2012

Enhancing the Investor Appeal of Renewable Energy

Felix Mormann
University of Miami School of Law, mormann@law.tamu.edu

ENHANCING THE INVESTOR APPEAL OF RENEWABLE ENERGY

BY

FELIX MORMANN*

This Article introduces an investor-oriented framework for the evaluation of renewable energy policy, applies these newly developed criteria to a qualitative comparison of the primary policy instruments, and offers recommendations to enhance the investor appeal of renewable energy in the United States.

The multi-trillion dollar task of scaling-up renewable energy technologies to mitigate climate change, ensure energy security, and create green jobs is one of the most daunting challenges of the twenty-first century. It is, in fact, too great a challenge for either the public or private sector to shoulder alone. Rather, public policy must catalyze private investment in renewable energy. Empirical evidence of deployment support for renewables from thirty-five countries reveals enormous differences in policy performance. Remarkably, some policies leverage four times as much investment in renewable energy as others, despite offering only half as much compensation to renewable power project developers. These results point to forces at play other than policy remuneration and generation costs alone.

To better understand these forces, this Article develops a framework of criteria to guide the evaluation of deployment policies beyond remuneration. Unlike previous studies, this Article assumes an investor perspective to explore how investment-based, market-based, and behavioral "soft-cost" factors determine a policy's ability to spur investment in renewable energy. Application of these "soft-cost" factors to analyze the primary policy instruments across the globe sheds light on their conceptual capacity to promote the deployment of renewable energy technologies. The results offer an explanation for the observed weak correlation between policy performance and remuneration.

* Associate Professor of Law, University of Miami School of Law; Faculty Fellow, Steyer-Taylor Center for Energy Policy and Finance, Stanford University. For their insightful comments, I am grateful to Jeffrey Ball, William Baude, Richard Buxbaum, Nathan Chapman, Brian Love, Milica Milosavljevic, Dan Reicher, Eric Talley, Buzz Thompson, and Michael Wara. For his superb research support, I am grateful to Sergio Stone. I would also like to thank participants in the faculty workshops at George Washington University, University of Miami, and University of Tulsa. Finally, I would like to thank my editors Adrienne Thompson, Susan Ma, and Daniel Timmons for their thoughtful comments and suggestions.

Indeed, the most successful and cost-effective deployment policies are those with the most favorable impact on the examined "soft-cost" factors and, hence, with the greatest conceptual appeal to renewable energy investors.

Drawing on these insights, this Article develops recommendations for the design and implementation of policies that offer greater appeal to renewable energy investors and allow for faster deployment of renewables—at lower cost to American ratepayers and taxpayers.

I. INTRODUCTION 683
II. THE GLOBAL POLICY POTPOURRI—AN OVERVIEW 690
   A. *Renewable Portfolio Standards* 691
   B. *Tender Regimes* 692
   C. *Feed-In Tariffs* 693
   D. *Production Tax Credits* 694
III. EMPERICAL EVIDENCE OF DEPLOYMENT POLICY SUCCESS 695
   A. *Scope, Methodology, and Metrics of the IEA Policy Review* 696
      1. *Measuring Policy Efficacy* 697
      2. *Measuring Policy Efficiency* 698
   B. *Policy-Based Deployment Success for Onshore Wind* 699
      1. *Policy Efficacy* 699
      2. *Policy Efficiency* 700
   C. *Policy-Based Deployment Success for Solar Photovoltaics* 700
      1. *Policy Efficacy* 701
      2. *Policy Efficiency* 702
   D. *Quantitative Answers and Qualitative Questions* 702
IV. "SOFT-COST" FACTORS—A FRAMEWORK FOR POLICY EVALUATION 704
   A. *Investment-Based Factors* 705
   B. *Market-Based Factors* 707
   C. *Behavioral Factors* 709
V. A "SOFT-COST" FACTOR ANALYSIS OF DEPLOYMENT POLICIES 710
   A. *Policy Impact on Investment-Based Factors* 711
      1. *Investment Certainty* 711
      2. *Transaction Costs* 713
      3. *Range of Potential Investors and Investment Opportunities* 714
   B. *Policy Impact on Market-Based Factors* 717
      1. *Grid Access* 717
      2. *Dispatch Priority* 719
      3. *Forecast and Balancing Responsibilities* 720
   C. *Policy Impact on Behavioral Factors—Social Acceptance* 722
   D. *Summary* 723
VI. TOWARD A MORE INVESTOR-ORIENTED U.S. RENEWABLES POLICY 725
   A. *Adjustments to Current U.S. Policy Instruments* 725
      1. *Enhancing the Market Efficiency of RPSs* 725

2. *Complementing Tax Credits with Direct Subsidies* 728
B. *Keys to Feed-In Tariff Success in the United States* 728
1. *Getting the Tariff Right—And Keeping it Right* 729
2. *Structuring a Nuanced, Multi-Tiered Feed-In Tariff* 731
3. *Ensuring Compatibility with Existing Policies* 732
VII. CONCLUSION 734

I. INTRODUCTION

The challenge of scaling-up technologies for the generation of electricity from renewable energy sources (renewables) is often compared to the 1960s Space Race.[1] In his 2011 State of the Union address, President Obama referred to America's pressing energy challenges as "our generation's Sputnik moment."[2] Indeed, there are striking parallels between the Space Race and the Race to Renewables,[3] beginning with the shared need for technological innovation at an unprecedented scale. It is no coincidence that the newly established Advanced Research Projects Agency-Energy (ARPA-E) tasked with promoting the necessary energy innovations is modeled after the Defense Advanced Research Projects Agency (DARPA), which is responsible for the development of many crucial space technologies.[4] Like the Space Race was in the 1960s, the Race to Renewables is motivated, at least in part, by concerns over national security. Just as maintaining the balance of power with the Soviet Union during the Cold War was a major motivation for NASA's Apollo Project,[5] one of the drivers behind the Race to Renewables is the desire to enhance America's energy security by decreasing its dependence on foreign oil and gas from geopolitically unstable parts of the world.[6]

---

1 *See, e.g.*, JAY INSLEE & BRACKEN HENDRICKS, APOLLO'S FIRE: IGNITING AMERICA'S CLEAN ENERGY ECONOMY 2–3 (2008); Daniel Van Fleet, Note, *Legal Approaches to Promote Technological Solutions to Climate Change*, DUKE L. & TECH. REV., Oct. 10, 2008, at ¶ 2, 28, *available at* http://www.law.duke.edu/journals/dltr/articles/pdf/11dltr65.pdf.

2 Barack Obama, President of the United States, *Remarks by the President in [the] State of the Union Address* (Jan. 25, 2011), http://www.whitehouse.gov/the-press-office/2011/01/25/remarks-president-state-union-address (last visited July 20, 2012).

3 This Article deliberately employs the term Race to Renewables instead of the broader term Clean Energy Race. To the extent that so-called clean energy technologies rely on non-renewable sources that are subject to eventual depletion, they cannot offer a long-term solution to America's and the world's energy challenges. While these technologies have a role to play as bridge technologies in the short to medium term, only renewable energy technologies can provide long-term solutions and, hence, are the focus of this work.

4 For more details on the parallels between DARPA and ARPA-E, see AM. ENERGY INNOVATION COUNCIL, A BUSINESS PLAN FOR AMERICA'S ENERGY FUTURE 26 (2010), *available at* http://www.americanenergyinnovation.org/wp-content/uploads/2012/04/AEIC_The_Business_Plan_2010.pdf.

5 *See* Van Fleet, *supra* note 1, at ¶ 2.

6 *See* Alan Nogee et al., *The Projected Impacts of a National Renewable Portfolio Standard*, ELEC. J., May 2007, at 33, 43; Shelley Welton, Note, *From the States Up: Building a National Renewable Energy Policy*, 17 N.Y.U. ENVTL. L.J. 987, 987 (2009).

Despite these apparent similarities, the analogy between the Space Race and the Race to Renewables is, in fact, an understatement. The latter features many more participants, including most industrially developed and many developing nations.[7] More importantly, the Race to Renewables has considerably higher stakes, adding overwhelming environmental and economic issues to concerns over national security.[8] Successful climate change mitigation requires that today's carbon-intensive economy turn low-carbon by 2050.[9] Only a complete and rapid transformation of the energy sector can limit global warming to a temperature increase of two degrees Celsius compared to pre-industrialization levels.[10] This two-degree scenario is vital to avoid massive and irreversible disruptions of the global ecosystem.[11] The necessary energy revolution will require massive efforts to improve energy efficiency and to facilitate the timely transition to a low-carbon electricity sector based on renewable sources of clean energy.

The large-scale deployment of renewables is by no means a purely environmental concern; it is also of significant economic importance. The U.S. electricity generation sector alone boasts annual retail revenues of more than $350 billion.[12] Global investment in solar energy technology has increased by over 250% annually between 2004 and 2008.[13] According to a 2011 survey among 350 venture capitalists from four different continents, more general partners anticipate an increase of venture capital investment

---

7 For an overview of the policy activism to promote renewables, see INT'L ENERGY AGENCY, DEPLOYING RENEWABLES: PRINCIPLES FOR EFFECTIVE POLICIES 94–156, 173–74 (2008), [hereinafter INT'L ENERGY AGENCY I], *available at* http://www.iea.org/textbase/nppdf/free/2008/deployingrenewables2008.pdf

8 *See* Alan S. Miller, *Energy Policy from Nixon to Clinton: From Grand Provider to Market Facilitator*, 25 ENVTL. L. 715, 718–19, 726 (1995).

9 *See* ORG. FOR ECON. CO-OPERATION AND DEV., CLIMATE CHANGE MITIGATION: WHAT DO WE DO? 6 (2008), *available at* http://www.oecd.org/dataoecd/30/41/41753450.pdf; *see also* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: SYNTHESIS REPORT 67 (2007), [hereinafter IPCC SYNTHESIS REPORT], *available at* http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis _report.htm. While carbon dioxide is only one of many greenhouse gases—others include methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride—it is the most prominent in the electricity sector and, hence, the focus of this Article and its terminology. *See generally* Energy Info. Admin., *Greenhouse Gases, Climage Change, and Energy: What are Greenhouse Gases?*, http://www.eia.gov/oiaf/1605/ggccebro/chapter1.html (last visited July 19, 2012) (describing how greenhouse gases, like carbon dioxide, contribute to climate change).

10 INT'L ENERGY AGENCY, WORLD ENERGY OUTLOOK 113 (2009).

11 For an overview of peer-reviewed studies and warnings not to exceed the two-degree scenario, see IPCC SYNTHESIS REPORT, *supra* note 9. *See also* Comm'n of the European Communities, *Limiting Global Climate Change to 2 Degrees Celsius: The Way Ahead for 2020 and Beyond*, at 3–5, COM (2007) 2 final (Jan. 10, 2007), *available at* http://eur-lex.europa.eu/LexUriServ/site/en/com/2007/com2007_0002en01.pdf

12 Annual revenue was $353 billion in 2009, down from $364 billion in 2008. ENERGY INFO. ADMIN., ELECTRIC POWER ANNUAL 2009, at 10 (2011).

13 INT'L ENERGY AGENCY, *supra* note 10, at 162 fig.3.7; *see also* EUROPEAN COMM'N, *Support Schemes for Renewable Electricity in the EU*, 31–35 (2010) (noting the various renewables-promoting policies and support schemes of several European countries).

for clean technology than for any other industry segment.[14] Some analysts forecast that by 2030, one in four U.S. workers, i.e., 37 million Americans, could be employed in the renewable energy and energy efficiency industries—assuming appropriate public policy support.[15] Others emphasize that a renewables-based energy sector will create more jobs per megawatt of power installed, per unit of energy produced, and per dollar of investment than a fossil fuel-based energy sector.[16] Denmark's world-leading wind turbine industry demonstrates the export potential of American-made clean energy products.[17] Conversely, American dependence on foreign oil continues to drive up the U.S. trade deficit with daily imports worth approximately $1 billion.[18] The 2008 oil price-shock cost the U.S. economy some $500 billion, underscoring the economic importance of improving the nation's energy security and independence.[19]

The good news is that a timely transition to a low-carbon, renewables-based electricity sector appears within technological reach. In 2008, former Vice President and Nobel Peace Prize winner Al Gore announced his plan to "Re-power America"[20] with 100% clean electricity from renewables within a decade. Since then, over half a dozen independent studies have confirmed the technological feasibility of meeting the entire electricity demand of a given country,[21] region,[22] or even the world,[23] with renewable sources of

14 DELOITTE, GLOBAL TRENDS IN VENTURE CAPITAL: STATE OF THE IPO MARKET (2011), *available at* http://www.deloitte.com/view/en_US/us/press/Press-Releases/bdd907c8aa1b0310VgnVCM1000001956f00aRCRD.htm. Venture capital and private equity investment in renewable energy recently exceeded $100 billion annually. 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, 4999 (2009).

15 AM. SOLAR ENERGY SOC'Y, DEFINING, ESTIMATING, AND FORECASTING THE RENEWABLE ENERGY AND ENERGY EFFICIENCY INDUSTRIES IN THE U.S. AND IN COLORADO 33 tbl.VII-1 (2008), *available at* http://cospl.coalliance.org/fez/eserv/co:2056/gov112r292008internet.pdf.

16 DANIEL M. KAMMEN ET AL., PUTTING RENEWABLES TO WORK: HOW MANY JOBS CAN CLEAN ENERGY INDUSTRY GENERATE? 3 (2004), *available at* http://rael.berkeley.edu/sites/default/files/very-old-site/renewables.jobs.2006.pdf.

17 *See* Judith Lipp, *Lessons for Effective Renewable Electricity Policy from Denmark, Germany and the United Kingdom*, 35 ENERGY POL'Y 5481, 5492 (2007).

18 AM. ENERGY INNOVATION COUNCIL, *supra* note 4, at 8.

19 *Id.* at 10.

20 Al Gore, Speech on Renewable Energy at Constitution Hall (July 17, 2008), http://www.npr.org/templates/story/story.php?storyId=92638501 (last visited July 20, 2012).

21 *See generally* PAUL WILLSON, ET AL., POWERING THE FUTURE – MAPPING OUR LOW-CARBON PATH TO 2050 (2009) (discussing the potential for renewable energy deployment in the U.K.); MATTHEW WRIGHT & PATRICK HEARPS, AUSTRALIAN SUSTAINABLE ENERGY: ZERO CARBON AUSTRALIA STATIONARY ENERGY PLAN (2010).

22 *See generally* EUROPEAN CLIMATE FOUND., ROADMAP 2050 – A PRACTICAL GUIDE TO A PROSPEROUS, LOW-CARBON EUROPE (2010); ARTHOUROS ZERVOS, ET AL., RE-THINKING 2050: A 100% RENEWABLE ENERGY VISION FOR THE EUROPEAN UNION (2010); PRICEWATERHOUSECOOPERS, 100% RENEWABLE ELECTRICITY: A ROADMAP TO 2050 FOR EUROPE AND NORTH AFRICA (2010)

23 *See* Mark Z. Jacobson & Mark A. Delucchi, *Providing all Global Energy with Wind, Water, and Solar Power, Part I: Technologies, Energy Resources, Quantities and Areas of Infrastructure, and Materials*, 39 ENERGY POL'Y 1154, 1164 (2011) [hereinafter *Wind, Water, and Solar Power*]; Mark Z. Jacobson & Mark A. Delucchi, *A Path to Sustainable Energy by 2030*, 301 SCI. AM, Nov. 2009, at 58, 64 [hereinafter *Path to Sustainable Energy*].

energy. In their timeframes for the shift to renewables, the feasibility studies range from 2050[24] as mandated by the two-degree scenario, to 2030,[25] to an extremely ambitious Gore-esque transition as early as 2020.[26]

The bad news is that we remain far from harnessing the full technological potential of power generation from renewable sources of energy. Current projections forecast that renewables will account for only 15% of American electricity generation by 2035.[27] Compared to a renewables share of 10% in 2010,[28] the projected growth over the next quarter of a century is relatively modest. Our business-as-usual trajectory, therefore, is too slow to reap the trifecta of environmental, economic, and energy security rewards that await the winner of the Race to Renewables. One U.S. commentator has already warned that, without a strong commitment to renewables, "we may look toward a future of imported clean technology as a substitute for imported dirty fuels."[29]

A whole plethora of obstacles presently stand in the way of a timely scale-up of renewable energy technologies. Economists have long warned of environmental externalities and other market failures and imperfections in the electricity sector that hinder renewables in their competition with fossil fuel incumbents.[30] Recent legal scholarship has investigated regulatory and other non-economic barriers to the large-scale deployment of renewable energy technologies, offering policy recommendations to cut through the red tape.[31]

Even if these barriers are removed, scaling-up renewable energy technologies will still require an enormous infusion of capital. At a macroeconomic level, the overall cost of transitioning to an electricity sector based on renewables has been estimated at around $100 trillion globally—not including the necessary investments in transmission infrastructure.[32] Notwithstanding recent growth in venture capital and other clean-tech investment, the transition to a low-carbon, renewables-based electricity sector will require a massive influx of trillions of dollars in additional

---

24 EUROPEAN CLIMATE FOUND., *supra* note 22, at 9; WILLSON, ET AL., *supra* note 21, at 05:06; ZERVOS ET AL., *supra* note 22, at 6; PRICEWATERHOUSECOOPERS, *supra* note 22; *Wind, Water, and Solar Power, supra* note 23, at 1154.

25 *Path to Sustainable Energy, supra* note 23.

