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The purpose of the *Texas Environmental Law Journal* is to provide members of the Environmental and Natural Resources Law Section of the State Bar of Texas and the public with legal articles and recent development columns on relevant environmental and natural resources law issues. The *Journal* also provides new of Section activities and other events pertaining to this area of law. The *Journal* is the leading source for articles on Texas environmental and natural resources law.

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The *Texas is an official publication of the Environmental and Natural Resources Law Section of the State Bar of Texas and is published jointly with the University of Texas School of Law's Texas Environmental Law Journal*. In 1990, the Environmental and Natural Resources Law Section reached an agreement with this student organization at the University of Texas School of Law to co-produce the *Journal* as the *Texas Environmental Law Journal*. The students' involvement began with the summer issue in 1990.

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Introduction to TELJ Special Edition: Climate Change and Energy Transition

As this special edition of the Texas Environmental Law Journal was being developed, the United Nations hosted the 26th Conference of the Parties (COP26), the U.N.'s Climate Change Conference. In the words of the COP26 organizers, "[w]e cannot afford to wait to act against the threat of climate change. We must work together to protect our planet and people and ensure a greener, more resilient future for us all."[1] Addressing the challenges of climate change and the transition to a low carbon energy future present a huge variety of multi-faceted and immensely complex problems. These challenges will touch virtually every aspect of the economy and society and require 'all hands on deck' to successfully navigate them. Albert Einstein reportedly once quipped that, "[w]e cannot solve our problems with the same thinking we used when we created them." This special edition of Texas Environmental Law Journal along with a symposium held in Austin, Texas on April 14, 2022 were developed together to promote and highlight new ideas, approaches, solutions and scholarship about climate and energy transition – to highlight the new different thinking we need to solve these problems.

On behalf of the Environmental and Natural Resources Law Section (ENRLS) of the State Bar of Texas, I would like to thank those who made this special edition possible. First, our authors. We were very fortunate to receive submissions across a swath of topics that help illustrate the scope of the climate and energy transition challenge. We very much appreciate the time, effort and scholarship of those who dedicated the time to writing on this vital them. Next, we are deeply indebted to the editors of TELJ for taking on this special edition and adding to an already full publication schedule. These dedicated and talented students are a vital link in developing and spreading the new thinking the world needs.

I also want to thank those that have so far committed to providing financial support the symposium and this special edition: Pillsbury Winthrop Shaw Pittman LLP, Miller Nash LLP, Lloyd Gosselink Rochelle & Townsend, P.C., Liskow & Lewis, APLC, Beveridge & Diamond PC, Arnold & Porter Kaye Scholer LLP, and BP America, Inc. And last but certainly not least, the membership of ENRLS whose participation in the section has made possible the decades long partnership with TELJ that produces this journal.

We are grateful for the opportunity to contribute to this important discussion and hope this will be the only the first of many such contributions from TELJ and ENRLS.

Sincerely,

Nathan Block
Chair, Texas Environmental and Natural Resources Law Section

1 Together for Our Planet - Together For Our Planet (ukcop26.org)

Redeveloping Brownfields and Other Contaminated Sites for Renewable Energy Projects: Benefits and Liability Protections

Katelyn J. Fulton

I. Introduction

There is no doubt that the United States is "going green"—both federal and state governments have passed laws, created incentive programs, and set lofty renewable goals in recent years that have accelerated the renewables industry from crawling towards prominence in the energy market to a full-on sprint. Today, the demand for renewable energy is growing at an exponential rate.[1] Nevertheless, many logistical challenges remain if renewable energy developers are to meet this demand, and chief among them is the question of where these renewable energy projects will be located.

One approach—using brownfields and other contaminated lands for project siting—may be the solution. Contaminated sites offer otherwise unusable land, often with infra-

1 Joel Jaeger, *Explaining the Exponential Growth of Renewable Energy*, World Res. Inst. (Sept. 20, 2021), https://www.wri.org/insights/growth-renewable-energy-sector-explained.

structure already installed, for renewable energy developers to build these projects.[2] In return, renewable energy projects on contaminated lands economically benefit surrounding communities and have a positive effect on the environment.[3] According to the Environmental Protection Agency (EPA), as of December 2020 there were 417 renewable energy installations sited on 390 contaminated sites in the United States, with a total capacity of 1,710.2 megawatts.[4] As of 2018, EPA had identified over 114,000 contaminated sites (including sites governed by brownfields, Superfund, the Resource Conservation and Recovery Act (RCRA), and state programs) with renewable energy potential.[5] State and federal regulators have already recognized the benefits to stakeholders of using contaminated sites for renewable development and have created incentive programs to encourage renewable energy developers to site projects on contaminated lands.[6] Still, a key issue remains for developers seeking to redevelop contaminated sites—how to best protect themselves from strict liability generally associated with owning or operating on these contaminated properties.

This paper proceeds in three main parts. First, it provides an overview of what brownfield lands are, how they can be used for renewable energy project siting, examples of current government incentives for brownfield development, and the benefits associated with developing contaminated sites for renewable energy projects. Second, this paper suggests liability-limiting mechanisms that renewable energy developers should explore when considering siting a renewable energy project on a contaminated property. Finally, this paper suggests that state and federal legislatures should carve out liability exceptions under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund) and other cleanup laws for renewable energy developers seeking to site renewable projects on brownfields and other contaminated lands.

II. WHAT ARE BROWNFIELDS?

According to the EPA, there are 450,000 brownfield sites in the United States.[7] A brownfield is defined in the Small Business Liability Relief and Brownfields Revitalization Act as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or

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2 *See RE-Powering America's Land: Potential Advantages of Reusing Potentially Contaminated Land for Renewable Energy*, ENV'T PROT. AGENCY (July 2012), https://www.epa.gov/sites/default/files/2015-04/documents/contaminated_land_resuse_factsheet.pdf.

3 *RE-Powering America's Land Initiative: Benefits Matrix*, ENV'T PROT. AGENCY 2 (Dec. 2020), https://www.epa.gov/sites/default/files/2020-12/documents/benefits_matrix_final_508_121520.pdf.

4 *Id*.

5 *RE-Powering America's Land Initiative: Renewable Energy Screening Fact Sheet*, ENV'T PROT. AGENCY 1–2 (Sept. 2018), https://www.epa.gov/sites/default/files/2018-10/documents/mapper-factsheet-508-100318-web.pdf.

6 *See* discussion *infra* Part IV.

7 *Overview of EPA's Brownfields Program*, ENV'T PROT. AGENCY, https://www.epa.gov/brownfields/overview-epas-brownfields-program (last updated July 26, 2021).

contaminant."[8] In addition to contaminants, brownfields also leave behind stigmatization from real or perceived contamination that may cause community blight and underdevelopment.[9] But these thousands of brownfields also present thousands of opportunities for the development of renewable energy projects in the form of open land.

III. How can Brownfields and Other Contaminated Land be Used for Renewable Energy Project Siting?

Brownfield remediation offers myriad economic, development, community, and health opportunities. For example, brownfield remediation can increase property values from 5% to 11.5%.[10] Additionally, as EPA noted, the use of contaminated land for renewable energy projects returns potentially contaminated land to productive and sustainable use while preserving undeveloped land.[11] As part of its RE-Powering initiative, EPA identified nearly 15 million acres of potentially contaminated sites that could be used for renewable energy, stating "[t]ogether, the sites contain an estimated one million megawatts (MW) of renewable energy generation potential—enough to power 1.5 to 2.5 million homes annually."[12] Brownfields and other contaminated lands therefore present favorable opportunities for renewable energy development on formerly abandoned properties.

There are numerous considerations when siting a renewable energy project on a brownfield or other contaminated site. A contaminated site's on-the-ground conditions will affect the feasibility of placing a renewable energy project. In conjunction with the National Renewable Energy Laboratory (NREL), EPA has created a system to search pre-screened contaminated sites (the "RE-Powering Mapper" app) for renewable energy project potential.[13] The map includes a number of criteria for site searches specific to solar, wind, geothermal, and biomass projects.[14] Developers should also consider other technical factors including the stage of the site's cleanup and the prospective renewable energy project's technical requirements and compatibility with a particular contami-

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8 *Id.*; 42 U.S.C. § 9601(39).

9 *Building Vibrant Communities: Community Benefits of Land Revitalization*, Env't Prot. Agency 1 (Oct. 2009), https://www.epa.gov/sites/default/files/2015-09/documents/comben.pdf.

10 Kevin Haninger, Lala Ma &Christopher Timmins, *The Value of Brownfield Remediation*, 4 JAERE 197, 197 (2017) (available at https://www.journals.uchicago.edu/doi/pdfplus/10.1086/689743).

11 *Handbook on Siting Renewable Energy Projects While Addressing Environmental Issues*, Env't Prot. Agency Off. of Solid Waste & Emergency Response 3, https://www.epa.gov/sites/default/files/2015-04/documents/handbook_siting_repowering_projects.pdf (last visited Aug. 18, 2021).

12 *Id.* at 1; *see also RE-Powering Mapper 2.0*, Env't Prot. Agency, https://geopub.epa.gov/repoweringApp/ (last updated Sept. 2018) [hereinafter *RE-Powering Mapper*] (mapping potentially contaminated sites and programs).

13 *How to Identify Sites*, Env't Prot. Agency, https://www.epa.gov/re-powering/how-identify-sites#decision (last visited Aug. 18, 2021).

14 *See* Env't Prot. Agency, *supra* note 7.

nated site[15]—for example, the availability of sunlight on a former landfill for a solar project.[16]

EPA addresses site considerations in the cleanup context in its *Handbook on Siting Renewable Energy Projects While Addressing Environmental Issues*.[17] EPA suggests integrating renewable energy projects into the site assessment and at each stage of the site cleanup and development—including site identification, environmental assessment, cleanup plan, cleanup, and post-cleanup.[18] A renewable energy developer who is assessing the possibility of brownfield development should ensure that the site's cleanup process and the project's design are compatible, paying special attention to engineered treatments such as landfill soil caps, impermeable liners, and bioremediation.[19]

IV. GOVERNMENT INCENTIVES FOR DEVELOPING CONTAMINATED SITES

Numerous state and federal funding sources are available for renewable projects on contaminated sites, including EPA funding for redeveloping contaminated land.[20] The EPA Brownfield Program assists developers with funding for brownfield assessment, cleanup, technical assistance, and even environmental job training and research.[21] The Brownfield Program funding also includes Assessment Grants, Revolving Loan Fund Grants, Cleanup Grants, Multipurpose Grants, Job Training Grants, and State and Tribal Response Program Grants.[22] Additionally, federal tax incentives may assist a renewable energy developer when siting a renewable energy project.[23] These tax incentives include Business Energy Investment Tax Credits, Renewable Energy Bonus Depreciation, and New Markets Tax Credit.

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15 *See, e.g.*, *Handbook on Siting Renewable Energy Projects While Addressing Environmental Issues*, *supra* note 11, at 17-18.

16 *Best Practices for Siting Solar Photovoltaics on Municipal Solid Waste Landfills*, ENV'T PROT. AGENCY 20 (Feb. 2013), https://www.epa.gov/sites/default/files/2015-03/documents/best-practices-siting-solar-photovoltaic-final.pdf.

17 ENV'T PROT. AGENCY, *supra* note 11, at 11–26.

18 *Id.* at 4, 17.

19 *Id.* at 9, 19.

20 *See Re-Powering America's Land Initiative: Financing Renewable Energy Projects on Contaminated Lands*, ENV'T PROT. AGENCY CTR. FOR PROGRAM ANALYSIS OFF. OF SOLID WASTE & EMERGENCY RESPONSE (May 2013), https://www.epa.gov/sites/default/files/2015-06/documents/re-powering_financing_fact_sheet.pdf (describing incentives provided by the Brownfields Program, Economic Development Administration, and Small Business Administration, among others).

21 *Types of EPA Brownfield Grant Funding*, ENV'T PROT. AGENCY, https://www.epa.gov/brownfields/types-epa-brownfield-grant-funding (last visited July 20, 2021).

22 *Id.*

23 *See* ENV'T PROT. AGENCY CTR. FOR PROGRAM ANALYSIS OFF. OF SOLID WASTE & EMERGENCY RESPONSE, *supra* note 20.

Funding for brownfield development is also available from state, tribal, private, and non-private sources.[24] Many states offer incentives for renewable energy projects on brownfields in the form of favorable loans and tax incentives. For example, New Jersey's Brownfield Redevelopment Incentive "will provide tax credits to support brownfields remediation projects and the Brownfields Loan Program makes low-interest loans of up to $5 million available to brownfield redevelopment projects for all aspects of revitalization, including assessment, investigation, and demolition."[25] The Massachusetts Renewable Target (SMART) provides incentives for developing solar on certain brownfields.[26] Connecticut also has several programs that provide incentives for development on brownfield sites, including loans through its Targeted Brownfield Development Loan Program.[27] These programs are only a handful of the many programs for the funding of renewable energy projects sited on brownfields across the United States.[28]

V. Siting Renewable Energy Projects at Contaminated Properties Benefits Developers, Surrounding Communities, and the Environment

Using brownfields and other contaminated sites for renewable energy project development benefits surrounding communities and the environment. Siting renewable

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24 Env't Prot. Agency, *supra* note 9, at 1; *Database of State Incentives for Renewables & Efficiency*, N.C. Clean Energy Technology Center, https://www.dsireusa.org/ (last visited Aug. 18, 2021) (compiling state policies and incentives in searchable map).

25 Press Release, Phil Murphy, Governor, State of New Jersey, Governor Murphy Highlights Brownfields Redevelopment Tax Credit, Launches Loan Program Supporting Brownfields Remediation (Feb. 8, 2021), https://www.nj.gov/governor/news/news/562021/20210208a.shtml#:~:text=THe%20Brownfield%20Redevelopment%20Incentive%20will,assessment%2C%20investigation%2C%20and%20demolition; *see also Brownfield Redevelopment Incentive*, N.J. Econ. Dev. Auth., https://www.njeda.com/brownfield-redevelopment-incentive%E2%80%8B/ (last visited Aug. 18, 2021).

26 *Solar Massachusetts Renewable Target*, Mass.gov, https://www.mass.gov/solar-massachusetts-renewable-target-smart (last visited Aug. 18, 2021); *see also Solar Massachusetts Renewable Target Program (225 CMR 20.00): Guideline Regarding the Definition of "Brownfield"*, Exec. Off. of Energy & Env't Aff.: Dep't of Energy Res. 1 (Apr. 26, 2018), https://www.mass.gov/doc/guideline-regarding-the-definition-of-brownfield-0/download (providing guidance on Massachusetts' renewable targets program).

27 *Siting Clean Energy on Connecticut Brownfields*, Conn. Dep't of Energy & Env't Prot., https://portal.ct.gov/DEEP/Remediation--Site-Clean-Up/Clean-Energy-on-Brownfields/Siting-Clean-Energy-on-Brownfields#state%20incentives (last updated Feb. 11, 2020).

28 *E.g.*, *Renewable Energy Fund*, R.I. Commerce, https://commerceri.com/financing/renewable-energy-fund/ (last visited Aug. 18, 2021) (detailing Rhode Island's renewable energy funding program); *see also Brownfield Redevelopment Program*, Mich. Dep't of Env't, Great Lakes, & Energy, https://www.michigan.gov/egle/0,9429,7-135-3311_29262---,00.html (last visited Aug. 18, 2021) (introducing Michigan's brownfield redevelopment program); *see also Sustainability Initiative*, Ind. Fin. Authority, https://www.in.gov/ifa/brownfields/sustainability-initiative/ (last visited Aug. 18, 2021) (detailing incentives for, among other things, "use of renewable energy sources" on brownfields).

projects on contaminated sites diminishes the need to site renewable projects on non-contaminated sites.[29] It also reduces greenhouse gas emissions by providing clean energy, and it can save money on cleanup for sites still undergoing remediation by providing cheaper and cleaner electricity to power the cleanup.[30] Projects can also decrease the cost of electricity by requiring minimal upfront investment, which in turn allows developers to provide electricity to the surrounding community at a lower cost.[31] Furthermore, projects contribute to the local economy by providing employment opportunities.[32] And by making use of previously unproductive land, renewable energy projects increase the tax base for the site, further benefitting local communities.[33]

Developers also benefit from siting their projects on contaminated sites. These sites often offer reduced development costs because they already contain infrastructure, like substations, roads, and power lines.[34] Land costs are also reduced due to its contaminated status.[35] There are tax incentives for developing contaminated land, as mentioned in Section IV. Furthermore, depending on the regulating agency, streamlined permitting and zoning incentive programs for redevelopment of contaminated sites may speed up project timelines.[36] Finally, communities may offer more support for developers than they would for projects on non-contaminated land because the development will not be taking useful land out of production, but instead will be utilizing and cleaning up contaminated sites, which in turn will increase property values and tax revenue, and provide the surrounding community with clean power.[37]

Considering the benefits to developers, surrounding communities, and the environment, contaminated properties show promise as future renewable energy project sites. As with every siting decision, however, developers will need to examine the project profile

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29 ENV'T PROT. AGENCY, *supra* note 2, at 4.

30 *RE-Powering America's Land Initiative: Program Overview*, ENV'T PROT. AGENCY 4 (Mar. 2021), https://www.epa.gov/sites/default/files/2015-09/documents/re_powering_program_overview.pdf.

31 *Id.*

32 *Id.*

33 *Id.*

34 ENV'T PROT. AGENCY, *supra* note 2, at 2; ENV'T PROT. AGENCY, *supra* note 30, at 4.

35 ENV'T PROT. AGENCY, *supra* note 2, at 3; ENV'T PROT. AGENCY, *supra* note 30, at 4. For example, the EPA notes that former landfills provide several unique opportunities for siting solar photovoltaic structures, including that they are often located near existing infrastructure and populated areas, with readily available electric lines and roads. *RE-Powering: How to Develop Sites*, ENV'T PROT. AGENCY, https://www.epa.gov/re-powering/re-powering-how-develop-sites#finance (last updated June 16, 2021).

36 ENV'T PROT. AGENCY, *supra* note 2, at 3; ENV'T PROT. AGENCY, *supra* note 30, at 4. In one example provided by the EPA, a Colorado project turned a former-mall site that was contaminated by Perchloroethylene (PCE) into a multi-use project consisting of businesses and municipal buildings, in addition to a solar roof system that produces enough electricity to power 350 homes. *RE-Powering America's Land: Siting Renewable Energy on Potentially Contaminated Land and Mine Sites Belmar Mixed Use Development, Lakewood, Colorado Success Story Mixed Use Development with Rooftop Solar Array Replaces Contaminated Site*, ENV'T PROT. AGENCY (March 2009), https://www.epa.gov/sites/default/files/2015-04/documents/success_belmar_co.pdf.

37 *See* ENV'T PROT. AGENCY, *supra* note 2, at 3; ENV'T PROT. AGENCY, *supra* note 30, at 4.

and site-specific facts to determine if the site is a good fit. Renewable energy developers will need to proceed with caution to protect themselves from cleanup liability that often flows from owning or operating a contaminated site.

VI. Renewable Energy Developers Should Explore Liability Protections When Considering Redeveloping a Contaminated Site

A. Federal and State Cleanup Statutes Attach Liability to Owners and Operators of Contaminated States

CERCLA's liability scheme centers on a "polluter pays" approach that requires potentially responsible parties (PRPs), rather than the public, to pay for contamination cleanup.[38] CERCLA sets forth four broad categories of PRPs: (1) the current owner or operator of a facility; (2) the owner or operator at the time of the disposal of hazardous substances; (3) an arranger for the disposal or treatment of hazardous substances; and (4) a person who accepted hazardous substances for transport to the site.[39] State cleanup laws also impose liability on owners and operators of contaminated sites, and often mirror CERCLA's general liability scheme. Indeed, most contaminated site cleanups are undertaken under state cleanup programs[40] Therefore, when considering liability exposure for redeveloping a specific contaminated site, a renewable energy developer should closely examine the state-specific cleanup program and work with state regulators, along with EPA, to understand its liabilities and how to best protect itself moving forward.

Entities siting a renewable energy project at a contaminated site such as a brownfield will almost certainly fall under the PRP category for current owner or operator. Therefore, a key consideration for renewable energy developers will be whether they can limit their liability under cleanup laws, either through statutory liability protections or through other liability limiting mechanisms.

B. Methods of Limiting Liability When Redeveloping a Contaminated Site

CERCLA already includes multiple liability protection provisions for parties who own or acquire contaminated property but did not cause or contribute to the contamination. For example, in 2002, the Brownfield Amendments created liability protections for "bona fide prospective purchasers" (BFPPs)[41] and "contiguous property owners,"[42] and

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38 This paper does not address liability concerns under RCRA or other federal or state waste programs. Renewable energy developers should also investigate potential liability under these statutes when considering siting a project at a contaminated site and should work with state and federal regulators to determine the best pathway forward to limit liability under these laws.

39 42 U.S.C. § 9607(a).

40 *Siting Renewable Energy on Contaminated Properties: Addressing Liability Concerns*, Env't Prot. Agency 3 (Mar. 2011), https://tinyurl.com/mrap8z45.

41 42 U.S.C. § 9607(r)(1); 42 U.S.C. § 9601(40).

42 42 U.S.C. § 9607(q).

clarified the so-called "innocent landowner" defense.[43] The 2002 Brownfield Amendments also bar EPA from CERCLA enforcement against parties cleaning up low risk sites (called "eligible response sites") under a state cleanup program.[44] Furthermore, "all states have programs or policies to provide some level of liability protection to new owners or lessees in specific situations"[45], and many states enter into a memorandum of agreement with EPA regarding their voluntary cleanup programs, which include agreements that EPA will refrain from commencing enforcement actions against parties cleaning up sites under the state's voluntary cleanup program.[46]

CERCLA's BFPP defense in particular offers potential liability protection in the context of brownfield redevelopment for renewable energy projects. Under the BFPP defense, a new purchaser of contaminated land is protected from CERCLA liability if:

- Ownership of the facility is acquired after January 11, 2002;
- All disposal of hazardous substances occurred before facility acquisition;
- The owner made all appropriate inquiries into the previous ownership and uses of the facility;
- The person seeking to qualify as a BFPP is not liable or affiliated with any other person that is potentially liable for costs associated with the site's cleanup;
- After acquiring the property, the BFPP continues to take reasonable steps to stop a continuing release, prevent a threatened future release, and prevent or limit human, environmental, or natural resource exposure to any previously released hazardous substance at the property;
- The BFPP provides full cooperation, assistance, and access to persons that are authorized to conduct response actions at the property;
- The BFPP complies with land use restrictions and does not impede the effectiveness or integrity of institutional controls employed at the facility in connection with a response action;
- The BFPP complies with requests for information or administrative subpoenas;
- The BFPP provides all legally required notices; and
- The BFPP does not impede any cleanup work or natural resource restoration.[47]

The BFPP defense may apply to renewable energy developers seeking to develop brownfields. However, depending on the specific site conditions, development may exacerbate existing contamination or at least impede the effectiveness of cleanup actions at the site.[48] For this reason, that renewable energy developers may not fit under the BFPP

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43 *See* 42 U.S.C. § 9607(b)(3).

44 ENV'T PROT. AGENCY, *supra* note 40, at 3; 42 U.S.C. § 9628(b); *see also* 42 U.S.C. § 9601(41) (defining "eligible response sites"). CERCLA does include some exceptions to this enforcement bar, the applicability of which will need to be evaluated on a project-specific basis. 42 U.S.C. § 9628(b)(1)(B)(i)-(iv).

45 ENV'T PROT. AGENCY, *supra* note 40, at 3.

46 *Id*.

47 42 U.S.C. § 9601(40).

48 *E.g.*, Mike Sowinski, *Brownfield Developer Fails to Meet BFPP Defense; Found Liable Under CERCLA for Removing Concrete Slab Above Contaminated Soil*, TERRADEX (Oct. 25, 2011),

defense, developers should consider other liability-limiting mechanisms before pursuing a project at a brownfield site, discussed below.

C. Renewable Energy Developers Should Work with State and Federal Regulators to Limit Liability at Contaminated Sites

A renewable energy developer seeking to take advantage of a brownfield or other contaminated site for a project will need to carefully maneuver state and federal cleanup liability schemes. The proper mechanisms for limiting liability will vary depending on which regulatory scheme governs the site's cleanup, which government entity is overseeing the cleanup, the state of the contamination, and other situation-specific facts and circumstances. The key is working with regulators (both federal and state) to best protect against potential liability,[49] and conducting environmental due diligence (e.g., Phase I and II Environmental Site Assessments) before entering any purchase or lease agreement to avoid surprise liabilities and risks when development commences.

Some liability-limiting mechanisms for renewable energy siting at contaminated sites include: (1) contractual indemnity provisions in the lease or purchase sale agreement for the property; (2) comfort or status letters from EPA or the governing state entity; (3) ready for reuse determinations from the regulator; (4) negotiating with EPA for partial deletion of the site from the Superfund National Priorities List (NPL); and (5) administrative agreements between the developer and regulator that limit liability for the site.[50]

First, parties can contractually shift risk by entering indemnification agreements with site owners or operators during the purchase or lease of the contaminated site. While this approach provides an avenue to recover costs incurred due to cleanup liability at the site for the developer, indemnity provisions cannot provide protection from regulatory enforcement regarding the cleanup, continuing operations and maintenance obligations at the site.[51] Therefore, working with regulators to secure liability protection from enforcement will likely be a better approach, though indemnity provisions offer additional protection.

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https://terradex.com/wp-brownfield-developer-fails-to-meet-bfpp-defense-found-liable-under-cercla-for-removing-concrete-slab-above-contaminated-soil/.

49 Such a relationship should be mutually beneficial to developers and the regulator considering the benefits of renewable energy projects, and regulators have shown that they are interested in working with developers on these issues. *See, e.g.*, Env't Prot. Agency, *supra* note 40, at 3 ("EPA will work with parties on a renewable energy project to determine whether a property-specific document from EPA may be needed for a transaction to go forward.").

50 While this paper focuses on protecting developers from liability imposed by regulators, there are other ways to safeguard against risks associated with developing contaminated sites. For example, developers should explore the possibility that prior owners or operators had environmental insurance policies that may offer coverage for cleanup liability. Developers should also consider making the redeveloping owner or operator entity an LLC.

51 *See* 42 U.S.C. § 9607(e)(1) ("No indemnification, hold harmless, or similar agreement or conveyance shall be effective to transfer from the owner or operator of any vessel or facility or from any person who may be liable for release or threat of release under this section, to any other person the liability imposed under this section. Nothing in this subsection shall bar any agreement to insure, hold harmless, or indemnify a party to such agreement for any liability under this section.").

Entities can also seek comfort or status letters from EPA or state entities. Comfort or status letters provide renewable energy developers with information that regulators have about a contaminated property, and they may also provide a regulator's intentions with respect to the property as of the date of the letter.[52] These letters often discuss steps that a renewable energy developer may need to take to achieve or maintain liability protection. For example, the letter may describe reasonable steps that a developer must take when installing project-specific infrastructure to avoid worsening site contamination and triggering cleanup liability.[53]

Other forms of liability protection include ready for reuse determinations and partial deletions of the site from the Superfund NPL, which is a list that identifies the most serious hazardous sites that warrant cleanup.[54] "[A]n RfR [Ready for Reuse] determination is an environmental status report that documents EPA's technical determination that all or a portion of a property is sufficiently cleaned up to support specified types of uses."[55] Partial deletion of the site from the NPL occurs when all response actions are completed and cleanup goals are achieved but future site work may still be necessary.[56] In either case, these actions indicate that a contaminated site may be appropriate for specific types of development, including renewable energy projects.[57]

Finally, in certain circumstances, regulators may enter into administrative agreements concerning the property to clarify potential cleanup liability. Although these kinds of agreements are typically more difficult and laborious to secure than the liability-limiting mechanisms previously discussed,[58] they are binding on regulators and thus offer more security than other methods.

D. LEGISLATURES SHOULD CARVE OUT SPECIFIC LIABILITY EXCEPTIONS FOR RENEWABLE SITING ON CONTAMINATED SITES

Although the above liability-limiting mechanisms are helpful in reducing risk for entities seeking to site renewable energy projects on contaminated sites, a patchwork approach to limiting liability presents complexities and risks that may deter developers from pursuing brownfields or other contaminated properties for project sites. Consequently, developers may instead purchase land that is more expensive, offers less infrastructure, and could be put to other uses, leaving contaminated sites to sit unused. Such

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52 ENV'T PROT. AGENCY, *supra* note 40, at 8.

53 *Id.*

54 *Id.* at 7; *About the Superfund Cleanup Process*, ENV'T PROT. AGENCY, https://www.epa.gov/superfund/about-superfund-cleanup-process#npl (last updated June 2, 2021).

55 *Id.*

56 40 C.F.R. § 300.425 (2020); *see also Superfund: National Priorities List Deletion*, ENV'T PROT. AGENCY, https://www.epa.gov/superfund/superfund-national-priorities-list-deletion (last updated Jan. 14, 2021).

57 ENV'T PROT. AGENCY, *supra* note 40, at 1.

58 *Liability Reference Guide for Siting Renewable Energy on Contaminated Properties*, ENV'T PROT. AGENCY 9 (July 2014), https://www.epa.gov/sites/default/files/2014-07/documents/liability-renew-energy-contamprop-2014.pdf ("EPA believes the need for these types of agreements has been largely addressed by the self-implementing landowner liability protections and the EPA's enforcement discretion guidance, the Agency recognizes that in limited circumstances, a property-specific agreement may be appropriate to facilitate a desirable reuse of a property.").

a result is worse for the environment and a waste for developers, surrounding communities, and regulators alike. Across the United States, the public and private sectors are investing in renewable energy projects at never-before-seen levels.[59] And the focus on renewable energy projects will only increase exponentially considering the Biden Administration's new focus on renewables development.[60] Although development of some sites may exacerbate preexisting contamination, the net effect on the environment of using contaminated sites for renewable projects can be overwhelmingly positive.[61]

All stakeholders would benefit from a simpler and cleaner approach to limiting liability at these sites for renewable projects. State and federal cleanup programs already recognize a BFPP defense, in which a purchaser may be exempt from liability associated with historical contamination at a site if the purchaser meets a long list of inquiry requirements and does not worsen contamination or interfere with remediation after purchasing the site.[62] Some developers may not meet these strict requirements.[63] Further, inquiry and other investigatory requirements associated with the BFPP defense increase the expense and time for a developer looking to site a project at the contaminated property, and such inquiries are often superfluous because regulators and previous owners or operators have usually already conducted extensive investigation of the site.[64]

To avoid the wasted time and effort associated with qualifying for the BFPP defense and to better incentivize renewable energy project siting on contaminated land, Congress and state legislatures should enact a defense to liability under CERCLA, RCRA, state cleanup programs, and private civil suits that is specifically tailored to renewable energy projects on contaminated lands. Unlike the BFPP defense, this new defense should not require extensive inquiry and due diligence requirements. This defense also would not be forfeited if existing contamination is disturbed or exacerbated. Instead, the defense should provide liability protection to renewable energy developers for historical contamination so long as their project meets the definition of a renewable energy project. Developers would only be liable for any release of contamination that occurs after the date the developer begins to own or operate the property (in other words, they would not be jointly and severally liable for existing contamination but would only be liable for prospective releases).

In crafting such a defense, Congress or state legislatures will have the challenge of immunizing renewable energy developers from many sources of cleanup liability (federal, state, and private). However, certain industries and types of activities receive similar categorical exemptions from liability, which legislatures can look to as instructive. For example, Washington's Model Toxics Control Act exempts from liability "[a]ny person who, for the purpose of growing food crops, applies pesticides or fertilizers without negli-

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59 *Total Energy Data*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/totalenergy/data/browser/index.php?tbl=T10.06#/?f=A (last visited Jan. 24, 2022).

60 Exec. Ord. No. 14,057, 86 Fed. Reg. 236 (Dec. 13, 2021).

61 ENV'T PROT. AGENCY, *supra* note 3, at 2.

62 *See Bona Fide Prospective Purchasers*, EPA, https://www.epa.gov/enforcement/bona-fide-prospective-purchasers; *see also* 42 U.S.C. § 9601(40).

63 *See, e.g.*, Sowinski, *supra* note 48.

64 *See* Andrew W. Marreo, *Innocent in the Land of the Guilty: Efficiency and Fairness in CERCLA Defenses*, 30 GEO. ENV'T L. REV., 521, 532–36 (discussing some of the drawbacks and pitfalls of the BFPP defense).

gence and in accordance with all applicable laws and regulations."[65] Oregon's cleanup law categorically exempts a "[s]ecurity interest holder" from liability as an owner or operator of a facility, which protects lenders and others holding mortgages or trust deeds from cleanup liability.[66] Similarly, although outside the realm of cleanup laws, the National Environmental Policy Act creates "categorical exclusion" for actions or industries that "do not individually or cumulatively have a significant effect on the human environment and for which, therefore, neither an environmental assessment nor an environmental impact statement is normally required."[67] Other non-environmental industry-specific exemptions from liability include protection of airlines under the Aviation and Transportation Security Act for reporting potential security threats to the Transportation Security Administration[68] and protection of firearms manufacturers and dealers for a wide range of liabilities under the Protection of Lawful Commerce in Arms Act.[69]

Federal and state legislatures should enact an industry- and activity-specific exemption to cleanup liability in all its forms—CERCLA, RCRA, state laws, private civil action, etc.—for contamination occurring prior to when the renewable energy developer purchased the contaminated site. When drafting the renewable energy project exemption, legislatures can use similar language to the BFPP defense with some broad modifications and deletions. An example of the potential liability exemption language, pulled from the BFPP defense, is below:

> A developer purchasing contaminated lands for the purpose of siting a qualifying renewable energy project is protected from all cleanup liability under [enter appropriate cleanup statutes based on legislature passing exemption] for contamination existing at the time of the developer's purchase of the contaminated land, and is immune from civil suits by private persons related to the past contamination, if the following requirements are met:
>
> - All disposal of hazardous substances occurred before facility acquisition;
> - The developer seeking to qualify for this immunity is not liable or affiliated with any other person that is potentially liable for costs associated with the site's cleanup;
> - The developer provides full cooperation, assistance, and access to persons that are authorized to conduct response actions at the property;
> - The developer complies with land use restrictions and does not impede the effectiveness or integrity of institutional controls employed at the facility in connection with a response action;
> - The developer complies with requests for information or administrative subpoenas;
> - The developer provides all legally required notices; and

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65 WASH. REV. CODE § 70A.305.040.

66 OR. ADMIN. R. 340-122-0120 (2021).

67 *Categorical Exclusions*, U.S. DEP'T OF ENERGY, https://ceq.doe.gov/nepa-practice/categorical-exclusions.html; 40 C.F.R. § 1508.1(d).These exclusions are numerous and include activities related to research, surveys, and more.

68 *See* 49 U.S.C. § 44941.

69 *See* 15 U.S.C. §§ 7901–7903.

- The developer does not impede any cleanup work or natural resource restoration.

The above language is merely a suggestion. There are many ways that such an exemption can be drafted. Enacting such a statutory defense would benefit the environment, regulators, developers, and surrounding communities by spurring further investment in renewable projects on contaminated sites.

VII. Conclusion

Contaminated sites present opportunities for cheaper and faster renewable energy development. They also offer myriad benefits for surrounding communities and the environment.[70] However, with these benefits comes risk for developers, including the potential for liability under state and federal cleanup laws. To protect themselves, developers should secure a solid legal and technical team to work with regulators to secure liability-limiting agreements. To help them, state and federal legislatures should strongly consider enacting statutory defenses or exemptions to cleanup liability for renewable energy developers who wish to redevelop contaminated sites. Such protections from liability are needed to increase the number of appropriate locations for renewable energy development and would not harm the environmental policy considerations underlying cleanup laws, particularly in light of renewable energy projects' importance to decarbonizing the energy sector.

Katelyn Fulton is an attorney at Miller Nash LLP. Katie's practice covers a wide array of environmental and energy matters. She provides legal service to clients at the Portland Harbor Superfund Site and advises clients on clean fuels programs, cap-and-trade, environmental due diligence, and ratemaking issues. Katie is a graduate of the University of Washington School of Law, and received her bachelor's summa cum laude from Washington State University.

70 *See* Env't Prot. Agency, *supra* note 30, at 4 (describing benefits to local communities from renewables-focused brownfield development).

Conferring Standing on Youth Plaintiffs via "Affirmative"[1] Citizen Suit Provisions in State and Federal Regulatory Systems

Kathrina Gafycz

I. The Stage Set by *Juliana v. United States*

Juliana v. United States has been hailed in the media as a landmark case in the world of climate change litigation. The novelty of the case stems from its allegations of harm caused by the U.S. government's failure to act to decrease carbon emissions, thus ushering in all the attendant consequences of rapidly escalating climate change, and that this harm specifically targets American youth. In its current round of litigation, the *Juliana* plaintiffs request one specific award—declaratory judgment explicitly stating that they have "a constitutional due process right to a 'climate system capable of sustaining human life.'"[2] For years, *Juliana* has bounced between courts battling the issue of standing. Again and again, *Juliana* has lost on the third element of Article III standing, as opinions have been handed down admitting that the harms of climate change have been amply established,[3] but that federal courts lack any authority to redress injuries related to cli-

1 The use of "affirmative" citizen suits throughout this article refers, if somewhat inelegantly, to the idea of a suit not requesting the enforcement of a statute, but instead one against a given agency's action—namely, here, the idea of suing a state or federal agency for promoting a system that hastens the threat of climate change, whether through the promotion of fossil fuels, or some other action specific to that agency.

