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Clean Energy Equity

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Abstract

Solar, wind, and other clean, renewable sources of energy promise to mitigate climate change, enhance energy security, and foster economic growth. But many of the policies in place to promote clean energy today are marred by an uneven distribution of economic opportunities and associated financial burdens. Tax incentives for renewables cost American taxpayers billions of dollars every year, yet the tax code effectively precludes all but the largest banks and most profitable corporations from reaping the benefits of these tax breaks. Other policies, such as renewable portfolio standards that set minimum quota to create demand for renewable electricity require such high levels of market expertise and financial acumen that they engender similarly disparate social impacts—all in the name of an environmentally sustainable energy future.

To date, policymakers and scholars have focused primarily on the efficacy and, more recently, the efficiency of clean energy policy. This Article makes the case that the next generation of policies should incorporate equity as another first-order consideration in policy design and implementation. Properly defined as the commensurate matching of costs and benefits, equity offers a more reliable metric for distributional impacts than the multitude of competing, normatively charged notions of fairness that currently dominate the public discourse.

Empirical assessment and qualitative analysis of today's leading clean energy policies reveal widespread issues related to equity. Insights gleaned from a representative sampling of the global policy potpourri yield valuable design recommendations for the next generation of clean

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energy policies—a generation that, ideally, will be at once effective, efficient, and more equitable.

As the greening grid becomes ever more interactive, so, too, should the process that produces the policy landscape driving the clean energy transition become more participatory. This Article suggests Elinor Ostrom's polycentricity model as a powerful governance tool to help produce more equitable clean energy policies.

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INTRODUCTION

Anthropogenic climate change has made the transition to a clean, low-carbon energy economy, or decarbonization,[1] a top priority for policymakers around the world.[2] At the end of 2017, nearly 180 countries across the globe had set targets and

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[1] Deep decarbonization is commonly defined as "steep reductions in energy-related CO2 emissions through a transformation of energy systems." *See, e.g.*, J.H. WILLIAMS ET AL., ENERGEY AND ENVTL. ECON., INC., PATHWAYS TO DEEP DECARBONIZATION IN THE UNITED STATES iii (2014), http://unsdsn.org/wp-content/uploads/2014/09/US-Deep-Decarbonization-Report.pdf [https://perma.cc/8JEW-2EQ6].

[2] *See, e.g.*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2013: THE PHYSICAL SCIENCE BASIS 1102–09 (2013) (discussing the abrupt and perhaps irreversible impact and projections of climate changes along with a number of temperature thresholds with 2 degrees Celsius being the most prominent target); *see also*

implemented policies to support the build-out of renewable energy infrastructure[3]—a more than tenfold increase compared to the fifteen countries reported for 2005.[4] Along the way, the share of low-carbon, climate-friendly renewables in the global power mix has grown to over 26 percent.[5] The first generation of clean energy policies deserves great credit for moving solar, wind, and other renewable energy technologies out of the lab and into the marketplace. As these technologies mature and their market share continues to grow, however, their enabling policy landscape requires rethinking.

To date, policymakers have focused primarily on the efficacy and, more recently, the efficiency of their policy commitment to renewables. Starting in the 1990s, clean energy policies sought to get as much steel in the ground (and solar panels on rooftops) as possible with little, if any, concern for the costs involved.[6] Since the late 2000s, as solar, wind, and other renewables graduated from niche markets and entered the mainstream, clean energy policies have been crafted with a growing concern for their cost efficiency in order to mitigate the financial burden on ratepayers and taxpayers.[7] Nearly three decades of efficacy- and, more recently, efficiency-oriented policymaking have produced considerable environmental and economic benefits.[8] Figure 1 illustrates the historic evolution of clean energy policymaking.

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, RENEWABLE ENERGY SOURCES AND CLIMATE CHANGE MITIGATION 6–26 (2011) (discussing the opportunities and challenges associated with the ramp-up of low-carbon, renewable energy technologies) [hereinafter IPCC, RENEWABLE ENERGY SOURCES].

[3] JANET L. SAWIN ET AL., RENEWABLE ENERGY POLICY NETWORK FOR THE 21ST CENTURY, RENEWABLES 2018 GLOBAL STATUS REPORT 49 (Lisa Mastny et al. eds., 2018) [hereinafter REN21 2018].

[4] JANET L. SAWIN ET AL., RENEWABLE ENERGY POLICY NETWORK FOR THE 21ST CENTURY, RENEWABLES 2015 GLOBAL STATUS REPORT 87 (Lisa Mastny ed., 2015) [hereinafter REN21 2015].

[5] REN21 2018, *supra* note 3 at 41.

[6] *See, e.g.*, INT'L ENERGY AGENCY, FULL COST RATES (2017), https://www.iea.org/policiesandmeasures/renewableenergy/ [https://perma.cc/8EJ2-6323] (using advanced search, select "Germany" under "Countries" subheading, click search; then type "Full Cost Rates" into the "Filter:" bar) (describing Germany's 1993 "Full Cost Rates" program, which offers to cover the full cost of solar photovoltaic installations).

[7] *See, e.g.*, American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (establishing the U.S. "Cash Grant" program to remedy renewable energy project financing inefficiencies flowing from the 2008/09 financial crisis); *see also* Lincoln L. Davies & Kirsten Allen, *Feed-in Tariffs in Turmoil*, 116 W. VA. L. REV. 937, 956–58 (2014) (describing repeated adjustments to the German feed-in tariff in order to prevent costs from getting out of hand).

[8] *See, e.g.*, Kyle Siler-Evans et al., *Regional Variations in the Health, Environmental, and Climate Benefits of Wind and Solar Generation*, 110 PROCEEDINGS NAT'L ACAD. SCIS. 11768 (2013) (exploring the diverse environmental benefits of renewable energy); Felix Mormann et al., *A Tale of Three Markets: Comparing the Renewable Energy Experiences of California, Texas, and Germany*, 35 STAN. ENVTL. L.J. 55, 74 (2016) (discussing the job

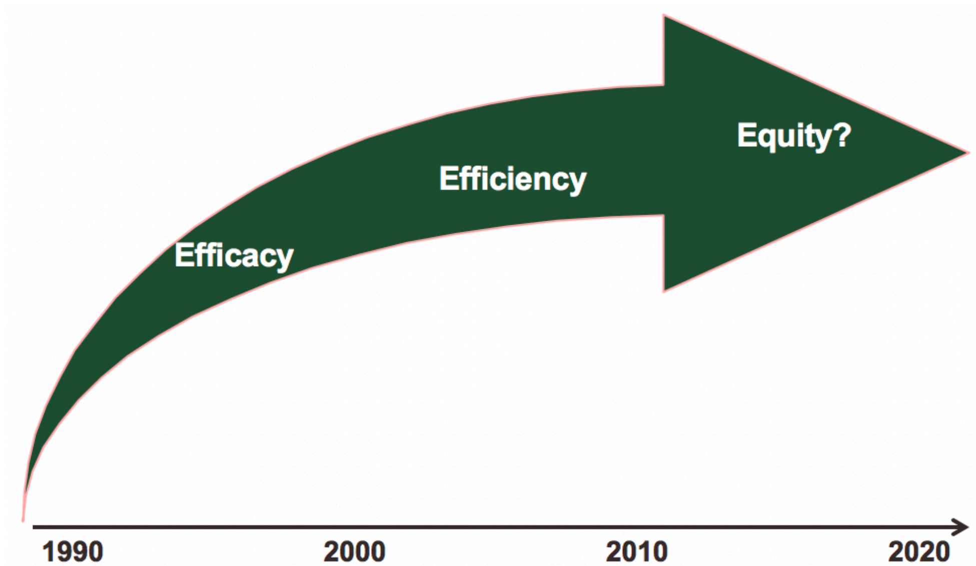

Figure 1: Historical Evolution of Clean Energy Policymaking

The prevailing focus on efficacy and efficiency, however, has led other policy considerations, such as equity, to go largely overlooked. As renewables gain ever-greater traction in the global energy economy, the social impacts of these technologies and the policies that support them are becoming more and more salient. Today's crop of clean energy policies creates winners and losers not only across competing technologies[9] but also among ratepayers, taxpayers, and other stakeholders. Federal tax incentives for renewables, for example, cost American taxpayers billions of dollars every year, yet the tax code effectively precludes all but the largest banks and most profitable corporations from reaping the benefits of these tax breaks.[10] In much the same vein, renewable portfolio standards require ratepayers to finance markets and demand for renewable electricity but require such high levels of market expertise and financial acumen that they prove similarly exclusive.[11]

This disconnect between the allocation of costs and access to the economic benefits created by clean energy policy suggests that policymakers prioritize environmental and economic outcomes at the expense of equity and social

creation benefits associated with renewable energy deployment in California, Texas, and Germany).

[9] *See, e.g.*, Zachary Liscow & Quentin Karpilow, *Innovation Snowballing and Climate Law*, 95 WASH. U. L. REV. 387 (2017) (describing the well-established narrative of public policy support for renewable energy technologies picking winners and losers).

[10] *See infra* Section III.D.

[11] *See infra* Section III.E.

sustainability.[12] The resulting disparate social impacts threaten to erode popular support for a key component of global efforts to mitigate anthropogenic climate change.[13] The sudden rollback of Spain's renewable energy support regime offers an illustrative example of these dynamics.[14] When Spanish regulators naively chose to offer local solar generators rates similar to those of Germany's then widely praised feed-in tariff, these rates proved overly generous given Spain's 60% greater insolation compared to Germany. The resulting windfall profits for developers and the hefty financial burden they imposed on Spanish voters caused public support for renewables to dwindle and, ultimately, led to the policy's unraveling.

A sizeable body of literature has examined the efficacy of policies to promote clean energy around the globe.[15] More recent scholarship has explored the cost efficiency of policies to promote the large-scale deployment of solar, wind, and other renewables.[16] The scholarly community is only just beginning, however, to explore the social challenges posed by the transition to a low-carbon, renewables-based

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[12] For a discussion of the complex relationships among environmental, economic, and social sustainability, see Felix Mormann, *Can Clean Energy Policy Promote Environmental, Economic, and Social Sustainability?*, 33 J. LAND USE & ENVTL. L. 343 (2018).

[13] *See* Framework Convention on Climate Change, *Adoption of the Paris Agreement*, U.N. DOC. FCC/CP/2015/L.9 (Dec. 12, 2015), https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf [https://perma.cc/DS9K-M28X]. The Paris agreement entered into force on November 4, 2016, less than a year after its adoption, following ratification by 55 states accounting for at least 55% of global greenhouse gas emissions, including the United States. *See Paris Accord—Status of Ratification*, U.N. FRAMEWORK CONVENTION ON CLIMATE CHANGE, https://unfccc.int/process/the-paris-agreement/status-of-ratification [https://perma.cc/5VEF-A8W9].

[14] *See* Felix Mormann, *Clean Energy Federalism*, 67 FLA. L. REV. 1621, 1661–62 (2015) [hereinafter Mormann, *Clean Energy Federalism*] (discussing the equity issues prompting the sudden suspension of Spain's policy incentives for solar facilities).

[15] The International Energy Agency has done foundational work in this space, exploring the relative efficacy of renewable energy policies in the OECD and BRIC countries using country-specific "effectiveness indicators" based on each country's renewable energy potiential. *See* INT'L ENERGY AGENCY, DEPLOYING RENEWABLES—BEST AND FUTURE POLICY PRACTICE (2011) [hereinafter IEA 2011]; INT'L ENERGY AGENCY, DEPLOYING RENEWABLES—PRINCIPLES FOR EFFECTIVE POLICIES (2008) [hereinafter IEA 2008]. *See generally* Gireesh Shrimali et al., *Wind Energy Deployment in the U.S.: An Empirical Analysis of the Role of Federal and State Policies*, 43 RENEWABLE & SUSTAINABLE ENERGY R. 796 (2015); Lucy Butler & Karsten Neuhoff, *Comparison of Feed-in Tariff, Quota and Auction Mechanisms to Support Wind Power Development*, 33 RENEWABLE ENERGY 1854 (2008). *See generally* Fredric C. Menz, *Green Electricity Policies in the United States: Case Study*, 33 ENERGY POL'Y 2398 (2005).

[16] This stream of research has sought to assess how much bang a policy delivers, in renewable energy capacity deployed, for the ratepayers' or taxpayers' buck. *See generally* Reinhard Haas et al., *Efficiency and Effectiveness of Promotion Systems for Electricity Generation from Renewable Energy Sources - Lessons from EU Countries*, 36 ENERGY 2186 (2011); Felix Mormann, *Enhancing the Investor Appeal of Renewable Energy*, 42 ENVTL. L. 681 (2012) [hereinafter Mormann, *Investor Appeal of Renewable Energy*].

energy economy.[17] To date, no systematic, comparative inquiry has probed into the relative equity of the primary tools of public policy support for clean energy. This Article seeks to help close that gap.

At first glance, equity may seem a less intuitive and harder-to-measure concept than efficacy or efficiency, the current staples of clean energy policy. Properly defined as the commensurate distribution of costs and benefits,[18] however, equity offers a reliable metric of a policy's socio-economic impacts—a metric untainted by the normative judgments underlying the many competing notions of fairness that dominate the rhetoric in ongoing battles over the future of net energy metering and other clean energy policies.[19] To be clear, this Article was motivated by the author's normative concerns over equity deficiencies in today's clean energy policy landscape. And these concerns over the uneven distribution of economic opportunities and costs form the basis of proposed pathways for policy reform.[20]

Not all policymakers, scholars, and other readers will share the author's normative valuation of equity improvements as a worthwhile goal for clean energy policy design and implementation. Few will deny, however, that a better understanding of the economic winners and losers a policy creates will result in more informed choices going forward, for policymakers, voters, and other stakeholders.

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[17] *See generally* Shelley Welton & Joel B. Eisen, *Clean Energy Justice: Charting an Emerging Agenda*, HARV. ENVTL. L. REV. (forthcoming 2019) (calling on the academic community to engage in a more holistic study of the distributive and procedural justice concerns raised by the clean energy transition); Shelley Welton, *Clean Electrification*, 88 U. COLO. L. REV. 571 (2017) [hereinafter Welton, *Clean Electrification*] (exploring the social implications of a "participatory grid"); Uma Outka, *Fairness in the Low-Carbon Shift: Learning from Environmental Justice*, 82 BROOK. L. REV. 789 (2017) (exploring the linkage between climate change and environmental and energy justice); Troy A. Rule, *Solar Energy, Utilities, and Fairness*, 6 SAN DIEGO J. CLIMATE & ENERGY L. 115 (2015) (taking stock of the fairness arguments raised for and against promotion of solar rooftop installations through net energy metering).

[18] *See, e.g.*, Benjamin K. Sovacool, *An International Comparison of Four Polycentric Approaches to Climate and Energy Governance*, 39 ENERGY POL'Y 3832, 3841 (2011); Welton, *Clean Electrification*, *supra* note 17, at 577 n.19 (defining equity concerns as "questions over how the benefits and burdens of the policies are allocated"); Daniel A. Farber, *Pollution Markets and Social Equity: Analyzing the Fairness of Cap and Trade*, 39 ECOLOGY L.Q. 1, 7 (2012) (defining equity as the consideration of "uneven impact of a program on different groups or individuals"). Use of the term "equity" for the purposes of this Article should not be confused with the term's use in the context of equity capital or tax equity, both staples in the clean energy finance discourse. *See, e.g.*, Felix Mormann, *Beyond Tax Credits: Smarter Tax Policy for a Cleaner, More Democratic Energy Future*, 31 YALE J. ON REG. 303 (2014) [hereinafter Mormann, *Beyond Tax Credits*] (discussing the challenges for clean energy finance associated with scarcity of tax equity).

[19] *See* Rule, *supra* note 17, at 116 (discussing the confusing use of fairness rhetoric on both sides of the raging debate over net energy metering policies with the astute observation that "[fa]irness is a notoriously fuzzy concept capable of describing a wide range of distinct policy ideals"); Outka, *supra* note 17, at 793 (stating that "discordant notions of fairness are competing for validation in the energy policy space").

[20] *See infra* Section III.F.

The goal of the following analysis of case studies in clean energy policy,[21] therefore, is not to sell readers on the author's normative convictions but, rather, to provide the background necessary for readers to form their own normative judgments, including but not limited to the "fairness," of the current policy landscape. To this end, the Article's working definition of equity facilitates an in-depth inquiry into the attribution of economic costs and benefits under select clean energy policies, tracing the flow of capital required to fund these policies as well as the revenue flowing to their economic beneficiaries.[22]

Some question the propriety of equity and other indicators of socio-economic impact in the context of clean energy policies intended to reduce the world's carbon footprint and thereby help mitigate global climate change. This Article makes the case that, in light of its transformative nature and repercussions felt across all sectors of society, deep decarbonization cannot proceed successfully without regard for the social implications of its enabling policy landscape. Moreover, energy law has long recognized equity as a key metric for the design of rates for transmission services, electric power, and natural gas, among others.[23]

Importantly, this Article does not seek to call into question the ongoing transition toward a low-carbon, largely renewables-based energy economy. To be sure, reduced reliance on oil, coal, and other carbon-intensive fossil fuels engenders its own social challenges, such as jobs lost in mining, refining, and related sectors.[24] But environmental and, ultimately, economic imperatives leave little room for alternative courses of action if global warming is to be limited to the crucial 2-degree Celsius mark.[25] The social costs of persistent carbon emissions from a primarily fossil-fueled power sector are simply too large to consider business as usual with continued reliance on fossil fuels a viable option.[26]

The research goal of this inquiry, therefore, is not to question the "*if*" but rather to assess and, ideally, improve the "*how*" of the shift toward a less carbon-intensive, renewably fueled energy economy. To this end, the Article assesses the equity of a

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[21] *See infra* Section III.A–E.