26 WRIGHT & HEARPS, *supra* note 21, at XV–XX.

27 ENERGY INFO. ADMIN., DOE-EIA 0383(2012), ANNUAL ENERGY OUTLOOK 2012 WITH PROJECTIONS TO 2035, at 3 (2011).

28 *Id.*

29 Miller, *supra* note 8, at 731.

30 *See, e.g.*, NICHOLAS STERN, THE ECONOMICS OF CLIMATE CHANGE: THE STERN REVIEW 347 (2007); European COMM'N. *supra* note 13, at 9–14 (2010); Atanas Kolev & Armin Riess, *Environmental and Technology Externalities: Policy and Investment Implications*, 12 EIB PAPERS 134, 143 (2007); Adam B. Jaffe et al., *A Tale of Two Market Failures: Technology and Environmental Policy*, 54 ECOLOGICAL ECON. 164, 168 (2005).

31 Felix Mormann, *Requirements for a Renewables Revolution*, 38 ECOLOGY L.Q. 903, 960 (2011) (noting that "there is considerably more red tape to be cut through for a megawatt of new capacity from renewable electricity than for the same capacity from fossil fuels").

32 *Path to Sustainable Energy, supra* note 23, at 64.

capital.[33] An investment of such magnitude, however, exceeds the financial means of even the wealthiest nations—including the United States, burdened with a national debt exceeding $15 trillion.[34] Budget austerity measures make it unlikely that military spending can provide renewable energy technologies with the type of capital injection that has helped other emerging technologies, such as the Internet or GPS, reach the stage of commercial application.[35] The private sector, therefore, is called upon to provide the capital necessary for the large-scale deployment of renewables.

From the private sector's microeconomic perspective, investment in renewable energy technologies is wrought with risks and uncertainties about, for example, technology innovation, fuel price development, emission regulation and pricing, and the fiercely debated comparative advantage between centralized utility-scale generation and distributed generation.[36] The high-stakes, high-risk nature of energy investment is exacerbated by the notoriously long "valley of death" between the proof of concept and commercial deployment of power generation technologies.[37] In the information technology industry, a simple mouse click may be all it takes to bring a new website or smartphone application online for its large-scale commercial deployment. In contrast, electricity generation technology often requires up-front investment of hundreds of millions of dollars to prove its suitability for large-scale commercialization. It is in these early stages of commercial deployment, however, that banks and financial markets are the most reluctant to provide the direly needed capital, much less at low cost. This Article starts with the presumption that public policy should serve as a catalyst to leverage the necessary private sector investment to deploy renewable energy technologies at scale.

Public policy support for renewables deployment across the globe presently manifests itself as four general policy approaches:[38] first, as feed-in tariffs, which offer producers of electricity from renewable sources subsidized rates for power sold to the grid;[39] second, as tender regimes that invite competitive bids for contracts over the supply of electricity from

---

33 *See, e.g.*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, SPECIAL REPORT RENEWABLE ENERGY SOURCES - SUMMARY FOR POLICYMAKERS 23 (2011), *available at* http://srren.ipccw g3.de/report/IPCC_SRREN_Full_Report.pdf.

34 *See U.S. Debt Clock*, http://www.usdebtclock.org (last visited July 7, 2012).

35 For the military's role as a driver of innovation, see CHARLES WEISS & WILLIAM B. BONVILLIAN, STRUCTURING AN ENERGY TECHNOLOGY REVOLUTION 20 (MIT Press 2009); AM. ENERGY INNOVATION COUNCIL, *supra* note 4, at 22.

36 For an instructive example of the demands of energy technology portfolio planning, see PETER FOX-PENNER, SMART POWER—CLIMATE CHANGE, THE SMART GRID, AND THE FUTURE OF ELECTRIC UTILITIES 124–25 (2010).

37 WEISS & BONVILLIAN, *supra* note 35, at 31, 40; *see also* Karsten Neuhoff, *Large-Scale Deployment of Renewables for Electricity Generation*, 21 OXFORD. REV. ECON. POL'Y 88, 97–98 (2005) (referring to the many barriers facing new, innovative technologies as compared to their more conventional and well-established incumbent competitors).

38 For an overview, see INT'L ENERGY AGENCY I, *supra* note 7, at 92–94.

39 The first nations to establish feed-in tariffs were Portugal (1988), Germany (1990), Denmark (1992), and Spain (1994). MIGUEL MENDONÇA ET AL., POWERING THE GREEN ECONOMY – THE FEED-IN TARIFF HANDBOOK 77 (2009).

renewables to the grid;[40] third, as tax incentives that reward the investment in renewable power plants through investment tax credits or the production of electricity from renewables through production tax credits;[41] and fourth, as renewable portfolio standards (RPSs), which require an increase of the share of renewables in the respective jurisdiction's energy mix. Coupled with renewable energy certificates, RPSs allow power generators that draw on renewable sources to sell both their electricity and the corresponding certificates to earn more than the market rate for electricity alone.[42]

In contrast to the international potpourri of policies, the political and scholarly debate over deployment support for renewables in the United States has been dominated by RPSs and the controversy over whether they are best implemented at the federal or state level.[43] More than twenty-five proposals for a federal RPS have been introduced on Capitol Hill, but none has passed both chambers to date.[44] In the meantime, some thirty states have adopted RPSs.[45] Following the political discourse, the scholarly community, too, has focused its attention primarily on the merits of RPSs and the ideal institutional level for their implementation.[46] All along, the

---

40 International advocates of tender regimes include the United Kingdom, Ireland, Canada, China, and most recently Denmark for offshore wind farms. *See* INT'L ENERGY AGENCY I, *supra* note 7, at 94–95.

41 Under the American Recovery and Reinvestment Act of 2009 (ARRA), producers of electricity from renewables may claim either investment tax credits or production tax credits. Pub. L. No. 111-5 §§ 1101–02, 123 Stat. 319. For details, see BIPARTISAN POL'Y CTR., REASSESSING RENEWABLE ENERGY SUBSIDIES – ISSUE BRIEF 6 (2011), *available at* http://bipartisanpolicy.org/sites/default/files/BPC_RE%20Issue%20Brief_3-22.pdf.

42 Early adopters of REC trading regimes include Belgium (Flanders), Sweden, and the United Kingdom. *See* Anna Bergek & Staffan Jacobsson, *Are Tradable Green Certificates a Cost-Efficient Policy Driving Technical Change or a Rent-Generating Machine? Lessons from Sweden 2003–2008*, 38 ENERGY POL'Y 1255, 1256 (2010).

43 In contrast, tax incentives such as those provided under section 1603 of the American Recovery and Reinvestment Act have elicited comparatively little debate among politicians and scholars. For details on the section 1603 incentives, see BIPARTISAN POL'Y CTR., *supra* note 41, at 6–7.

44 For a summary of the congressional deadlock over a federal RPS, see Lincoln L. Davies, *Power Forward: The Argument for a National RPS*, 42 CONN. L. REV. 1339, 1341 (2010). *See also* Welton, *supra* note 6, at 996.

45 As of June 2012, 29 states and the District of Columbia have implemented RPSs, 8 more states have adopted non-binding goals for the deployment of renewables. *See* Database of State Incentives for Renewables & Efficiency, *Quantitative RPS Data Project*, http://www.dsireusa.org/rpsdata/index.cfm (last visited July 21, 2012). For a discussion of the history and political background of state RPSs, see BARRY G. RABE, RACE TO THE TOP: THE EXPANDING ROLE OF U.S. STATE RENEWABLE PORTFOLIO STANDARDS (2006), *available at* http://www.c2es.org/docUploads/RPSReportFinal.pdf.

46 *See generally* Davies, *supra* note 44, at 1399; Steven Ferrey, *Renewable Orphans: Adopting Legal Renewable Standards at the State Level*, 19 ELEC. J., Mar. 2006, at 52; Joshua P. Fershee, *Changing Resources, Changing Market: The Impact of a National Renewable Portfolio Standard on the U.S. Energy Industry*, 29 ENERGY L.J. 49 (2008); Joshua P. Fershee, *Moving Power Forward: Creating a Forward-Looking Energy Policy Based on a National RPS*, 42 CONN. L. REV. 1405 (2010) [hereinafter Fershee, *Moving Power Forward*]; Robin J. Lunt, *Recharging U.S. Energy Policy: Advocating for a National Renewable Portfolio Standard*, 25 UCLA J. ENVTL. L. & POL'Y 371 (2006–2007); Robert J. Michaels, *A National Renewable Portfolio Standard: Politically Correct, Economically Suspect*, ELEC. J., Apr. 2008, at 9; Robert J. Michaels, *National*

superiority of RPSs over other deployment policies appears to be taken for granted, despite strong empirical evidence to the contrary. In fact, one of the most comprehensive studies to date observed that feed-in tariffs deliver up to four times the deployment success of RPSs—at half the cost.[47] Yet, the heated debate among legal scholars over a national versus state RPS appears to have left little room to consider other policies in support of renewables' large-scale deployment. One commentator aptly describes the distractive spell of the RPS debate: "It also distracts policy makers from addressing the tangible legal, regulatory, and economic obstacles faced by developers of renewable power projects."[48] Ultimately, the goal of every policy to promote renewables deployment is to attract private-sector investment. It is all the more surprising, therefore, that no previous article has examined these policies from the investor's point of view. This Article aims to close that gap with three original contributions.

This Article is the first to assume an investor perspective to develop a framework of criteria that can guide the evaluation of renewable energy policies beyond sheer remuneration. My analysis applies this framework of "soft-cost" factors to the primary policy instruments across the globe, and explains their vastly different policy performances. The results of this analysis allow me to develop recommendations for more cost-effective and investor-friendly renewable energy policies in the United States.

Renewable Portfolio Standard: Smart Policy or Misguided Gesture?, 29 ENERGY L. J. 79 (2008); Mary Ann Ralls, *Congress Got it Right: There's no Need to Mandate Renewable Portfolio Standards*, 27 ENERGY L. J. 451 (2006); 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 (2008) [hereinafter Sovacool & Cooper, *Congress Got It Wrong*]; Benjamin K. Sovacool & Christopher Cooper, *State Efforts to Promote Renewable Energy: Tripping the Horse with the Cart?*, 8 SUSTAINABLE DEV. L. & POL'Y 5 (2007) [hereinafter Sovacool & Cooper, *State Efforts to Promote Renewable Energy*]; Welton, *supra* note 6. For an economic analysis of state renewable portfolio standards see CLIFF CHEN ET AL., ERNEST ORLANDO LAWRENCE BERKELEY NAT'L LAB., WEIGHING THE COSTS AND BENEFITS OF STATE RENEWABLES PORTFOLIO STANDARDS: A COMPARATIVE ANALYSIS OF STATE-LEVEL POLICY IMPACT PROJECTIONS (2007), *available at* http://eetd.lbl.gov/ea/emp/reports/61580.pdf.

47 INT'L ENERGY AGENCY I, *supra* note 7, at 106 fig.3.

48 Jim Rossi, *The Limits of a National Renewable Portfolio Standard*, 42 CONN. L. REV. 1425, 1450 (2010). To the limited extent the legal literature does address other policies in support of renewables deployment, it is usually in the broader context of climate change policies. *See* Van Fleet, *supra* note 1, at ¶ 3 (providing a cursory overview of climate change policies in general); Neil Craik & Joseph F. C. Dimento, *Climate Law and Policy in North America: Prospects for Regionalism*, 1 SAN DIEGO J. CLIMATE & ENERGY L. 195 (2009) (examining the status quo and future potential for regional climate-change governance in North America); Timothy P. Duane, *Greening the Grid: Implementing Climate Change Policy Through Energy Efficiency, Renewable Portfolio Standards, and Strategic Transmission System Investments*, 34 VT. L. REV. 711, 711–12 (2010) (discussing renewables along with energy efficiency and electricity transmission); Andrew Schatz, *A Tale of Three Signatories: Learning From the European Union, Japanese, and Canadian Kyoto Experiences in Crafting a Superior United States Climate Change Regime*, 70 U. PITT. L. REV. 593 (2009) (employing a more comparative approach). For a rare in-depth discussion of non-RPS policies, 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 (2010); Lincoln L. Davies, *Incentivizing Renewable Energy Deployment: Renewable Portfolio Standards and Feed-in Tariffs*, 1 KLRI J.L. & LEGIS. 39 (2011).

Part II opens with an overview of the primary policy approaches to promote renewables deployment: feed-in tariffs, tender regimes, tax incentives, and renewable portfolio standards. Part III reviews empirical evidence from thirty-five countries regarding these policies' efficacy and efficiency at promoting the large-scale deployment of renewable energy technologies. The results of this secondary data analysis indicate that policy efficacy does not necessarily correlate with high levels of remuneration, pointing to forces at play other than generation costs alone.

Against this background, Part IV develops a framework of criteria to guide the analysis of deployment policies beyond their remuneration levels. Unlike previous studies, this Article assumes an investor perspective to explore how investment-based, market-based, and behavioral factors determine a deployment policy's capacity to leverage investment in renewable energy technologies. Consideration of these "soft-cost" factors allows for a better understanding of each policy's conceptual capacity to promote the large-scale deployment of renewables.

Part V examines an array of investment-based, market-based, and behavioral "soft-cost" factors to determine the ability (or inability) of the aforementioned policy quartet to leverage investment in renewable energy technologies. The results of my analysis offer an explanation for the observed weak correlation between policy efficacy and remuneration, and for the superior performance of feed-in tariffs as the policy with the greatest conceptual appeal to renewables investors. Part VI offers policy recommendations to enhance the investor appeal and,. hence, deployment success of renewable energy in the United States.

II. THE GLOBAL POLICY POTPOURRI—AN OVERVIEW

In light of compelling environmental, economic and security-related concerns, most industrially developed nations have adopted policies to promote the large-scale deployment of renewable energy technologies.[49] Despite the general consensus on the underlying policy rationale, the different measures vary considerably in their design, implementation, and success. Deployment policies across the globe run the gamut from libertarian and market-driven to command-and-control.

There is no universally accepted dichotomy or classification for deployment policies in support of renewable energy technologies.[50] Some

49 *See* Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the Promotion of the Use of Energy from Renewable Sources, pmbl., art. 1, 2009 O.J. (L 140) 16, 27 *available at* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009L0028:EN:NOT (stating that renewable energy development is necessary to reduce GHG. emissions and establishing a framework for developing renewable energy in the European Union). *See also* Lunt, *supra* note 46, at 374 ("It makes sense ecologically, economically, and for national security to create policies that promote the development of new renewable energy sources.").

50 *See* JOHN A. ALIC ET AL., U.S. TECHNOLOGY AND INNOVATION POLICIES: LESSONS FOR CLIMATE CHANGE 15 (2003), *available at* http://www.c2es.org/docUploads/us-technology-innovation-policies.pdf (noting that "the United States has never had a coherent set of innovation policies"

commentators categorize such policy measures according to the level of government intervention.[51] Others distinguish between quantity-based and price-based policies.[52] Yet another classification differentiates between policy measures that incentivize investment in equipment for electricity generation from renewables and policies that reward the operation of such equipment.[53] The "California Wind Rush" of the 1980s and more recent experiences with wind farms in India have shown investment-based deployment incentives to be less effective at raising the share of renewables in the electricity mix in the long term than operation-based incentives.[54] Accordingly, this Article focuses on deployment policies that reward the operation of equipment for the generation of electricity from renewables—renewable portfolio standards, tender regimes, feed-in tariffs, and production tax credits.[55]

A. Renewable Portfolio Standards

Renewable portfolio standards—also known as renewable quota obligations—are generation-based, quantity-driven policy instruments.[56] An RPS requires the addressees—usually electricity utility companies[57]—to source a certain share of the electricity they sell from renewable sources of energy.[58] Utilities prove their compliance with these requirements through renewable energy credits (RECs).[59] These RECs are issued, usually on a per kilowatt-hour (kWh) or megawatt-hour (MWh) basis, to producers of

---

and that "no universally accepted nomenclature or taxonomy summarizes or describes" policies affecting innovation).

51 *E.g.*, Van Fleet, *supra* note 1, at ¶ 3 (suggesting four categories of technological development, including "market-related incentive" and "creation of government institutions").

52 *E.g.*, Reinhard Haas et al., *A Historical Review of Promotion Strategies for Electricity from Renewable Energy Sources in EU Countries*, 15 RENEWABLE & SUSTAINABLE ENERGY REV. 1003, 1011 (2011).

53 INT'L ENERGY AGENCY I, *supra* note 7, at 92.

54 *See* MENDONÇA ET AL., *supra* note 39, at 171. In particular, investment-based deployment incentives fail to reward continuous service and maintenance of generation facilities. As a result, many of the wind turbines installed across California in the early 1980s operated only briefly or intermittently. In fact, some clean energy pioneers claim that many of these early wind turbines were not even connected to the grid. *See id.* (discussing the unreliability of the early wind farms built "to take advantage of tax credits" and not to "produce electricity.")

55 *Infra* Parts II.A–D.

56 Haas et al., *supra* note 52, at 1014.

57 Unlike most countries, Sweden initially aimed its RPS at electricity consumers. In 2006, however, the Swedish RPS was amended to target electricity utility companies. *See* Bergek & Jacobsson, *supra* note 42, at 1258.

58 In contrast, some jurisdictions, including eight states in the U.S., have adopted merely voluntary renewable energy goals. Davies, *supra* note 44, at 1386. In light of their limited promotional impact, this Article ignores such voluntary renewables goals and focuses on mandatory RPSs.