2 Juliana v. United States, 947 F.3d 1159, 1175 (9th Cir. 2020).

3 As of this writing, while the *Juliana* plaintiffs await a ruling on their Motion for Leave to File a Second Amended Complaint, they are in settlement negotiations with the Department of Justice and Magistrate Judge Thomas M. Coffin. The decision cited in this article refers to the appeal brought before the Ninth Circuit in 2019, with a decision handed down on January 17, 2020; plaintiffs filed a petition for rehearing *en banc* on March 2, 2020. The

mate change.[4] The declaratory judgment sought would establish the constitutional due process right to a livable climate that the Ninth Circuit, at least, is not convinced exists.[5]

A. THE COURT'S REACH

One of the greatest barriers to persuading the court to recognize a habitable planet as a constitutional right is the court's understanding of its own reach. One argument against the requested relief proffered by the Ninth Circuit was that "courts are ill-suited to supervise such a complex compliance plan."[6] Of course, this would not be the first time in history that a federal court approved an extensive remedial plan requiring intensive oversight—*Brown II* authorized the oversight of compliance to the lower district courts, directing them to do so "with all deliberate speed."[7]

While the efficacy of that directive, based on the subsequent intransigence of the district courts,[8] could be debated, *Brown II* at the very least set a precedent that it is well within the court's power to oversee complex remedial plans.

The Ninth Circuit majority opinion also rejected the suit on the premise that the proposed remedial plan failed to sufficiently "stop catastrophic climate change or even ameliorate their injuries."[9] As pointed out in the dissent, this logic is not a reasonable barrier to judicial redress: "the mere fact that this suit alone cannot halt climate change does not mean that it presents no claim suitable for judicial resolution."[10] Referring back to the alleged inability of an Article III court to oversee a complex remedial plan, the dissent notes that "a federal court need not manage all of the delicate foreign relations and regulatory minutiae implicated by climate change to offer real relief."[11]

B. REDRESSABILITY

Arguably, the greatest obstacle described by the Ninth Circuit opinion is that of redressability, as the court held that this matter was under the purview of the legislative and executive branches. The majority instructs the plaintiffs to make their case to "the political branches or to the electorate at large," noting that "the latter of which can change the composition of the political branches through the ballot box."[12] The Ninth Circuit, in this case, apparently lost sight of the parties. They directed the twenty-one youth plaintiffs to bring their grievances to the ballot box, but "children lack political

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Ninth Circuit's panel decision was upheld in February of 2021. The currently pending Motion to Amend was filed on March 9, 2021.

4 *Juliana*, 947 F.3d at 1175.

5 *See id.* at 1165 ("assuming" such a right exists).

6 *Id.* at 1175.

7 Brown v. Bd. of Educ., 349 U.S. 294, 300 (1955) (*Brown II*).

8 *See* James E. Pfander, *Brown II: Ordinary Remedies for Extraordinary Wrongs*, 24 MINN. J. OF L. & INEQ. 47 (2006).

9 *Juliana*, 947 F.3d at 1171.

10 *Id.* at 1175 (Staton, J., dissenting).

11 *Id.*

12 *Id.* at 1175.

power and therefore have no recourse there."[13] Despite being "uniquely and disproportionately harmed by climate change," children are unable to influence the government policies that promote the use of fossil fuels and directly contribute to this harm.[14]

Climate change is shaping the future now—the future landscape that today's children will inherit, and which they will spend the greatest length of time living in, is out of their hands to mold. Directing the next generation to the legislative branch, with the full knowledge that they cannot participate as members of the electorate until they reach the age of majority, essentially creates a marginalized class which is perpetually acted upon but powerless to react. But even a non-voting class has "as vital an interest in the legislation of the country as those who actually deposit the ballot."[15]

The Ninth Circuit's directive constitutes a violation of the youth plaintiffs' due process rights, a term which is "only applicable to the process and proceedings of the courts of justice; [and] can never [refer] to an act of the legislature."[16] To be more specific, it is "not to say that due process principles do not apply [to acts of the legislature], but that the legislature is institutionally incapable of satisfying them."[17] Legislative acts, by nature, are always prospective—in the words of James Kent, "[t]he very essence of a law is a rule for future cases"[18] —while the due process afforded by the judiciary must necessarily always confront a past harm.[19] Denied a forum in the legislative and executive bodies by law, and a forum in the judiciary by writ, this begs the question—how can the class of youth most profoundly affected by climate change lend their voices to the effort to legally address the United States government's role in significantly disrupting the climate system? The answer could lie with one of the environmental lawyer's oldest tools: the citizen suit.

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13 Brief of *Amici Curiae* Children's Rights Advocates In Support of Plaintiffs-Appellees' Petition for Rehearing *En Banc* at 1, Juliana v. United States 947 F.3d 1159 (9th Cir. 2020) (No. 18-36082).

14 *Id.*

15 Evenwel v. Abbott, 578 U.S. 54, 67 (2016) (quoting Cong. Globe, 39th Cong., 1st Sess., 141 (1866)).

16 Nathan S. Chapman & Michael W. McConnell, *Due Process as Separation of Powers*, 121 YALE L.J. 1672, 1715 (2012).

17 *Id.* at 1716.

18 *Id.* at 1731.

19 This speaks to another misconception of what *Juliana* seeks to accomplish: while the relief initially requested (prior to the Motion for Leave to Amend) included an injunction against future government action contributing to climate change, the harm addressed by the suit itself is strictly a *past* harm—the current cumulative effects of actions that have contributed to the climate change the planet is *presently* experiencing.

II. A YOUTH-SPECIFIC AFFIRMATIVE CITIZEN SUIT PROVISION

A. ENVIRONMENTAL CITIZEN SUIT PROVISIONS

At least fifteen major environmental statutes passed by Congress contain citizen suit provisions,[20] which allow "citizens to serve as 'private attorneys general' to enforce the environmental laws of the United States."[21] The statutory language of such provisions give "citizens the right to sue [an agency] for failing to perform a nondiscretionary duty."[22] In other words, a suit may be brought to compel agency enforcement of an extant statute. These provisions provide a useful tool for environmentalists seeking to engage with agencies whose missions are (or are intended to be) in line with an environmentally-conscious ethos. Citizen suit provisions have an environmentally-focused history, having "originated with the passage of the Clean Air Act in 1970."[23] Several other statutes contain similar citizen suit provisions, including the Clean Water Act, the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Toxic Substances Control Act (TSCA), and the Safe Drinking Water Act (SDWA).[24]

The limits of these citizen suit provisions become clear when separated from the context of federal agencies with mandates to act in accordance with environmental principles. Even among the environmental statutes administered by the Environmental Protection Agency (EPA), at least two—the Marine Protection Research and Sanctuaries Act and the Emergency Planning and Community Right-to-Know Act—"do not explicitly provide a right of action to enforce a nondiscretionary duty."[25] What is to be done when the problem does not require enforcement of a statute, but an immediate cessation of an agency's actions?

B. U.S. ENERGY-POLICY NEXUS

United States energy policy implicates a number of federal agencies, including the U.S. Department of Energy (DOE),[26] the U.S. Department of the Interior (encompassing the U.S. Bureau of Land Management, the U.S. Fish and Wildlife Service, and the U.S. National Park Service, among others),[27] the U.S. Energy Information Administration (EIA),[28] and the Federal Energy Regulatory Commission (FERC).[29]

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20 Katherine A. Rouse, *Holding the EPA Accountable: Judicial Construction of Environmental Citizen Suit Provisions*, 93 N.Y.U. L. REV. 1271, 1277 (2018).

21 *Id.* at 1276.

22 *Id.* at 1277.

23 *Id.* at 1276.

24 *Id.* at 1277.

25 *Id.* at 1278.

26 *Mission*, U.S. DEP'T OF ENERGY, https://www.energy.gov/mission.

27 *Interior Organizational Chart*, U.S. DEP'T OF THE INTERIOR, https://www.doi.gov/whoweare/orgchart.

28 *About EIA: Mission and Overview*, U.S. ENERGY INFO. ADMIN. (Oct. 25, 2021), https://www.eia.gov/about/mission_overview.php.

29 *What is FERC?: What FERC Does*, FED. ENERGY REG. COMM'N (Nov. 19, 2020), https://www.ferc.gov/about/what-ferc/what-ferc-does.

American energy policy is, of course, not limited to the federal government, and even this abbreviated list of agencies presents a tangle of jurisdictions and policies. Individual states can maintain dramatically different approaches in their respective energy policies. Compare, for example, California and Utah. On September 10, 2018, California's then-governor Jerry Brown signed a law "requiring the state to produce all its electricity from renewable sources by 2045."[30] At the time, roughly "half of the state's electricity production" came from fossil fuels.[31] By contrast, "the majority of electricity in Utah comes from coal."[32] Utah's goal for 2025 is to get "twenty percent of the electricity [it sells] from renewable sources."[33]

The commitment to sustainable energy varies widely, creating an uneven playing field for environmentally-minded plaintiffs scattered amongst the fifty states. The landscape becomes more muddled still by the interstate transport of fossil fuels. Utah produces more power than it consumes and sells its surplus to California, thus requiring it to comply with California's renewable resource mandate where Utah itself has made no such commitment.[34]

Continuing with an examination of Utah's energy policy as one example of many similar states: nowhere in its state constitution does Utah guarantee a right to a sustainable climate. Rather, the Utah Legislature has called for the expansion of coal mining in the state, noting that coal mining operations "presently contribute significantly to the nation's energy requirements," and that it is "essential to the national interest to insure the existence of an expanding and economically healthy underground coal mining industry."[35] Indeed, the Utah Coal Regulatory Program (UCRP), administered by Utah's Division of Oil, Gas, and Mining, has the stated mission of "regulat[ing] exploration for, and development of, coal in the State of Utah which . . . support[s] the existence of a viable coal mining industry to meet the nation's energy needs[.]"[36] The maintenance of a "viable coal mining industry" under present circumstances is plainly antithetical to the objective of combating climate change, and plaintiffs seeking to use the UCRP's citizen suit provision to do so would seem to be acting against the statute's stated purpose.[37] This reveals the grave limitation of relying upon citizen suits in the context of climate change: "private attorneys general" can only bring suits to force agencies to fulfill their legislative mandate, and are therefore limited by the provisions of the statutes at hand.

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30 Darrell Proctor, *California Mandates 100% Renewable Energy*, POWER MAG (Sept. 10, 2018), https://www.powermag.com/california-mandates-100-renewable-energy/.

31 *Id*.

32 Nadja Popovich & Brad Plumer, *How Does Your State Make Electricity?*, N.Y. TIMES (Oct. 28, 2020), https://www.nytimes.com/interactive/2020/10/28/climate/how-electricity-generation-changed-in-your-state-election.html (surveying generation fuel mixes across the United States, including Utah).

33 *Id*.

34 *Id*.

35 Utah Code § 40-10-1.

36 *Coal Mine Permit Processing – Frequently Asked Questions*, UTAH DIV. OF OIL, GAS, & MINING, https://www.ogm.utah.gov/coal/permitting.php#coalPermitFaqs (last visited May 28, 2021).

37 *See* Utah Code 40-10-21 (authorizing civil actions to compel compliance with the statute's provisions).

C. Creation of a Youth-Specific Affirmative Citizen Suit Provision

The above system makes sense on its face. Voters have their say at the ballot box, influencing the composition of the legislature, which then acts on its mandate by enacting legislation. Similarly, the executive branch is reshaped every four years with a mandate from the national voting public. It would be cumbersome to authorize "affirmative" suits by any individual seeking an injunction against a governmental agency action simply because they were outvoted. Indeed, given the adversarial nature of the American two-party system, it is imaginable that all governmental agencies under such a system would be subjected to an onslaught of lawsuits from the electorally disadvantaged. Allowing citizen suits of such a broad scope would lend credence to the late Justice Scalia's warning that a lack of limits on standing would result in an "overjudicialization of the processes of self-government."[38]

However, a provision limited in scope would grant authorization to a marginalized non-voting class denied access to the processes that shape both the legislative and executive branches: children. Children lack political power, but are not protected or exempt from the consequences of political actions and are particularly threatened by climate change.[39] Due to their immature physiological development, children are "exposed to more pollutants and contaminants than adults, as they 'breathe more air, drink more water, and eat more food per unit of body weight.'"[40] In addition to that heightened exposure, "children's weak immune systems and underdeveloped organs make it difficult for their bodies to adapt to shifting climate patterns."[41] While the future threat of climate change is much greater than today's reality, and will disproportionately affect the next generation, it is not exclusively a problem of the future. Today, children already feel the effects of an overburdened climate, with increases in rates of asthma, Lyme disease, and the mental health impacts of a rapidly-declining global environment.[42]

An affirmative citizen suit provision solely authorizing suits by minors would be in keeping with a "[p]recedent [that] recognizes a special judicial role in protecting children where children are explicitly excluded from influencing policies detrimental to them."[43] Preserving the due process rights of children as a class—a class which is uniquely prevented from seeking redress in the other political branches—has been done before by the Supreme Court. For example, in *Plyler v. Doe*, the Supreme Court provided a remedy to immigrant children who were excluded from public schools.[44] Similarly, the Court provided a remedy to Black children who were denied admission to schools based on race in *Brown v. Board of Education*.[45] An affirmative citizen suit provision would bypass the

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38 Antonin Scalia, *The Doctrine of Standing as an Essential Element of the Separation of Powers*, 17 SUFFOLK U. L. REV. 881 (1983).

39 *See supra* Part I.

40 Brief of *Amici Curiae* Children's Rights Advocates in Support of Plaintiffs-Appellees' Petition for Rehearing *En Banc* at 11, Juliana v. United States, 947 F.3d 1159 (2020) (No. 18-36082).

41 *Id.* at 4.

42 *Id.*

43 *Id.*

44 *Plyler v. Doe*, 457 U.S. 202 (1982).

45 Brown v. Board of Educ. of Topeka, 347 U.S. 483 (1954).

usual requirement to establish the third traditional element of standing: likelihood that the plaintiff's injury would be redressed by a favorable judicial decision.

Of course, the Ninth Circuit's opinion in *Juliana v. United States* also referred to the "host of complex policy decisions" that the youth plaintiffs' requested remedial plan would require.[46] *Juliana* implicated a whole host of agencies and officials for their overlapping roles in promoting the use of fossil fuels and a general energy policy that exacerbated the threats of climate change. Not only would an affirmative citizen suit provision cut through years of litigation, but a blanket policy of incorporating such provisions, specifically authorizing suits by children across all state and federal agencies, would have allowed for multiple suits, each targeting different, specific agency actions. A natural consequence of a lawsuit limited in scope would be to neutralize the Ninth Circuit's criticism that the *Juliana* plaintiffs simply asked for too much, from too many sources. Ultimately, it would not rest on one high-profile suit to act as David against Goliath.

III. Conclusion

Children are uniquely positioned in the legal climate change battle: bearing the brunt of climate change harms, but excluded from the legal mechanisms that exist to challenge the actors who promote the energy policies causing those consequences. Therefore, the adoption of a network of "affirmative" youth-specific citizen suit provisions would empower children to seek relief from the judiciary while their adult counterparts have the power to choose the legislative and executive branches. Not only would this allow for focused lawsuits—ones which allege specific harms implicating a single agency's actions—but it would expedite a notoriously lengthy process by *de facto* establishing the third element of standing.

Kathrina Gafycz is a third-year law student at the City University of New York School of Law in New York City. She studied at the University of Brighton for an MA in Aesthetics and Critical Theory, and studied at Oxford University and Mount Saint Mary College for a BA in English. She is a senior staff editor for the CUNY Law Review, a judicial intern, and former president of Outlaws and the Student Animal Legal Defense Fund. She has worked in family law, specifically child advocacy and family defense, with the Support Center for Child Advocates in Philadelphia and with Main Street Legal Services in New York City. She has worked in environmental law with Our Children's Trust in Oregon and with the NYC Department of City Planning. Her research work focuses on the intersection between these two fields.

46 *Juliana*, 947 F.3d at 1171.

On The Road Again: The Policies, Promises, and Potential for Transportation Electrification

Jen-Ann Lee

I. Introduction

In recent years, California has suffered unprecedented weather, drought, fires, and sea-level rise.[1] Scientists agree that this is a result of climate change and a disregard for the environment. Vehicles are significant contributors to greenhouse gas emissions, and reduction could drastically improve the health and resilience of our communities. In a concerted attempt to eliminate the source of 50% of the state's greenhouse gas emissions, California Governor, Gavin Newsom signed Executive Order N-79-20 on September 23, 2020 to ban the sale of all new internal combustion engine (ICE) passenger cars by

1 Ezra David Romero & Nicole Nixon, *All New California Cars, Trucks Must Be Zero-Emission By 2035, Newsom Announces In Executive Order*, Cap. Pub. Radio Network (Sept. 23, 2020), https://www.capradio.org/articles/2020/09/23/all-new-california-cars-trucks-must-be-zero-emission-by-2035-newsom-announces-in-executive-order/.

2035.[2] The executive order directs the California Air Resources Board (CARB) and other state agencies to develop regulations and plans to achieve 100% zero emission off-road vehicles by 2035 and similar regulations for medium- and heavy-duty trucks by 2045.[3]

Electric vehicle technology has improved dramatically over the last decade, becoming more capable and finding its way into a growing list of applications and duty cycles.[4] Aided by government incentives and mandates, components like batteries and inverters are achieving greater production volumes and reducing technology costs through economies of scale.[5] As a result, the path to 100% zero-emission vehicles is more attainable than ever.

Section I of this paper addresses how governments have internalized electric vehicle goals and attempted to manufacture incentives to further production. Section II will discuss how transportation electrification (TE) is further facilitated by energy initiatives and infrastructure. Lastly, Section III discusses the unique positive feedback loop surrounding automakers and their incentives to transition to electric vehicle production.

II. GOVERNMENT INTERVENTION ON TRANSPORTATION ELECTRIFICATION

A. BASIC INCENTIVES FOR ELECTRIC VEHICLE PRODUCTION

Electric vehicles have been around for more than a century, but the costs, unfamiliarity, and negative publicity and reception from automakers caused the repeal of the 1990 California electric vehicle mandate that originally required automakers to begin production of electric vehicles.[6] Furthermore, with the ever-present "range anxiety" (fear that electric vehicles have insufficient range to reach its destination and would strand drivers), lack of charging infrastructure, and high sticker prices, electric vehicles have not been as popular as ICE vehicles.[7]

Automakers are compelled by many sources to produce electric vehicles. Using the analogy of motivating a horse, both the "carrot" and "stick" methods are utilized as positive and negative reinforcement feedback loops, respectively.[8]

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2 Cal. Exec. Order No. N-79-20 (Sept. 23, 2020), https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf.

3 Romero & Nixon, *supra* note 1.

4 *See* Joseph D. Simpson & Wesley Van Barlingen, *The History of Electric Cars*, EVBox (Nov. 2, 2021), https://blog.evbox.com/electric-cars-history (detailing history of electric vehicles and recent technology growth over the last decade).

5 *See* CAL. AIR RES. BD., APPENDIX D: Heavy-Duty Investment Strategy at D-13 (2019), https://ww2.arb.ca.gov/sites/default/files/2019-09/fy1920fundingplan-appd.pdf.

6 *Timeline: History of the Electric Car*, U.S. DEP'T OF ENERGY, https://www.energy.gov/timeline/timeline-history-electric-car (last visited Dec. 10, 2020).

7 Charles Riley, *The Great Electric Car Race Is Just Beginning*, CABLE NEWS NETWORK (Aug. 2019), https://www.cnn.com/interactive/2019/08/business/electric-cars-audi-volkswagen-tesla/.

8 Spencer Bokat-Lindell, *Can America Really Drive Its Way Out of Climate Change?*, N.Y. TIMES (Aug. 12, 2021), https://www.nytimes.com/2021/08/12/opinion/electric-cars.html.

An example of a "carrot" method is customer pressure for corporate social responsibility, including lowering or eliminating the production of harmful emissions and the favorable public image that accompanies these goals.[9] When automakers make the decision to lower or eliminate the production of harmful emissions, the public views those automakers in a positive light, incentivizing continued electric vehicle production.[10] Early adoption of new technologies can lead to an increase in company interest as well as accompanying future revenue, so some automakers may not necessarily need motivation through government mandates to begin developing electric vehicles. Tesla, Chevrolet, and Nissan are all good examples of early adopters of electric vehicles and are a few of the most popular producers in the United States.[11]

Some automakers rely to traditional revenue sources instead of investing in electric alternatives and only make electric vehicles when required to by regulation. The "stick" of regulation motivates automakers to produce electric vehicles through fear of punishment.[12] For example, Ford continues to produce their F-series line of trucks, the most popular vehicle for sale in at least thirty states, which traditionally contain ICE.[13] Only recently, likely pushed by new electric vehicle regulations, have they began advertising their first all-electric 2021 Mustang Mach-E.[14] The "stick" here would be the legislation, regulations, standards, and other governmental motivators that compel these automakers to take action towards electric vehicle production.

More complex, underlying motivators exist for automakers to increase electric vehicle production. Major motivators for any business are profitability and sustainability. If an automaker believes its future lies in electric vehicles and greener alternatives, this may incentivize it to join the market earlier to grow accustomed to new demands, set standards, and transition their resources.[15]

B. Direct Government Intervention in Transportation Electrification

The government plays a huge role in promoting both the production and consumption of electric vehicles. In recent years, California alone has invested over $6 billion in

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9 Donald S. Siegel, *Green Management Matters Only If It Yields More Green: An Economic/Strategic Perspective*, 23 Acad. Mgmt. Persps. 3 Aug. 2009, at 5.

10 Bokat-Lindell, *supra* note 8.

11 *Who Are The Top Electric Car Companies?*, Enel X (Oct. 19, 2018), https://evcharging.enelx.com/news/blog/492-top-electric-cars.

12 Riley, *supra* note 7.

13 Liane Yvkoff, *Americans Are Still Car Shopping: The Top 20 Selling Vehicles Despite A Global Pandemic*, Forbes (Aug. 6, 2020, 3:46 PM), https://www.forbes.com/wheels/news/top-20-selling-vehicles-first-six-months-2020/.

14 *The Family of Ford Hybrid and Electric Vehicles*, Ford, https://www.ford.com/new-hybrids-evs/ (last visited Dec. 10, 2020).

15 Jason S. Johnston, *Regulatory Carrots and Sticks in Climate Policy: Some Political Economic Observations*, 6 Texas A&M L. Rev. 107, 109 (2018) (defining regulatory sticks as "regulations that impose costly compliance requirements on firms); *see* Russell Hensley et al., McKinsey & Co., The Fast Lane to the Adoption of Electric Cars, 1, 3 (2011), https://www.mckinsey.com.br/~/media/McKinsey/Industries/Automotive%20and%20Assembly/Our%20Insights/The%20fast%20lane%20to%20the%20adoption%20of%20electric%20cars/The%20fast%20lane%20to%20the%20adoption%20of%20electric%20cars.pdf.

zero emission vehicle development and market acceleration from automaker pilots to consumer purchase incentives.[16]

1. *Supply Side Investments*

Governments can catalyze the beginning of electric vehicle production by funding early research and development. Governments that fund feasibility assessments, research and development, pre-commercial demonstrations, and early market pilots can strategically commercialize future zero emission technologies and drive total market transformation.[17]

For example, California's Low Carbon Transportation Investments and Air Quality Improvement Program, established by the legislature in 2007 and implemented by the CARB, leverages proceeds from Cap-and-Trade auctions, a market for purchasing and selling environmental credits, to support the development and deployment of advanced technology and clean transportation in both the light- and heavy-duty sectors.[18] In addition to purchase incentives for commercially-available zero emissions vehicles, this program funds pre-commercial demonstrations and early commercial pilots to facilitate research and development while providing the public and stakeholders with valuable lessons learned on new technologies and supporting the infrastructure.[19] This allows for mutually beneficial outcomes for society and industry. Companies can now research and innovate further to produce safer, more cost-effective technologies, all while supporting the State's goals for air quality, climate change, and zero emission market transformation.[20] The government is essentially funding research and development to incentivize innovation in clean energy.

2. *Consumer Incentives*

Consumer purchase incentives play an important role in the adoption of electric vehicles before they reach cost-parity with ICE vehicles. A survey of California plug-in vehicle purchasers between 2010 and 2017 found that, "the most important incentives for plug-in electric vehicle (PEV) owners are the federal tax credit, the California state rebate, and high occupancy vehicle (HOV) lane access."[21]

Consumer interest is stimulated by non-monetary incentives, such as access to HOV lanes, parking incentives, charging infrastructure development, road toll fee waivers, and

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16 Rob Nikolewski, *Here's How Much California Is Spending to Put Electric Cars on the Road*, THE SAN DIEGO UNION-TRIB. (Feb. 3, 2019), https://www.sandiegouniontribune.com/business/energy-green/sd-fi-california-ev-costs-20190203-story.html (describing the $2.46 billion in spending dedicated to electric car initiatives).

17 CAL. AIR RES. BD., *supra* note 5, at D-1, D-9.

18 *Low Carbon Transportation Investments and Air Quality Improvement Program*, CAL. AIR RES. BD., https://ww2.arb.ca.gov/our-work/programs/low-carbon-transportation-investments-and-air-quality-improvement-program/about (last visited Dec. 10, 2020).

19 CAL. AIR RES. BD., *supra* note 5, at D-13.

20 CAL. AIR RES. BD., PROPOSED FISCAL YEAR 2021–22 FUNDING FOR CLEAN TRANSPORTATION INCENTIVES 1, 11–12 (Oct. 8, 2021), https://ww2.arb.ca.gov/sites/default/files/2021-10/fy21-22_fundingplan.pdf.

21 Alan Jenn et al., *An In-Depth Examination of Electric Vehicle Incentives: Consumer Heterogeneity and Changing Response Over Time*, 132 TRANSP. RSCH. PART A: POL'Y & PRAC., 97-109 (Feb. 2020).

licensing incentives.[22] However, based on consumer purchasing behavior, electric vehicle sales are most responsive to monetary purchase incentives.[23] The timing of incentives is also a critical factor for influencing purchase decisions, as they are likely to work best when they are immediate, and where the discount is well-understood by customers while they are shopping for the vehicle.[24] The U.S. federal tax incentive allows dealerships to apply a large dollar amount at the point of sale (or customers can choose to receive it when filing taxes), so customers can receive the discount instantaneously if they so choose.[25] In contrast, state programs often require customers to file for a reimbursement, which can reduce the appeal of the incentive because consumers do not receive the incentive until much later. Thus, California recently opened a grant program that will provide a reward to the consumer of up to $5,000 to the consumer that is paid directly to the dealership.[26] Consumer incentives play an important role in vehicle electrification as they encourage the public to purchase the vehicles causing the overall demand to rise. Incentives also increase the value of an automaker's intellectual property portfolios.

3. Planning Documents

Goals and planning documents are important tools for administrative agencies to use as they guide the development of supporting policy and policy works. Governments have been publicizing many types of goals to aid the shift towards electric vehicles.

As such a large state, California has taken many strides in its planning process for electric vehicle goals.[27] The September 2020 executive order brings to light substantial and specific goals and promises that the state hopes to achieve.[28] While documents like these seem to have so much potential, they lack enforcement and legal teeth. The governor has asked state agencies to create regulations aligning with the state's goals.[29] However, absent additional action or backlash from consumer-constituents, industry and policy stakeholders will not face accountability if they do not contribute to the state's goals. For example, original equipment manufacturers will not face any immediate consequences and are not subject to the executive order.[30] While the executive branch is

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22 Scott Hardman, *Understanding the Impact of Reoccurring and Non-Financial Incentives on Plug-In Electric Vehicle Adoption – A Review*, Transp. Rsch. Part A: Pol'y & Prac. 1, 1-14 (2019).

23 Sherilyn Wee et al. *Do Electric Vehicle Incentives Matter? Evidence From The 50 U.S. States*. 47 Rsch. Pol'y 1601, 1602 (2018).

24 Zifei Yang et al., Int'l Council on Clean Transp., Principles for Effective Electric Vehicle Incentive Design 1, 5 (2016), https://theicct.org/sites/default/files/publications/ICCT_IZEV-incentives-comp_201606.pdf.

25 *Federal Tax Credits for New All-Electric and Plug-in Hybrid Vehicles*, U.S Dep't of Energy, https://www.fueleconomy.gov/feg/taxevb.shtml (last visited Dec. 10, 2020).

26 *Other Grants and Rebates*, Bay Area Air Quality Mgmt. Dist., https://www.baaqmd.gov/funding-and-incentives/residents/clean-cars-for-all/resources/other-clean-car-grants-and-rebates (last visited Dec. 10, 2020).

27 *See Transportation Electrification*, Cal. Pub. Utils. Comm'n, https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/transportation-electrification (last visited Jan. 22, 2022).

28 Cal. Exec. Order No. N-79-20, *supra* note 2.

29 *Id.*

30 *Id.*

compelled to meet the goals of the executive order, it is not a statutory mandate or actual law.[31] Furthermore, as the industry is moving so quickly, these planning documents can rapidly become outdated and thus require future amendments to keep up with new electric vehicle development and progress.

4. Laws

Law is the strongest tool to drive electric vehicle adoption. More specifically, legislative statutes and administrative regulation. Although laws are likely the most effective method, they are also the most difficult to develop and implement. Approved on June 25, 2020, the Advanced Clean Truck regulation requires manufacturers to sell zero-emission trucks as an increasing percentage of their annual California sales from 2024 to 2035.[32] This is an effective strategy, as it compels industry to engage in the changes that will lead to the overall electric vehicle goals. Understandably, in these situations, there may be a significant amount of pushback from industries, lobbyists, and others who disagree with these regulations, but administrative agencies have received stakeholder issues through public comments and hearings.[33]

With extra nudges from the government and demand from incentivized consumers, automakers are motivated to produce electric vehicles. Laws are the most direct method of inspiring automakers to produce electric vehicles and likely the most effective. With the threat of penalties and violations looming over their production process, automakers are more likely to comply with the regulations to meet governmental goals, including environmental protection.

III. THE EFFECT OF ENERGY PRODUCERS AND INFRASTRUCTURE

The crucial element to electric vehicles is electricity. These vehicles are literally dependent on the availability and accessibility of energy. Thus, energy law plays a decisive role in the advancement of transportation electrification.

Concurrent with a broader government push for electric vehicles discussed in Section I, the California Public Utilities Commission (CPUC) is involved in reaching the state's goals through managing electrical utilities and energy infrastructure.[34] While many sources of energy are available to consumers, electrical utilities, specifically investor-owned utilities (IOUs), tend to have greater resources, better developed infrastructure, and power, both literally and figuratively, to influence TE initiatives.[35] For

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31 *Id.*

32 *Advanced Clean Trucks Fact Sheet*, CAL. AIR RES. BD. (June 25, 2020), https://ww2.arb.ca.gov/resources/fact-sheets/advanced-clean-trucks-fact-sheet.

33 *ACT—Meetings & Workshops*, CAL. AIR RES. BD., https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks/act-meetings-workshops (last visited Jan. 23, 2022).

34 *Transportation Electrification*, *supra* note 27.

35 *See generally* Nancy E. Ryan & Luke Lavin, *Engaging Utilities and Regulators on Transportation Electrification*, 28 THE ELEC. J. 4, May 2015, at 78 (explaining that "[e]lectric utilities are critical actors in shaping the speed, cost, and environmental impacts of transportation electrification."); *see* Cameron Brooks et al., U.S. Dep't of Energy, Expanding the Scope of Commercial Opportunities for Investor-Owned Electric Utilities, at iii (2021), https://eta-

example, California is home to three large IOUs—Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E), and Southern California Edison Company (SCE)—which all adhere to the authority and rulemaking of the CPUC and have the potential to significantly influence the role that energy can play in electric vehicle expansion.[36]

A. Energy Investments

Government investments in TE can also come in the form of commitments and regulations on IOUs. On July 15, 2021, the CPUC issued a Final Decision, D.21-07-028, to set near-term priorities for transportation investments by the IOUs.[37] This decision supports the state environmental policies set out by Governor Newsom as well as Assembly Bill (AB) 841, which requires that at least 35% of transportation electrification incentives made by large IOUs be made in "underserved communities".[38]

In the near-term, the decision adopts a TE framework for the IOUs to submit proposals for investments to stimulate TE as well as setting out clear requirements for TE Plans for IOUs to submit.[39] While these may seem like arbitrary, bureaucratic red-tape issues that administrative agencies often create, upon further consideration, these tools are simplifying these processes for IOUs and catalyzing the TE process. Thus, the CPUC and its Commissioners understand the importance of transportation electrification, acting to facilitate and encourage its growth. This decision also addresses the needs of consumers without access to home charging, which speaks to the government's motivations to address environmental and social justice communities specifically and enable their access to electric vehicles.[40]

B. Microgrid and Resiliency Solutions

Strong infrastructure is essential for California to achieve its goal of banning the sale of all new ICE passenger cars by 2035. Electric vehicles will need to consume a significant amount of energy and this charging could significantly impact the electric grid.[41] Thus, microgrids can allow the nation to accommodate more electric vehicles while

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publications.lbl.gov/sites/default/files/utility_commopps_typology_reg_issues_final_20210210.pdf.

36 Michelle Melton, *Utility Involvement in Electric Vehicle Charging Infrastructure: California at the Vanguard*, Ctr. for Strategic & Int'l Stud. (Apr. 6, 2016), https://www.csis.org/analysis/utility-involvement-electric-vehicle-charging-infrastructure-california-vanguard; *see generally* Brooks et al., *supra* note 35.

37 Cal. Pub. Utils. Comm'n, No. 21-07-028, Order Instituting Rulemaking to Continue the Development of Rates & Infrastructure for Vehicle Electrification (2021), https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M394/K347/394347617.pdf.

38 Assemb. B. 841, 2019–2020 Assemb., Reg. Sess. (Cal. 2020).

39 Cal. Pub. Utils. Comm'n, *supra* note 37.

40 *Id.* at 19 ("The proposed TE [Framework] recommended that Electrical Corporations address the following barriers and issues for . . . customers without access to home charging: . . . Include a component to address environmental and social justice communities."); *id.* at 28 ("This decision holds that as a matter of law, transportation electrification in California must be equitable.").

41 Melton, *supra* note 36.

lessening the impact of vehicle charging on the electrical grid system.[42] A microgrid serves an area with an independent source of energy that is capable of disconnecting or "islanding" from the utility grid. Not only can this improve resiliency, but in the event of utility-grid outages, it can also create islands of power for electric vehicle charging stations.[43] For example, transit agencies in states like Maryland and Massachusetts have turned to renewable energy microgrid projects to power electric vehicle fleets.[44]

The government of California recognized the importance and capabilities of this powerful tool and its potential effect on TE through the implementation of SB 1339.[45] In response to SB 1339, the CPUC developed an entire proceeding dedicated to the commercialization of microgrids for customers of large IOUs.[46] This is another example of the CPUC utilizing its authority to influence and carry out the goals of the California government, this time through regulation of a critical tool that will support electrical grid resiliency as well as effectuating TE.

Most recently, in October of 2021, the CPUC has issued a Proposed Decision adopting microgrid and resiliency solutions for reliability in the summers of 2022 and 2023.[47] If approved by the full CPUC, it would approve the expansion of PG&E's Temporary Generation Program and approve of several energy storage projects of SDG&E.[48] The Temporary and Emergency Generation Program "will accelerate the state's transition to clean electricity by streamlining permitting and other processes to help bring new resources on-line . . . as fast as possible, particularly battery storage projects."[49] This Decision also discussed several ongoing IOU programs that advance microgrids such as SCE's Self-Generation Incentive Program (SGIP), which provides incentives for customers to install self-generating energy storage systems to offset energy use and work as backup

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42 Jane Palmer, *Electrical Vehicle Charging: First of a Kind National Lab Project Will Stimulate Fast Charging Station Microgrids*, IDAHO NAT'L LAB'Y (Apr. 8, 2021), https://inl.gov/article/electric-vehicle-charging-first-of-a-kind-national-lab-project-will-simulate-fast-charging-station-microgrids/.

43 *Department of Energy Releases New Tool Tracking Microgrid Installations in the United States*, OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY (May 26, 2021), https://www.energy.gov/eere/amo/articles/department-energy-releases-new-tool-tracking-microgrid-installations-united.

44 Skip Descant, *Transit Agencies Are Turning to Microgrids to Power EV Fleets*, GOV'T TECH. (May 26, 2021), https://www.govtech.com/fs/transit-agencies-are-turning-to-microgrids-to-power-ev-fleets.

45 S.B. 1339 Elec.: microgrids: tariffs, 2017–18 Leg., Reg. Sess. (Cal. 2018), https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1339.

46 Ord. Instituting Rulemaking Regarding Microgrids Pursuant to Senate Bill 1339, CAL. PUB. UTILS. COMM'N (Sept. 19, 2021), https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M314/K274/314274617.PDF.

47 Proposed Decision Adopting Microgrid and Resiliency Solutions to Enhance Summer 2022 and Summer 2023 Reliability, CAL. PUB. UTILS. COMM'N (Oct. 29, 2021), https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M418/K717/418717729.PDF.

48 *Id*.

49 *Temporary and Emergency Generation Program*, CAL. ENERGY COMM'N, https://www.energy.ca.gov/programs-and-topics/programs/temporary-and-emergency-generation-program (last visited Nov. 14, 2021).

batteries to provide power during an electricity outage.[50] While grid strengthening and resilience to power outages may seem detached from the promotion of electric vehicles, the CPUC's strong efforts in strengthening and supporting microgrids do have a direct impact on TE goals.

