LEVERAGING MANDATORY LICENSING UNDER THE CLEAN AIR ACT — A NOVEL FRAMEWORK TO DOMESTIC REDUCTION OF GREENHOUSE GASES

BY

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With climate change looming closer to the tipping point each day, and the United States government unable to pass any form of a comprehensive climate action policy, the Environmental Protection Agency (EPA) must step up to fill this void. At this time, many environmentally beneficial technologies exist that can mitigate climate change. For instance, many fossil-fuel companies hold patents to some of the most promising carbon neutral or carbon negative technologies. Unfortunately, the Patent Act does not require that these technologies be put into practice. This Comment proposes a two-step framework that leverages a never-utilized provision of the Clean Air Act, the Mandatory Licensing provision, and the EPA's authority to regulate greenhouse gases under the New Source Performance Standards, to fill the void left by the absence of a comprehensive federal climate action policy.

The two-step framework this Comment proposes relies on the EPA's existing authority and agency deference in regulating greenhouse gases from fossil-fuel electric generation plants. First, the EPA utilizes a statutorily authorized pathway to regulate carbon dioxide emissions based on the availability of carbon-capture technologies. And second, the EPA invokes the Mandatory Licensing provision to provide accessibility to the carbon-capture technologies in the marketplace. This Comment explores anticipated industry-based challenges to the proposed technology-based emission reduction standards and analyzes the potential impacts that invoking (or threatening to invoke) the Mandatory Licensing provision may have on the technology market and regulated industries. In addition, the Comment considers the potential to deter monopolistic behavior and how the market may proactively take control to avoid government intrusion and facilitate technology transfer at reasonable licensing fees. The Comment concludes with a brief review of a similarly

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stringent air pollution regulation that affected the fossil-fuel electricity generating industry and how this proposed framework may play out in light of that previous regulation.

With no comprehensive climate change policy, the EPA should establish a steep carbon dioxide emissions regulation of fossil-fuel electric generating facilities. To anticipate and counter industry claims of inaccessible technologies and to deter anticompetitive behavior, the EPA should leverage its full authority and invoke the Mandatory Licensing provision. Such an action would ensure technology transfer and reasonable licensing of critical patented technologies.

I. INTRODUCTION

It is incredible the speed at which the United States government and the private sector can quickly develop solutions when faced with a substantial public health crisis. In light of recent developments surrounding the COVID-19 pandemic, it was inspiring to see how quickly technological advances in testing were achieved through private sector and government cooperation.[1] Those with an interest in Intellectual Property Rights (IPRs) cannot help but consider the negotiation of licensing agreements over the sharing of this technology and information. During this time of crisis, it is likely that patented scientific processes were shared to achieve significant progress in medical advancement for the greater good.[2] What if law makers channeled an effort of equal magnitude of technology sharing and government involvement toward the greatest public health crisis that lies ahead of us—climate change?

With the tipping point of climate change looming closer every day, and no sense of urgency from the federal government, we must consider what avenues are available to quickly decrease greenhouse gas (GHG) emissions and place environmentally beneficial technologies into the right hands. Presently, climate change is occurring at a rate which will require global net zero carbon dioxide emissions by 2050.[3] A "business as usual" approach will not be sufficient to drive innovation and decrease carbon emissions.[4] Despite multiple efforts by both the Senate and the House,[5] the United States still has no comprehensive climate change policy either requiring a reduction in GHGs or mandating a timely transition from a fossil fuel–based to a wholly renewable or "net-zero" electricity grid. It may, however, be possible for the country to make substantial reductions to GHG emissions at the speed necessary to

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[1] *NIH to Launch Public-Private Partnership to Speed COVID-19 Vaccine and Treatment Options*, NAT'L INST. OF HEALTH (Apr. 17, 2020), https://perma.cc/UR8T-CV5N.

[2] *See generally* Lola E. Peters, *Vaccinate the World Against COVID-19 Like We Did with Polio*, CROSSCUT (Dec. 4, 2020), https://perma.cc/2SNA-V2EM; *The Pledge*, OPEN COVID PLEDGE, https://perma.cc/A6PS-4Y6D (last visited Feb. 10, 2021).

[3] Intergovernmental Panel on Climate Change, *Summary for Policymakers: Global Warming of 1.5°C: An IPCC Special Report on the Impacts of Global Warming of 1.5°C Above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty* 116 (2018), https://perma.cc/7EQD-DA37.

[4] *See* Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units (Clean Power Plan (CPP)), 80 Fed. Reg. 64,510, 64,575 (Oct. 23, 2015) (codified at 40 C.F.R. pt. 60) ("By examining U.S. research funding and patenting activity over the past century, the . . . researchers found that promulgation of national policy requiring large reductions in power-plant emissions resulted in a significant upswing in inventive activity to develop technologies to reduce those emissions.").

[5] *See, e.g.*, 100% Clean Economy Act of 2019, H.R. 5221, 116th Cong. 1 (2019) ("To declare a national goal that the United States achieve a 100 percent clean economy by not later than 2050. . . ."); S.J. Res. 8, 116th Cong. IIA (2019) ("Recognizing the duty of the Federal Government to create a Green New Deal.").

combat climate change through government and private sector cooperation.

To facilitate progress toward policy that resembles a climate change action plan, this Comment looks to existing options of government drivers: environmental regulations and the patent system. Unfortunately, the current patent system does not quickly transfer impactful and economically feasible technologies into the right hands—it may actually create roadblocks. Technology and environmental protection go hand in hand. However, the monopolistic rights afforded to patent holders are often in tension with access to environmentally beneficial technologies.[6] And because patents are inherently monopolistic, patent holders may exhibit anticompetitive behaviors, which create additional barriers to technology sharing.[7] Despite (maybe) understanding the impact that technologies have on combating climate change, Congress has no interest in weakening patent laws to assist with the deployment of energy and environmentally related technologies.[8] Although patented technologies exist which prevent carbon dioxide emissions from reaching the atmosphere, the fossil-fuel industry maintains that the technologies are too costly or technologically infeasible to implement on a large scale.[9] The industry claims infeasibility despite the fact that these same fossil-fuel companies own patents to and provide research funding for these beneficial technologies.[10]

Many environmentalists are hoping for a swift transition from a fossil fuel to renewable-based electricity grid, but what drivers are in place to make this push in the absence of a comprehensive federal climate action plan? Additionally, the current structure of the United States patent system does not punish a patentee for not practicing their patented technology.[11] The lack of a government driver to force useful technologies into the marketplace is especially concerning when companies in the fossil-fuel industry hold patents to some of the most promising environmentally beneficial carbon-capture technologies.[12] While there are statutes which authorize the government to force patent

6 Ofer Tur-Sinai, *Patents and Climate Change: A Skeptic's View*, 48 ENV'T L. 211, 213–14 (2018).

7 *Id.* at 226, 230.

8 155 CONG. REC. 6430, 6489 (daily ed. June 10, 2009) (statement of Rep. Blackburn). Instead, Congress prefers to believe that strong patent rights will result in more and better technological developments—but what good are these new developments if they are too costly to implement? *Id.*

9 INTERAGENCY TASK FORCE ON CARBON-CAPTURE AND STORAGE, REPORT OF THE INTERAGENCY TASK FORCE ON CARBON-CAPTURE AND STORAGE 34 (2010), https://perma.cc/8F5W-4SAT [hereinafter INTERAGENCY TASK FORCE].

10 BERNICE LEE ET AL., WHO OWNS OUR LOW CARBON FUTURE? 39 (Chatham House ed., 2009), https://perma.cc/2HZ3-R4HA.

11 Neil S. Tyler, *Patent Nonuse and Technology Suppression: The Use of Compulsory Licensing to Promote Progress*, 162 U. PA. L. REV. 451, 453 (2014) ("The Supreme Court has adamantly held that patents do not require that patentees use or commercialize their inventions.").

12 LEE ET AL., *supra* note 10, at 39, 43.

holders to provide access to their inventions in the interest of the protection and preservation of the public health or national security, referred to as "compulsory licensing," these statutes have never been invoked.[13] Interestingly, the Patent Act does not have a generalized compulsory licensing provision.[14]

Surprisingly the Clean Air Act[15] (CAA), of all areas of law, provides some leverage to force technologies into industry and discourage anticompetitive behavior. In the 1970s, when the country was experiencing significant environmental degradation, Congress passed monumental environmental protections through amendments to environmental statutes such as the CAA.[16] When drafting the CAA amendments, Congress knew that any impactful control on air pollution would require economical access to pollution control technologies.[17] Recognizing the potential roadblocks in achieving meaningful air pollution control at emitting facilities, Congress crafted the "Mandatory Licensing" provision, which authorizes the EPA to step in and, under particular circumstances, require that a patentee license a technology for a reasonable royalty.[18] Since its enactment, however, the EPA has never exercised its authority under the Mandatory Licensing provision.

In the absence of a comprehensive federal climate policy, the EPA should utilize its existing statutory authority to impose mandatory licensing of carbon-capture technologies while modifying existing emissions performance standards that can only be achieved through implementation of these technologies. Currently, Congress is not poised to pass significant environmental legislation.[19] Therefore, now is the time for the EPA to exercise its full authority under mandatory licensing, utilizing the path of least resistance to work toward carbon-neutral energy generation.

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13 *See* discussion *infra* Part II.C.2.

14 CONG. RESEARCH SERV., R43266, COMPULSORY LICENSING OF PATENTED INVENTIONS 2–3 (2014), https://perma.cc/5HJA-9JKG (search in search bar for "R43266") [hereinafter CRS, PATENTED INVENTIONS].

15 Clean Air Act (CAA), 42 U.S.C. §§ 7404–7671q (2018).

16 Clean Air Amendments of 1970, Pub. L. No. 91-604, § 308, 84 Stat. 1709 (codified at 42 U.S.C. § 7608 (1970)) (establishing the requirements that trigger and the method by which the EPA may make patented technologies otherwise available), *reprinted in* ENV'T POLICY DIV., CONG. RESEARCH SERV., 93D CONG., SERIAL NO. 93-18, A LEGISLATIVE HISTORY OF THE CLEAN AIR AMENDMENTS OF 1970 TOGETHER WITH A SECTION-BY-SECTION INDEX 99–100 (1974) [hereinafter ENV'T POLICY DIV.].