59 Haas et al., *supra* note 52, at 1014; MENDONÇA et al., *supra* note 39, at 155, 161. Internationally, these are also referred to as Tradable Green Certificates or Renewable Energy Guarantees of Origin. *Id.* at 156.

electricity from eligible renewable sources of energy.[60] Non-utility power generators sell the electricity they produce at regular market prices. In addition, they can also sell the corresponding RECs to utilities, thereby receiving a premium for their reliance on renewables. Alternatively, utilities that are subject to RPSs can invest in their own renewable energy power generation facilities to earn RECs for the electricity they produce. At the end of each reporting period, utilities are required to hold RECs tantamount to the share of renewables in the electricity mix set forth by the RPS. Failure to do so triggers penalty payments designed to enforce compliance with the RPS. In general, RPSs are technology-neutral and award the same amount of RECs for all eligible strands of renewable energy technologies. Some jurisdictions, however, have implemented technology-specific RPSs that offer credit multipliers for select renewables technologies.[61]

RPSs have been particularly popular at the U.S. state level, as demonstrated by their adoption by twenty-nine states and the District of Columbia.[62] Around the world, the United Kingdom, Sweden, Belgium, and Australia feature prominently among the nations who have adopted RPSs to promote the large-scale deployment of renewable energy technologies.[63]

B. Tender Regimes

Under a tender regime—sometimes described as a reverse auction mechanism[64]—the government invites competitive bids to supply a specified amount of electricity from a certain renewable energy technology over a predetermined period of time.[65] The successful bidder is awarded a long-term power purchase contract at its winning bid's price per 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.[66] In contrast to RPSs, tender regimes are

60 *See* Davies, *supra* note 44, at 1359.

61 *See, e.g., id.* at 1377 (pointing to technology-specific REC multipliers in no less than 16 states in the U.S.).

62 *See* Database of State Incentives for Renewables & Efficiency, *Quantitative RPS Data Project*, http://www.dsireusa.org/rpsdata/index.cfm (last visited July 7, 2012). The first state to adopt an RPS was Iowa in 1983. Davies, *supra* note 44, at 1357.

63 *See* MENDONÇA ET AL., *supra* note 39, at 150–51; *see also* INT'L ENERGY AGENCY I, *supra* note 7, at 94–95 tbl.2 (listing countries that utilize RPSs).

64 For an introduction to the terminology and mechanics of tender regimes / reverse auction mechanisms in liberalized markets see Christian Jaag & Urs Trinkner, *Tendering Universal Service Obligations in Liberalized Network Industries* 2 (Swiss Economics, Working Paper No. 0013, 2009), *available at* http://www.swiss-economics.ch/RePEc/files/0013JaagTrinkner.pdf.

65 For further information on tender regimes in the renewable electricity context, see Claus Huber et al., *Economic Modelling of Price Support Mechanisms for Renewable Energy: Case study on Ireland*, 35 ENERGY POL'Y 1172, 1175 (2007); INT'L ENERGY AGENCY I, *supra* note 7, at 92.

66 Robert Gross & Phil Heptonstall, *Time to Stop Experimenting with UK Renewable Energy Policy* 8 (Imperial College Centre for Energy Policy and Technology, Working Paper No. ICEPT/WP/2010/003, 2010), *available at* https://workspace.imperial.ac.uk/icept/Public/Time%20to%20stop%20experimenting.pdf.

inherently technology-specific, as the call for bids specifies the eligible strand of renewable energy technologies.[67]

China, France, Ireland, the United Kingdom, and some states in the United States have used tender regimes to promote the deployment of various renewable energy technologies.[68] Most recently, Denmark has relied on tender regimes for offshore wind farms.[69]

C. Feed-In Tariffs

Feed-in tariffs, or FITs, are two-pronged policy instruments for the promotion of renewables' large-scale deployment.[70] The "feed-in" element guarantees renewable electricity generators the right to connect to the power grid. The "tariff" element requires local utilities to purchase the power that these generators feed into the grid at subsidized rates above market prices for an extended period of time.[71] The subsidized rates determine 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.[72] The cost of the tariff's subsidy is usually distributed across all electricity customers so as not to unduly burden the electric utilities or the government.[73] As a price-based policy instrument, feed-in tariffs require regulators to set the subsidized rates at a level that is high enough to incentivize private sector investment in power generation from renewables without offering windfall profits.[74] Feed-in tariffs are usually technology-specific, offering different tariff rates to different strands of renewable energy technologies, typically based on their respective technological

67 *See* MENDONÇA ET AL., *supra* note 39, at 174–75.

68 Bent Ole Gram Mortenson, *International Experiences of Wind Energy*, 2 ENVTL. & ENERGY L. & POL'Y J. 179, 202 (2008); Haas et al., *supra* note 52, at 1020; MENDONÇA ET AL., *supra* note 34, at 174–75.

69 Haas et al., *supra* note 52, at 1020.

70 *See* Wilson H. Rickerson et al., *If the Shoe FITs: Using Feed-in Tariffs to Meet U.S. Renewable Electricity Targets*, ELEC. J., May 2007, 73. For a detailed description of the various feed-in tariff design elements, see MENDONÇA ET AL., *supra* note 35, at 15–38. In the U.S., feed-in tariff regimes are increasingly referred to as "CLEAN Programs" (Clean Local Energy Accessible Now). For further information see: http://www.clean-coalition.org/introduction-to-clean-programs/ (last visited July 7, 2012). *See also* John Farrell, *CLEAN v SRECs: Finding the More Cost-Effective Solar Policy* (October 2011) at 4, *available at* http://energyselfreliantstates.org/content/clean-v-srecs-finding-more-cost-effective-solar-policy.

71 The duration of this purchase obligation ranges from 8 years in Spain, to 15 years in France, to 20 years in Germany. *See* Dominique Finon, *Pros and Cons of Alternative Policies Aimed at Promoting Renewables*, 12 EIB PAPERS 110, 115 (2007), *available at* http://www.eib.org/attachments/efs/eibpapers/eibpapers_2007_v12_n02/eibpapers_2007_v12_n02_a05_en.pdf.

72 The second option is sometimes referred to as a "feed-in premium" or "premium feed-in tariff." *See* MENDONÇA ET AL., *supra* note 39, at 40. For an example of the retail rate percentage option see Lucy Butler & Karsten Neuhoff, *Comparison of Feed in Tariff, Quota and Auction Mechanisms to Support Wind Power Development*, 33 RENEWABLE ENERGY 1854, 1855 (2008). Unless expressly stated otherwise, this Article refers to all of these options uniformly as feed-in tariffs.

73 MENDONÇA ET AL., *supra* note 39, at 28–29.

74 *Id.* at 19.

maturity and generation costs.[75] In addition, feed-in tariff design can be size-specific in order to account for the different cost structures of utility-scale and distributed generation.[76]

Feed-in tariffs have been especially popular in Europe, pioneered by countries like Denmark, Germany, Portugal, and Spain.[77] Non-European jurisdictions with feed-in tariffs to promote renewables deployment include South Africa, Kenya, the Canadian province of Ontario, the Indian states West Bengal, Rajasthan, Gujarat, and Punjab, as well as Australia's Capital Territory, New South Wales, and South Australia.[78] Recently, a few pioneering U.S. states, including California,[79] Hawaii,[80] Oregon,[81] Rhode Island,[82] Vermont,[83] and Washington,[84] as well as some U.S. municipalities[85] have enacted feed-in tariff regimes.

D. Production Tax Credits

Like feed-in tariffs, production tax credits, or PTCs, are price-based support mechanisms.[86] In terms of remuneration, both policy instruments appear to be two sides of the same coin.[87] In lieu of the feed-in tariff

---

75 *Id.* at 26. For an example of cost reductions through technology learning in solar photovoltaics and onshore wind energy see INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 33, at 13.

76 MENDONÇA ET AL., *supra* note 39, at 26–27.

77 *See* INT'L ENERGY AGENCY I, *supra* note 7, at 92–94; *see also* Grinlinton & Paddock, *supra* note 48, at 949 (noting that Germany's FIT laws, which were introduced in 1990, have been a major driver behind the country's solar PV development).

78 MENDONÇA ET AL., *supra* note 39, at 90–91, 97–100, 102–07.

79 S.B. 32, 2009–2010 Reg. Sess. (Cal 2009) (codified at CAL. PUB. UTIL. CODE § 399.20).

80 Order Approving FIT Tiers 1 and 2 Tariffs, Standard Agreement, and Queuing and Interconnection Procedures, Docket No. 2008-0273 (Haw. P.U.C. 2010).

81 H.B. 3690, 75th Leg., Spec. Sess. (Or. 2010); H.B. 3039, 75th Leg., Reg. Sess. (Or. 2009); Pilot Programs to Demonstrate the Use and Effectiveness of Volumetric Incentive Rates for Solar Photovoltaic Energy Systems, Order No. 11-339 (Or. P.U.C. Sept. 1, 2011); Pilot Programs to Demonstrate the Use and Effectiveness of Volumetric Incentive Rates for Solar Photovoltaic Energy Systems, Order No. 10-198 (Or. P.U.C. May 28, 2010); Rulemaking Regarding Solar Photovoltaic Energy Systems, Order No. 10-200 (Or. P.U.C. May 28, 2010).

82 H. 6104, Gen. Assemb. (R.I. 2011).

83 H. 446, Gen. Assemb. (Vt. 2009).

84 S.B. 6658, 61st Leg., Reg. Sess. (Wash. 2010); S.B. 6170, 61st Leg., Reg. Sess. (Wash. 2009); S.B. 5101, 59th Leg., Reg. Sess. (Wash. 2005).

85 For some examples of recently adopted municipal feed-in tariffs, see: Zachary Shahan, *Los Angeles Solar Feed-in Tariff Launched*, CLEAN TECHNICA (Apr. 12, 2012), http://cleantechnica.com/2012/04/12/los-angeles-solar-feed-in-tariff/ (last visited July 21, 2012); Joshua Hill, *Palo Alto Gets Feed-in Tariff for Photovoltaics*, CLEAN TECHNICA, http://cleantechnica.com/2012/03/07/palo-alto-solar-feed-in-tariff-for-photovoltaics/ (last visited July 21, 2012); RENEWABLE ENERGY WORLD, http://www.renewableenergyworld.com/rea/news/article/2009/02/gainesville-solar-feed-in-tariff-a-done-deal (last visited July 21, 2012) (describing the first-ever municipal U.S. feed-in tariff adopted in Gainesville, FL).

86 In keeping with its focus on generation-based deployment policy support, this Article uses the terms "production tax credit" and "tax credit" interchangeably. Unless otherwise stated, the term "tax credit" does not encompass investment tax credits.

87 Some claim that a production tax credit, "in effect, acts equivalently to a feed-in premium." INT'L ENERGY AGENCY I, *supra* note 7, at 101. As I will point out in greater detail later,

payments, production tax credit regimes reward the owner of a qualifying power plant with tax credits for each unit of electricity output, e.g., a kWh, generated from renewable sources.[88] At the end of each year, the accumulated tax credits can be used to reduce the tax liability of the renewable energy plant owner. Like feed-in tariffs, production tax credits are usually technology-specific, setting different reward levels for various strands of renewable energy technologies.[89]

Production tax credits play a prominent part in deployment support for renewables at the U.S. federal level, as evidenced by the American Recovery and Reinvestment Act's (ARRA's) current tax credits for qualifying plants that generate electricity from renewables.[90] Other nations that rely primarily on tax credits to promote electricity from renewables include Finland and Malta.[91] Many countries use tax credits in tandem with other policy instruments, such as tender regimes or RPSs.[92]

III. EMPIRICAL EVIDENCE OF DEPLOYMENT POLICY SUCCESS

The quest for the policy that most effectively and efficiently promotes the large-scale deployment of renewable energy technologies has elicited much debate, especially among economists.[93] The discussion is by no means limited to the scholarly community; it also has a strong political dimension. Libertarians advocate for quantity-based, market-oriented mechanisms, such as RPSs and tender regimes, while supporters of "big government" favor price-based mechanisms, such as feed-in tariffs or tax credits.[94] Comprehensive policy comparisons across a large sample of jurisdictions are few and far between. Instead, studies tend to focus on a few select sample jurisdictions—the "usual suspects" in the Petri dish of renewable energy policy.[95] A comparison across these studies to create a larger

tax credits and feed-in tariffs are, in fact, fundamentally different in their ability to promote the deployment of renewable energy technologies. *See* discussion *infra* Part IV.

88 MENDONÇA ET AL., *supra* note 39, at 172.

89 *Id.* at 173.

90 American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (2009). For a more detailed discussion of ARRA's tax credit provisions and previous tax credit regimes at the U.S. federal level see BIPARTISAN POL'Y CTR., *supra* note 41.

91 Haas et al., *supra* note 52, at 1016.

92 *Id.*

93 A comprehensive review of the related economic literature is beyond the scope of this Article. However, to name but a few see STERN, *supra* note 30, at 347; EUROPEAN COMM'N, *supra* note 13, at 9–12; Finon, *supra* note 71, at 117–24; Kolev & Riess, *supra* note 30, at 143–46; Jaffe et al., *supra* note 30, at 168–73; Carolyn Fischer & Richard G. Newell, *Environmental and Technology Policies for Climate Mitigation*, 55 J. ENVTL. ECON. & MGMT. 142, 145–46 (2008).

94 For an instructive summary of the fierce debate over RPSs and feed-in tariffs, *see, e.g.*, Rickerson et al., *supra* note 70, at 3–4; Finon, *supra* note 71, at 115–16.

95 *See generally* Butler & Neuhoff, *supra* note 72 (focusing on Germany and the United Kingdom); Lipp, *supra* note 17, at 5481 (focusing on Denmark, Germany and the United Kingdom); Staffan Jacobsson et al., *EU Renewable Energy Support Policy: Faith or Facts?*, 37 ENERGY POL'Y 2143 (2009) (focusing on Sweden, the United Kingdom, and the Belgian province of Flanders); C. Mitchell et al., *Effectiveness Through Risk Reduction: A Comparison of the*

aggregate sample of jurisdictions and policies is not only beyond the scope of this Article, it also offers no satisfactory solution, as different studies tend to use differing definitions and metrics for policy efficacy and efficiency.[96]

The following discussion relies on the International Energy Agency's (IEA) empirical review of deployment policy success in thirty-five countries across the globe.[97] Following an outline of the IEA study's scope, methodology, and metrics, I will examine its results regarding the deployment success of policies regarding onshore wind and solar photovoltaics.[98] Both feature prominently among the renewable energy technologies with the greatest potential for future deployment.[99] Moreover, they represent two technology strands at vastly different levels of market maturity and cost-competitiveness:[100] Under favorable conditions, onshore wind is already cost-competitive with some fossil fuel incumbent technologies.[101] Solar photovoltaic technology, in turn, tends to be several times more expensive, requiring considerably higher levels of deployment policy support.[102]

A. Scope, Methodology, and Metrics of the IEA Policy Review

In its review of the efficacy and efficiency of deployment policies, the IEA examined the renewable energy markets and policies of thirty OECD member nations, as well as the five "BRICS" nations: Brazil, Russia, India, China, and South Africa.[103] The study covers the period from 2000 to 2005. To

---

Renewable Obligation in England and Wales and the Feed-in System in Germany, 34 ENERGY POL'Y 297 (2006) (focusing on Germany, Wales, and England).

96 For an overview of the different schools of thought on how to measure policy efficacy, see INT'L ENERGY AGENCY I, *supra* note 7, at 87–88.

97 *See id.* at 85–87 (providing an overview of the "effectiveness and efficiency of deployment policies implemented to support" renewable energy technologies).

98 *Infra* Parts III.A–C. For recent trends, albeit with different and less appropriate metrics for the purposes of this Article, see also INT'L ENERGY AGENCY, DEPLOYING RENEWABLES: BEST AND FUTURE POLICY PRACTICE (2011) [hereinafter INT'L ENERGY AGENCY II].

99 *See, e.g., Path to Sustainable Energy*, *supra* note 23, at 60 (noting that about 1,700 TW of wind capacity and 6,500 TW of solar capacity is available globally).

100 For an instructive categorization of different strands of renewable energy technologies according to their levels of market maturity see Neuhoff, *supra* note 37, at 89.

101 Sonja Lüthi & Thomas Prässler, *Analyzing Policy Support Instruments and Regulatory Risk Factors for Wind Energy Deployment—A Developers' Perspective*, 39 ENERGY POL'Y 4876, 4876 (2011).

102 *See* EUROPEAN COMM'N, *supra* note 13, at 15 fig.4 (providing an overview of the production costs of electricity for different sources of energy, including projections for future price developments based on the European Union's CASES (Cost Assessments for Sustainable Energy Research Markets) research project). For more detail see Comm'n of the European Communities, *Energy Sources, Production Costs, and Performance of Technologies for Power Generation, Heating and Transport*, SEC (2008) 2872 (Nov. 13, 2008), *available at* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SEC:2008:2872:FIN:EN:PDF (providing a comparative analysis of energy technologies for power generation).

103 *See* INT'L ENERGY AGENCY I, *supra* note 7, at 86 (examining OECD member countries Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Great Britain, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the

account for more recent trends, results are reported both for the entire period and, separately, for the years 2004 and 2005. Data was collected from the Global Renewable Energy Policies and Measures Database and with the help of government and consultant experts.[104] The study includes deployment data for onshore wind, biomass, biogas, geothermal, solar photovoltaics, and hydroelectric power.[105] Following the prevailing nomenclature in the literature, policy deployment success was measured in terms of policy efficacy and policy efficiency.[106]

1. Measuring Policy Efficacy

The energy policy literature has produced a cornucopia of ways to measure policy efficacy.[107] One approach compares the achieved results with a pre-defined deployment target. This methodology, however, impedes cross-country comparisons, and suffers from a bias in favor of conservatively set targets.[108] A second approach focuses on the absolute growth in renewables capacity or generation achieved over a certain period of time. While slightly more reliable than the first approach, this methodology fails to control for a country's size, and is therefore biased in favor of larger countries.[109] Conversely, reliance on the achieved annual growth rate of a country favors smaller countries as well as countries that have only just entered the Race to Renewables.[110]

In response to the shortcomings of the aforementioned methods to measure policy efficacy, the IEA study relies on an efficacy indicator that correlates annual growth with the respective country's actual renewable energy potential.[111] The study's point of reference is the "realizable mid-term potential" for renewable energy deployment by 2020 —a benchmark based on country-specific resource availability, technology development,

---

Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Turkey, and the U.S.).

104 *Id.* at 87.

105 Other technologies such as offshore wind, enhanced geothermal, wave, tidal, and marine currents, were not included as they had not yet progressed sufficiently beyond the demonstration phase to show significant deployment. *Id.* at 86.