[22] As Professor William Boyd put it in his helpful comments on an earlier draft of this work, it is, indeed, a "follow-the-money" type of investigation.

[23] *See infra* Part I.

[24] *See, e.g.*, DEP'T OF ENERGY, U.S. ENERGY AND EMPLOYMENT REPORT 23 (2017), https://www.energy.gov/downloads/2017-us-energy-and-employment-report [https://perma.cc/J96A-7D23] (describing the recent decline in employment in oil and gas extraction and coal mining compared to job growth in solar and other renewable energy); Shalanda H. Baker et al., *Beyond Zero-Sum Environmentalism*, 47 ENVTL. L. REP. 10328, 10344 (2017) (discussing perceived trade-offs between environmentalists and the mining industry).

[25] *See supra* note 2 and accompanying text.

[26] *See, e.g.*, Jonathan Levy & Jack Spengler, *Health Benefits of Emissions Reductions from Older Power Plants*, 9 RISK IN PERSP. 1, 2–4 (2001) (reporting on the high concentration of air pollutants and adverse health impacts in the vicinity of coal and other fossil-fueled power plants); Siler-Evans et al., *supra* note 8; Mathew E. Hauer & Jason N. Evans, *Millions Projected to Be at Risk from Sea-Level Rise in the Contintental United States*, 6 NATURE CLIMATE CHANGE 691, 697 (2016) (highlighting the threat of mass migration due to anthropogenic climate change).

sampling of representative case studies from today's potpourri of policies for the promotion of solar, wind, and other renewables. Application of a uniform rating scale across case studies is intended to allow policymakers to compare the relative equity of competing options in the clean energy policy toolbox. These ratings offer the basis for policy-specific reform suggestions to improve equity outcomes and guide policymakers toward a more equitable, next generation of clean energy policies.

As the project of decarbonization and its enabling policies continue to evolve, equity will likely remain a moving target for policymakers. It is imperative, therefore, that equity inquiries become part of the policymaking process, rather than to be voiced *post hoc* by scholars and other outside critics. As regulators, utilities, and ratepayers move toward an increasingly interactive grid powered by renewables,[27] the process that produces its enabling policies and regulations must also become more participatory. This Article suggests a modified version of Elinor Ostrom's Nobel prize-winning framework for polycentric governance as a model to facilitate greater public participation—to produce a next generation of clean energy policies that more transparently balances and reconciles efficacy, efficiency, and equity considerations.

This Article proceeds in four parts. Part I makes the case for including equity as a first-order consideration in clean energy policy design and implementation. Part II gives a brief overview of the principal policies to promote clean energy technologies in place today. Part III evaluates the equity of a sampling of case studies that represent the current generation of clean energy policies and offers suggestions for reform. Merging substance with process, Part IV draws on Elinor Ostrom's polycentric governance models to propose a more participatory policymaking process that ensures greater consideration of equity concerns going forward.

I. THE CASE FOR EQUITY CONSIDERATIONS IN CLEAN ENERGY POLICY

To better understand the importance of equity considerations in clean energy policy, this Part begins by surveying equity's historic role in energy law (*infra* Section I.A.), before making the case for greater focus on the equity of policy pathways toward deep decarbonization beyond the literature's current preoccupation with an outcome-oriented investigation of the social implications of a deeply decarbonized energy economy (*infra* Section I.B.). Part I closes by exploring the proper place of equity in clean energy policymaking, alongside efficacy, efficiency, and other top-level policy considerations (*infra* Section I.C).

[27] *See* Welton, *Clean Electrification*, *supra* note 17, at 584–85 (describing initiatives to foster greater consumer participation in the electric grid).

A. Equity's Historic Role in Energy Law

Equity, or the notion of matching costs with benefits as the term is used in this Article, has long been a staple of energy law and regulation in the United States. As early as in the 1890s, electricity pioneer Samuel Insull used the Wright meter, a novel device that, much like today's "smart meters," could record a customer's overall electricity consumption as well as the timing and maximum level of her demand, to revolutionize the rate design for electric power.[28] The meter's detailed data allowed Insull to replace the traditional flat rate for electricity with a two-tiered rate structure.[29] This new rate design used the customer's overall consumption to determine her share of the utility's operating expenses, while her peak demand represented the customer's share in the utility's capital investment to provide sufficient generating capacity.[30] In equity terms, this two-tiered rate structure matched a customer's benefits from electrical service to the costs the utility incurred to provide that service.[31] Natural gas pipeline rates reflect a similar commitment to equity, with firm customers required to pay both a demand charge representing their peak demand and a usage charge for their overall consumption, while customers who agree to have their service interrupted in the event of a shortage only pay the usage charge.[32]

The allocation of costs for new transmission infrastructure offers another, more recent example of energy law's enduring commitment to equity. In 2011, the Federal Energy Regulatory Commission (FERC) adopted Order 1000 in part to prevent free ridership by those who benefit from new transmission projects without sharing in their cost.[33] To this end, FERC adopted a set of cost allocation principles requiring that "all regional and interregional cost allocation methods allocate costs for new transmission facilities in a manner that is at least roughly commensurate with the benefits received by those who will pay those costs."[34] The language used by FERC in Order 1000 is not novel but, rather, reflects energy law's well-established "cost

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[28] *See* HAROLD L. PLATT, THE ELECTRIC CITY: ENERGY AND THE GROWTH OF THE CHICAGO AREA, 1880–1930, at 141–42 (1991).

[29] *Id.* at 126.

[30] *Id.* at 139–42.

[31] This type of matching has since become a staple of electricity rate regulation. *See, e.g.*, Alabama Elec. Co-op., Inc. v. FERC, 684 F.2d 20, 27 (D.C. Cir. 1982) ("Properly designed rates should produce revenues from each class of customers which match, as closely as practicable, the costs to serve each class or individual customer.") (emphasis omitted) (internal quotation omitted).

[32] In the wake of restructuring, federal regulations prohibit interstate natural gas pipelines from charging customers with interruptible service with a demand or reservation fee. *See* 18 C.F.R. § 284.9(c); *see also* Paladin Assocs., Inc. v. Montana Power Co., 97 F. Supp. 2d 1013, 1019 (D. Mont. 2000) (describing the mechanics of firm and interruptible natural gas service).

[33] *See* Transmission Planning & Cost Allocation by Transmission Owning & Operating Public Utilities, 18 C.F.R. 35, 136 FERC ¶ 61051 (July 21, 2011).

[34] *Id.*; *see also* Illinois Commerce Comm'n v. FERC, 721 F.3d 764, 770 (7th Cir. 2013) (offering an illustrative example of such cost-benefit matching).

causation" principle. Anchored in the Federal Power Act's requirement that rates be "just and reasonable,"[35] cost causation requires that rates reflect the costs actually caused by the customer who must pay them.[36] In a near-perfect reprise of the economics literature's definition of equity, courts assess compliance with the cost causation principle "by comparing the costs assessed against a party to the burdens imposed or benefits drawn by that party."[37]

Some commentators view energy law's reliance on the cost causation principle as an (over)emphasis of efficiency at the possible expense of equity.[38] Critics bemoan that causal allocation of costs creates a barrier to access for lower-income consumers whose electricity and natural gas rates should be discounted.[39] Notwithstanding their merit in ensuring widespread access to affordable energy, rate discounts and rebates for lower-income households do not fall within the purview of equity as that term is defined in the economics literature and used here.[40] To characterize the cost causation principle as running counter to equity objectives confuses equity with more normative concepts such as distributional fairness or social sustainability.[41]

B. Policy Equity Before Outcome Equity

Notwithstanding the robust body of scholarship on the role of fairness in law generally,[42] legal scholars are only just beginning to explore the appropriate role, if

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[35] 16 U.S.C. § 824d(a); *see also* 15 U.S.C. § 717c(a) (discussing the regulation of natural gas rates).

[36] *See, e.g.*, KN Energy, Inc. v. FERC, 968 F.2d 1295, 1300 (D.C. Cir. 1992); Transmission Access Policy Study Group v. FERC, 225 F.3d 667, 708 (D.C. Cir. 2000); Pacific Gas & Elec. Co. v. FERC, 373 F.3d 1315, 1320–21 (D.C. Cir. 2004).

[37] Illinois Commerce Comm'n v. FERC, 576 F.3d 470, 476 (7th Cir. 2009) (citing Midwest ISO Transmission Owners v. FERC, 373 F.3d 1361, 1368 (D.C. Cir. 2004)); *see also* William Boyd, *Just Price, Public Utility, and the Long History of Economic Regulation in America*, 35 YALE J. ON REG. 721, 727 (2018) (noting "reciprocity . . . in exchange" as a core element of the public utility idea).

[38] *See, e.g.*, Welton, *Clean Electrification*, *supra* note 17, at 609–10 (noting that "scholars have long portrayed the field of public utility law as a protracted ideological battle between 'equity' on the one hand and 'efficiency' on the other").

[39] *Id.* at 610.

[40] *See supra* note 18 and accompanying text.

[41] For a snapshot of the burgeoning literature on social sustainability, see, e.g., Thomas M. Parris & Robert W. Kates, *Characterizing and Measuring Sustainable Development*, 28 ANN. REV. OF ENV'T & RES. 559, 561 (2003) (noting the importance of equal opportunity for the taxonomy of sustainable development); G. Assefa & B. Frostell, *Social Sustainability and Social Acceptance in Technology Assessment: A Case Study of Energy Technologies*, 29 TECH. SOC'Y 63, 65 (2007) (highlighting the role of "fairness in distribution and opportunity" for socially sustainable systems); *see also* Mormann, *supra* note 12 (offering a framework of proxy criteria to assess the social sustainability of clean energy policies).

[42] *See, e.g.*, FAIRNESS IN LAW AND ECONOMICS (Lee Anne Fennell & Richard H. McAdams eds., 2013) (featuring a collection of scholarly articles on fairness).

any, for concepts such as fairness and equity in renewable energy policy. In a recent article,[43] Professor Troy Rule has posed the critical question to which extent, if any, fairness considerations should drive energy policy.[44] He finds that the multitude of competing definitions renders fairness a potentially elusive goal to pursue as stakeholders frequently differ in their views of what would constitute a fair outcome.[45] Rule concludes that polarizing fairness rhetoric in the clean energy discourse is unlikely to produce the policy landscape that will create a sustainable energy future.[46]

Replacing the "notoriously fuzzy"[47] concept of fairness with a less normatively defined notion of equity (closer to this Article's working definition), Professor Shelley Welton has probed into the social implications of a participatory electric grid that encourages ratepayers to make behavioral changes and adopt innovative technologies in order to keep electricity affordable.[48] She argues that ongoing debates over the distributional impacts of clean energy should be resolved through a renewed focus on electricity law's original commitment to facilitating widespread access to affordable power.[49] While Professors Rule and Welton differ in the precise metric by which to judge the social implications of clean energy (fairness vs. equity), both their inquiries share a focus on the ultimate policy outcomes, framed in terms of a sustainable energy future and access to affordable clean electricity, respectively.

This Article seeks to expand the discourse by focusing not only on the equity (or fairness) of an eventual policy outcome but, critically, also on the equity of the policy measures adopted in pursuit of said outcome. The global potpourri of policies to promote clean, renewable energy offers ample evidence of how different policy pathways can lead to the same outcome. As these policies seek to leverage trillions of dollars[50] for clean energy investment, they inevitably impact income and wealth distribution among the affected citizenry.[51] Pareto optimality in the sense of making everyone better off and no one worse off is beyond the reach of virtually all law and policy.[52] The importance of *outcome equity* as the focus of recent scholarship is undisputed. This Article posits that *policy equity*, that is, the commensurate

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[43] *See* Rule, *supra* note 17, at 116 ("This basic question underlies much of the current debate over the net metering programs and related policies . . . .").

[44] *See infra* Section II.C.

[45] *See* Rule, *supra* note 17, at 127.

[46] *Id.* at 148; *see also* Outka, *supra* note 17, at 810 (observing that "competing conceptions of fairness in the distributed solar context are widely divergent").

[47] *See supra* note 19 and accompanying text.

[48] *See* Welton, *Clean Electrification*, *supra* note 17, at 585 (offering examples of what a participatory grid could look like).

[49] *Id.* at 649.

[50] *See, e.g.*, INT'L ENERGY AGENCY, WORLD ENERGY OUTLOOK 21 (2016) ("An increasing slice of the roughly $1.8 trillion of investment each year in the energy sector has been attracted to clean energy . . . .").

[51] *See, e.g.*, Guido Calabresi, *The Pointlessness of Pareto: Carrying Coase Further*, 100 YALE L.J. 1211, 1214 (1991).

[52] Richard J. Lazarus, *Pursuing "Environmental Justice": The Distributional Effects of Environmental Protection*, 87 NW. U. L. REV. 787, 792–93 (1993).

distribution of costs and benefits a policy creates along the path to said outcome, logically comes first. The case for policy equity is especially strong in the context of a task as Herculean in scope as decarbonization, with policy timelines measured in decades rather than years. Policymakers and scholars alike would do well, therefore, to include both outcome and policy equity considerations as they design and implement the next generation of clean energy policies.

C. The Proper Role for Equity in Clean Energy Policy

Equity does not operate in a vacuum. It is but one of many aspects for policymakers to consider as they craft clean energy policies, chief among them the current staples of policy design and analysis—efficacy and efficiency. In a policy equation with three variables "e," how do you know which "e" to solve for? This conundrum is further complicated by the fact that efficacy, efficiency, and equity all interact in a variety of ways.[53]

Consider the fundamental requirement that a policy must produce some, however minimal, deployment of clean energy technology to create the empirical evidence necessary to properly assess its efficiency. Simple as this may sound, not every policy passes the basic efficacy test. The city of Palo Alto's 2012 solar feed-in tariff, for example, failed to incentivize any deployment during the first three years of its existence.[54] An equity inquiry may help explain the policy's lack of efficacy, perhaps as the result of targeting too few potential developers and other economic beneficiaries. At the other end of the efficacy spectrum, a policy that delivers significantly higher-than-expected deployment may offer overly generous incentives, raising concerns over windfall benefits for developers and, ultimately, the policy's cost efficiency. Oregon's Solar Photovoltaic Volumetric Incentive Program[55] illustrates this dynamic. Initial rates of up to $0.65 per kilowatt-hour of solar electricity led to substantial oversubscription of early deployment rounds prompting widespread criticism of the program as wasteful and inefficient.[56]

Efficiency and equity have a similarly complex relationship. The scholarly literature has long debated the tension between equity and efficiency in energy law.[57]

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[53] Making a similar point, albeit in the broader context of sustainable development, *see* J.B. Ruhl, *Sustainable Development: A Five-Dimensional Algorithm for Environmental Law*, 18 STAN. ENVTL. L.J. 31, 31 (1999) ("Environment, economy, and social equity are not mutually exclusive, hermetically sealed spheres of life.").

[54] *See* Mormann, *Clean Energy Federalism*, *supra* note 14, at 1661.

[55] *See* OR. PUB. UTIL. COMM'N, SOLAR PHOTOVOLTAIC VOLUMETRIC INCENTIVE PROGRAM: REPORT TO THE LEGISLATIVE ASSEMBLY 2–3 (2013).

[56] *See, e.g.*, OR. PUB. UTIL. COMM'N, UM 1505, SOLAR PHOTOVOLTAIC COMMENTS AND REGULATIONS 3 (2011) (statement of Dave Sullivan) ("The incentive rates were at least 30 percent too high . . . .").

[57] *See, e.g.*, Welton, *supra* note 17, at 609–10 ("scholars have long portrayed the field of public utility law as a protracted ideological battle between 'equity,' on the one hand, and 'efficiency,' on the other"); Richard A. Posner, *Taxation by Regulation,* 2 BELL J. ECON. &

In reality, both may but need not necessarily pull in opposite directions. In some instances, equity improvements may produce sizeable gains in policy efficiency, as demonstrated by the American Recovery and Reconstruction Act's impact on U.S. wind power development. When the Act's § 1603 grant temporarily allowed clean energy developers to choose a direct cash subsidy in lieu of their traditional tax credits,[58] the pool of direct economic beneficiaries increased dramatically beyond the small group of banks and highly profitable corporations able to monetize tax credits in a timely fashion.[59] Remarkably, these gains in policy equity resulted in a 100% increase in policy efficiency.[60] Figure 2 illustrates the intricate connections and interactions among policy efficacy, efficiency, and equity.