17 S. REP. NO. 91-1196, at 442 (1970) (discussing mandatory licensing and explaining "[t]he intent of section 309 is to prohibit any one from refusing to make available discoveries or inventions which would assist in the control and abatement of air pollution"), *reprinted in* ENV'T POLICY DIV., *supra* note 16, at 442.

18 42 U.S.C. § 7608(2).

19 *See, e.g.*, Emily Cochrane & Lisa Friedman, *House Democrats Push Environmental Bills, but Victories are Few*, N.Y. TIMES (Jan. 10, 2020), https://perma.cc/XCG9-BFRW (noting that both parties have failed to pass legislation that includes "far-reaching environmental provisions").

The EPA can rely on mandatory licensure and agency deference to make significant headway in curbing carbon dioxide emissions from the fossil-fuel electricity generators. First, the EPA should promulgate aggressive carbon dioxide emission standards based on the implementation of carbon-capture technology. The standards may be challenged, but the EPA is traditionally afforded a high level of deference in its promulgation authority.[20] Second, the EPA should invoke the CAA Mandatory Licensing provision to provide economical access to the necessary technologies. This two-step framework provides an improvised climate action plan in lieu of a comprehensive legislative act. Carrying out the proposed framework may result in two different outcomes in the regulated industry. One, the fossil-fuel electricity generators will meet the stringent emissions standards by utilizing the technologies made economically available by mandatory licensing. Alternatively, the proposed plan may make it economically infeasible for inefficient plants or plants with limited remaining life to implement the technologies, even when made available through compulsory licensing. Consequently, these plants may shut down, accelerating the transition to renewable energy.

Part II of this Comment presents background on key components of the proposed framework: the current state of carbon-capture technology and challenges to implementation of full-scale carbon capture and storage (CCS), the CAA's regulation of GHGs of emitting facilities, and compulsory licensing in the United States and the Mandatory Licensing provision of the CAA. Part III presents the two-step proposed framework—first, the EPA's statutorily authorized pathway to regulating carbon dioxide emissions based on the availability of carbon-capture technologies, and second, the EPA's invocation of the Mandatory Licensing provision to provide accessibility to the carbon-capture technologies. Part III also explores anticipated industry-based challenges to the proposed technology-based emission reduction standards. Part IV analyzes the potential impacts that invoking (or threatening to invoke) the Mandatory Licensing provision may have on the technology market and regulated industries. Specifically, Part IV considers the potential to deter monopolistic behavior and how the market may proactively take control to avoid government intrusion and facilitate technology transfer at reasonable licensing fees. In addition, Part IV describes how a similarly stringent air pollution regulation affected the fossil-fuel electricity generating industry and how this proposed framework may play out in light of that previous regulation.

With no comprehensive climate change policy, the EPA should establish a steep carbon dioxide emissions regulation of fossil-fuel electric generating facilities. To avoid challenges from industry on the basis that technologies cannot be readily accessed and to deter anticompetitive behavior, the EPA should leverage its full authority and invoke the

[20] *See* discussion *infra* Part II.B.2.

Mandatory Licensing provision to ensure technology transfer and reasonable licensing of the critical patented technologies.

II. BACKGROUND

Part II presents background on key components of the proposed framework—the current state of carbon-capture technology and challenges to implementation of full-scale CCS, the CAA's regulation of GHGs of emitting facilities, and compulsory licensing in the United States and the Mandatory Licensing provision of the CAA.

A. Carbon-Capture Technologies and Barriers to Implementation

1. State of Carbon-Capture Technologies and Patent Ownership

Renewable energy technologies include solar, wind, and hydropower—those that do not rely on fossil fuels for power generation.[21] Alternatively, net- or near-zero emission technologies support "responsible" fossil fuel consumption by capturing, or even sequestering and converting, carbon dioxide during various processes of fossil fuel use (extraction, pre-, and post-combustion).[22] This Comment focuses on carbon-capture technologies used in post-combustion—those technologies at the front end of the CCS pathway, which are typically able to be retrofitted into existing fossil-fuel electric generation facilities or considered during new construction as part of plant design.[23] To describe carbon capture in the simplest of terms, these technologies can be thought of as a sieve that captures carbon dioxide as gases flow up a smoke stack and through the sieve.[24] There are a variety of media that are used to capture carbon dioxide. The criteria for selecting the media is based on its efficiency in large-scale use and the ease of reusing the carbon dioxide, if the intent is utilization rather than transporting to a storage facility.[25] For example, some companies are currently researching how to utilize the captured carbon dioxide to assist with the removal of subsurface fossil-

[21] *See Renewable Energy Explained*, U.S. ENERGY INFO. ADMIN., https://perma.cc/2VS3-UXFM (last updated June 22, 2020) (explaining what constitutes a renewable energy source and listing major sources of renewable energy).

[22] Howard Herzog & Dan Golomb, *Carbon-capture and Storage from Fossil Fuel Use*, MASS. INST. OF TECH LABORATORY FOR ENERGY & THE ENV'T 1 https://perma.cc/98F5-45QK (last visited Dec. 3, 2020).

[23] Brian Pattengale & Anthony D. Sabatelli, *Guest Post-Rising Carbon Dioxide Levels: Capture Methods & Patent Trends*, PATENT DOCS (Feb. 11, 2019), https://perma.cc/7XDD-KC2M.

[24] *See id.*

[25] *What are the Main Types of Carbon-capture and Storage Technology?*, GUARDIAN (Mar. 18, 2011), https://perma.cc/F6HV-4Q6E.

fuel gases, which is a beneficial and economical use for the fossil-fuel industry.[26]

Major fossil-fuel companies and the U.S. government hold patents to some of the most promising of these carbon-capture technologies.[27] Beginning in the 1960s, fossil-fuel companies invested in and patented carbon-capture technologies.[28] However, these technologies were never promoted in the industry or utilized.[29] Recently there has been a resurgence in research funding from fossil-fuel companies toward carbon-capture technologies and utilization of the captured carbon. [30]

Exxon, Shell, and Chevron are three of the top six patent owners of carbon-capture technologies.[31] Most likely, the industry has recognized that with the growth and declining cost of renewables, continuing business as usual would be financially challenging in the long term with the looming threat of the EPA establishing stringent emission standards.[32] Even the Trump Administration supported carbon capture, disguising its support of Big Coal in the form of tax credits for facilities deploying these technologies.[33] Much like the tax credits that helped spur renewable energy technology development and growth, this tax credit incentivizes the use of carbon capture and utilization.[34] Passed in 2018, the tax credit requires that electric generating facilities utilize or store at least 500,000 tons of carbon dioxide per year to qualify for the credit.[35] While many opponents to fossil fuel use view tax breaks as a way to solidify fossil fuels in electricity systems, the tax credits help to reduce the costs of carbon-capture technologies,[36] which negates the industry's argument that the cost to utilize emission reduction controls is too burdensome.

All of this goes to show that the use of carbon-capture technology is not an unattainable technological solution, but rather is reasonable for

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[26] *Occidental Petroleum and White Energy to Study Feasibility of Capturing CO2 for Use in Enhanced Oil Recovery Operations*, OXY (June 19, 2018), https://perma.cc/CAC8-RMSM.

[27] *See* Pattengale & Sabatelli, *supra* note 23 (Exxon-mobile owns a patent to a material which increases "overall efficiency of CO2 capture by reducing the amount of steam needed during the desorption step").

[28] Matt Smith, *The Oil Industry Sought Patents for Low-Carbon Technologies Decades Ago—Then Abandoned Them*, VICE (May 19, 2016), https://perma.cc/NU7S-MPNB.

[29] *Id.*

[30] Clifford Krauss, *Blamed for Climate Change, Oil Companies Invest in Carbon Removal,* N.Y. TIMES (Apr. 7, 2019), https://perma.cc/G3SC-67ZY.

[31] LEE ET AL., *supra* note 10, at 39.

[32] *See generally* Krauss, *supra* note 30 (noting the financial and regulatory pressure for fossil-fuel industry to invest in CCS).

[33] Bipartisan Budget Act of 2018, Pub. L. No. 115-123, § 41119, 132 Stat. 162–68 (codified at 26 U.S.C. § 45Q (2018)). *See also* Brad Plumer, *A Rare Trump-Era Climate Policy Hits an Obstacle: The Tax Man*, N.Y. TIMES (Feb. 11, 2020), https://perma.cc/3QL9-THQ9.

[34] Jennifer Christensen, *Primer: Section 45Q Tax Credit for Carbon-capture Projects*, GREAT PLAINS INST. (June 17, 2019), https://perma.cc/3U9X-SDAE.

[35] *Id.*

[36] *U.S. Department of Energy Announces $110M for Carbon Capture, Utilization, and Storage*, DEP'T OF ENERGY (Sept. 13, 2019), https://perma.cc/RYZ3-KDHC.

the EPA to consider as part of a system of emission reduction and a climate change action plan.

2. Existing Industry Challenges the Proposed Framework Overcomes

Despite there being many patented CCS technologies, challenges to large-scale deployment still exist. In 2010, the U.S. government formed an interagency task force for CCS, and instructed the task force to take a hard look at the current state of CCS and the challenges faced for wide-spread use.[37] The task force identified four significant barriers to implementing CCS on a large-scale: absence of comprehensive climate legislation to encourage emission reductions; the need for a regulatory framework that facilitates project development; concrete understanding of the long-term liability of CCS, particularly in regards to the legacy of carbon storage sites; and public education and outreach to build trust with communities about the use of these processes.[38] Despite the report explicitly stating that the greatest barrier to CCS implementation is the absence of comprehensive federal climate legislation,[39] there is still no legislation in place ten years after the report's issuance.