106 *Id.* at 87.

107 *Id.* at 88–89. The following discussion draws on the overview of different methods and indicators to measure policy efficacy.

108 *Id.* at 89.

109 *Id.*

110 *Id.*

111 *Id.* This efficacy indicator was adopted from a series of European Union research projects. *See, e.g.*, Comm'n of the European Communities, *The Support of Electricity from Renewable Energy Sources*, SEC(2008) 57, at 9, 24, (Jan. 23, 2008), *available at* http://ec.europa.eu/energy/renewables/doc/sec_2008_57__electricity_report.pdf. *See generally* MARIO RAGWITZ ET AL., INTELLIGENT ENERGY EUROPE, *ASSESSMENT AND OPTIMISATION OF RENEWABLE ENERGY SUPPORT SCHEMES IN THE EUROPEAN ELECTRICITY MARKET*, (2007), *available at* http://www.optres.fhg.de/OPTRES_FINAL_REPORT.pdf (discussing the goals, design criteria, and competitive framework conditions necessary to improve current renewable energy policymaking in Europe).

maximum market growth rates, and planning constraints.[112] Controlling for these country-specific factors allows for a more reliable comparison of deployment success across policies and countries.[113]

2. Measuring Policy Efficiency

The success of renewable energy policies depends not only on their achieved growth in renewables deployment but, crucially, on the level of financial support required to induce it.[114] A comparison of support levels across countries helps identify the most cost-efficient policy regimes. In the IEA study, this comparison is based on the total remuneration level.[115] To calculate normalized remuneration levels, the 2005 levels under the primary policy regime are annualized for each investigated renewable energy technology over a common period of twenty years.[116] This approximation comes at a price—for RPS regimes, the total remuneration level of the electricity market price plus the average value of RECs is based on the assumption of constant REC prices at 2005 levels;[117] for feed-in tariffs, the total remuneration is annualized accordingly if the support period is less than twenty years.[118] Tariff degressions are not taken into account. The IEA metrics for policy efficiency, therefore, should be interpreted as an efficiency indicator rather than a calculation of actual remuneration levels.[119]

---

112 INT'L ENERGY AGENCY I, *supra* note 7, at 61–62, 88.

113 *See also* INT'L ENERGY AGENCY II, *supra* note 98. This Article deliberately focuses on the original IEA study, *see supra* note 7, as its methodology and metrics for policy performance are more appropriate to measure and compare the investor appeal of policies to promote the deployment of renewable energy technologies. Unlike the original IEA study, the follow-up study measures policy performance by a "Policy Impact Indicator." This indicator measures the percentage of the gap that has been closed between 2005 generation and the 2030 target scenario for 450 ppm to limit global warming to two degrees Celsius. *See* INT'L ENERGY AGENCY II, *supra* note 98, at 108. The "Policy Impact Indicator" carries risks regarding the accuracy of disaggregating of regional projections to national levels. *Id.* at 110. Unlike the original study's "Efficacy Indicator," the new "Policy Impact Indicator" cannot control for country-specific variations in resource endowment. *Id.* at 111. These shortcomings may be acceptable for studies that assume a macroeconomic perspective, which prioritizes climate change mitigation through renewables at global scale. They are, however, suboptimal when assuming this Article's microeconomic, investor-oriented perspective to assess and compare the investor appeal of competing national policies to promote renewables deployment. Accordingly, this Article's secondary data analysis focuses on the original IEA study. *See* INT'L ENERGY AGENCY I, *supra* note 7.

114 *See id.* at 90.

115 The IEA chose the remuneration level as a proxy to account for missing data in the country and technology-specific generation cost profiles. *See id.*

116 *Id.* at 91 (including in the annualization formula an annual discount rate of 6.5% to determine the net present value of each country's support payments for each technology examined in the study).

117 *Id.* at 90–91. *See supra* text accompanying notes 55–62 (describing RECs).

118 INT'L ENERGY AGENCY I, *supra* note 7, at 91.

119 *Id.*

B. Policy-Based Deployment Success for Onshore Wind

The IEA evidence of deployment rates for onshore wind renewables facilities points to feed-in tariffs as the most successful policy instruments—in terms of both efficacy[120] and efficiency.[121]

1. Policy Efficacy

Seven of the eight nations that are grouped in the highest policy efficacy tier used feed-in tariffs to promote the deployment of onshore wind generation facilities.[122] In fact, all but one of the countries that occupy the IEA ranking's top two tiers relied on feed-in tariffs.[123] The robustness of these results is strengthened by a number of control events in the form of policy changes that occurred during the reporting period. For instance, Denmark's efficacy indicator decreased by several orders of magnitude after the country eliminated its feed-in tariff in late 2003.[124] Conversely, South Korea and Portugal experienced significant growth in their onshore wind deployment from 2004 to 2005, with both moving up one tier following the adoption of new feed-in tariff regimes.[125]

Countries with RPSs fare considerably worse in the IEA ranking than their feed-in tariff counterparts. The most successful RPS representative, Japan, tops the third tier, ranked 9th overall.[126] It should be noted that Japan's deployment success is the product of an RPS that works in tandem with strong investment incentives.[127] The highest-ranking nation to rely primarily on an RPS for deployment support is Italy (12th), followed by Great Britain (13th), Belgium (15th), and the United States (16th) at the bottom of the third tier.[128]

The IEA evidence of deployment success is less conclusive for countries that employed tender regimes. At the upper end of the spectrum, Ireland ranks within the top tier, at 3rd overall.[129] No other nation with a tender regime, however, has come close to replicating the Irish success. Rather, the next highest-ranking representatives of tender regimes are India

---

120 *Infra*, Part III.B.1.

121 *Infra*, Part III.B.2.

122 These countries are, in order of their efficacy ranking, Germany, Spain, Denmark, Portugal, the Netherlands, Austria, and Luxembourg. *Id.* at 102 tbl.4. *See also* INT'L ENERGY AGENCY II, *supra* note 98, at 19 (noting that feed-in tariffs were significantly more effective in stimulating deployment than RPSs and other policies).

123 INT'L ENERGY AGENCY I, *supra* note 7, at 102 tbl.4 (noting that tier one requires a policy efficacy indicator above 7%, tier two 3%–7%, tier three 1%–3%, and tier four less than 1%).

124 *Id.* at 102 tbl.4, 104.

125 *Id.*

126 *Id.* at 102 tbl.4.

127 *Id.* at 122.

128 For the U.S., the IEA data aggregates state-level RPS deployment support with federal tax credit deployment support. *Id.* at 102 tbl. 4, 106–08.

129 *Id.* at 102 tbl.4.

(14th) in tier three and Canada (21st) in tier four, both of which employ tender regimes as part of a policy mix.[130]

Evidence of deployment success induced by production tax credits is similarly inconclusive, as most countries employed tax credits in tandem with one or more of the aforementioned policy instruments.[131] Even with such a policy mix, however, the most successful tax credit countries—India (14th) and the United States (16th)—are found in tier three. Finland and Mexico, who both rely exclusively on tax incentives to foster onshore wind energy deployment, are ranked in tier four, at 30th and 35th, respectively.[132]

2. Policy Efficiency

One of the IEA study's most interesting findings is that the most effective deployment policies were not the ones that offered the highest remuneration levels. While a minimum support level of $0.07 per kWh was required for a policy to show any effect, higher remuneration levels did not guarantee greater policy efficacy.[133] The IEA data reveals feed-in tariffs as the most cost-efficient deployment policy. Nine of the top ten feed-in tariff representatives offered "medium" remuneration levels of $0.07–$0.12 per kWh, including all but one of the countries ranked in tiers one and two.[134] In contrast, the top four RPS nations all offered "high" remuneration levels of more than $0.12 per kWh. Yet, the deployment success that these countries achieved ranks them no higher than tier three.[135] Again, the evidence is less conclusive for tender regimes and tax credits.[136] Ireland, the tender regime poster child, offered "medium" remuneration levels to place in the top tier, as did India (14th) in tier three.[137] Canada (21st) and China (26th) may owe their fourth tier rankings to "low" remuneration levels of less than $0.07 per kWh.[138] Remarkably, the only two representatives to rely solely on tax incentives—Finland (30th) and Mexico (35th)—rank near the bottom of tier four despite offering "medium" and "high" remuneration levels, respectively.[139]

130 India combines tenders with a feed-in tariff and tax credits, while Canada combines tenders with tax credits. *Id.*

131 *Id.* at 102–06.

132 *Id.* at 102–03 tbl.4.

133 *See id.* at 106.

134 Only the Netherlands, ranked 6th overall, has employed a feed-in tariff with a "high" remuneration level. *See id.* at 102.

135 *See id.*

136 *See id.* at 102–06.

137 *See id.* at 102 tbl.4.

138 *See id.* at 102–03 tbl.4.

139 *See id.*

C. Policy-Based Deployment Success for Solar Photovoltaics

The IEA study's evidence of deployment success for solar photovoltaic installations is less straightforward than for onshore wind facilities. Nonetheless, the data again points to feed-in tariffs as the policy instrument with the highest efficacy.[140] In terms of cost-efficiency,[141] however, no policy can claim a significant advantage over the others.

1. Policy Efficacy

Solar photovoltaic technology is considerably further from full market maturity than onshore wind. In fact, deployment efforts in many countries still focus on the technology demonstration stage.[142] As a result, the IEA study's overall policy efficacy indicator for solar photovoltaics is over ten times lower than for onshore wind.[143] Four of the five most successful countries relied on feed-in tariffs to promote the deployment of solar photovoltaic facilities for electricity generation.[144] The competitive edge of the top three feed-in tariff representatives is all the more impressive, as their policy efficacy exceeds that of the following nations by a factor of ten.[145]

The spread in deployment success for countries relying on RPSs is more pronounced in solar photovoltaics than for onshore wind. In fact, Japan ranks third overall and within tier one, breaking the phalanx of feed-in tariff representatives.[146] It should be noted, however, that RPS support can only claim partial credit for the Japanese deployment success, as the RPS is complemented by strong investment incentives covering up to 50% of project costs.[147] Sweden and Poland, who both relied exclusively on RPSs, have been rather ineffective at promoting solar photovoltaics deployment, placing in tier four at 24th and 33rd, respectively.[148]

Countries relying on tax credits achieved limited deployment success at best. Leading the pack, India ranks 9th at the bottom of tier three.[149] All other tax credit representatives are ranked within tier four. Finally, none of the

140 *Infra*, Part III.C.1.

141 *Infra*, Part III.C.2.

142 *See, e.g.*, INT'L ENERGY AGENCY I, *supra* note 7, at 125 (noting IEA evidence of solar photovoltaics deployment in China).

143 *Id.* at 122. Accordingly, the IEA study's first tier requires an efficacy indicator of over 0.5%, 0.2%–0.5% for tier two, 0.05%–0.2% for tier three, and less than 0.05% for tier four. *See id.* at 124 tbl.8.

144 *See id.* at 123. The dominant feed-in tariff candidates are, in order of their IEA efficacy ranking, Luxembourg, Germany, Switzerland, and the Netherlands. Interestingly, far more nations relied on feed-in tariffs to promote deployment of solar photovoltaics than for onshore wind.

145 *See id.* This gap is, in fact, so significant that, over the entire period of 2000–2005, no other nation has made it even into tier two of the IEA ranking. *See id.* at 125–27; *see also* INT'L ENERGY AGENCY II, *supra* note 97, at 20 (noting for solar photovoltaics deployment that "nearly all countries with growing markets have used FITs").

146 INT'L ENERGY AGENCY I, *supra* note 7, at 123.

147 *See id.* at 122.

148 *See id.* at 124 tbl.8.

149 *See id.* at 123 tbl.8.

thirty-five countries included in the IEA study employed tender regimes to promote the deployment of solar photovoltaics facilities.[150]

2. Policy Efficiency

The generation costs of solar photovoltaic projects are significantly higher than for onshore wind turbines.[151] As a result, the correlation between remuneration levels and policy efficacy is stronger. No country was able to achieve significant deployment success offering "low" levels of remuneration of less than $0.10 per kWh.[152] At the other end of the spectrum, the three most successful nations—two feed-in tariff representatives and one RPS country—all offered "high" remuneration levels of over $0.30 per kWh.[153] The three tax credit representatives in the IEA study also performed according to the "medium" level of remuneration they offered, i.e., $0.10–$0.30 per kWh, ranking in midfield at the bottom of tier three and the top of tier four.[154] There are, however, some exceptions to this correlation between deployment success and remuneration levels. Using a feed-in tariff, Switzerland was the only country to place in tier one, despite offering only a "medium" level of remuneration.[155] A look at the other end of the policy performance spectrum, however, suggests caution in interpreting the Swiss example as conclusive proof of feed-in tariffs' greater cost-efficiency in the context of solar photovoltaics. After all, no less than five feed-in tariff nations placed poorly—in tier four—despite offering "high" levels of remuneration.[156] The IEA evidence, therefore, does not support strong claims that any one policy has proven to be more cost-efficient than another at promoting deployment of solar photovoltaic technology.

D. Quantitative Answers and Qualitative Questions

The IEA study of deployment success across countries and policies yields a number of insights—some expected, others less so. Among the former is the need for a minimum level of remuneration to induce any significant deployment at all. The comparison between onshore wind and solar photovoltaics illustrates that the minimal support level is technology-specific, based on the respective technology's cost characteristics and its market maturity.[157]

---

150 *See id.* at 123–24 tbl.8.

151 *See id.* at 121.

152 *Id.* at 123–24 tbl.8.

153 *Id.* at 122–26 (noting the high efficacy levels of Luxembourg and Germany—which both use feed-in tariffs—and Japan, an RPS country).

154 Tax credit countries include India (9th), South Africa (12th), and Mexico (14th). *See id.* at 123 tbl.8.

155 While Switzerland did complement its feed-in tariff with investment incentives, the combined level of the two was still "medium." *See id.*

156 These countries are Spain, Italy, France, Portugal, and Greece. *See id.* at 123–24 tbl.8.

157 *See id.* at 121–27.

Another, less obvious insight is that onshore wind and photovoltaic technologies appear to differ not only in the absolute levels of policy remuneration they require, but also in the relative importance of said remuneration for their overall deployment success. With few exceptions, deployment success for solar power correlated strongly with the remuneration offered, independent of whether it was under an RPS, tender regime, feed-in tariff, or tax incentives.[158] In contrast, deployment success for onshore wind technology correlated much less strongly with the level of remuneration offered.[159] The IEA data, therefore, suggests that remuneration levels are of greater relative importance for less mature technologies, such as solar photovoltaics, to the point of drowning out other factors in the deployment equation. As costs come down, however, and technologies approach market maturity—and, with it, grid parity—deployment factors beyond policy remuneration appear to gain in relative importance. The IEA notes that for onshore wind deployment, "higher remuneration levels do not appear to yield greater levels of policy effectiveness."[160] Rather, the same financial incentives brought forth vastly different deployment success across the examined policies, pointing to forces at play other than technology-specific generation costs or remuneration levels alone. For instance, the top three feed-in tariff countries achieved four times the deployment success of the top three RPS countries—at half the cost.[161] Figure 1 illustrates this observation.

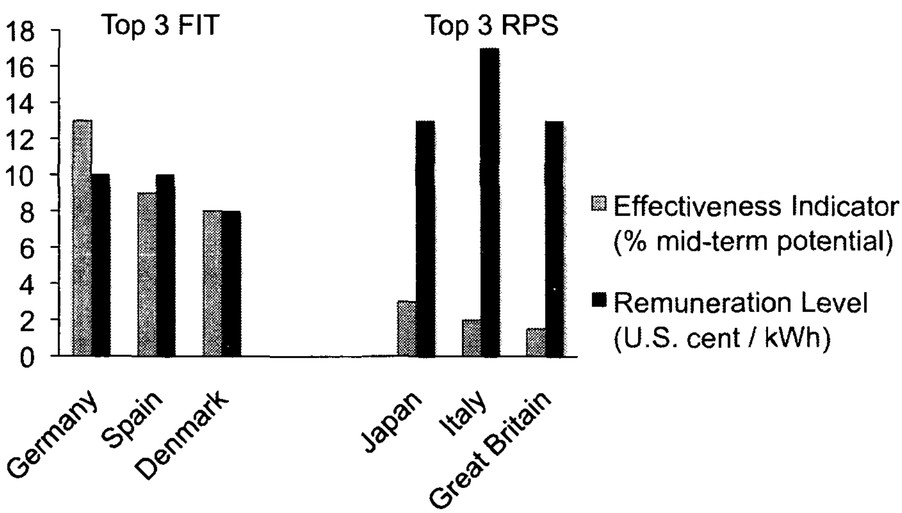

Figure 1. Onshore Wind Deployment of Top 3 FIT and RPS Countries (2004–05) [162]

[158] *See id.*; *see also supra* Part III.C.2.

[159] *See* INT'L ENERGY AGENCY I, *supra* note 7, at 102; *see also supra* Part III.B.2.

[160] *See* INT'L ENERGY AGENCY I, *supra* note 7, at 101.

[161] *Id.* at 106 fig.3.

[162] Based on INT'L ENERGY AGENCY I, *supra* note 7, at 106 fig.3.

With more and more renewable energy technologies following onshore wind toward grid parity, factors beyond the technology-specific cost of generation are gaining ever-greater importance. If we can identify these factors, they will allow us to find an explanation for the surprising disconnect between remuneration levels and deployment success as observed in the IEA study. More importantly, if we understand how public policy can shape these factors to better promote renewable energy technologies, then we can design better, more cost-effective deployment policies going forward. In other words, we will be able to enhance the investor appeal of renewable energy as the industry comes of age.