C. The Role of IOUs

IOUs also have independently developed programs and solutions to TE issues. In October 2021, PG&E requested that the Commission approve its Electric Vehicle Charge 2 Program (EVC 2).[51] This application proposes $224.4 million to be collected in rates over an eight-year period, from 2023 to 2030 to support behind-the-meter electric vehicle charging infrastructure, program administration, marketing outreach and education, and equity initiatives to support installation of approximately 16,000 charging ports for multifamily housing residents.[52] If accepted by the Commission, this program would direct customer proceeds toward vehicle electrification efforts.[53] Utilities like PG&E recognize the importance of electric vehicle integration and have decided to make this commitment by utilizing their role as businesses to raise funds for research and development of TE.[54] As the availability of electricity and number of charging stations increases, this opens doors and lowers barriers for so many consumers looking to break into the electric vehicle world. As a result, a consumer demand increase will inevitably put pressure on automakers to produce enough and adequate supply of quality vehicles.

IV. The Positive Feedback Loop for Automakers

In addition to complying with government guidelines and consumer demand, automakers have discovered new incentives to entering the new electric vehicle market, beyond generally supporting climate change goals.

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50 *Save on Energy Storage Systems to Keep Your Home Powered*, S. Cal. Edison Co., https://www.sce.com/residential/generating-your-own-power/incentive-program (last visited Nov. 14, 2021).

51 *Notice of Pacific Gas and Electric Company's Request to Increase Rates for its Electric Vehicle Charge 2 Application (A.21-10-010)*, Plumas News (Nov. 10, 2021), https://www.plumasnews.com/notice-of-pacific-gas-and-electric-companys-request-to-increase-rates-for-its-electric-vehicle-charge-2-application-a-21-10-010.

52 *Id.*

53 *Id.*

54 *California approves expedited pathway for near-term utility EV investments, despite cost concerns*, Util. Dive (July 16, 2021), https://www.utilitydive.com/news/california-expedited-pathway-utility-electric-vehicles/603441/#:~:text=the%20CPUC%20has%20already%20authorized,regulators%20reasoned%20in%20the%20decision.

A. Standardization

Not only is Tesla spearheading the market for batteries in electric vehicles, but it may also be setting the standard for others to follow.[55] If more companies rely on Tesla's innovations, whether it be their patent strategies or batteries, Tesla will have had a profound, singular influence on the electric vehicle market. Once governments and regulating agencies set standards for electric vehicles that are consonant with Tesla products, Tesla's products will have pervaded throughout the industry which would likely lead to adoption of their technologies as the industry standard. If adopted, Tesla eliminates stranded asset costs, as well as any cost to redesign or retool.[56]

This is similar to the steel freight shipping containers in the 1953 case *Smith v. Dravo*, where the defendant stole the trade secrets from the plaintiff and created a product with many similar features but four inches smaller in width. However, the defendant marketed their product well, encouraging widespread uptake of their containers. This ultimately drove the plaintiff out of business because of their non-uniform size, although the court eventually enjoined use of plaintiff's trade secrets.[57] This is a practical lesson to manufacturers to strive to set industry standards where strategically useful.

Tesla is also moving extremely quickly to bring products to market.[58] This could be an important business tactic since traditionally, government and state agencies move rather slowly in producing regulation.[59] Thus, owing to its sheer speed, Tesla may dodge or defeat bureaucratic hurdles that regulators will eventually impose on the sector.[60]

B. Market Effects

Automakers that choose allow others to license or use their patents do help to provide what they promise: widespread adoption of electric vehicles. By eliminating a barrier to entry through providing access to relevant patents, they help enable other automakers can enter the market, which would decrease in the cost of parts through innovation, price competition, and economies of scale.[61] Thus, a decrease in the cost of parts could increase the number of automakers involved in the electric vehicle space.[62] Consumers will then see an overall decrease in the price per vehicle as well as falling prices, while an overall growth in product availability will likely increase electric vehicle sales.[63]

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55 Martha Engel, *Why Tesla's Patent Move May Standardize Electric Cars, Not Patent Strategies*, JD SUPRA PERSP. (Jun. 16, 2014), https://www.jdsupra.com/legalnews/why-teslas-patent-move-may-standardize-25427.

56 Loan Programs Office, *Tesla*, U.S. DEP'T OF ENERGY (June 2017), https://www.energy.gov/lpo/tesla.

57 Smith v. Dravo Corp., 203 F.2d 369 (7th Cir. 1953).

58 Neal E. Boudette, *Tesla Reports 87% Increase in 2021 Deliveries*, N.Y. TIMES (Jan. 2, 2022), https://www.nytimes.com/2022/01/02/business/tesla-sales.html.

59 Hans Eric Melin et al., *Global Implications of the EU Battery Regulation*, 373 SCIENCE 384, 385 (2021).

60 *Id.*

61 *See How Monopolies Form: Barriers to Entry*, BA CAMPUS, https://opentextbc.ca/principlesofeconomics/chapter/9-1-how-monopolies-form-barriers-to-entry/, (last visited Jan. 20, 2022).

62 *See id.*

63 *See id.*

C. Batteries

Batteries are a crucial part of the electric vehicle chain of production.[64] With more producers and more demand, one can expect a decrease in the price of upstream parts and materials commonly used for electric vehicle production.[65] Tesla, a vertically-integrated manufacturer, currently has distinct advantages in the industry for battery production, producing a cylindrical cell battery pack for $158.27 per kilowatt-hour as compared to that of $200 per KWH from other automakers.[66] However, by inviting more competitors to join them through relinquishing traditional patent protections, Tesla, along with established automaker Toyota, hope to help ease adoption and production of electric vehicles by increasing access to their components.[67] Ultimately, having more competitive options for parts reduces the price for the end-user, the electric vehicle consumers.[68]

Tesla is branching out into another very profitable market: providing battery pack components to its competitors using the Gigafactory.[69] Tesla has also announced that in addition to licensing their software to others, it will also be supplying powertrains and batteries.[70] Thus, Tesla is enhancing its position as an electric vehicle component manufacturer through its patent pledge, which is apt in drive uptake of technology compatible with its own parts.[71] This strategy may increase the electric vehicle market's dependence on Tesla. On September 22, 2020, Tesla held a "Battery Day" event, unveiling its "million mile" lithium-ion battery pack engineering that significantly improves the range for its electric vehicles.[72] By focusing more on the battery production side of their business, Tesla essentially can penetrate the supply side of the electric vehicle production chain.

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64 *See Electric Vehicle Battery Makers Are Getting Their Hands On Everything*, The Econ. Times, https://economictimes.indiatimes.com/industry/renewables/electric-vehicle-battery-makers-are-getting-their-hands-on-everything/articleshow/88986366.cms, (last visited Jan. 20, 2022).

65 *See* BA Campus, *supra* note 61.

66 Phil LeBeau, *Tesla's Competitors Play Catch-Up on Electric Batteries*, Consumer News & Bus. Channel (Feb. 10, 2020, 11:05 AM), https://www.cnbc.com/2020/02/10/teslas-competitors-play-catch-up-on-electric-batteries.html.

67 Press Release, Elon Musk, Chief Executive Officer, Tesla, All Our Patents Are Belong to You (June 12, 2014), https://www.tesla.com/blog/all-our-patent-are-belong-you; Press Release, Toyota Motor Corp., Toyota Promotes Global Vehicle Electrification by Providing Nearly 24,000 Licenses Royalty-Free (Apr. 3, 2019), https://global.toyota/en/newsroom/corporate/27512455.html.

68 *See Tesla's Musk says open to supplying batteries to other automakers*, Reuters News Agency (Jul. 28, 2020, 9:41 PM), https://www.reuters.com/article/us-tesla-batteries/teslas-musk-says-open-to-supplying-batteries-to-other-automakers-idUSKCN24U0E1.

69 Shawn S. Chang & Jason E. Stach, *Maximizing a Patent's Value by Pledging Not to Assert It?*, Finnegan, Henderson, Farabow, Garrett & Dunner, LLP (Apr. 2015), https://www.finnegan.com/en/insights/articles/maximizing-a-patent-s-value-by-pledging-not-to-assert-it.html.

70 *See* Reuters News Agency, *supra* note 68.

71 Chang & Stach, *supra* note 69.

72 *Tesla Battery Day: News and Updates From Elon Musk's Announcement*, Verge (Sept. 21, 2020), https://www.theverge.com/2020/9/22/21451469/tesla-battery-day-news-announcement-elon-musk-updates-highlights.

Further, Tesla is again able to affect the standardization of the market through widespread commercialization and dependence on their batteries.

D. Charging Infrastructure

Charging stations are another major consideration for market effects. Range anxiety is a major concern for prospective purchasers an electric vehicles, a concern that broader deployment of charging infrastructure may help alleviated.[73] While many electric vehicle owners have the option to charge their vehicle at home, availability and accessibility to a charging station is extremely important consideration.[74] With more producers entering the market and higher demand for electric vehicles, it is likely that charging infrastructures will become more prominent and customary in communities.[75]

E. Patent Pledges

In 2014, Tesla's CEO, Elon Musk, headlined business, environmental, and legal news with his patent pledge.[76] On the Tesla website, the legal effect of the pledge stated, "as long as someone uses our patents for electric vehicles and doesn't do bad things, such as knocking off our products or using our patents and then suing us for intellectual property infringement, they should have no fear of Tesla asserting its patents against them."[77] Tesla invites other automakers and manufacturers to join in and compete with them to produce greener and more energy efficient products.[78] Additionally, this strategy yields the company certain legal benefits. Primarily, its pledge not to sue against those who use their patents decreases uncertainty and potential transaction costs. Large companies that hold hundreds of patents retain large legal teams or law firms to assert or protect against patent infringement claims.[79] In patent law, competitors generally initiate litigation to try and cancel the patent claims of others.[80] By pledging not to assert its patents against competitors, Tesla is limiting this risk for other market participants.[81] This act also allows Tesla to goad its competitors into doing the same, clearing additional hurdles Tesla may face as it develops its technology.

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73 *See generally* Rob Stumpf, *Americans Cite Range Anxiety, Cost as Largest Barriers for New EV Purchases: Study*, THE VERGE (Feb. 26, 2019), https://www.thedrive.com/news/26637/americans-cite-range-anxiety-cost-as-largest-barriers-for-new-ev-purchases-study.

74 Dominick Reuter, *1 in 5 Electric Vehicle Owners in California Switched Back to Gas Because Charging Their Cars Is a Hassle, Research Shows*, INSIDER (Jul. 28, 2021), https://www.businessinsider.com/electric-car-owners-switching-gas-charging-a-hassle-study-2021-4.

75 *Id.*

76 Musk, supra note 67.

77 *Legal*, TESLA, https://www.tesla.com/about/legal#patent-pledge (last visited Dec. 11, 2020).

78 *Id.*

79 *See* Paul Roberts, *"Any Business with a Web Presence is a Potential Target,"* THE SEATTLE TIMES (May 13, 2021) https://www.seattletimes.com/business/local-business/a-patent-troll-targeting-small-businesses-is-sued-by-washington-state/.

80 *Patent Infringement and Litigation*, FINDLAW (Feb. 16, 2018), https://www.findlaw.com/smallbusiness/intellectual-property/patent-infringement-and-litigation.html.

81 Chang & Stach, *supra* note 69.

F. Corporate Responsibility

Many consumers now research and consider the environmental and social responsibilities of a company before purchasing its goods or services.[82] The notion of "voting with your dollar" is pervasive and encourages consumers to consider the values underlying the goods they purchase. For one, Tesla's products and public image identify it as a forward-looking leader in electric vehicle production. Publicity benefits aside, its approach to intellectual property matters allows others to engage with their technology, enhancing the Tesla brand and proving to be a boon to its business.[83] Indeed, as Tesla announced their patent pledge, average consumers may not have understood the true implications, yet Tesla received large amounts of publicity and its market value increased by 16%.[84]

V. Conclusion

With the goal of combatting climate change, governments have recognized that lowering carbon emissions can be significantly aided increasing electric vehicle production and use. As a result, there is a strong commitment to transportation electrification and general societal infiltration of electric vehicles into society. Together, governments, administrative agencies, electrical utilities, and automakers all have separately and congruently developed plans to advance this one goal. Ultimately, these interconnections exemplify that there are many solutions to one goal. For one as critical and universal as combatting climate change through transportation electrification, society has and will continue to produce feedback cycles through incentivization structures for different groups. While this paper only discusses a few sectors that interact to advance TE, it is crucial to examine these intricacies and the push and pull of demand and values to fully comprehend and plan for the future of electric vehicles.

Jen-Ann Lee is a third-year law student at the University of California - Davis (King Hall). She has worked in environmental and transportation policy in both the State and non-profit sectors. Jen-Ann is also a licensed Professional Civil Engineer and has worked for the California Air Resources Board and the California State Water Resources Control Board before attending law school. Jen-Ann is interested in many different areas of the law, including energy, reproductive rights, and intellectual property.

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82 Greg Petro, *Study: Consumers Expect Retailers to Share Their Values*, FORBES (Jan. 21, 2022), https://www.forbes.com/sites/gregpetro/2022/01/21/study-consumers-expect-retailers-to-share-their-values/.

83 Gideon Myles, *Balancing Open Source and Proprietary IP—They Can Co-Exist*, DROPBOX (Dec. 13, 2017), https://dropbox.tech/infrastructure/balancing-open-source-and-proprietary-ip-they-can-co-exist.

84 Chang & Stach, *supra* note 69.

Diffusion of Green Technology: Patents, Licenses, and Incentives

Jayne Piana

I. Introduction

With wildfires raging, flood waters ravaging, and heat domes suffocating, it is clear that the climate crisis is one of the largest issues facing the planet today. And while weather events such as the wildfires suffered in the western U.S., the flooding experienced in Germany, and the heat domes breaking temperature records in Canada may seem to each be regional manifestations of climate change, the entire globe is being impacted, according to the Intergovernmental Panel on Climate Change (IPCC) report issued in August 2021.[1] The IPCC Report offered a sobering conclusion that many of the changes observed in the current climate are unprecedented in thousands, if not hundreds of thousands of years, and some of the changes already experienced such as continued sea level rise are largely irreversible.[2]

In response to this global crisis, companies around the world, including energy and heavy industrial companies, are acknowledging the situation and looking at ways to reduce carbon footprints and their other negative environmental contributions. When confronted with a problem of planetary proportions, technology is the logical starting point to search for solutions. Indeed, the critical role of technology in battling climate change is well-recognized.[3] Stimulating innovation in any area of technology is closely

1 Press Release, Int'l Panel on Climate Change, Climate Change Widespread, Rapid, and Intensifying, U.N. Press Release (Aug. 9, 2021).

2 *Id.*

3 *See, e.g.*, Michael Grubb, *Technology Innovation and Climate Change Policy: An Overview of Issues and Options*, 41 Keto Econ. Studies 103-32 (2004) (emphasizing the crucial role of technologies in combating climate change); Int'l Ctr. for Trade & Sustainable Dev. [ICTSD], *Climate Change, Technology Transfer and Intellectual Property Rights*, 1 (Aug. 2008),

tied to intellectual property protection, primarily patents. Patent filings can be used as a proxy for the level of development in a particular technology area.[4] Since 2014, the number of "green" patent applications filed globally has been decreasing. Intervention is needed to incentivize the continued development of green technology. Once developed, distributing green technology to facilitate its adoption around the world requires an effective technology transfer mechanism.

This article reviews the historical programs for encouraging creation of green technology by fast-tracking green patent applications and concludes that, given the falling numbers of green patent applications since 2014, a different incentive, like a tax incentive, is necessary to stimulate a resurgence. This article also addresses different technology sharing frameworks designed to encourage green technology, evaluates their successes and shortcomings, and suggests paths forward. It concludes that public-private partnerships, like World Intellectual Property Organization (WIPO) GREEN, have solved many of the challenges associated with other technology-sharing frameworks, but opportunities to expand its reach remain untapped. To fill the gaps in WIPO GREEN, tax and marketplace incentives including the rise of ESG awareness among investors and consumers are key to accelerate the development and dissemination of green technology. An initiative to tie the incentive programs together, such as a graduated tax incentive for each step from filing, contribution to WIPO GREEN, and execution of technology sharing deals, should be considered.

II. GREEN TECHNOLOGY AND PATENT APPLICATIONS

Historically, there have been several programs around the world to incentivize green patent applications based on the assumption that patents incentivize technology creation.[5] These programs have all focused on fast-tracking the prosecution of green technology patents, assuming that a shorter timeline from patent application filing to patent grant is an incentive.[6] The data shows, however, that several such programs, including the U.S. Patent and Trademark Office (USPTO) program, have had low participation

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https://www.iisd.org/system/files/publications/cph_trade_climate_tech_transfer_ipr.pdf ("Technological solutions are imperative in meeting the challenges of climate change."); William Dibble, *Justifying Intellectual Property*, 1 UCL JURIS. REV. 74, 74 (1994) ("The need for intellectual goods in contemporary culture means that we place an enormous value on them. The value however can only be realized in the form of a price if it is protected by some form of law or recognized within law.").

4 *See* Christopher A. Eusebi & Richard Silberglitt, *Identification and Analysis of Technology Emergence Using Patent Classification*, RAND CORP. (2014), https://www.rand.org/pubs/research_reports/RR629.html (finding that a "rapid increase in patent application filing is a signal of technology emergence and industry acceptance.").

5 Antoine Dechezlepretre, *Fast-tracking Green Patent Applications: An Empirical Analysis*, ICTSD Programme on Innovation, Technology, and Intellectual Property, February 2013, available at https://www.files.ethz.ch/isn/161230/fast-tracking-green-patent-applications-an-empirical-analysis.pdf [hereinafter *Fast-tracking Green Patent Applications*].

6 *Id.*

levels, raising the question of whether fast-tracking green patent applications is the best way to incentivize development of green technology.[7]

A. Background on patents and why patents incentivize innovation

It is widely recognized that patents promote innovation.[8] Indeed, the U.S. Constitution provides for a patent system to "promote the progress of science and useful arts, by securing for a limited time to . . . inventors the exclusive Right to their respective . . . discoveries."[9] This view transcends U.S. borders. The World Trade Organization has also recognized this role of intellectual property rights:

> The protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations.[10]

Under the U.S. patent system, as well as most patent systems around the world, a patent protects technology for twenty years from filing in exchange for disclosing the technology to the world.[11] That is, the patent system is a *quid pro quo*. In exchange for granting the inventor exclusive rights in the invention for a limited time, the inventor provides a detailed description of the technology to the public.[12] This detailed description can form the basis of improvements on the invention. Depending on the level of departure from the invention, the improvement may be used during the term of the patent. After the patent expires, the technology as claimed in the patent is available for anyone to use. The patent system thus creates an ongoing cycle of innovation that perpetuates more inventions.[13]

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7 *Id.*

8 Intellectual property includes patents, copyrights, trade secrets, and trademarks. All of these may be relevant to green technology, as discussed in other publications. *See, e.g.*, Abbe E. L. Brown, *Intellectual Property and Climate Change*, *in* The Oxford Handbook of Intellectual Property Law: V. The Political Economy of Intellectual Property 958, 965 (Rochelle Dreyfuss & Justine Pila eds., 2018), https://doi.org/10.1093/oxfordhb/9780198758457.013.34. This paper will focus on how patents can be leveraged to incentivize the creation and dissemination of and green technology.

9 U.S. Const. art. I, § 8.

10 Agreement on Trade-Related Aspects of Intellectual Property Rights art. 7, 33 I.L.M. 81 (1993) [hereinafter TRIPS]. TRIPS is the most comprehensive multilateral agreement on intellectual property, globally, and provides the member nations of the WTO to accord the protection of IP provided for under the Agreement to the persons (including individuals and companies) of other Members. *Overview: The TRIPS Agreement*, World Trade Org., https://www.wto.org/english/tratop_e/trips_e/intel2_e.htm (last visited Dec. 1, 2021).

11 *See Frequently Asked Questions: Patents*, World Intell. Prop. Org., https://www.wipo.int/patents/en/faq_patents.html (last visited Oct. 14, 2021).

12 *See id.*

13 *See* Patrick Gattari, *The Role of Patent Law in Incentivizing Green Technology*, 11 Nw. J. Tech. & Intell. Prop. 41, 42 (2013).

Studies demonstrate that innovation is increased with a patent system because people are driven by the possibility of making money from their work.[14] As posed to this author's children's elementary school class during a presentation on patents: if an inventor spends hours, days, weeks toiling only to have that invention copied by another, how would the inventor feel about making another invention? The children—and economists—agree that the inventor would not be incentivized to repeat that hard work to innovate.[15]

In addition to financial gain, patents can signal value to investors and potential partners, such as government collaborators. Patent activity of new green technology startup companies increases by over 73% every time there is a collaboration with a government agency towards green technology development, compared with startups not engaged in such collaborations.[16] When patent applications are published, entities can signal to other companies that the claimed technology is worth pursuing. Thus, recompilations of patents become "a library with the most innovative and strong information regarding the newest technologies" that "can be used by other entities in the regionalization of technologies, as, for example, technology developed in the U.K. related to solar energy that can be adapted to solar energy-fluent countries like Egypt and Libya."[17] For instance, WIPO GREEN stakeholders agree that the "dissemination of green technology contributes to fostering innovation"[18] and that patents have an "important relationship" with green technology dissemination.[19]

Because of this link between green technology and patents, several programs have been established by patent offices around the world to incentivize green patent applications to in turn incentivize the creation of green technology. As shown below, these programs have had varying degrees of success but are all based on the assumption that a shorter timeline from patent application filing to granted patent is an effective incentive for developing green technology. Unfortunately, the statistics show that the number of

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14 *How Do Patents Encourage Innovation? What You Need to Know*, UPCOUNSEL, https://www.upcounsel.com/how-do-patents-encourage-innovation (last visited Oct. 12, 2021) (detailing arguments for and against patents, as well as how patents can promote innovation).

15 *See, e.g.*, Bingbin Lu, *Expedited patent examination for green inventions: Developing countries' policy choices*, 61 ENERGY POL'Y 1529, 1529 (2013) ("Patent rights can provide incentives for green technology research and development."); *see also, e.g.*, David Encaoua et al., *Patent systems for encouraging innovation: Lessons from economic analysis*, 35 RSCH. POL'Y, 1423, 1423 (2006); *see also, e.g.*, Dibble, *supra* note 3.

16 Claudia Doblinger et al., Governments as Partners: The Role of Alliances in U.S. Cleantech Startup Innovation, 48 RSCH. POL'Y 1458, 1458 (2019).

17 *The Role of IP Rights in Green Technologies Innovation*, METIS PARTNERS (July 21, 2019), https://metispartners.com/thought-leadership/the-role-of-ip-rights-in-green-technologies-innovation/.

18 WORLD INTELL. PROP. ORG., WIPO GREEN Strategic Plan 2019-2023: Accelerating the Transition to a Greener Global Economy 1, 22 (2019), https://www.wipo.int/publications/en/details.jsp?id=4422 [hereinafter WIPO GREEN Strategic Plan 2019-2023] ("The dissemination of green technology contributes to fostering innovation (97 percent of respondents agree).").

19 *Id.* ("IP is considered to have an important relationship with green technology dissemination (85 percent of respondents).").

green patent applications have been falling, not rising, despite these fast-track programs. To meet current challenges, other approaches need to be considered.

B. USPTO: Green Technology Pilot Program and Track One

To encourage innovation and patenting of green technologies, the USPTO adopted a "Green Technology Pilot Program" in 2009.[20] When announced, the program claimed it would "accelerate the development and deployment of green technology, create green jobs, and promote U.S. competitiveness in this vital sector."[21] Under the program, a green patent application would be given special status enabling expedited examination, essentially jumping ahead in the line to have its patent application examined by the USPTO, saving an average of one year in the U.S. patenting process. Green technology was defined as including "greenhouse gas reduction (applications pertaining to environmental quality, energy conservation, development of renewable energy resources or greenhouse gas reduction)" and was restricted to certain technology classifications.[22] When announced, the program had industry support, praising the program as providing an incentive to innovate clean technology. The chief intellectual property counsel of General Electric stated, "[w]e hail this initiative as an excellent incentive to fuel further innovation of clean technology and a terrific mechanism to speed the dissemination of these patented technologies throughout the world."[23]

Six months after it was announced, the program was expanded to include more technologies, removing the classification requirement in May 2010.[24] The program was then extended to the earlier of either March 30, 2012 or to the date upon which a total of 3,500 applications had been accorded special status.[25] The USPTO hit the total of 3,500 applications well before March 2012 and, after granting over 1,000 U.S. patents on green technology, announced that the Green Technology Pilot Program would be phased out on December 15, 2011.[26]

While much was made of the Green Technology Pilot Program by the USPTO, uptake was limited, with an estimated 8% of the average annual number of green patent applications requesting accelerated examination.[27] There are several theories explaining this small uptake, including that expedited examination under the patent system may not truly be an advantage, as expedited examination also expedites costs associated with the examination.[28] Expedited examination may also outpace the development of the

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20 Press Release, U.S. Dep't of Com., U.S. Commerce Department's Patent and Trademark Office to Accelerate Review of Green Technology Patents to Speed Deployment to Marketplace (Dec. 7, 2009), https://2010-2014.commerce.gov/node/11670.html.

21 *Id.*

22 *Green Technology Pilot Program – CLOSED*, U.S. Pat. & Trademark Off. (May 7, 2021), https://www.uspto.gov/patents/initiatives/green-technology-pilot-program-closed.

23 U.S. Dep't of Com., *supra* note 20.

24 Elimination of Classification Requirement in the Green Technology Pilot Program, 75 Fed. Reg. 28, 554 (May 10, 2010).

25 Sunset of the Patent Application Backlog Reduction Stimulus Plan and a Limited Extension of the Green Technology Program, 76 Fed. Reg. 77,979–77,980 (Dec. 15, 2011).

26 U.S. Pat. & Trademark Off., Green Petition Report Summary (2012), https://www.uspto.gov/sites/default/files/patents/init_events/green_report_summary20120426.pdf.

27 *Fast-tracking Green Patent Applications*, *supra* note 5, at 6.

28 *Id.* at 7.

technology, as it provides a limited time period in which to adjust claims to fit the commercial embodiment of the invention.[29]

The Green Technology Pilot Program was replaced by another fast-track examination program, the Track One Prioritized Examination Program, whose goal is to provide final disposition of an application within twelve months, regardless of technology field.[30] The Track One program requires a special handling fee of $4,200.[31] Despite the additional fee, Track One applications are disproportionately filed by small firms rather than large companies, with the notable exception of Google.[32] While the Track One program delivers on shortening patent examination time, with Track One patents issuing about a year to eighteen months faster than the typical timeline, there is still a low uptake of green patent applications.[33] Explanations for the low utilization of the Track One program are similar to those for the Green Technology Pilot Program and include potential lack of awareness, a preference for delaying patent examination costs, and a desire to defer strategic choices like finalizing a patent's claims.[34] Regardless of the reasons for the low uptake, the USPTO's fast-track patent examination programs have not accomplished the objective of incentivizing the development of green technology as measured by the number of green patent applications.

C. OTHER FAST-TRACK PATENT EXAMINATION PROGRAMS

Other countries have implemented similar fast-track patent examination programs for green technology, including Australia, Canada, Israel, Japan, Korea, and the U.K.[35] The utilization of these programs varies, notably with the U.K. having the largest participation of twenty percent of eligible applications participating, trending downward to between one percent and two percent for the programs in Australia, Canada, Japan, and Korea.[36] As with the U.S. fast-tracking programs, the users tend to be start-ups.[37] While the overall utilization rates are low, it has been suggested that the technologies taking advantage of the fast-track examination programs are the technologies that matter most to these companies and are thus high-quality.[38] Some commentators have suggested that these fast-track patent programs can help with sharing the technology, even though the

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29 *Id.* at 8.

30 *USPTO's Prioritized Patent Examination Program*, U.S. PAT. & TRADEMARK OFF., https://www.uspto.gov/patents/initiatives/usptos-prioritized-patent-examination-program (last visited Oct. 4, 2021).

31 *USPTO fee schedule*, U.S. PAT. & TRADEMARK OFF., https://www.uspto.gov/learning-and-resources/fees-and-payment/uspto-fee-schedule#Patent%20Petition%20Fee (last revised June 25, 2021) ("Fee code 18147/2817/3817 Request for prioritized examination").

32 Jeffrey M. Kuhn & Mike H.M. Teodorescu, *The Track One Pilot Program: Who Benefits from Prioritized Patent Examination?*, 15 STRATEGIC ENTREPRENEURSHIP J. 185, 187, 203 (2021) [hereinafter *Track One Pilot Program*].

33 *Id.* at 199, 203.

34 *Id.*

35 *See Fast-tracking Green Patent Applications*, *supra* note 5 (presenting a comprehensive overview of the various fast-track systems around the world).

36 *Id.*

37 *Id.*

38 *See Track One Pilot Program*, *supra* note 32, at 199, 203; *see also Fast-tracking Green Patent Applications*, *supra* note 5.

technology is protected, based on citations of these patents. Patent citations are used to measure knowledge flows because patent applications must cite patents and other publications on which the inventor has built to develop the new technology.[39] Thus, a citation of a patent in another patent application, called a "forward citation," means the technology in the cited patent is foundational for the technology in the patent application, which may be an improvement.

That the fast-tracking programs have not effectively increased the development of green technology, at least as measured by the number of green patent applications, is borne out by recent statistics showing that the number of green technology patent applications across the globe has been lagging, or even falling. In 2020, the WIPO issued a report that reviewed four categories of green energy: alternative energy production (renewable energy technologies), energy conservation technologies, green transportation, and nuclear power generation.[40] According to the report, the number of patent applications covering these green technologies rose only 1.3% from 2018 to 2019, compared to a 5.5% growth from 2017 to 2018.[41] While green technologies in these categories slowed, "efficient use technologies" increased by 9% since 2013, driven by energy conservation technologies and transportation-related innovation.[42] In the U.S., patent application filings in the four categories of green energy listed in the WIPO report have been steadily declining since a peak in 2014.[43]

D. Recommendations

Programs to fast-track patent examination have not sufficiently incentivized the development of green technology, at least as measured by the number of green patent applications utilizing such programs. The disproportionate utilization by start-ups suggests that additional fees associated with the programs may not be the reason for the low uptake, although reform efforts may consider a waiver of fees for technology committed to be shared in a public-private partnership aimed at disseminating green technology, such as WIPO GREEN, discussed later in this paper. To address the reluctance to finalize patent claims before issuance, a reduced-fee or even fee-free continuation application could be offered for green technology. This would allow the claims of the patent to be fast-tracked, but still provide some flexibility for claims on an invention in the develop-

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39 *See id.* ("Using citations to patents as a measure of knowledge spillovers, we found that fast-track patents received more than twice as many citations in the same time period, compared with patents filed in the same month, of similar value but not fast-tracked. Thus, we found strong evidence that green patent fast-tracking programmes have accelerated the diffusion of technological knowledge in green technologies in the short run (during the first years following the publication of the patents."). *See also id.* at 12.

40 Press Release, World Intell. Prop. Org., *World Intellectual Property Day 2020: Green Innovation Surge Needed to Address Climate Change, New WIPO Figures Show* (Apr. 23, 2020), https://www.wipo.int/pressroom/en/articles/2020/article_0007.html.

41 World Intell. Prop. Org., Annex to PR/2020/851 (2021), https://www.wipo.int/export/sites/www/pressroom/en/documents/pr_2020_851_annex.pdf.

42 World Intell. Prop. Org., *supra* note 40.

43 Parker Brogdon, *Green Technology at the USPTO*, Juristat (June 11, 2020), https://blog.juristat.com/green-tech.

ment phase.[44] A more dramatic reform would grant certain defined areas of green technology such as carbon capture and storage or zero-carbon electricity production a presumption of patentability in exchange for prioritized examination and a shorter patent period. This level of reform would likely require implementation at the global level through the Trade-Related Aspects of Intellectual Property Rights (TRIPS), administered by the World Trade Organization.

Other institutional incentives must be considered, such as a tax incentive for filing green patent applications, tax incentives for investors in and producers of green technology, green technology research grants, or loan guarantees for companies producing green energy.[45] Government stimulus aimed at renewable energy technologies in the form of tax credits, cash grants, and research grants—all part of the American Recovery and Reinvestment Act passed in February 2009—has been effective in boosting the development of green technology.[46]

Perhaps the best incentive is demonstrating the market for green technology.[47] Demand for green technology—specifically in the categories of (1) energy generation, storage, and distribution, (2) energy efficiency, (3) raw materials and material efficiency, (4) sustainable mobility, (5) circular economy, and (6) sustainable water management—is expected to grow by 6.9% annually to nearly $7 billion U.S. dollars in 2025.[48]

III. How to incentivize sharing green technology?

Once green technology has been developed and protected, how can that technology be distributed? Access to green technology has been recognized as a critical part of the climate crisis solution. The United Nations Framework Convention on Climate Change (UNFCCC), established by the United Nations in 1992, acknowledges that access to green technology is a fundamental component of its framework.[49] The UNFCCC re-

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44 *See generally* Reinhilde Veugelers, *Which policy instruments to induce clean innovating?*, 41 RES. POLICY 1770 (2012) (finding that fiscal incentives are highly motivating factors leading to sustainable technological transfer in some sectors of activity).

45 *See* Jonathan M.W.W. Chu, Developing and Diffusing Green Technologies: The Impact of Intellectual Property Rights and their Justification, 4 WASH. & LEE J. ENERGY CLIMATE & ENV'T 53, 64 (2013) (citing Andrew Wait, Investment in Clean Technologies as a Public Good: a Discussion Paper Presented for the Clean Energy Council 4 (2010) (noting that the government can implement subsidies, grants, tax incentives or other incentive schemes to address and promote the research and development of new technologies).

46 Luis Mundaca & Jessica Luth Richter, Assessing 'Green Energy Economy' Stimulus Packages: Evidence From the U.S. Programs Targeting Renewable Energy, 42 RENEWABLE & SUSTAINABLE ENERGY REVS. 1174, 1174–75 (Feb. 2015).

47 *See, e.g.*, Mohammad Tavakolifar et al., *Media attention and its impact on corporate commitment to climate change action*, 313 J. OF CLEANER PROD. 127833 (2021) (asserting that "companies do not engage in environmental initiates unless economic or competitive advantage are likely to accrue.").

48 WIPO GREEN, STRATEGIC PLAN 2019-2023, *supra* note 18, at 5.

49 Under the Kyoto Protocol to the UNFCCC, signatory parties were committed to "cooperating in the promotion of effective modalities for the development, application and diffusion of, and take all practicable steps to promote, facilitate and finance, as appropriate, the

newed its commitment to the development and dissemination of green technology since its establishment, including in the 2015 Paris Agreement, which recognized "the need for an effective and progressive response to the urgent threat of climate change on the basis of the best available scientific knowledge."[50]

Patents are inherently exclusionary; a patent provides the owner with the right to exclude others from practicing the claimed technology. It has been observed that traditional intellectual property (IP) law "does little to encourage transfer of technology for a global response to climate change because it is so rooted in protecting one's exclusive rights and using those rights for wealth building."[51] As a result, sharing patented technology may at first sound counter-intuitive: why patent a technology just to turn around and give away one's exclusive rights? There are several answers to this question, including that the exclusive right may be retained in some circumstances. Thus, a royalty-free license may be appropriate for applications of technology in the environmental space, but exclusivity could be maintained for other applications. In addition, a royalty-free license may be offered in certain developing countries struggling with environmental issues, but exclusivity could be maintained in wealthier nations. Without patent protection on the green technology, the technology owner would have no legal control over the technology—the genie would already be out of the bottle—and would not have the option to determine how the technology is accessed and for what purpose. Maintaining some control over the technology is likely important for investors; it has been observed that without "strong and predictable intellectual property rights to encourage private investors, there would be reduced development of green technology."[52] Additionally, potential positive public relations benefits associated with pooling, pledging, or licensing patented technology should not be undervalued, especially with the increased emphasis on environment social and governance (ESG).

There are several available frameworks to share patented technology. Reviewing these frameworks and understanding their advantages and disadvantages provides important insight to develop a program that diffuses green technology.

A. Patent pools

One framework of sharing patented technology is through a patent pool. Patent pools have been thoroughly analyzed as an accepted technology-sharing mechanism.[53] A patent pool is a setup where members contribute patents to a "pool", and members are

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transfer of, or access to, environmentally sound technologies, know-how, practices and processes pertinent to climate change." Kyoto Protocol to the United Nations Framework convention on Climate Change Annex A, Dec. 11, 1997, 37 I.L.M. 32. The Kyoto Protocol was superseded by the 2015 Paris Agreement.

50 Paris Agreement to the United Nations Framework Convention on Climate Change, *opened for signature* 12 Dec. 2015, 55 I.L.M. 743 (entered into force 4 Nov. 2016).

51 Andrea Nocito, Innovators Beat the Climate Change Heat with Humanitarian Licensing and Patent Pools, 17 Chi.-Kent J. Intell. Prop. 164, 177 (2018).

52 *See* Chu, *supra* note 45, at 79.