To overcome the barriers, the report suggested that government support for technology development was paramount to implementing CCS.[40] The report went on to propose several solutions: a substantial research and development program supported by the U.S.; interagency coordination, specifically between the EPA and Department of Energy (DOE); and a regulatory framework that would support implementation of CCS.[41] Furthermore, the report encouraged the U.S. to support leveraging resources and sharing results across the country for the development and deployment of CCS technologies.[42]

This Comment's proposed framework would help overcome CCS implementation barriers. First, in the absence of a comprehensive federal climate policy—identified by the task force as the main barrier to CCS implementation—the proposed framework establishes carbon dioxide emission reduction standards for categories of polluters. The emission reduction standards partly fill the void and act to provide a governmental driver for deployment of carbon-capture technologies, in lieu of a comprehensive federal climate policy. Second, the proposed framework establishes a stronger marketplace for the CCS technologies because the reduced emissions standards will only be achievable through the use of those technologies. The emission standards provide a clear incentive for

[37] *Interagency Task Force on Carbon Capture and Storage*, DEP'T OF ENERGY: OFFICE OF FOSSIL ENERGY, https://perma.cc/EQ75-MWTC (last visited Dec. 3, 2020).

[38] INTERAGENCY TASK FORCE, *supra* note 9, at 53.

[39] *Id.* at 10.

[40] *Id.* at 11.

[41] *Id.* at 11–12. In 2019, DOE announced $110 million in funding for CCS research and development (R&D). *U.S. Department of Energy Announces $110M for Carbon Capture*, *supra* note 36.

[42] INTERAGENCY TASK FORCE, *supra* note 9, at 12.

patentees to leverage their technologies, even if the EPA holds off on invoking the Mandatory Licensing provision. Finally, the use of mandatory licensing results in the requirement of licensing resources and sharing of information across the country to support CCS development. The proposed framework thus has the potential to overcome the barriers identified by the task force, and it need only rely upon existing law to overcome them.

B. Overview of the Clean Air Act

Understanding the various pieces that will come together to support the proposed framework begins with the storied tale of how the EPA is authorized to regulate GHGs from stationary sources (i.e., fossil-fuel electric generating plants) and the role of technology in establishing the GHG emission standards.

1. The Clean Air Act: Enactment and Key Components Relied Upon by the Proposed Framework

Congress passed the CAA in 1955,[43] with the most significant and impactful provisions of the Act passed in the 1970[44] and 1990 amendments.[45] Congress passed the 1970 amendments during a time of heightened environmental stewardship, and the amendments that followed in 1990 increased the effectiveness of the Act's ability to target air pollution problems that had developed since the 1970 enactment, such as acid rain.[46] The CAA provides four main pathways for regulation of emissions from stationary sources[47]—New Source Performance Standards (NSPS),[48] New Source Review/Prevention of Significant Deterioration (NSR/PSD),[49] National Emissions Standards for Hazardous Air Pollutants (NESHAPs),[50] and Title V.[51]

The NSPS program develops standards of performance specific to categories of stationary sources. Stationary sources can range from equipment such as gas turbines to municipal solid waste landfills.[52] The

[43] Clean Air Act of 1955, Pub. L. No. 84-159, 69 Stat. 322 (codified at 42 U.S.C. § 7401 (2018)).

[44] Clean Air Act Amendments of 1970, Pub. L. No. 97-604, 84 Stat. 1676 (codified as amended at 42 U.S.C. § 7401 (2018)).

[45] Clean Air Act Amendments of 1990, Pub. L. No. 101-549, 104 Stat. 2399 (codified as amended at 42 U.S.C. § 7401 (2018)).

[46] *Clean Air Act Requirements and History*, U.S. ENV'T PROTECTION AGENCY, https://perma.cc/FE5B-8N6J (last updated Jan. 10, 2017).

[47] Stationary sources are "any building, structure, facility or installation which emits or may emit any air pollutant." 42 U.S.C. § 7411(a)(3).

[48] *Id.* § 7411.

[49] *Id.* § 7470.

[50] *Id.* § 7412.

[51] *Id.* § 7661.

[52] *New Source Performance Standards*, U.S. ENV'T PROTECTION AGENCY, https://perma.cc/AW5H-FZYP (last updated Oct. 7, 2020).

EPA establishes the categories of stationary sources that, in its judgment, significantly contribute air pollution, which may be reasonably anticipated to endanger public health or welfare.[53] This Comment's proposed framework relies upon the NSPS program for the EPA's authority to regulate GHG emissions of stationary sources, specifically fossil-fuel electric generating facilities.

After identifying a stationary source, the EPA establishes standards of performance for the identified source. Standards of performance are "a standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of the *best system of emission reduction*."[54] When considering the best system of emission reduction (BSER), the EPA must take into account "the cost of achieving such reduction and any non-air quality health and environmental impact and energy requirements."[55] In addition, the technology or system of technologies must have been adequately demonstrated.[56] In other words, the emission standard that the EPA promulgates based on the BSER must be technologically feasible.[57]

While the EPA cannot require a *specific* technology be used to achieve the BSER, it may establish a standard of performance based on available technologies, including patented technologies.[58] For example, the EPA may consider currently patented carbon-capture technologies which have demonstrated the potential to be operational on a large-scale. Therefore, the EPA can consider carbon-capture as part of a larger CCS project as a BSER when the EPA promulgates an NSPS.[59]

With this background of the EPA's NSPS program for regulating emissions from stationary sources, the next section presents how the CAA regulates GHGs.

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[53] 42 U.S.C. § 7411(b).

[54] *Id.* § 7411(a) (emphasis added).

[55] *Id.*

[56] *Id.*

[57] CPP, 80 Fed. Reg. 64,510, 64,538 (Oct. 23, 2015) (codified at 40 C.F.R. pt. 60) ("an 'adequately demonstrated' system, according to the D.C. Circuit, is 'one which has been shown to be reasonably reliable, reasonably efficient, and which can reasonably be expected to serve the interests of pollution control without becoming exorbitantly costly in an economic or environmental way'" (quoting Essex Chem. Corp. v. Ruckelshaus, 486 F.2d 427, 433 (D.C. Cir. 1973)). It does not mean that the system 'must be in actual routine use somewhere.' Rather, the Court has said, '[t]he Administrator may make a projection based on existing technology, though that projection is subject to the restraints of reasonableness and cannot be based on 'crystal ball' inquiry.'") (citing and quoting Portland Cement Ass'n v. Ruckelshaus, 486 F.2d 375, 391 (D.C. Cir. 1973)).

[58] 42 U.S.C. § 7411(b)(5) and (h). *See* 80 Fed. Reg. 64,510, 64,527 (the EPA considers a variety of existing patented technologies in considering what technologies are adequately demonstrated and technologically feasible to achieve partial CCS).

[59] *See U.S. Department of Energy Announces $110M for Carbon Capture*, *supra* note 36 ("DOE's program has successfully deployed various large-scale [carbon capture, utilization, and storage (CCUS)] pilot and demonstration projects, and it is imperative to build upon these learnings to test, mature, and prove CCUS technologies at the commercial scale.").

2. Regulating GHGs of Stationary Sources

Up to this point in this Comment (and only since 2007 for the CAA), reference to pollutant in the CAA did not include GHGs. "Air pollutant" is broadly defined under the CAA as "any air pollution agent or combination of such agents, including any physical, chemical, biological, radioactive . . . substance or matter which is emitted into or otherwise enters the atmosphere."[60] It seems natural that this broad definition would encompass GHGs (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride),[61] putting them within the EPA's regulatory purview. However, even after several states, private organizations, and local governments petitioned the EPA to regulate GHGs, the EPA declined to exercise its authority and denied the petition for rulemaking.[62] This led to what many consider the most important environmental case ever decided.[63]

By declining the petition for rulemaking, it was up to the Supreme Court to decide if GHGs were an air pollutant. In *Massachusetts v. EPA.,* when considering the EPA's argument for declining to regulate GHGs, the Court recognized the high level of deference that is typically afforded to an agency when it denies a petition for rulemaking.[64] However, the Court concluded that the EPA had "refused to comply with [the] clear statutory command" when it declined to regulate GHGs as an air pollutant.[65] Consequently, the Court ordered the EPA to reconsider its denial of the petition for rulemaking for regulating GHGs.[66]

Following *Massachusetts v. EPA,* the EPA issued its "Endangerment Finding," which concluded that the six GHGs did fall under the CAA's broad definition of an air pollutant because "they are 'without a doubt' physical chemical substances emitted into the ambient air."[67] Furthermore, the EPA concluded that the GHGs were "reasonably anticipated to endanger public health and welfare."[68] Because of the *Massachusetts v. EPA* decision and the issuance of the Endangerment Finding, the EPA may promulgate regulations to limit GHG emissions under its existing permitting programs, including the NSPS. This authority allows the EPA to promulgate regulations to reduce GHGs, including carbon dioxide from stationary sources such as fossil-fuel electricity generators, which is the first step of this proposed framework.

60 42 U.S.C. § 7602(g).

61 Endangerment Finding for GHGs, 74 Fed. Reg. 66,496, 66,497 (Dec. 15, 2009) [hereinafter Endangerment Finding].

62 Massachusetts v. U.S. Env't Prot. Agency (*Mass. v. EPA*), 549 U.S. 497, 505 (2007).

63 *See id.*

64 *Id.* at 527.

65 *Id.* at 533.

66 *Id.* at 535.

67 74 Fed. Reg. 66,496, 66,510 (citing *Mass. v. EPA*, 549 U.S. at 532).

68 *Id.* at 66,499.

C. Compulsory Licensing in the U.S.

The second component of the proposed framework is the EPA's invocation of its authority under the Mandatory Licensing provision of the CAA. Without the EPA invoking its authority, the proposed framework lacks the bite it needs. Mandatory licensing requires that the technologies necessary to achieve the reduced emissions limitations are made available to the regulated industry. Before presenting the EPA's argument for imposing mandatory licensing, this subpart provides background on the U.S. patent system and its experience with compulsory licensing.