IV. "SOFT-COST" FACTORS—A FRAMEWORK FOR POLICY EVALUATION

Ultimately, the long-term success of any policy to promote renewables deployment depends on its ability to leverage private-sector investment.[163] But, remarkably, existing scholarship has by and large failed to assess these policies from an investor's point of view.[164] The multi-trillion dollar challenge to scale-up renewable energy technologies and to decarbonize the energy sector is too great and too costly for the public sector to shoulder alone.[165] At the same time, the private sector is wary to assume the enormous technological and other risks associated with energy innovation, especially where electricity rate regulation imposes limitations on the expected return on investment.[166] It is crucial, therefore, that public policy to deploy renewables be designed with an investor's perspective in mind. Whether business angels, venture capitalists, private equity funds, utilities, corporations, businesses, or households choose to invest in renewable energy technologies depends on the profit they expect from their investment.

The relatively weak correlation between remuneration levels and policy efficacy for onshore wind suggests that investors do not judge a policy's attractiveness solely by the face value of its financial incentives.[167] A recent survey among European and U.S. wind energy project developers confirms this intuition and offers some insight into the factors that influence investment decisions in renewable energy technologies.[168] For instance, the

163 *See* Fershee, *Moving Power Forward, supra* note 4246 at 1420–21 ("Energy investment, especially renewable energy investment, is expensive and moves slowly. Mild nudges are not likely to have any discernible effect.").

164 For two rare exceptions with surveys and interviews of clean-tech investors, *see* Lüthi & Prässler, *supra* note 101, at 4878; Bürer & Wüstenhagen, *supra* note 14, 4999–5000.

165 *See, e.g., Path to Sustainable Energy, supra* note 23, at 64 (quoting a 100 trillion dollar cost for the transition to renewables, not counting necessary investments in transmission infrastructure).

166 *See* Mormann, *supra* note 31, at 917–19.

167 *See* INT'L ENERGY AGENCY I, *supra* note 7, at 101.

168 Lüthi & Prässler, *supra* note 101. The survey does not, however, offer an exhaustive evaluation of the factors that guide energy project developers in their investment decisions. The structured interviews were limited to six topics: administrative process, legal security, grid access, remuneration, credit financing, and cash grants. *Id.* at 4878, 4879 tbl.2.

surveyed developers indicated a high priority for streamlined administrative processes and grid access regulation that favors renewable energy technologies.[169] Favorable grid access regulation was particularly important to U.S. developers.[170]

The survey results confirm recent legal scholarship on barriers to renewables deployment that do not relate directly to technology-specific generation costs.[171] In particular, barriers related to the electricity market and its regulation, administrative barriers, and issues of social acceptance represent significant obstacles in the Race to Renewables.[172] Some of these obstacles, such as permit procedures, are beyond the immediate scope of deployment policies and require separate regulatory action.[173] Others, however, are impacted—sometimes more, sometimes less directly—by the design characteristics of policies to deploy renewable energy technologies.[174]

Deployment policies with a positive impact on these "soft-cost" factors promise to be effective without the need to offer excessively high remuneration. Conversely, policies that ignore "soft-cost" factors or have an adverse effect on them are likely to achieve limited deployment success, absent very high levels of remuneration. Based on the relevant literature, surveys, and my own scholarship and experience as an advisor to clean-tech investors, I have compiled a set of "soft-cost" factors that can guide the evaluation of existing policies and help design better policies for the future.[175] These "soft-cost" factors can be categorized into investment-based factors,[176] market-based factors,[177] and behavioral factors related to social acceptance.[178]

A. Investment-Based Factors

The face value of a deployment policy's remuneration level is an essential, but by no means the only, investment-based factor that determines whether a private, profit-oriented party will invest in electricity generation from renewable sources of energy. Other key factors include investment certainty, associated transaction costs, and the range of potential investors and investment opportunities.

Investment certainty determines the amount and longevity of expected cash flows. Accordingly, it is of critical importance to the net present-value

---

169 *Id.* at 4883, 4888 figs. 9 & 10, 4889.

170 *Id.* at 4890.

171 Mormann, *supra* note 31, at 921–28.

172 *Id.*

173 *See generally id.* (providing reform suggestions in the realm of regulatory matters).

174 *See also* INT'L ENERGY AGENCY II, *supra* note 98, at 19 (noting "the importance of other factors, e.g. the overall level of investor confidence engendered by the whole policy portfolio").

175 This compilation neither claims nor intends to be exhaustive. Rather, it is designed to frame and inspire a new approach to deployment policy evaluation and design, which extends beyond remuneration levels and other traditional metrics.

176 *Infra*, Part IV.A.

177 *Infra*, Part IV.B.

178 *Infra*, Part IV.C.

calculations that precede all large-scale investment decisions.[179] Renewable energy deployment policies can affect investment certainty in two ways. From an *inter*-policy perspective, the longevity and stability of a policy determine investor confidence in its continued availability.[180] The greater the (perceived) likelihood of a policy's modification, elimination, or replacement by another less favorable policy, the more reluctant investors will be to fund renewable energy projects.[181] From an *intra*-policy perspective, investors require reasonable certainty of the remuneration they can expect while the respective policy is in place.[182] Market-based policies that are subject to fluctuating market conditions, for instance, may score lower in terms of intra-policy certainty than price-based policies, which guarantee compensation at predetermined levels.

Investment in facilities that generate electricity from renewable energy sources is accompanied by a whole plethora of individual transactions, including siting and feasibility studies, permit procedures, financing, land leases, etc.[183] Most of these transactions and their associated costs occur equally under all deployment policies.[184] However, transactions and related costs that determine eligibility to receive policy support or to monetize that support are policy-sensitive. The share of these transaction costs in the overall cost of the project will co-determine the investor appeal of policies for the deployment of renewable energy technologies.

The range of potential investors and investment opportunities that a deployment policy addresses is crucial for its success. The more diverse the pool of investors, the greater the available capital will be that a policy can leverage.[185] Increased competition among investors also tends to drive down

---

179 *See, e.g.*, ANDREW METRICK, VENTURE CAPITAL AND THE FINANCE OF INNOVATION 31–32 (2007); *see also* Christopher B. Berendt, *A State-Based Approach to Building a Liquid National Market for Renewable Energy Certificates: The REC-EX Model*, 19 ELEC. J., June 2006, at 54–55 ("[I]t is essential that renewable energy investors have reliable information regarding the levels of return from the start of the financing process."); KIRSTY HAMILTON, UNLOCKING FINANCE FOR CLEAN ENERGY: THE NEED FOR 'INVESTMENT GRADE' POLICY 10 (2009), *available at* http://www.chathamhouse.org/publications/papers/view/109217; INT'L ENERGY AGENCY II, *supra* note 98, at 18 (noting that "even where RE technologies could be competitive, deployment can be delayed or prevented by barriers related to, for example, regulatory and policy uncertainty").

180 HAMILTON, *supra* note 179, at 13, 26–27.

181 *See id.* (providing a general discussion of the importance of policy continuity for investment in renewable energy innovation); Neuhoff, *supra* note 37, at 103–05; STERN, *supra* note 30, at 352, 354–58; Jaffe et al., *supra* note 30, at 169.

182 *See* Jaffe et al., *supra* note 30, at 167–68; Lüthi & Prässler, *supra* note 100, at 4889; Neuhoff, *supra* note 37, at 105. *See also* UDAY VARADARAJAN ET AL., THE IMPACTS OF POLICY ON THE FINANCING OF RENEWABLE PROJECTS: A CASE STUDY ANALYSIS 15–16 (2011) (noting that duration of revenue support and revenue certainty are the two most important factors in reducing the cost of financing renewable energy projects).

183 For an overview of the necessary financial transactions see Braden W. Penhoet, *Financing Structures and Transactions*, *in* THE LAW OF CLEAN ENERGY: EFFICIENCY AND RENEWABLES 241, 241–57 (Michael B. Gerrard ed., 2011).

184 *See id.* at 241–42.

185 *See* Penhoet, *supra* note 183, at 241–57 (describing the diversity of investments required to fund renewable energy projects).

overall project costs.[186] In addition, a larger pool of investors tends to broaden the support-base for renewable energy projects and, hence, promote their local acceptance.[187] What types of investors a policy appeals to depends, in part, on its level of investment certainty and associated transaction costs. Other important factors include the variety of technology strands and plant sizes encompassed in the deployment policy.

B. Market-Based Factors

The electricity market and its complex regulatory framework play an important part in the due diligence of any investor who contemplates funding the deployment of renewable energy technologies. As one commentator put it: "[T]he success of renewable energy deployment does not only depend on the design of the support policies but also on the electricity market design and the interaction of both fields of regulation."[188] Key factors include how regulators answer questions related to grid access, dispatch priority, and the level of risk exposure to the electricity market's forecast and balancing obligations.

Except for the rare scenario in which a renewable electricity generator can sell all of its output directly (e.g., to a local industrial plant), access to the electricity grid is indispensable. While this physical requirement holds true under all deployment policies, they vary considerably in the way they address the two key questions surrounding grid access regulation: the strength of a renewable electricity generator's right to be connected to the grid, and how the related costs are allocated between the renewables plant and the local network operator. Connection costs can reach up to a quarter of the overall investment costs.[189] Accordingly, the regulatory allocation of these costs is almost as important to an investor's profit expectations as his grid access right.

Mere connection to the grid does not guarantee renewable energy generators that they will actually be able to sell all of the electricity that they generate. At present, the U.S. market is characterized by an oversupply of generation capacity, especially during off-peak times.[190] A plant's ability to

---

186 *See* Jaffe et al., *supra* note 30, at 167 (positing that competition drives prices down and benefits consumers).

187 *See* Felix Mormann & Dan Reicher, Op-Ed., *How to Make Renewable Energy Competitive*, N.Y. TIMES, June 2, 2012, http://nyti.ms/LmGDI7 (last visited July 19, 2012) (discussing the critical importance of broadening the pool of available capital to lower the cost of financing renewable energy and democratize America's energy future).

188 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, 3646 (2008).

189 MENDONÇA ET AL., *supra* note 39, at 31. For an overview of connection costs relative to overall investment cost across a wide array of renewable energy technologies, see *id.*, at 31–33.

190 This market characteristic is especially relevant for wind energy plants as their wind-dependent output tends to be strongest at night when electricity demand is relatively low. *See, e.g.*, California ISO, *Daily Renewables Watch*, http://www.caiso.com/green/renewableswatch.html (last visited July 21, 2012).

sell its electricity, therefore, depends on its dispatch priority—i.e., how high it ranks in the order of plants that are called upon (dispatched) to feed their electricity into the grid.[191] Most jurisdictions in the United States do not guarantee dispatch priority to electricity generators that rely on renewable energy technologies.[192] In Texas, for instance, the dispatch-related curtailment of electricity from wind turbines reached a record 17% of potential wind energy generation in 2009.[193] Simply put, one out of six kWh of available electricity from wind energy was wasted. From an investor's perspective, dispatch priority is closely related to intra-policy certainty, as curtailment directly affects generation-based remuneration. Without dispatch priority, output curtailment severely reduces the profitability and, therefore, the attractiveness of renewable energy technology investment.[194] Recognizing the crucial role of dispatch priority for the large-scale deployment of renewable energy technologies, the European Union recently passed legislation that requires all of its member states to ensure dispatch priority for electricity from renewable sources of energy.[195]

Many of the most promising renewable energy technologies, such as those relying on solar or wind energy, depend on favorable meteorological conditions to generate electricity. The resulting intermittency of their output presents a serious challenge to network operators. To help dispatch planning and ensure a stable supply of electricity, generators are usually required to sell their power in forward markets, e.g., through bids to supply power for five-minute intervals on a day-ahead basis.[196] If a generator fails to deliver the contracted-for amount of electricity, it has to compensate the system operator under their balancing services agreement, in order to cover for the generator's lack of performance. The cost of these balancing services varies depending on the time period covered, how much advance notice is given, and the balancing market's liquidity.[197] In some cases, balancing costs may significantly exceed the generator's sales price for electricity.[198] Accordingly, the level of exposure to the electricity market's forecast and balancing obligations can have an enormous impact on the profitability of renewable energy plants. Moreover, a strict forecast and balancing regime

---

191 For an illustrative overview of the processes behind dispatch and balancing see Klessmann et al., *supra* note 188, at 3647–49; *see also* FOX-PENNER, *supra* note 36, at 26–27; Rossi, *supra* note 48, at 1439.

192 Lüthi & Prässler, *supra* note 100, at 4887.

193 RYAN WISER & MARK BOLINGER, U.S. DEP'T OF ENERGY, 2009 WIND TECHNOLOGIES MARKET REPORT 50 (2010).

194 Klessmann et al., *supra* note 188, at 3651 (pointing to uncertainty as the main predicament for investors in renewable electricity (RES-E)): "The insecurity introduced by the fact that the rate of curtailment is difficult to predict for RES-E operators might be considered more significant than the actual losses of income." *Id.*

195 *See* Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the Promotion of the Use of Energy from Renewable Sources, *supra* note 49, at art. 16.

196 For an introduction to the architecture of the electricity market see Klessmann et al., *supra* note 180, at 3647–48.

197 *Id.*

198 *See id.* at 3653 (noting that "system-buy and system-sell prices are very volatile and sometimes take values tens of times larger than their average").

imposes a particularly heavy burden on smaller and independent power generators who cannot balance their supply with other elements of a utility's broad portfolio of generation technologies.[199] A deployment policy's capacity to shield renewable energy plants from these obligations, therefore, is essential for its appeal to investors and its ability to drive the large-scale deployment of renewable energy technologies.

C. Behavioral Factors

Behavioral factors for investors and policymakers to consider revolve around issues related to the social acceptance of renewable energy technologies. Conflicts over local acceptance are among the most commonly cited non-economic barriers to deployment.[200] Local opposition to the siting and construction of renewables plants does not always match national or global concerns over climate change and energy security.[201]

The growing "Not-In-My-Backyard" (NIMBY) mentality among American communities can cause costly delays to renewable energy projects, as illustrated by the recent opposition to wind power projects in Vermont, Wisconsin, Wyoming, and the Nantucket Sound.[202] Spatial planning and local zoning regulation effectively enable communities to delay or even prevent the deployment of wind turbines and other renewables plants of disputed aesthetic value.[203] Wisconsin recently estimated that over 600 MW of proposed wind projects had been stalled by local permit requirements that the state authorities considered unduly burdensome.[204] In response, the state legislature enacted new statewide standards for siting wind projects.[205] These standards aim to preempt local permit regulations to the extent that they are more restrictive than the Wisconsin Public Service Commission

199 Butler & Neuhoff, *supra* note 72, at 16–17.

200 *See, e.g.*, STERN, *supra* note 30, at 369; INT'L ENERGY AGENCY, *supra* note 7, at 85–86, 100, 175; INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 33, at 24–25; Neuhoff, *supra* note 37, at 96; Duane, *supra* note 48 at 775–76; Lüthi & Prässler, *supra* note 100, at 4890. *See also* INT'L ENERGY AGENCY II, *supra* note 98, at 18 ("Sustainability and social acceptance can also be critical issues for some technologies.").

201 *See, e.g.*, Mortenson, *supra* note 68, at 203 ("[S]ome local and regional zoning efforts have been accused of taking too many local interests into consideration.").

202 For details on local zoning efforts against wind development in Wyoming, the protracted conflict over wind power projects in the Nantucket Sound, and debates over the aesthetics of ridgeline wind projects in Vermont, see Duane, *supra* note 48, at 775–76. *See also* Kari Lydersen, *Wisconsin Feels Turbulence Over Pulling Power From Air*, WASH. POST, Apr. 8, 2008, at A02.

203 For an illustrative summary of the perceived nuisances related to wind turbines see Mortenson, *supra* note 67, at 189–92.

204 Jeffery S. Dennis et al., *Report of the Renewable Energy & Demand-Side Management Committee*, 31 ENERGY L.J. 287, 300 (2010).

205 2009 Wis. Act 40, 2009–2010 Wisc. Legis. Serv. (West) (codified at WIS. STAT. § 66.0401(l)(m)(2010)). The controversy over wind energy siting is illustrated by the fact that the Wisconsin legislation was temporarily suspended in March of 2011, and not reinstated until March 2012, *see* Press Release, Clean Wisconsin, Statewide Wind Siting Rules Go Back into Effect (Mar. 16, 2012), http://www.cleanwisconsin.org/index.php?module=cms&page=580 (last visited July 21, 2012).

standards. In the absence of such strong state mandates, issues related to the social acceptance of renewable energy technologies continue to influence local permit processes.[206]

Short of active opposition, sheer passivity among local planners is enough to diminish the investor appeal of renewable energy. Many American communities fail to include renewable energy technologies in their spatial planning.[207] Outdated zoning ordinances may treat solar rooftop installations and other micro-generation from renewable energy the same as a large-scale nuclear power plant.[208] The resulting long lead times for renewables plant deployment raise overall investment costs. How deployment policies affect the public perception and acceptance of renewable energy technologies, therefore, determines their ability to leverage the investments necessary to drive the transition to a renewables-based electricity sector. Figure 2 summarizes the framework of investment-based, market-based and behavioral "soft-cost" factors that this Article proposes to guide the analysis and design of deployment policies for renewable energy beyond sheer remuneration.