53 *See, e.g.*, Carl Shapiro, Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting, in Innovation Policy and the Economy 119 (Josh Lerner & Scott Stern eds., 2000); *see also* Steven C. Carlson, *Patent Pools and the Antitrust Dilemma*, 16 Yale J. on Regul. 359 (1999).

then licensed to use the technology in the pool. Patent pools are one solution to the problem of blocking patents, which occurs when a patent on one innovation blocks further improvements to that innovation. The broader patent, or "dominant patent" thus blocks the improvement, or "subservient patent" because the subservient patent "cannot be exploited without infringing upon the dominant patent."[54] Similarly, the subservient blocks the dominant patent from innovating in a way that overlaps with the subservient patent. If the dominant patent owner and the subservient patent owner are both members in a patent pool that requires all improvements to be contributed back to the patent pool, the blocking patent problem is solved because both members would receive licenses to all the patents in the pool.[55] Thus, patent pools are a form of cross-licensing, typically on a broader scale as they usually involve several members instead of two competitors entering into a cross-licensing arrangement.[56] Patent pools typically focus on a particular sector of industry to best leverage the pooled technology.[57] Patent pools can become quite complex as commercial realities are considered, such as how to divide royalty streams among the patents in the pool.[58]

As with any collaboration among competitors, patent pools are often subject to antitrust scrutiny. Such scrutiny of patent pools dates back to the last century, when "absolute freedom" of patentees to collude through patent pools came to an end.[59] In 1912, the Supreme Court affirmed the dissolution of a patent pool directed at sanitary ironware in *Standard Sanitary Manufacturing Co. v. United States*.[60] There, the pool license agreement required members to abide by a minimum sales price, enforce resale prices, and refuse to deal with companies that were not members. The Supreme Court held that the rights of the patentees had resulted in "evil consequences," and that the Sherman Act was the weapon to attack these evils.[61] Since then, the level of antitrust scrutiny applied to patent pools has evolved from strict enforcement, as evidenced by the "Nine No-Nos" issued by the Antitrust Division of the Department of Justice in 1970 that were considered per se violations of the antitrust laws,[62] to a more relaxed approach as reflected in

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54 *See, e.g.*, *id.* at 363.

55 Patent pools may be set up with varying terms and conditions, however, and so it is important for the patent pool to require that all improvements be contributed back to the patent pool solve the blocking patent problem. A patent pool that does not require any improvements to be contributed to the pool may actually encourage blocking patents. Most patent pools do require contribution of improvements back to the pool. *See id.*

56 *Id.* at 367-68, 369.

57 *Id.* at 368.

58 *Id.*

59 *See* E. Bennett & Sons v. Nat'l Harrow Co., 186 U.S. 70, 91 (1902) (stating that the "general rule" was the "absolute freedom in the use or sale of rights under the patent laws . . . The very object of these laws is monopoly.").

60 *See* Standard Sanitary Mfg. Co. v. United States, 226 U.S. 20 (1912).

61 *Id.* at 49.

62 The Nine No-Nos are: "(1) Tying of purchase of unpatented materials as a condition of a patent license; (2) Requiring the licensee to assign back or grant an exclusive grant-back license of subsequent patents obtained by the licensee; (3) Restricting the right of the purchaser of the product in the resale of the product; (4) Restricting the licensee's ability to deal in products outside the scope of the patent; (5) Promising a licensee that the licensor would not grant further licenses; (6) Mandating that the licensee to take a 'package li-

the updated guidelines issued in 2017.[63] Assistant Attorney General Makan Delrahim in remarks to the Licensing Executive Society in 2019, shared that the Nine No-No's were "increasingly replaced in favor of a flexible effects-based analysis on those same licensing practices" and hypothesized that "stark antitrust rules and prohibitions would become a thing of the past."[64] While the Department of Justice has somewhat relaxed its position on patent pools, any patent pool must be cognizant of the antitrust risks. These risks may not be a concern for green technology patent pools, provided the patent pool is open to any company wishing to enter under the terms of the arrangement.[65] An open-invitation framework would thus be both consistent with the objective of disseminating green technology and alleviate antitrust concerns.

One criticism of patent pools—and other technology sharing frameworks—is that they merely provide a license to the patented technology. The pool members do not receive any technology transfer, nor guidance on how to apply, market, or even operate the technology. Given this limitation, patent pools are typically set up with a narrow focus, where the participants already have know-how on how to use the pooled technology.[66]

While much has been written about patent pools, there are not many examples of patent pools in the green technology space.[67] However, some guidance is available from the pharmaceutical industry. The Medicines Patent Pool is a United Nations-backed public health organization working to increase access to, and facilitate the development of, life-saving medicines for low- and middle-income countries.[68] To date, it has obtained patented knowledge related to fighting HIV, hepatitis C, and tuberculosis from

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cense'; (7) Imposing royalty provisions not reasonably related to the licensee's sales; (8) Restricting a licensee's use of a product made by a patented process; and (9) requiring a minimum resale price for the licensed products. William D. Coston, *The Patent-Antitrust Interface: Are There Any No-No's Today?*, VENABLE (Jan. 2013), https://www.venable.com/files/publication/fc1499d2-4dc6-441d-b24d-21a93f06769d/preview/publicationattachment/7896b76f-4d3e-44be-9089-24d70be3cea2/coston—the-patent-antitrust-interface.pdf.

63 *See* U.S. DEP'T OF JUST., ANTITRUST GUIDELINES FOR THE LICENSING OF INTELLECTUAL PROPERTY (2017), https://www.justice.gov/archives/opa/blog-entry/file/925906/download.

64 Makan Delrahim, Assistant Attorney General, U.S. Dep't of Just., Remarks at the Licensing Executives Society 2019 Annual Meeting (Oct. 21, 2019) (https://www.justice.gov/opa/speech/times-they-are-achangin-nine-no-nos-2019).

65 Ilian Iliev & Karsten Neuhoff, Balancing Technology Access & Innovation Incentives: Lessons from Patent Pools and Cooperative Standards as a Channel for Climate Change Technology Cooperation 7–8 (2009), https://climatestrategies.org/wp-content/uploads/2014/11/isda-intellectual-property-september-2009-report.pdf.

66 *See* Chu, *supra* note 45, at 79 (recognizing that technological "know-how" is "often a necessary factor for the adoption of technology and a lack of such "know-how" may itself remain a barrier).

67 *See* Nocito, *supra* note 51 (asserting that "patent pools are solutions for addressing this dilemma" of sharing intellectual property rights to combat climate change but not providing any examples of patent pools being applied in green technology). Some commentators cite a patent pledge known as the Eco-Patent Commons as an example of a patent pool, but as discussed later in this paper, the Eco-Patent Commons did not only benefit members of the Eco-Patent Commons and thus is not a traditional patent pool.

68 *About Us*, MEDS. PAT. POOL, https://medicinespatentpool.org/ (last visited Oct. 1, 2021).

ten companies[69] and licensed it to companies creating generic drugs in developing countries.[70]

In the green technology space, potential applications of patent pools could include pools aimed at a particular subset of green technology, for example turbine blades used in the production of wind energy. Such an arrangement could expedite transfer of green technology while avoiding the issues of insufficient application and implementation know-how. An open membership policy would help mitigate antitrust risks. Providing commercial incentives to members in a pool aimed at green technology, for example tax incentives as well as other incentives discussed elsewhere in this paper, could be a helpful to establish more green technology patent pools.

B. PATENT PLEDGES

An alternative to a patent pool is a patent pledge, or a voluntary waiver of intellectual property rights. Patent pledges have been in the news over the last few years, perhaps most famously following Tesla CEO Elon Musk's announcement that Tesla would apply an open-source philosophy to its patents and would not initiate patent lawsuits against anyone who, in good faith, wants to use its technology, on the premise that "other companies making electric cars, and the world would all benefit from a common, rapidly evolving technology platform."[71]

Other industries, such as high-tech and biotechnology, have also implemented patent pledges in furtherance of sharing technology with the goal of development.[72] Like a patent pool, one issue with a patent pledge is that there is no technology or know-how transfer. In addition, patent pledge arrangements generally do not have many, if any, conditions on the patent contributor, such as requiring that any improvements on the pledged technology are also donated. Without this requirement, patent pledges have a potential to create a blocking patent problem, where a company improves on the pledged technology, patents that improvement, and thus blocks future use of the improvement and future secondary improvements.

Led by IBM, the Eco-Patent Commons was a patent pledge framework established in 2008 to encourage diffusion of green technologies and to increase the potential for follow-up innovation. Other founding members included Nokia, Sony, and Pitney Bowes. The Eco-Patent Commons was focused on five specific areas of green technology: energy conservation, pollution control, environmentally friendly materials, water or materials

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69 *Id*.

70 *See* Armin Rosencranz et al., *Climate change and the patent regime: are patents the answer?*, 23 J. INTELL. PROP. RTS. 22, 23 (2018) (India).

71 Elon Musk, *All Our Patent are Belong to You*, TESLA (June 12, 2014), www.tesla.com/blog/all-our-patent-are-belong-you.

72 For a comprehensive discussion of patent pledges, *see, e.g.*, Jorge L. Contreras et al., *Pledging Patents for the Public Good: Rise and Fall of the Eco-Patent Commons*, 57 HOUS. L. REV. 61, 66-67 (2019) (observing that "over the past few decades significant patent pledges have been made in areas such as open source software (*e.g.*, IBM, Sun, Google and Red Hat (now owned by IBM) have each pledged that they will not assert hundreds of patents against open source software implementations); electric vehicles (in addition to Tesla Motors' famous pledge, Toyota has made a significant pledge of patents covering its hydrogen cell vehicles); and biotechnology (*e.g.*, Monsanto's pledge not to assert patents covering genetically modified seeds against famers inadvertently growing them.").

use, and reduction and recyclability. When the Eco-Patent Commons was shut down in 2016, the thirteen Eco-Patent Commons participants had collectively pledged a total of 248 "green technology" patents, representing 94 priority patents or distinct inventions.[73]

As a patent pledge, the Eco-Patent Commons benefitted all users of technology, regardless of membership in or contribution to the Eco-Patent Commons. A pledge of a patent to the Commons included an irrevocable covenant to not assert the patent against any third parties using the patented technology, with a limited caveat for defensive rights.[74] If a patent contributor was involved in a patent infringement lawsuit, the patent contributor could defensively assert its contributed patents against (1) any Commons participant that asserted any environmental patent against it, or (b) any non-Commons participant that asserted any patent against it.[75]

After the Commons closed its doors in 2016, an extensive post-mortem concluded that the Commons did not effectively increase the diffusion of the green technologies in the pledged patents.[76]

> Pledged patents are cited less than the matched control patents before they enter the commons, suggesting that they were already less valuable, and their pledge does not change this. Inventors of citing patents unanimously indicated that the pledge, i.e. royalty-free access, did not affect their decision to rely on an EcoPC patent as prior art. In fact, none of the inventors that responded to our query were even aware that the cited patent was part of the EcoPC and hence royalty-free access played no role in their decision to rely on it as prior art. These results suggest that the commons had no effect on technology diffusion.[77]

Upon reflection, the structure of the Commons presented issues for both technology adopters and patent contributors. From a potential technology adopter's perspective, the Eco-Patent Commons did not provide the potential users of the technology any information other than the text of the pledged patents. While patents must contain enough information to enable one of ordinary skill in the art to make or use the invention, they do not need to be as detailed as a user manual or explain how to apply the technology to a user who is not of ordinary skill. The lack of technology transfer has been recognized as one of the flaws of the Commons[78] and patent pledge programs in general.[79]

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73 Contreras et al., *supra* note 72, at 67-68.

74 World Business Council for Sustainable Development, *Eco-Patent Commons: Joining or Submitting Additional Patents to the Commons* 3 (n.d.), http:// ERROR! HYPERLINK REFERENCE NOT VALID.www.otromundoesposible.net/wp-content/uploads/2012/07/EcoPatentGroundRules.pdf.

75 *Id.* at 5.

76 *See* Contreras et al., *supra* note 72, at 70.

77 *See id.* at 70-71.

78 *See id.*

79 A recent debate has been raging about the waiver of patent rights regarding the COVID-19 vaccine. *See, e.g.*, Priti Krishtel & Rohit Malpani, *Suspend intellectual property rights for covid-19 vaccines*, BMJ 2021:373:n1344 (May 28, 2021), https://www.bmj.com/content/373/bmj.n1344 (favoring a waiver of IP rights); *see also, e.g.*, *A patent waiver on COVID vaccines is right and fair*, 593 NATURE 478 (May 25, 2021) (calling for a waiver of IP rights). While the details of that debate are beyond the scope of this paper, one of the consistent criticisms of the position in favor of a waiver of patent rights has been the lack of technology transfer.

From the patent contributor perspective, there were minimal incentives to participate in the Commons. Contributed technology was open to anyone, including competitors. Since the patents contributed to the Commons remained the property of the contributor, the contributor also retained the responsibility for paying costly maintenance fees. As a result, to minimize maintenance costs, contributors were incentivized to pledge patents to the Commons that had little commercial value and then allow them to lapse after they were pledged.

The main commercial incentive for the contributors participating in the Commons was potentially favorable public perception. One study that interviewed several of the participants in the Commons, however, found that none of the individuals interviewed identified a public relations benefit as a principal justification for joining the Commons.[80] This is surprising as, according to the interviewed participants, the decision to join the Commons was made by an executive or manager within the company's Environmental and Social Responsibility department.[81] While the motivation to join the Commons may have stemmed from a perceived corporate social responsibility, it is difficult to believe that such spirit would not have been leveraged from a public relations perspective, even if public relations was not the primary motivator to join.[82] However, the Commons shut down in 2016 before the current wave of corporate environmental, social and governance (ESG) commitments.[83] It is therefore possible that a patent pledge today would be more attractive to corporations, especially if intentionally coupled with more public attention. With a few exceptions, however, patent pledges have limited effectiveness in disseminating technology and so may not be an ideal path forward to meet the objective of sharing green technology to combat climate change.

C. PUBLIC-PRIVATE PARTNERSHIPS, INCLUDING WIPO GREEN

In addition to efforts led by private industry, such as the Eco-Patent Commons and patent pools, public-private partnerships tasked with diffusing green technology have been a source of optimism.[84] While the previously discussed mechanisms influence the

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Press Release, Michelle McMurray-Heath, President, Biotechnology Innovation Org., Support of 'TRIPS' Waiver Sets Dangerous Precedent, (May 5, 2021), https://www.bio.org/press-release/support-trips-waiver-sets-dangerous-precedent?mkt_tok=NDkwLUVIWi05OTkAAAF84P_KZsnGoRmOmXFEKOnsZqTd_IMtoXpmJIkZfJKc4q2-RCpxGr1NeXeCe06dz9R4QSAZPbHxcIP72ZQblEhXRrANVyj7V6rVlP8PJ56BXf0Y ("Handing needy countries a recipe book without the ingredients, safeguards, and sizeable workforce needed will not help people waiting for the vaccine. Handing them the blueprint to construct a kitchen that – in optimal conditions – can take a year to build will not help us stop the emergence of dangerous new COVID variants.").

80 *See* Contreras et al., *supra* note 72, at 77-78.

81 *Id.*

82 *Id.*

83 *See* Tavakolifar et al., *supra* note 47.

84 *See, e.g.*, Ahmed Abdel-Latif, *The Rise of Public–Private Partnerships in Green Technologies and the Role of Intellectual Property Rights*, *in* THE CAMBRIDGE HANDBOOK OF PUBLIC-PRIVATE PARTNERSHIPS, INTELLECTUAL PROPERTY GOVERNANCE, AND SUSTAINABLE DEVELOPMENT 226 (Margaret Chon et al. eds., 2018) (emphasizing the role of public-private partnerships and that "the emphasis on the collaboration and complementarity between public and private actors is a central aspect of the overall philosophy underpinning the

strength of patents (the fast-track examination programs increase their strength and the patent pledge and patent pools decrease their strength), a public-private partnership that provides an opportunity for countries and companies to work together to develop and deploy green technology on mutually agreeable terms through a neutral and independent ownership may be the "Goldilocks" solution.[85]

There are several examples of public-private partnerships in the green technology space, including two involving the U.S. government: the U.S.-China Clean Energy Research Centre (CERC) and the U.S.-India Partnership to Advance Clean Energy (PACE). These bilateral government partnerships are aimed at accelerating innovation in clean energy technologies and focused on technology creation, including joint development of technology, as opposed to sharing existing technology.[86] The CERC provides a framework for jointly developed intellectual property, specifying that where IP is created in a jointly funded research project, the project's participants in both countries have the right to obtain a non-exclusive license.[87] One commentator has suggested that the CERC may be a model on which other public-private partnerships should be based.[88]

Apart from the U.S. government, there are other public-private partnerships targeting green technology.[89] The UNFCCC established the Climate Technology Centre and Network (CTCN), which "promotes the accelerated transfer of environmentally sound technologies for low carbon and climate resilient development at the request of developing countries."[90] The CTCN provides three core services: providing technical assistance to developing countries that accelerates the transfer of climate technologies; increasing

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approach which led to the adoption of the Paris Agreement"); Van Smith, *Enabling Environments or Enabling Discord: Intellectual Property Rights, Public-private Partnerships, and the Quest for Green Technology Transfer*, 42 GEO. J. INT'L L. 817 (2011) (arguing that public-private partnerships are a "more potent technology transfer strategy" because they can be "more rapidly implemented on a broad scale" than intellectual property rights solutions and also "comprehensively address non-IPR barriers to technology transfer").

85 *See, e.g.*, Tabrez Y. Ebrahim, Clean and sustainable technology innovation, Environmental Sustainability, 45 SCI. DIRECT 113 (2020); Tim Forsyth, *Promoting the "Development Dividend" of Climate Technology Transfer: Can Cross-sector Partnerships Help?*, 35 WORLD DEV. 1684, 1698 (advocating for greater discussion at a global level of cross-sector partnerships, and suggesting that providing contractual certainty for international investors willing to engage in cross-sector partnerships may be a priority for national governments).

86 *See, e.g.*, Abdel-Latif, supra note 84, at 226.

87 *See, e.g.*, *id.* at 226.

88 JOANNA LEWIS, A BETTER APPROACH TO INTELLECTUAL PROPERTY?: LESSONS FROM THE US-CHINA CLEAN ENERGY RESEARCH CENTER 9 (2015), http://www.paulsoninstitute.org/wp-content/uploads/2017/01/PPEE_US-China-Coop-in-Cleantech-IP_English_R.pdf.

89 Indeed, one commentator has argued there are too many overlapping efforts in this space and there is an opportunity to align on a more centralized model. *See* Matthew Rimmer, *Beyond the Paris Agreement: Intellectual Property, Innovation Policy, and Climate Justice*, 8 LAWS 7 (2019) (discussing Mission Innovation, the Breakthrough Energy Coalition, and the International Solar Alliance, and arguing that duplication among these various international initiatives creates a need to better align intellectual property, innovation policy, and technology transfer to achieve access to "clean energy and climate justice under the framework of the Paris Agreement 2015.").

90 *About Us*, CLIMATE TECH. CTR. & NETWORK, https://www.ctc-n.org/about-ctcn.

access to information about climate technologies; and fostering stakeholder collaboration stakeholders via its network experts from academia, the private sector, and pubic and research institutions.[91] However, the CTCN acknowledges it suffers from funding issues and other problems, and critics have taken aim at its investment in "dubious, unproven technologies—such as so-called 'clean coal' technologies related to carbon capture and storage."[92]

Indeed, perhaps the most successful approach diffusing green technology to date is the public-private partnership WIPO GREEN. WIPO GREEN is an international platform, operated by the World Intellectual Property Organization (WIPO) of the United Nations, and connects green technology providers and green technology seekers through its marketplace and network. WIPO GREEN's mission is "an online platform for technology exchange that will contribute to the accelerated adaptation, adoption and deployment of green technology solutions by connecting technology providers with technology seekers."[93] WIPO GREEN was launched in 2013 and provides an online marketplace for companies to both contribute and seek technology.[94] It has been described as a green technology matchmaker and, unlike CTCN, is not limited to developing countries.[95]

WIPO GREEN has two facets: (1) the technology database that contains data uploaded by technology providers for green technologies, which may be at varying developmental stages; and (2) the WIPO GREEN network, which provides global forums and builds networking contacts for users, including access to WIPO GREEN "experts" to "help innovators find specialists with the knowledge and skills needed to move green business ventures forward."[96]

WIPO GREEN is not a patent pool or a patent pledge. The technologies provided to the WIPO GREEN database are not required to be patented, and the rights remain the property of the technology provider. The legal terms under which the technology is shared by the provider with the seeker—including whether the technology is sold or licensed and at what rates—are to be worked out among themselves, "in the manner they feel is most appropriate and effective."[97] Indeed, the WIPO GREEN charter states that "The sustained deployment and uptake of technologies occurs when parties freely

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91 *Id*.

92 Rimmer, *supra* note 89, at 14.

93 WIPO GREEN STRATEGIC PLAN 2019-2023, *supra* note 18, at 3.

94 WIPO GREEN began after discussions between WIPO and the Japan Intellectual Property Association, as well as other industry partners, who were interested in establishing a mechanism to bring transparency into green technology markets, particularly for developing countries. In 2012, WIPO established a pilot database of green technologies available for license or sale, which was then followed by the formal launch of WIPO GREEN and its network in 2013. *About WIPO Green*, WORLD INTELL. PROP. ORG., https://www3.wipo.int/wipogreen/en/aboutus/.

95 WIPO GREEN STRATEGIC PLAN 2019-2023, *supra* note 18, at 3 ("The proposed approach is to increase both the quantity and quality of technology 'matches,' which in turn will lead to increased diffusion of green technology.").

96 *WIPO GREEN Experts Database*, WORLD INTELL. PROP. ORG., https://www3.wipo.int/wipogreen-expertsdatabase/search.

97 *Frequently Asked Questions: WIPO GREEN*, WORLD INTELL. PROP. ORG., https://www3.wipo.int/wipogreen/en/faqs.html.

enter into a contract on mutually agreed terms. Agreements that originate through the use of the WIPO GREEN are the responsibility of the contracting parties."[98] WIPO GREEN thus keeps out of deals between technology providers and seekers, although it does provide a licensing checklist to guide parties.[99]

The process of gaining membership in WIPO GREEN is straightforward and free; an entity can become a member by filling out a registration form that is then reviewed by WIPO GREEN.[100] As of August 2021, WIPO GREEN has over 120,000 listed technologies, needs and experts, and over 700 connections made via the database.[101] WIPO GREEN partners include large global companies like Toyota,[102] Fujitsu,[103] Mitsubishi,[104] Canon,[105] and Ricoh,[106] and other smaller enterprises.[107]

WIPO GREEN's database includes green technologies that address both climate change adaptation and mitigation, including climate smart agriculture approaches and technologies.[108] Toyota contributed 208 patents to the WIPO GREEN database in three categories: plastic glazing (a lightweight material that replaces glass and weighs about 50% less); carbon fiber reinforced plastic (a lightweight material that replaces iron and aluminum, but is almost 1/5 lighter than iron); and solar heat collection tubes (a key component of a concentrated solar thermal power generation system that collects sunlight with a reflector and extracts high-temperature heat).[109] Fujitsu contributed over 200 intellectual property assets to the WIPO GREEN database, including the "GaN-HEMT AC adapter technology," a "highly efficient and small AC adapter using gallium nitride high electron mobility transistors (GaN-HEMT), which have low dynamic resistance, as switch elements."[110] Ricoh contributed 83 patents in two fields: dry washing

98 WIPO GREEN: CHARTER, WORLD INTELL. PROP. ORG. 1 (2013), https://www3.wipo.int.wipogreen/docs/en/charter.pdf.

99 *See* LICENSING CHECKLIST, WORLD INTELL. PROP. ORG., https://www3.wipo.int/wipogreen/docs/en/wipogreen_licensingchecklist_061216.pdf.

100 *Frequently Asked Questions: WIPO GREEN*, *supra* note 97.

101 *WIPO GREEN – The Marketplace for Sustainable Technology*, WORLD INTELL. PROP. ORG., https://www3.wipo.int/wipogreen/en/.

102 Press Release, Toyota Indus. Corp., Toyota Industries Has Joined WIPO GREEN As a Partner (Mar. 23, 2020), https://www.toyota-industries.com/news/release/2020/03/23/002608/.

103 Press Release, Fujitsu, Fujitsu Partners with WIPO GREEN to Achieve SDGs (Sept. 19, 2017), https://www.fujitsu.com/global/about/resources/news/press-releases/2017/0919-02.html.

104 Press Release, Mitsubishi Elec., Mitsubishi Electric Joins WIPO GREEN as Partner (Mar. 15, 2021), https://www.mitsubishielectric.com/news/2021/0315.html.

105 Press Release, Canon Global, Canon becomes a partner of WIPO GREEN, an international program promoting coordination of technologies for environmental protection (Jan. 24, 2020), https://global.canon/en/news/2020/20200124.html.

106 Press Release, Ricoh, Ricoh joins WIPO GREEN and provides 83 patented environmental technologies to contribute to solving social issues (Mar. 8, 2021), https://www.ricoh.com/release/2021/0308_1.

107 WIPO GREEN STRATEGIC PLAN 2019-2023, *supra* note 18, at 4.

108 *Id*.

109 Toyota Indus., *supra* note 102.

110 Fujitsu, *supra* note 103.

technology, which does not use water or solvents; and waste liquid treatment technology, which uses high-temperature and high-pressure underwater combustion.[111]

In addition to an enthusiastic reception by industry players, WIPO GREEN has been lauded by IP professionals such as the International Association for the Protection of Intellectual Property (AIPPI). In 2021, AIPPI co-presented a webinar with WIPO GREEN to encourage and support green technology, stating that WIPO GREEN has "deep experience, network and critical information resources."[112]

WIPO GREEN has solved several of the challenges inherent in other technology-sharing frameworks. Administered by both public and private interests, WIPO GREEN avoids institutionalizing potentially one-sided industry-only perspective of patent pools and patent pledges. Further, it provides for and encourages technology transfers in conjunction with patent licensing, a shortcoming of patent pools and patent pledges. Because the terms between a technology provider and seeker are specific to a particular deal instead of the one-size-fits-all approach favored by patent pools and patent pledges, there is flexibility for the technology provider to retain control over improvements to the technology and to ensure improvements are handled deliberately. This flexibility, however, also creates a potential disadvantage of WIPO GREEN. Because the terms are deal-specific, there is more complexity associated with getting the technology matchmaking deals completed than if the terms were one-size-fits-all.[113] These attributes are summarized in Table 1 below.

	Administration		Tech Transfer		Terms & Conditions		Control over improvements?		Improve diffusion of technology?	
	Public	Private	Yes	No	Deal-specific	One size fits all	Yes	No	Yes	No
Patent pools		Private		No Tech Xfer		OSFA	Yes, depending			No
Patent pledges (e.g., Eco-Patent Commons)		Private		No Tech Xfer		OSFA		No		No
WIPO GREEN	Public	Private	Tech Xfer		Deal-specific		Yes, depending		Maybe	

TABLE 1. COMPARISON OF VARIOUS TECHNOLOGY SHARING FRAMEWORKS

111 Ricoh, *supra* note 106.

112 AIPPI, *WIPO-AIPPI Joint Webinar on Green Tech and Digital IP: Creating the Green Technology Revolution*, YOUTUBE (June 30, 2021), https://aippi.org/wipo-aippi-joint-webinar-on-green-tech-and-digital-ip-creating-the-green-technology-revolution.

113 Compare the IP framework of the CERC, discussed *supra* notes 86–88, and associated text.

Still, WIPO GREEN has acknowledged that while it has cleared many obstacles, some challenges remain with its approach, including "poor quality control of data/technology listings," difficulty in "[m]easuring impact for intangible outcomes . . . misalignment of technology providers and technology seekers," and "limited number of success stories."[114]

IV. Suggested Path Forward

Because WIPO GREEN has such an extensive network of partners already, is not limited to developing countries, and has also solved many of the challenges associated with technology-sharing frameworks, using lessons noted above may help solve these challenges and further incentivize technology providers' participation in WIPO GREEN, a far more efficient approach than devising an entirely novel solution.

With the growing prominence of ESG, companies may already be incentivized to participate meaningfully in public-private partnerships like WIPO GREEN. While positive public relations was not an identified reason for companies to join the Eco-Patent Commons back in 2008, things have changed over the past twelve years. Larry Fink, the CEO of investment management company BlackRock, writes a letter to other CEOs each year to highlight issues. Given BlackRock's sizeable portfolio of over $9 trillion,[115] Fink has a platform not only in the companies in which BlackRock owns stock but also in the broader market.[116] For the past several years, Fink's letter has pushed sustainability and made the business case for companies to be more ESG responsible. Fink's most recent letter in January 2022 noted that sustainable investments globally have now reached over U.S.$ 4 trillion and that most stakeholders "from shareholders, to employees, to customers, to communities, and regulators, now expect companies to play a role in decarbonizing the global economy." He also asserts that "[e]very company and every industry will be transformed by the transition to a net zero world" and provides several examples of industries that are working "around the clock" to decarbonize, noting that "decarbonizing . . . the global economy is going to create the greatest investment opportunity of our lifetime. It will also leave behind the companies that don't adapt, regardless of what industry they are in.".[117] Indeed, according to a BlackRock report, growing investor preference has contributed to the success of sustainable assets: in the first quar-

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114 WIPO GREEN Strategic Plan 2019-2023, *supra* note 18, at 24.

115 *BlackRock tops $9 trillion on record inflows*, Pensions & Investments Online (Apr. 19, 2021), https://www.pionline.com/money-management/blackrock-tops-9-trillion-record-inflows.

116 Tim Mohin, *The Top 5 Takeaways from BlackRock Head Larry Fink's 2021 Letter to CEOs*, FastCompany (Jan. 27, 2021), https://www.fastcompany.com/90598091/the-top-5-takeaways-from-blackrock-head-larry-finks-2021-letter-to-ceos. https://www.jdsupra.com/legalnews/blackrock-2022-letter-to-ceos-4323790.

117 Larry Fink, *Larry Fink's 2021 Letter to CEOs*, Markets Media (Apr. 8, 2021), https://www.marketsmedia.com/larry-finks-2021-letter-to-ceos-2/; Larry Fink, *Larry Fink's 2022 Letter to CEOs: The Power of Capitalism*, BlackRock (2022), https://www.blackrock.com/corporate/investor-relations/larry-fink-ceo-letter (2022 letter).

ter of 2020, global sustainable open-ended funds brought in $40.5 billion in new assets, a 41% increase year-over-year.[118]

In addition to investors, consumers and employees are demanding companies do more on ESG. A PricewaterhouseCoopers study conducted in early 2021 found that 83% of consumers think companies should be actively shaping ESG best practices and that 86% of employees prefer to support or work for companies that care about the same issues they do.[119] Executives at large companies have been aware of the importance of stakeholder demands—including consumers and investors—for over a decade. In a 2010 global survey of executives of 300 large companies drawn from 16 countries, 84% of those surveyed viewed stakeholder demands as an important or very important consideration in their decision to act on climate change.[120] BlackRock has observed that during the last two years of "market turbulence and economic uncertainty" caused by the global pandemic, companies with strong "ESG characteristics indicate resilience" of a company, in part because of the strength of customer relations and the job satisfaction of employees.[121]

While ESG investments' benefits may be a carrot for some companies, the risk of failing to invest in such efforts may be the stick, particularly for the publicly traded companies.[122] Indeed, a recent study demonstrates that increased media attention to a company—whether positive or negative—affects the likelihood that the company will make a greater commitment to climate change.[123]

In addition to the investor and consumer demand for ESG, additional incentives could influence company policies. Renewable energy and energy efficiency is incentivized by favorable tax treatment in the US.[124] A similar tax benefit for contributing valuable green technology to WIPO GREEN should be considered. In addition, a tax benefit for deals that match technology providers with seekers may provide an additional incentive for providers to explore other benefits offered by WIPO GREEN. As discussed around incentivizing green patent applications—not by relying solely on a fast-track patent examination program but by also providing a proper commercial incentive structure—such a structure could also be used to manage the "poor quality control of data/technology listings," which was also an issue with the Eco-Patent Commons.[125] An effective incentive structure that is aligned with existing tax incentives, research grants,

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118 BLACKROCK, SUSTAINABLE INVESTING: RESILIENCE AMID UNCERTAINTY 3–4 (2020), https://www.blackrock.com/corporate/literature/investor-education/sustainable-investing-resilience.pdf.

119 *Beyond Compliance: Consumers and Employees Want Business to do More on ESG*, PWC, https://www.pwc.com/us/en/services/consulting/library/consumer-intelligence-series/consumer-and-employee-esg-expectations.html.

120 *See* Tavakolifar et al., *supra* note 47, at 4 (citing ERNST & YOUNG, ACTION AMID UNCERTAINTY; THE BUSINESS RESPONSE TO CLIMATE CHANGE, (2010)).

121 BLACKROCK, *supra* note 118, at 3.

122 PricewaterhouseCoopers found that 76% of consumers agreed with the statement: "I will discontinue my relationship with companies that treat the environment, employees, or the community in which they operate poorly." PwC, *supra* note 119.

123 *See* Tavakolifar et al., *supra* note 47, at 4.

124 *See generally* Jerome L. Garciano, Green Energy Tax Policies: State and Federal Tax Incentives for Renewable Energy and Energy Efficiency, 25 NAT. RES. & ENV'T 12 (2011).

125 WIPO GREEN STRATEGIC PLAN 2019-2023, *supra* note 18, at 24.

and loan applications would incentivize companies to provide strategically valuable technology to WIPO GREEN, not just the leftovers.

In addition, WIPO GREEN should consider the approach implemented by the CERC, which provides a framework for IP license rights for jointly developed technology. Such a framework may give technology providers and technology seekers some certainty on IP rights that could further incentivize participation in WIPO GREEN. Appropriate incentives for technology sharing deals completed through WIPO GREEN would also further the objective of disseminating green technology. A full analysis of tax incentives is beyond the scope of this paper, but evidence has established that fiscal incentives are highly motivating for transfers of sustainable technologies.[126] For governments to promote technology and be an important part of the technology transfer solution, they must partner with industry in designing tax incentives and adjusting when necessary to ensure success.

A comprehensive structure to stack incentives for accomplishing the steps in the process of filing green patent applications, committing such green technology to WIPO GREEN, and then closing a technology sharing deal under WIPO GREEN has promise. For example, tax incentives could be unlocked at each step, giving companies an even bigger reason to complete the process share green technology. In addition, companies could potentially select from a menu of incentives to ensure alignment with their business strategy. To incentivize filing green patent applications, the lessons of the fast-track examination programs should be considered, and a fee-free continuation application could be offered in lieu of a tax incentive. Loan guarantees and grants have also proven to be effective incentives in encouraging companies to develop green technology and could be extended to the filing of green patent applications, commitment to WIPO GREEN, and sharing under a WIPO GREEN program.

V. Conclusion

Technology is a critical piece of the solution to the climate crisis. Intellectual property rights, in particular patent rights, are key to encourage the development of green technology. Effective technology transfer is key to diffusing green technologies across the globe to solve the climate crisis. Over the past two decades, industry and government have been driving various efforts to determine the best ways to incentivize the development and dissemination of green technology. These prior efforts have produced many learnings, including that fast-track examination of green patents does not, in fact, incentivize the development of green technology and that companies must be incentivized to share not just their green technology "left-overs." There have been several initiatives set up to share green technology, initiatives led by private companies and initiatives that have been public-private partnerships. WIPO GREEN is the best example to date, although it still has some gaps to fill. Because of its broad reach and well-established network, energy should be invested in filling these gaps instead of developing yet another green technology sharing initiative. Providing incentives to file green patent applica-

126 *See generally* Veugelers, *supra* note 44 (finding that fiscal incentives are highly motivating factors leading to sustainable technological transfer in some sectors of activity).

tions, contribute such green technology to WIPO GREEN, and sharing such green technology through an agreement under WIPO GREEN would go a long way to fill those gaps and thus help accomplish the overall objective of solving the climate crisis.

Jayne Piana is a shareholder at Fletcher Yoder P.C. and is based in Houston, Texas. Jayne's practice focuses on guiding clients through all aspects of intellectual property protection, including innovation-based transactions and disputes, freedom-to-operate issues, as well as general commercial matters. Jayne has over 20 years of experience in intellectual property law, split between 10 years as in-house counsel at an international energy company, and 10+ years in private practice. Jayne graduated cum laude from Texas A&M University in 1997 with a bachelor's degree in Chemical Engineering. Jayne then went to law school at the University of Texas at Austin, and graduated in 2000, Order of the Coif. Jayne is a member of the Texas bar, and she is registered to practice before the U.S. Patent and Trademark Office

International Law and Climate Displacement: Why a Climate Justice Approach is Needed

Madison Shaff

I. Introduction

"Climate Justice" is a portion of the environmental justice movement that highlights climate change as a social issue, exploring the disproportionate impacts borne by the world's least culpable, and most at-risk, populations.[1] Specifically, such communities have and will bear the brunt of the impacts of climate change-related environmental degradation driving displacement and forced migration. Residents of these vulnerable areas are driven out of their homes and cultural centers or else risk their lives because of other people's gratuitous consumption and development. These injustices are reflected in statistics documenting the danger posed by adverse weather aggravated by climate

1 Daisy Simmons, *What Is 'Climate Justice'?*, Yale Climate Connections (July 29, 2020), https://yaleclimateconnections.org/2020/07/what-is-climate-justice/.

change. "[T]he Least Developed Countries (LDCs) of the world experience 99% of all deaths from [climate and] weather-related disasters . . . [but] contribute less than 1% of global carbon emissions."[2] Significantly, many such deaths occur in the course of a migration or displacement event.[3]

Climate change-driven international conflict driven by displacement and resource scarcity are expected to significantly increase in the coming years.[4] Accordingly, international law is the proper tool to address these issues, and stakeholders in the international legal system should use climate justice to inform an expansion or reform of international legal principles.[5] To contribute to this effort, this note proceeds by examining two major shortcomings in international law that exacerbate the climate injustices outlined above: (1) limited enforceability from an overly restrictive causation requirement for environmental harms, and (2) uneven resource distributions, particularly access to capital.