1. General Overview of the U.S. Patent System

Just as real property has a "bundle of sticks" associated with the rights one has over their property, so too does intellectual property. Applying for and receiving a patent affords inventors the right to exclude others from practicing their patented inventions.[69] Through the right to exclude others, patent protection affords patent holders an opportunity to profit off of their investments.[70] The patentee has this right to exclude for a maximum term of twenty years from the date the patent application is filed.[71] During this time, there is no requirement for patent owners to use or employ the patented invention.[72] By not practicing the patent, the patent holder can limit the use of the technology by the public. But this does not provide them an opportunity to recoup the costs of research and development.[73] To generate profits, patentees may decide to license the patent for use by others for a royalty fee. This contractual arrangement is termed a voluntary license because the parties come to the table and agree upon a reasonable fee with no government or judicial intrusion. A licensing agreement is essentially a promise by the licensor that the licensor will not sue the licensee for use of the patented invention, assuming that the licensee conducts itself within the terms of the

[69] 35 U.S.C. § 271 (2018).

[70] Joseph A. Yosick, *Compulsory Patent Licensing for Efficient Use of Inventions*, 2001 U. ILL. L. REV. 1275, 1290 (2001).

[71] 35 U.S.C. § 154(a)(2).

[72] Marketa Trimble, *Patent Working Requirements: Historical and Comparative Perspectives*, 6 U.C. IRVINE L.R. 483, 484 (2016). In patent law, using or employing the patent is referred to as "working" the patent or "practicing" the patented invention.

[73] However, a patentee can profit by not practicing and excluding others from practicing the patented invention. For example, when the patent owner has an alternative improved widget that is related to an older patented widget and they refuse to license the improved widget to others. Through this nonuse of the improved widget, the patent owner is expanding the zone of exclusion for his patented invention by driving consumers toward the older patented widget. *See* Paul Gormley, *Compulsory Patent Licenses and Environmental Protection*, 7 TUL. ENV'T L.J. 131, 135 (1993) ("Instances where an inventor may reap economic benefits by withholding a license are not common, but they do exist. For example, it is beneficial to withhold the patent when the inventor uses the invention as a means to reduce costs to eliminate its competitors in the market.").

agreement.[74] On the other hand, mandatory licensing, or what is more commonly referred to as compulsory licensing, is government sanctioned use of a patented invention without permission from, but with compensation provided to, the patent owner.[75] There is no general compulsory licensing provision in the Patent Act, but several other statutes have compulsory licensing provisions.[76]

2. Compulsory Licensing and the U.S. Experience

Outside of the Patent Act, Congress has provided the government with limited authority to use a patent without the permission of the patent owner and provides compulsory licenses to—"alleviate health or safety needs,"[77] ensure national security,[78] and stop anticompetitive practices.[79] Despite the availability of compulsory licensing, these statutes have never been invoked by authorized agencies. Like the Court said in *Dawson v. Rohm*,[80] "compulsory licensing is a rarity in our patent system."[81] To justify the use of such an intrusion into IPRs, most compulsory licensing provisions are narrowly tailored to specific provisions which promote the public good.[82] In addition to government mandated licensing, equitable remedies provided through patent litigation are considered "judicially endorsed" compulsory licensing.[83] For example, as a remedy for patent misuse, a court may order reasonable royalty compulsory licensing.[84] Courts may also refuse to grant injunctions when doing so would be injurious to the public interest.[85] Furthermore, courts have denied affording the equitable remedy of injunctive relief to patent owners not practicing the patent.[86] While courts

74 *General Information Concerning Patents*, UNITED STATES PATENT AND TRADEMARK OFFICE (Oct. 2015), https://perma.cc/SN3E-ZLTA.

75 CRS, PATENTED INVENTIONS, *supra* note 14, at 1.

76 *Id.* at 6.

77 35 U.S.C § 203 (2018). The government may only exercise this authority if the patented invention is created under a funding agreement with a federal agency.

78 42 U.S.C. § 2183(b) (2018).

79 United States v. Nat'l Lead Co., 332 U.S. 319, 348 (1947).

80 448 U.S. 176 (1980).

81 *Id.* at 215.

82 Yosick, *supra* note 70, at 1279; CRS, PATENTED INVENTIONS, *supra* note 14, at 3.

83 Mark W. Lauroesch, *General Compulsory Patent Licensing in the United States: Good in Theory, But Not Necessary in Practice*, 6 SANTA CLARA HIGH TECH. L.J. 41, 44 (1990).

84 *Nat'l Lead Co.*, 332 U.S. at 348.

85 *See* Vitamin Technologists v. Wisconsin Alumni Research Found., 146 F.2d 941, 944 (9th Cir. 1944) ("[I]t is not the private use but 'the public interest which is dominant in the patent system.'") (quoting Mercoid Corp. v. Mid-Continent Inv. Co., 320 U.S. 661, 665 (1944)). *See also* Z4 Techs., Inc. v. Microsoft Corp., 434 F. Supp. 2d 437, 443–44 (E.D. Tex. 2006) ("[I]t is likely that any minor disruption to the distribution of the products in question could occur and would have an effect on the public due to the public's undisputed and enormous reliance on these products.").

86 Lauroesch, *supra* note 83, at 49–50. *See also* Foster v. Am. Mach. & Foundry Co., 492 F.2d 1317, 1319 (2d Cir. 1974) (court imposes compulsory licensing for patent that plaintiff

have recommended the use of compulsory licensing to address patents rights used contrary to the public interest, compulsory licensing has typically only been used to a limited extent to address anticompetitive behavior.[87] Part IV of this Comment dives deeper into how the use of compulsory licensing will deter anticompetitive behavior specific to patented carbon-capture technologies.

Currently, there is no general compulsory licensing provision under the Patent Act and it is unlikely the Act will ever be amended to include one. Despite there being no general compulsory licensing provision, there are several statutory compulsory licensing provisions enacted into law relating to energy and environmental technologies. Compulsory licensing statutes exist in the CAA,[88] the Energy Storage Competitiveness Act (ESCA),[89] the Atomic Energy Act,[90] and the government's reserved march-in-rights for federally funded projects.[91] Under the ESCA, the government reserves the right to require research participants of a government-funded energy storage research center to enter into nonexclusive licensing agreements.[92] The ESCA aims to "advance the capability of the United States to successfully compete in global energy storage markets."[93] The Atomic Energy Act allows for the licensing of patents that contain a technology necessary for the utilization of "special nuclear material or atomic energy."[94] The purpose of this provision is to "[t]o encourage widespread participation in the development and utilization of atomic energy for peaceful purposes."[95] To date, none of the compulsory licensing or march-in-right provisions have been successfully exercised,[96] including the provision of most concern to this Comment, mandatory licensing under the CAA. [97]

3. CAA Mandatory Licensing Provision

While drafting the 1970 CAA amendments, Congress recognized the scope of the emissions standards it was proposing would require new

had "never engaged in any manufacturing or other business connected with the patent in suit.").

87 Yosick, *supra* note 70, at 1284.

88 CAA, 42 U.S.C § 7608 (2018).

89 United States Energy Storage Competitiveness Act of 2007, 42 U.S.C § 17231 (2018).

90 Atomic Energy Act of 1954, 42 U.S.C. § 2183(c) (2018).

91 Bayh-Dole Act, 35 U.S.C § 203 (2018).

92 42 U.S.C § 17231(h)(7).

93 *Id.* § 17231(h)(7)(C).

94 *Id.* § 2183(c).

95 *Id.* § 2013(d).

96 CRS, PATENTED INVENTIONS, *supra* note 14, at 8. Under the Bayh-Dole Act (35 U.S.C § 203), there have been several unsuccessful petitions to the National Institute of Health (NIH) all regarding the manufacturing of pharmaceuticals; NIH did not act on any of the petitions. *See* Anthony D. So et al., *Is Bayh-Dole Good for Developing Countries? Lessons from the US Experience*, 6 PLOS BIOLOGY 2078, 2081 (2008).

97 CRS, PATENTED INVENTIONS, *supra* note 14, at 7–8.

devices and techniques be developed.[98] The intent of the Mandatory Licensing provision was to "guarantee [that] all producers in a given field [would have] adequate supply of technology . . . to meet the statutory obligations . . . imposed by the bill."[99] Specifically, the Senate was concerned that smaller facilities with limited resources would potentially be foreclosed from acquiring the technologies needed to meet the standards, thereby creating competitive disadvantages in the marketplace.[100] In addition, industry voiced its concern that it would otherwise be unable to meet the amendments of the CAA because of a "lack of technological capability."[101] Initially, the Senate version of the Mandatory Licensing provision subjected not only patents, but also trade secrets and "know-how" of pollution control devices, to the potential of compulsory licensing.[102] Due to the overbreadth of the provision and concerns about the workability of compelling trade secret and know-how licensure,[103] mandatory licensing was ultimately applied only to patented technologies.[104]

In 1994, the EPA issued a notice in the Federal Register establishing regulations that the EPA must follow when exercising its mandatory licensing authority.[105] The regulations were promulgated to bring the statute into accordance with provisions on compulsory licensing in the North American Free Trade Agreement (NAFTA).[106] The regulations prescribe how a party that is subject to the NSPS emission requirements may petition the EPA administrator for a mandatory license.[107] The regulated party's petition argues why access to the patented invention is necessary to achieve the NSPS emission standard, and therefore, why issuing a mandatory license would be appropriate.[108] Despite some scholarship discussing the potential impact of mandatory licensing published shortly after the Mandatory Licensing provision was enacted and around the time of the NAFTA related regulations,[109] the Mandatory

98 Clean Air Act Amendments of 1970, Pub. L. No. 97-604, § 308, 84 Stat. 1676 (codified as amended at 42 U.S.C. § 7401) *reprinted in* ENV'T POLICY DIV., *supra* note 16, at 442 (1974).

99 *Id.*

100 *Id.*

101 *Id.* at 443.

102 *Id.*

103 *Id.* at 339.

104 CAA, 42 U.S.C § 7608 (2018).

105 Mandatory Patent Licenses Under Section 308 of the Clean Air Act, 59 Fed. Reg. 67,636 (Dec. 30, 1994) (codified at 40 C.F.R. pt. 95).