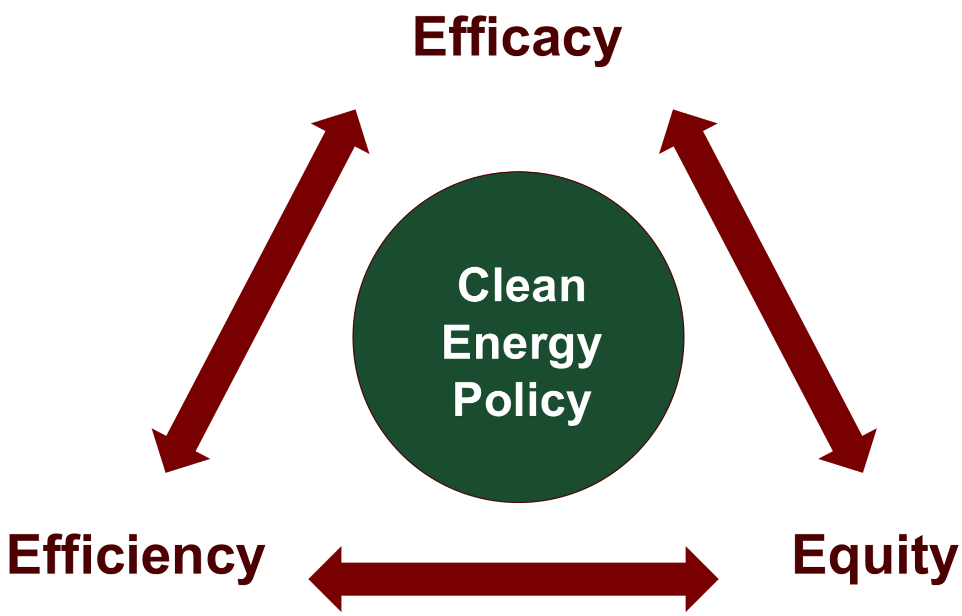

Figure 2: Interconnectedness Among Policy Efficacy, Efficiency, and Equity

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MGMT. SCI. 22, 44 (1971); EDWARD E. ZAJAC, FAIRNESS OR EFFICIENCY: AN INTRODUCTION TO PUBLIC UTILITY PRICING (1978).

[58] *See* Pub. L. No. 111-5, 123 Stat. 115.

[59] For a discussion of the challenges in monetizing federal tax incentives and their implications for policy equity, *see infra* Section III.D.

[60] *See* Ethan Zindler & Tyler Tringas, *Cash Is King: Shortcomings of US Tax Credits in Subsidizing Renewables*, BLOOMBERG NEW ENERGY FIN. 1 (2009) ("One dollar in cash has, on average, gone twice as far as one dollar of tax credits in subsidizing wind."); Mormann, *Beyond Tax Credits*, *supra* note 18, at 319–23 (comparing the policy efficiency of federal tax credits and cash subsidies for wind energy deployment).

In light of the above, it is easy to see why equity should not be misconstrued as the trump card in the clean energy policy deck. Rather, it is one consideration among many for policymakers to balance in a multi-factorial framework. And there may well be instances where deviations from equity's tenet of a commensurate distribution of costs and benefits are called for, for example in the interest of universal access to electric service. One such instance is reflected in the "lifeline rates" encouraged by the 1978 Public Utility Regulatory Policies Act to meet the essential needs of low-income residential consumers by offering electricity at rates below the utility's actual cost.[61] The cross-subsidization inherent in these and other discount energy programs for low-income households results in an uneven distribution of economic benefits and costs. But that distortionary effect should not a priori eliminate them from the public policy toolbox. After all, cross-subsidies can serve efficiency as well as other important social goals.[62] This Article's equity lens helps draw attention to cross-subsidies and other mismatches between the allocation of costs and benefits in order to facilitate the public scrutiny necessary to ensure that they are, in fact, used in furtherance of important public policy objectives, and not for hand-outs to special interest groups or pork barreling.[63]

II. CLEAN ENERGY POLICY TODAY: AN OVERVIEW

Policies to promote solar, wind, and other renewable energy technologies can take a variety of forms. Economists have long suggested that pricing greenhouse gas emissions, in the form of a carbon tax[64] or cap-and-trade regime,[65] is, in theory at least, the single most efficient policy to mitigate climate change and promote abatement technologies, such as solar, wind, and other low-carbon renewables.[66] A price on greenhouse gas emissions would require producers to internalize the cost of their emissions and thereby penalize pollution and encourage abatement. Over time, this direct, static effect would be complemented by an indirect, dynamic effect of encouraging the refinement of existing and development of new abatement

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[61] *See* 16 U.S.C. § 2624. For a review of electricity rate discount programs in the United States, see STEVEN FERREY, THE LAW OF INDEPENDENT POWER § 10:17 (2018).

[62] *See* Rule, *supra* note 17, at 131, 133.

[63] *See, e.g.*, CHARLES WEISS & WILLIAM B. BONVILLIAN, STRUCTURING AN ENERGY TECHNOLOGY REVOLUTION 208 (2009) (noting the risk of pork barreling inherent in energy policy incentive programs).

[64] *See, e.g.*, Gilbert E. Metcalf & David Weisbach, *The Design of a Carbon Tax*, 33 HARV. ENVTL. L. REV. 499 (2009).

[65] *See, e.g.*, Ann E. Carlson, *Designing Effective Climate Policy: Cap-and-Trade and Complimentary Policies*, 49 HARV. J. ON LEGIS. 207 (2012).

[66] *See, e.g.*, NICHOLAS STERN, THE ECONOMICS OF CLIMATE CHANGE 348 (2007); Dominique Finon, *Pros and Cons of Alternative Policies Aimed at Promoting Renewables*, 12 EIB PAPERS 110, 112 (2007); Adam B. Jaffe et al., *A Tale of Two Market Failures: Technology and Environmental Policy*, 54 ECOLOGICAL ECON. 164, 165, 169 (2005); Atanas Kolev & Armin Riess, *Environmental and Technology Externalities: Policy and Investment Implications*, 12 EIB PAPERS 134, 140 (2007).

technologies.[67] From an efficiency perspective, a tax on greenhouse gas emissions or a cap-and-trade scheme would incur lower opportunity costs than direct public policy support for specific clean energy technologies.[68] Notwithstanding its theoretical appeal, the adoption of a nationwide or, better yet, global policy regime that accurately prices the societal cost of greenhouse gas emissions is politically unlikely in the near-to-medium term.[69] Accordingly, this Article focuses its equity inquiry on policies directly aimed at promoting the large-scale deployment of solar, wind, and other renewables.

Around the world, feed-in tariffs (*infra* Section II.A.) dominate the clean energy policy landscape, followed by tender regimes (*infra* Section II.B.) and net energy metering programs (*infra* Section II.C.).[70] In the United States, federal policy support for renewables comes primarily in the form of tax credits[71] (*infra* Section II.D.) while twenty-nine states, three territories, and the District of Columbia have adopted renewable portfolio standards (*infra* Section II.E.) to promote solar, wind, and other renewables.[72]

A. Feed-in Tariffs

Feed-in tariffs are two-pronged policy instruments for the promotion of renewables deployment.[73] The "feed-in" prong guarantees renewable power generators access to their local power grid in order to ensure viable sales and

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[67] *See* Kolev & Riess, *supra* note 66, at 137 (discussing the impact of environmental policy on technological change).

[68] *See* Felix Mormann, *Requirements for a Renewables Revolution*, 38 ECOLOGY L.Q. 901, 929 (2011) [hereinafter Mormann, *Renewables Revolution*].

[69] For issues related to the political economy of emission pricing, see *id.* at 930–32. For evidence of the failed campaigns for a federal cap-and-trade regime, see S. 1733, 111th Cong. (2010) and H.R. 2454, 111th Cong. (2009). *See also* Gary Lucas, Jr., *Voter Psychology and the Carbon Tax*, 90 TEMPLE L. REV. 1 (2017) (discussing how a variety of biases and heuristics influence the electorate's perception of carbon taxation).

[70] *See* REN21 2015, *supra* note 4, at 89 (listing nearly eighty countries with feed-in tariffs, sixty with tender regimes, and close to fifty with net energy metering programs).

[71] *See* Mormann, *Beyond Tax Credits*, *supra* note 18, at 311–17, 319–23 (describing and critiquing federal tax credit support for renewable energy in the United States).

[72] *See* N.C. CLEAN ENERGY TECH. CTR., RENEWABLE PORTFOLIO STANDARD POLICIES 1 (2017), http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2014/11/Renewable-Portfolio-Standards.pdf [https://perma.cc/J2TQ-VVTF]. Eight more states and one U.S. territory have adopted nonbinding goals for the deployment of renewables. *See id.* For a discussion of the history and political background of state renewable portfolio standards, see Barry Rabe, *Race to the Top: The Expanding Role of U.S. State Renewable Portfolio Standards*, 7 SUSTAINABLE DEV. L. & POL'Y 10, 10 (2007).

[73] Wilson H. Rickerson et al., *If the Shoe FITs: Using Feed-in Tariffs to Meet U.S. Renewable Electricity Targets*, 20 THE ELECTRICITY J. 73, 73 (2007). For a detailed description of the various feed-in tariff design elements, see MIGUEL MENDONÇA ET AL., POWERING THE GREEN ECONOMY – THE FEED-IN TARIFF HANDBOOK 15–16 (2010).

distribution channels for their electricity.[74] The "tariff" prong requires local electric utilities to purchase the power output of these generators at above-market rates that are designed to cover the generator's cost and offer a reasonable return on investment.[75] These rates can be set as a fixed total price for electricity from renewables, a premium to be paid in addition to the market price, or a percentage of retail rates.[76] While renewable portfolio standards let the market determine trading prices for renewable energy credits and, hence, the overall value of renewable electricity, feed-in tariffs require regulators to set tariff rates at a level that is high enough to effectively incentivize investment in renewable power generation without offering windfall profits.[77] Like portfolio standards, feed-in tariffs pass the costs of premium payments for renewable energy onto ratepayers.[78] Feed-in tariffs are usually technology-specific, offering different tariff rates for different strands of renewable energy technologies based on their respective technological maturity and generation costs.[79] In addition, feed-in tariff design can be size-sensitive so as to account for the different cost structures of utility-scale and distributed generation.[80] Historically, feed-in tariffs have been particularly popular in European countries such as Denmark, Germany, Portugal, and Spain.[81] Recent U.S. adopters of feed-in

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[74] Rickerson et al., *supra* note 73, at 1.

[75] The first-ever feed-in tariff in the United States, implemented with great success by the municipality of Gainesville, Florida, was designed to offer a return on investment of five to six percent. *See* KARLYNN CORY ET AL., NAT'L RENEWABLE ENERGY LAB., FEED-IN TARIFF POLICY: DESIGN, IMPLEMENTATION, AND RPS POLICY INTERACTIONS (2009), https://www.nrel.gov/docs/fy09osti/45549.pdf [https://perma.cc/N3MP-PMNK]. The duration of the utility's purchase obligation under a feed-in tariff ranges from 8 years in Spain to 15 years in France to 20 years in Germany. *See* Finon, *supra* note 66, at 115.

[76] The second option is sometimes referred to as a "feed-in premium" or "premium feed-in tariff." *See* MENDONÇA ET AL., *supra* note 73, at 40. For an example of the retail rate percentage option. *See* Butler & Neuhoff, *supra* note 15, at 1855. Unless expressly stated otherwise, this Article refers to all of these options uniformly as feed-in tariffs.

[77] MENDONÇA ET AL., *supra* note 73, at 19.

[78] *Id.* at 29.

[79] *Id.* For an example of cost reductions through technology learning in solar photovoltaics and onshore wind energy, see IPCC, RENEWABLE ENERGY SOURCES, *supra* note 2.

[80] MENDONÇA ET AL., *supra* note 73, at 27.

[81] *See* IEA 2008, *supra* note 15, at 94. For further background, see David Grinlinton & LeRoy Paddock, *The Role of Feed-in Tariffs in Supporting the Expansion of Solar Energy Production*, 41 U. TOL. L. REV. 943, 949 (2010). More recently, many jurisdictions outside of Europe have adopted FITs to promote renewable energy, including the Canadian province of Ontario, South Africa, Kenya, the Indian states West Bengal, Rajasthan, Gujarat, and Punjab, as well as Australia's Capital Territory, New South Wales, and South Australia. *See* MENDONÇA ET AL., *supra* note 73, at 77.

tariff programs to promote renewables include California,[82] Hawaii,[83] Maine,[84] Oregon,[85] Rhode Island,[86] Vermont,[87] and Washington.[88]

B. Tender Regimes

Under a tender regime—sometimes described as a reverse auction mechanism[89]—the government invites competitive bids to supply a specified amount of electricity from a certain renewable energy technology over a pre-determined period of time.[90] The successful bidder is awarded a long-term power purchase contract at its winning bid's price per kilowatt hour (kWh). The additional cost, i.e., the winning bid's premium over the market rate of electricity, is usually recovered through a levy or system benefits charge that is distributed across all ratepayers.[91] Tender regimes are inherently technology-specific, as the call for bids specifies the eligible strand of renewable energy technologies.[92]

China, France, Ireland, the United Kingdom, and some states in the United States have used tender regimes to promote the deployment of various renewable

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[82] *See* S.B. 32, 2007-2008 Sess. (Cal. 2008).

[83] *See* HAW. PUB. UTIL. COMM'N, DECISIONS AND ORDERS, DOCKET 2008-0273, (2008).

[84] *See* An Act to Establish the Renewable Energy Feed-in Tariff, S.P. 367, 126th Leg., (Me. 2013).

[85] *See* H.B. 3039, 75th Gen. Assemb. Reg. Sess. (Or. 2009); H.B. 3690, 75th Leg. Spec. Sess. (Or. 2010).

[86] *See* H.B. 6104 (R.I. 2011).

[87] *See* Public Act No. 45, Bien. Sess. (Vt. 2009); Public Act No. 170, Adj. Sess. (Vt. 2012).

[88] *See, e.g.*, S.B. 5101, 66th Leg. Reg. Sess. (Wash. 2005); S.B. 6170, 61st Leg. Reg. Sess. (Wash. 2009); S.B. 6658, 61st Leg. Reg. Sess. (Wash. 2010).

[89] *See* Christian Jaag & Urs Trinkner, *Tendering Universal Service Obligations in Liberalized Network Industries*, 10 COMPETITION & REG. NETWORK INDUSTRIES 314 (2009), http://www.swiss-economics.ch/RePEc/files/0013JaagTrinkner.pdf [https://perma.cc/2LBA-KEJ6] (providing an introduction to the terminology and mechanics of tender regimes / reverse auction mechanisms in liberalized markets).

[90] *See* Claus Huber et al., *Economic Modelling of Price Support Mechanisms for Renewable Energy: Case Study on Ireland*, 35 ENERGY POL'Y 1172 (2007); IEA 2008, *supra* note 15, at 92 (providing further information on tender regimes in the renewable electricity context).

[91] Robert Gross & Phil Heptonstall, *Time to Stop Experimenting with UK Renewable Energy Policy* 8 (Imperial Coll. Ctr. for Energy Policy and Tech., Working Paper No. ICEPT/WP/2010/003, 2010), http://www.biee.org/wpcms/wp-content/uploads/Time_to_stop_experimenting_with_UK_renewable_energy_policy_2010_pap.pdf [https://perma.cc/S35X-XKHR].

[92] *See* MENDONÇA ET AL., *supra* note 73, at 174–75.

energy technologies.[93] Denmark, too, has recently relied on tender regimes for offshore wind farms.[94]

C. Net Energy Metering Programs

Net energy metering has evolved into the primary mechanism for tracking and rewarding distributed renewable energy generation in the United States.[95] Following the policy's early adoption by Idaho, Arizona, and Massachusetts back in the 1980s, net metering has since proliferated to over forty states.[96] Notwithstanding some variation across programs, net energy metering generally allows an electric utility's customer to run her meter forward while consuming power from the grid and backward while feeding power into the grid, e.g., from solar panels on her rooftop.[97] At the end of the billing period, the utility charges the customer for the amount of power consumed from the grid minus power generated on-site and fed into the grid.[98] So long as the customer-generator, on balance, consumes more electricity from the grid than she feeds in, her locally generated power is effectively remunerated at the retail electricity rate.[99]

D. Tax Credits

For more than two decades, tax incentives have been the federal policy of choice to promote the deployment of renewable energy technologies.[100] These tax breaks come primarily in the form of two distinct instruments—accelerated

[93] *See, e.g.*, Bent Ole Gram Mortenson, *International Experiences of Wind Energy*, 2 ENVTL. & ENERGY L. & POL'Y J. 179, 201 (2008); Reinhard Haas et al., *A Historical Review of Promotion Strategies for Electricity from Renewable Energy Sources in EU Countries*, 15 RENEWABLE & SUSTAINABLE ENERGY RES. 1003, 1020 (2011); MENDONÇA ET AL., *supra* note 73, at 174–75.

[94] Haas et al., *supra* note 16, at 1020.

