric concentrations of greenhouse gases, would determine the acceptable level of total emissions of greenhouse gases. Certainly it is difficult to make these calculations and the values finally chosen would depend as well on other economic goals. However, the progress in the sciences of atmospheric chemistry, global climate change modeling and economic analysis make the procedure feasible, to a reasonable approximation. By comparison, the 1990 level of emissions that serves in the Kyoto Protocol as the base from which reductions are to be made is quite arbitrary and has no scientific or economic rationale. Perhaps it has persisted simply because it would now be politically difficult to establish another base. Yet, it is surprising that the intense negotiations have not resulted in more rational targets.

The next logical step after the determination of overall targets for emissions restrictions is the specification of the tax rates or quantity restrictions necessary to achieve the targets.⁷ That requires prescription of a tax base, or a basic output level, and tax rates or differential emissions constraints. With respect to the base, it was decided at Kyoto that the emissions to be included in the constraints should include not only carbon dioxide but other trace gases. The global warming potentials of the latter should be used to convert the trace gas emissions to equivalent amounts of carbon dioxide. While there are difficult scientific and economic problems that are neglected in this procedure, it is relatively straightforward compared to the implications of the ambiguous decision to also include some carbon dioxide sinks in trees.

Regulations and taxes are the implementation of restrictions

Babiker & Eckaus MIT, Joint Program on the Science and Policy of Global Change **2000**

Mustafa J. & Richard S. "Rethinking the Kyoto Emissions Targets" MIT Joint Program on the Science and Policy of Global Change Report No 65

http://web.mit.edu/globalchange/www/MITJPSPGC_Rpt65.pdf

The approach to international allocation of responsibilities for emissions constraints that is explored here is to consider reductions in greenhouse gas emissions as a public good. The allocations of the economic burdens of such restrictions are self-imposed regulations or taxes.² This is not a new idea, of course. Previous analyses have focused on issues of efficient implementation, which become questions of tax rates, pricing and trading of emissions permits and, perhaps, offsetting side payments among countries. This paper will consider the character of the public good and alternative ways in which it might be created.

Restriction is a legal requirement to restrict emissions – distinct from taxation policies

Petersen Resource Management in Asia-Pacific Program, Research School for Pacific and Asian Studies, The Australian National University, Canberra, **Schilizib** School of Agricultural and

Resource Economics, Faculty of Natural and Agricultural Sciences, University of Western Australia, & **Bennett** NRM Pty Ltd (Natural Resource Management Consultants) **2003**
Elizabeth, Steven & David “The impacts of greenhouse gas abatement policies on the predominantly grazing systems of south-western Australia” *Agricultural Systems* 78.3 Science Direct

The three policy options are compared in this section. However, a brief discussion of the emission restriction policy, where the farmer is legally required to restrict emissions, is provided first. This policy has the same managerial outcomes as providing a subsidy for abatement. The marginal cost (the change in costs for a given change in output) to the farmer of restricting emissions is the size of the subsidy needed to be paid to achieve the same decrease in emissions. However, financial outcomes would differ depending on whether the farmer is compensated for restricting emissions, as would be the case for a subsidy policy. The marginal cost curve for emission abatement is presented in Fig. 6. As expected, the marginal cost of abatement increases as the level of abatement increases. This indicates that the cheapest methods for abatement are adopted first. As the level of required abatement increases, the system adopts the more expensive methods. At a marginal cost of \$33/t CO₂-e (the zero-profit tax rate), emissions are reduced by 250t CO₂-e (14% compared with 8% with the taxation policy). The marginal cost curve exhibits a threshold at approximately 550 tonnes of CO₂-e where almost the maximum amount of pasture is substituted for crop on LMUs 3, 4 and 5.