106 *Id.* at 67,636. During notice-and-comment, the EPA received three comments; each was only concerned with the Mandatory Licensing provision being used to require licensing of technologies that are only marginally related to reducing air pollution. *Id.* at 67,637.

107 Mandatory Patent Licenses, 40 C.F.R. § 95.2 (2020).

108 *Id.*

109 *See* Gormley, *supra* note 73, at 140–41 (claiming criticisms that the mandatory license provision would reduce "incentive to innovate in the field of pollution control technology" were unfounded); Jeffry C. Gerber & Peter W. Kitson, *Compulsory Licensing of Patents Under the Clean Air Act of 1970*, 54 J. PAT. OFF. SOC'Y 650, 653–54 (1972) (stating by adopting the provision, "Congress has . . . diminished the incentives for procuring new

Licensing provision has been a sleeping giant. The EPA has not been vocal on why it has not leveraged its authority under this statute. Most likely the agency has been hesitant to utilize the statute because of negative views associated with compulsory licensing, the lack of evidence demonstrating the success of compulsory licensing in the U.S., or because the mere existence of the provision encourages parties to agree to licensing on their own terms.[110]

Part III presents the argument for finally waking the sleeping giant—invoking the Mandatory Licensing provision to provide economical access to the technologies necessary for industry to achieve aggressive but necessary reductions in carbon dioxide emissions.

III. THE EPA EXERCISES ITS FULL AUTHORITY—EMISSION REDUCTIONS AND INVOKING MANDATORY LICENSING

With background on the current barriers facing large-scale deployment of CCS technologies, the CAA's NSPS program, and compulsory licensing in the U.S., Part III presents how the EPA would carry out the proposed two-step framework. This Part presents the EPA's pathway for establishing emission reduction standards for stationary sources, followed by the arguments supporting a decision to invoke the CAA's Mandatory Licensing provision, and concludes with arguments for disarming industry's potential challenges to the proposed framework.

A. Step One: The EPA Promulgates an NSPS Based on Carbon-Capture Technology

Key to invoking its mandatory licensing authority, the EPA should reduce carbon dioxide emissions thresholds through the promulgation of an NSPS for fossil-fuel electricity generating units. Armed with the scientific information of the effects carbon dioxide emissions, the current state of carbon-capture technologies, and the explicit authority to revise emission limitations,[111] the EPA should establish a substantially low threshold for carbon dioxide emissions. The Mandatory Licensing provision cannot reasonably be invoked without significant reduction in the emissions threshold because there currently are *no* carbon dioxide emission standards for fossil-fuel electricity generating plants. With no emission standard to be achieved, there is no driver for implementation

patents in this area of technology."); Warren F. Schwartz, *Mandatory Patent Licensing of Air Pollution Control Technology*, 57 VA. L. REV. 719, 726 (1971) (analyzing "the problems that emerge from" the mandatory licensing provision).

110 *See* Yosick, *supra* note 70, at 1277–78 ("The U.S. patent system has generally been hostile toward the practice of compulsory licensing."); *id.* at 1279 ("Although there does not appear to have been any attempts to obtain a compulsory license under this provision, it is possible that it has persuaded parties to come to their own licensing agreements.").

111 CAA, 42 U.S.C. § 7411(d) (2018).

of the patented carbon-capture technologies and, therefore, no need to resort to the Mandatory Licensing provision.

The EPA should establish an NSPS for fossil-fuel electric generation plants for carbon dioxide emissions which reflects the ability of large-scale carbon-capture projects to achieve a steep reduction in carbon dioxide emissions. While the EPA cannot require a specific technology be used to achieve an emissions limitation,[112] a standard of performance can be based on available technology.[113] Under the authority of the "Standards of performance for new stationary sources," the EPA has authority to regulate stationary sources to achieve an emission standard through the use of a system of emission reduction.[114] In doing so, the EPA must consider "non-air quality health and environmental impacts and energy impacts" such as water and power usage to implement the technology, as well as the cost of achieving the revised emission reduction.[115] In considering cost, the EPA should assume that all patented technology will be available at an affordable price because the EPA has the power to force that affordable price through mandatory licensing.

The proposed framework focuses on fossil-fuel electric generating units (i.e. coal fired power plants and natural gas plants), as opposed to cement plants or waste incinerators as the stationary sources subject to the NSPS.[116] The NSPS will not be limited to coal fire power plants (the dirtiest emitters of the bunch) because researchers project that natural gas is likely to be the most widely-used fossil fuel for new construction of electricity-generating capacity through 2020 (along with renewable energy, nuclear power, and a limited amount of coal).[117]

This first step of the proposed framework—promulgating a regulation to reduce carbon dioxide emissions based on the implementation of carbon-capture technology—is not an entirely new idea. In 2015, the EPA successfully finalized a rule to reduce carbon dioxide from stationary sources—an NSPS for fossil-fuel electric generating units (and other fossil fuel–based units).[118] The NSPS required reduction of carbon dioxide emissions through the use of partial CCS (as opposed to full CCS which captures greater than ninety-percent

112 *Id.* § 7411(b).

113 *Id.* § 7411(a).

114 *Id.* § 7411(g).

115 *Id.*

116 The proposed framework focuses on fossil-fuel-electric-generating units because of the impact that regulating these stationary sources would have on the electricity grid to potentially transition to renewable resources more quickly. The proposed framework could also be applied to other fossil fuel–based sectors, such as automobiles, or significant GHG-emitting industries, like cement plants.

117 U.S. ENERGY INFO. ADMIN., DOE/EIA-0383(2013), ANNUAL ENERGY OUTLOOK 2013 WITH PROJECTIONS TO 2040, at 72 (2013). *See also As Coal and Nuclear Generating Capacity Retires, New Capacity Additions Come Largely from Natural Gas and Renewable Technologies*, U.S. ENERGY INFO. ADMIN. (Feb. 3, 2021), https://perma.cc/RGP7-5T6E.

118 CPP, Fed. Reg. 64,510, 64,510 (Oct. 23, 2015).

of carbon dioxide emissions).[119] The EPA rule is referred to as the Clean Power Plan (CPP).[120] In support of the final rule, the EPA prepared a Technical Support Document which concluded that partial CCS "has been adequately demonstrated; it is technically feasible; it can be implemented at reasonable costs; it provides meaningful emission reductions; and its implementation will serve to promote further development and deployment of the technology."[121] Unfortunately, and unsurprisingly, the Trump administration revoked the CPP and promulgated a much less stringent rule for regulation of power plants.[122]

In an ideal situation, the EPA promulgates a new rule similar to the CPP but takes the level of emission reduction one step further to *full* CCS which would achieve approximately ninety-percent reduction in carbon dioxide emissions.[123] The EPA should promulgate this rule with knowledge gained during preparation of the CPP and with the plan to impose mandatory licensing, if needed, to ensure that the rule achieves its full potential.

B. Step Two: The EPA Invokes the Mandatory Licensing Provision

Following the EPA's promulgation of revised standards of performance for applicable stationary sources, the stage is set for the EPA to invoke, or threaten to invoke, its authority for mandatory licensing of carbon-capture technologies. In brief, the Mandatory Licensing provision requires that each one of the following steps are met. First, the EPA finds the use of a specific patent is necessary to meet emissions standards set by the New Source Performance section of the CAA.[124] Second, the patented technology is not otherwise available to the potential licensee and there is no other *reasonable* alternative means to achieve the reduced emissions levels.[125] Third**,** if the courts were to deny the request for licensing, this denial would create a lessening of competition of the regulated industry.[126] Each of these steps are explored below.

First, because the proposed EPA regulations for reduction of carbon dioxide would be based on the evaluation of carbon-capture technologies that have already been patented, there is a direct connection between the emission limitations and the patents at issue. Therefore, access to the specific patents would be necessary to meet emission standards. To trigger the first step, a regulated entity, who is subject to the emission

119 *Id.* at 64,512–13.

120 *Id.* at 64,524.

121 OFF. OF AIR & RADIATION, U.S. ENV'T PROTECTION AGENCY, GREENHOUSE GAS MITIGATION MEASURES 5-1 (2015).

122 Umair Irfan, *Trump's EPA Just Replaced Obama's Signature Climate Policy with a Much Weaker Rule*, VOX (June 19, 2019), https://perma.cc/N8NX-DAUE.

123 *Carbon Capture,* CTR. FOR CLIMATE & ENERGY SOLUTIONS, https://perma.cc/RG7L-R55Y (last visited Dec. 3, 2020).

124 CAA, 42 U.S.C. § 7608 (2018).

125 *Id.*

126 *Id.*

requirements and needs access to the patent, must petition the EPA stating that access to the patent is necessary to achieve the requirements.[127] When an entity petitions the EPA to impose mandatory licensing, they provide information on the need and intended use of the requested patent, including efforts to obtain a license from the patent holder prior to petitioning the EPA.[128] The inability of the petitioner to obtain a reasonable license prior to resorting to the EPA assistance is both a necessary showing and strong support that government intrusion is necessary.

Second, accessing these technologies without a license will be difficult because they are neither manufactured on a large-scale nor in widespread use. Access to these technologies will also be difficult because of the limited number of patents for carbon-capture technologies and the fact that patents are held by a handful of companies, many of which will also be regulated by the emission standards.[129] With no large-scale manufacturing of carbon-capture technologies, or agreement to license the EPA can justify requiring mandatory licensing of the patent because the patented technology is not otherwise available to the potential licensee *and,* as was established under the first step, the patented technology is necessary to achieve the emission standard.