A close examination of international environmental laws and legal principles reveals some viable options for addressing climate displacement. Environmental legal principles are incorporated into a variety of international instruments, such as the United Nations Framework Convention on Climate Change (UNFCCC).[6] Such principles represent the international "conscience" concerning climate change and are incorporated into what this note will define as a "Climate Justice Approach."[7]

While there is not yet a concrete universal definition of a "Climate Justice Approach," scholars have already begun to apply "climate justice" in their search for cli-

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2 This note will primarily discuss the impacts on the Global South as a whole, but many of the countries referred to as Least Developed Countries fall within the Global South; Global Humanitarian Forum, *Human Impact Report: Climate Change – the Anatomy of a Silent Crisis* (2009), http://www.ghf-ge.org/human-impact-report.pdf; *Protecting Climate Refugees*, ENV'T JUST. FOUND., https://ejfoundation.org/what-we-do/climate/protecting-climate-refugees?gclid=CJ0KCQiAkuP9BRCkARIsAKGLE8UvsVSkF0-1a387rq7BILLdfG5W5YHl7_ZI4KzXtYYmja-E9xqiqIaAhf5EALw_wcB ("While no country is safe from climate impacts, it's the poorest and most vulnerable communities - those who did the least to cause the climate crisis - who are hardest hit. While they account for just 1% of global emissions, the world's Least Developed Countries have seen 99% of the deaths from climate and weather related disasters.").

3 ENV'T JUST. FOUND., *supra* note 2.

4 *Climate Change and Disaster Displacement*, UN REFUGEE AGENCY, https://www.unhcr.org/en-us/climate-change-and-disasters.html (stating that as climate change causes threats to livelihood and food availability, climate change can multiply existing tensions to add to the potential for conflicts).

5 As an example of a displacement-minded proposal for one multinational climate effort discussed later herein *see* Francesco Bassetti, *The Green Climate Fund Must Focus on Adaptation*, FORESIGHT (Nov. 14, 2019), https://www.climateforesight.eu/jobs-growth/green-climate-fund-adaptation/.

6 To review the UN Framework, *see* United Nations Framework Convention on Climate Change, June 12, 1992, S. Treaty Doc No. 102-38, 1771 U.N.T.S. 107 [hereinafter UNFCCC Treaty].

7 *See* Simon Evans, *Analysis: Which countries are historically responsible for climate change?*, CARBON BRIEF (Oct. 5, 2021), https://www.carbonbrief.org/analysis-which-countries-are-historically-responsible-for-climate-change.

mate-displacement solutions, supporting the use and application of this term.[8] For instance, Carmen Gonzalez, a Law Professor at the Seattle University School of Law, has proffered several different approaches to climate in current international law, but each fails to properly address climate displacement.[9] Other scholars have pointed to specific international principles in need of an expansion to account for climate justice. Calling for an expansion to the concept of "Common but Differentiated Responsibilities"[10] in international law, Robyn Eckersley seeks to impose a responsibility on countries that have contributed to climate change to accept climate refugees.[11] Teresa M. Thorp has suggested an expansion of the Good Neighborliness Principle through a Climate Justice approach.[12] Within this note, the "Climate Justice Approach" refers to decision making that strives to ameliorate inequities in climatic impacts. The Climate Justice Approach attempts to resolve inequities through a focus on the intersectional

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8 David Schlosberg & Lisette B. Collins, *From Environmental to Climate Justice: Climate Change and the Discourse of Environmental Justice*, 5(3) WIRES CLIMATE CHANGE 359, 374 (2014) (discussing the need to use climate justice to find a solution to address historical inequities that have persisted); Yuchih Pearl Kan, *Towards a Critical Poiesis: Climate Justice and Displacement*, EQUAL JUSTICE WORKS FELLOW 1, 13 (2013), https://law.ucdavis.edu/centers/environmental/files/2013-spring-papers/Towards-a-Critical-Poiesis-Environmental-Justice-and-Displacement.pdf (discussing climate justice as a way to address the legal system's gap in not requiring externalities to be accounted for that arise out of the fossil fuel industries; the article cites climate justice as a way to account for external costs, such as the impacts to climate displaced people).

9 Carmen G. Gonzalez, *Climate Justice and Climate Displacement: Evaluating the Emerging Legal and Policy Responses*, 36 WIS. INT'L L. J. 366, 391 (2019) (for discussion of the failures in each of the three approaches currently used in international laws. The three approaches are the national security approach, the humanitarian approach, and the migration management approach. The "national security approach" fosters a narrative that climate migrants will disrupt the public order of the places that they migrate too, continuing xenophobia and racism. The "national security approach" shifts the responsibility off the Global North, so that there may be reasoning for lack of an empathetic or Common but Differentiated Responsibilities response. The "humanitarian approach" was pointed to as a failure because it fosters the narrative that the Global North is acting as a savior through charity when aiding the Global South, rather than an owed responsibility resulting from the North's consumption. Conversely, the migration management approach creates the narrative that the Global South is fully autonomous and should be able to address the issue of climate displacement on their own.).

10 Charlotte Epstein, *Common but Differentiated Responsibilities*, BRITANNICA, https://www.britannica.com/topic/common-but-differentiated-responsibilities (defines the CBDR as "[a] principle of international environmental law establishing that all states are responsible for addressing global environmental destruction yet not equally responsible. The principle balances, on the one hand, the need for all states to take responsibility for global environmental problems and, on the other hand, the need to recognize the wide differences in levels of economic development between states. These differences in turn are linked to the states' contributions to, as well as their abilities to address, these problems.").

11 Robyn Eckersley, *The Common But Differentiated Responsibilities of States to Assist and Receive 'Climate Refugees'*, 14 EUR. J. OF POL. THEORY 481, 482–500 (2015).

12 TERESA M. THORP, CLIMATE JUSTICE: A VOICE FOR THE FUTURE 259–69 (Palgrave Macmillan ed., 2014) (discussing an expansion of good-neighborliness).

reasons for current injustices, while striving to dismantle the systems that created such imbalances. This approach is different from general solution-seeking because it brings together environmental and social injustices at the center of discussion when addressing disparities.[13]

This note emphasizes the intersection of poverty, technological advancements, resource access, and climate impacts as the issues which together drive climate displacement. It follows that a wholly intersectional Climate Justice Approach would be the most effective solution to address climate displacement, and that international treaties without such an approach will remain comparatively ineffective at addressing displacement and other climate justice issues. This means that existing principles of such treaties must be revamped using a Climate Justice Approach to adopt an intersectional approach to addressing both the developed countries in the Global North and developing countries in the Global South.[14] This note uses the UNFCCC to explore an application of the Climate Justice Approach.

Of course, re-evaluation and expansion of the international principles outlined in this note would impact each international instrument differently. To explore one possible outcome, this note evaluates a potential expansion of the UNFCCC's Green Climate Fund.[15] Using a climate justice lens, this note examines principles set forth in the UNFCCC, particularly its overbearing causation standards, and one of the UNFCCC's shortcomings in addressing maldistributions in resources.

Part I of this note will discuss the background of climate change injustice and the UNFCCC, specifically as it pertains to climate-displaced people. Part II of this note will describe the foundational international law principles within the UNFCCC: Good-Neighborliness, the "Duty to Not Cause Transboundary Harm" (Transboundary Harm Principle), "Common but Differentiated Responsibilities" (CBDR), and the "Polluter Pays Principle" (PPP). Part III establishes the dire need to reexamine these principles and how they should be expanded using the Climate Justice Approach to properly address injustices facing displaced people. To this end, Part III also considers the legal and moral reasoning for a new application of the UNFCCC principles discussed above to parties in the Global North – specifically those as developed as the United States. In the final section, the note argues that the way to account for a Climate Justice Approach would be to amend the existing finance mechanisms within the UNFCCC. This amendment must be done in a manner to properly address the inadequacies of the Global North's efforts to address climate change and associated displacements.

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13 Maxine Burkett, *Just Solutions to Climate Change: A Climate Justice Proposal for A Domestic Lean Development Mechanism*, 56 BUFF. L. REV. 169, 188-90 (2007).

14 Sumudu Atapattu & Carmen Gonzalez, *The North-South Divide in International Environmental Law: Framing the Issues*, in INTERNATIONAL ENVIRONMENTAL LAW AND THE GLOBAL SOUTH 1–20 (Gonzalez & Razzaque eds., 2016) (defining the "Global North" countries as the "wealthy, industrialized" nations: United States, Canada, Australia, New Zealand, Japan, and members of the European Union; the "Global South" countries are those "generally less prosperous counterparts[,]" including most of the Asian, African, and Latin American continents, and the UN negotiating bloc known as the "Group of 77.").

15 For a synopsis of the Green Climate Fund (GCF), *see About GCF*, GREEN CLIMATE FUND, https://www.greenclimate.fund/.

II. Background

Incorporation of the climate-displaced people in the Global South into international legal frameworks requires large-scale change in international law. Exploration of these possible changes requires background discussion of climate inequities, climate displacement, and the UNFCCC.

A. Climate Inequities

Though widely politicized, a global understanding of climate change has rapidly developed. It is now commonly understood that humans have contributed to global warming effects and some regions of the world are more responsible for the sudden increase in global temperatures due to their higher emissions.[16] Historically, Global North countries have been the largest emitters of greenhouse gases (GHG).[17] The unequal emissions have been caused by the Global North countries' heavy reliance on fuels and methods of production that produce GHGs for rapid economic growth beginning during the Industrial Revolution.[18] That industrial boom and greater access to resources has resulted in higher energy consumption in the Global North and greater effects on the global climate.[19] While relying on GHG-based industries, the Global North exploited resources of the Global South and built a one-sided global economic architecture without sharing their technology, goods, or information to include the Global South in their success.[20]

In recent years, the effects of climate change have entered into mainstream discussion and are widely accepted within and beyond the scientific community.[21] Many regions have experienced these changes firsthand. For instance, climate change has been linked to severe droughts in some areas (like California,[22] the Middle East,[23] East Af-

16 *How Do We Know that Humans Are the Major Cause of Global Warming?*, Union of Concerned Sci. (Aug. 1, 2017), https://www.ucsusa.org/resources/are-humans-major-cause-global-warming; Jyoti Parikh, *North-South Issues for Climate Change*, 29 Econ. & Pol. Wkly. 2940, 2942 (1994).

17 *Id.*

18 Parikh, *supra* note 16, at 2942; Melissa Denchak, *Greenhouse Effect 101*, Nati'l Res. Def. Fund (July 16, 2019), https://www.nrdc.org/stories/greenhouse-effect-101 (for explanation of greenhouse gasses as they contribute to the global warming effect through CO_2 release in fossil fuel burning, methane released in livestock raising, and chemicals used in refrigerants and air conditioners); David Hunter et al., International Environmental Law and Policy, 607 (5th ed. 2015).

19 Parikh, *supra* note 16, at 2942.

20 Atapattu & Gonzalez, *supra* note 14.

21 Michael Burger et al., *The Law and Science of Climate Change Attribution*, 45 Columbia J. of Env't L. 57 (2020); *see generally* Ilan Kelman & Jennifer J. West, *Climate Change and Small Island Developing States: A Critical Review*, 5 Ecological & Env't. Anthropology 1, 2–16 (2009).

22 Benjamin Cook, *Guest Post: Climate Change Is Already Making Droughts Worse*, Carbon Brief (May 14, 2018), https://www.carbonbrief.org/guest-post-climate-change-is-already-making-droughts-worse.

23 *See generally* Benjamin I. Cook et al., *Spatiotemporal drought variability in the Mediterranean over the last 900 years*, 121 J. Geophysical Rsch.: Atmospheres 2060 (2016) (looking at

rica[24]) and flooding and heavy precipitation in other areas (like Tennessee[25] and Bangladesh[26]). Climate change intensifies weather events, increases ocean temperature, shifts global climate zones, destroys habitats, and many more detrimental impacts to the environment.[27] The tangible effects of climate change have a harmful relationship with the history of oppression and colonialism, seen through the disproportionate impact on impoverished regions and communities of color.[28]

These disproportionate impacts include which communities have access to clean water, which communities have access to nutritious food or the ability to cultivate food, which communities are given priority during disaster relief, which communities can finance an adaptive measure, and ultimately which communities will be forced to migrate from their homes due to climate change.[29] This evaluation shows that the affluent communities in the Global North will have disproportionate access to necessary resources, while impoverished communities of color in the Global North and South are more likely to be forced into climate displacement.[30] The fact that certain global communities are in

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drought concerns linked to climate change in the Middle East states of Cyprus, Israel, Jordan, Lebanon, Palestine, Syria, and Turkey).

24 *Horn of Africa Sees 'worst drought in 60 years'*, BBC (June 28, 2011), https://www.bbc.com/news/world-africa-13944550.

25 *Pouring It On: How Climate Change Intensifies Heavy Rain Events*, CLIMATE CENTRAL (May 5, 2019), https://www.climatecentral.org/news/report-pouring-it-on-climate-change-intensifies-heavy-rain-events.

26 *See generally* Sjoukje Philip et al., *Attributing the 2017 Bangladesh Floods from meteorological and Hydrological perspectives*, 23 HYDROLOGICAL EARTH SYST. SCI. 1409 (2019) (attributing the 2017 precipitation-induced flooding to anthropogenic climate change in Bangladesh).

27 Maxine Burkett, *Just Solutions to Climate Change: A Climate Justice Proposal for a Domestic Clean Development Mechanism*, 56 BUFF. L. REV. 169, 170 (2008); *see also* Nicola Jones, *Redrawing the Map: How the World's Climate Zones Are Shifting*, YALE SCH. OF THE ENV'T (Oct. 23, 2018), https://e360.yale.edu/features/redrawing-the-map-how-the-worlds-climate-zones-are-shifting.

28 Atapattu & Gonzalez, *supra* note 14, at 17.

29 Margaux J. Hall & David C. Weiss, *Avoiding Adaptation Apartheid: Climate Change Adaptation and Human Rights Law*, 37 YALE J. OF INT'L L. 309, 310 (2012) (providing examples of stark differences in climate change responses based on access to resources, for example, "As the United Nations Development Programme (UNDP) has explained, 'In the Netherlands, people are investing in homes that can float on water. The Swiss Alpine ski industry is investing in artificial snow-making machines,' but '[i]n the Horn of Africa, 'adaptation' means that women and young girls walk further to collect water.").

30 *See, e.g.*, *Climate Change and the Developing World: A Disproportionate Impact*, U.S. GLOB. LEADERSHIP COAL. (Mar. 2021), https://www.usglc.org/blog/climate-change-and-the-developing-world-a-disproportionate-impact/; *see also World's Billionaires Have More Wealth than 4.6 Billion People*, OXFAM INT'L (Jan. 20, 2020), https://www.oxfam.org/en/press-releases/worlds-billionaires-have-more-wealth-46-billion-people; *see* Lesley Williams & Adrien Salazar, *Amidst Multiple Storms of Injustice and the 15th Anniversary of Hurricane Katrina, the Fight for Climate Justice Continues*, DEMOS Next 20 (Aug. 28, 2020), https://www.demos.org/blog/amidst-multiple-storms-injustice-and-15th-anniversary-hurricane-katrina-fight-climate-justice (establishing that the disproportionate impacts on impoverished and communities of color is not only a global, there is evidence of these impacts within the

a better position than others in the face of climate impacts is not a novel concept.[31] Generally, the absence of resources in developing countries of the Global South makes those countries more vulnerable to climate impacts.[32] Overall, the broad reality of disproportionate impacts on poor communities of color manifests again in the inequitable consequences of climate displacement.

B. Climate Displacement

Climate change impacts more vulnerable areas that are disproportionately concentrated in the Global South. These vulnerable areas are predominantly made up of communities of color or impoverished people.[33] As stated above, LDCs experience the bulk of climate-related deaths, despite being responsible for only 1% of global emissions.[34] Many of these deaths result from the dangers and instability related to climate migration.[35] Climate migration is a result of global warming making an area uninhabitable or otherwise inhospitable.[36] Among the climate change multipliers contributing to uninhabitability are a lack of access to water, loss of land due to sea level rise, increased competition for resources, natural disasters, and the shifting weather patterns that impact crop productivity.[37]

Most often, climate migrants are internally displaced, remaining within their countries of origin.[38] This trend is attributed to the migrants' desire to stay closer to support networks and maintain historical ties, or their lack of financial means to move farther due to a loss of income.[39] According to the Groundswell Report by the World Bank, it is estimated that there will be "more than 143 million internal climate migrants" by 2050 if

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United States borders. These effects can be shown through disaster relief from Hurricane Katrina and presently COVID-19 impacts).

31 *See, e.g.*, Matija Zorn, Natural Disasters and Less Developed Countries, *in* Nature, Tourism, and Ethnicity as Drivers of (De)Marginalization 59 (Stanko Pelc & Miha Koderman eds., 2018) ("Between 1991 and 2005, nearly 90% of disaster-related deaths and 98% of people affected by disasters were in developing nations. Future adaptation to the increasing impact of weather-related natural disasters due to global climate change will also be more costly in these countries.").

32 *Id.* at 60.

33 Amali Tower, *We Need To Talk About Climate Migration As A Justice Issue*, Climate Refugees (Jul. 29, 2020), https://www.climate-refugees.org/perspectives/2020/7/29/we-need-to-talk-about-climate-migration-as-a-justice-issue.

34 Env't Just. Found., *supra* note 2.

35 *Id.*

36 *Id.*

37 John Podesta, *The Climate Crisis, Migration, and Refugees*, Brookings (July 25, 2019), https://www.brookings.edu/research/the-climate-crisis-migration-and-refugees (defining climate change as "multiplier," meaning it is often not the sole reason for migration, but is often a strong factor for movement).

38 Oli Brown, Migration and Climate Change, No. 31 IOM Migration Res. Series, ISSN 1607-338X, at 19 (2019).

39 *Id.*

no action is taken.[40] Those displaced may experience a number of negative impacts to their physical and mental health, as well as face difficulties accessing educational resources and housing.[41] Additionally, communities hosting the displaced may face their own resource limitations, or may be otherwise unsuited to support an influx of climate-displaced people.[42]

Although most displacement is domestic, some displaced people attempt to relocate into neighboring countries or those farther afield. These efforts have led some prospective host countries to tighten border controls, relying upon strict interpretations of international agreements.[43] In an effort to legally turn away climate-displaced people, some states claim there is no obligation to accept migrants who have moved in response to climate-related hardships, as such migrants do not fit the definition of a "refugee" under the 1951 Refugee Convention.[44] For the purposes of this note, "climate-displaced" people will refer to people forced to migrate internally or externally because of climate change; however, it can be credibly argued that some portion of those displaced by climate change credibly should be considered "refugees."[45]

Thus, states may point to the fact there are no explicit, binding protections for people displaced because of climate change-related environmental degradation.[46] In failing to use their structural power to push for a remedy, the Global North has caused many of the world's most vulnerable and least culpable to disproportionately suffer the impacts of climate change. An intersectional solution is necessary to account for the consequences of these differences in position between the states of the Global North and South.

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40 Kumari Rigaud et al., *Groundswell: Preparing for Internal Climate* Migration (2018), THE WORLD BANK (2018), https://openknowledge.worldbank.org/bitstream/handle/10986/29461/WBG_ClimateChange_Final.pdf.

41 Christelle Cazabat, *The Ripple Effect: Economic Impacts of Internal Displacement*, Internal Displacement Monitoring Centre (Oct. 2018), https://www.internal-displacement.org/sites/default/files/inline-files/201810-literature-review-economic-impacts.pdf.

42 *Id.*; *see also* Tower, *supra* note 33 (discussing an example of internal displacement impact, newly defined as "climate gentrification," where the wealth gentrify climate-resilient areas and push their previous inhabitants, often people of color, to other areas).

43 B. Rose Huber, *Tighter Border Policies Leave Migrants Vulnerable to Effects of Climate Change*, PRINCETON U. (Oct. 12, 2020, 3 PM), https://www.princeton.edu/news/2020/10/12/tighter-border-policies-leave-migrants-vulnerable-effects-climate-change; Kayly Ober, *Climate, Migration, and Displacement-What are the implications for Human Rights Law?* REFUGEES INT'L (May 7, 2020), https://www.refugeesinternational.org/reports/2020/5/7/climate-migration-and-displacement-what-are-the-implications-for-human-rights-law.

44 Ober, *supra* note 43.

45 *See* UN REFUGEE AGENCY, *supra* note 5 (stating that climate-displaced people usually do not satisfy the legal burden of showing persecution for race, religion, nationality, or membership of a group with a particular opinion, but *could* be categorized as refugees where "adverse climate change interact[s] with armed conflict and violence.").

46 *See* Genevieve Zingg, *When the Wave Comes: Climate Change, Migration, and International Law*, RIGHTSVIEWS (June 5, 2018), https://blogs.cuit.columbia.edu/rightsviews/2018/06/05/when-the-wave-comes-climate-change-immigration-and-international-law (noting that under the present international legal regime, "millions of people soon to be displaced due to climate-related impacts will have no legal grounds to seek international protection").

C. UNFCCC as it Pertains to Climate Displacement

The UNFCCC is an international environmental treaty which sought to stabilize greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic interference with the climate system."[47] The UNFCCC is a framework treaty that entered into force in 1994.[48] The UNFCCC specifies that developed countries were the primary cause of the current climate.[49] A developed nation's level of responsibility was indicated through the categorization according to its level of industrialization.[50] These categories assigned different duties to contribute to global mitigation efforts based on a country's past reliance on GHGs.[51] The UNFCCC has been near-universally ratified, meaning that parties can be held liable for a violation of the treaty's enumerated duties.[52] Thus, the UNFCCC is a potentially useful instrument moving forward on climate displacement issues, particularly the international environmental principles embedded within it.[53]

The UNFCCC also identifies the geographic areas that will be disproportionately impacted by climate change.[54] The areas named in the UNFCCC as at-risk for disproportionate impacts of climate change are:

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47 UNFCCC Treaty, *supra* note 5.

48 *What is the United Nations Framework Convention on Climate Change?*, U.N. Climate Change, https://unfccc.int/process-and-meetings/the-convention/what-is-the-united-nations-framework-convention-on-climate-change; *see also* U.N. Secretariat, Framework Convention Concept, Note by the Secretariat, U.N. Geneva (Oct. 2011) (defining a "framework convention" as an umbrella document for broad responsibilities. Framework conventions are equally as legally binding to parties as other types of treaties, but the framework title signifies that there will be future compacts and protocols to narrow down responsibilities from the broader agreement laid out in the framework).

49 U.N. Climate Change, *supra* note 48, at 2.

50 Industrialized countries were categorized into "Annex I Parties" and developing countries were categorized into "Non-Annex I Parties." *Id.*

51 Annex I Parties must report to the UN their efforts to minimize climate change and annual greenhouse gas emission data, while Non-Annex I Parties have looser reporting duties. The LDC's within the Non-Annex I Parties have particularly amenable duties to mitigate only when they Annex I Parties have provided support or funding. *Id.*

52 *Glossary*, United Nations Treaty Collection, https://treaties.un.org/Pages/-Overview.aspx?path=overview/glossary/page1_en.xml#:~:text=of%20Treaties%201969%5D-Ratification,consent%20by%20such%20an%20act (defining "ratification" as "the international act whereby a state indicates its consent to be bound to a treaty if the parties intended to show their consent by such an act.") (last visited Nov. 18, 2021).

53 The Oxford Handbook of International Climate Change Law, 773–81 (Cinnamon P. Carlarn et al. eds., 2016).

54 UNFCCC Treaty, *supra* note 47, art. 4 (establishing what the UNFCCC has listed most vulnerable to climate change under Article 4(8)); *see also* Koko Warner, *Coordinated Approaches to Large-Scale Movements of People: Contributions of the Paris Agreement and the Global Compacts for Migration and on Refugees*, 39 Population & Env't, 384, 392 (2018) (discussing displacement first recognized in an international instrument through the Cancun Adaptation Framework, which is part of the UNFCCC, stating, "14(f) which is significant because it laid out the range of movements people may take, what measures should be taken, and who should undertake these actions: '14. Invites all Parties to enhance action on adaptation under the Cancun Adaptation Framework. . .by undertaking, inter

(a) Small island countries;
(b) Countries with low-lying coastal areas;
(c) Countries with arid and semi-arid areas, forested areas and areas liable to forest decay;
(d) Countries with areas prone to natural disasters;
(e) Countries with areas liable to drought and desertification;
(f) Countries with areas of high urban atmospheric pollution;
(g) Countries with areas with fragile ecosystems, including mountainous ecosystems;
(h) Countries whose economies are highly dependent on income generated from the production, processing and export, and/or on consumption of fossil fuels and associated energy-intensive products; and
(i) Land-locked and transit countries.[55]

The most recent manifestation of the UNFCCC convention is the Paris Agreement, which aims to stabilizing greenhouse gas emissions and pays explicit attention to vulnerable communities within the Global South that need Climate Justice.[56] Despite mention of vulnerable communities, the UNFCCC and the Paris Agreement do not explicitly reference "vulnerable communities displaced by climate change." The instruments do, however, identify that the most vulnerable areas need "capacity building."[57] Capacity building through mitigation and adaptation is listed as a way to combat the adverse effects of climate change (including climate displacement).[58]

The UNFCCC serves as a good case study for the application of the Climate Justice Approach to international legal frameworks because it was a pioneer in international law for climate change, acknowledged climate vulnerabilities, and has been widely ratified.

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alia, the following. . .(f) Measures to enhance understanding, coordination and cooperation with regard to climate change induced displacement, migration and planned relocation, where appropriate, at national, regional and international levels.").

55 UNFCCC Treaty, *supra* note 5, art. 4, § 8.

56 Paris Agreement art. 7, § 2, Dec. 12, 2015, 55 I.L.M. 743 (2016) ("Parties recognize that adaptation is a global challenge faced by all with local, subnational, national, regional and international dimensions, and that it is a key component of and makes a contribution to the long-term global response to climate change to protect people, livelihoods and ecosystems, taking into account the urgent and immediate needs of those developing country Parties that are particularly vulnerable to the adverse effects of climate change"); s*ee also id*. art. 8 (stating "averting, minimizing, and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow-onset events, and the role of sustainable development in reducing the risk of loss and damage").

57 *Id*. art. 11, § 1 ("Capacity-building under this Agreement should enhance the capacity and ability of developing country Parties, in particular countries with the least capacity, such as the least developed countries, and those that are particularly vulnerable to the adverse effects of climate change, such as small island developing States, to take effective climate change action, including, inter alia, to implement adaptation and mitigation actions, and should facilitate technology development, dissemination and deployment, access to climate finance, relevant aspects of education, training and public awareness, and the transparent, timely and accurate communication of information").

58 *Id.; see* HUNTER ET AL., *supra* note 18, at 607–16.

The UNFCCC embodies international law principles that would serve a Climate Justice Approach to help climate-displaced people.

III. UNFCCC International Law Principles

The Good Neighborliness Principle, the Transboundary Harm Principle, the CBDR, and PPP are essential philosophies of the UNFCCC. Each of these principles are tied together through the philosophy of causation. Causation is a common indicator of legal liability that international environmental conventions use to assign responsibility for global environmental harms.

A. The Element of Causation within International Principles

Many of the international principles that this note argues need a climate justice upgrade hinge upon the requirement to show causation. Both criminal and tort law rely on the element of causation to assign blame or liability.[59] "Causation" has two distinct aspects: "actual cause" and "proximate cause." Actual cause, or otherwise referred to as "cause in-fact," implements a directness test denoted as the "but-for test" or synonymously the "necessary condition test."[60] The actual cause prong of causation encompasses the necessary condition test, blame is assigned if the victim's harm would not have occurred without the defendant's action, making it the necessary condition.[61] The second prong is proximate cause. Proximate cause exists if the action was the direct cause of the harm and the actor could foresee that such actions would naturally cause the harm to the claimant.[62] These definitions are central to the arguments made in this note regarding the principle of Good Neighborliness, Transboundary Harm Principle, CBDR, and PPP, which are woven throughout the UNFCCC.

F. Good Neighborliness

The Good Neighborliness Principle generally encourages States to resolve conflicts peacefully and maintain each other's state sovereignty, but also emphasizes a shift to preserve "mutual interests and cooperation."[63] State sovereignty, much like Good Neighborliness, is multifaceted. Internally, state sovereignty means that a State has the ultimate authority over all aspects of its territory, without outside interference.[64] It also means that the States have equal rights in relation to other States.[65] In theory, state

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59 Michael Moore, *Causation in the Law*, *in* Stanford Encyclopedia of Philosophy (Edward N. Zalta & Winter eds., 2019).

60 *Id.*

61 *Id.*

62 *Id.*

63 Sompong Sucharitkul, *The Principles of Good-Neighborliness in International Law (Paper 559)*, Golden Gate U. Sch. of L., Dig. Commons 1, 16 (1996).

64 Samantha Besson, *Sovereignty*, Oxford Public International Law, Encyclopedia Entries for Sovereignty, para. 70 (2011).

65 *Id.*; Hunter et al., *supra* note 18, at 441–45.

sovereignty and Good Neighborliness work together to create a globally connected world, where States recognize, respect, and take care to not harm one another.[66]

The UNFCCC established its reliance on Good Neighborliness in the instrument's preamble. The UNFCCC states that Nations are agreeing to "[a]knowledg[e] that the global nature of climate change calls for the widest possible cooperation by all countries and their participation in an effective and appropriate international response, in accordance with their common but differentiated responsibilities and respective capabilities and their social and economic conditions[.]"[67] Thus, this section of the UNFCCC adheres the Good Neighborliness Principle because it is an agreement to cooperate for mutual interest of humankind.[68]

C. DUTY TO NOT CAUSE TRANSBOUNDARY ENVIRONMENTAL HARM

The Transboundary Harm Principle was first recognized in the *Trail Smelter Arbitration*.[69] The *Trail Smelter Arbitration* was a bilateral arbitration which established that sovereign nations have a duty to not allow activities within their jurisdiction that would pollute neighboring States.[70] The United States, as a plaintiff, brought a cause of action against Canada for damages resulting from transboundary air pollution.[71] The Transboundary Harm Principle was later adjusted to include protection from general environmental damage in the Stockholm Declaration.[72]

The first multilateral codification of the Transboundary Harm Principle was in Stockholm Principle 21, which was later mirrored in the subsequent Rio Declaration, Principle 2.[73] Stockholm Principle 21 reads:

> States have, in accordance with the Charter of the United 'Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.[74]

The Stockholm Declaration in its entirety is not a "binding" instrument, but some principles such as the Transboundary Harm, have become binding customary law.[75]

The UNFCCC does not explicitly state that nations have an obligation not to cause transboundary harm in the context of climate change, but this principle has reached

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66 Id. at 445.
67 UNFCCC Treaty, *supra* note 5, at 2.
68 Sucharitkul, *supra* note 63, at 7.
69 Arthur K. Kuhn, *The Trail Smelter Arbitration –United States and Canada*, 32 AM. J. OF INT'L L. 785, 785-88 (1938).
70 *Id.* at 787.
71 *Id.* at 786.
72 U.N. Conf. on Ent. Dev., *Report of the Conference*, A/CONF.151/26 (Vol. I) (Aug. 12, 1992) [hereinafter Stockholm Declaration].
73 *Id.*
74 *Id.* princ. 21.
75 Mortimer N. S. Sellers, *Why States Are Bound by Customary International Law,* in REPUBLICAN PRINCIPLES IN INTERNATIONAL LAW 48 (2006) ("binding" meaning an agreement to be liable for violations).

customary law status. [76] In 2006, the UNFCCC acknowledged the failure to include transboundary climate change related harm by adding it to the handbook, which states that "environmental measures addressing transboundary or global environmental problems should, as far as possible, be based on an international consensus."[77] Importantly, by reaching customary status, all States are bound by the duty to not cause transboundary harm.[78] Since customary international law is established through general consensus shown by state actions and *opinio juris*, it follows that States understand that they cannot permit activities in their jurisdiction that will irreparably harm the environment of those outside of it.[79]

D. Common but Differentiated Responsibilities and Polluter Pays Principle

The CBDR allows for the apportionment of responsibility for how much a nation, or a group of nations, have contributed to the harms at issue.[80] Starting in 1992, the CBDR principle has been incorporated into global treaties and declarations relating to climate change.[81] The UNFCCC expressly and consistently calls for a CBDR approach. It begins its "commitments" section with, "All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances . . ."[82] This principle is consistently woven throughout the instrument's framing of the issues. For instance, Article 3, Section 1 states:

> The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof.[83]

The UNFCCC and its international principles have been influential in the global response to stabilizing climate change; however, these principles must be updated to properly incorporate the novel issues of mass climate displacement.

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76 Intergovernmental and Legal Affairs, Climate Change Secretariat, United Nations Framework Convention on Climate Change – Handbook 1–30 (Daniel Blobel et al. eds., 2006).

77 *Id*. at 26.

78 Hunter et al., *supra* note 18, at 510–19.

79 *Id*. at 311, 51; *Opinio juris (international law)*, Cornell Law School: Legal Information Institute, https://www.law.cornell.edu/wex/opinio_juris_(international_law) (stating that "Opinio juris denotes a subjective obligation, a sense on behalf of a state that it is bound to the law in question. The International Court of Justice reflects this standard in ICJ Statute, Article 38(1)(b) by reflecting that the custom to be applied must be 'accepted as law.'").

80 Hunter et al., *supra* note 18, at 463–64.

81 *Id*.

82 UNFCCC Treaty, *supra* note 47, art. 4, § 1.

83 *Id*. art. 3, § 1; *see also id*. art. 1, definitions (defining "Adverse effects of climate change" as "changes in the physical environment or biota resulting from climate change which have significant deleterious effects on the composition, resilience or productivity of natural and managed ecosystems or on the operation of socio-economic systems or on human health and welfare.").

IV. REVISITING INTERNATIONAL ENVIRONMENTAL LAW PRINCIPLES THROUGH A CLIMATE JUSTICE APPROACH

International Law Principles must be expanded using the Climate Justice Approach and applied to Global North nations to adequately address the injustices faced by climate-displaced communities. The Climate Justice Approach requires that the international community reevaluate existing international environmental law principles and incorporate them in novel and meaningful ways to address climate displacement issues. The principles stated above are relevant to climate displacement because they have been consistently under-utilized in a way to allow the Global North to evade blame and responsibility for the current climate changes. As stated, these principles have already been embedded in many international law instruments like the UNFCCC, which makes them prime targets for an intersectional renovation.

The international environmental principles within the UNFCCC must include a climate justice lens when applied to signatories like the United States. The principles must be expanded to catalyze the meaningful action necessary to address climate displacement and many other inequity issues stemming from climate change. Since the United States is a world leader in carbon emissions, this section will apply the suggested expansions to the United States.

A. EXPANSION OF CAUSATION ELEMENT IN INTERNATIONAL PRINCIPLES

The principles of Good Neighborliness, Transboundary Harm, CBDR, and PPP require an expansion of permitted causation. This expansion would remedy the deaths and damages resulting from climate displacement by holding those who contributed the most to climate change responsible. Adjusting these principles would be equitable because bad actors have long been shielded by the lack of direct causation for climate impacts and thus have escaped responsibility for the external costs that are often borne by the least culpable.

B. EXPANSION OF GOOD NEIGHBORLINESS PRINCIPLE

When considering a climate justice lens, the Good Neighborliness Principle must be reevaluated in the context of climate displacement to include all States as neighbors. The principle of Good Neighborliness should no longer be confined to geographic proximity. As the world is now more connected than ever, we may all be considered "neighbors" in the broader sense.[84] Since at least the 1990s, scholars have been discussing an expansion to update the vague language of the Good Neighborliness Principle.[85] According to Sompong Sucharitkul, the way to expand the principle to account for environmental justice would involve two prongs: incorporating anti-hegemonism and

84 Sucharitkul, *supra* note 63, at 7.

85 *See Id.* at 9 ("Any attempt to identify and clarify elements of good-neighborliness will of necessity entail an examination of State practice as an indication of the current trend in the progressive development of principles of international law rather than pure codification. It will include a study of a series of soft-law principles as there are as yet no hard and fast rules of international law requiring a certain standard of conduct on the part of a State in every given set of circumstances involving its relations with another State as its neighbor.").

dropping the requirement of geographic proximity.[86] This expansive view is required to address climate displacement because impacts of emissions from one country can be felt globally and have lasting impacts on all people.[87] This view is also important when considering the social justice impacts of a hegemonic status quo. The Global North persists to create and enforce a social structure that hoards decision making power and access to resources from the Global South, where States are most vulnerable to climate displacement.

Taking climate justice into account, the Global North has violated the fundamental principle of Good Neighborliness to its neighbors of the world, which the Global North States were legally bound to adhere to according to the UNFCCC. As the impacts of imminent climate change are coupled with the continued consumption patterns of the Global North, the Global South continues to feel the consequences, such as climate displacement. The Global North is therefore working against the mutual interests of all humankind by creating an uninhabitable world, violating the Good Neighborliness Principle. Additionally, the North's disregard for their obligations rejects the cooperation to which all States are bound under the Good Neighborliness principle.