[95] *See* REN21 2015, *supra* note 4, at 89; *see also* U.S. ENERGY INFO. ADMIN., U.S. DEP'T ENERGY, DIRECT FED. FIN. INTERVENTIONS & SUBSIDIES IN ENERGY IN FISCAL YEAR 2013 (2015), https://www.eia.gov/analysis/requests/subsidy/archive/2013/pdf/subsidy.pdf.

[96] *See* Richard L. Revesz & Burcin Unel, *Managing the Future of the Electricity Grid: Distributed Generation and Net Metering*, 41 HARV. ENVTL. L. REV. 43, 47, 59 (2017).

[97] *See, e.g.*, EDISON ELEC. INST., STRAIGHT TALK ABOUT NET METERING 1–2 (2013).

[98] *See, e.g.*, Steven Ferrey, *Solving the Multimillion Dollar Constitutional Puzzle Surrounding State "Sustainable" Energy Policy*, 49 WAKE FOREST L. REV. 121, 128–29 (2014).

[99] *See, e.g.*, NAIM R. DARGHOUTH ET AL., LAWRENCE BERKELEY NAT'L LAB., NET METERING AND MARKET FEEDBACK LOOPS: EXPLORING THE IMPACT OF RETAIL RATE DESIGN ON DISTRIBUTED PV DEPLOYMENT 1 (2015), http://emp.lbl.gov/sites/all/files/lbnl-183185_0.pdf [https://perma.cc/Q43S-QDPW].

[100] *See* Mark Bolinger et al., *Preliminary Evaluation of the Section 1603 Treasury Grant Program for Renewable Power Projects in the United States*, 38 ENERGY POL'Y 6804 (2010).

depreciation rates[101] and tax credits.[102] From an economic perspective, tax credits tend to be of relatively greater importance to renewable energy deployment than accelerated depreciation.[103] Accordingly, this Article focuses on tax credits. Federal tax policy seeks to promote the deployment of renewable energy technologies through two types of credits. Production tax credits reward the generation of electricity from renewable sources by awarding eligible facilities tax credits in proportion to the quantity of electricity they produce and feed into the grid.[104] Investment tax credits honor capital expenditures in equipment for renewable power generation by awarding eligible projects tax credits equal to a percentage of their qualifying investment costs.[105] The Consolidated Appropriations Act of 2016 recently extended tax credits for solar and wind by another five years.[106]

E. Renewable Portfolio Standards

A renewable portfolio standard, also known as a renewable target or quota obligation, requires electric utility companies to source a certain share of the electricity they sell to end-users from renewable sources of energy.[107] Utilities prove their compliance with these requirements through "renewable energy credits" (RECs).[108] Power plant operators normally receive one such credit for every megawatt hour (MWh) of electricity generated from renewable resources.[109] Non-utility power generators can sell their renewable energy credits to utilities in order to receive a premium on top of their income from power sales in the wholesale electricity market. Utilities subject to a renewable portfolio standard's sourcing requirements can also invest in their own renewable power generation facilities to earn renewable energy credits for the electricity they produce. Whether utilities choose to earn their own credits or purchase them from others, they eventually pass

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[101] *See generally* Tax Reform Act of 1986, Pub. L. No. 99-514, 100 Stat. 2085 (1986). (creating the accelerated depreciation rates that renewable energy assets enjoy today).

[102] *See generally* Energy Policy Act of 1992, Pub. L. No. 102-486, 106 Stat. 2776 (1992) (creating the first Federal tax credits for renewable energy for wind power).

[103] *See* Chadbourne & Parke LLP, *State of the Tax Equity Market*, PROJECT FINANCE NEWSWIRE 28, 29 (2012). In fact, one industry insider has stated that "[m]any tax equity investors have turned their noses up at the bonus [depreciation rates]." *Id.* at 33.

[104] *See* 26 U.S.C. § 45 (2018).

[105] *See* 26 U.S.C. § 48 (2018).

[106] *See* Felix Mormann, *Fading into the Sunset: Solar and Wind Get Five More Years of Tax Credits with a Phase-Down*, 47 ABA TRENDS 9, 9–10 (2016).

[107] For details, see Haas et al., *supra* note 16, at 1011–12; MENDONÇA ET AL., *supra* note 73, at 150–51.

[108] MENDONÇA ET AL., *supra* note 73, at 161. Internationally, renewable energy credits are also referred to as Tradable Green Certificates or Renewable Energy Guarantees of Origin. *Id.* at 155.

[109] *See* Lincoln L. Davies, *Power Forward: The Argument for a National RPS*, 42 CONN. L. REV. 1339, 1359, 1378 (2010) (reporting that some states award RECs for every kWh of renewable electricity generation).

the associated costs on to their ratepayers.[110] Many portfolio standards are technology-neutral and award the same amount of credits for all eligible renewable energy technologies. More and more jurisdictions, however, implement technology-specific renewable portfolio standards, that offer carve-outs or credit multipliers for select renewable energy technologies and projects based on size and location.[111] In 1983, Iowa became the first state in the union to adopt a renewable portfolio standard.[112] Today, twenty-nine states, the District of Columbia, and three U.S. territories have adopted portfolio standards to promote the large-scale deployment of renewable energy technologies.[113] International adopters of renewable portfolio standard policies include Australia, Belgium, Sweden, and the United Kingdom.[114]

III. ASSESSING THE EQUITY OF TODAY'S CLEAN ENERGY POLICIES

This Part explores the policy equity of a representative sampling of clean energy policies in place today. The costs and benefits generated under a policy vary in terms of the immediacy and saliency of their accrual. The monetary incentives offered and the taxes or charges imposed to fund them represent the type of benefits and costs that are relatively easy to attribute to a specific clean energy policy. In addition to these *direct* costs and benefits, the following inquiry also considers a policy's more *indirect* impacts on participants in the respective energy economy, such as the burden on ratepayers to fund balancing services for intermittent renewables or wholesale market price reductions resulting from the displacement of less efficient and more expensive peaker plants.[115]

It is important to note that the present assessment is limited to select *economic* impacts and does not extend to a policy's impact on greenhouse gas emissions, air pollution, or other *environmental* outcomes. The decision to exclude environmental costs and benefits from the scope of inquiry is motivated by two observations. First, assuming their effectiveness in facilitating the intended deployment of solar, wind and other clean energy technologies, all of the examined policies should yield similar

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[110] *See id.* at 1374.

[111] *See* Felix Mormann, *Constitutional Challenges and Regulatory Opportunities for State Climate Policy Innovation*, 41 HARV. ENVTL. L. REV. 189, 198 (2017) [hereinafter Mormann, *State Climate Policy Innovation*].

[112] *See* Davies*, supra* note 109, at 1357.

[113] *See* N.C. CLEAN ENERGY TECH. CTR., RENEWABLE PORTFOLIO STANDARD POLICIES (2015), http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2014/11/Renewable-Portfolio-Standards.pdf [https://perma.cc/J2TQ-VVTF]. Eight more states and one U.S. territory have adopted nonbinding goals for the deployment of renewables. *Id.* For a discussion of the history and political background of state renewable portfolio standards, see Barry Rabe, *Race to the Top: The Expanding Role of U.S. State Renewable Portfolio Standards*, 7 SUSTAINABLE DEV. L. & POL'Y 10 (2007).

[114] *See* MENDONÇA ET AL., *supra* note 73, at 151; IEA 2008, *supra* note 15, at 94–95.

[115] *See also* Revesz & Unel, *supra* note 96, at 78–79 (offering a similar taxonomy in their exploration of the impact of distributed generation on the "parties involved in the transactions that take place in the electricity market").

environmental benefits.[116] When controlling for variations in deployment efficacy, differences in net carbon reduction, air pollution abatement and other environmental outcomes are more likely attributable to the respective electricity market's pre-existing resource mix and other exogenous factors than to the underlying policy.[117] Second, most of the environmental benefits delivered by clean energy technologies and their enabling policies accrue at a regional, if not global level, with limited potential for appropriation and exclusion, raising fewer equity concerns than their economic counterparts.[118]

As always, when evaluating and comparing policies, it is important to differentiate between general issues related to policy equity that arise from a policy's conception and more particularized issues that result from the specific implementation of said policy. In a world without resource constraints (or word limits), increasing the sample size to ten or more case studies per policy might facilitate a better differentiation between concept- and implementation-related issues. A sampling of fifty-plus policies, however, would likely require sacrificing analytical depth for jurisdictional breadth. The following inquiry, therefore, is limited to one representative case study for each of today's five most dominant clean energy policies. Unless otherwise indicated, any insights apply only to the policy as implemented in that particular case. The choice of case studies was based on the availability of pertinent data as well as the respective jurisdiction's role as a thought leader and role model for the policy in question.

To facilitate a better comparison across policies, policy equity is rated on a four-step scale ranging from poor to moderate to good to excellent, applied to the matching of direct and indirect costs and benefits, respectively. Table 1 illustrates this qualitative grading scale.

Rating	**Policy Equity Characteristics**
Excellent	Matching distribution of costs and benefits
Good	Substantial match in distribution of costs and benefits
Moderate	Partial match in distribution of costs and benefits
Poor	Severe mismatch in distribution of costs and benefits

Table 1: Rating Scale and Criteria for Case Study Analysis

116 The same rationale motivates the exclusion of macro-economic benefits, such as job creation and tax revenue. For an international discussion of the employment effects of tax incentives, feed-in tariffs, and renewable portfolio standards, among other policies, see Mormann et al., *supra* note 8, at 74–76 (comparing job creation across California, Texas, and Germany); *see also* Welton & Eisen, *supra* note 17, at 28–35 (exploring the distribution of "green jobs").

117 Which policy delivers the greatest environmental bang for the ratepayers' or taxpayers' buck is a separate question, explored in detail, in the rich literature focused on the relative efficiency of clean energy policies. *See supra* note 15.

118 *See, e.g.*, Mormann, *Clean Energy Federalism*, *supra* note 14, at 1638–41 (surveying the various environmental benefits associated with solar, wind, and other clean energy technologies as well as the scope of their accrual).

A. Feed-in Tariffs – Case Study Germany

Germany's feed-in tariff experience has elicited a mixed response. Some praise the country's "healthy" feed-in tariff and the resulting "proliferation of solar systems."[119] Others consider it "clear that the transformation, if plausible, will be wrenching"[120] as "German families are being hit by rapidly increasing electricity rates."[121] This critique reflects concern over the social implications of Germany's feed-in tariff implementation to promote solar, wind, and other low-carbon renewables. Based on this Article's inquiry, the German feed-in tariff system scores moderately in overall terms of policy equity's tenet of commensurately matching the program's costs and benefits.

On the positive side, the German feed-in tariff system creates direct economic opportunities open to a wide swath of the country's population. Unlike competing policies,[122] feed-in tariffs incur very low transaction costs thanks, in large part, to the local utility's obligation to execute a power purchase agreement based on standard terms that guarantee the full tariff payment without the need for time-consuming and, hence, costly negotiations. It is up to the local utility in cooperation with other network operators to recover the cost of the feed-in tariff from its ratepayers.[123] In addition, Germany's system of feed-in tariffs differentiates among a diverse portfolio of technologies, project sizes and sites to create a wide range of development opportunities. In total, the Renewable Energy Sources Law establishes some thirty different tariffs custom-tailored to address the needs of over ten distinct renewable energy technologies and applications while also accounting for differences in size, location, etc.[124] The hair in Germany's feed-in tariff soup, as far as access to its economic benefits is concerned, lies in the fact that, as a general matter, only owners of real property but no tenants can make use of the program's financial incentives.

The German feed-in tariff's overall equity rating is brought down by its regime for allocating direct program costs. Critics of Germany's *Energiewende*[125] decry that

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[119] John Pang et al., *Germany's Energiewende*, 152 PUB. UTIL. FORT. 14, 14 (2014).

[120] Justin Gillis, *Sun and Wind Alter Global Landscape, Leaving Utilities Behind*, N.Y. TIMES, Sept. 13, 2014, at A1.

[121] Melissa Eddy & Stanley Reed, *Germany's Effort at Clean Energy Proves Complex*, N.Y. TIMES, Sept. 18, 2013, at A6; *see also* Matthew Karnitschnig, *Germany's Expensive Gamble on Renewable Energy*, WALL ST. J. (Aug. 26, 2014), http://www.wsj.com/articles/germanys-expensive-gamble-on-renewable-energy-1409106602 [https://perma.cc/69ZP-53SS].

[122] *See infra* Sections III.D–E.

[123] *See* MENDONÇA ET AL., *supra* note 73, at xxii fig.0.1 (offering an instructive overview of the flow of payments under Germany's feed-in tariff).

[124] *See* Erneuerbare-Energien-Gesetz [EEG] [Renewable Energies Act], July 21, 2014, §§ 40—51 (Ger.), http://www.gesetze-im-internet.de/bundesrecht/eeg_2014/ge-samt.pdf [https://perma.cc/5VCV-J4CX].

[125] For an introduction to Germany's ambitious energy policy, sometimes translated as "energy transition," see FED. MINISTRY OF ECON. AND TECH., GERMANY'S NEW ENERGY

"German families are being hit by rapidly increasing electricity rates" and "[b]usinesses are more and more worried that their energy costs will put them at a disadvantage to competitors in nations with lower energy costs . . . ."[126] These concerns are warranted insofar as the levy imposed on residential ratepayers to finance Germany's commitment to renewables has steadily grown in recent years, accounting for eight cents per kWh or 24 percent of average residential retail rates in 2017.[127] Overall, however, the feed-in tariff surcharge is only the second largest driver of residential power pricing, behind grid-related charges (26 percent) but ahead of energy procurement costs (19 percent) and applicable taxes (23 percent).[128]

The main criticism to be leveled against Germany's feed-in tariffs, from an equity perspective, is that the cost burden is not spread evenly among ratepayers. The Renewable Energy Sources Law exempts nearly 2,000 electricity-intensive industrial customers, such as large-scale chemical, steel, and paper industries, from part, if not all, of the feed-in tariff levy.[129] When those who consume the most electricity contribute the least—if anything—to funding policies for the energy economy's decarbonization, policy equity suffers due to the mismatch between widely available economic benefits but selectively borne costs.[130]

Germany's feed-in tariffs perform moderately as far as indirect program costs and benefits are concerned. On the positive side, the "merit-order effect" that determines the order in which network operators call on, or dispatch, available

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POL'Y (2012), http://www.bmwi.de/English/Redaktion/Pdf/germanys-new-energy-policy [https://perma.cc/44PM-3JFF].

[126] Eddy & Reed, *supra* note 121.

[127] *See* BUNDESVERBAND DER ENERGIE UND WASSERWIRTSCHAFT, ERNEUERBARE ENERGIEN UND DAS EEG: ZAHLEN, FAKTEN, GRAFIKEN 29 (2017), https://www.bdew.de/media/documents/Awh_20170710_Erneuerbare-Energien-EEG_2017.pdf [https://perma.cc/P46T-XTMB] [hereinafter BDEW 2017].

[128] *Id*.

[129] *See* BUNDESVERBAND DER ENERGIE UND WASSERWIRTSCHAFT, ERNEUERBARE ENERGIEN UND DAS EEG: ZAHLEN, FAKTEN, GRAFIKEN 51 (2014), https://www.bdew.de/internet.nsf/id/bdew-publikation-erneuerbare-energien-und-das-eeg-zahlen-fakten-grafiken-2014-de/$file/Energie-Info_Erneuerbare% 20Energien%20und%20das%20EEG%202014_korr%2027.02.2014_final.pdf [https://perma.cc/K9JQ-C35K] [hereinafter BDEW 2014]; *see also* Mormann et al., *supra* note 8, at 73 (placing Germany's electricity cost in international and macroeconomic context); BDEW 2017, *supra* note 127, at 33 (estimating that, in 2017, exempt industrial ratepayers consumed 140 TWh while paying only a fraction, if any, of the feed-in tariff levy).

[130] The German legislature's decision to exempt major industrial players from funding the nation's feed-in tariff is a good example of the multi-factorial decisionmaking process that policymakers have to engage in. From a social perspective, the exemption may have been viewed as the only way (short of border adjustments made difficult by the country's E.U. membership) to ensure the domestic industry's international competitiveness and, with it, local employment, tax revenue, and other economic benefits. This Article's equity inquiry renders no judgment on the validity of such reasoning, simply seeks to draw attention to the resulting cross-subsidization to allow readers to form their own opinion. *See also supra* Section I.C.

generators,[131] has allowed the growing share of renewable power generators to push older, higher-cost—and frequently higher-emitting—generators out of the market. Between 2008 and 2013, this indirect program benefit has helped to reduce wholesale electricity prices by over 50 percent.[132]

On the negative side, the German policymaker has privileged renewables by exempting them from the forecast and balancing responsibilities of forward power markets.[133] In these markets, generators typically offer to supply electricity to the system operator for five-minute intervals on a day-ahead basis.[134] The following day, when the relevant five-minute window opens, the generator has to deliver the promised amount of electricity or else compensate the system operator under their imbalance settlement for balancing services the latter uses to cover for the generator's lack of performance under their contract. As a concession to their weather-dependency and the resulting output intermittency of solar and wind generators, this exemption made sense early on when weather data and forecast models were lacking and the overall market share of these intermittent generators was still small.[135]

As forecasts have improved and market shares have grown, however, such exemption privileges are no longer required, especially for utility-scale installations. Otherwise, these generators externalize the cost of their intermittency with ratepayers picking up the tab for balancing services provided by other generators filling in for no-show renewables. Over the course of four years, Germany saw a near fivefold increase in network operator requests to power plant operators to adjust their output to maintain grid stability from 209 requests in 2010 to 1,009 requests in 2013.[136] Recently, Germany has begun to offer additional incentives for renewable

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[131] *See* HANS POSER ET AL., FINADVICE, DEVELOPMENT AND INTEGRATION OF RENEWABLE ENERGY: LESSONS LEARNED FROM GERMANY 37 (2014), https://docs.wind-watch.org/germany-lessons-learned-0714.pdf [https://perma.cc/KQZ8-L3KP] ("[T]he offer curve of a power market is determined by the marginal costs in ascending order of the available power sources. This is the so-called merit order."); *see also* Emily Hammond & David B. Spence, *The Regulatory Contract in the Marketplace*, 69 VAND. L. REV. 141, 154 (2016) ("[W]hen the grid operator dispatches power from individual electric generating facilities to the grid, it does so on a least-cost basis.").