Furthermore, the second step of the Mandatory Licensing provision is also concerned with *reasonable* alternatives. To date, carbon-capture technologies are the premier technology to address carbon dioxide capture and removal from post-combustion flue gas.[130] If alternative technologies exist, they may be considered reasonable depending on the stage of development and technical feasibility. The EPA has previously suggested that for fossil-fuel plants to meet an emission standard, an alternative to a technology is the use of an alternative fuel, or fuel-switching.[131] Because of the significant retrofitting that is necessary for a plant to operate off of a different fuel, fuel switching is not considered a *reasonable* alternative. Previously, the EPA has attempted to require fuel switching as a proposal for BSER.[132] However, the courts have held that fuel switching is not an acceptable BSER because fuel switching redefines the proposed construction to such a degree that the plant becomes a completely different creature from its initial conception.[133] For this reason, it is unlikely that a permittee petitioning the EPA for mandatory licensing of a technology or the EPA would consider fuel-switching as a reasonable

127 Mandatory Patent Licenses, 40 C.F.R. § 95 (2020).

128 *Id.*

129 LEE ET AL., *supra* note 10, at 39.

130 INTERAGENCY TASK FORCE, *supra* note 9, at 7.

131 *See* Sierra Club v. U.S. Env't Prot. Agency, 499 F.3d 653, 657 (7th Cir. 2007) (EPA may consider alternative fuels as part best available control technology, but it cannot "redefine the fundamental purpose or basic design of its proposed Facility" (internal quotations omitted)).

132 *Id.*

133 *Id.*

alternative to pursuing a mandatory license of the patented technology to achieve the BSER.

Finally, if a court were to deny the request for mandatory licensing of a patent, the denial of access could result in shutting down of facilities, which consequently would result in a lessening of competition in the marketplace. For environmentalists, this is an ideal outcome of the reduced emission standard. However, a significant decrease in competition with the shutting down of plants could result in reliability issues in the electricity grid and even greater monopolization of the electricity sector, which is not in the public interest. Therefore, in this instance it is likely that, without access to the BSER technology, companies that do not possess patents to necessary technologies will be unable to continue to operate to achieve the emissions standards. Consequently, these facilities will either need to pay inordinate amounts for access to a technology or shut down, resulting in a significant lessening of competition in the electricity sector. This last step, requiring a finding that denial of a mandatory license would result in significant lessening of competition in the marketplace, is especially important because of the potential for patent holders who are also regulated entities to practice anticompetitive behaviors. Part IV evaluates how mandatory licensing may overcome anticompetitive behaviors of patent holders in this category (i.e. those patent holders who are also regulated entities).

C. Anticipated Challenges from Regulated Entities

The EPA often finds itself in court after promulgation of a regulation, especially regulations regarding the fossil-fuel industry.[134] It is likely that the EPA would again find itself in court defending the proposed NSPS, specifically in regard to the BSER based on full CCS. When determining the final BSER, the EPA considers the technical feasibility of the technology, the cost that the facility will incur for operation of the BSER, the reasonable emission reductions that the technology will provide, and "the [p]romotion of [t]echnology and [o]ther [s]ystem of [e]mission [r]eduction."[135] Following promulgation of the regulation, the new or existing stationary sources are required to implement the necessary BSER technologies to meet the permitting standards. If technologies are commercially manufactured and can be obtained for a reasonable price, the permittee will be able to utilize the technology and meet the permitting requirements. This scenario would not require the EPA to get involved in the transaction and mandate licensing of the necessary technology. However, if large-scale manufacturing of the necessary carbon-capture technologies is not available, the permittee will need to approach the patent owner(s) and seek to engage in voluntary licensing.

134 Alex Kotch, *As GOP State Attorneys General Fight Environmental Regulations, Fossil Fuel Companies Bankroll Their Campaigns*, P.R. WATCH (Dec. 13, 2019), https://perma.cc/87CK-RLHG.

135 CPP, 80 Fed. Reg. 64,510, 64,599–64,600 (Oct. 23, 2015).

If voluntary licensing is unsuccessful, permittees can petition for the EPA's involvement, or challenge the EPA's BSER as being 1) inadequately demonstrated because it has not been widely used on a full-scale or 2) prohibitively costly. On both of these issues, precedent weighs in favor for the EPA to promulgate an NSPS with full CCS.

The first anticipated challenge from industry is that the EPA incorrectly considered full CCS as an adequate BSER because of the limited experience with full-scale operation. The EPA has broad discretion for selecting a technology despite only having been demonstrated on a pilot-scale level.[136] In *Sierra Club v. Costle*,[137] the EPA promulgated a rule for regulating emissions of sulfur dioxide from coal plants, which was challenged because the technology required by the rule had only at the time been demonstrated on a pilot-scale.[138] Based on analysis of data from pilot studies and supporting information from technology vendors, however, the EPA was confident that the technology would be successful if ramped up to large-scale.[139] The court found the EPA's decision to consider the potential for advancements in the technology from pilot to full-scale reasonable and in line with the purpose of the NSPS provisions of the CAA.[140] Specifically, the court noted that, in promulgating a rule that considered a new technology, the EPA could not consider "uncertain or unproven technolog[ies]" but it was within the EPA's discretion to consider new technologies in line with the CAA's intent to "create incentives for new technologies."[141] In light of *Sierra Club v. Costle,* the EPA is likely to prevail against a challenge that full CCS technology has not been adequately demonstrated because it is within the EPA's reasoned discretion to consider the potential of pilot-scale technologies for full-scale implementation.

The second anticipated challenge from industry to the proposed regulation is that the required BSER is too costly for implementation. Again, this would not be the first time that an EPA regulation was challenged on the grounds that it created a financially burdensome requirement on industry. Unfortunately for potential petitioners, precedent that is precisely on point with this challenge exists in favor of the EPA. In *Michigan v. EPA*,[142] the EPA considered costs to be irrelevant

136 *Id.* at 64,557 ("[D]ata from pilot-scale, or less than full-scale operation, can be shown to reasonably demonstrate performance at full-scale operation, although it is incumbent on the EPA to explain the necessary steps involved in scaling up a technology and how any obstacles may reasonably be surmounted when doing so.").

137 657 F.2d 298 (D.C. Cir. 1981).

138 *Id.* at 341. Since the promulgation of the CPP, there has been completion and operation of a full-scale CCS facility. *See Secretary Perry Celebrates Successful Completion of Petra Nova Carbon Capture Project*, DEP'T OF ENERGY (Apr. 13, 2017), https://perma.cc/GX9F-ET84.

139 *Costle*, 657 F.2d at 364.

140 *Id.*

141 *Id.* at 346 n.174, 347.

142 Michigan v. U.S. Env't Prot. Agency (*Michigan v. EPA*), 576 U.S. 743 (2015).

to the regulation of power plants.[143] The Court held that the EPA *must* consider cost before promulgating regulations.[144] However, the Court left the degree of consideration on how to account for cost in determining if a regulation was appropriate and necessary to the EPA's discretion.[145] Following the Court's directive, the EPA reevaluated the regulation of GHGs from fossil-fuel plants and considered technology options that would be reasonable in light of costs.[146] The EPA determined that full CCS was the BSER but did not proceed to develop the regulation around full CCS because the costs of that configuration exceeded the projected cost of other dispatchable technologies (such as partial CCS) and would therefore be unreasonable.[147]

Because this Comment's proposed framework utilizes full CCS to achieve steep carbon dioxide emission reductions, the EPA must consider the cost of full CCS. However, two key factors weigh in favor of the proposal despite potentially high costs. First, the EPA can rely on the Supreme Court precedent which established that it is within the EPA's discretion to determine what weight to give costs when determining the appropriate BSER.[148] Second, the EPA can rely upon the work that the Mandatory Licensing provision does as a cost control measure to push down the costs of these technologies. When faced with the potential use of mandatory licensing as a cost control measure, patent holders (who may also be regulated entities) may proactively provide the technologies at reasonable costs to avoid government intrusion.

IV. HOW THE PROPOSED FRAMEWORK WILL STIFLE ANTICOMPETITIVE BEHAVIOR

Part IV evaluates how mandatory licensing of carbon-capture technologies may deter or be used to overcome anticompetitive behavior by patent holders. This is especially important in relation to the proposed framework because many of the entities that will be regulated under the proposed emission standards also hold key patents to carbon-capture technology. Therefore, the use (or even the threat) of compulsory licensing has the potential to eliminate monopolistic behavior by patent holders of critical carbon-capture technology. For example, the threat of compulsory licensing may potentially encourage the formation of patent pools, which has occurred in the past after the threat of government intrusion.[149] Also,

143 *Id.* at 759.

144 *Id.* at 759.

145 *Id.*

146 CPP, 80 Fed. Reg. 64,510, 64,548 (Oct. 23, 2015).

147 *Id.*

148 *Michigan v. EPA*, 576 U.S. at 759.

149 *See* Trimble, *supra* note 72, at 501 (discussing the interplay between government regulation, patent pools, innovation, and competition). *See, e.g.*, Marco Poggio, *Carbon Capture: Will It Save the Climate, or the Fossil Fuel Industry?*, CLIMATE DOCKET (Mar. 13, 2019), https://perma.cc/2MES-QHZ2 (discussing Exxon's large number of carbon-capture patents to suppress the use of carbon-capture technologies and regulations); Suzanne

with the more stringent emissions standards in place by the EPA, regulated entities may not survive without compulsory licensing providing access to these necessary technologies. Part IV begins with analysis of how compulsory licensing has the potential to stop anticompetitive behavior, specifically non-working of patents and refusal to license.

A. Overcoming Anticompetitive Behavior

The possibility for anticompetitive behavior in the carbon-capture marketplace is high, considering that many of the entities that would be regulated under the proposed emission standard are also those that have patents to carbon-capture technologies and may wish to suppress access to these technologies. This subpart evaluates two potential avenues for patentees to practice anticompetitive behavior—non-working of a patent and a refusal to license—and how the invocation of compulsory licensing, or even the threat of invoking mandatory licensing, would discourage these practices.

1. Compulsory License in the Absence of a Working Requirement

Patent owners are afforded many IPRs under a patent, including the right to control how the patent is used.[150] This includes the option not to use or work the patented process or technology.[151] This inaction by the patentee does not put them in violation of the Patent Act because there is no requirement that a patent be worked or practiced after receipt of a patent. Furthermore, while this inaction is not expressly condoned by the courts, it alone is not sufficient to grant an injunction or a finding of anticompetitive behavior.[152] If an industry needs a technology and a patentee is not working a patent, compulsory licensing should be utilized to overcome the barrier to accessing the patented technology. Therefore, compulsory licensing can be used to fill the void created in the absence of a working requirement under the Patent Act.