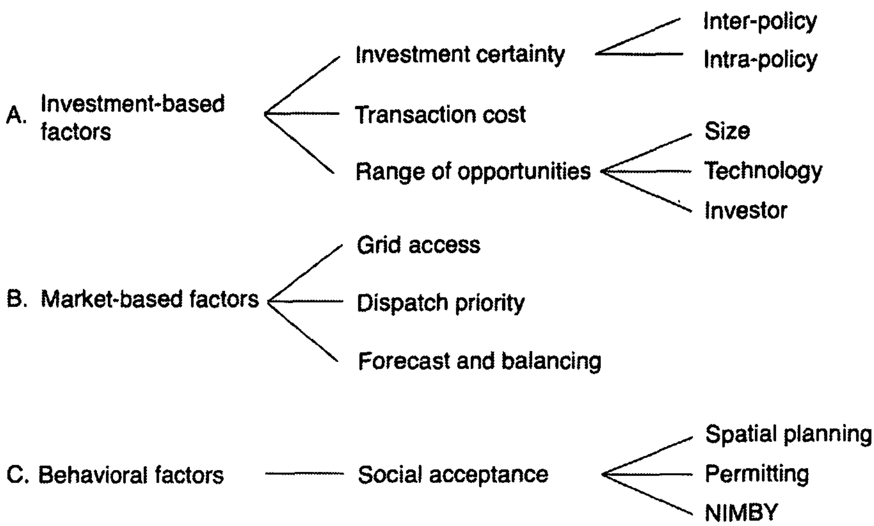

Figure 2. "Soft-Cost" Factor Framework for Deployment Policy Analysis

---

206 *See* Alexandra B. Klass, *Property Rights on the New Frontier: Climate Change, Natural Resource Development, and Renewable Energy*, 38 ECOLOGY L.Q. 63, 117–18 (2011) ("[T]he scale of wind projects themselves as well as the state-wide concerns associated with wind-related environmental and siting challenges argue in favor of a greater emphasis on a state-wide system of permitting for large wind projects than is the case for solar projects on private lands.").

207 Megan Lewis et al., *The Role of Planning in the New Energy Era*, PAS MEMO (Am. Planning Assoc./Planning Advisory Serv.), Mar.—Apr. 2006, at 1, 9.

208 A prominent example of the need to adjust spatial planning to the needs and benefits of distributed generation from renewable sources of energy involves climate change combatant Al Gore whose plans to install solar panels on his roof were stalled by the local zoning ordinance. *See* George Homsy, *Earth, Wind, and Fire*, PLANNING Aug.—Sept. 2007, at 46, 46–47.

V. A "SOFT-COST" FACTOR ANALYSIS OF DEPLOYMENT POLICIES

The following qualitative analysis rates and compares the conceptual capacity of various deployment policies to influence "soft-cost" factors in a way that spurs investment in renewable energy technologies. To facilitate comparisons across policies and factors, qualitative ratings range from "poor" to "moderate" to "good" to "excellent." Sections A, B, and C of this Part address feed-in tariffs, RPSs, tax credits, and tender regimes in the reverse order of their favorable impact on the "soft-cost" factors that co-determine an investor's decision to fund renewables projects. Only the summary in section D discusses the four policies in their positive merit order.

A. Policy Impact on Investment-Based Factors

Topping the list of investment-based "soft-cost" factors considered by renewable energy investors is the certainty with which they can expect to make a profit on their investments.[209] Another important variable in these profit calculations is the anticipated transaction costs the investment would incur.[210] Finally, the range of investors and investment opportunities that a deployment policy addresses defines the size of the capital pool that it may draw from.[211]

1. Investment Certainty

Tender regimes beckon renewable energy investors with excellent intra-policy certainty. The reverse auction's winning bidder is awarded a long-term power purchase agreement based on its bid price.[212] That price is guaranteed for the entire term of the agreement, for example over fifteen years under the British Non-Fossil Fuel Obligation.[213] Inter-policy certainty, however, is poor. Tenders represent singular events that are announced at random, unpredictable intervals and, as a result, afford renewable energy investors little to no planning certainty.[214] Even if they are ready and willing to compete with other bidders, investors rarely know when or where the next tender will be announced far enough in advance to adjust their investment strategy accordingly. Finally, the cap inherent in the overall capacity set out in every tender process deters additional investment.

Production tax credit regimes offer good intra-policy certainty to investors. They guarantee a stable cash flow, albeit in terms of "negative

209 *See infra* Part V.A.1.

210 *See infra* Part V.A.2.

211 *See infra* Part V.A.3.

212 *See supra* Part II.B.

213 For a sample discussion of the tender regime under the British Non-Fossil Fuel Obligation see Niels I. Meyer, *European Schemes for Promoting Renewables in Liberalised Markets*, 31 ENERGY POL'Y 665, 668 (2003).

214 *Id.* at 669; Butler & Neuhoff, *supra* note 72, at 1863 (noting the "long and unpredictable time lags" between auctions).

costs" for every unit of electricity produced over their entire duration. To reap the full benefits of the accruing tax credits, however, investors must have sufficient tax liability or, simply put, hefty tax bills to offset.[215] This dependence of the actual reward-value on the investors' tax liability reduces the overall intra-policy certainty offered by tax credit regimes. The inter-policy investment certainty of tax credit regimes is moderate. As a result of their immediate budget relevance, tax policies are prone to frequent modification or even elimination, e.g., due to changes in government or budget austerity measures. The short timeframes and intermittency of tax credit support for renewables at the U.S. federal level illustrate these shortcomings.[216]

In contrast, RPS regimes induce an excellent level of inter-policy certainty among investors. RPSs rely on the market—i.e., the buyers of RECs—to provide the necessary remuneration to promote renewables deployment.[217] Hence, RPS policies do not (directly) burden state budgets and, consequently, are less prone to modification or elimination in times of budget austerity.[218] Their market reliance, however, causes RPSs to perform poorly in terms of intra-policy certainty. Sophisticated RPS design can suggest an upper boundary for REC trading prices by setting a penalty that utilities must pay for every REC they should—but fail—to procure.[219] This "buy-out" price may set a price ceiling but it does not establish a price floor. Consequently, a renewable power investor's revenue from REC sales is left to fluctuate according to the market's invisible hand, with regulatory limitations on its upside potential but not on its downside potential.[220] And the emerging—often fragmented and, hence, illiquid—nature of REC markets makes them difficult to predict for investors. Finally, the inherent cap in the capacity-targets set by RPS regimes further undermines their intra-policy certainty.[221]

By comparison, feed-in tariffs offer the highest overall level of certainty to investors in renewable energy technologies. Their excellent inter-policy certainty benefits from their budget independence. Since the costs of

---

215 *See supra* Part II.D.

216 *See, e.g.*, MENDONÇA ET AL., *supra* note 39, at 172–73; INT'L ENERGY AGENCY I, *supra* note 7, at 108; Mortenson, *supra* note 68, at 183. *See also* JESSE JENKINS ET AL., BROOKINGS INST., *Beyond Boom & Bust - Putting Clean Tech on a Path to Subsidy Independence*, 37 (2012), (noting that the federal production tax credit regime for wind power "was first enacted in 1992, but has since expired three times, and has been renewed a total of seven times, often with less than a month to spare before pending expiration").

217 *See supra* Part II.A.

218 *See, e.g.*, Michaels, *supra* note 46, at 109.

219 Consider, for example, the United Kingdom's penalty design under its Renewables Obligation, in which suppliers of electricity who do not hold sufficient RECs are required to pay a penalty into a buy-out fund. The proceeds from this fund are then distributed among the suppliers who have complied with their RPS obligations. Klessmann et al., *supra* note 180, at 3653.

220 *See* INT'L ENERGY AGENCY I, *supra* note 7, at 24–25.

221 The investment uncertainties associated with RPS policies are commonly blamed for their poor cost-efficiency compared to other deployment policies, as investors require a high risk premium. *See id.* at 101.

supporting renewables are distributed across all ratepayers, feed-in tariffs are less likely to be curtailed or eliminated due to state budget austerity, as compared to tax credit policies. Moreover, feed-in tariffs offer excellent intra-policy certainty. In duration, tariff payments are guaranteed for timeframes that approach or exceed most power purchase agreements awarded under tender regimes.[222] Unlike under RPS or tax credit regimes, investor cash flows from a fixed-rate feed-in tariff are not subject to the fluctuations of the electricity market and—in the case of RPSs—the REC market. Finally, the actual reward value of feed-in tariff payments does not depend on extrinsic factors such as the investor's tax liability, as is required for tax policies.

2. Transaction Costs

RPS regimes perform poorly, as they incur the greatest transaction costs of any deployment policy. Electricity generators that rely on renewable sources of energy are required to negotiate and execute one or multiple power purchase agreements to sell the electricity they generate.[223] But the market rates offered under these agreements are unlikely to cover the renewable power sellers' generation costs. To close this gap, the renewables generators need to sell the RECs they receive for their electricity, often on a separate market, thus incurring additional transaction costs. Inclusion of RECs under the original power purchase agreements can help reduce overall transaction costs somewhat. However, legal uncertainty and inconsistent judicial treatment of REC ownership and entitlement across states threaten to further drive up transaction costs.[224]

Production tax credits fare moderately well regarding remuneration-related transaction costs. Like RPSs, tax credit regimes require renewable electricity generators to negotiate and execute their own power purchase agreements and bear the associated costs. Unlike with an RPS, tax credit benefits accrue automatically without the need for further trading.[225] To reap the full value of these benefits, however, may require a complex and costly investment structure to ensure sufficient tax liability, or tax equity, to offset the tax credits. Accordingly, a recent comparison of ARRA's tax credits and its section 1603 cash grant equivalent identified the scarcity of available tax equity and the resulting high costs of investment structures with outside

222 For an overview of the guaranteed terms of payment under a variety of feed-in tariff regimes, see Haas et al., *supra* note 52, at 1017–18 tbl.3.

223 For an insight into the complexity of power purchase agreements see Jeremy D. Weinstein, *Contract Techniques for Renewable Resource Power Purchase Agreement Offtakers*, *in* ENERGY AND ENVIRONMENTAL PROJECT FINANCE LAW AND TAXATION: NEW INVESTMENT TECHNIQUES 493–520 (Andrea S. Kramer & Peter C. Fusaro eds., 2010).

224 For a summary of the inconsistent court rulings on REC entitlement and the resulting misalignment of RPS deployment incentives see Davies, *supra* note 44, at 1378, 1410–15.

225 U.S. DEP'T OF TREASURY, OFFICE OF COMPTROLLER OF THE CURRENCY, FACT SHEET: SOLAR ENERGY INVESTMENT TAX CREDITS AND GRANTS 1 (2011).

tax equity as major deterrents to greater renewables investment in the United States.[226]

Tender regimes offer moderate transaction-cost efficiency similar to tax policies, albeit for different reasons. In contrast to tax credits or RPSs, tender regimes do not require the successful bidder to negotiate and execute a power purchase agreement and bear the related costs. Rather, the winning bid is automatically rewarded with a corresponding contract.[227] To win the bidding contest, however, requires substantial and costly preparation and calculation of different cost scenarios. Similar calculations and resulting costs are required under any other deployment policy. Yet, this Article attributes greater relative value to them under tender regimes because every tender carries the risk that a losing bidder's incurred costs will end up as a sunk investment. As one commentator put it: "[T]here is no certainty of success for an application, which means the developer runs the risk of wasted development costs."[228]

In comparison, feed-in tariffs offer excellent transaction-cost efficiency, as they impose the lowest transaction costs on investors in order to reap the deployment policy's full rewards. The feed-in tariff requires the local utility to execute a power purchase agreement based on standard terms that guarantee the full tariff payment. This "one-stop-shopping" design relieves investors of the burden and cost of contractual negotiations. It is up to the local utility in cooperation with other network operators to recover the cost of the feed-in tariff by passing it on to all of their ratepayers.[229]

3. Range of Potential Investors and Investment Opportunities

Tender regimes do poorly in the range of investors they speak to. The high up-front cost to prepare a competitive bid, and the uncertainty of its eventual payoff, discourage the vast majority of potential investors. Only institutional investors 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.[230] The tender process is "a bureaucratic process with several application deadlines which create busy periods for those involved . . . and therefore staffing and time management problems."[231]

226 *See* BIPARTISAN POL'Y CTR., *supra* note 41, at 11. *See also* Mormann & Reicher, *supra* note 187.

227 *See supra* Part II.B.

228 Catherine Mitchell, *The Renewables NFFO: A Review*, 23 ENERGY POL'Y 1077, 1086 (1995).

229 For an instructive overview of the flows of capital for the cost recovery under feed-in tariff regimes see MENDONÇA ET AL., *supra* note 39, at xxii fig.0.1.

230 In fact, the harsh competition under tender regimes has led some investors to place bids that, upon winning the tender, proved too low to implement and operate the renewables project at a profit. As a result, many of these investors abandoned their projects and let their bidding special purpose vehicle file for bankruptcy to avoid paying a default penalty or other financial responsibility for their lack of performance under the tender contract. *See id.* at 174–75; Butler & Neuhoff, *supra* note 72, at 1859.

231 Mitchell, *supra* note 228, at 1086.

Tender regimes demonstrate a moderate capacity to promote a range of investment opportunities. They are inherently technology-specific, inviting bids to supply electricity from a specified strand of renewable energy technology (e.g., offshore wind).[232] However, tender regimes generally focus on large, utility-scale plants. As a result, they fail to harness the huge potential of renewable energy technologies for use in distributed generation applications that promise greater system reliability while requiring little to no investment in new transmission infrastructure.[233]

RPS policies have moderate potential to mobilize a wider range of investors than tender regimes, but the overall investor appeal of RPSs suffers from their low intra-policy certainty and relatively high transaction costs. Both tend to discourage small-scale investors as well as capital-sources that lack the industry-specific experience necessary to master the challenges of REC trading. Accordingly, investors often criticize RPSs as "big corporation policies" with "neutral or negative effects on smaller, entrepreneurial firms."[234] RPS policies' general lack of appeal to small-scale investors severely reduces their promotional impact on households, businesses, and other distributed generation applications for renewable energy technologies.[235] To date, most RPS regimes are technology-neutral and, consequently, favor the current least-cost renewables technologies—such as onshore wind and biomass—at the expense of emerging technologies like solar photovoltaics or advanced geothermal.[236] RPSs are, however, not completely incompatible with technology-specific sourcing mandates. The RPS regimes of Colorado and New Jersey, for instance, require that a certain portion of the utilities' overall sourcing quota for renewables be supplied from solar technologies.[237] One caveat to these so-called carve-outs and their use in designing technology-specific RPS policies is that carve-outs tend to foster fragmented, and therefore less efficient, REC

---

232 A leading renewables country to employ tender regimes for the deployment of offshore wind energy farms is Denmark. Haas et al., *supra* note 52, at 1017 tbl.3.

233 A recent proposal by California's Governor Jerry Brown to install 12,000 MW worth of distributed generation capacity from renewables illustrates the importance of small-scale generation facilities. *See* Luskin Center for Innovation, *Local Energy Generation Resources: A Working Conference (July 25–26)*, http://luskin.ucla.edu/events/local-energy-generation-resources-working-conference (last visited Apr. 2, 2012); *see also* FOX-PENNER, *supra* note 36, at 109 (noting that "capacity planners . . . need to distinguish between large- and small-scale renewable, or, equivalently, centralized and distributed generation"). The avoidance of new transmission construction is especially important at a time when courts curtail FERC backstop transmission jurisdiction. *See* Fershee, *Moving Power Forward*, *supra* note 46, at 1418.

234 Bürer & Wüstenhagen, *supra* note 14, at 5005.

235 With the exception of hydroelectric facilities, RPS policies do not usually include size-specific provisions. In the hydro context, such provisions primarily serve to exclude existing large-scale hydro plants from inclusion under RPS mandates. *See* Davies, *supra* note 44, at 1377.

236 *See* MENDONÇA ET AL., *supra* note 39, at 153.

237 COLO. REV. STAT. § 40-2-124 (2004); N.J. ADMIN. CODE § 14:8-2.3 (2010). For a detailed discussion of solar carve-outs and their deployment effects see JASON COUGHLIN & KARLYNN CORY, NAT'L RENEWABLE ENERGY LAB., NREL-TP-6A2-44853, SOLAR PHOTOVOLTAIC FINANCING: RESIDENTIAL SECTOR DEPLOYMENT (2009).

markets.[238] An alternative option that avoids market proliferation is to use technology-specific credit multipliers within one common certificate market for all renewable energy technologies.[239] But credit multipliers are prone to another distortion of the REC market. Different technologies do not move in lockstep but at different speeds along their uniquely shaped and sloped technology learning curves.[240] As a result, credit multipliers, even if initially set at the correct ratio, soon become inaccurate, eventually over-incentivizing some technologies at the expense of others.[241] The technology-specific design of RPS deployment policies continues to represent a huge challenge in theory and practice. Accordingly, RPSs show only moderate conceptual ability to leverage investment for a wide range of renewable energy projects.

Interestingly, the limitations of tax credits as to the investor groups they mobilize are somewhat inverse to those found in tender and RPS regimes. On the one hand, the required tax liability to benefit from tax credits deters investment from institutional investors who aim for high debt-equity ratios.[242] The tax equity market may offer solutions through alternative investment models but at considerable legal and other costs.[243] Similarly, tax policies struggle to attract investment from tax-exempt pension funds or sovereign wealth funds and other foreign entities unless foreign investors already have a domestic business presence with sufficient local tax liability.[244] On the other hand, tax policies are relatively attractive for domestic businesses and home owners, whose tax obligations tend to be high enough to reap the full benefit of tax credits for rooftop photovoltaic and other small-scale renewable power plants. Finally, size- and technology-specific tax credit designs can account for the different cost characteristics of various plant sizes and renewable energy technologies. Overall, tax credits show moderate capacity to appeal to a broad range of investors, but feature excellent potential to incentivize investment in a wide variety of renewables projects.

Feed-in tariffs show excellent capacity to appeal to a broad range of investors, and they also incentivize a wide variety of investment

---

238 *See* Davies, *supra* note 44, at 1375. For further discussion of the concerns related to REC market proliferation, see *id.* at 1375–95.

239 *Id.* at 1376–78.

240 *Id. See also* PATRICK HEARPS & DYLAN MCCONNELL, MELBOURNE ENERGY INST., RENEWABLE ENERGY TECHNOLOGY COST REVIEW 17, 27, *available at* http://www.garnautreview.org.au/update-2011/commissioned-work/renewable-energy-technology-cost-review.pdf.