The United States is particularly in violation of Good Neighborliness. as it has "contributed more CO2 than any other country to date: at around 400 billion tonnes since 1751, it is responsible for 25% of historical emissions."[88] Under this note's proposed Climate Justice Approach, the United States has violated its obligations to its neighbors of the world, through its lack of cooperation with "an appropriate international response."[89] This uncooperative stance is further evidenced by the United States continuously increasing consumption patterns, despite ratifying the UNFCCC's objective to "stabilize greenhouse gas emissions."[90] A proper climate justice amendment to the UNFCCC finance mechanism would expand the Good Neighborliness Principle so parties must be "good neighbors" to all people of the world.[91] This expansion would likely trigger a closer look at possible remedies and solutions for those disproportionately impacted by climate displacement threats, as owed to them by neighbors who have caused the environmental conditions forcing their displacement.[92]

The Good Neighborliness Principle, as it is now, allows the Global North parties to evade their responsibilities to the Global South. This note argues that their apathetic

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86 *Id.*

87 HUNTER ET AL., *supra* note 18, at 607–16.

88 Hannah Ritchie, *Who Has Contributed Most to Global CO2 Emissions?*, OUR WORLD IN DATA (Oct. 1, 2019), https://ourworldindata.org/contributed-most-global-co2 (for CO2 emissions comparison, also noting that the U.S. emissions are more than twice China's emissions when taking into account cumulative emissions).

89 Sucharitkul, *supra* note 63; UNFCCC Treaty, *supra* note 47.

90 UNFCCC Treaty, *supra* note 47; *UNFCCC Parties: United States of America*, UNITED NATIONS CLIMATE CHANGE , https://unfccc.int/node/61231 (for dates of signature and ratification by the United States in the UNFCCC) (last visited Nov. 18, 2021); U.S. ENERGY INFO. ADMIN., U.S. ENERGY-RELATED CARBON DIOXIDE EMISSIONS (2019) (stating that, "[w]ith increased consumption, U.S. natural gas CO2 emissions increased in total 35.6% (443 MMmt) from 2007 to 2019. From 2018 to 2019, natural gas-related CO2 emissions increased by 3.3% (54 MMmt).").

91 *See* discussion *infra* Section IV.

92 *See* discussion *infra* Section IV.

contributions to climate change have infringed on the Global South's sovereignty to access to their own resources. The Global South has been deprived of resources and the ability to live within their homes due to the Global North's consumption and lack of cooperation to fight climate change as a good neighbor of the world. The adoption of an expanded Good Neighborliness Principle would help solve the disparate harms faced by climate-displaced people.

C. EXPANSION OF THE DUTY TO NOT CAUSE TRANSBOUNDARY ENVIRONMENTAL HARM

Under a Climate Justice Approach, the Transboundary Harm Principle would account for more than directly attributable environmental harms and be expanded to include protections from impairments that are not unmistakably from one source.[93] This expansion would hold anonymous joint contributors responsible. As such, it would be a stark contrast to the *Trail Smelter Arbitration* and similar cases that have followed, which require a clear causal connection from the environmentally detrimental actor to the harmed party.[94] The lack of a causal connection has been a common rationale for courts dismissing claims.[95]

A climate justice application of the Transboundary Harm Principle would, in practice, include indirect actions that have a detrimental effect on resources necessary to life and force climate migration and displacement. Some factors linked to climate change disruption that contribute to displacement include: lack of access to water, loss of land due to sea level rise, increased competition for resources, increased food insecurity, intensifying natural disasters, and impacts from shifting climatic zones on crop productivity.[96] An extension is necessary to evaluate transboundary harm caused to climate-displaced people because the impacts of climate change are slow, making it difficult to pinpoint particular harms and their specific causes.[97]

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93 For a discussion of the history of the Transboundary Harm Principle, *see supra* Section II(C).

94 *See* Kuhn, *supra* note 63 for facts of the *Trail Smelter* case. *See* Greenpeace USA v. Stone, 748 F.Supp. 749, 767 (1990) (plaintiffs claim to be harmed by the transboundary damages from hazardous waste transportation and disposal by defendant; injunctions were denied because of costs that would be incurred by the defendants in a balancing test of hardships); *see also, e.g.*, Venancio Aguasanta Arias et al. v. Dyncorp et al., No. 1:01cv01908, 2016 WL 6496214 (D.D.C. Nov. 2, 2016) (plaintiffs were harmed by the spraying of herbicides from the defendant's plane).

95 *See, e.g.,* Native Village of Kivalina v. ExxonMobil Corp., 696 F.3d 849, 858 (9th Cir. 2012) (stating "In sum, the Supreme Court has held that federal common law addressing domestic greenhouse gas emissions has been displaced by Congressional action. . . . Therefore, we affirm the judgment of the district court. We need not, and do not, reach any other issue urged by the parties."); *see also Greenpeace USA*, 748 F. Supp. at 768 (stating cannot pass judgment "on the wisdom of the decision made by Congress and the President to remove the European stockpile from the FRG to Johnston Atoll. Under our constitutional form of government that is solely within the purview of the legislative and executive branches of government.").

96 Podesta, *supra* note 37.

97 *See* Tamma A. Carleton & Solomon M. Hsiang, *Social and Economic Impacts of Climate*, 353 SCI. 1112-1120 (2016).

Referring to the previously discussed good neighborliness principle, transboundary harms should not be limited to actions between countries sharing a border.[98] This limitation would be an improper interpretation of these principles because global connectivity has increased since their creation.[99] The extensive list of climatic impacts that force displacement require the international law principles created by the UNFCCC to be the legal backbone for filling gaps in protections for climate-displaced people. Use of the Transboundary Harm Principle to fill such gaps has been incorporated in other scholarly works that were recently presented before the Children's Rights Committee.[100] For instance, in *The Impact of Climate Change on the Rights of a Child,* U.N. Human Rights Council 32/33, the plaintiffs argued that a State has an obligation to not violate the enjoyment of rights by their children through their *global* contributions to climate change, not just their environmental harms to neighboring States.[101] Although scholars support applying the Transboundary Harm Principle to climate-displaced people, there is still debate regarding whether sufficient evidence of causation supports enforcement of any obligation on the Global North under the principle.[102]

The United States interprets the Transboundary Harm Principle as requiring a causal element to state a cause of action.[103] The UNFCCC, however, recognizes the shortcomings of this approach; signatories to the UNFCCC acknowledge that actions within a jurisdiction should not cause harm in another.[104] Therefore, in the UNFCCC's reading, the activities that have occurred within the United States such as the manufacturing boom and massive contributions to global carbon emissions create a responsibility not to cause damage to the environment beyond U.S. jurisdiction through a Climate Justice Approach.

By dismissing claims of transboundary harm that fail to satisfy the causal element, U.S. courts kick the can down the road in hopes that the other branches of government will take a definitive stance on climate change liability.[105] The Ninth Circuit Court of Appeals stated this explicitly in deciding *Native Village of Kivalina, City of Kivalina v. ExxonMobil Corporation et al.*:

> Our conclusion obviously does not aid Kivalina, which itself is being displaced by the rising sea. But the solution to Kivalina's dire circumstance must rest in

98 Sucharitkul, *supra* note 42, at 9.

99 *Id.*

100 U.N. Human Rights Council 32/33, *The Impact of Climate Change on the Rights of a Child*, A/HRC/RES/32/33 (July 18, 206) https://www.ohchr.org/EN/Issues/HRAndClimateChange/Pages/RightsChild.aspx [hereinafter *Rights of a Child*].

101 *Id.*

102 *Rights of a Child, supra* note 100; City of New York v. BP P.L.C., 325 F. Supp. 3d 466, 471 (S.D.N.Y. 2018); Barry Kellman, *Standing to Challenge Climate Change Decisions*, 46 ENV'T L. REPORTER NEWS & ANALYSIS 10116, 10118 (2016); Petra Minnnerop & Friederike Otto, *Climate Change and Causation: Joining Law and Climate Science on the Basis of Formal Logic*, 27 BUFFALO ENV'T L. J. 49 (2020).

103 *See* Native Village of Kivalina v. ExxonMobil Corp., 696 F.3d 849, 858 (9th Cir. 2012).

104 See discussion of the Transboundary Harm Principle, *supra* Section II(C).

105 *Id.*

> the hands of the legislative and executive branches of our government, not the federal common law.[106]

In recent years, some cases have been brought in U.S. courts using the innovative approach for broad climate change-related damages without a "direct" causal connection.[107] BP was sued for causing injuries to the City by contributing to sea level rise.[108] Despite its novel application of the Transboundary Harm Principle to include damages resulting from climate change, the Court expressed skepticism regarding the attenuated causation between BP's greenhouse gas emissions and the alleged injuries.[109] Further, the court referenced Supreme Court precedent stating that it is not the responsibility of the judicial branch, but rather that of the legislative and executive branches, to decide whether to promulgate rules establishing a private action for liability stemming from climate change-related harms.[110]

As the cases discussed above illustrate, the application of the Transboundary Harm Principle must be expanded. There are too many actors who contributed to the current state of the climate and, additionally, too many ways to evaluate responsibility for current emissions.[111] Allowing these arguments to persist would amount to global consent to the evasion of justice for those most impacted by climate change, like climate-displaced people. For those responsible to be held accountable and for real policy change to be enforced globally, applying a Climate Justice Approach requires a broader interpretation of "causation" for transboundary harm. The Approach would require that transboundary harm be extended beyond direct causal harms between nations that share a border, by modifying the principle to reflect current global connectivity.

D. EXPANSION OF THE COMMON BUT DIFFERENTIATED RESPONSIBILITIES AND POLLUTER PAYS PRINCIPLE

The CBDR and PPP must similarly be reconsidered to not require as strict of a standard for causation. In the context of climate-related environmental harms, the standards for causation must be expanded to include actions from numerous sources, that in a nonlinear way has led to slow degradation of the environment. An expansion of this principle is necessary for equitable solutions, and this development has already been incorporated into other scholarly evaluations. For example, Justin Lee, a Legal Fellow for the California District Attorney Association, points to CBDR as a way to equalize the resource allocation globally to address impacts of climate change.[112] Graham Mayeda of the University of Toronto argues that CBDR must be expanded to account for past

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106 *Id.*

107 *E.g.*, City of New York v. BP P.L.C., 325 F. Supp. 3d 466, 471 (S.D.N.Y. 2018).

108 *Id.* at 473.

109 *Id.* at 474.

110 *Id.*

111 Hannah Ritchie & Max Roser, *CO2 Emissions*, OUR WORLD IN DATA (Feb. 8, 2021), https://ourworldindata.org/co2-emissions (for discussion of the many ways to evaluate who contributed most to the carbon emissions and therefore, climate change. Methods of evaluation discussed include annual emissions by country, emissions per person within each country, and historical contributions).

112 Justin Lee, *Rooting the Concept of Common But Differentiated Responsibilities in Established Principles Of International Environmental Law*, 17 VT. J. OF ENV'T L. 27, 43 (2015).

injustices, not only the current tangible injustices.[113] Their works reflects an emerging recognition that, in order for international customary law principles to properly address nebulous issues like climate change, they must be applied in a less linear or first-order-consequence-focused fashion.

The Global North's ability to avoid responsibility while reaping the benefits of activities that contribute to climate change undermines the credibility of the UNFCCC's call for CBDR. The PPP should be used to address the moral obligation on polluters to give back to the communities that the Global North has helped to destroy. This would be a proper expansion of the PPP because there may not be a direct causal connection between a particular polluter and the harm to which they contribute and break with the tradition of the *Trail Smelter Arbitration*, *Arias et al.*, or *Greenpeace* cases, which consider specific harms caused by a specific actor.[114]

According to the CBDR principle, the burden to mitigate damage and foster adaptation for safe climate displacement *should* fall primarily on the Global North for their contributions to global emissions.[115] Some have even argued that places like the United States should open their borders to a number of climate-displaced people to account for the harm that the United States has contributed through emissions over time.[116]

The argument for the United States taking more of the apportioned responsibility for aid under CBDR is bolstered by the United States' domestic "polluter pays" principle. The PPP is woven throughout United States domestic law in statutes such as the Comprehensive Environmental Response, Compensation, and Liability Act, the Resource Conservation and Recovery Act, and portions of the Clean Air Act and Clean Water Act.[117] Through these domestic laws, the United States has implemented a system that assigns costs for clean-up to potentially responsible parties.[118]

Conversely, the United States is unwilling to be bound by strict international treaty obligations,[119] which would require aid to countries that have been impacted by its ac-

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113 Graham Mayeda, *Where Should Johannesburg Take Us? Ethical And Legal Approaches to Sustainable Development in the Context of International Environmental Law*, 15 COLO J. OF INT'L L. & POL. 29, 67 (2004); *see also* Eckersley, *supra* note 11, at 482 (stating that the common but differentiated responsibilities is a big portion of the UNFCCC and developed nations should have open borders to climate change migrants, in addition to providing to financing mechanisms).

114 *See* Kuhn, *supra* note 69 (describing facts of the *Trail Smelter* case); *see also* Venancio Aguasanta Arias et al. v. Dyncorp et al., No. 1:01cv01908, 2016 WL 6496214 (D.D.C. Nov. 2, 2016); *see also* Greenpeace USA v. Stone, 748 F.Supp. 749, 767 (1990).

115 *Id.*; UNION OF CONCERNED SCI., *supra* note 10 (showing that the United States is responsible for 15% of the total global CO2 emissions).

116 Eckersley, *supra* note 11, at 482.

117 Ved P. Nanda, *Agriculture and the Polluter Pays Principle*, 54 AM. J. COMP. L. 317, 319 (2006) (discussing the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. §§ 9601-9657 (1980) ("CERCLA")).

118 Nanda, *supra* note 117.

119 *See* Jon Hovi, Detlef F. Sprinz & Guri Bang, *Why the United States Did Not Become a Party to the Kyoto Protocol: German, Norwegian, and U.S. Perspectives*, 18 EUR. J. OF INT'L RELATIONS 2 (2010) (noting that President Bush stated the United States would not ratify the Kyoto Protocol due to strict enforcement and funding mechanismsnot required of the Global South's high emitting states. Similarly, the Byrd-Hagel Resolution restricted the

tions and reliance on GHG producing fuels.[120] The aversion to being bound to strict enforcement and payment mechanisms to support the Global South shows the United States' refusal to be held accountable. This refusal is in direct opposition to the way that the United States holds the industries accountable within its own borders. Internally, the United States imposes liability on polluters, but at the same time will not acknowledge or address its own responsibility for global pollution. The external denial by the United States, as a polluting contributor to climate change, is a prime example of the Global North's "Not in My Backyard" mindset. [121] In this way, the United States is eager to put other countries' living conditions at risk, but not its own. The detrimental "Not in My Backyard" mindset is exactly what would be remedied through application of a Climate Justice Approach.

A climate justice application of the CBDR would amend UNFCCC to give tangible obligations with apportioned financial aid requirements, in relation to a State's culpability for climate displacement. The elimination of an opportunity to avoid obligation is the moral reason for expanding CBDR and PPP, as the North has incurred what some scholars have called a "climate debt" to the Global South.[122] Climate debt refers to the "debt" countries incur by exceeding their "fair share" of global emissions, owed to those that have not exceeded their own.[123] To pay this climate debt, an expanded CBDR and PPP would require the Global North to pay an amount proportionate to their emissions, and avoid providing such countries a no-causation loophole through which to escape liability.

United States from joining any protocol adding commitments not also required of developing countries.); *compare with* Melissa Denchak, *Paris Climate Agreement: Everything You Need to Know*, NRDC (Feb. 19, 2021), https://www.nrdc.org/stories/paris-climate-agreement-everything-you-need-know (noting, for comparison that the United States did sign and ratify the Paris Agreement (part of the UNFCCC) which has no funding enforcement mechanism); *see also* Jack Fitzpatrick, *Treaty or Not? Debate over Paris Climate Accord Revives Key Question*, Morning Consult (Apr. 27, 2017), https://morningconsult.com/2017/04/27/treaty-not-debate-paris-climate-accord-revives-key-question/ (discussing that because the Paris Agreement contained no climate change enforcement mechanisms, United States ratification was more likely).

120 Nicolas Loris, *Staying in Paris Agreement Would Have Cost Families $20K*, The Heritage Found. (Nov. 5, 2019), https://www.heritage.org/environment/commentary/staying-paris-agreement-would-have-cost-families-20k.

121 Peter D. Kinder, *Not in My Backyard Phenomenon*, BRITANNICA (Oct. 9, 2019), https://www.britannica.com/topic/Not-in-My-Backyard-Phenomenon (defining "Not in my backyard" as "the unwillingness of individuals to accept the construction of large-scale projects by corporations or governmental entities nearby, which might affect their quality of life and the value of their property.").

122 Kason Hickel, *Quantifying National Responsibility for Climate Breakdown: An Equality Based Attribution Approach for Carbon Dioxide Emission in Excess of the Planetary Boundary*, 4 THE LANCET PLANETARY HEALTH 400 (2020).

123 *Id.*

V. Expanded International Principles In Action: A Hypothetical Application to the Green Climate Fund of the UNFCC

To varying degrees, the UNFCCC and its mechanisms recognize the heightened responsibility of developed countries to address climate change issues and stabilize climate change to livable conditions, yet the structure is lacking in enforcement and clear obligations.[124] As a party to the UNFCCC, the United States has ostensibly agreed to be bound to the principles and obligations set out in the UNFCCC and its mechanisms.[125] However, the UNFCCC has no enforcement mechanisms to hold its parties accountable for violations that contribute to climate injustices, allowing countries like the United States to escape scrutiny.[126]

In 2010, the UNFCCC developed the Green Climate Fund (GCF) to funnel financial support to developing countries for adaptation and mitigation measures to prevent climate displacement, among other things.[127] However, the GCF fails in several key respects. The GCF is funded only on a voluntary basis and distributes its funds primarily for mitigation projects in the North rather than the South; additionally, it imposes barriers to the receipt of funds, and allocates them only to areas at high risk for future displacement, without considering populations who have already been displaced.[128]

The voluntary funds solicited under the GCF are often never paid because there is no mechanism in place for strict enforcement or to ensure consistent support when administrations change. For example, in 2016, the United States, under the Obama Administration, pledged $500 million to the Green Climate Fund, but in 2018, the Trump Administration ceased all payments to UN Climate Change Programs.[129] The United

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124 Lavanya Rajanmani & Jutta Brunnee, *The Legality of Downgrading Nationally Determined Contributions Under the Paris Agreement: Lessons from the US Disengagement*, 29 J. of Env't L. 537, 546 (discussing the ways that the CBDR became less pronounced under the Paris Agreement, even though it is still a guiding principle therein).

125 UNFCCC Parties, U.N. Climate Change (Aug. 7, 2018), https://unfccc.int/process/parties-non-party-stakeholders/parties-convention-and-observer-states?field_partys_partyto_target_id%5B512%5D=512&field_partys_partyto_target_id%5B511%5D=511 [hereinafter UNFCCC Parties].

126 Michael Gillenwater, *The Treaty Compliance Challenge: Enforcement Under the Kyoto Protocol*, Greenhouse Gas Mgmt. Inst. (Feb. 10, 2010), https://ghginstitute.org/2010/02/10/the-treaty-compliance-challenge-enforcement-under-the-kyoto-protocol/ (stating that the UNFCCC lacks an enforcement mechanism).

127 Gonzalez, *supra* note 9, at 391; *About GCF*, *supra* note 15.

128 Gonzalez, *supra* note 9, at 391; Bassetti, *supra* note 4; Green Climate Fund, Indep. Evaluation Unit, Forward-Looking Performance Rev. of the Green Climate Fund Final Report 9 (2019), https://ieu.greenclimate.fund/sites/default/files/document/fpr-final-report.pdf; Chris Perry, *Environmental Migration: Policy Gaps and Response Strategies*, Int'l Peace Inst., 1–6 (2011), https://www.ipinst.org/wp-content/uploads/publications/ipi_e_pub_env_migration.pdf; Chloe Farand, *Green Climate Fund Replenishment Fails to Fill Hole Left By Trump's US*, Climate Home News (Oct. 25, 2019), https://www.climatechangenews.com/2019/10/25/green-climate-fund-replenishment-fails-fill-hole-left-trumps-us/.

129 *The Green Climate Fund,* Cong. Res. Service (Oct. 9, 2019), https://fas.org/sgp/crs/misc/IF10382.pdf.

States did not face any tangible consequences for halting the United States contributions to the Fund — rather, other states were forced to account for the shortfall .[130] Even as the United States recommits to the funding under Biden Administration, the need for this recommitment merely highlights the problem of relying on voluntary contributions.[131]

Of course, as a party to the UNFCCC, the United States has ostensibly agreed to be bound by the principles and obligations set out in the UNFCCC. However, UNFCCC has no enforcement mechanisms to hold parties accountable for violations that contribute to climate injustices.[132] This lack of enforceable obligations, coupled with the lack of a diplomatic push for the United States to take more responsibility, has contributed to its inadequate contributions to the GCF.[133]

As some scholars have pointed out, "adaptation and mitigation share the ultimate purpose of reducing climate change impacts but have different objectives: mitigation aims to reduce emissions or enhance the sinks of greenhouse gases, while adaptation addresses the effects of climate change on people and ecosystems."[134] The GCF often prioritizes mitigation projects over adaptation.[135] Adaptation serves less of a return to private sector interests, resulting in their contributions going to mitigation projects because mitigation strategies produce commodities such as energy and transport, giving more room for profits.[136] Because of these interests, the private sector has less incentive to invest in adaptation strategies.[137] The lack of incentive results in only nineteen percent of GCF funds being allocated to adaptation projects in the Global South, where the benefits remain local.[138] Due to the reality that the funds are not distributed equally, climate-displaced people are not receiving as much aid as they could be. This illustrates the need for an equal disbursement to both mitigation and adaptation projects in the Global South—mitigation to reduce the acceleration of climate change, and adaptation to address the issues already in existence and those that will become more pronounced, such as climate-displaced people.

In addition to a lopsided financing of profitable projects, these climate justice issues are then exacerbated by the fact that many countries in the Global South cannot get

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130 *Id.*; Brad Plumer and Nadja Popovich, *The World Still Isn't Meeting Its Climate Goals*, N.Y. TIMES (Dec. 7, 2018), https://www.nytimes.com/interactive/2018/12/07/climate/world-emissions-paris-goals-not-on-track.html (noting that paying into the climate fund is discretionary).

131 Rebecca Beitsh, *Biden Recommits U.S. to Paris Climate Accord*, THE HILL (Jan. 20, 2021), https://thehill.com/policy/energy-environment/535075-biden-recommits-us-to-paris-climate-accord.

132 Rajanmani & Brunnee, *supra* note 124.

133 Bassetti, *supra* note 4.

134 Rico Kongsager et al., *Addressing Climate Change Mitigation and Adaptation Together: A Global Assessment of Agriculture and Forestry Projects*, 57 ENV'T MGMT. 271 (2016).

135 Bassetti, *supra* note 4.

136 *Id.*

137 *Id.*

138 *Id.*

support because of barriers blocking direct access to the funds.[139] Such barriers include stringent requirements to gain accreditation. Accreditation is the part of the GCF application process where applicants must demonstrate their capacity to "undertake projects or programmes" to gain funding.[140] Accreditation may also require financial capital from the vulnerable countries to implement structures just to be eligible for the funding. To gain accreditation, and thus access to funds:

> [T]o gain accreditation to then gain access to the funds, "Institutions must prove they have: a track record of delivering mitigation and adaptation projects, a fully functional independent audit committee with plans for the past three years, various procurement committees, relevant guidelines and data on complaints handled in the past two years, examples of conflicts of interest in the past two years and how they were dealt with – and so on."– two years is a long time to wait.[141]

Two years is a long time to wait. A Climate Justice Approach employed by the GCF would require amendments to allow for easier accreditation, implement obligations for financial support from States, and ensure equal disbursement for mitigation and adaptation projects through explicit amendment of the international instrument. This would help Global South countries decide how the funds will best be used to support a specific group of people, preserving their sovereignty. Thus, the UNFCCC would become a material climate justice effort.

VI. Conclusion

Scholar Chris Perry characterized the issue of climate change and its consequences succinctly by stating, "[w]hat is today an issue of sustainable development could quickly become an issue of crisis management tomorrow."[142] Thus, it is vital to keep the climate justice lens at the forefront of international discussions addressing climate displacement and assignment of responsibility. These solutions should take the form of amending current international law principles to better attach responsibility to actors in the Global North actors.

The principles underlying the UNFCCC provide a starting point for the application of a Climate Justice Approach. However, these principles need expanding to adequately address climate injustices. A core part of this expansion should be refining the concept of causation to address the nebulous, widespread nature of climate-related harms and their numerous causes. The causation element within all international principles must be

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139 Joe Lo, *Why Can't Poor Countries Access the Climate Finance They Were Promised?*, The Guardian (Feb. 15, 2016), https://www.theguardian.com/global-development-professionals-network/2016/feb/15/small-island-states-green-climate-fund.

140 *Entity Accreditation*, Green Climate Fund, https://www.greenclimate.fund/accreditation/process#:~:text=during%20the%20accreditation%20process%2C%20an,of%20the%20Green%20Climate%20Fund.

141 Lo, *supra* note 139.

142 Chris Perry, *Environmental Migration: Policy Gaps and Response Strategies*, Int'l Peace Inst. (Nov. 30, 2011), https://www.ipinst.org/2011/11/environmental-migration-policy-gaps-and-response-strategies.

expanded to not require direct causal links, especially in the CBDR and PPP. The Transboundary Harm Principle and Good Neighborliness Principle must be expanded to include responsibilities to distant States, beyond close and adjacent States.

The international environmental law principles outlined above demonstrate a baseline for protentional changes needed to implement equitable justice for climate-displaced people. The world must work together to take responsibility for past actions and contributions, increase financial support to climate-displaced people, and listen to impacted communities to understand and account for their priorities. It is in everyone's best interest to prepare for and work to alleviate the harms caused by climate change and ensuring that international legal institutions contribute to this mission is essential.

Madison Shaff is a J.D. candidate at the Elisabeth Haub School of Law at Pace University, 2022; B.A. at Florida State University, 2019. She is a Haub Scholar, student body President, and Articles Editor for the Pace Environmental Law Review (PELR). Madison is the recipient of the 2021 Bronze Medal Jefferson Award for sustained community service. *She would like to thank Smita Narula, Inga Caldwell, Sarena Malsin, and Allison Wood for their thoughtful edits and encouragement. Madison is also very grateful to the Texas Environmental Law Journal for their work on this note and for granting her this opportunity to speak on environmental justice.*

Direct Air Capture Facilities and Production of Carbon-Neutral Hydrocarbons

Neil Segel

I. Introduction

Growing demand for further decarbonization will drive industrial changes in the decades to come. Global population and gross domestic product will grow rapidly, and most outlooks anticipate an increase of approximately 20% to 30% in global energy demand by 2040.[1] This growth in energy demand and resultant production presents a "dual challenge of providing affordable, reliable energy while addressing the risks of climate change."[2]

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1 *See* BP, BP Energy Outlook: 2019 Edition, 135 (2019), https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2019.pdf (projecting a 32% increase in "primary energy" consumption between 2017 and 2040); ExxonMobil, 2019 Outlook for Energy: A Perspective to 2040, 48 (2019), https://corporate.exxonmobil.com/-/media/Global/Files/outlook-for-energy/2019-Outlook-for-Energy_v4.pdf (projecting global energy demand to increase by 20% from 2017 to 2040); Int'l Energy Agency, World Energy Outlook 2019, 679 tbl.A.3 (2019), https://www.iea.org/reports/world-energy-outlook-2019 (projecting an increase in global energy demand by approximately 25% between 2018 and 2040).

2 Nat'l Petrol. Council, Meeting the Dual Challenge: A Roadmap to At-Scale Deployment of Carbon Capture, Use, and Storage 30 (2019), https://dualchallenge.npc.org/files/CCUS_V1-FINAL.pdf.

Anthropogenic activities account for almost all of the increase in greenhouse gases (GHGs) in the earth's atmosphere over the past 150 years.[3] It is imperative that government and private industry alike work hand-in-hand to address the concerning rise of atmospheric GHGs to stave off climate change as much as possible. To the extent that these ambient GHG levels lock in certain anthropogenic changes to earth's climate, the foremost step is to mitigate current emissions. In addition, however, decarbonization will require not just net-neutral, but net-negative solutions. To achieve a net-negative goal, bridging that divide with net-neutral technological adaptation through certain directed policies is essential.

In the 2015 Paris Agreement, the international community committed itself to limiting global warming by the year 2100 to "well below 2°C" and "to pursue efforts to keep warming below 1.5°C" compared to pre-industrial levels.[4] The United Nations' Intergovernmental Panel on Climate Change modeled hundreds of emissions scenarios and found only 76 pathways that could attain these targets.[5] Of these 2°C pathways, 87% of them rely on the assumption of large-scale atmospheric carbon dioxide (CO_2) removal (CDR) from the ambient atmosphere, reaching net-zero emissions at some point in the 21st century followed by a period of net-negative emissions, where CDR rates would exceed residual emissions.[6]

According to the U.S. Environmental Protection Agency (EPA), the transportation sector generates the largest share of anthropogenic GHG emissions, entailing 28.2% of 2018 total GHG emissions.[7] These GHG emissions from transportation primarily come from burning fossil fuel for cars, trucks, ships, trains, and planes. More than 90% of the fuel used for transportation is petroleum-based and is primarily gasoline and diesel.[8] To address the need for deeper decarbonization, it is essential to both capture the single largest carbon-emitting sector's emissions and to initiate necessary interim measures to

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3 Intergovernmental Panel on Climate Change, Climate Change 2007: The Physical Science Basis, 2 (Susan Solomon et al. eds., 2007), https://www.ipcc.ch/site/assets/uploads/2018/05/ar4_wg1_full_report-1.pdf.

4 Paris Agreement to the United Nations Framework Convention on Climate Change art. 2, Dec. 12, 2015, T.I.A.S. 16-1104.

5 Tracy Hester, Legal Pathways to Negative Emissions Technologies and Direct Air Capture of Greenhouse Gases, 48 ENV'T L. REP. 10413 (May 2018).

6 Christoph Beuttler et al., *The Role of Direct Air Capture in Mitigation of Anthropogenic Greenhouse Gas Emissions*, 1: FRONTIERS IN CLIMATE art. 10, 1 (2019), https://www.frontiersin.org/articles/10.3389/fclim.2019.00010/full; *see also* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014: MITIGATION OF CLIMATE CHANGE. CONTRIBUTION OF WORKING GROUP III TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (Ottmar Edenhofer et al. eds., 2014), https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_full.pdf.

7 *Sources of Greenhouse Gas Emissions*, U.S. ENV'T PROT. AGENCY, https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions (last updated July 27, 2021).

8 *See* Suzana Kahn Ribeiro et al., *Transport and Its Infrastructure*, *in* Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change 323, 325 (Bert Metz et al. eds., Cambridge University Press 2007), https://www.ipcc.ch/site/assets/uploads/2018/03/ar4_wg3_full_report-1.pdf (finding that "[t]ransport predominantly relies on a single fossil resource, petroleum that supplies 95% of the total energy used by world transport.").

neutralize carbon emissions as a penultimate step toward a carbon-neutral transportation system. This can be accomplished without overly disrupting existing transportation systems, which do not necessarily require liquid hydrocarbon fuels. To do so will require active government intervention to better incentivize and subsidize enormous capital development and operational overhead costs.

A promising and rapidly developing area addressing transportation sector-based CO_2emissions is the development of direct air capture (DAC) technologies and their ability to aid in the production of clean-burning synthetic carbon-neutral hydrocarbons (CNHCs). DAC technologies refer to "any industrialized and scalable methods to remove GHGs from the ambient atmosphere and either store or reuse those gases, especially (although not always) in a way that does not allow them to escape back into the atmosphere."[9]

One of the most promising features of DAC technologies is that they can extract CO_2 from ambient air at any location. Untethered from the requirement of co-locating point source carbon capture around existing emissions sources (such as flue gas capture from industrial plants), the infrastructure requirements for DAC are more flexible and can be manipulated based on localized economic factors. Captured carbon sequestration, however, presents potentially high transmission costs and legal permitting issues,[10] depending on the final destination and use.[11]

Location-independent capture and sourcing of CO_2 would significantly reduce legal permitting barriers, transport costs, and emissions resulting from transportation. Location independence would allow for synthetic fuel production to be performed at locations with the most favorable renewable energy prices. Significantly, "[a] cost advantage of just 1 [cent per kilowatt hour] ct/KWh could offset or even overcompensate any potential extra costs of CO_2 derived from DAC compared to . . . CO_2 that is captured from industrial point-source emissions."[12] Employing DAC as a feedstock for "power-to-X" (PtX) technologies would allow cities to produce their own synthetic, hydrogen-based fuels.[13]

Comparing configurations in presently operational DAC facilities, minimal variety exists in terms of design structure and process elements. However, many proposals seek to address localized needs and design constraints. The proposed configurations vary in

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9 Hester, *supra* note 5, at 10415.

10 *See id.* at 10426-29 (summarizing the legal obligations arising from negative emissions technology (NET) wastes and emissions, particularly addressing the nexus of managing and disposing of captured CO_2 with the federal Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act, and the Safe Drinking Water Act).

11 For example, transmission costs may be high for CO_2 deposition in offshore saline aquifers or onshore geologic formations, versus compression and interim in situ tank storage, or compression and electrolysis for in situ fuel synthesis.

12 Beuttler et al., *supra* note 6, at 5.

13 *Id.* at 4–5 ("Together with its partners, Climeworks has demonstrated the viability of large-volume energy storage through PtX technology in real-life applications," including synthetic fuel production and producing synthetic building materials made from atmospheric CO_2.).

their treatment of power system, oxygen supply, and CO_2 compression.[14] Several variations have been optimized to provide CO_2 for direct fuel synthesis.

For example, Carbon Engineering is developing "air-to-fuel" systems in which the hydrogen required as feedstock for the fuel synthesis step is produced by electrolysis.[15] In such a configuration, the oxygen from electrolysis is sufficient to supply the DAC facility's needs, so an air separation unit in the DAC process is not needed, thereby cutting costs.[16] The advantage of a fuel synthesis system is that it requires a lower CO_2 supply pressure, thereby reducing the cost and complexity of the CO_2 compression and output cleanup.[17] Carbon Engineering is also developing methods to integrate the DAC and fuel synthesis, which is itself a promising area of research and development (R&D) that could lead to future deployment of globally dispersed DAC fuel stations.

Ambient atmospheric CO_2 capture through DAC provides a renewable, cyclically neutral, and virtually inexhaustible carbon source that can allow the continued use of derived carbon fuels.[18] In this way, DAC technology can contribute to the development of a circular economy independent from fossil hydrocarbons. As DAC facility deployment increases, DAC could complement this circular economy by geologically sequestering "excess" CO_2 captured. For designated-use CO_2, recycling via chemical reduction with hydrogen can produce a variety of CNHC fuels of similar molar mass, such as octane, methanol,[19] and/or dimethyl ether (DME, also known as methoxymethane).[20]

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14 David W. Keith et al., *A Process for Capturing CO_2 From the Atmosphere*, 2 JOULE 1573, 1582 (2018).

15 *See* George A. Olah et al., Chemical Recycling of Carbon Dioxide to Methanol and Dimethyl Ether: From Greenhouse Gas to Renewable, Environmentally Carbon Neutral Fuels and Synthetic Hydrocarbons, 74:2 J. ORGANIC CHEMISTRY 487, 492 (2009). ("Electrolysis is energy intensive . . . in water electrolyzers . . . the cost of electricity has been estimated to represent about 80% of the cost of hydrogen produced, while capital investment represented only 11%. In large electrolysis units, the cost of electricity would therefore dictate the overall economics and will be the major driving factor for producing hydrogen. The electricity needed for the process can be provided by any form of energy [e.g., geothermal, wind, solar, etc.].").

16 Keith et al., *supra* note 14, at 1582.

17 *Id*.

18 Much remains to be determined about the potential carbon removal budget and the implications of increasingly higher CO_2 removal on atmospheric and terrestrial conditions. A certain amount of atmospheric CO_2 is essential to keep in heat and facilitate photosynthesis.