The use of compulsory licensing would be especially valuable for forcing a patentee to work a patent in an area that is relatively new. Opponents of compulsory licensing believe it will reduce incentive for innovation and encourage inventors to maintain their knowledge as a trade secret rather than disclose through patents.[153] And while obtaining a patent requires sufficient disclosure so that a "person having ordinary

Goldenberg, *Oil Company Records from 1960s Reveal Patents to Reduce CO2 Emissions in Cars*, GUARDIAN (May 20, 2016), https://perma.cc/7DT3-MND8 (discussing Exxon creating patents to stifle innovation and prevent the use of carbon mitigation technology and regulation).

150 5 DONALD S. CHISUM, CHISUM ON PATENTS § 16.02 (2020) (discussing basic patent rights, including the right to exclude).

151 *Id.*

152 Trimble, *supra* note 72, at 505.

153 Yosick, *supra* note 70, at 1278.

skill in the art" may practice the patent, disclosure (without actual reduction to practice and use in the industry) of newer technologies, such as carbon capture, is not as useful as it is for more established technologies. Consequently, in areas of newer technology, innovation is *stifled* when there is no practicing of the technology, which allows innovators to understand how the technology works.[154] Especially in the case of newer technologies, compulsory licensing would actually support innovation by forcing the technology's real-world application, thereby allowing other innovators to improve upon the technology.

While the EPA has significant discretion in selecting a BSER, no existing precedent allows the EPA to establish regulations on the sole basis that a patent exists but has not been demonstrated to be technologically feasible, on even a very small scale. Therefore, the absence of a working requirement under the Patent Act jeopardizes the EPA's ability to regulate GHGs.[155] The Mandatory Licensing provision provides authority for the EPA to pursue mandatory licensing of patented technologies necessary to achieve emissions standards. Invocation of the provision does not require a showing that the patented technology has been adequately demonstrated.[156] However, to establish the emission standards in the first place, the technology used to achieve the standards must have been adequately demonstrated (i.e. worked and put into practice even in some small fashion).[157] If a technology has not been adequately demonstrated, it should not be considered by the EPA to be part of an emission reduction system.[158] In this instance, a general compulsory licensing provision under the Patent Act would help work technologies, show them to be technologically feasible, and ultimately allow the EPA to consider them as part of a BSER.

Opponents to compulsory licensing argue that it is unnecessary to invoke compulsory licensing to mitigate non-working of patents because inventors of useful inventions will want to recoup their investments and

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154 *See, e.g.*, Poggio, *supra* note 149 (discussing Exxon's large number of carbon-capture patents to suppress the use of carbon-capture technologies by not using the patented technology); Goldenberg, *supra* note 149 (discussing Exxon creating patents to stifle innovation by not using new carbon reducing technology).

155 Gormley, *supra* note 73, at 137 ("First . . . , these [compulsory] licenses make it possible for regulators, such as the [EPA], to mandate the use of technology protected by a patent. Absent the compulsory license, a polluter could validly claim that a certain required technology is not available. By using these licenses, however, the agency can insist that the polluter use a method or product which is patent-protected.").

156 *See* discussion *supra* Part III.B. The EPA could attempt to make the argument that even if a technology is not being worked or put into practice, that emissions standards can be established on the basis of a combination of academic literature, research data, and industry testimony. Promulgating emission standards based on patented technology that is not worked would allow the EPA to utilize mandatory licensing to overcome the absence of a working requirement in the Patent Act.

157 *See* discussion *supra* Part III.A.

158 *See* CPP, 80 Fed. Reg. 64,510, 64,554–58 (Oct. 23, 2015) (discussing consideration of factors for CCS to be considered a technologically feasible BSER).

will do so through working or licensing of the patent.[159] However, this argument fails to take into consideration that some entities *will not want* the patent to be put into use. When a patent is subject to use as part of an environmental regulation, its use would adequately demonstrate the patented material and make it readily available. Therefore, regulated entities would rather have these categories of patents suppressed in an attempt to avoid potential environmental regulation.

Patent suppression by fossil-fuel companies has already occurred, as discovered by state prosecutors.[160] The prosecutors were looking into whether fossil-fuel companies misled their investors by making statements dispelling climate change and the impacts that it would ultimately have on the companies' viability.[161] These investigations led to the discovery that these same companies patented carbon-capture technologies and never put them into use, suppressing them since the 1960's.[162]

The non-working of patented carbon-capture technology is already occurring, possibly to keep patented technologies from EPA consideration. For example, Exxon has the highest number of patented carbon-capture technologies and is funneling millions into research,[163] yet it does not operate any plant in the U.S. with large-scale carbon-capture. It is obvious that, with no regulatory driver to reduce carbon dioxide emissions and require the installation of carbon-capture technologies, industry will not utilize these technologies in the absence of a compliance threshold. The proposed framework provides a regulatory driver to implement the technologies. The emission threshold would deter patent suppression, and if not, then the second step of the framework—mandatory licensing—prevents suppression. Under the second step, the EPA would threaten to step in and require licensing of those technologies if industry was not willing to provide reasonable licenses to others in the industry.

2. A Tool to Encourage Voluntary Licensing

Refusal to license patents after the enactment of the new emission standards could have a detrimental effect on industry's ability to comply with the strict standards. Once emission standards are in effect, patentees could reasonably license their patents to other industry participants without government intrusion or proceed to practice monopolistic market power. A refusal to license a patent could mean a unilateral outright refusal, or that restrictions on the patent use are

159 Yosick, *supra* note 70, at 1294.

160 Smith, *supra* note 28.

161 *Id.*

162 *Id.*

163 Poggio, *supra* note 149; Goldenberg, *supra* note 149; *ExxonMobil Collaborates on Discovery of New Material to Enhance Carbon Capture Technology*, BUSINESSWIRE (July 24, 2020), https://perma.cc/D9MV-TJSS.

unreasonable or the price to license is so prohibitive that it equates to an outright refusal.[164]

In the U.S., a refusal to license typically will not lead to a finding of monopolization unless there is a finding that the refusal is completely unrelated to the patent.[165] It is unlikely that *court-mandated* compulsory licensing will be used to require licensing solely to address refusal to license or the use of monopolistic pricing. In *Verizon Communications v. Law Offices of Curtis V. Trinko,*[166] the Supreme Court emphasized that "[t]he opportunity to charge monopoly prices . . . induces risk taking that produces innovation and economic growth."[167] Furthermore, monopolistic power alone is not unlawful, but rather it needs to be "accompanied by an element of anticompetitive *conduct*."[168] However, the Court goes on to clarify that, while the right to refuse to license with other firms may be allowed, it "does not mean that the right is unqualified."[169] Because the threshold for finding anticompetitive behavior by a patentee is quite high, it may be necessary to resort to *statutorily authorized* compulsory licensing to overcome monopolistic behavior and establish reasonable and fair licensing agreements.

In addition to a refusal to license existing carbon-capture technologies, another opportunity exists for patent holders to further monopolize the market when existing patent holders build upon existing carbon-capture technologies. For example, companies are investing in research and development for scaling up and integrating carbon-capture into plant design, as opposed to retrofitting, and developing more integrated approaches to carbon-capture utilization.[170] The ability to build upon existing patented technologies with no willingness to license (or work) these technologies is troublesome because these improvements will result in new patents which will be valid for up to another twenty years, the critical time period necessary for deployment of technologies that reduce emissions contributing to climate change.[171]

Even though statutory compulsory licensing has never been invoked by the government, some individuals contemplate the threat of compulsory licensing when considering the cost of their innovation.[172]

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164 Kurt M. Saunders, *Patent Nonuse and the Role of Public Interest as a Deterrent to Technology Suppression*, 15 HARV. J.L. & TECH. 389, 419 n.188 (2002).

165 Michael A. Carrier, *An Antitrust Framework for Climate Change*, 9 NW. J. TECH. & INTELL. PROP. 513, 520 (2011).

166 540 U.S. 398 (2004).

167 *Id.* at 407.

168 *Id.*

169 *Id.* at 408 (quoting Aspen Skiing Co. v. Aspen Highlands Skiing Corp., 472 U.S. 585, 601 (1985)).

170 *See* Agence France-Presse, *ExxonMobil Launches Venture for Low-Cost Carbon Capture*, INDUSTRY WEEK (May 5, 2016) https://perma.cc/YC4L-8AP9 (stating that ExxonMobil is researching the potential to utilize captured carbon for use in fuel cells to generate additional energy).

171 LEE ET AL., *supra* note 10, at 41.

172 Gormley, *supra* note 73, at 147 ("[It] found that the mandatory licensing provision did have an effect on one type of decision made by companies involved with innovation in the

Their concern is that the government will step in before they can recoup their research and development costs. The potential negative effect of compulsory licensing on the incentives for innovation could be outweighed by the positive impact on innovation for an industry as a whole, particularly in the context of climate change action.[173] The potential threat of compulsory licensing alone may be enough to encourage entities to license on more flexible terms to avoid governmental intrusion.[174]

B. Potential for Patentees to Take Control of the Marketplace

Technology-based statutes, such as the CAA, provide a marketplace for innovators to profit on their inventions and recuperate investments, especially when the regulated industry heavily relies on the technology to achieve the regulated standards. If the EPA's prospective emissions limitations are established, patentees and regulated entities would potentially be more willing to engage in voluntary licensing on their own terms because of the threat of compulsory licensing. It is in the patent holders' best interests to take control of the carbon-capture marketplace to avoid government intrusion.

One way patent owners can exploit the marketplace is to participate in patent pools. Patent pools have been associated with anticompetitive behavior, but they have also been encouraged when a handful of entities hold critical patents to a larger component that is necessary for the greater good and in need of rapid deployment.[175] While patent pools have traditionally been labeled anticompetitive, when they are used for a focused effort in a highly specific field, they can beneficially provide technology to an industry at reasonable fees. For example, in the 1910s, as the U.S. was entering World War I, two companies had patents to vital

pollution control market. The affected decision was the determination as to whether to invest resources into a particular idea.").