Now consider a comparison of all three policy options. Sheep numbers and pasture area for each policy option do not vary significantly from one another across different levels of abatement. However, farm profit for each policy option does vary substantially according to Fig. 7. An emission restriction policy allows the farm to remain more profitable for all levels of abatement than the taxation policies as farmers are not financially penalised for the farm's emissions, but are simply restricted in the level of emissions allowed. With a tax on methane emissions only, farm profit is, of course, greater than that under the tax on all emissions. As illustrated in Table 9, the zero-profit level of abatement for the restriction on emission policy is 850t CO₂-e (48% abatement), for the tax on methane emissions policy is 180t CO₂-e (10% abatement), and for the tax on all emissions policy is 150t CO₂-e (8% abatement). Hence, restrictions on emissions allows the farm to remain profitable for approximately four times the abatement levels of the taxation policies.

Total

Total/absolute

World Resources Institute 11/25/2014 “6 Graphs Explain the World’s Top 10 Emitters”

2014 <http://www.wri.org/blog/2014/11/6-graphs-explain-world%E2%80%99s-top-10-emitters>

The previous chart defines the top 10 emitters based on their total annual emissions, also known as “absolute emissions.” Why? Over time, the absolute amount of GHGs emitted is what ultimately affects atmospheric concentrations of GHGs and the global carbon budget (see cumulative emissions, below). So the largest absolute emitters today have a larger role to play in determining the climate of the future. Regardless of other factors, these total annual numbers will have to be reduced for the top 10 emitters if global warming is to be limited to 2 degrees C.

Total emissions

EPA last update 5/26/2016 “Sources of Greenhouse Gas Emissions”

<https://www3.epa.gov/climatechange/ghgemissions/sources.html>

EPA tracks total U.S. emissions by publishing the Inventory of U.S. Greenhouse Gases and Sinks. This annual report estimates the total national greenhouse gas emissions and removals associated with human activities across the United States.

The primary sources of greenhouse gas emissions in the United States are:

Electricity production (30% of 2014 greenhouse gas emissions) - Electricity production generates the largest share of greenhouse gas emissions. Approximately 67% of our electricity comes from burning fossil fuels, mostly coal and natural gas.[2]

Transportation (26% of 2014 greenhouse gas emissions) - Greenhouse gas emissions from transportation primarily come from burning fossil fuel for our cars, trucks, ships, trains, and planes. Over 90% of the fuel used for transportation is petroleum based, which includes gasoline and diesel.[3]

Industry (21% of 2014 greenhouse gas emissions) - Greenhouse gas emissions from industry primarily come from burning fossil fuels for energy as well as greenhouse gas emissions from certain chemical reactions necessary to produce goods from raw materials.

Commercial and Residential (12% of 2014 greenhouse gas emissions) - Greenhouse gas emissions from businesses and homes arise primarily from fossil fuels burned for heat, the use of certain products that contain greenhouse gases, and the handling of waste.

Agriculture (9% of 2014 greenhouse gas emissions) - Greenhouse gas emissions from agriculture come from livestock such as cows, agricultural soils, and rice production

Land Use and Forestry (offset of 11% of 2014 greenhouse gas emissions) - Land areas can act as a sink (absorbing CO₂ from the atmosphere) or a source of greenhouse gas emissions. In the United States, since 1990, managed forests and other lands have absorbed more CO₂ from the atmosphere than they emit.

Section 4: Resolutions

1. Resolved: The United States federal government should establish a domestic climate policy, including at least substantially increasing restrictions on private sector emissions of greenhouse gases in the United States.

This is the resolution that the college policy circuit debated in 2016-2017.

1A. Resolved: The United States federal government should substantially increase restrictions on private sector emissions of greenhouse gases in the United States.

This is the same as 1 but removes the phrase "establish a domestic climate policy."

2. Resolved: The United States federal government should establish market-based regulations on the private sector to: substantially reduce greenhouse gas emissions and/or substantially increase renewable electricity generation.

This was the runner up to the 2016 college topic.

3. Resolved: The United States federal government should substantially increase regulations requiring reductions in greenhouse gas emissions.

This is a modified version of the 1996-97 college debate topic.

4. Resolved: The United States federal government should (establish a climate policy to) reduce greenhouse gas emissions in the United States to at least 80% below 2005 levels by 2050.

This was on the proposed college slate.