[132] *See* POSER ET AL., *supra* note 131, at 3–4, 37–38; *see also* EDITH BAYER, AGORA ENERGIEWENDE, REPORT ON THE GERMAN POWER SYSTEM 22 (2015), http://www.agora-energiewende.de/fileadmin/downloads/publikationen/CountryProfiles/Agora_CP_Germany_web.pdf [https://perma.cc/MX3N-UY9W].

[133] For an introduction to the architecture of the electricity market, see Corinna Klessmann et al., *Pros and Cons of Exposing Renewables to Electricity Market Risks—A Comparison of the Market Integration Approaches in Germany, Spain, and the UK*, 36 ENERGY POL'Y 3646, 3647 (2008).

[134] *Id.*

[135] *See* Mormann, *Renewables Revolution*, *supra* note 68, at 957 (calling for exemptions from forecast and balancing responsibilities for intermittent renewables early in the innovation cycle).

[136] *See* Julia Mengewein, *German Utilities Bail Out Electric Grid at Wind's Mercy*, BLOOMBERG (July 25, 2014), https://www.bloomberg.com/news/articles/2014-07-

power generators to enter—and play by the rules of—the country's wholesale power markets.[137] In the meantime, however, the existing renewables fleet continues to enjoy carte blanche—incurring indirect program costs borne by ratepayers who have to pay for costly balancing services.

B. Tender Regimes – Case Study Ireland

As one of the policy's earliest adopters, Ireland's experience with competitive tenders to promote renewable energy has become the subject of intense study by scholars around the world.[138] Limited supply of indigenous fuel resources, a peripheral location restricting electricity imports from the rest of Europe, and the presence of high-quality wind resources led Irish policymakers to adopt the Alternative Energy Requirement (AER) to accelerate the deployment of renewables.[139] During the course of six bidding rounds held over a period of ten years, renewable energy projects with a total nameplate capacity of 1,130 megawatts (MW) were awarded long-term power purchase agreements.[140] In terms of policy equity, Ireland's AER tender regime matches direct costs and benefits moderately but receives poor marks for its treatment of indirect costs.

The Irish tender regime has a mixed track record when it comes to the scope of economic benefits it creates. The AER earns points for its sensitivity to the varied generation cost profiles of different renewable energy technologies, requiring bidders to compete only within the same technology strand.[141] The first AER auction, for example, solicited separate bids for specified amounts of capacity to be provided by wind, hydro, biomass, and cogeneration, respectively.[142] Ireland's tender regime further differentiates between renewable power projects based on their size, carving out, for example, separate bidding areas for small- and large-scale wind projects.[143]

24/german-utilities-bail-out-electric-grid-at-wind-s-mercy [https://perma.cc/D2SL-SKPR] (reporting data for Tennet TSO, Germany's second-largest grid operator).

[137] *See* MATT CROUCHER ET AL., AZ SMART, MARKET-BASED INCENTIVES 23–29 (2010).

[138] *See, e.g.*, SIMONE STEINHILBER, AUCTIONS FOR RENEWABLE ENERGY SUPPORT IN IRELAND: INSTRUMENTS AND LESSONS LEARNT (2016); Huber et al., *supra* note 90; BRIAN P. Ó GALLACHÓIR ET AL., WIND ENERGY POLICY DEVELOPMENT IN IRELAND – A CRITICAL ANALYSIS (2002); RYAN WISER, BERKELY LAB & CLEAN ENERGY GROUP, THE U.K. NFFO AND IRELAND AER COMPETITIVE BIDDING SYSTEMS (2002).

[139] *See* CROUCHER ET AL., *supra* note 137, at 52; Ó GALLACHÓIR ET AL., *supra* note 138.

[140] *See* H.J. DE VRIES ET AL., ENERGY RESEARCH CTR. OF THE NETHERLANDS, RENEWABLE ELECTRICITY POLICIES IN EUROPE 61 (2003); CROUCHER ET AL., *supra* note 137, at 55. From an efficacy perspective, the main criticism of Ireland's AER is that only about a third of all contracted capacity was actually installed by 2015. *See* STEINHILBER, *supra* note 138, at 11.

[141] *See* STEINHILBER, *supra* note 138, at 12.

[142] *See* DE VRIES ET AL., *supra* note 140, at 57–58; CROUCHER ET AL., *supra* note 137, at 55.

[143] *See* DE VRIES ET AL., *supra* note 140, at 57–58.

The AER's sensitivity to generation technology and size, however, is largely outweighed by its inability to mobilize a wider range of bidders. The high up-front cost required to prepare a competitive bid and the uncertainty of its eventual pay-off discourage the vast majority of potential bidders. Only institutional actors or incumbent utilities—who possess sufficient overhead capacity and industry-specific knowledge—tend to be willing to assume the risk of preparing and submitting a costly but ultimately unsuccessful bid. The tender procedure itself has been characterized as "a bureaucratic process with several application deadlines which create busy periods for those involved . . . and therefore staffing and time management problems."[144] In the case of Ireland's AER, these tender-typical policy challenges are exacerbated by the fact that auctions took place at irregular intervals with constantly changing technology preferences leaving potential bidders with little, if any, ability to plan ahead.[145] A lack of transparency resulting from the classification of contract prices awarded under the AER as commercially sensitive information reduces incentives for new market entrants.[146]

Ireland's AER receives moderate marks for matching direct costs and benefits. The national utility company recovers the extra costs incurred under its tender awards through a Public Service Obligation levy.[147] Unlike Germany's feed-in tariff levy that, in the interest of international economic competitiveness, exempts energy-intensive industrial electricity customers, the Irish levy applies without exemption spreading the financial burden across all ratepayers.[148] Even in the wake of growing unrest over the economic impact of Brexit, Irish regulators remain steadfast in their refusal to lower the levy for corporate electricity customers.[149]

The AER misses a higher policy equity rating, however, because the levy's administration as a flat rate—largely decoupled from a ratepayer's overall electricity consumption[150]—gives it the effect of a regressive tax that imposes a disproportionately large burden on low-income ratepayers. In fact, higher-volume electricity customers might well be able to recover part, or even all, of their flat rate levy through reductions in volumetric electricity rates thanks to the merit-order effect of AER-deployed renewables in the wholesale market.[151] This disparity is all

[144] Catherine Mitchell, *The Renewables NFFO—A Review*, 23 ENERGY POL'Y 1077, 1086 (1995).

[145] *See* STEINHILBER, *supra* note 138, at 12.

[146] *Id.* at 13.

[147] *See* SHRUTI SHUKLA & STEVE SAWYER, INTERNATIONAL RENEABLE ENERGY AGENCY, 30 YEARS OF POLICIES FOR WIND ENERGY: LESSONS FROM 12 WIND ENERGY MARKETS 99 (2012).

[148] *See* COMM'N FOR ENERGY REG., PUBLIC SERVICE OBLIGATION LEVY 2016/17, at 4 (2016).

[149] *Id.* at 18–20.

[150] The Public Service Obligation levy distinguishes between three different classes of customers—households, small commercial, and medium to large electricity customers. *Id.* at 4–5.

[151] *See supra* note 129 and accompanying text; *see also* DE VRIES ET AL., *supra* note 140, at 57–58.

the more problematic considering that the levy's flat-rate structure hits those hardest who, for the reasons outlined above,[152] are least likely to partake in the economic benefits created by Ireland's tender regime.

The AER performs poorly in terms of indirect costs and benefits. From a grid-management perspective, Ireland's tender regime engenders indirect costs and benefits similar to those caused by Germany's feed-in tariffs. On the positive side, as the tender regime has increased the market share of renewable energy generation, the same merit-order effect observed in Germany[153] has helped drive down prices in the Irish wholesale market for electricity.[154] On the negative side, Ireland, like Germany, grants dispatch priority to all renewable energy generation at the expense of conventional power plants.[155]

Unlike Germany, the Irish regulator requires newer wind and other variable renewable power generators to assume certain forecast and balancing responsibilities that are commonplace for conventional power plants, including imbalance settlement payments.[156] Older renewable generators with intermittent output, including the majority of those developed under the AER regime, however, remain exempt from forecast and balancing responsibilities.[157] The latter are further privileged vis-à-vis the former insofar as they are less likely to be subject to curtailment in the event of transmission bottlenecks and other grid constraints.[158] The privileges afforded to AER generators might have seemed reasonable at the time to help a fledgling industry. In light of dramatically improved forecast accuracy and remote-control capacity for wind and other weather-dependent generators, they are, however, difficult to justify today. The continuing preferential treatment for AER generators imposes indirect costs on Irish ratepayers as conventional power plants but also newer renewable generators pass on the costs for their relatively greater balancing responsibilities to bring up the slack caused by exempt legacy generators.

Beyond grid management and operations, the lack of a reliable auction schedule and the resulting stop-and-go nature of the Irish tender regime further imposed undue hardship on spatial planning and permitting agencies that have found themselves inundated with waves of applications at unpredictable intervals.[159]

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[152] *See* DE VRIES ET AL, *supra* note 140, at 57–58; Mitchell, *supra* note 144, at 1086 and accompanying text.

[153] *See supra* note 129 and accompanying text.

[154] *See* COMM'N FOR ENERGY REG., *supra* note 148, at 23–24 .

[155] *See* EIRGRID & SONNI GROUP, ANNUAL RENEWABLE ENERGY CONSTRAINT AND CURTAILMENT REPORT 2016 (2017).

[156] *See* COMM'N FOR ENERGY REG., THE SINGLE ELECTRICITY MARKET (SEM) TRADING AND SETTLEMENT CODE 25 (2017) (summarizing the regulatory treatment of Variable Price Taker Generator Units).

[157] *Id*. at 128 (describing the regulatory treatment of Autonomous Generator Units).

[158] *See* EIRGRID & SONNI GROUP, *supra* note 155, at 18.

[159] *See, e.g.*, STEINHILBER, *supra* note 138, at 12 (mourning the "lack of coordination between grid connection, permitting procedures, and the auctioning process"); Ó GALLACHÓIR ET AL., *supra* note 138 (reporting that the lack of a reliable auction schedule caused developers to withhold planning applications and development work).

C. Net Energy Metering – Case Study United States

Net energy metering policies, adopted by over forty states,[160] have emerged as the most common tool to remunerate the power output of solar and other distributed generation assets.[161] Across the country, net metering programs have recently come under attack by special interest groups.[162] Led by electric utilities, opponents argue that net metering enables wealthy homeowners with rooftop solar to effectively stop paying for vital network maintenance and upgrades despite using the grid to supply electricity to their homes when their solar panels do not produce enough energy to meet the homeowner's demand.[163] A closer look at the equity of state net metering programs suggests that the current batch of policies does, indeed, leave room for improvement. The prevailing net metering model[164] performs well in terms of matching indirect costs and benefits but provides a poor match between direct costs and benefits.

Net metering programs generally create economic opportunities open to a wide range of ratepayers. Pre-determined remuneration rates for excess generation and the local utility or network operator's obligation to allow customers to net meter within the limits of a state's capacity cap minimize transaction costs. As price-based policy tools, net metering programs do not require participants to trade in the various electricity markets and, hence, offer good revenue certainty. The primary barrier to accessing the economic opportunities provided by net metering policies lies in the general requirement that participating ratepayers own the real estate that is the site of their distributed generation assets.[165] The relatively high upfront expenditures and

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[160] Revesz & Unel, *supra* note 96, at 47.

[161] *See id.* at 59.

[162] *See, e.g.*, Hiroko Tabuchi, *Rooftop Solar Dims Under Pressure from Utility Lobbyists*, N.Y. TIMES (July 8, 2017), https://www.nytimes.com/2017/07/08/climate/rooftop-solar-panels-tax-credits-utility-companies-lobbying.html [https://perma.cc/T4UX-KRPD]; Diane Cardwell, *Solar Panel Payments Set Off a Fairness Debate*, N.Y. TIMES (June 4, 2012), https://www.nytimes.com/2012/06/05/business/solar-payments-set-off-a-fairness-debate.html [https://perma.cc/3UH7-LMZF].

[163] For a thoughtful summary and critique of the various arguments leveled against net energy metering programs, see Rule, *supra* note 17, at 12–47. *See also* Charles E. Bayless, *Piggybacking on the Grid: Why Net Energy Metering is Unfair and Inefficient*, PUB. UTIL. FORT. 38 (2015) (offering a strong critique of net metering customers' free riding on the electric grid at the expense of utilities and other ratepayers).

[164] This article's equity assessment of net metering policies is based on a stylized model that reflects the most prevailing design features across state policies, including remuneration at full retail rates, the ability to carry over excess credits, and a cap on the permissible size of individual net-metered distributed generation facilities, among others. For a more detailed survey of the various design features of state net metering policies, see Revesz & Unel, *supra* note 96, at 59–64.

[165] A growing number of states allow their citizens to participate in community solar programs that enable ratepayers to engage in virtual net metering, crediting their share of generation from an off-site facility against the ratepayers' on-site consumption. *See, e.g.*, INTERSTATE RENEWABLE ENERGY COUNCIL, FREEING THE GRID 2013: BEST PRACTICES IN

overhead costs required to deploy solar and other distributed generation assets further limit the practical appeal of net metering policies to higher-consumption households.[166]

The direct costs imposed by net metering policies are harder to quantify than those of other policies. At a glance, one might well assume that ratepayers who use customer-sited distributed generation to reduce their net demand for electricity from the grid in exchange for a lower utility bill impose no costs on others. After all, allowing a ratepayer to run her meter backwards effectively remunerates her on-site generation at the local retail rate for electric power.[167] In a perfectly competitive market, where the clearing price equals marginal cost, the retail rate would reflect the cost that the local utility would have incurred to provide the energy now self-generated by its customer.[168] In this perfectly competitive scenario, remunerating the customer's on-site energy production at the retail rate would be cost-neutral for the utility who would have incurred generation costs tantamount to the retail revenue it foregoes by virtue of net metering.

In reality, however, retail electricity rates do not reflect the electricity providers' marginal cost of production. In addition to the variable cost of generation, retail rates also include charges designed to cover the fixed costs associated with transmission and distribution, among other services.[169] Even though transmission, distribution, ancillary services, and other fixed costs account for over 50 percent of the average electricity bill, expressly noted fixed charges make up less than 10 percent of the total.[170] The vast majority of fixed costs is folded into volumetric retail rates and, hence, inefficiently tied to a ratepayer's actual electricity usage. As net metering enables customers to reduce their net consumption of utility-provided electricity, they avoid paying volumetric rates. At the same time, they also stop paying for much of the network-related costs that the utility incurs for their continued reliance on the grid as a source of back-up power and a receptacle for their excess generation.[171] To be clear, net metered distributed generation assets have the

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STATE NET METERING POLICIES AND INTERCONNECTION PROCEDURES 20–21 (describing the mechanics and benefits of community shared renewables).

[166] *See also* Revesz & Unel, *supra* note 96, at 76 ("[B]ecause of the expenses associated with owning or leasing solar panels and a greater incentive among high-consumption households to pursue distributed generation as a means of lowering utility bills, net metering is often disproportionately concentrated among wealthier customers").

[167] *See, e.g.*, EDISON ELEC. INST., SOLAR ENERGY AND NET METERING 1–2 (2016).

[168] For further information on the underlying concept of "avoided cost" and its regulatory treatment, see 16 U.S.C. § 824a–3(b). *See also* Steven R. Miles, *Full-Avoided Cost Pricing Under the Public Utility Regulatory Policies Act: "Just and Reasonable" to Electric Consumers?*, 69 CORNELL L. REV. 1267, 1269 (1984).

[169] For an instructive example of how retail electricity rates are set in regulated markets using cost-of-service regulation, see FRED BOSSELMAN ET AL., ENERGY, ECONOMICS, AND THE ENVIRONMENT: CASES AND MATERIALS 60–64 (3rd ed. 2015).

[170] *See* Revesz & Unel, *supra* note 96, at 72.