19 *Alternative Fuels Data Center: Methanol*, U.S. DEP'T OF ENERGY, https://afdc.energy.gov/fuels/emerging_methanol.html (last visited Mar. 25, 2021) ("Methanol . . . is considered an alternative fuel under the Energy Policy Act of 1992. As an engine fuel, methanol has chemical and physical fuel properties similar to ethanol."); *see also* Alan Ingham, *Reducing the Carbon Intensity of Methanol for Use as a Transport Fuel*, 61 JOHNSON MATTHEY TECH. REV. 297 (2017), ("[T]he carbon intensity of methanol used as a transport fuel . . . [is] lower . . . than gasoline under all production methods studied and can even produce lower GHG emissions compared to ethanol."); *see also* L. Bromberg & W.K. Cheng, *Methanol as an Alternative Transportation Fuel in the US: Options for Sustainable and/or Energy-Secure Transportation*, MASS. INST. OF TECH., (2010), https://afdc.energy.gov/files/pdfs/mit_methanol_white_paper.pdf; Richard L. Bechtold et al., *Use of Methanol as a Transportation Fuel*, METHANOL INST., 7-8 (2007), http://www.methanol.org/wp-content/uploads/

Synthetic fuels production via CO_2 hydrogenation could replace current automobile gasoline and diesel fuel, a concept that has been referred to as the "methanol economy."[21] This concept obviates the need to drastically alter the nature of existing energy use, storage, and transportation infrastructure.[22] These synthetic CNHC fuels would have to satisfy regulatory requirements under Title II of the federal Clean Air Act (CAA),[23] which includes stringent limits on the qualities and components of fuels commercially marketed to be burned for energy.[24] Upon their combustion and use, methanol, DME, and other DAC-produced synthetic CNHCs would form only CO_2 and H_2O (water);[25] thus these fuels create an achievable pathway toward conforming with Title II's existing standards, notwithstanding fuel production processes that may create volatile organic compounds and nitrogen oxide (NO_x) emissions.[26]

2016/06/Methanol-Use-in-Transportation.pdfhanol-Use-in-Transportation.pdf ("The Clean Air Act (CAA) Amendments of 1990 . . . envisaged" that there would be a move toward "vehicles designed to run on methanol, either neat or as M85, to meet various special programs for alternative fuel vehicles (AFVs)." [Subsequently, the] "Then, the Energy Policy Act of 2005 eliminated the oxygen requirement for RFG while imposing a "Renewable Fuel Standard," essentially a requirement for use of increasing volumes of ethanol by refiners. Absent the RFG oxygen requirement . . . all major U.S. refiners [ceased] blending of MTBE and it has virtually disappeared from U.S. gasoline supply since May 2006. With the elimination of MTBE, the only significant use of methanol in U.S. fuel supply is its use in production of methyl ester biodiesel.").

20 Frank S. Zeman & David W. Keith, *Carbon Neutral Hydrocarbons*, 366 PHIL. TRANSACTION ROYAL SOC'Y A 3901, 3907 (2008); *see also* Olah et al., *supra* note 15, at 496; *Alternative Fuels Data Center: Dimethyl Ether*, U.S. DEP'T OF ENERGY, https://afdc.energy.gov/fuels/emerging_dme.html (last visited Mar. 25, 2021) ("[DME] has several fuel properties that make it attractive for use in diesel engines. . . . The energy efficiency and power ratings of DME and diesel engines are virtually the same. . . . Because of its lack of carbon-to-carbon bonds, using DME as an alternative to diesel can virtually eliminate particulate emissions and potentially negate the need for costly diesel particulate filters."); Vincent Dieterich et al., *Power-to-Liquid via Synthesis of Methanol, DME, or Fischer-Tropsch-Fuels: A Review*, 13 ENERGY & ENV'T SCI. 3207 (2020) (comparing PtX pathways to transform electricity to chemicals via electrolysis and synthesis); Beuttler et al., *supra* note 6, at 4-5.

21 Olah et al., *supra* note 15, at 496.

22 *Id*.

23 42 U.S.C. § 7545 (providing for the regulation of on-road and non-road fuels).

24 Hester, *supra* note 5, at 10425.

25 Olah et al., *supra* note 15, at 496.

26 *See* Michael Matzen & Ya°ar Demirel, Methanol and dimethyl ether from renewable hydrogen and carbon dioxide: Alternative fuels production and life-cycle assessment, 139 J. CLEANER PROD. 1068, 1068 (2016 ("Results show that production of dimethyl ether impacts the environment more than methanol production. However[,]the combustion of methanol fuel evens out many of the emissions metrics compared to dimethyl ether. The largest environmental impact was found to be related to the fuel production stage for both fuels. Both biofuels were shown to be comparable to biomass-based gasification fuel production routes. Methanol and dimethyl ether from CO_2 hydrogenation were shown [to] outperform conventional petroleum-based fuels, reducing greenhouse gas emissions 82-86%, minimizing other criteria pollutants ([sulfur oxide] SO_x, NO_x, etc.) and reducing fossil fuel

The production of CNHCs from DAC of CO_2will enable a more rapid closure of the carbon budget gap. At present, the carbon budget amounts to about 1,100 gigatons (Gt) of CO_2.[27] For reference, of the 49 (±4.5) Gt emitted per year in total anthropogenic GHG emissions in 2010, CO_2 was—and continues to be—the dominant GHG, accounting for 76% (38±3.8 Gt CO_2per year) of total anthropogenic GHG emissions.[28] Global carbon capture, utilization, and storage (CCUS) capacity (which excludes naturally sourced CO_2 for enhanced oil recovery (EOR)) is currently just 40 megatons (Mt) per year, or 0.040 Gt, accounting for 0.12% of total energy-related CO_2 emissions.[29]

Current capacity to offset carbon output is growing by about 8% a year, but to actually start closing the gap and add meaningful time to the carbon budget, an additional 1 to 5 Gt each year is needed, requiring a doubling or tripling of current efforts.[30] In the absence of DAC-based CNHC production, this increased demand for DAC CCUS will require a tremendous volume of global storage capacity. Such permanent storage would be in the form of geologic sequestration in underground formations in either gaseous or solid (basaltic) form.[31] The launch in September 2021 of "Orca," Swiss DAC firm Climeworks' new direct air capture and storage plant in Iceland demonstrates the feasibility on a large scale of combining captured CO_2 with permanent underground basaltic -based storage. A broad "CNHC economy" (encompassing the proposed "methanol economy"), given the right economic incentives, would greatly complement global CO_2sequestration efforts.

Over the past two decades, the United States has introduced increasingly stronger federal measures to incentivize the production of low-carbon synthetic fuels and to provide tax credits and other monetary incentives for non-EOR CO_2 utilization from DAC projects. The federal government (and certain states) have mandated the use of certain products and technologies to reduce emissions. They have also established performance standards that certain technologies must achieve, such as the federal Renewable Fuel Standard (RFS) (which requires that specified volumes of biofuels be blended into U.S.

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depletion by 82-91%."); see also 42 U.S.C. § 7545(k)(2)-(3) (concerning requirements and performance standards of gasoline/reformulated gasoline).

27 Trent Jacobs, *CO_2EOR Could Be Industry's Key to a Sustainable Future or Its Biggest Missed Opportunity*, J. PETROL. TECH. 17, 18 (Nov. 2020). This 1.1 teraton (Tt) carbon budget is not an annual limit; rather, it reflects the cumulative allowable emissions to remain under 2°C.

28 Ottmar Edenhofer et al., *Technical Summary*, *in* Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change 45 (Ottmar Edenhofer et al. eds, Cambridge University Press 2014), https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_technical-summary.pdf echnical-summary.pdf.

29 Jacobs, *supra* note 27; POLLUTION SOLUTIONS, SIGNIFICANT ADDITIONAL CAPACITY FOR CCUS WILL BE NEEDED TO ACHIEVE NET-ZERO EMISSION TARGETS (2021), https://www.pollutionsolutions-online.com/news/green-energy/42/global-data/significant-additional-capacity-for-ccus-will-be-needed-to-achieve-net-zero-emission-targets/55849.

30 *Id*.

31 *See* Beuttler et al., *supra* note 6, at 3 for more information about the CarbFix and CarbFix2 projects, which demonstrate that negative emissions via DAC with rapid mineralization is possible and replicable.

transportation fuels)[32] and California's Low Carbon Fuel Standard (LCFS).[33] Federal action in particular has made substantial progress, but it has not adequately kept pace with CCUS technologies that can produce CNHCs.

A recent equity research report by investment banking firm Goldman Sachs entitled "Carbonomics: The Green Engine of Economic Recovery" notes that past recessions, such as the 2008-2009 recession, did not significantly derail low-cost decarbonization technologies, but that higher-cost technologies with less regulatory support such as biofuels and carbon capture never recovered.[34] The authors of the report suggest that this past occurrence raises the risk of a "two-speed decarbonization re-emerging in the aftermath of COVID-19."[35] Although equity markets performed at an all-time high during the fourth quarter of 2020 and a new presidential administration was elected based in part on a robust climate action plan for federal decarbonization efforts, the risk of history repeating itself in the form of a widening chasm between bimodal cost distributions driven by market forces will require firm regulatory control to overcome.

This Article aims to provide policy guidance on how the U.S. federal government's regulatory framework can draw level to the technological advancements in this area. To expedite production of carbon-neutral hydrocarbons, it proposes changes in two areas. First, it recommends that federal agencies amend existing regulations and guidelines to provide for stronger federal monetary policy incentives for DAC projects to make CNHC development more economically viable on a large scale.

Second, it recommends vital policy improvements to stimulate production of CNHCs by modifying key legislation (such as the RFS) to allow the federal government to approve broader fuel pathways beyond conventional biofuels. By taking a combined approach in these areas, these adaptations will allow for existing infrastructure utilization toward carbon-neutral fuel production and a resultant carbon-neutral transportation system until carbon-negative transportation technologies, sequestration schemes, and regulations are commercially viable, available, and well understood.

II. Federal Incentives and Regulation for DAC Facility Development

Over the past decade, as technological advancements have progressed in CCUS, the U.S. federal government has undertaken numerous measures to help propel investment in research, development, and deployment of DAC facilities. These measures, however ambitious, have not kept pace with the increasingly pressing need for alternative energy

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32 Nat'l Petrol. Council, *supra* note 2, at 30.

33 The LCFS is designed to decrease the carbon intensity (CI) of California's transportation fuel pool by assigning CI scores for various fuel types that are then compared to a declining CI benchmark each year. *Low Carbon Fuel Standard*, Cal. Air Res. Bd. https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/about (last visited Oct. 18, 2021).

34 Michele Della Vigna et al., Goldman Sachs, Carbonomics: The Green Engine of Economic Recovery 4 (2020), https://www.goldmansachs.com/insights/pages/gs-research/carbonomics-green-engine-of-economic-recovery-f/report.pdf.

35 *Id.*

and fuel sources considering the increasing pace of climate change and the technological developments in these areas. Deployment of DAC facilities will cost in the billions of dollars,[36] and thus far, Congress has relied narrowly on federal tax credits under Internal Revenue Code (I.R.C.) § 45Q to offset some of these costs to private developers. In the absence of more robust federal policies and programs, DAC facilities are currently unable to generate significant cash flow to provide for operating overhead nor significant return on investment.

As a result, developers must turn to alternative fund-raising schemes, such as tax-equity financing partnerships, which, while productive, fail to provide much-needed direct stimulus. Enhancements to the current 45Q tax credit are necessary to stimulate private financing and scale deployment of CCUS projects, ranging between values of \$60-\$180/ton of captured CO_2 for qualified use.[37] Development stimuli also fail to take into account project longevity à la Solyndra,[38] the lessons of which can be summarized into a need for further government oversight during the early development phase, and a need for better cradle-to-grave/gate life-cycle planning and partnership to regulate and secure adequate output demand and use.

By some estimates, renewable energy infrastructure is 1.5–3.0 times more capital intensive than traditional energy developments per unit of energy produced, thus requiring an attractive regulatory framework and a low cost of capital.[39] Despite the higher capital intensity per unit of "cleaner" energy for transportation, this increased cost does

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36 *See* YUKI ISHIMOTO ET AL., PUTTING COSTS OF DIRECT AIR CAPTURE IN CONTEXT (Forum for Climate Engineering Assessment Working Paper No. 002, 2017); *see also* Noah McQueen et al., *Cost Analysis of Direct Air Capture and Sequestration Coupled to Low-Carbon Thermal Energy in the United States*, 54 ENV'T SCI. & TECH. 7542 (2020), *available at* https://pubs.acs.org/doi/10.1021/acs.est.0c00476 (noting that actual costs for projected full-scale DAC facilities are presently uncertain, as existing pilot plants do not mirror projected full-scale engineering design schematics, making price modeling incredibly difficult and highly variable based on thousands of input factors. Regarding full deployment-scale costs broadly, the author relies on representations made in direct conversations with executive leadership from DAC engineering companies and their investors. The costs of capture per ton/CO_2 annually, which largely drive the economics of full-scale design, are however increasingly surveyed both globally and domestically.).

37 Julio Friedman et al., Columbia U., Capturing Investment: Policy Design to Finance CCUS Projects in the U.S. Power Sector 6 (2020) (advocating for prices in the \$60-\$110 range), https://www.energypolicy.columbia.edu/sites/default/files/file-uploads/CCUS-Finance_CGEP-Report_040220.pdf; *see also* John Larsen et al., Rhodium Group, Capturing Leadership: Policies for the US to Advance Direct Air Capture Technology 6 (2019), https://rhg.com/research/capturing-leadership-policies-for-the-us-to-advance-direct-air-capture-technology/ (advocating for prices as high as \$180/ton).

38 *See* Joe Stephens & Carol D. Leonnig, *Solyndra Scandal*, WASH. POST, Dec. 25, 2011, https://www.washingtonpost.com/politics/specialreports/solyndra-scandal/ (describing the Solyndra scandal). Solyndra was a startup manufacturer of unique solar panel cells that received a \$535 million DOE development loan (the first of its kind) under the American Recovery and Reinvestment Act of 2009, as well as a \$25.1 million tax break from California's Alternative Energy and Advanced Transportation Financing Authority. Due to inaccurately reported application information and changed market conditions, the company cost the federal government a \$528 million loss following its bankruptcy.

39 DELLA VIGNA ET AL., *supra* note 34, at 3.

not necessarily correlate to higher consumer costs, assuming the availability of highly available, well-regulated, low-cost financing and lower operating expenses (OPEX) (compared to traditional hydrocarbon production).[40] Done properly, DAC deployment can become a model for "pro-growth, pro-environment, public-private collaboration."[41]

This Article aims to provide policy guidance on how the federal government's regulatory framework can better economically incentivize the development of both large-scale DAC facilities and ancillary CNHC refining facilities, as well as smaller-scale, *in situ* facilities. Acknowledging the importance of the more general legal hurdles relating to deployment and operation, which include construction and infrastructure legal issues, legal consequences of operational impacts, and legal requirements for management of process wastes,[42] the analysis seeks to pivot toward development (i.e., capital expenditure (CAPEX)) policy and associated legal challenges.

Public law considerations involved in expediting DAC technologies are essential, and the pathway toward broad deployment must be laid out with a robust policy framework. At its core, such a framework deployed in the United States must "provide a clear statutory and regulatory endorsement of CO_2 removal as a desired goal of . . . environmental policy."[43] The Biden Administration's establishment of an international climate envoy—a new Cabinet-level position—as well as a domestic policy advisor on climate change is a step in the direction toward broader endorsement of DAC technologies and engaging in a unified decarbonization effort. The next step in this process should entail a decision by the National Climate Task Force's Climate Innovation Working Group to endorse an Advanced Research Projects Agency-Climate (ARPA-C), which has been proposed by the Biden administration. The ARPA-C would exist in parallel to the ARPA-E (Energy), both under the umbrella of the U.S. Department of Energy (DOE). Among ARPA-C's top DAC-focused initiatives the following four key areas should be of utmost priority: tax credits, public and private project financing, carbon pricing, and permitting barriers.

A. Tax Credits

The present framework for incentivizing carbon oxide sequestration was born out of Congress' desire to enhance available tax credits for such activities. Congress originally enacted the Energy Improvement and Extension Act of 2008 to incentivize the reduction of carbon oxide emissions and support redeployment through efforts such as EOR by enacting a tax credit under 45Q. This production tax credit, commonly utilized in the renewable energy sector, is "transactionally easier for investors, owners, and operators."[44] It also provides "clear public benefit" in that payment is contingent upon performance of CO_2 emissions.[45]

The Bipartisan Budget Act (BBA) of 2018 substantially modified the existing 45Q credits for carbon oxide sequestration by expanding its application to the CO_2DAC, and substantially increased the amount of the tax credit for captured CO_2. For facilities

40 *Id.* at 13.
41 *Id.* at 3.
42 Hester, *supra* note 5, at 10414.
43 *Id.* at 10428.
44 Friedman et al., *supra* note 37, at 7.
45 *Id.*

placed in service after the enactment of the BBA, the current 45Q legislation relating to DAC conveys a $50 tax credit per ton of CO_2securely geologically sequestered and a $35 tax credit for CO_2utilized in another qualified manner, with the credits for both increasing annually until the full value is reached in 2026.[46] A "qualified [DAC] facility" is defined as one that captures not less than 100,000 tons of CO_2 annually.[47]

S. 2230, the CATCH (Coordinated Action To Capture Harmful Emissions) Act, and S. 986, the 45Q Carbon Capture, Utilization, and Storage Tax Credit Amendments Act of 2021 were both introduced in the 117th Congress to raise the value of the 45Q tax credit that incentivizes the deployment of carbon capture technologies. These proposed bills represent a vast improvement on their predecessor, H.R. 5883, which was introduced in the 116th Congress that sought to amend the I.R.C. to provide for marginally increased credit for carbon oxide sequestration for DAC facilities (from $50 per metric ton of qualified carbon oxide capture to $62.50), as well as a reduction in minimum carbon oxide capture volume (from 100,000 metric tons to not less than 50,000 metric tons) during the taxable year.[48]

The CATCH Act proposes increasing the 45Q credit value from $50 to $120 per metric ton for CO_2?captured and stored in saline geologic formations and from $35 to $60 per ton for CO_2?stored?via enhanced oil recovery.[49] The Carbon Capture, Utilization, and Storage Tax Credit Amendments Act of 2021 proposes increasing the 45Q credit value from $50 to $120 per metric ton for CO_2?captured and stored in geologic formations and from $35 to $75 per ton for CO_2?stored?via enhanced oil recovery, with this value reverting back to $35 in 2030.[50] These bills also coincide with the recently proposed S. 1034 Financing Our Energy Future Act, which seeks to expand the Master Limited Partnership structure to include renewable and alternative energy, including CCUS.[51] Allowing for an expanded scope of MLP structures in this regard would allow for better means of raising capital through public markets to support the buildout of critical energy infrastructure.

This progression in regulation and the current proposed modifications are commendable but remain nevertheless insufficient to properly incentivize rapid DAC development and deployment, particularly in light of the IPCC's press release relating to their Sixth Assessment Report (AR6), which states that "unless there are immediate, rapid and large-scale reductions in greenhouse gas emissions, limiting warming to close to 1.5°C or even 2°C will be beyond reach."[52]

In their article "The Role of Direct Air Capture in Mitigation of Anthropogenic Greenhouse Gas Emissions," executives from Climeworks note that "various climate scenarios predict negative emissions at gigaton scale by mid-century . . . to reach a mean

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46 *The Tax Credit for Carbon Sequestration (Section 45Q)*, CONG. RSCH. SERV., https://sgp.fas.org/crs/misc/IF11455.pdf (last updated Jun. 8, 2021).

47 *Id.*

48 H.R. 5883, 116th Cong. § 1(a)(1), 1(b) (2020).

49 S. 2230, 117th Cong. § 1(a) (2021).

50 S. 986, 117th Cong. § 6(a)(1)(B) (2021).

51 S. 1034, 117th Cong. (2021).

52 Intergovernmental Panel on Climate Change, IPCC Press Release: Climate change widespread, rapid, and intensifying (2021), https://www.ipcc.ch/site/assets/uploads/2021/08/IPCC_WGI-AR6-Press-Release_en.pdf.

CDR pathway of around 6 gigatons of CDR by 2050 from 2019 onwards, CDR would require an annual growth rate of over 55%."[53] The authors note that delaying scale-up to 2025 would require a sustained growth of 80% per year, while scale-up starting in 2030 (which is when most CDR policies are currently recommended to commence), would require an approximate yearly doubling of CDR capacity. Growth trends of this magnitude would be incredibly difficult to achieve, and thus the authors determine "that it would therefore be vital to start scaling earlier."[54]

A fundamental policy consideration that is presently overlooked is that the determinative figures need to better balance ambitious goals with present economics of scale. The 45Q credits at present do not account for the high up-front CAPEX costs that necessarily exist in such a nascent technological field where large-scale development is the primary goal. Instead of using comprehensive life-cycle determinations of tax credit qualifications designed to allow current negative emissions technologies (NETs) to take advantage of the tax credits by recognizing the high up-front technology costs and low-capacity volume (that will inevitably fall over time as new technologies evolve), the current tax credits provide an inadequate life-cycle accounting.

This significantly increases the financial risks involved in deployment and operation of such infrastructure. With a present minimum eligibility of 100,000 tons of CDR per year (and even a proposed 50,000 tons), DAC facilities of this size "would very likely exceed current market capitalization of all leading DAC companies and put the ones that decide to try [to scale to the 100,000 ton annual CDR goal] at considerable risk of failure."[55] In addition, the authors note that the revenue stream that the present 45Q establishes at up to $50 per ton of CO_2 is insufficient to cover the costs of atmospheric CDR with current technologies.[56]

The direct pay incentives of the latest proposed legislation are a good step in the right direction toward recognizing this conundrum; nevertheless, CDR policies—including and beyond 45Q—need to accommodate this fact by allowing for even lower removal thresholds at higher prices while implementing market demand mechanisms to drive the pace of technological innovation. To meet the growing demand of CNHC fuel production and carbon sequestration credits, installed capacity will increase and new efficiencies in design will allow for companies to require less and less support. This inverse relationship is what is missing. The absolute amount of financing required to fund initially high-priced CDR technology is negligible compared to the required gigaton-scale carbon removal.[57]

A 2019 report by independent research firm Rhodium Group highlighted some of the necessary policy changes involving the aforementioned inadequately priced tax credits. In outlining a comprehensive industrial strategy to stimulate DAC technological demand, the report's authors appropriately call for extending the commence-construction deadline for DAC eligibility to the end of 2030; extending the credit payout period from 12 years to 30 years; increasing the value of the credit for geologic storage from $50

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53 Beuttler et al., *supra* note 6, at 5-6.

54 *Id.* at 6.

55 *Id.*

56 *Id.* (noting that these calculations apply to both Climeworks and Carbon Engineering—presently the two foremost companies worldwide in the DAC/CDR space).

57 *Id.*

to $180 per ton; and lowering the minimum capture thresholds from 100,000 to 10,000 tons per year.[58] These changes will allow the first wave of commercial DAC plants to break even, particularly if they also were to incorporate revenue from California's LCFS. The report's authors note that "the total annual cost to the government in 2031 would be just $1.5 billion to support nine-million tons of DAC capacity, roughly half the current annual cost of solar photovoltaic tax credits."[59] This proposal is the most aggressive proposal to date that also accurately reflects the market dynamics required to achieve both short- and long-term success in decarbonization efforts of this kind. The reduced volumetric requirements would also create an opening for R&D into smaller-scale DAC PtX units that might play a role in future technological advancements.[60]

A technology and cost analog to DAC is the area of solar and wind energy. Between 2010 and 2019, the cost of solar power generation fell 85% and the cost of wind power generation fell 49%; the costs of both continue to decline.[61] A recent analysis by Bloomberg New Energy Finance shows that the global benchmark levelized cost of electricity (LCOE) from utility-scale wind and solar power generation fell 9% and 4% respectively from late 2019 to early 2020 while benchmark LCOE for battery storage likewise declined to about half of what it was in mid-2018.[62] By mid-2020, renewable energy power was cheaper than fossil fuels in two-thirds of the world.[63]

This comparison to DAC in other renewable power generation sectors is very important, as it clearly demonstrates the capacity for nascent utility-scale technologies to gain cost efficiencies and capacity very quickly. Much of this is due to the long-term outlook of the output purchasing entities that can insert stability into the output purchase agreements to give developers a certain return on investment over time.[64] If the federal government can establish policies that go beyond tax credits to take into consideration both CAPEX and OPEX with an aim of supporting the DAC sector in a comprehensive way (as opposed to merely offsetting investment costs), then DAC will likely enjoy the output stability and resultant cost and technology efficiencies that wind and solar benefit from.

Avoiding a two-speed decarbonization will be essential to the longevity of DAC as a viable CDR method and potential fuel-generation source. The European Renewable Energy Directive 2 (RED2) demonstrates this concept clearly. RED2 allows for atmospheric CO_2as a feedstock for synthetic fuels; however, the regulation also allows for point source CO_2capture from fossil fuel-based flue gas, which is sourced at much lower cost (due to the higher CO_2 concentration). In the marketplace, regulations like RED2 place an overall incentive on point-source CO_2 capture rather than ambient DAC CO_2 and

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58 LARSEN ET AL., *supra* note 37, at 6.

59 *Id.*

60 Such as in areas constrained by land-use availability, or for niche uses, such as combined DAC and fuel synthesis/production co-located with transportation service stations.

61 Sarah Golden, *What Engie's Tax Equity Deal Tells Us About Financing Renewables*, GREENBIZ, May 1, 2020, https://www.greenbiz.com/article/what-engies-tax-equity-deal-tells-us-about-financing-renewables.

62 *Scale-Up of Solar and Wind Puts Existing Coal, Gas at Risk*, BLOOMBERGNEF, Apr. 28, 2020, https://about.bnef.com/blog/scale-up-of-solar-and-wind-puts-existing-coal-gas-at-risk/.

63 Golden, *supra* note 61.

64 *Id.*

therefore fail to trigger much-needed CDR scale-up, leading to a two speed decarbonization that disincentivizes DAC technological development and mass deployment.[65]

A two-speed decarbonization may also arise from fiscal stimulus competition of CDR/DAC technologies with existing, at-scale renewable solar, wind, and biofuel projects. In Goldman Sachs' "Carbonomics" equity research report, the authors note that this inherent conflict "may ultimately delay the technological breakthroughs necessary to flatten the de-carbonization cost curve and achieve cost-efficient net zero carbon."[66] In the absence of robust regulation and long-term, government-backed purchase programs, high deployment costs will almost certainly delay the development of carbon markets, and in turn will "delay R&D and pilot projects that could lead to technological breakthroughs for the high end of the de-carboni[z]ation cost curve."[67] While two-speed decarbonization is nevertheless decarbonization, it may ultimately inhibit the acceleration toward an eventual net-negative scenario.

The Internal Revenue Service (IRS) published a notice of proposed rulemaking (NPRM) on June 2, 2020, calling for public comments in response to proposed regulations under I.R.C. §45Q.[68] More than fifty-five public comments were submitted in response, covering a range of issues and concerns. The most pressing of these comments that concern DAC and potential decarbonization of transportation networks address the life-cycle assessment (LCA) methodology, seek to define qualified utilization purposes, seek to modify "fuel" requirements, and seek to make credit determination more streamlined and transparent.

LCA is a well-established method that takes the entire life cycle of an extracted compound into account, from the extraction of raw materials to the final use or disposal (thus the terms "cradle-to-gate" and "cradle-to-grave"). LCA International Organization for Standardization (ISO)[69] standards have recently been adapted for CO_2utilization in LCA guidelines developed by the Global CO_2 Initiative and the U.S. DOE's National Energy Technology Laboratory. In a recent report addressing the carbon footprint of CO_2 as a feedstock, the authors note that "carbon footprints . . . range from positive—implying that CO_2 capture is harmful to the climate—to negative which suggests benefits" and therefore call for a more consistent determination of the carbon feedstock CO_2, as these differences "can substantially impact the selection of environmentally beneficial

65 *See* LARSEN ET AL., *supra* note 37, at 41.

66 DELLA VIGNA ET AL., *supra* note 34, at 3-4 (demonstrating via cost curve that ~50% of global CO_2 emissions need a carbon price in excess of $100/ton to be decarbonized with current technologies).

67 *Id.* (noting further that only 16% of total global emissions are currently taxed and the average global carbon price is $3/ton—"a long way from the price required to foster broad clean tech innovation").

68 Credit for Carbon Oxide Sequestration; Correction, 85 Fed. Reg. 39113 (June 30, 2020) (to be codified at 26 C.F.R. pt. 1), https://www.govinfo.gov/content/pkg/FR-2020-06-30/pdf/2020-13705.pdf20-13705.pdf.

69 ISO creates global commercial product standards, identified by their ISO number. *Standards*, INT'L STANDARDIZATION ORG., https://www.iso.org/standards.html (last visited Dec. 15, 2021).

CO_2 sources in industry and policy-making, and even the perception of CCU in general."[70]

The Rhodium Group's report also notes that accounting for appropriate LCA methodologies is important for identifying the total effect of carbon footprint reduction for purposes of regulatory planning.[71] The report also splits the LCA for a DAC fuel generation output scenario (as opposed to a sequestration output scenario), and illustrates that $CO_2$from fossil fuel-based point sources does not have the same life-cycle CO_2reduction effect (unless the CO_2 in the flue gas stream comes from biomass), "as fossil CO_2 in essence is reused once more in the synthetic fuel, before it is released back into the atmosphere."[72]

One of the most significant public comment letters that is DAC-industry specific was submitted jointly by the executives of Carbon Engineering, CarbonPoint Solutions, Core Energy, Cornerpost CO_2, and Perdure Petroleum, in which the authors acknowledge that "the statute in Section 45Q establishes the beginning boundary" of LCA for purposes of the 45Q credit and that 45Q utilization LCA "only starts after the qualified carbon oxide is captured."[73] The letter clarifies that one of the purposes of the LCA analysis "is to ensure that a utilization process does not emit more carbon oxide than was captured . . . [and] to preclude a claim of 45Q credits when more carbon oxide is emitted through the utilization process than the amount of qualified carbon oxide captured in the first place."[74] The letter goes on to state that the authors support developing clear and simplified criteria "for utilization process approvals, and for approval in the final regulations of fuels as a commercial market and product for a utilization process."[75]

Other pivotal determinations to proposed 45Q modifications that are essential to the longevity of the industry concern utilization, commercial product/market determinations, and §45Q(f)(5)(A)(iii) determinations. Section 45Q(f)(5)(A) defines "utilization of qualified carbon oxide" as one of three different processes: (1) a photosynthesis/chemosynthesis process, (2) a chemical conversion process, and (3) a process where the qualified carbon oxide is used for any other purpose for which a commercial market exists (other than CO_2-EOR/EGR)[76] to be determined by the secretary.[77] The third process (the "commercial product provision") arguably must take into consideration that "commercial market" may refer both to a market for a product (e.g., DAC-based CO_2 synthesized fuels) or a service (e.g., DAC and CO_2geologic sequestration in a carbon budget trading market).

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70 Leonard Jan Müller et al., *The Carbon Footprint of the Carbon Feedstock CO2*, 9 ENERGY & ENV'T SCI. 2979, 2980 (2020).

71 *See* LARSEN ET AL., *supra* note 37, at 63.

72 Beuttler et al., *supra* note 6, at 6.

73 Letter from Presidents/Chief Executive Officers of Carbon Engineering et al. cmt. 39 (Aug. 1, 2020), Notice of Proposed Rulemaking on Section 45Q Credit for Carbon Oxide Sequestration (Docket IRS-2020-0013) (in response to IRS NPRM for the Credit for Carbon Oxide Sequestration, 85 Fed. Reg. 34050 (June 2, 2020)) (on file with Baker Botts L.L.P. at https://www.bakerbotts.com/thought-leadership/publications/2020/august/finding-tool-for-public-comment-letters-carbon-capture-tax-credit-proposed-regulations-section-45q).

74 *Id.*

75 *Id.*

76 Enhanced gas recovery.

77 26 U.S.C. §45Q (as of Dec. 7, 2020).

The LCA required for each utilization process will differ, but both should be provided for in legislation to qualify for a 45Q credit. The authors of the letter myopically support final regulations, stating that carbon oxide's use as a service should not qualify for a 45Q credit and that "a product must be the end result of any approved utilization process that uses up or converts the qualified carbon oxide."[78] This overlooks the dual potential of DAC to provide for both CNHC fuels as a product toward a carbon-neutral fuel economy and sequestration as a service (in a government-mandated carbon management regime).

The letter's authors, focusing on product-based utilization, rightfully determine that the I.R.C. must better explain the criteria taxpayers must satisfy to obtain a §45Q(f)(5)(A)(iii) determination. A determination must be sufficiently broad to include "both (a) processes where the qualified carbon oxide is placed into the product, and (b) processes where the qualified carbon oxide loses its chemical identity and is used up in some way in the process of making the product."[79] The intent of this request, pivotal to the long-term success of DAC CO_2 as a product, is to establish that, by regulation, there should be an express determination of "fuels" as being an example of a qualified commercial market.

Fuels have a commercial market in transportation and energy production and can be produced through CO_2 synthesis through a process that uses captured carbon oxide, including qualified carbon oxide. Therefore, it is essential that Congress' intent in leaving "commercial market" ambiguous does not prevent otherwise qualified companies appropriately seeking to claim 45Q credits from claiming credits, even when certain end products may not yet compete in the open market (e.g., due to lack of infrastructure, fuel utilization methods in transportation, undeveloped markets, or consumer bases, etc.), and may not be "commercially" profitable at the time of the request.

B. Financing

Funding large-scale DAC projects has thus far been difficult, as the extent of research and design has been limited to presently only a few pilot demonstration projects worldwide. Opening the doors to broader capital inflows would allow for more rapid deployment of technological and economic feasibility studies and scale-up of proven designs to sooner address climate change goals. Avenues of financing vary widely, from a proposal by the National Petroleum Council (NPC) calling on Congress to expand access to I.R.C. §48 tax credits[80] to all CCUS projects,[81] to greater third-party tax-equity financing incentives through investment tax credits (ITCs), to modifying the existing

78 Letter from Presidents/Chief Executive Officers of Carbon Engineering et al., *supra* note 73.

79 *Id*.

80 *See* H.R. 5165, 116th Cong. (2019) (providing tax credits to advanced coal projects and related emissions sequestration).

81 Letter from Greg Armstrong, Chair, NPC, to Dan Brouillette, Secretary of Energy, DOE (Dec. 12, 2019) (on file with NPC) (effectively expanding current policies to a level of ~$90/ton of CO_2 in the "expansion phase" to provide incentive for further economic investment and then to $110/ton in the "at-scale" phase, while simultaneously increasing the level of R&D funding for CCUS technologies to $15 billion over the next 10 years, "with a significant amount directed to less mature and emerging technologies that offer the greatest potential for a step change in performance and cost reduction").

45Q tax credit and turning it permanently into a "direct pay" incentive to monetize the tax credit without tax equity investors,[82] to DOE's ARPA-E and proposed ARPA-C programs to rapidly grow the industry.

Presently, the most widely available funding mechanism for DAC technologies that need CAPEX inflow and have tax credits to trade for up-front cash would be to conduct tax-equity financing through a partnership flip. Partnership flips are a common tax-equity financing structure in renewable energy markets,[83] allowing technologies to mature in production capability until which point companies can swap with the investor(s) to reclaim the credits once they begin to become financially self-sustaining for OPEX needs. The tax equity investor would in turn be able to benefit by obtaining production or ITCs, as well as depreciation credit, interest deductions, and operating income deductions.[84]

During the initial phase of the project, the tax equity investor will receive most of the tax benefits, as well as the income or loss (often the share is 99%), while the developer retains a small allocation of tax benefits and income (profit or loss).[85] Once the tax equity investor has achieved a targeted internal rate of return, the partners' interests in the project company will flip, with the developer now receiving most of the tax benefits and income (profit or loss) associated with the project (typically 95%, leaving the tax equity investor with 5%).[86] In certain circumstances, a profitable developer may also seek to buy out the tax equity investor, such that the tax equity investor no longer owns any part of the project.

Tax equity generally provides a portion of a project's capital needs—somewhere from 30% to 60%, depending on the specifics of the project.[87] However, DAC tax-equity financing is likely to track more closely with other renewable energy projects, where tax equity is generally more expensive than other sources of debt financing. In the absence of appropriately sized direct governmental grants or awards,[88] the IRS is effectively mandating the use of this tax financing structure for DAC facilities, which cannot otherwise rely on existing economics and regulations to achieve full-scale deployment.

One major concern for future renewables, NETs, and DAC technology funding regarding third-party tax-equity financing arose when the Tax Cut and Jobs Act was signed into law in 2017, which lowered the corporate tax rate from 35% to 21%. These

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82 *See* Deepika Nagabhushan, *The Status of Carbon Capture Projects in the U.S. (And What They Need to Break Ground)*, CLEAN AIR TASK FORCE, Apr. 22, 2020, https://www.catf.us/2020/04/the-status-of-carbon-capture-projects-in-the-u-s-and-what-they-need-to-break-ground/; Lee Beck & Troy Shaheen, *U.S. lawmakers introduce a suite of bills to support carbon capture*, CLEAN AIR TASK FORCE, Mar. 25, 2021, https://www.catf.us/2021/03/u-s-senators-introduce-a-crucial-bill-to-support-carbon-capture/.

83 Mark P. Keightley et al., Cong. Rsch. Serv., Tax Equity Financing: An Introduction and Policy Considerations 9 (2019), https://www.everycrsreport.com/files/20190417_R45693_01142998298c9e6feec6aba5c48b6ff238a58886.pdf.

84 *Id.*

85 *Id.*

86 *Id.*

87 *Id.*

88 *See* H.R. 3607, 116th Cong. §969G(i)(1) (pending re-introduction in the 117th Cong., 2019) (establishing air capture technology prize and referencing the DOE/ARPA OPEN grant program).

lower corporate tax rates "mean[t] a reduced appetite for tax credits generally, which create[d] a serious challenge for renewable energy project financing," given that tax equity makes such a large share of the total financing for most of these projects.[89] In the wake of the passage of the Tax Cut and Jobs Act, Bloomberg reported that $3 billion worth of tax equity deals were on hold.[90] On March 31, 2021 President Biden formally proposed a $2 trillion infrastructure spending package, which among other proposals included raising the corporate tax rate to 28% in an effort to re-ignite these deals.[91]

Calling for an alternative format to monetize the carbon capture tax credit without tax equity investors, the Clean Air Task Force (CATF) and the latest proposed Congressional legislation have called for modifications to the existing 45Q tax credit to turn it permanently into a "direct pay" incentive.[92] A direct pay incentive, CATF argued, would act as a tax reimbursement, helping to ensure the taxpayer could monetize the full value of the credit and access general investing and lending markets, instead of relying on the specialized and shrunken tax equity investment market.[93]

In line with providing better access to lending markets for these NET companies, another possible financing mechanism could be to obtain debt financing through direct loans and guaranties of up to $1 billion for tenors as long as 25 years through the U.S. International Development Finance Corporation (DFC). Targeting growth, innovation, and inclusion (i.e., environmental justice) initiatives, the DFC's investment goals would sync well with DAC deployment goals. As the major DAC companies presently in the market are not American, obtaining support from the DFC would be best suited for DAC companies that meet the DFC's preferences, such as having U.S. persons as sponsors, or being located in countries that are compliant with international climate or trade obligations that align with the DFC's mission.