5. Resolved: The United States federal government should establish a domestic climate policy including one or more of the following goals: an increase in alternative energy incentives, regulations requiring reductions in greenhouse gas emissions, and/or eliminate all or nearly all subsidies for fossil fuels.

This resolution looks longer, but it is a probable world of what the 3rd resolution would do.

6. Resolved: The United States federal government should establish a climate policy.

Because it is clear we don't have one.

7. Resolved: The United States federal government should substantially increase its domestic mitigation of climate change.

hs 2008-2009

Resolved: The United States federal government should substantially increase alternative energy incentives in the United States.

hs 1998

Resolved: That the federal government should establish a policy to substantially increase renewable energy use in the United States.

hs 1993

Resolved: That the United States government should reduce worldwide pollution through its trade and/or aid policies.

1971 – Resolved: That the federal government should establish, finance and administer programs to control air and/or water pollution in the United States.

Section 5: Negative Ground

Overview

Generic negative ground addressing climate change has a number of possibilities. After researching various ideas, the strongest generic policy 2NRs against most, if not all, affs would be one of the following:

1. Politics DA and Alternate Implementation Mechanism CP
2. Business Confidence DA/Economic Sector DA and Private Industry CP or Regulatory Negotiation CP
3. States and Federalism

These strategies are considered the strongest as the literature base is very diverse and strong. In addition, links and solvency mechanisms do not have to be tailored to specific affirmative action to solve. This makes these strategies probably the core of most negative teams absent a smart specific strategy.

There is other possible negative ground, but the literature was either not as in depth or not as widely applicable. These strategies are included in the “Possible Negative Ground” subsection.

For critical ground, negative teams can look forward to a wide spectrum of arguments that will be pertinent to individual cases but may also be applicable on a resolution-wide scale.

Kritiks

Some of the mainstays of kritik debaters, such as various versions of the capitalism kritik, are clearly able to fit into the topic. This is particularly true given that the topic unapologetically encourages affirmative teams to focus their attention on using economic modalities to repair the environment.

Beyond the kritiks that are available on a yearly basis, a number of arguments will be available through generic negative ground, yet these generic kritiks can also be tweaked depending on the sectors being discussed. One such example is the consumption/environmental managerialism kritik, primarily authored by Timothy Luke:

Luke 99 Timothy W. Luke, Professor of Political Science at Virginia Polytechnic Institute and State University, 1999, *Discourses of the Environment*, p. 141-42

In some sectors or at a few sites, ecologically more rational participation in some global commodity chains may well occur as a by-product of sustainable development. Over-logged tropical forests might be saved for biodiversity-seeking genetic engineers; over-fished reefs could be shifted over to eco-tourist hotel destinations; over-grazed prairies may see bison return as a meat industry animal. In the time—space compression of postmodern informational capitalism, many businesses are more than willing to feed these delusions with images of environmentally responsible trade, green industrialization, or ecologically sustainable commerce, in order to create fresh markets for new products. None the less, do these policies contribute to ecologically sustainable development? or do they simply shift commodity production from one fast track to another slower one, while increasing opportunities for more local people to gain additional income to buy more commodities that further accelerate transnational environmental degradation? or do they empower a new group of outside experts following doctrines of engagement to intervene in local communities and cultures so that their geo-power may serve Global Marshall Plans, not unlike how it occurred over and over again during Cold War-era experiments at inducing agricultural development, industrial development, community development, social development and technological development? Now that the Cold War is over, as the Clinton/Gore green geopolitics suggests, does the environment simply substitute for Communism as a source and site of strategic contestation, justifying rich/powerful/industrial states' intervention in poor/weak/agricultural regions to serve the interests of outsiders who want to control how forests, rivers, farms or wildlife are used?