[171] *See, e.g.*, AM. LEGISLATIVE EXCHANGE COUNCIL, REFORMING NET METERING: PROVIDING A BRIGHT AND EQUITABLE FUTURE 1 (2014) (noting that "distributed generation technologies rely extensively upon the electric grid to operate efficiently"); Bayless, *supra*

potential to reduce the local utility's network-related expenditures,[172] but these cost savings and other network benefits can be hard to quantify and are more attenuated, placing them among net metering's more indirect benefits discussed below.

The prevailing practice of recovering fixed costs primarily through consumption-dependent, volumetric rates leads to cost shifting among customer groups when one group reduces its (net) consumption, be it through energy efficiency upgrades, behavioral changes, or net metering. Under the current model, a utility no longer able to recover its fixed costs from one group needs to raise its volumetric retail rates to make up for the shortfall. While the adjusted rate, in theory, applies to all customers alike, the increase imposes a disproportionately large burden on those customers whose continued exclusive reliance on utility-provided power requires them to pay a significant amount of volumetric charges.[173] As a result, customers who participate in and benefit from net metering programs contribute the least, if anything, to the costs imposed by their selective reliance on the electric grid. While the precise magnitude of this cost shifting effect varies by jurisdiction and remains in dispute, recent studies suggest that the proliferation of net metered distributed generation assets imposes a significant financial burden on other ratepayers.[174] This cost shifting dynamic earns net metering policies a poor rating for their matching of direct costs and benefits.

Net energy metering policies perform well when it comes to matching indirect costs and benefits. Customer-sited distributed generation provides a variety of indirect benefits to the grid and the broader pool of electricity market participants. Like any other policy that promotes the deployment of clean energy technologies with effective dispatch priority, net metering's merit-order effect[175] helps drive down wholesale market prices by pushing more expensive plants out of the market, to the benefit of all ratepayers. These grid-wide cost savings are especially prominent in hot climates where distributed solar generation can help shave peak

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note 163, at 39–40 (criticizing the reality that net metering customers may have reached a "net zero" threshold on energy for themselves but do so at the expense of a large net negative on grid services).

[172] For a thoughtful discussion of these benefits and their sensitivity to local conditions, *see, e.g.*, GALEN BARBOSE, LAWRENCE BERKELY NAT'L LAB., PUTTING THE POTENTIAL RATE IMPACTS OF DISTRIBUTED SOLAR INTO CONTEXT (2017).

[173] *See* AM. LEGISLATIVE EXCHANGE COUNCIL, *supra* note 171, at 8–11 (describing how net metering ratepayers shift the cost burden to other ratepayers).

[174] New York utilities, for example, suggest that shifted costs might soon exceed $300 million annually. Joint Utilities Response to Staff's Information Request, Case 15-E-0751, at 2 (N.Y. Pub. Serv. Comm'n, In the Matter of the Value of Distributed Energy Resources, June 10, 2016). California's utility regulators expect up to $370 million in fixed costs to be shifted to non-net-metered ratepayers by 2020. CAL. PUB. UTILS. COMM'N, CALIFORNIA NET ENERGY METERING RATEPAYER IMPACTS EVALUATION 6 (2013).

[175] *See supra* note 129 and accompanying text.

demand during mid-day driven by the need for air conditioning, thereby eliminating the need for inefficient and costly peaker plants.[176]

As discussed earlier, net metered distributed generation also provides value to the transmission and distribution systems.[177] A customer's consumption of her self-generated power, for example, eliminates the need to deliver electricity to her through a congested and, hence, less efficient grid and may allow for postponing otherwise necessary network upgrades.[178] When a net metered customer's excess generation is consumed locally, electricity needs to travel significantly shorter distances than from the utility's generation assets that are often sited well outside load centers.[179] With line losses accounting for up to 8 percent of a utility's total generation output, the ability of net metering policies to bring generation and consumption closer together offers significant efficiency benefits that translate to cost savings for all ratepayers.[180]

Net metered distributed generation can further help improve the electric grid's resiliency so as to avoid or minimize power outages during extraordinary or hazardous events.[181] Combined with smart inverters, microgrids, and energy storage, distributed generation can fill in for utility-scale generation during extreme weather events thereby reducing the frequency and severity of weather-induced service interruptions responsible for tens of billions of dollars in economic losses every year in the United States alone.[182]

The many indirect benefits that net metering policies generate for the electric grid and its stakeholders are not free. The two-way traffic of electricity required to harness the resiliency improvements, congestion relief, and other benefits of distributed generation, for example, requires significant upgrades to a network

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[176] *See also* Revesz & Unel, *supra* note 96, at 79 ("Avoided energy benefits can be especially significant if distributed energy resources help avoid generation from costlier peak plants.").

[177] *See supra* note 172 and accompanying text.

[178] *See* Revesz & Unel, *supra* note 96, at 73. The precise value of these benefits is difficult to quantify and varies based on seasonal and diurnal grid demand and distributed generation output patterns.

[179] *See also* Joel B. Eisen & Felix Mormann, *Free Trade in Electric Power*, 2018 UTAH L. REV. 49, 59–60 (describing how solar and other non-polluting generation technologies can be sited closer to consumers than traditional utility-scale thermal power plants, yielding significant benefits to the transmission and distribution systems).

[180] *See* U.S. DEP'T OF ENERGY, THE POTENTIAL BENEFITS OF DISTRIBUTED GENERATION AND RATE-RELATED ISSUES THAT MAY IMPEDE THEIR EXPANSION 3–18 (2007).

[181] *See* MILES KEOGH & CHRISTINA CODY, NAT'L ASS'N OF REG. UTIL. COMM'RS, RESILIENCE IN REGULATED UTILS. 1 (2013) (offering an industry-wide definition of resiliency) [https://perma.cc/9F9N-BCYU].

[182] *See* NAT'L RENEWABLE ENERGY LAB., DISTRIBUTED SOLAR PV FOR ELECTRICITY SYSTEM RESILIENCY 1 (2014). While there is no universally accepted methodology for quantifying the resiliency benefits of distributed generation, studies suggest a monetary value of $0.010 to $0.025 per kWh of distributed power generation. *See* Revesz & Unel, *supra* note 96, at 81.

historically designed for the mono-directional flow of electrons from utility-scale power plants to consumers.[183]

The peak-shaving benefits associated with net metered distributed generation also come at a cost. As illustrated by the (in)famous California duck curve, solar and other weather-dependent distributed resources require fast-ramping back-up power to maintain the grid's delicate balance between demand and supply.[184] As net metering and distributed generation continue to proliferate, conventional plants will increasingly have to ramp down during the day and stand by to, quickly, ramp up in the event of cloud cover or other adverse weather conditions and, of course, as the sun sets. This ramping up and down, or cycling, increases the average operating costs of affected plants and, ultimately, requires additional compensation from utilities and their ratepayers.[185] To be sure, all of the policies discussed here require back-up power to make up for variations in the output from solar, wind, and other intermittent renewables. Net metering policies, however, pose a particularly iffy challenge for network operators because the behind-the-meter location of net metered distributed generation assets exacerbates the difficulty in predicting and managing their net impact on grid demand.[186]

D. Tax Credits – Case Study United States

Federal tax credits for clean energy provide a poor match between direct program costs and benefits, and score poorly on indirect costs and benefits, too. This overall poor report card for the primary federal policy instrument to support solar, wind, and other renewables may come as a surprise to some considering the strong support for federal tax breaks within the renewable energy industry.[187] The scholarly literature, however, has long critiqued tax credit support for clean energy as "the rich man's feed-in tariff."[188]

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[183] *See* Eisen & Mormann, *supra* note 179, at 61 (explaining how the electric grid's current architecture, frequently dating back to the late nineteenth and early twentieth century, is poorly adapted to accommodate and harness the many benefits offered by distributed generation); Revesz & Unel, *supra* note 96, at 83 (discussing the additional strains that bi-directional flow of electricity imposes on the grid).

[184] *See, e.g.,* CAL. INDEP. SYS. OPERATOR, WHAT THE DUCK CURVE TELLS US ABOUT MANAGING A GREEN GRID 3 (2013), http://www.caiso.com/Documents/ FlexibleResources HelpRenewables_FastFacts.pdf [https://perma.cc/LUS5-47VU].

[185] *See* MASS. INST. OF TECH., THE FUTURE OF THE ELECTRIC GRID 64 (2011).

[186] *See, e.g.*, Mormann et al., *supra* note 8, at 68–69 (noting the California grid operator's difficulty in keeping track of distributed solar facilities that are customer-owned and located behind the meter).

[187] *See, e.g.*, *Tax Policy*, AM. WIND ENERGY ASS'N, https://www.awea.org/policy-and-issues/tax-policy [https://perma.cc/X223-U8NX]; *Solar Investment Tax Credit*, SOLAR ENERGY INDUSTRIES ASS'N, http://www.seia.org/policy/finance-tax/solar-investment-tax-credit [https://perma.cc/FK65-4AYR].

[188] David Toke, *Are Green Electricity Certificates the Way Forward for Renewable Energy? An Evaluation of the United Kingdom's Renewables Obligation in the Context of International Comparisons*, 23 ENV'T & PLANNING C. GOV'T & POL'Y 361, 368 (2005).

Federal tax credits score poorly in terms of terms of matching direct costs and benefits because they create economic opportunities only for a small group of banks, financial firms, and other highly profitable corporations.[189] This limited economic appeal is due to the mismatch between tax credits' inherent profitability requirements and the revenue profile of renewable power projects.[190] Many project developers lack the quintessential requirement to benefit from federal tax breaks—a tax bill that is high enough to offset and thereby realize the full and immediate monetary value of tax credits.[191] Renewable power plants may not incur the same fuel costs as their fossil fuel counterparts, but they require relatively greater up-front capital expenditures for planning, construction, and equipment.[192] It frequently takes ten or more years before a renewable power project has recovered these expenditures and begins to generate the necessary profits and tax liability to use its tax credits.[193] To be sure, the project developer could simply carry forward her tax credits year after year until her tax bill eventually is high enough, but, in the case of a standalone wind project, for example, this lack of current tax liabilities would cost her up to two-thirds of the net present value of her project's tax benefits.[194]

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[189] Historically, fewer than two dozen highly profitable and sophisticated entities—mostly large banks, insurance companies, and other financial firms—have been willing and able to support renewable energy projects through their tax equity investments. *See* BIPARTISAN POL'Y CTR., REASSESSING RENEWABLE ENERGY SUBSIDIES—ISSUE BRIEF 10 (2011).

[190] *See* Mormann, *Beyond Tax Credits*, *supra* note 18, at 303.

[191] *See* Bolinger et al., *supra* note 100, at 6804; STEVE CORNELI, U.S. PARTNERSHIP FOR RENEWABLE ENERGY FIN., CLEAN ENERGY AND TAX REFORM: HOW TAX POLICY CAN HELP RENEWABLE ENERGY CONTRIBUTE TO ECONOMIC GROWTH, ENERGY SECURITY AND A BALANCED BUDGET 13 (2012); BIPARTISAN POL'Y CTR., *supra* note 189, at 9; MINTZ LEVIN & GTM RESEARCH, RENEWABLE ENERGY PROJECT FINANCE IN THE U.S.: 2010–2013 OVERVIEW AND FUTURE OUTLOOK (2012), http://www.mintz.com/DesktopModules/Bring2mind/DMX/Download.aspx?EntryId=231&PortalId=0&DownloadMethod=attachment [https://perma.cc/L9AK-NLJ2]; *see also* JOHN P. HARPER ET AL., LAWRENCE BERKELEY NAT'L LAB., WIND PROJECT FINANCING STRUCTURES: A REVIEW & COMPARATIVE ANALYSIS (2007), http://emp.lbl.gov/sites/all/files/REPORT%20lbnl%20-%2063434.pdf [https://perma.cc/CA87-58QD] (noting that only a handful of large developers are able to make use of the federal tax credits).

[192] *See* HARPER ET AL., *supra* note 191, at i (comparing up-front capital expenditures relative to generation capacity).

[193] *See* PHILIP BROWN & MOLLY F. SHERLOCK, CONG. RESEARCH SERV., R41635, ARRA SECTION 1603 GRANTS IN LIEU OF TAX CREDITS FOR RENEWABLE ENERGY: OVERVIEW, ANALYSIS, AND POLICY OPTIONS 8 (2011). For a wind project, for example, it takes approximately twelve years to fully work through net operating losses from depreciation deductions before the project even begins to generate the taxable income required to be able to self-monetize available tax credits. Bolinger et al., *supra* note 100, at 17.

[194] UDAY VARADARAJAN ET AL., CLIMATE POLICY INITIATIVE, SUPPORTING RENEWABLES WHILE SAVING TAXPAYERS MONEY 1, 4 (2012).

Enter the "tax equity"[195] investor whose participation enables the developer to monetize the project's tax credits in a timely fashion.[196] Such tax equity investment effectively allows a renewable energy project to sell the tax credits that the project itself cannot presently monetize against its own income to the tax equity investor.[197] But tax equity investors are few and far between—and they exploit their exclusivity status to exact higher rates of return than the risk profile of their involvement would normally warrant.[198] The tax equity market's cyclical nature further reduces the value of tax credits during economic downturns when developers need them most.[199] To make matters worse, the tax code renders tax equity for renewable energy a highly illiquid investment thereby impeding the formation of secondary markets that would allow developers to refinance their projects in the near to medium term.[200] In addition, participation of a tax equity investor in renewable power projects requires complex and costly deal structures that drive up transaction costs.[201] The need to

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[195] Tax equity, not to be confused with the concept of equity as used elsewhere in this Article, is a hybrid investment position that combines characteristics of conventional debt and equity stakes. Like traditional equity, tax equity bears the ultimate performance risk of a project. Like debt, tax equity receives preferential treatment regarding project cash flows. These include positive cash flows such as payments under a power purchase agreement with a local utility or other off-taker and, most importantly, negative cash flows in the form of tax credits and other benefits that the tax equity investor can use to offset her tax liabilities outside of the project. *See, e.g.,* BROWN & SHERLOCK, *supra* note 193, at 17–19; CORNELI, *supra* note 191, at 13; BIPARTISAN POL'Y CTR., *supra* note 189, at 9.

[196] *See, e.g.*, ETHAN ZINDLER & TYLER TRINGAS, BLOOMBERG NEW ENERGY FIN., CASH IS KING: SHORTCOMINGS OF US TAX CREDITS IN SUBSIDIZING RENEWABLES 2 (2009).

[197] *See, generally,* Mormann, *Beyond Tax Credits*, *supra* note 18, at 325–26.

[198] *See* BROWN & SHERLOCK, *supra* note 193, at 18; HARPER ET AL., *supra* note 191, at v; MINTZ LEVIN & GTM RESEARCH, *supra* note 191, at 8; *see also* Mormann, *Beyond Tax Credits*, *supra* note 18, at 326–27 (pointing to higher-quality project development as a positive side effect of competition among developers for a spot at the tax equity trough).

[199] *See, e.g.,* MINTZ LEVIN & GTM RESEARCH, *supra* note 191, at 3 ("Macro-trends in tax equity financing . . . are highly correlated to the financial health of a limited number of large financial institutions.").

[200] The investment tax credit for solar and other renewable projects, for instance, becomes available in full in the year that the facility is placed into service. But the credit actually takes five years to linearly vest in its entirety requiring the tax equity investor to hold on to her stake in the project for at least five years in order to realize the tax credit's full value. Should the investor decide to pull out of the project earlier, say after three years, the non-vested portion of her tax credit, in this case 40 percent, would be subject to recapture and the associated tax savings would need to be paid back to the Internal Revenue Service (IRS). *See* 26 U.S.C. § 50(a)(1)(B) (2018).

[201] The tax code's general prohibition of trafficking in tax credits and other tax attributes according to 26 U.S.C. § 382 (2012) rules out a straight-forward sale of these attributes and, instead, requires inventive—and costly—deal structures in order to legally assign what would otherwise be the developer's tax benefits to the tax equity investor. The three main tax equity structures in use today are the partnership flip, the sale-leaseback, and the inverted lease. DIPA SHARIF ET AL., BLOOMBERG NEW ENERGY FIN., THE RETURN – AND RETURNS –

bring in a tax equity investor, finally, limits a developer's ability to raise project capital from other, more cost-efficient sources as tax equity often forestalls less expensive debt financing.[202]

In the end, even when bringing in a tax equity investor, renewable energy developers can realize no more than two-thirds of the value of their project's tax benefits.[203] The highly limited economic appeal of federal tax credits for renewables, therefore, bodes ill not only for the policy's equity and but also for its cost efficiency.[204]

The poor equity rating of federal tax credits is driven by the *de facto* reservation of direct program benefits to a small group of tax equity investors while funding for these credits comes out of the U.S. Treasury's general tax revenue thereby spreading the cost across all taxpayers. The enormous discrepancy between this quasi-socialization of costs and the oligopolization of economic opportunities flies in the face of commensurately matching costs and benefits as required under this Article's equity framework.