173 The positive impact of compulsory licensing on society (e.g., technologies available for climate change efforts) may result in potentially less incentives to inventors. With weaker patent protection, where is the positive impact on innovation? While stricter emissions regulations will create a new marketplace for green technologies, companies may need to make a policy choice because they will not be able to recoup as much R&D costs with less control on their inventions. This has the potential to spiral into further negative effects on R&D and better technologies. *See id.* at 146 ("In order to encourage invention it is necessary to allow inventors the freedom to exercise their property rights as they wish. The exercise of these rights includes the right to withhold the patented material from the competition. But this position presents particularly pressing conflicts in the area of federal environmental policy, such as a serious concern that patent rights may inhibit the attainment of air quality standards. Companies holding monopolies on technology which prevents or reduces air pollution have the incentive, and the ability, to seriously retard progress toward cleaner air.").

174 *See* Beatrice Stirner & Harry Thangaraj, *Learning from Practice: Compulsory Licensing Cases and Access to Medicines*, 2 PHARMACEUTICAL PAT. ANALYST 195, 195 (2013) ("Brazil successfully employed the threat of compulsory license as a negotiation tool to receive substantial price reductions on patented pharmaceutical products.").

175 Steven C. Carlson, *Patent Pools and the Antitrust Dilemma*, 16 YALE J. ON REG. 359, 368, 383 (1999).

components of airplanes.[176] The two parties refused to cooperate with each other, so at the pressure of the government, which needed to ramp up manufacturing of airplanes, the patent owners formed a patent pool.[177] The patent pool was not only a means of pre-litigation negotiation but also helped to rapidly deploy a necessary technology. By coming to an agreement on their own terms, the patent holders were able to take control of the market and avoid government-forced licensing.

Encouraging developments in the area of patented green technology indicate companies may be more willing than previously thought to participate in a sharing economy rather than be forced into patent licensing. For instance, some companies may have one patented technology that is part of a larger system. In that case, the best way to recoup investments is to participate in a patent pool with other complementary patents.[178] This concept could be especially important when a newer technology has only been successfully proven at pilot-scale, such as carbon-capture technology. Because carbon-capture technology is not just one process or technology, but rather a suite of patents, the use of patent pools for these complementary patents would be *procompetitive* and facilitate accelerated sharing of technology.[179]

The concept of patent pools is not new but has taken on new forms in the climate change setting for environmentally based patents, including the Eco-Patent Commons[180] and Green Xchange patent pools.[181] Both patent pools are comprised of complementary, rather than substitute, patents.[182] The "green technology" patent pools are not anticompetitive but are procompetitive because they increase innovation by creating a commons for innovators to access and share information. In obtaining access to technologies, innovators can focus their efforts on improving upon the existing technologies or making other complementary patents. Furthermore, complementary patent pools accelerate technology sharing and create an environment of procompetitive behavior. The establishment of complementary patent pools for carbon-capture technologies would facilitate the creation of reasonable licensing agreements. Consequently, this would negate the EPA's need to impose mandatory licensing, which may not be a bad thing. Ultimately, it would

176 *Id.* at 368–69.

177 *Id.*

178 *Id.* at 364–65 ("Complementary patents result when different inventors independently patent different components of a larger invention.").

179 *Id.* at 377.

180 Jo Bowman, *The Eco-Patent Commons: Caring Through Sharing*, WIPO MAG. (June 2009), https://perma.cc/2SJ8-8XXH.

181 Michael A. Carrier, *Antitrust and Climate Change*, *in* RESEARCH HANDBOOK ON INTELLECTUAL PROPERTY AND CLIMATE CHANGE 253, 263–64 (Joshua D. Sarnoff ed., 2016).

182 Patent pools comprised of substitute patents present anticompetitive harms because the patent pools include patents that are not necessary for the use of the other patents in the pools. These patent pools comprised of substitute patents "present alternate ways of creating products that otherwise would be used in competition with each other." *Id.* at 262, 264.

be optimal for the regulated entities and patent holders to take control of the marketplace without government intrusion.

C. Effect on Industry to Survive When Technology Standards Are Stringent

If the marketplace does not react in a procompetitive fashion through voluntary licensing and patent pools, the combination of strict carbon dioxide emission standards and limited access to the necessary technologies will force regulated entities to consider the most economical path forward. In some cases, this may result in plant shutdowns, creating reliability issues in the electricity grid or an accelerated transition to renewable energy. The availability of technology at a reasonable price will be especially important to plants that are inefficient, those with limited remaining life, those that are smaller or with few existing environmental controls, and plants that operate very low capacity factors. This "forced" shutdown of plants almost played out after the EPA passed its most stringent technology driven emission standards, the Mercury and Air Toxics Standards (MATS).[183] The impact on reducing emissions was substantial, and despite strict emission standards, technologies were available, and industry took only a small hit.[184] The effects of MATS on the regulated industry highlights some potential issues that the EPA mandatory licensing helps resolve.

In 2013, EPA finalized the MATS emission standard to reduce mercury and other toxic air emissions from coal and oil-fired power plants.[185] The final rule required a reduction of mercury emissions from coal fired power plants by ninety-percent.[186] This is a significant percentage in reduction of emissions considering approximately forty-percent of plants at the time did not have any advanced pollution control equipment in place.[187] The fossil-fuel electric generation industry fought the rule, concerned with the substantial cost associated with compliance and installation of equipment which would result in a significant number of plant closures.[188] However, between 2014 and early 2016, fewer than ten-percent of coal based plants shut down.[189] Many of the plants that retired were coal-fired power plants, which were considered older and inefficient and were already facing low profit margins because of the cost competitiveness of natural gas.[190]

183 Mercury and Air Toxics Standards, 78 Fed. Reg. 24,073 (Apr. 24, 2013) (codified at 40 C.F.R. pt. 60 and 63); Sonal Patel, *How Did MATS Affect U.S. Coal Generation?*, POWER MAG. (Oct. 4, 2018), https://perma.cc/CQ2D-CUPB.

184 Patel, *supra* note 183.

185 78 Fed. Reg. 24,073.

186 *Mercury and Air Toxics Standards*, ENV'T PROTECTION AGENCY, https://perma.cc/47UV-J48L (last updated Oct. 23, 2020).

187 *Id.*

188 Patel, *supra* note 183.

189 *Id.*

190 *See id.*

The implementation of MATS resulted in an approximately eighty-five percent overall decrease in mercury emissions and only a small percentage of plant closures.[191] The significant reduction in emissions can be attributed to coal-based facilities retrofitting to install pollution control equipment or changing to operate off of "cleaner" natural gas.[192] But the majority of regulated plants utilized new and existing pollution-control devices that provided the co-benefits of mercury and other pollutant removal, with the majority relying upon one particular technology: activated carbon injection (ACI).[193] Interestingly, at the time, ACI technology had not been widely demonstrated for scaled-up use.[194] The regulated industry and technology developers identified the best technology that was available at a pilot-scale, scaled it up to full, and made the technology work to meet emission standards.[195]

So, what does the implementation of MATS foreshadow for a strict carbon dioxide emission reduction that heavily relies upon limited technologies? First, without access to technology via voluntary or mandatory licensing, implementation of stricter emissions standards may result in closures of the most inefficient plants because of the significant costs of both obtaining the technology and operating an inefficient plant. This is certainly a plus for environmentalists hoping to accelerate the shutdown of fossil fuel-based plants. Even with mandatory licensing requiring reasonable licensing fees for these technologies, facilities may weigh the cost of retrofitting to the long-term operation of the plant and decide to retire—a plus for reducing carbon dioxide emissions.

Second, the majority of facilities retrofitting to comply with MATS relied upon one technology.[196] This is especially important because it shows that once a technology is proven to be effective and economically viable, there is a serious potential for monopolization of the technology by the patent owner. The threat of compulsory licensing mitigates the potential for a company to practice monopolistic behavior. On the other hand, when a rule is proposed, the innovators may view it as an opportunity to develop or improve upon technologies that will be utilized.[197] This will help the market participants take control of the

191 *Id.*

192 *See id.*

193 Sheila Glesmann & Chethan Acharya, *MATS and Beyond: The Role of Technology Choices in Present and Future Coal Plant Compliance*, POWER ENGINEERING (Nov. 17, 2016), https://perma.cc/2YNV-LEYJ.

194 Jon Norman, *DSI-ACI Technology for MATS Compliance*, POWER ENGINEERING (Jan. 20, 2014), https://perma.cc/5D4P-Y5S9.

195 *See id.*

196 *Id.* Approximately 83 percent of facilities used activated carbon injection (ACI). *Id.* ACI technologies have the shortest construction lead time and the lowest installation cost of the compliance control technologies. *Id.*

197 *See* Adam Pratt, *Alstom Secures Patent for Injection Methodology to Enhance Mercury Removal,* ALSTOM (June 20, 2012), https://perma.cc/88RC-42P4 (showing technology developer seizes on opportunity to patent technology that would be used for the prospective MATS regulation).

market, leaving the EPA to wait in the wings to break up anticompetitive behavior, when and if needed.

V. CONCLUSION

In the absence of a comprehensive climate change policy, it is incumbent upon the agency charged with the nation's environmental protection to take aggressive steps toward mitigation of carbon dioxide emissions. Because of the strong connection between technology and environmental protection, it is inevitable that the patent system and its anticompetitive nature are harmful to achieving climate change goals. A compulsory licensing amendment to the Patent Act specific to green technologies may be the answer to facilitating reasonable access to environmentally beneficial technologies. In the meantime, and considering the challenges of passing comprehensive climate-related legislation, the EPA should promulgate regulations which tighten carbon dioxide emission standards, backed by the potential to invoke the Mandatory Licensing provision. The proposed framework has the potential to significantly decrease carbon dioxide emissions, and it may accelerate a transition to 100% renewable energy when inefficient plants shutdown rather than install costly emission technologies.