241 *See* Davies, *supra* note 44, at 1376–78. Unlike feed-in tariffs, credit multipliers within RPS regimes do not set technology-specific tariff degression rates to account for different technology learning effects. *Id.*

242 Accordingly, one commentator refers to production tax credits as "the rich man's feed-in tariff." *See* 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 ENVT. & PLANNING C: GOV'T & POL'Y 361, 368 (2005).

243 BIPARTISAN POLICY CTR., *supra* note 41, at 13.

244 *See* Paul Schwabe et al., *Mobilizing Public Markets to Finance Renewable Energy Projects: Insights from Expert Stakeholders*, National Renewable Energy Laboratory Technical Report No. NREL/TP-6A20-55021, at ii, 3 (2012), *available at* http://ssrn.com/abstract=2083851.

opportunities. Like tax credits, feed-in tariffs can easily accommodate size- and technology-specific tariff structures.[245] As a result, they attract investment in a rich array of renewable energy technologies for applications of various sizes, from utility-scale to distributed generation.[246] The lack of a REC trading requirement or need for tax equity make feed-in tariffs attractive for institutional, strategic, business, and private investors alike. In contrast to tax credits, feed-in tariffs are ideally suited to leverage foreign investment, as evidenced by internationally funded renewable energy generation facilities, such as those found in Spain.[247]

B. Policy Impact on Market-Based Factors

Market-based "soft-cost" factors include grid access regulation, dispatch priority, and the level of renewable energy investors' exposure to the electricity market's forecast and balancing obligations.[248]

1. Grid Access

Conceptually, RPSs and tax policies are poorly designed to address and resolve issues pertaining to the grid access of electricity generators drawing on renewable sources of energy. Tax credit regimes focus on the relationship between renewable energy plants and the State in a budgetary context.[249] RPSs regulate the relationship between the State and renewables plants through the issuance of RECs. By requiring REC procurement, RPSs also regulate the relationship between the State and its utilities. RPSs do not, however, regulate the relationship between renewable power generators and their local utilities or network operators.[250] The resolution of grid access claims and the allocation of connection costs, therefore, remain outside the conceptual scope of RPSs and tax policies.[251] As a result, grid access is often

---

245 *See* Pierre Bull et al., *Designing Feed-in Tariff Policies to Scale Clean Distributed Generation in the U.S*, ELEC. J., Apr. 2011, at 52, 53–55. For a discussion of feed-in tariffs' potential to support distributed generation applications of renewable energy technologies in the U.S., see *id.*

246 In Spain, for instance, feed-in tariff support for renewables has leveraged capital for the deployment of solar facilities, ranging from solar photovoltaics rooftop installations to Iberdrola's 50 MW solar thermal plant in Puertollano. Elisabeth Rosenthal, *Solar Industry Learns Lessons in Spanish Sun*, N.Y. TIMES, Mar. 9, 2010, at A1.

247 For an investor's view of feed-in tariffs as an instrument to leverage cross-border renewable energy investment, see Rainier Weng, *Photovoltaic Investments Outside Germany?: Looking into the Southern EU States*, THE SOLAR-SERVER: FORUM FOR SOLAR ENERGY, Apr. 23, 2007, http://www.solarserver.com/solarmagazin/solar-report_0407_e.html (last visited July 20, 2012).

248 *See infra* Parts V.B.1–3.

249 *See supra* Part II.D.

250 As a tribute to their libertarian roots, RPSs are designed to leave the relationship between generators and utilities or network operators to the market. *See supra* Part II.A.

251 Under the United Kingdom's Renewables Obligation RPS, grid access requirements and procedures are regulated under the U.K. Grid Code with little to no preferential treatment for renewables compared to their fossil fuel counterparts. *See* Klessmann et al., *supra* note 188, at 3654; *see also* Gross & Heptonstall, *supra* note 66, at 16 (noting that the access requirements

subject to inconsistent state or local regulation, adding considerable legal uncertainty to investors' business plans.

Historically, tender regimes have not always included explicit provisions related to grid access.[252] Conceptually, however, the legislative framework behind tender regimes is well suited to include mandates for granting grid access to incoming renewable power generators. The tender regime's underlying framework already includes a mandate for the local utility to purchase all of the winning bidder's electricity at the winning bid's price. Moreover, tender regimes usually provide for recovery of the additional cost in the form of a levy or system-benefits charge that is distributed across all ratepayers.[253] Thus, tender regimes address the electricity grid and its operators, as well as utilities and their customers, and could well include a strong mandate to grant low-cost grid access to renewable electricity generators. Until tender regimes harness their full conceptual potential, however, grid access will remain a topic of concern for investors.[254]

Feed-in tariffs are every investor's favorite when it comes to their excellent regulatory treatment of grid access. The feed-in prong guarantees the right to interconnection as the policy's cornerstone.[255] It should be noted, however, that the actual strength of this right varies across feed-in tariff regimes. Some implementations, for instance, make grid access rights subject to network capacity constraints.[256] More effective feed-in tariff design guarantees grid access regardless of network capacity, and addresses any capacity constraints through dispatch priority regulation.[257] Unlike other deployment policies, feed-in tariffs usually include regulation to allocate the costs of grid connection and any necessary network enforcements. The most successful feed-in tariffs require that the renewables generator pay the cost of connection to the closest grid access point, while the network operator has to bear the cost of any necessary upgrades and reinforcements to the grid.[258] Figure 3 illustrates the crucial differences in the regulatory frameworks behind RPSs and feed-in tariffs as they pertain to grid access.

---

of the U.K.'s grid connection system make it more difficult for renewables to get in the connection queue).

252 *See, e.g.*, Gross & Heptonstall, *supra* note 66, at 11, 15–16, 19.

253 *See, e.g.*, *id.* at 8.

254 *See* Lüthi & Prässler, *supra* note 101, at 4890.

255 *See, e.g.*, MENDONÇA ET AL., *supra* note 39 at xxi, 30.

256 *See, e.g.*, Ontario's 2006 feed-in tariff that allows for the denial of grid access to incoming renewables based on network capacity constraints. *Id.* at 31.

257 *See infra* Part V.B.2; Mormann, *supra* note 31, 955–57.

258 *See, e.g.*, the German feed-in tariff's cost allocation regime. Klessmann et al., *supra* note 180, at 3651. In contrast, Spain's feed-in tariff follows hybrid approach where the plant operator also bears the costs for upgrades and reinforcements at the distribution level but only part of the costs at the transmission level. *Id.* at 3652. For an overview of the different cost allocation approaches, *see* Mormann, *supra* note 31, 921–24.

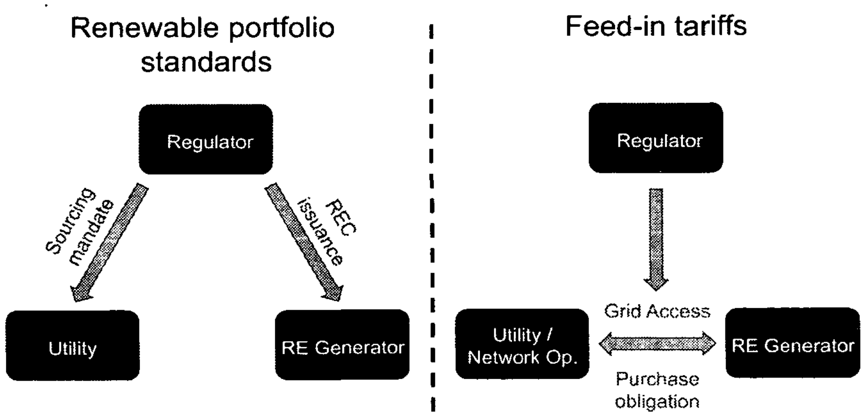

Figure 3. Grid Access Regulation under RPS and Feed-In Tariffs

2. Dispatch Priority

Tax and RPS policies are poorly conceived to guarantee dispatch priority to renewable energy plants. As discussed in the context of grid access, their regulatory frameworks are not designed to address the relationship between generators and network operators.[259] It is hardly surprising, then, that the aforementioned example of renewables output curtailment—Texas—employs an RPS to promote the deployment of renewable energy technologies.[260]

Conceptually, tender regimes offer excellent capacity to award dispatch priority to renewable energy technologies. The British Non-Fossil Fuel Obligation, for instance, mandated that all electricity from renewable generation be bought regardless of whether it was generated during times of peak load or low demand.[261] Under its tender regime for offshore wind deployment, Denmark, also, guarantees dispatch priority to the power produced from the successful bidder's wind turbines.[262]

Feed-in tariffs also demonstrate excellent capacity to guarantee dispatch priority for renewable energy technologies under their feed-in prong. Accordingly, leading feed-in tariff countries like Spain[263] or Germany[264] guarantee renewable power generators dispatch priority over their fossil fuel competitors.

---

259 *See supra* Part V.B.1.

260 For further information on the Texas RPS see David Hurlbut, *A Look Behind the Texas Renewable Portfolio Standard: A Case Study*, 48 NAT. RESOURCES J. 129, 130 (2008).

261 Mitchell, *supra* note 228, at 1087.

262 *See* ENERGIE, EUROPEAN COMM'N, CONCERTED ACTION FOR OFFSHORE WIND ENERGY DEPLOYMENT 35–37 (2005), *available at* http://www.offshorewindenergy.org/cod/Final_COD_report_legal_frameworks.pdf.

263 *See* Klessmann et al., *supra* note 188, at 3651–53 (discussing Spain's Royal Decree 661/2007).

264 *See id.* at 3650–51 (discussing Germany's Renewable Energy Sources Act of 2000).

3. Forecast and Balancing Responsibilities

RPSs and tax policies are poorly conceived to offer investors protection from the electricity market's forecast and balancing responsibilities. Both require renewables plants to sell their electricity through the same market as other power generators.[265] This market generally requires participants to comply with its forecast obligations, and to accept financial responsibility for any charges incurred by balancing service deviations.[266] Accordingly, the United Kingdom's Renewables Obligation, one of the most internationally prominent RPS regimes, requires renewables plants to bear the full forecast and balancing responsibility for their electricity output.[267] Others, like the Pacific Northwest's Bonneville Power Administration, charge intermittently operating renewable power plants a flat "integration rate" for every unit of electricity fed into the grid, so as to cover the network operator's balancing expenses while limiting the plant's balancing responsibility and risk.[268] Similarly, the California Independent System Operator has established the Participating Intermittent Resource Program that charges intermittent renewables plants for balancing services only in the amount of their net monthly forecast deviations.[269] As over-forecasting and under-forecasting errors tend to cancel each other out, at least in part, the monthly aggregation of forecast deviations aims to limit the net liability of intermittent renewable power plants for balancing costs in California.[270] These arrangements reflect the tremendous importance of limited risk exposure for intermittent electricity generation from renewables. They also illustrate the regulatory complexity and challenges of limited balancing responsibility caused by policymakers' reliance on tax credits and RPS policies.

Tender regimes and feed-in tariffs are better suited to incorporate protection from the electricity market's forecast and balancing responsibilities, as both policies are designed to operate outside the market's forward-trading regime. They require the local utility or network operator to buy all power directly from the renewable power generator at the price set by the winning bid or the established tariff.[271] The risk of output intermittency and the responsibility for imbalance settlements can easily be assigned to the local utility or network operator. In exchange, the latter can recoup all associated balancing costs from their ratepayers, along with the

---

265 *See supra* Part V.B.1.

266 *Supra* notes 182–84 and accompanying text.

267 *See* Klessmann et al., *supra* note 180, at 3653.

268 For a detailed discussion of one federal agency's rationale for its integration rate, see BONNEVILLE POWER ADMIN., WP-10-A-02/TR-10-A-02, 2010 WHOLESALE POWER AND TRANSMISSION RATE ADJUSTMENT PROCEEDING (BPA-10)—ADMINISTRATOR'S FINAL RECORD OF DECISION 235–42 (July 2009), *available at* http://www.bpa.gov/corporate/pubs/RODS/2009/.

269 For more information on the Participating Intermittent Resource Program, see California ISO, *Participating intermittent program initiative*, http://www.caiso.com/1817/181783ae9a90.html (last visited July 21, 2012).

270 For a numerical example of these netting effects, see: http://www.caiso.com/Documents/PIRPSettlementChargesReport_Jan-Jun2011.pdf (last visited July 21, 2012).

271 INT'L ENERGY AGENCY I, *supra* note 7, at 92; Finon, *supra* note 71, at 115.

cost of the tender or feed-in tariff. This arrangement is especially fruitful under feed-in tariffs, which, unlike tender regimes, promote not only utility-scale plants, but also distributed generation facilities such as solar rooftop installations. These small- or medium-sized plants rarely have the expertise, overhead, or capacity to engage in sophisticated forecasting. Therefore, concentrating their forecast and balancing responsibilities in the hands of the local utility or network operator is likely to prove both more effective and more efficient, building on existing economies of scale.[272] It is for these reasons, and others outlined below, that this Article rates the capacity of feed-in tariffs to favorably impact forecast and balancing responsibilities as excellent and, hence, higher than tender regimes, which receive a good rating.

Feed-in tariffs can be designed to incentivize the assumption of forecast obligations and balancing responsibilities by renewables plant operators in the longer term. As market-penetration rates increase for intermittent renewable energy technologies, the overall cost of their forecast and balancing requirements may become too great a burden to distribute among ratepayers.[273] At the same time, such high levels of penetration imply advances in market maturity and cost-competitiveness that will enable intermittent renewable power generators to assume forecast and balancing responsibilities and still operate profitably and competitively. Feed-in tariffs have the conceptual flexibility to encourage this transition. The Spanish feed-in tariff, for instance, offers a choice between two tariff options.[274] The fixed tariff option provides traditional feed-in tariff remuneration and large-scale exemptions from forecast and balancing responsibilities.[275] The premium tariff option offers a premium payment in addition to the market rate for electricity, but requires participation in the electricity market's forward-trading regime and compliance with its imbalance settlement requirements.[276]

---

272 There is an inherent agency problem in this arrangement, as the ability to pass any balancing costs on to ratepayers may deter network operators from diligent forecasting. As a result of their natural network monopoly, however, these operators are subject to close regulatory scrutiny, which can easily include a review of their forecast and balancing efforts. Christine Müller, Advancing Regulation with Respect to Smart Grids: Pioneering Examples from the United Kingdom and Italy, *in* FOURTH ANNUAL CONFERENCE ON COMPETITION AND REGULATION IN NETWORK INDUSTRIES (Nov. 25, 2011) *available at* http://www.crninet.com/2011/c10a.pdf.

273 Several independent studies have shown, however, that the overall system cost of intermittency is relatively low, up to a market share of 30% for wind and other intermittent renewables technologies. *See, e.g.*, J. Charles Smith et al., *Utility Wind Integration and Operating Impact State of the Art*, 22 IEEE TRANSACTIONS ON POWER SYS. 900, 900 (2007), *available at* http://www.nrel.gov/docs/fy07osti/41329.pdf; TIMUR GÜL & TILL STENZEL, VARIABILITY OF WIND POWER AND OTHER RENEWABLES 8 (2005), *available at* http://www.uwig.org/IEA_Report_on_variability.pdf.

274 MENDONÇA ET AL., *supra* note 39, at 40.

275 *See* Klessmann et al., *supra* note 188, at 3650–51.

276 For a detailed discussion of the Spanish feed-in tariff options, see MENDONÇA ET AL., *supra* note 39, at 40–42; Klessmann et al., *supra* note 188, at 3651–53.

C. Policy Impact on Behavioral Factors—Social Acceptance

Tax policies offer poor capacity to improve the public perception of renewable energy technologies, or, rather, of their deployment in people's proverbial backyards. The need for income or other forms of tax liability to offset, has given tax credits the public image of a "rich man's" policy.[277] Worse still, the immediate effects on the public budget give the impression that tax credits offer already wealthy renewables entrepreneurs the chance to enrich themselves further at the taxpayers' expense.[278]

Tender regimes, too, have relatively poor potential to disperse local concerns over the large-scale deployment of renewable energy technologies. As indicated, the tender process primarily targets energy incumbents or institutional investors with industry-specific experience. As a result, tenders create few opportunities for local investment.[279] Moreover, site-specific tenders are usually announced at the state or national level with limited involvement or consideration of local governments and their concerns. Under the British Non-Fossil Fuel Obligation's tender regime, for instance, local communities felt overwhelmed and bypassed by the speed of deployment, with some feeling "that wind energy deployment was happening too quickly, with too limited a local involvement."[280] In terms of cost recovery, the general perception of tender regimes tends to be slightly more positive than of tax credits, as the distribution of policy costs among ratepayers is generally considered to be fairer than their socialization across taxpayers.

The moderately positive public view of RPS policies benefits from their widespread characterization as market-based instruments rather than subsidies. Closer scrutiny of their implementation, however, reveals that utilities normally recoup their additional costs for REC procurement by passing them on to ratepayers, just like under tender regimes or feed-in tariffs.[281] More importantly, the considerable transaction costs stemming from REC trading have earned RPSs the reputation of being "big corporation" policies that afford little access to local investors to participate in the profits from renewables deployment.[282] Local suspicion of RPS regimes and the deployment they support is further fueled by the lack of a transparent and regulated market for certificate trading.[283]

In contrast, feed-in tariffs show good conceptual capacity to improve the public perception of renewable energy deployment. The greatest asset of

277 *See* Toke, *supra* note 242, at 368.

278 *See* Timothy P. Carney, *Grants for Renewable Energy Test Party Principles*, WASH. EXAM'R, Dec. 21, 2011, http://washingtonexaminer.com/article/1020881 (last visited July 7, 2012).

279 *See supra* Part IV.A.3.

280 Mitchell, *supra* note 228, at 1082.

281 *See* Fershee, *Moving Power Forward*, *supra* note 46, at 1410–12. For a detailed discussion of a New Mexico utility's attempt to pass its REC expenses onto ratepayers, see *id.* at 1412–14.