The latest legislation pertaining to DAC financial incentivization in the newly formed 117th Congress includes H.R.1062 (Accelerating Carbon Capture and Extending Secure Storage Through 45Q (ACCESS 45Q) Act), H.R. 1761, S. 985[94], and the aforementioned S. 986.[95] Collectively, these bills—all introduced in the first few months of the latest Congress—constitute a launching point for a re-invigoration of the section 45Q and 48C ITCs. H.R. 1062 calls for an extension of the tax credit for carbon

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89 CohnReznick LLC/CohnReznick Capital Market Securities LLC, 2019 Trends in Renewable Energy Financing (2019), https://www.cohnreznick.com/media/resources/2019_trends_in_utility_renewable_energy_financing.pdfnds_in_utility_renewable_energy_financing.pdf.

90 Brian Eckhouse & Chris Martin, *How Trump's Tax Plan Made It Harder to Finance Renewables*, Bloomberg, Jan. 12, 2018, https://www.bloomberg.com/news/articles/2018-01-12/seeking-renewables-financing-trump-s-tax-plan-made-it-harder.

91 As of Oct. 1, 2021, the proposed bipartisan infrastructure bill remains in limbo.

92 Nagabhushan, *supra* note 82.

93 *Id*.

94 H.R. 1062, 117th Cong. (2021); H.R. 1761, 117th Cong. (2021); S. 985, 117th Cong. (2021) (calling for an amendment to the Internal Revenue Code of 1986 to provide direct payments of the renewable electricity production credit, the energy credit, and the carbon oxide sequestration credit.

95 S. 986, 117th Cong. (2021) (calling for an amendment to the Internal Revenue Code of 1986 to provide for a 5-year extension of the carbon oxide sequestration credit (and for other purposes).

oxide sequestration through 2035 and allows taxpayers an election to receive payments in lieu of the credit.[96] This direct-pay incentive has been highly sought-after by developers, seeking to finance large-scale projects without needing to enter into equity swaps to monetize their credits.

H.R. 1761 calls for an amendment to title XVII of the Energy Policy Act of 2005 relating to the eligibility for loan guarantees for carbon capture, utilization, and storage projects (and for other purposes).[97] Sister bills S. 985, and S. 986 likewise focus on the Internal Revenue Code's tax credits and mirror in large part their House counterparts above. S. 985 calls for an amendment to the Internal Revenue Code of 1986 to provide direct payments of the renewable electricity production credit, the energy credit, and the carbon oxide sequestration credit.[98] S. 986 calls for, among other things, a five-year extension of the carbon oxide sequestration credit.[99] These bills largely mirror their counterparts that expired in the 116th Congress, yet there are a few notable bills that have yet to be re-introduced into the 117th as of this writing.

From the 116th Congress, H.R. 3607 sought to amend the Energy Policy Act of 2005. It would have directed the DOE to carry out atmospheric, large-scale CCUS R&D programs, to submit a report to Congress on CCUS activities, and to establish air capture technology prizes provided under a competition as well as grants for centers that test DAC and storage technologies.[100] Similarly, S. 1201 sought to amend the Energy Policy Act of 2005 to direct the DOE to carry out an expanded program of research, development, and demonstration for CCUS and to authorize DOE programs regarding large-scale removal of atmospheric CO_2 (including DAC technologies).[101] Lastly, H.R. 5165 sought to renew and expand the section 48C ITC for investments in building new manufacturing facilities or expanding existing facilities to produce clean energy technologies.[102] The final iteration of H.R. 5165 called for a $2.5 billion annual credit limitation from 2020-2024. The 48C credit supports manufacturing facilities of wind and solar power technologies, electric vehicles, carbon capture, smart grid technologies, and renewable fuels, among others.

The planned growth of these industries in the coming years and decades will require a substantially greater dollar value investment and increased year-on-year funding to meet our targeted climate intervention objectives, particularly as new technologies emerge, and existing ones mature.[103] A re-introduction of the aforementioned bills—updated appropriately—into the 117th Congress is an essential next step towards broad-

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96 H.R. 1062, 117th Cong. (2021) (referred to House Committee on Ways and Means).

97 H.R. 1761, 117th Cong. (2021) (referred to Committee on Energy and Commerce, and Committee on Science, Space, and Technology).

98 S. 985, 117th Cong. (2021) (referred to Committee on Finance).

99 S. 986, 117th Cong. (2021) (referred to Committee on Finance).

100 H.R. 3607, 116th Cong. (2019) (referred to Committee on Science, Space, and Technology).

101 S. 1201, 116th Cong. (2019) (referred to Committee on Energy and Natural Resources).

102 H.R. 5165, 116th Cong. (2019) (referred to Committee on Ways and Means).

103 *See* Jackie Toth, *Manufacturing the Future of Clean Energy With 4*8C, THIRD WAY, Dec. 18, 2020, https://www.thirdway.org/memo/manufacturing-the-future-of-clean-energy-with-48c (calling on Congress to make at least $3 billion available in new 48C credits in each of the next five tax years to increase the number of manufacturers throughout the country that can benefit from the program).

ening the financial pathways for DAC technologies and feedstock output utilization. Reintroduction would also benefit from a re-consideration of the primary constituent base, as several of these bills reflected a legislative intent to benefit of the fossil fuel industry, not the nascent decarbonization industry. For example. H.R. 3607's "authorization of appropriations" under § 961, authorized "to be appropriated to the Secretary for activities under this section regarding carbon utilization (1) $25,000,000 for fiscal year 2020 . . . [up to] (5) $30,387,656 for fiscal year 2024," representing an appropriation in 2020 reflecting 0.0005% of the U.S. annual budget (which in 2020 was $4.79 trillion) for a climate crisis that portends economic loss far beyond this meager appropriated R&D amount.

However, the proposed acts both paved the way for greater development of CDR and DAC-fuel synthesis programs. Notably, H.R. 3607 called for

> a program of research, development, and demonstration for carbon utilization . . . [that] shall identify and evaluate novel uses for carbon, including the conversion of carbon oxides, in a manner that, on a full life-cycle basis, achieves a permanent reduction in, or avoidance of a net increase in carbon dioxide in the atmosphere, for use in commercial and industrial products, such as . . . fuels.[104]

Additionally, H.R. 3607, in section 11 (Carbon Removal), sought to further amend Title IX of the Energy Policy Act of 2005 by adding language calling for the establishment of a research, development, and demonstration program to remove $CO_2$from the atmosphere on a large scale that shall identify and develop carbon removal technologies and strategies that consider, inter alia, commercial viability and economic co-benefits.[105]

The bill took the bold step of seeking to establish an "air capture technology prize" to support carbon removal pilot and demonstration projects with their own declining appropriations schedule, beginning with $75 million for fiscal year 2020 ($15 million of which would apply to the air capture technology prize). In S. 1201 section 969 (Carbon Utilization Program), the proposed act called for the secretary to (1) "establish a program of research, development, and demonstration for carbon utilization," and to (2) "identify and assess novel uses for carbon, including the conversion of carbon oxides for commercial and industrial products, such as . . . (D) fuels."[106] While similar to H.R. 3607 §963A, the overall focus of S. 1201 was to enhance fossil fuel carbon technology, not to fund decarbonization technologies directly.

Ideally, Congress would revive, combine, and accelerate components of currently proposed acts in the 117th with expired legislation remodeled from the 116th and with existing laws. New legislation must be designed exclusively to promote decarbonization efforts, taking into consideration the pressing need for higher appropriation amounts, larger prize incentives, more robust R&D support, greater assurances of feedstock and/or product output demand, and reduced legal liability and/or government indemnifications for climate effects of large-scale CO_2removal.

Another high-impact area is the DOE's ARPA-E program, and the proposed ARPA-C program. The ARPA-E, modelled on the renowned Defense Advanced Research Projects Agency (DARPA), was created in 2007 under the Bush Administration and

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104 H.R. 3607, 116th Cong. §963A(a)(2)(D) (2019).
105 42 U.S.C. §§ 16291–16297.
106 S. 1201, 116th Cong. § 969(a) (2019).

funded in 2009 under the Obama Administration, and focuses on "transformational low-carbon energy technologies."[107] At the outset of 2021, ARPA-E made its latest $100 million funding opportunity announcement, targeted at specific technical areas both inside and outside of the current agency portfolio. President Biden's proposed ARPA-C, expected to take on a larger suite of climate-related tools,[108] will require an act of Congress to create the new agency, and appears to have significant research overlap with ARPA-E.

Given this lack of clear delineation, the Biden Administration should encourage DOE to more narrowly tailor each agency's scope to better increase the odds of passing ARPA-C through Congress. The failure to pass ARPA-C would likely result in an expanded ARPA-E mandate, which could "maroon those clean technologies not directly related to energy, perhaps including carbon sequestration."[109] Ideally, Congress will pass President Biden's proposed $2 trillion climate investment plan, narrowly tailor ARPA-E and -C to better distinguish the two and guarantee broader funding pathways overall, and ensure a stronger mandate within each for funding DAC facilities and renewable fuel programs.

C. LEGAL PERMITTING

In the world of environmental law, legal permitting is the paramount hurdle for any proposed course of action that could influence the natural world. In terms of expediting NETs into operation, "regulatory agencies and policymakers, especially EPA and state agencies with delegated authority to issue environmental permits, can explore whether to reduce permitting barriers or environmental review disincentives for laboratory research or limited field testing of NETs."[110] In his article "Legal Pathways to Negative Emissions Technologies and Direct Air Capture of Greenhouse Gases," Professor Tracey Hester outlines five legal-oriented angles to expedite NET deployment:

1) EPA could extend RCRA and CERCLA exemptions for captured industrial CO_2 emissions to also include CO_2 captured from ambient air.
2) EPA and state agencies could adopt standardized approval and review procedures, as well as general permits, for NETs that would have a small or predictable and controlled impact on the environment.
3) An Executive Order could direct expedited federal review of NET projects and activities.
4) Federal legislation could provide waivers or reduced environmental review for NET projects, similar to federal waivers from state programs based on CERCLA.

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107 James Temple, *Here's Biden's Plan to Reboot Climate Innovation*, MIT TECH. REV., Feb. 11, 2021, https://www.technologyreview.com/2021/02/11/1018134/heres-bidens-plan-to-reboot-climate-innovation/.

108 *Id.*

109 Donna Barnett et al., *What Will Clean Energy Look Like in the Biden Administration?*, PERKINS COIE, Dec. 16, 2020, https://www.jdsupra.com/legalnews/what-will-clean-energy-look-like-in-the-34852/.

110 Hester, *supra* note 5, at 10429.

5) Congress and state legislatures could exercise condemnation powers and extend those powers, under appropriate oversight and protection limitations, to private parties engage in industrial-scale NET activities.[111]

Concerning DAC and fuel production output, among these legal permitting options, list item (1), an EPA extension of exemptions to include CO_2 captured from the ambient atmosphere by DAC operations, would provide greater investor and operator clarity in obtaining financing while also giving assurances of federal preemption and immunity for actions in this respect. Additionally, the potential of list item (3)—an Executive Order directing expedited federal holistic feasibility assessments and reviews of NET projects and activities[112] seems highly likely given the representations made by the current Biden Administration and would be well received by the DAC industry as a means of accelerating utility-scale market operations entry.

D. Carbon Pricing

In his article, Professor Hester notes that "the most powerful concept that could accelerate private-sector NET research and deployment would be the imposition of a carbon tax or other pricing mechanism that would expressly allow NET operators to obtain a financial return on the CO_2 they capture from the atmosphere."[113] If the federal government should fail to adequately address the needs of the DAC industry in the abovementioned categories, states themselves may seek to follow the leads of California or New York in establishing either a comprehensive carbon credit trading market or simply a specific carbon emission tax. This laissez-faire approach would function at the whim of market forces, allocating resources where investors identify the most gains.

Problems with this methodology arise quickly, however, as it reduces the largest possible incentives for investors to migrate their assets toward such nascent technologies in the absence of mature technologies and adequate demonstrations of such, which themselves require enormous investment. Further:

> the use of NET projects to generate tradable carbon credits . . . would likely prove controversial in light of concerns over verifying the validity of the traded credits and unexpected side effects created by prior CO_2 trading systems . . . [or by] a large number of credits generated by commercial NET ventures [that] might overwhelm other policy, ethical, and social goals.[114]

California's LCFS and New York's Climate Leadership and Community Protection Act (Climate Act)[115] both set excellent examples of state leadership in areas of federal inaction, and each provides model frameworks and lessons for both the federal govern-

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111 *Id.*

112 *See* Terese Thoni, et al., *Deployment of Negative Emissions Technologies at the National Level: A Need for Holistic Feasibility Assessments*, 2 Frontiers in Climate (Nov. 20, 2020) (examining the potential contribution of NETs to meet global emission goals through 17 Long-Term Low Greenhouse Gas Emission Development Strategies in the context of available NETs feasibility assessments).

113 Hester, *supra* note 5 at 10430.

114 *Id.* at 10430–31.

115 Energy and Environmental Economics, Inc., Pathways to Deep Decarbonization in New York State (2020).

ment and other states to follow. These states show that regulation and legislation are best used in concert, providing the market with both carrots and sticks.

New York's Climate Act has identified a "high technology availability" pathway relying on a diverse portfolio of GHG mitigation options, including "high levels of efficiency and end-use electrification, as well as contributions from measures not yet widely commercialized, such as advanced biofuels, carbon capture and storage (CCS), and bioenergy with carbon capture and storage (BECCS)."[116] The state's report concludes with six proposed areas of future research, the final area being "[to] improve assessment of carbon capture and storage potential within the state, especially focusing on geographic opportunities for carbon storage and utilization."[117] New York would do well to construe "carbon capture," "carbon storage," and "utilization" in their broadest senses, so as to increase their likelihood of meeting their high technology pathway goals by 2030 and beyond, while simultaneously supporting a market for investment that could spur greater technological growth.

The Biden Administration, recognizing the power of carbon markets to better incentivize NETs, should capitalize on its majority in both the House and the Senate and follow these states' lead by prioritizing the alignment of federal climate goals and federal capital allocation.[118] By establishing a federal carbon cap-and-trade system, akin to that passed in the House as the American Clean Energy and Security Act of 2009, such a program could firmly incentivize rapid carbon removal through carbon pricing and pure market forces. This program could also include elements from the proposed 2009 Carbon Limits and Energy for America's Renewal (CLEAR) Act, which would have capped CO_2 emissions and allowed for limited emissions trading as well as rebating the revenue back to the public. By rebating the revenue from a federal cap-and-trade program back into federal climate action-earmarked funds, this in turn could supplement the available financing resources discussed above.

Such a federal mandate was recently tested in Canada, where conservative oil-producing provinces challenged the constitutionality of the federal government's imposition of carbon taxes. Canada's Supreme Court, in a 6-3 ruling, held that the carbon taxes were constitutional, reasoning that reducing greenhouse gas emissions to mitigate climate change was a matter of national concern and thus protected under the constitution.[119] It is time for the United States to follow suit, using the example Canada has set for the world.

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116 *Id.* at 11.

117 *Id.* at 46.

118 *See* Lee Beck, *Seven Carbon Capture Policy Priorities for the Biden-Harris Administration*, CLEAN AIR TASK FORCE (Dec. 4, 2020), https://www.catf.us/2020/12/seven-carbon-capture-policy-priorities-biden-harris-administration (setting out policy proposals to be taken up as part of an "urgency-driven" approach toward achieving climate goals).

119 Ian Austen, Canada Supreme Court Rules Federal Carbon Tax Is Constitutional, N.Y. TIMES, Mar. 26, 2021, at A11.

III. Federal Incentives and Regulation for DAC Feedstock Output and Adaption

At present, DAC technologies have the capacity to capture, isolate, and compress $CO_2$for either geologic sequestration, non-geologic storage, or pipeline transportation for various downstream uses. Research going back more than a decade has demonstrated the capability of $CO_2$to act as a feedstock for synthetic fuels, and promising new R&D from DAC firms demonstrates the capacity of DAC facilities to provide adequate CO_2 feedstock for CNHC production for broad fuel use, and potentially to combine the capture and synthesis process in situ. This process, if rapidly deployable and scalable, would very quickly enable a drive toward a carbon-neutral transportation cycle, eliminating the need for present production volume of fossil/organic hydrocarbons. Until such point that the market for hydrocarbon fuels is entirely eclipsed by alternative energy sources and technologies, CNHCs provide the best climate-friendly solution.

More than ever in human history, there is a pressing need to improve domestic federal incentives for production of CNHCs. Noting that the "continuous rise of CO_2 levels in the atmosphere represent[s] one of the most critical environmental issues of the twenty-first century," the authors of a 2014 report on advances in catalytic hydrogenation of CO_2call for "urgent measures for a major cut of CO_2 emissions by an extensive recycle to valuable chemicals and fuels, like methanol (MOH) and dimethylether (DME)."[120] To incentivize such intensive recycling, a strong approach would target a modification of the existing RFS and support development of either statewide or federal carbon-capture programs to allow EPA to approve broader fuel pathways beyond conventional biofuels.

To do so would require amending the Energy Independence and Security Act of 2007 (EISA),[121] specifically the RFS and the CCUS provisions.[122] Additionally, there are several broader-scope measures that the federal government can employ to incentivize demand growth of CNHCs. The federal government could tighten emissions standards while excepting CNHC-powered vehicles, establish a prioritized fuel taxation regime or eliminate CNHC fuel taxes altogether for retail and wholesale consumption, change federal procurement standards, and incorporate nonautomotive fuels into the RFS regime.

The most recent calculated economics for production of CNHCs, published in 2008, assumed air capture costs of \$100–\$200/ton CO_2, and determined production costs of CNHCs ranging from \$23.50–\$30 per gigajoule (/GJ).[123] A 2018 update compared DAC costs with prior estimates and determined an updated CO_2 capture cost range of \$94–\$232/ton CO_2 and \$107–\$249/ton CO_2, based on separately modeled variants.[124] Based on this data, which reveal the initial 2008 cost estimate to have been quite pre-

120 Francesco Arena et al., *Latest Advances in the Catalytic Hydrogenation of Carbon Dioxide to Methanol/Dimethylether*, *in* Transformation and Utilization of Carbon Dioxide 103 (Bhalchandra Bhanage & Masahiko Ardi eds., Springer 2014).

121 42 U.S.C. §§–17021–17054 (Subchapter II: Energy Security Through Increased Production of Biofuels), §§17251-17272 (Subchapter VI: Carbon Capture and Sequestration).

122 *Id.* §§ 17021–17022; *id.* §§17251–17272.

123 Zeman & Keith, *supra* note 20, at 3910.

124 Keith et al., *supra* note 14, at 1590.

scient, a price comparison of CNHC fuel at ~$30/GJ and chemically comparable premium unleaded gasoline (with an average cost in the United States of $3.824/gallon as of October 4, 2021)[125] at a cost of $28.970/GJ ((1,000 megajoules (MJ) per gallon of premium gasoline/132 MJ) x $3.824/gallon of premium gasoline) reveals that with current federal incentives automotive transportation fossil fuel costs are only ~3.6% lower than projected CNHC costs (not accounting for a minor variation due to available 45Q offset credits). Rising fossil fuel prices in the latter half of the global COVID recovery have helped bridge the gap between fossil-fuel and CNHC prices, showing that CNHC fuels can be market competitive. Yet the lack of infrastructure development to capitalize on this technology demonstrates a clear need for government fiscal intervention to generate widespread adaptation if this technology is to survive.

There are numerous policy pathways that can increase DAC CO_2output demand, and a comprehensive strategy needs to be put in place to stimulate demand. Many pathways can be based on existing federal policy frameworks, whereas others will require a build-from-the-ground-up approach. Many of the proposed policy pathways function independently and, if fully implemented, could put DAC deployment and resultant output on track for long-term needs. Other policies may be interdependent and may need ancillary support to achieve the maximum effect. Therefore, it is essential that implementation of any of these policies be comprehensive in nature to account for potentially wide-ranging effects.

A. AMENDING THE EISA

The EISA sets out the Corporate Average Fuel Economy (CAFE) standards, the RFS, and a variety of appliance and lighting efficiency standards.[126] The RFS is of the greatest potential utility to DAC and potential CNHC production. The capacity of the industry to use captured CO_2 to directly synthesize carbon-neutral, liquid fuels to replace gasoline, diesel, aviation, and maritime fuels is dependent on necessary modifications of the EISA to expand fuel pathways.

To expand fuel eligibility, in addition to the 45Q modifications proposed above,[127] Congress must expand eligibility by amending the RFS and the CCUS provisions. At present, the RFS addresses only biomass-based diesel and biodiesel. In the absence of DAC-based renewable fuels, there is no policy guidance for industry operators, nor can operators take advantage of statutory grants for production of advanced fuels (as is the case with advanced biofuels).

Therefore, the definition of "renewable fuel" (the EISA currently defines the term to mean "fuel that is produced from renewable biomass and that is used to replace or reduce the quantity of fossil fuel present in a transportation fuel"[128]) needs to be modified to "fuel that is produced from renewable biomass *or produced from point-source or ambient atmospheric carbon capture and chemical synthesis* and that is used to replace or reduce the quantity of fossil fuel present in a transportation fuel." Further, 42 U.S.C. § 17022,

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125 American Automobile Association. *2021 AAA Gas Prices* (accessed Oct. 4, 2021), https://gasprices.aaa.com/ (as of Oct. 4, 2021).

126 *See* 42 U.S.C. §§ 17001–17386.

127 *See supra* Part I.

128 Energy Independence and Security Act of 2007, Pub. L. No. 110-140, § 201(J), 121 Stat. 1521, 1521 (2007).

which establishes grant programs to produce advanced biofuels, must also be modified in parallel with the proposed text above to expand CNHC production potential.[129]

Outside of the RFS, the EISA also sets forth a requirement for the secretary of energy to carry out a program "to demonstrate technologies for the large-scale capture of carbon dioxide from *industrial sources*."[130] In making awards under this program, the secretary is required to select, as appropriate, "a diversity of capture technologies to address the need to capture carbon dioxide from a range of *industrial sources*."[131] The scope of these requirements must too be modified to ". . . industrial sources *and ambient direct air capture*." The scope of the awards under this program[132] must likewise be modified as above to "Awards under this section [§ 17251(a)(2)] shall be only for the portion of the project that—(A) carries out the large-scale capture (including purification and compression) of carbon dioxide from industrial sources *and from ambient direct air capture*." Additionally, § 17251(a)(2)(B) must be modified to "Awards under this section shall be only for the portion of the project that—(B) provides for the transportation and injection of carbon dioxide, *or for the synthesis of sequestered carbon dioxide into alternative fuel sources*."

B. Modifying Emissions and Performance Standards for Moving Sources

Another policy pathway that the federal government could undertake would be to modify existing moving source emissions standards under Title II of the CAA.[133] Presently, fuel standards under Title II, § 7545 must meet copious requirements concerning the volatility, oxygen content, sulfur concentrations, viscosity, corrosivity, and other qualities and components of fuels commercially marketed to be combusted for energy, as well as for special engine uses.[134] While synthetic fuels can indeed be made in a carbon-neutral manner, they would likely still require additives for engine performance under various conditions. One potential pathway toward expanding CNHC adaptation would be to establish explicit exceptions/favored treatment for DAC-based CNHC fuel performance standards, or simply to exempt such fuels altogether from standards that are imposed on existing transportation fuels.

Additionally, §7546(b) calls for a loan guarantee program, §7546(c) authorizes relevant appropriations, and §7546(d) establishes renewable fuel production R&D grants, all of which focus on biomass-based ethanol feedstock.[135] To expedite deployment of broader fuel pathways, Congress should consider expanding the feedstocks eligible under this section.

DAC-based CNHCs can be made into a range of synthetic materials and fuels beyond conventional automobile fuel. "This has the advantage that 'hard-to-electrify' sectors such as aviation or long-distance heavy transportation (e.g., maritime shipping) can be 'indirectly electrified' via production and utilization of synthetic CNHC fuels such as

129 *See* 42 U.S.C. § 17022 (establishing grant programs for advanced biofuels production).
130 42 U.S.C. § 17251(a)(1) (emphasis added).
131 *Id.*
132 *Id.* § 17251(a)(2).
133 42 U.S.C. §§ 7521–7590.
134 *See* 42 U.S.C. § 7545.
135 *See id.* §§ 7546(b)–(d).

methane or Fischer-Tropsch fuels as well as a range of other products (e.g., polymers)," all of which have historically relied on fossil-based feedstocks.[136] Incorporating changes made to the CAA in these other transportation sectors may allow for broader and deeper demand, which could yield greater production efficiencies, lower costs, and technological advances.

In the aviation context, the International Civil Aviation Organization (ICAO) has a program to develop technologies in the area of sustainable aviation fuels, which the ICAO identifies as one element of the ICAO basket of measures to "reduce aviation emissions, which also includes technology and standards, operational improvements, and the Carbon Offsetting and Reduction Scheme for International Aviation."[137] In the marine fuel context, the International Maritime Organization (IMO) has imposed regulations to reduce sulfur oxide (SO_x) emissions from heavy fuel "bunker" oil in ship propulsion.[138] This regulation first came into force in 2005 under the International Convention for the Prevention of Pollution From Ships (MARPOL).[139] In both contexts, the ICAO and the IMO could look to adopt DAC-based CNHC fuels.

C. Carbon Pricing

Likely the most powerful policy pathway that the federal government could undertake to achieve broad demand and adaptation for DAC-based CNHCs would be to establish federal mandates for increased use of DAC-based fuels over a certain timetable, which would likely include specific CNHC fuel taxing regimes (or eliminate CNHC fuel taxes altogether for both retail and wholesale consumption). Through either congressional or executive action, the federal government could choose to establish a standalone mandate for carbon-neutral, "drop-in" fuels to increase consumption of DAC-derived fuels. This mandate would ideally extend to federal procurement standards as well, in which the General Services Administration could launch a competitive procurement program for carbon removal from DAC and establish a federal contract with the DAC operators to purchase a certain volume of DAC fuel across the entire government transportation fleet. In this scenario, the U.S. Department of Defense could ramp up competitive procurement of DAC-based fuels "from zero to roughly 23% of 2017 operational fuel consumption by 2030."[140]

As part of such action, the Biden Administration and Congress could also seek to establish a federal "Carbon Removal Administration" that could mandate public procurement, codify a permanent version of the 45Q tax credit, or "authorize a new public agency . . . that would receive dedicated funding to remove a specified amount of CO_2 each year . . . with sole responsibility for achieving negative-emissions goals."[141] The Rhodium Group, in proposing this latter option, notes that "pursuing this option means separate policies to accelerate energy efficiency, end-use electrification, decarbonization

136 Beuttler et al., *supra* note 6, at 4.

137 Int'l Civil Aviation Org., Annex 16 to the Convention on Int'l Civ. Aviation, vol. 4, at II-2 (Oct. 2018).

138 Shelby E. Brown, *IMO 2020: Industry Conditions and Readiness*, 44 TUL. MAR. L. J. 145, 147–48 (2019).

139 *Id.* at 145–46 (discussing history of relevant MARPOL fuel regulations).

140 LARSEN ET AL., *supra* note 37.

141 *Id.*

of the electric power sector, and other mitigation and carbon removal actions would still be necessary to meet the ambitious GHG reduction targets" set forth by the 2015 Paris Agreement.[142]

A federal (and perhaps state) mandate could also seek to modify the appropriate I.R.C. concerning fuel taxes and choose to exempt DAC-based CNHC fuels. Under CAA regulations, "gasoline" is defined as "any fuel sold in any State for use in motor vehicles and motor vehicle engines, *and* commonly or commercially known or sold as gasoline."[143] Should the government choose to go this route, avoiding classification of CNHC fuels as "gasoline" in lieu of an alternative classification (such as "syngas" or some other appropriate variation) would allow for recycled and synthetic fuel utilization to obtain greater economic parity with the existing single-use, carbon-positive fuel market that dominates today.

Given DAC technology's location-independent nature, Congress could also seek to address the fuel tax issue by classifying fuels produced for interstate sales versus fuels produced and marketed in state. While obviously some fossil fuels would fall within this interstate category, DAC fuel that has no piping infrastructure because of *in situ* synthetization can be made and consumed anywhere. This alternative may invoke Commerce Clause issues, depending on the strictness of interpretation, and whether the DAC activity is judicially determined to be a part of a larger interstate commercial scheme.[144]

D. Standards of LCAs

The aforementioned section on LCA for DAC tax credits would also apply toward integrating LCA for utilizing CO_2 as feedstock and would need to be integrated further into LCA-based regulations and monitoring standards. The IRS should codify approval of DAC-based LCAs if the LCAs show that the DAC-based product results in a permanent neutralization or permanent net decrease in GHG emissions over a broad time period. The impact of the LCA could be measured using EPA's Tool for the Reduction and Assessment of Chemicals and Other Environmental Impacts (TRACI) or alternatively could be measured by a "method of system expansion or by product-specific environmental impacts using the substitution approach."[145] "[T]he carbon footprint of feedstock CO_2 strongly depends on the method used to solve the multifunctionality problem at the CO_2 source in a life cycle assessment.[T]his ambiguity can potentially lead to suboptimal decisions for the climate."[146] Thus, "[i]n the absence of known market effects, assessing the difference between existing operations with and without carbon

142 *Id.*

143 40 C.F.R. § 80.2(c) (2020) (emphasis added); *see also* 42 U.S.C. § 7545 (Regulation of fuels).

144 *See* U.S. Const. art. 1, § 8, cl. 3. The most recent notable determination under the Commerce Clause, in *National Federation of Independent Business v. Sebelius*, 567 U.S. 519 (2012), focused on the requirement set forth in *United States v. Lopez*, 514 U.S. 549 (1995), that Congress regulate only "commercial activity." A possible determination would be that DAC deployment and resultant CNHC production and downstream marketing constitutes "commercial activity." Whether associated commercial activity is interstate or intrastate remains to be determined.

145 Müller et al., *supra* note 70, at 2989.

146 *Id.*

capture by using the substitution approach to imply direct 100% market substitutions creates a consistent and comparable approach for determining the carbon footprint of CO_2."[147]

Boundaries must also seek to define product life-cycle states that the LCA will include, such as "cradle-to-grave" and "cradle-to-gate." The determination of these boundaries depends on the downstream life of the product or service, which may be difficult to assess in a cyclical/renewable fuel economy.

IV. CONCLUSION

DAC and related CNHC production have the potential to have a consequential role in mitigating climate change and accelerating the push toward a net-negative economy. In this sense, these technologies can act as a bridge toward a more sustainable global economy. DAC deployment and fuel production must complement a broad array of technological advancements in carbon sequestration, power generation, and fuel production/utilization. "Because of the scales likely needed and the time it takes to develop [such technologies], climate policy *urgently* needs to develop and implement suitable mechanisms to trigger sufficient mitigation and scaling of NETs alike."[148] DAC should not be seen necessarily as a mitigation technology alone, but rather as a piece in the overall strategy of replacing carbon-positive activity.

One essential component of a shift toward a lower carbon economy is a determination of an environmental merit order for carbon source substitution. In a LCA of DAC, based on Carbon Engineering's commercial-scale plant (capturing ~1 Mt of CO_2 annually), the researchers found that the DAC process emits -0.592 kilogram (kg) CO_2 equivalent (eq.) from cradle-to-gate for each kg of feedstock CO_2.[149] In another study, the authors reported -0.62 kg CO_2eq. for a similar DAC process with slightly different assumptions.[150]

In a comparison analysis with other CO_2 feedstock sources (e.g., an ammonia plant (-0.95 kg CO_2 eq. per kg of feedstock CO_2) and a fermentation plant (-0.94 kg CO_2eq. per kg of feedstock CO_2)), the authors found that "the least beneficial scenario is . . . [DAC] since it leads to a substantially larger carbon footprint from a system-wide perspective."[151] Consequently, the authors determined that DAC should be utilized only if the CO_2 supply capacities of first the ammonia plant and second the fermentation plant are exceeded, noting that "selecting an ammonia plant as CO_2 source instead of a direct air capture plant could reduce the carbon footprint by 63%."[152] However, policy changes that seek to incentivize a rapid shift toward carbon-neutral renewable energy products

147 *Id.* at 2990.
148 Beuttler et al., *supra* note 6, at 6 (emphasis in original).
149 Müller et al., *supra* note 70, at 2985.
150 Melinda M.J. de Jonge et al., Life cycle carbon efficiency of Direct Air Capture systems with strong hydroxide sorbents, 80 INT'L J. GREENHOUSE GAS CONTROL 25, 29 (2019).
151 Müller et al., *supra* note 70, at 2985.
152 *Id.* at 2989.

may improve the entire spectrum of carbon footprints, and thus can shrink the gap between various approaches' carbon footprints.[153]

Now more than ever, there is a pressing need for a research governance framework in this area of decarbonization. According to a 2019 report from the National Academies of Sciences, Engineering, and Medicine, "[a]ppropriate governance of NETs and sequestration is critical because overly lax oversight would lead to ineffective CO_2 removal and loss of public confidence, while overly strict oversight would limit deployment. Governance is especially critical when largescale deployment is imminent."[154] The authors of the report note that one way to maintain public confidence during rapid deployment of NETs is "to invest in a substantial effort to educate the public during the research and development stage."[155]

As part and parcel of the policy efforts the federal government should seek to undertake to rapidly decarbonize, it will be essential to educate consumers about their choices and the carbon consequences of their actions to justify federal action. This public educational plan will necessarily require an advanced research plan for each phase of program rollout. These plans should be standardized and published in a transparent and understandable format to not only lay out the policy justification for likely impending federal action, but also to be a model for global scientific leadership and program replication. President Biden's appointment of a national climate adviser and a presidential climate envoy marks a tremendous step toward elevating the importance of this task at both the domestic and international levels.

In a post-COVID environment, it is highly unlikely that domestic hydrocarbon use will return to pre-pandemic levels; to quote U.S. Federal Reserve Chairman Jerome Powell, "we're not going back to the same economy . . . we're recovering, but to a different economy."[156] While in the short term "markets for petrochemicals will continue to grow, and both aviation and shipping will be relatively untouched", transitions elsewhere are inevitable.[157] For example, the article states "it's only a matter of time before tanker ships start running on hydrogen [as] once a technology reaches scale and price parity, conditions can change dramatically."[158]

The analogies between DAC and renewable energies abound, and there should be little reason that this nascent, yet rapidly developing sector will be any exception. Rather than waiting for the decline of hydrocarbons, which many international oil companies predict may have already peaked, public and private industry alike should work in tandem to accelerate its replacement with sustainable, carbon-neutral, and carbon-negative technologies for energy generation. Steve Oldham, former CEO of Carbon Engineering, notes that one of the largest hurdles facing the CCUS industry is existing

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153 *See id.*

154 Nat'l Acad. of Sciences, Eng'g, & Med., Negative Emissions Technologies and Reliable Sequestration: A Research Agenda 12 (2019).

155 *Id.*

156 Tom Randall & Hayley Warren, *Peak Oil Is Suddenly Upon Us*, BLOOMBERG (Dec. 1, 2020) https://www.bloomberg.com/graphics/2020-peak-oil-era-is-suddenly-upon-us/ (quoting U.S. Federal Reserve Chairman Jerome Powell).

157 *Id.*

158 *Id.* For more discussion of the coming hydrogen economy, *see* Neil Segel, *Is Hydrogen the Future of Global Energy Production?,* NAPE DEALMAKERS MAGAZINE, Oct. 2021, at 37-43.

carbon policy and legislation that favors emissions control but does not enable carbon removal: "We need to see that removing a CO_2 molecule from the atmosphere is the same as stopping a CO_2 molecule from entering the atmosphere."[159]

To achieve this vision, the federal government must immediately begin providing heightened targeted incentives for carbon-neutral and carbon-negative energy options across all sectors of the economy. Implementing the financing pathways, addressing the legal permitting issues, and establishing the federal carbon programs all addressed herein would be a monumental step in the right direction. The transition will take a tremendous amount of regulatory oversight, but such oversight is essential to attain the necessary paradigm shift to a greatly decarbonized and more sustainable future.

Neil Segel is currently in his final year of pursuing his J.D. at the University of Houston Law Center, where he is also the President of the Energy & Environmental Law Society. He completed his undergraduate degree at the University of Arizona and his master's degree at Tel Aviv University. He is the owner of Houston-based NES Consulting LLC, which provides international business strategy and support in the energy sector. His prior experience includes working for the Israeli government's Ministry of National Infrastructures, Energy & Water Resources and Ministry of Economy & Industry, as well for Control Risks – a leading global risk consulting firm.

159 E-mail from Steve Oldham, CEO, Carbon Engineering, to Neil Segel, Author (Sept. 18, 2020, 11:50 CST) (on file with author).