In terms of indirect costs and benefits, federal tax credits for renewables rate poorly due to their disruptive effect on wholesale electricity markets. On the positive side, tax-credit-funded renewable power capacity has helped reduce wholesale market clearing prices thanks to the same merit-order effect discussed above.[205] The production tax credit has, however, forced network operators to increasingly send out negative price signals to encourage generators to ramp down their power output during times of low demand—at the expense of other, especially non-wind, generators. To be sure, negative price signals predate the Energy Policy Act of 1992 that created the production tax credit, but they have become much more frequent since. That is because wind power generators earn production tax credits only for electricity they generate *and* feed into the grid for sale to a third party.[206] The latter requirement has had a profound effect on wholesale electricity markets. Historically, network operators could effectively signal to power plants that they should decrease their output, or ramp down, by gradually reducing the offer price near or, in some cases, to zero. With no fuel requirement to drive marginal costs and a production tax credit tied to power production and sales, however, wind generators continue to produce and feed power into the grid unless and until prices go so far below zero

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OF TAX EQUITY FOR US RENEWABLE PROJECTS 10–15 (2011) (offering a concise comparison across all three tax equity structures).

[202] Tax equity investors are wary of losing their preferred access to project cash flows to lenders. *See supra* note 195 (describing the preferred access to project cash flows for tax equity investors). In addition, the complex deal structures required for tax equity deals preclude purely debt-financed projects. *See* Chadbourne & Parke LLP, *supra* note 103, at 34–35 (describing how debt financing would take over if tax credits were replaced with direct cash subsidies).

[203] *See* VARADARAJAN ET AL., *supra* note 194, at 4.

[204] *See* Mormann, *Beyond Tax Credits*, *supra* note 18, at 315; VARADARAJAN ET AL., *supra* note 194, at 4 .

[205] *See supra* note 131 and accompanying text.

[206] *See* 26 U.S.C. § 45(a)(2)(B) (2018).

that they eat up all of their tax credits. As a result, where network operators used to send a zero-price signal, in wind-rich markets they now have to use a negative price signal actually penalizing other generators who may struggle to ramp down their output quickly enough at times of low demand.[207] These negative price signals impose harsh burdens on generators without tax credits, such as coal power plants who take longer than others to ramp down and, ultimately pay a penalty in the amount of negative pricing required to persuade wind generators and other recipients of production tax credits that they should reduce their output to maintain the electric grid's delicate balance between demand and supply.[208]

E. Renewable Portfolio Standards – Case Study United States

Renewable portfolio standards—adopted by twenty-nine states, three U.S. territories, and the District of Columbia—have evolved as one of the principal drivers of clean energy deployment in the United States. Minor differences across state policies notwithstanding,[209] the prevailing model of renewable portfolio standards receives moderate equity marks in terms of direct costs and benefits due to the limited pool of economic beneficiaries compared to the allocation of procurement costs across all ratepayers. They earn excellent marks, however, regarding indirect costs and benefits thanks to the planning certainty they afford to network operators and their role as a potential gateway policy for cap-and-trade regimes. How is it that one of the most widely adopted and longest-standing clean energy policies in the United States is not more equitable in its distribution of direct costs and benefits? The answer to this question lies in the considerable revenue uncertainty and transaction costs that renewable portfolio standards impose on generators and their investors.

Unlike feed-in tariffs and other price-based policies that guarantee a specific rate for renewable electricity, portfolio standards rely on the fluctuating market forces of demand and supply to determine the ultimate level of remuneration for

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[207] *See, e.g.*, FRANK HUNTOWSKI, AARON PATTERSON & MICHAEL SCHNITZER, THE NORTHBRIDGE GROUP, NEGATIVE ELECTRICITY PRICES AND THE PRODUCTION TAX CREDIT 12 fig. 8 (2012), http://www.hks.harvard.edu/hepg/Papers/2012/Negative_Electricity_Prices_and_the_Production_Tax_Credit_0912.pdf [https://perma.cc/R3TT-JQX8]; *id.* at 12 ("Negative prices are most prevalent when wind output is highest relative to overall demand, such as during the overnight hours in the spring and fall months when wind output is high but demand is relatively low and less power is needed.").

[208] Some may consider the prevalence of negative price signals in wind-rich markets and their detrimental impact on conventional generators a feature rather than a bug. After all, the stated policy goal of tax incentives for clean energy is to increase the market share of solar, wind, and other low-carbon renewables—at the expense of coal and other incumbents. As before, *see supra* note 130, this Article's equity inquiry does not pass judgment on the strategic value of such policy characteristics but merely seeks to bring them to the fore so that readers may from their own opinion. *See supra* Section I.C.

[209] For an instructive overview of differences in design and implementation across state renewable portfolio standards, see Davies, *supra* note 109, at 1398–1403 (comparing resource eligibility, REC shelf life, and other key features across state policies).

renewable power.[210] In fact, portfolio standard policies often require renewable generators to trade on not one but two separate markets—the wholesale electricity market for selling their power output and the REC market for selling their credits.[211] As a result, generators find themselves exposed to the price risk of two distinct markets, each with its own set of risks and rules. Day-ahead trading in wholesale electricity markets, for instance, may require weather-dependent solar or wind generators to submit a bid for power they may prove unable to supply when called upon the next day.[212] On the REC side, fragmented and often illiquid markets may expose generators to extreme trading volatility as illustrated by geographic price fluctuations ranging from $1.75 in California to $35.00 in New England for a credit issued for 1 MWh of wind energy.[213] Within a one-year period, temporal price fluctuations have been reported to range from $6.00 to nearly $40.00 for 1 MWh worth of Connecticut RECs.[214]

A renewable portfolio standard's inherent requirement that eligible generators participate in two separate markets not only increases their overall exposure to market risk but also drives up associated transaction costs. In contrast to a feed-in tariff or tender regime, portfolio standards require renewable generators to negotiate and execute one or more power purchase agreements to sell their output.[215] Together, the heightened market risks and transaction costs impose significant barriers to access to the economic opportunities created under renewable portfolio standards. This exclusivity has led some to characterize portfolio standards as "'big corporation' policies" with "neutral or negative effects on smaller, entrepreneurial firms."[216] To be sure, firms such as SolarCity, Sungevity, or SunRun offer to assume some of the market risks and manage the necessary transactions on behalf of residential and other, smaller-scale generators, but these intermediaries charge a fee for their involvement that reduces the overall economic upside to generators.[217] While not quite as exclusive as tax credits, renewable portfolio standards suffer from a similarly limited access to the policy's economic benefits.

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[210] *See supra* notes 106–109 and accompanying text.

[211] *See* Mormann, *Clean Energy Federalism*, *supra* note 14, at 1660.

[212] *See* Klessmann et al., *supra* note 133, at 3647.

[213] *See* Benjamin K. Sovacool & Christopher Cooper, *Congress Got it Wrong: The Case for a National Renewable Portfolio Standard and Implications for Policy*, 3 ENVTL. & ENERGY L. & POL'Y J. 85, 105 (2008).

[214] *See* Ryan Wiser et al., *The Experience with Renewable Portfolio Standards in the United States*, 20 ELECTRICITY J. 8, 16 (2007).

[215] *See* Mormann, *Investor Appeal of Renewable Energy*, *supra* note 16, at 713.

[216] Mary Jean Bürer & Rolf Wüstenhagen, *Which Renewable Energy Policy Is a Venture Capitalist's Best Friend? Empirical Evidence from a Survey of International Cleantech Investors*, 37 ENERGY POL'Y 4997, 5005 (2009).

[217] *See, e.g.*, KATHARINE KOLLINS ET AL., U.S. DEP'T OF ENERGY, SOLAR PV PROJECT FINANCING REGULATORY AND LEGISLATIVE CHALLENGES FOR THIRD-PARTY PPA SYSTEM OWNERS (2010) (giving an overview of the competing models for third-party financing of solar systems).

The limited number of economic beneficiaries stands in stark contrast to the allocation of program costs across all ratepayers. The extra costs incurred by a utility to procure the RECs necessary to comply with the standard's sourcing requirement are usually folded into its retail electricity rates thereby spreading the financial burden across all ratepayers *pro rata* of their power consumption.[218] A cost allocation that so closely correlates the financing of a clean energy policy with the consumption of energy and, hence, the environmental and other social costs of its generation might warrant top marks in terms of *environmental* equity. For purposes of the present inquiry into a policy's *economic* equity, however, the mismatch between the quasi-socialization of costs and the limited availability of economic opportunities created by renewable portfolio standards prevents a higher than moderate rating.

Renewable portfolio standards receive excellent marks regarding indirect costs and benefits thanks to the planning stability they afford to grid operators and to the priming effect they have in preparing constituents for cap-and-trade policies as an economy-wide approach to greenhouse gas emission reductions. With their market reliance for pricing and remuneration, portfolio standards do not require dispatch priority and, hence, need not impose negative externalities on other generators. At the same time, they deliver similar merit-order benefits to wholesale markets as the above policies. When policymakers adopt renewable portfolio standards mandating that a certain percentage of retail electricity sales come from renewables, they create demand and, hence, a market for renewable power and, at the same time, limit the size of that market.[219] As deployed capacity and projects already underway approach the mandated demand target, developers looking to benefit from the policy's financial incentives will be wary to launch new projects.[220]

Under a feed-in tariff or similar price-based policy, the volume and pace of renewable energy deployment depend on the interplay between policy remuneration, hardware costs, installation costs, and other factors subject to changing market conditions. If costs come down faster than anticipated, a level of policy remuneration that was reasonable at the outset may become overly generous leading to greater-than-expected deployment. Germany experienced such an overheating in its solar market during the early 2010s when the country's feed-in tariff rates failed to adjust to rapidly declining prices for solar panels.[221] The resulting surge in solar deployment created enormous challenges for grid management and operations.[222] With their simultaneous creation and limitation of clean energy markets, renewable

[218] *See* Davies, *supra* note 109, at 1363–64.

[219] *See* Mormann, *Investor Appeal of Renewable Energy*, *supra* note 16, at 712 (discussing the cap inherent in the sourcing requirements set by renewable portfolio standards).

[220] *See* Michael Mendelsohn, *Does RPS Still Gun the Engines*, RENEWABLE ENERGY PROJECT FIN. (Nov. 7, 2012, 10:00 AM), https://financere.nrel.gov/finance/content/does-rps-still-gun-engines [https://perma.cc/Z2HG-YCKK] (questioning the capacity of state RPS programs to drive deployment as achievement of the RPS target draws nearer).

[221] *See* Mormann et al., *supra* note 8, at 97.

[222] *See supra* note 135 and accompanying text.

portfolio standards enable network operators to anticipate growth in order to ensure the grid's ability to absorb a growing share of intermittent renewable power generators. This planning certainty is all the more pronounced when the sourcing requirement ramps up gradually over a period of several years, as is the case under most renewable portfolio standards in the United States.[223]

The second driver behind the excellent rating of portfolio standards in terms of indirect costs and benefits is their educational impact setting the stage for future implementation of cap-and-trade policies to promote greenhouse gas emission reductions. Recent research suggests that green industrial policies like feed-in tariffs and renewable portfolio standards fuel progress toward more comprehensive climate policies, such as a tax on carbon or a cap-and-trade regime.[224] This enabling effect of green industrial policies is attributed to their moving economic constituents into coalitions for decarbonization and creating positive feedback loops.[225] The same rationale would apply to all clean energy support policies discussed in this Part and, therefore, would not warrant special recognition of the renewable portfolio standard. The latter, however, goes above and beyond the previously discussed policies insofar as its market reliance helps familiarize key stakeholders—from regulators to utilities to generators—with the trading dynamics that are crucial to a successful cap-and-trade regime, one of the policies economists consider most promising to decarbonize the energy economy and mitigate global climate change.[226]

F. Summary and Suggestions for Reform

The preceding inquiry into the policy equity of the leading policies in place to promote clean energy technologies today offers but a snapshot of the broader, increasingly diverse policy landscape. The limited sample size of one case study per policy and the need to distinguish between conceptual and implementation issues caution against drawing overly general conclusions. Accordingly, this Section expressly focuses on the respective policy as implemented in the studied jurisdiction. To the extent that other jurisdictions have followed a similar implementation route for the same policy, however, some of the following observations and suggestions for reform may translate to these jurisdictions. Table 2 summarizes the policy equity ratings for the studied policies and jurisdictions.

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[223] *See, e.g.*, CAL. PUB. UTIL. CODE § 399.30(c)(2) (West 2017) (laying out the ramp-up schedule for California's renewable portfolio standard, from 25% by the end of 2016 to 33% by 2020, 44% by 2024, 52% by 2027, and 60% by 2030).

[224] *See* Jonas Meckling et al., *Winning Coalitions for Climate Policy: Green Industrial Policy Builds Support for Carbon Regulation*, 349 SCI. 1170, 1170 (2015).

[225] *Id.*; *see also* Eric Biber, *Cultivating a Green Political Landscape: Lessons for Climate Change Policy from the Defeat of California's Proposition 23*, 66 VAND. L. REV. 399, 426 (2013) ("The first priority in climate change policy should be to increase the economic and political support for future climate legislation by building the industry that has a political and economic stake in expanding climate legislation.").

[226] *See, e.g.*, Robert N. Stavins, *A Meaningful U.S. Cap-and-Trade System to Address Climate Change*, 32 HARV. ENVTL. L. REV. 293, 296–97 (2008).

POLICY (Case Study)	POLICY EQUITY RATING Direct	Indirect
FEED-IN TARIFF (GERMANY)	*Moderate*	*Moderate*
TENDER REGIMES (IRELAND)	*Moderate*	*Poor*
NET METERING (UNITED STATES)	*Poor*	*Good*
TAX CREDITS (UNITED STATES)	*Poor*	*Poor*
PORTFOLIO STANDARDS (UNITED STATES)	*Moderate*	*Excellent*

Table 2: Policy Equity Ratings for Case Studies

Feed-in tariffs, as implemented in Germany, display moderate overall policy equity with points scored for relatively widespread access to the policy's direct economic benefits but points deducted for the German policymaker's decision to exempt nearly 2,000 of the country's most energy-intensive firms from bearing direct program costs. Two tweaks would go a long way toward improving direct policy equity. First, industrial ratepayers should be required to contribute their share to the levy imposed to finance feed-in tariff payments. Concerns over international competitiveness could be addressed through increased self-generation for on-site consumption thereby lowering an industrial firm's overall consumption of grid-provided electricity and, hence, its obligations under the feed-in tariff levy. Second, the German feed-in tariff could be amended to enable greater participation by ratepayers who do not own real property, for example through community-level projects such as those championed by wind cooperatives in Denmark.[227] Indirect policy equity of Germany's commitment to low-carbon renewables suffers primarily due to the externalization of balancing efforts and costs by renewable power generators exempt from the grid's usual forecasting and balancing requirements. Acceleration of the ongoing shift toward greater forecast and balancing the responsibility of solar, wind, and other intermittent generators would go a long way toward relieving the burden on other generators and improving indirect policy equity.

[227] *See* H. C. SOERSENSEN ET AL., INT'L SOC'Y OF OFFSHORE AND POLAR ENGINEERS, MIDDELGRUNDEN 40 MW OFFSHORE WIND FARM, A PRESTUDY FOR THE DANISH OFFSHORE 750 MW WIND PROGRAM 1 (2000), http://www.middelgrunden.dk/middelgrunden/sites/default/files/public/file/Middelgrunden%2040%20MW%20offshore%20wind%20farm%20prestudy.pdf [https://perma.cc/CP7K-SDML] (reporting that, by 2001, more than 100,000 Danish families were part of wind cooperatives that accounted for 80 percent of the country's wind turbines).

Ireland's tender regime offers moderate direct policy equity but performs poorly in terms of indirect policy equity. On the positive side, Ireland allocates direct costs across all ratepayers without exemptions and uses technology-specific auctions to create economic opportunities for a greater range of projects. A higher rating is prevented, however, by the auction process's complexity, lack of transparency, and limited planning certainty for potential bidders, restricting the program's ability to mobilize a greater pool of participants in the tender rounds. Improvements to the auction process would help raise both direct and indirect policy equity while converting the tender regime's surcharge from a flat rate fee to a levy that allocates costs *pro rata* a ratepayer's electricity consumption would positively impact direct policy equity.

The prevailing model of state net metering policies offers good indirect policy equity but delivers poor direct policy equity. From enhanced resiliency to congestion relief and peak shaving, net metering provides a host of indirect benefits to the electric grid and its stakeholders. These benefits come at the cost of grid upgrades and higher fees for fast-ramping back-up power, among others. In the end, both the indirect costs and benefits associated with net metering tend to accrue primarily at the ratepayer level, delivering good indirect policy equity. The same, unfortunately, cannot be said of the match between net metering's direct costs and benefits. Economic opportunities are relatively accessible, at least for homeowners, but access could be significantly expanded through more widespread adoption of community-solar and virtual net metering programs.[228] They are financed, in large part, through cost shifting from net metering ratepayers to their non-net metering counterparts, raising serious equity concerns. These cost shifts are by no means an ineluctable by-product of net metering, however. A simple tweak to utility rate-setting and billing practices would go a long way toward improving the policy equity of net metering. Once the fixed charges currently folded into volumetric retail rates are billed separately and thus decoupled from a ratepayer's consumption, remuneration of net metering customers at retail rates will entail significantly less cost shifting among different groups of ratepayers. Conversely, better understanding and quantification of the time- and location-variant system benefits produced by distributed generation would allow to adjust the overall compensation for net metering customers where appropriate.