In the college topic proposal, Herndon et.al. offer a quick “google test” to highlight the variety of critical arguments. Here is that section of their paper (their google test has not been updated since they proposed this paper, but it is probably a safe guess that the number of articles have risen steeply):

So, there are a lot of articles about climate change and every major philosophical tradition. But, if you are interested in a particular subject, then people are most likely discussing that issue in the context of climate change. Let me google that for you [with apologies for leaving anyone out]:

A. Philosophy “climate change” – 17,600 articles since 2015 -

https://scholar.google.com/scholar?q=philosophical+%22climate+change%22&btnG=&hl=en&as_sdt=0%2C11&as_ylo=2015&as_vis=1

B. neoliberalism “climate change” – 7,510 articles since 2015

https://scholar.google.com/scholar?q=neoliberalism+%22climate+change%22&btnG=&hl=en&as_sdt=0%2C11&as_ylo=2015&as_vis=1

C. ontology “climate change” – 6,870 articles since 2015

https://scholar.google.com/scholar?q=ontology+%22climate+change%22&btnG=&hl=en&as_sdt=0%2C11&as_ylo=2015&as_vis=1

D. intersectionality “climate change” – 803 articles since 2015

https://scholar.google.com/scholar?q=intersectionality+%22climate+change%22&btnG=&hl=en&as_sdt=0%2C11&as_ylo=2015&as_vis=1

E. "settler colonialism" "climate change" – 216 articles since 2015

https://scholar.google.com/scholar?as_ylo=2015&q=%22settler+colonialism%22+%22climate+change%22&hl=en&as_sdt=0,11

F. "queer theory" "climate change" – 194 articles since 2015

https://scholar.google.com/scholar?q=%22queer+theory%22+%22climate+change%22&btnG=&hl=en&as_sdt=0%2C11&as_ylo=2015

G. “critical race theory” “climate change” – 161 articles since 2015

https://scholar.google.com/scholar?q=%22critical+race+theory%22+%22climate+change%22&btnG=&hl=en&as_sdt=0%2C11&as_ylo=2015&as_vis=1

H. "afro pessimism" "climate change" – 27 articles since 2015 [186 total]

https://scholar.google.com/scholar?q=%22afro+pessimism%22+%22climate+change%22&btnG=&hl=en&as_sdt=0%2C11&as_ylo=2015

Politics/Elections DA

The politics debate will be quite interesting on this topic outside of the divided government philosophically opposed on how to handle the climate question. Debates over the “Green New Deal” only prove the volatility of these political discussions. Additionally, any proposal will set the Democratic House and Republican Senate highly at odds with each other. Either because it takes a large progressive leap forward on climate or increases the regulatory regime which the Trump administration is straight up opposed to. Second, we will be in a Presidential election

cycle, and several Democrats have listed climate change as one of their top priorities, if not the largest existential crisis facing humanity. Needless to say, the politics link literature will be hot and super timely.

Business Confidence DA

Biz con functions in tandem with the private industry counterplan. Affirmatives would require increasing government regulation of the private sector. These regulations will be seen with potentially negative reactions by both businesses and consumers which may have an adverse economic impact.

Regulatory Negotiations CP

This is obviously very similar to the private industry counterplan. However, instead of providing regulations on private industries with no feedback, this counterplan would negotiate with private industry about the roles and regulations for a given emissions target or energy system. Part of this literature is based on the idea that since infrastructure is owned by private industry, they should have a say in what happens to it.

Carafano, leading expert in defense affairs, intelligence, military operations and strategy, and homeland security at The Heritage Foundation. He was an Assistant Professor at the U.S. Military Academy in West Point, **2008**

(James Jay, June 26, “Resiliency and Public-Private Partnerships to Enhance Homeland Security” Family Security Matters, http://www.familysecuritymatters.org/publications/id.467/pub_detail.asp)

Determining the criticality of assets, however, should be a shared activity. In many cases, the private sector owns or is responsible for managing both private and public infrastructure that provide vital goods and services for the society. Meanwhile, only the national government has the overall perspective to determine national needs and priorities during disasters and catastrophic threats. The private sector and the national government ought to work together to determine what is truly critical to maintaining the heartbeat of the nation at a time of adversity. The issue of vulnerability should be the primary responsibility of the partner that owns, manages, and uses the infrastructure, so it is largely the private sector's duty to address vulnerability by taking reasonable precautions in much the same way that society expects the private sector to take reasonable measures for safety and environmental protection. Equipped with these assessments and a commonsense division of roles and responsibilities, public-private partnerships ought to be able to institute practical measures to reduce risk and enhance resiliency. Governments should participate in defining "reasonable" as a performance-based metric and in improving information sharing to enable the private sector to perform due diligence (i.e., protection, mitigation, and recovery) in an efficient, fair, and effective manner. A model public-private regime would define what is reasonable through clear performance measures, create transparency and the means to measure performance, and provide legal protections to encourage information sharing and initiative.