Federal tax credits receive a poor overall policy equity rating due to the gross mismatch between the oligopolization of direct economic benefits among a small group of high-income tax investors and the quasi-socialization of direct program costs across American taxpayers. Indirect policy equity is hurt by wholesale market distortions resulting from the need for negative price signals to discourage wind

[228] A growing number of states are adopting policies to require community-solar virtual net metering programs where ratepayers use off-site solar generation to reduce their electricity bills. *See, e.g.*, Gabriel Chan et al., *Design Choices and Equity Implications of Community Shared Solar*, 30 ELECRICITY J. 37, 37, 40 (2017) (discussing programs in fifteen states and the District of Columbia, noting that the "normative goal to increase access to solar energy for those without an adequate roof or finances" is at the heart of community-solar programs).

generators from feeding surplus power into the grid during times of low demand. The latter distortion could be remedied by replacing the production tax credit regime for wind power with the kind of investment tax credit that has proven to be an effective driver of solar deployment.[229] Overall policy equity of either type of tax credit would further be improved significantly if tax credits for renewable energy were made refundable thereby obviating the need for costly tax investment structures to monetize these credits in a timely fashion.[230]

The prevailing model of state-level renewable portfolio standards receives excellent marks for its indirect policy equity thanks to the planning stability that these programs offer to grid operators and their role as primers for a future cap-and-trade regime to regulate economy-wide greenhouse gas emissions. Direct policy equity, meanwhile, is no more than moderate due to revenue uncertainty and transaction costs that restrict access to the policy's economic benefits. These barriers to access will be difficult to eliminate altogether without sacrificing the market reliance that defines renewable portfolio standards. They could, however, be mitigated through better coordination among state policymakers toward a unified market for RECs resulting in greater liquidity and lower price volatility.[231] Another option would be the joint implementation of renewable portfolio standards and feed-in tariffs to simultaneously reduce both investor and regulatory risk thereby promoting more widespread participation in these policies.[232]

IV. POLYCENTRICITY AS A CATALYST FOR GREATER POLICY EQUITY

Assessing and, more importantly, improving policy equity requires a deep understanding of the flow of costs and benefits—direct and indirect—generated by clean energy policy. Direction and magnitude of these flows will depend on program specifics as well as the investment needs and abilities of stakeholders. As a first step toward more equitable clean energy policy, the process of policymaking, from design to adoption to implementation, should become more inclusive.

The polycentric approach to governance championed by Professors Elinor and Vincent Ostrom offers a promising path forward. For the Ostroms and their colleagues, polycentricity connotes multiple centers of decisionmaking that are formally independent of each other but may, in practice, interact through competitive relationships, collaborative endeavors, and otherwise function in a

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[229] *See, e.g.*, SOLAR ENERGY INDUS. ASS'N, SOLAR ITC IMPACT ANALYSIS, https://www.seia.org/sites/default/files/ITC%20Impact%20Analysis%20Factsheet_Sep2015.pdf [https://perma.cc/VKM7-GZ5M].

[230] The tax code has long recognized refundable tax credits such as the Child Tax Credit under 26 U.S.C. § 24 (2018) or the Earned Income Tax Credit under 26 U.S.C. § 32 (2018).

[231] *See* Mormann, *Clean Energy Federalism*, *supra* note 14, at 1644 (discussing the benefits of a unified REC trading market).

[232] *See* Felix Mormann, *Re-Allocating Risk: The Case for Closer Integration of Price- and Quantity-Based Support Policies for Clean Energy*, 27 ELECTRICITY J. 9, 15 (2014) (proposing a model for greater integration of feed-in tariffs and renewable portfolio standards toward better mitigation and allocation of investor and regulatory risk).

coherent manner.[233] Late in her career, Nobel Laureate Elinor Ostrom advocated for a more polycentric approach to climate governance.[234] According to Ostrom, polycentricity tends to "enhance innovation, learning, adaptation, trustworthiness, levels of cooperation of participants, and the achievement of more effective, equitable, and sustainable outcomes at multiple scales."[235]

Compared to traditional, monocentric governance models, polycentric decisionmaking offers two chief advantages of relevance to climate and clean energy policy.[236] First, polycentric approaches provide greater opportunities for experimentation and learning to improve policies over time. Second, they increase communications and interactions among parties facilitating the exchange of critical information while building the mutual trust necessary for better cooperation.

Clean energy policymaking in the United States already leverages many of the benefits flowing from policy experimentation and learning across jurisdictions and institutions. In the absence of a comprehensive federal policy approach to clean energy, states and municipalities have stepped up to fill the policy void, breathing life into the Brandeisian vision of states as laboratories of democracy.[237] The resulting policy potpourri showcases an impressive diversity, running the gamut from top-down regulatory mandates to market-based approaches, with ample evidence of inter-jurisdictional policy learning.[238] Intra-jurisdictional communication, learning, and cooperation among institutions and stakeholders, however, continues to lag.

Over a quarter-century ago, Professor Richard Lazarus effectively jumpstarted the legal literature on environmental justice when he lamented the lack of participatory processes in environmental policymaking and called for more widespread access to relevant decisionmaking fora.[239] Shortly after, Professor Alice Kaswan noted the widespread perception of environmental law as a "significant

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[233] *See* Vincent Ostrom, et al., *The Organization of Government in Metropolitan Areas: A Theoretical Inquiry*, 55 AM. POL. SCI. REV. 831, 831–32 (1961); *see also* Elinor Ostrom, *Beyond Markets and States: Polycentric Governance of Complex Economic Systems*, 100 AM. ECON. REV. 641 (2010) (tracing the genesis and evolution of the polycentric governance approach).

[234] *See* Elinor Ostrom, *A Polycentric Approach for Coping with Climate Change* 32–39 (The World Bank Policy Research, Working Paper No. 5095, 2009).

[235] Elinor Ostrom, *Polycentric Systems for Coping with Collective Action and Global Environmental Change*, 20 GLOB. ENVTL. CHANGE 550, 552 (2010).

[236] *See* Daniel H. Cole, *Advantages of a Polycentric Approach to Climate Change Policy*, 5 NATURE CLIMATE CHANGE 114, 114 (2015).

[237] *See* New State Ice Co. v. Liebmann, 285 U.S. 262, 311 (1932) (Brandeis, J., dissenting).

[238] *See, e.g.,* Mormann, *Clean Energy Federalism*, *supra* note 14, at 344 (describing the "panoply of federal and state renewable energy policies").

[239] *See* Lazarus, *supra* note 52, at 850 (urging that serious consideration should be given to reforming the structure of environmental policymaking so as to enhance access to relevant decisionmaking fora). Beyond the community of legal scholars, Robert Bullard is generally credited as the father of the environmental justice movement. *See, e.g.*, Robert D. Bullard, *Solid Waste Sites and the Black Houston Community*, 53 SOC. INQUIRY 273 (1983).

cause of disproportionate burdens."[240] This Article's equity inquiry suggests that today's clean energy policies create similarly pervasive distributional distortions, likely due, at least in part, to deficits in participation and transparency. While environmental lawmakers are increasingly seeking input from a wide range of stakeholders,[241] policymakers and regulators rarely manage to muster the same level of engagement with the public in the context of energy-related decisionmaking.[242] In a forthcoming article, Professors Shelley Welton and Joel Eisen offer empirical evidence suggesting that more widespread public participation in clean energy policymaking is prevented by "byzantine decision-making processes" as well as the "particularly technical" nature of the issues involved.[243]

As the electric grid and other aspects of the energy economy become more interactive,[244] so, too, should the policy landscape that supports these developments become more participatory. With climate change a key driver of the clean energy transition, Ostrom's pitch for more polycentric governance in climate issues readily translates to clean energy governance. In a recent study of climate and energy programs in Bangladesh, Brazil, China, and Denmark, Professor Benjamin Sovacool found that "polycentric approaches to climate and energy governance can offer an equitable, inclusive, informative, accountable, protective, and adaptable framework for promoting renewable energy."[245]

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[240] Alice Kaswan, *Environmental Justice: Bridging the Gap Between Environmental Laws and Justice*, 47 AM. U. L. REV. 221, 223 (1997).

[241] *See, e.g.*, Sheila Foster, *Environmental Justice in an Era of Devolved Collaboration*, 26 HARV. ENVTL. L. REV. 459, 460 (2002) (noting increasing participation by local collaborative groups, or "devolved collaboration," in environmental decisionmaking); Kaswan, *supra* note 240, at 226–27 (describing the Environmental Protection Agency's establishment of the Environmental Equity Workgroup and similar efforts to ensure more widespread participation in environmental lawmaking).

[242] Energy regulation is often likened to a black box. *See, e.g.*, Klaus Heine, *Inside the Black Box: Incentive Regulation and Incentive Channeling on Energy Markets*, 17 J. MGMT. & GOVERNANCE 157, 158 (2013); KEN BANISTER, NAVIGATING THE BLACK BOX OF ENERGY REGULATION: A PEEK INSIDE THE ALBERTA ENERGY REGULATOR 1, http://kbanister.com/dl/Black_Box.pdf [https://perma.cc/9BYF-BJG2]. For an illustrative example of the widespread practice of using "black-box settlements" to resolve disputes over the rates for energy services and products, see, e.g., City of Osceola v. Entergy Arkansas, Inc., 154 F.E.R.C. ¶ 61099, 2016 WL 682824, at *5 (F.E.R.C. Feb. 18, 2016).

[243] Welton & Eisen, *supra* note 17, at 40.

[244] *See, e.g.*, Welton, *Clean Electrification*, *supra* note 17, at 583 ("[S]tates are more directly mediating the relationship between consumers and electricity, seeking to prompt more active grid participation on the part of consumers.").

[245] Sovacool, *supra* note 18, at 3842.

Building on these insights, policymakers should solicit more widespread feedback and participation at the design and implementation stages of the next generation of clean energy policies. A better understanding of diverse and often competing stakeholder interests will allow for more accurate mapping of the anticipated flows of costs and benefits under a policy. Close monitoring of actual policy impacts and iterative learning through regular stakeholder participation as well as information exchange among policymakers can help fine-tune policies over time.

To be clear, participation is no panacea. More widespread stakeholder involvement in the energy policymaking process poses its own challenges. If the impact of participatory policymaking is to extend beyond mere lip service, institutional frameworks must allow for consideration and incorporation of stakeholder input into the actual decisionmaking process. The latter, however, may require significant time and resources. The rulemaking process for federal agencies under the Administrative Procedures Act (APA)[246] aptly illustrates this point. In developing the Obama Administration's Clean Power Plan,[247] the Environmental Protection Agency (EPA) received well over four million comments on its proposed rule.[248] The scale of this unprecedented input from states, tribes, utilities, and other stakeholders is all the more remarkable considering that EPA followed the APA's—theoretically, at least—more streamlined track of notice-and-comment rulemaking.[249]

Not every institution tasked with energy-related policymaking and regulation has the resources required to sift through millions of pages of comments or conduct weeks of hearings. This is especially true of institutions at the state, municipal, and other subnational levels—the primary fora for clean energy policymaking in recent years.[250] Any attempts at reform to render decisionmaking processes more democratic should, therefore, be careful not to let widespread participation overwhelm and, ultimately, paralyze the policymaker or regulator in question. Along the way, participatory policymaking may have to move beyond hearings, comments, and other traditional methods of soliciting input from the general public. Recent scholarship, for example, suggests prediction markets as a means of aggregating and

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246 5 U.S.C. § 500 et seq. (2018).

247 *See* Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64, 662 (Oct. 23, 2015) (to be codified at 40 C.F.R. pt. 60) [hereinafter Clean Power Plan].

248 *Id.* at 64, 663 (pegging the overall number of comments received at 4.3 million).

249 *See* 5 U.S.C. § 553.

250 For an overview of state and municipal policy activism in climate and clean energy, see, e.g., Mormann, *State Climate Policy Innovation*, *supra* note 111, at 190–91; Kirsten H. Engel & Barak Y. Orbach, *Micro-Motives and State and Local Climate Change Initiatives*, 2 HARV. L. & POL'Y REV. 119, 123 (2008); Daniel A. Farber, *Climate Change, Federalism, and the Constitution*, 50 ARIZ. L. REV. 879, 883 (2008); Richard B. Stewart, *States and Cities as Actors in Global Climate Regulation: Unitary vs. Plural Architectures*, 50 ARIZ. L. REV. 681, 683 (2008).

evaluating widely dispersed information and expertise in a manner that is both time- and cost-effective.[251]

Even with these challenges and caveats in mind, the potential to anticipate and mitigate, if not altogether avoid, the equity deficits observed under today's batch of clean energy policies suggests that the benefits of more participatory policymaking far outweigh the associated costs. Moreover, participatory decisionmaking processes have the potential to build greater popular support for climate and clean energy policy. The literature has long lamented democratic deficits in the regulatory process, suggesting that new laws and policies would meet with greater public approval if constituents feel that their voice has, or at least could have, been heard.[252] Greater transparency of the anticipated flows of costs and benefits, meanwhile, makes it harder for politicians to highjack clean energy policy as a vehicle for doling out favors to special interests thereby reducing the risk of pork-barreling practices that have long marred energy policymaking.[253]

As the clean energy transition transforms the global energy economy, its repercussions are felt across all sectors of society. Decarbonization, therefore, cannot proceed successfully without regard for the equity implications of its enabling policy landscape. To date, clean energy policymaking primarily follows a monocentric, top-down approach with limited opportunity, let alone a sophisticated process, for soliciting and considering stakeholder input. A polycentric approach to clean energy governance has the potential to accelerate the clean energy transition through more effective, better-informed policymaking, while building greater popular support for a key component of global efforts to mitigate anthropogenic climate change.[254]

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[251] *See* Gary Lucas, Jr. & Felix Mormann, *Betting on Climate Policy: Using Prediction Markets to Address Global Warming*, 52 U.C. DAVIS L. REV. 1429 (2019) (exploring the potential for prediction markets to inform the design and implementation of net energy metering programs, feed-in tariffs, and renewable portfolio standards, among other clean energy policies).

[252] *See, e.g.*, David Arkush, *Democracy and Administrative Legitimacy*, 47 WAKE FOREST L. REV. 611, 611–12 (2012) ("[T]he administrative process is often inaccessible to the public . . . and the public lacks tools to assess adequately the quality of regulatory policies and outcomes."); Mark Seidenfeld, *A Civic Republican Justification for the Bureaucratic State*, 105 HARV. L. REV. 1511, 1512 (1992) (arguing that "the political theory of civic republicanism, with its emphasis on citizen participation in government and deliberative decision-making, provides the best justification for the American bureaucracy"); Paul Brest, *Further Beyond the Republican Revival: Toward Radical Republicanism*, 97 YALE L. J. 1623, 1624 (1988) (suggesting that "participatory citizenship is good in itself").

[253] *See* WEISS & BONVILLIAN, *supra* note 63, at 208.

[254] For persuasive evidence of the need to accelerate the clean energy transition, see, e.g., Intergovernmental Panel on Climate Change, *Summary for Policy Makers*, *in* GLOBAL WARMING OF 1.5°C (2018) (noting that limiting global warming to 1.5 degrees Celsius will deliver clear benefits to people and natural ecosystems but requires rapid and far-reaching policy action).

CONCLUSION

Policymakers and scholars have historically assessed the performance of clean energy policies through an efficacy-oriented lens and, more recently, through an efficiency-oriented lens. This Article has made the case for adding equity as another first-order consideration in the design, implementation, and assessment of policies to promote the transition to a clean and decarbonized energy economy. Properly defined as the commensurate distribution of costs and benefits, the concept of equity offers a more reliable metric than the competing, normatively charged notions of fairness that dominate the public discourse today. Doctrinally, equity is no stranger to energy law but, rather, deeply rooted in rate design and other staples of public utility law.

For a task as Herculean in scope as the clean energy transition, where timelines are measured in decades and capital requirements in trillions of dollars, it is important to consider not only the equity of the end goal of decarbonization. Rather, any inquiry should logically begin with the distribution of costs and benefits that policies create along the way. Accordingly, this Article calls on policymakers and scholars to include both the equity of the desired outcome and the equity of the enabling policy landscape as they craft the next generation of clean energy policies.

Application of this metric to a sampling of representative case studies reveals significant differences in the policy equity of today's leading clean energy policies. While the present sampling offers but a snapshot of the broader policy landscape, the universally observed room for improvement suggests a systemic underappreciation of the importance of policy equity.

Going forward, this Article proposes the polycentric governance model championed by Nobel Laureate Elinor Ostrom as a catalyst for more equitable clean energy policies. As the clean energy transition continues to make the electric grid ever more interactive, the process of policymaking itself must also become more participatory. A polycentric approach provides significantly more opportunities for experimentation and learning while increasing communication among parties to facilitate greater exchange of critical information and build the trust necessary to inspire more widespread participation and collaboration.