The States CP

It will exist, the federalism DA will be pretty OK on this issue as the states have heavily pivoted in the direction of managing their own climate policies in a world post-Paris withdrawal.

Other Possible Generic Ground

Court Clog DA – This scenario is based on private industry and individuals reacting to the aff. To avoid compliance with standards, companies are likely to go to the courts. Individuals would also get involved depending on how the government goes about implementing the plan. We have seen litigation on both sides of the climate issue, so there will be some unique ground for this disad. Students who debated immigration will also benefit because they can use their knowledge of how the legal system works and apply that knowledge to a different area of policy.

Resource-Based DAs – There are a variety of economic sectors that would be directly impacted by any of the proposed resolutions: fossil fuels, manufacturing, agriculture...any industry will be impacted. All of these bring different unique economic impacts.

Section 6: Why this Topic

Resources Available

As seen throughout the paper, there is a wide variety of resources available to help students research the topic. Emissions can be reduced through a variety of methods, and climate change affects nearly all aspects of our life. It is a highly discussed issue, making research relatively easy to find to justify this topic. There are frequent publications of news articles, scholarly journals and books all focused on climate policy.

Topic Balance

This topic has balanced division between affirmative and negative ground. While there are many methods through which the affirmative could work to mitigate climate change, this is checked by broad-reaching, competitive negative strategies like the states or private actor counterplans. There is also a depth of research in terms of analyzing each mechanism by which emissions could be reduced which should ensure robust debate for both sides in any area of the topic.

Significance

The impacts of climate change are profound. They extend far beyond an increase in temperature, affecting ecosystems and communities both in the United States and around the world. The things we depend upon and value – human health, energy, ecosystems, economy, agriculture, water, infrastructure, and wildlife – are experiencing the effects of climate change. The latest IPCC report warns that if climate change is not mitigated, the risks of drought, floods, extreme heat, extinction of species, and poverty for hundreds of millions of people would increase significantly.

Additionally, the high school debate community has NEVER debated climate change as a topic. It was definitely an impact area in 1997-98 and 2008-2009 (renewable/alternative energy use or incentives), air and water pollution was an area in both 1971 and 1993 (controlling pollution and conditioning trade or aid). But reducing emissions has never been the sole focus of a resolution.

Timeliness

Climate change is one of the most important issues of our time. It has already had observable effects on the environment: glaciers have shrunk, ice on rivers and lakes is breaking up earlier, plant and animal ranges have shifted, and trees are flowering sooner. These impacts have negative implications on our environment and future. The latest IPCC report warns there are only 12 years for global warming to be kept to a maximum of 1.5 C, beyond which any increase would significantly worsen the impacts. Additionally, climate change is currently an issue where domestic policy is out of step with what is internationally recognized as necessary. These nuances make climate change even more pressing to debate.

Each day we go without addressing climate change, the threats only continue to grow in number and magnitude. With this topic, students will be debating one of the most important challenges of their time.

Interest

Climate change gets shoe-horned into every topic, but typically only as an impact. We have never debated an entire topic on this issue to any depth in recent years. It seems silly to eliminate this topic from consideration simply because we have had very minimal discussion of this topic on the margins of other topics. Under that logic, we would not be able to debate any topic in the future.

A climate change topic gets to the heart of one of the most pressing issue facing us today. Unlike previous years, this topic would incentivize a holistic approach in addressing the issue and would allow for consideration of all the nuances of climate change mitigation. There would be meaningful and in-depth debates solely focused on climate change, allowing debaters to develop a deeper understanding on the subject.

Section 7: Works Cited

*Definitions are excluded from the works cited

**Some sources might be missing, but there are full citations for every card as well

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