282 Bürer & Wüstenhagen, *supra* note 14, at 5005.

283 *See* Kelly Crandall, Comment, *Trust and the Green Consumer: The Fight for Accountability in Renewable Energy Credits*, 81 U. COLO. L. REV. 893, 950–52 (2010) (calling for greater transparency around REC purchases).

feed-in tariff policies in their plight for local acceptance is their capacity to attract local investment in renewable energy technologies.[284] Feed-in tariff support for distributed generation allows private households to partake in the environmental and economic benefits derived from renewables deployment, for example, through solar photovoltaic panels on their roofs.[285] With their own stake in the Race to Renewables, local constituents no longer feel like the victims of an aesthetic assault on their backyards by anonymous corporate wind developers. European feed-in tariff representatives, such as Denmark or Germany, have long utilized the power of popular participation to promote renewables deployment. In 2009, more than 200,000 Danish families were stakeholders in local wind farms.[286] Similarly, hundreds of thousands of Germans have become shareholders in so-called "citizens' wind farms" scattered across the country.[287] Nonetheless, poorly administered feed-in tariffs can damage the public perception of renewables if regulators fail to adjust tariff rates to track cost-improvements as renewable energy technologies mature. No ratepayer wants to fund windfall profits for project developers through feed-in tariff rates that fail to take into account, for example, the tumbling prices of solar panels.

D. Summary

The qualitative "soft-cost" factor analysis of feed-in tariffs, RPSs, tax credits, and tender regimes offers a compelling explanation for the differences in policy efficacy and efficiency observed in the IEA study.[288] The superior performance of feed-in tariff countries can be attributed to the greater conceptual capacity of feed-in tariffs to positively affect the "soft-cost" factors that determine the investor appeal of renewable energy technologies. Feed-in tariffs score highest across all investment-based and market-based factors, as well as in their ability to improve the social acceptance of renewable energy technologies.

Tender regimes assume a distant second place. Tender policies fare especially well, albeit worse than feed-in tariffs, when considering all market-based factors and transaction costs.[289] However, tenders are poorly designed to positively affect social acceptance and to attract a wide range of

---

284 *See* Miguel Mendonça et al., *Stability, Participation and Transparency in Renewable Energy Policy: Lessons from Denmark and the United States*, 27 POL'Y & SOCIETY 379, 384–85 (2009).

285 *Id.*

286 Stefan Gsanger, *Community Power Empowers*, DISCOVERY NEWS, May 26, 2009, http://news.discovery.com/tech/community-wind-power-opinion.html (last visited July 21, 2012); *see also* Nicolaj Stenkjaer, *Wind Turbine Co-Ops in Denmark*, NORDIC FOLKECENTER FOR RENEWABLE ENERGY, Dec. 2008, http://www.folkecenter.net/gb/rd/wind-energy/48007/windturbinecoopsdk/ (last visited July 21, 2012) (discussing the development of wind energy cooperatives in Denmark).

287 Gsanger, *supra* note 286.

288 *See supra* Part III.

289 *See supra* Parts V.A.2, V.B.

investors for a variety of investment opportunities.[290] The heterogeneity of the conceptual characteristics of tender regimes helps explain the wide spread between Ireland's impressive deployment success and the mediocre performance of other tender representatives such as India and Canada.[291]

RPSs and tax policies demonstrate similarly limited conceptual capacities to positively influence investor interest in the deployment of renewable energy technologies. Tax credits claim a slight edge over RPSs thanks to their relative strengths in keeping transaction costs down and attracting a wider range of investors for a variety of investment opportunities.[292] The only relative strength of RPS regimes lies in their ability to foster social acceptance of renewables deployment.[293] Overall, these results correspond with the somewhat inconclusive but predominantly poor to moderate deployment success of RPSs and tax policies according to the IEA study.[294]

Furthermore, the findings of this Article's qualitative analysis offer an explanation for how international clean-tech investors perceive renewable energy deployment policies.[295] A recent survey asked principals and senior managers from sixty venture capital and private equity firms to rate the efficacy of policy options at stimulating investment interest in clean energy technology projects.[296] Participants rated the efficacy of market-pull—i.e., deployment policies[297]—on a scale from one (very ineffective) to five (very effective). Of all the surveyed market-pull policies, feed-in tariffs ranked the highest, with an average effective score of 4.16, well ahead of tax credits (3.35) and RPS (3.27) policies.[298] The survey did not explicitly ask participants to rate the efficacy of tender regimes. However, the market-pull options to be rated included public procurement policies that resemble and, in some cases, may include tender regimes. Remarkably, the surveyed investors rated public procurement policies as slightly more effective than tax credits and RPSs, but well below feed-in tariffs.[299] Thus, the survey participants' rating of deployment policies' efficacy at stimulating investment in clean energy technologies is consistent with—and can be explained through—the findings of the preceding qualitative analysis.

290 *See supra* Parts V.A.3., V.C.

291 *See supra* Part III.B.

292 *See supra* Part V.A.

293 *See supra* Part V.C.

294 *See supra* Parts III.B–C.

295 *See* Bürer & Wüstenhagen, *supra* note 14, at 4997–98.

296 *Id.* at 4999.

297 The survey defines market-pull policies to include "strategic deployment policies relevant to the pre-commercial stage of technology development all the way down to the supported commercial stage of technology maturity." *Id.* at 5001–02.

298 *Id.* at 5002 fig.3. Interestingly, REC policy options were surveyed separately from RPS policies but received a similarly low efficacy rating (3.22). *Id.*

299 *Id.* (noting an efficacy rate of 3.38).

VI. TOWARD A MORE INVESTOR-ORIENTED U.S. RENEWABLES POLICY

Both empirical evidence across the globe and this Article's qualitative "soft-cost" factor analysis suggest that the United States would be well advised to adopt a feed-in tariff approach to leverage greater investment in renewable energy. However, designing and implementing a feed-in tariff that spurs sustainable growth of U.S. renewables while limiting the financial burden on ratepayers requires careful consideration of a number of factors, and must not be rushed into.[300] In the meantime, well-targeted, specific adjustments to the currently employed policy instruments represent crucial first steps toward a more investor-oriented U.S. renewables policy.[301]

A. Adjustments to Current U.S. Policy Instruments

For the past quarter of a century, renewable energy policy in the United States has been dominated by RPSs and tax credits.[302] Based on this Article's qualitative analysis, both policy instruments would considerably improve their attractiveness to investors if they offered a more favorable treatment of the "soft-cost" factors related to the electricity market structure, such as grid access, dispatch priority, and balancing responsibilities.[303] In addition, policy-specific tweaks in design and implementation could significantly improve the impact of RPSs and production tax credits on investment-based "soft-cost" factors and, hence, enhance their ability to leverage investment in renewable energy technologies.[304]

1. Enhancing the Market Efficiency of RPSs

There are about thirty state-level RPS regimes in force in the United States today.[305] Under these RPSs, renewable energy investors are exposed to the dual market risks of the wholesale electricity market (to sell their power) and the REC market (to sell the certificates they receive for relying on renewables).[306] The REC market in particular imposes enormous uncertainty on the profit expectations of investors and, as a result, drives up the cost of capital.

The absence of a unified national REC market and the multiplicity of competing standards have led to a proliferation of state certificate

300 *See infra* Part VI.B.

301 *See infra* Part VI.A.

302 *See* Welton, *supra* note 6, at 991.

303 *See supra* Parts IV–V.

304 *See infra* Parts VI.A.1–2.

305 As of June 2012, 29 states and the District of Columbia have implemented RPS regimes. *See* Database of State Incentives for Renewables & Efficiency, *Quantitative RPS Data Project*, http://www.dsireusa.org/rpsdata/index.cfm (under Archives by Year, click on "RPSspread051812 .xlsx") (last visited July 20, 2012).

306 Other RPS regimes, such as the United Kingdom's Renewables Obligation, expose investors to a total of four distinct market risks. *See* Butler & Neuhoff, *supra* note 72, at 18–21.

markets.[307] The various state RPS mandates have brought forth a panoply of inconsistent definitions of eligible renewable energy technologies. As a result, the U.S. renewables market has splintered into regional and state markets, offering investors poor liquidity and, with it, enormous volatility.[308] The problem posed by different REC definitions is exacerbated by conflicting rules on the treatment and value of these certificates.[309] The REC shelf life, for instance, ranges from three years in Michigan, to indefinite validity in Arizona.[310] The vastly different ability to bank RECs for future sale or proof of compliance directly affects their market value, and inevitably fosters the creation of different REC sub-classes. To make matters worse, there is not even a universally accepted currency for state-issued RECs. While most states award one certificate per MWh of eligible electricity, some issue RECs on a per kWh basis.[311] In addition, state RPS mandates vary considerably in their aspirational aggressiveness, as well as in their planning and enforcement rigor, all of which affect—directly or indirectly—the market value of RECs.[312] This multiplicity of state RPS mandates has produced huge fluctuations in certificate market prices, ranging from $1.75 in California to $35 in New England for a REC over 1 MWh of wind energy.[313] With such uncertainty, it is hardly surprising that investors are reluctant to fund U.S. renewable energy projects, and, when they do so, charge a premium for their risk exposure.

A federal RPS is often celebrated as the panacea that would reduce the REC market risk to investors by creating a unified national certificate market with harmonized definitions, accounting, and compliance rules.[314] A more liquid, transparent, and less volatile national REC market could indeed be expected to increase investment in renewable energy technologies, while saving utilities and ratepayers billions of dollars.[315] Washington's history of more than twenty-five failed proposals for a federal RPS, however, makes it politically unlikely that a federal RPS will unify the panoply of fragmented state REC markets in the near future.[316]

---

307 Welton, *supra* note 6, at 999–1000.

308 Sovacool & Cooper, *Congress Got It Wrong*, *supra* note 46, at 105.

309 *Id.*

310 Davies, *supra* note 44, at 1378.

311 *Id.*

312 *See id.* at 1360–61.

313 Sovacool & Cooper, *Congress Got It Wrong*, *supra* note 46, at 105.

314 *See* Davies, *supra* note 44, at 1363; Sovacool & Cooper, *State Efforts to Promote Renewable Energy*, *supra* note 46, at 8; Welton, *supra* note 6, at 999.

315 *See* Berendt, *supra* note 179, at 66 ("The security that a liquid national REC market would bring to U.S. renewable energy finance is of paramount importance."). For projections of the expected savings in compliance costs, see Sovacool & Cooper, *Congress Got It Wrong*, *supra* note 46, at 108–09. *See also* Davies, *supra* note 44, at 1379 ("Federal competition should not just make REC prices more uniform; it should drive them down.").

316 For a summary of the congressional deadlock over a federal RPS see Davies, *supra* note 44, at 1341–42. *See also* Welton, *supra* note 6, at 996.

In the meantime, RPS states should continue to fulfill their role as laboratories of democracy,[317] but cooperate more to create a harmonized RPS market from the bottom-up. The Northeast's Regional Greenhouse Gas Initiative and the Western Climate Initiative have demonstrated the ability of regional, multi-state collaboration to combat climate change.[318] To better align REC trading with the physical sale and delivery of electricity, I recommend that states join forces to create regional certificate trading markets that unite RPS states in the Eastern and Western Interconnects.[319] In the near term, RPS states would be well advised to at least increase the transparency and predictability of their in-state REC markets, for example by replacing the widespread over-the-counter trade of certificates with a mandatory trading platform. Such a platform could build on the certificate tracking systems developed in Texas, Wisconsin, and the New England Power Pool.[320] More transparent REC markets would also do a better job of conveying relevant information to potential investors, such as how close a jurisdiction is to reaching its RPS target. At present, prospective investors have to rely on publicly available information about pending interconnection applications in order to assess the market's saturation.[321] The transmission interconnection queue, however, is a poor source of information, since many proposed projects apply for interconnection long before they secure financing or regulatory approval and, as a result, never come to fruition.

---

317 *See* New State Ice Co. v. Liebmann, 285 U.S. 262, 311 (1932) (Brandeis, J., dissenting) ("[A] single courageous State may, if its citizens choose, serve as a laboratory; and try novel social and economic experiments without risk to the rest of the country.").

318 The Regional Greenhouse Gas Initiative (RGGI) originates from an invitation of New York's then Governor George Pataki to his fellow Northeast governors for concerted action against climate change. For details regarding the political process that eventually gave birth to RGGI see Note, *The Compact Clause and the Regional Greenhouse Gas Initiative*, 120 HARV. L. REV. 1958, 1959–60 (2007). The Western Climate Initiative (WCI) consists of seven western U.S. states—Arizona, California, Montana, New Mexico, Oregon, Utah, and Washington—and four Canadian provinces—British Columbia, Manitoba, Ontario, and Québec. The WCI published design recommendations for its own cap-and-trade program in September of 2008. *See* Western Climate Initiative, *The WCI Cap & Trade Program*, http://www.westernclimateinitiative.org/the-wci-cap-and-trade-program (last visited July 21, 2012). For an investigation of the constitutionality of such a multi-state approach under the Dormant Commerce Clause and Compact Clause, see Berendt, *supra* note 179, at 61–65.

319 The Eastern Interconnect covers parts of Montana, Texas and South Dakota as well as Nebraska, Kansas, Oklahoma, and points east. *See* U.S. Dep't of Energy, *North American Electric Reliability Corporation Interconnections*, *available at* http://energy.gov/sites/prod/files/oeprod/DocumentsandMedia/NERC_Interconnection_1A.pdf. The Western Interconnect encompasses the rest of Montana, Texas, and South Dakota as well as Colorado, New Mexico, and all points west. *See id.* The Texas Interconnect, finally, serves most of Texas. *Id.*

320 For an explanation of the certificate tracking systems developed in Texas, Wisconsin, and the New England Power Pool, see Berendt, *supra* note 179, at 58.

321 For an introduction to the mechanics of the transmission interconnection queue under FERC Order 2003, see NAT'L WIND COORDINATING COLLABORATIVE, TRANSMISSION UPDATE—April 2008 (2008), *available at* http://www.nationalwind.org/assets/publications/NWCC_Transmission_Update.pdf.

2. Complementing Tax Credits with Direct Subsidies

The need for sufficient tax liabilities to reap the benefits of the federal tax credit program has already been identified as a major deterrent to renewables investment in the United States.[322] A recent study illustrates the enormous cost of tax equity to investors and taxpayers.[323] Between 2005 and 2008, tax credits worth $10.3 billion were drawn to deploy some 19 gigawatts (GW) of new wind turbine generation capacity.[324] Factoring in the cost of tax equity, the same deployment could have been achieved with approximately $5 billion in direct cash subsidies—in other words, at half the cost to taxpayers and the mounting national budget deficit.[325]

Until a feed-in tariff establishes a direct cash subsidy for renewable energy deployment and reassigns the associated costs to ratepayers rather than taxpayers, the federal tax credit should be complemented with an option to receive cash subsidies instead. Such an opt-out would not yet fully remove the burden of tax credits on the national budget, but it would, at least, ensure more efficient use of taxpayers' money and, hence, help relieve the national budget deficit. From 2009 to 2011, the Treasury's section 1603 Cash Grant offered this sort of cash subsidy in lieu of tax credits, which revived America's struggling renewable energy industry.[326] Regrettably, the section 1603 Grant was not extended beyond 2011 and federal support for renewables deployment has reverted back to its historic reliance on tax incentives alone.[327] To maintain the investor appeal of renewable energy in the United States, and spare the industry another chapter in its long history of boom and bust cycles,[328] I recommend the immediate renewal of the section 1603 Cash Grant.

B. Keys to Feed-In Tariff Success in the United States

Successful feed-in tariff design and implementation represent a huge challenge. In contrast to RPSs or other quantity-based policy instruments, regulators cannot rely on the market's invisible hand to determine the

322 *See supra* note 204 and accompanying text.

323 BIPARTISAN POL'Y CTR., *supra* note 41, at 11.

324 *Id.* at 13.

325 *Id.*

326 *Id.* at 17. For an overview of the section 1603 grant and its promotional success, see U.S. Dep't of the Treasury, *Recovery Act, 1603 Program: Payments for Specified Energy Property in Lieu of Tax Credits*, http://www.treasury.gov/initiatives/recovery/Pages/1603.aspx (last visited July 21, 2012).

327 *See* Gloria Gonzales, *Expiration of Cash Grant to Affect Biomass & Wind More than Solar*, OILPRICE.COM, Jan. 9, 2012, http://oilprice.com/Alternative-Energy/Renewable-Energy/Expiration-of-Cash-Grant-to-Affect-Biomass-Wind-More-than-Solar.html (last visited July 21, 2012) (pointing out that the expiration of the cash grant program will be particularly hard on small-scale projects that lack sufficient tax equity).

328 *See* INT'L ENERGY AGENCY I, *supra* note 7, at 107–08 (referring to "substantial boom-and-bust cycles in U.S. wind power installations in the 2000s"); Mortenson, *supra* note 68, at 183 (noting that without economic incentives "[h]istorically, wind turbine activity has dropped dramatically").

appropriate level of financial support. As a price-based policy, feed-in tariffs require regulators to set tariff rates at a level that balances investor needs with ratepayer concerns.[329] To harness the full promotional potential of feed-in tariffs, a multi-tiered tariff structure should account for differences across technology strands and project sizes.[330] Finally, a successful feed-in tariff must be compatible with, and sensitive to, the existing panoply of competing policy approaches at the U.S. state and federal level.[331]

1. Getting the Tariff Right—And Keeping it Right

To effectively leverage investment in American renewable energy, a U.S. feed-in tariff must offer financial subsidies that allow investors to make a reasonable profit without imposing an undue burden on electricity ratepayers. Argentina's feed-in tariff experience illustrates that, if the tariff is set too low, it will fail to attract the necessary investment to deploy renewable energy technologies. As a concession to political opposition, Argentina's 2006 feed-in tariff for wind energy was set too low to inspire serious investment, leaving deployed wind capacity stable at a meager 30 MW nationwide—the equivalent of fifteen present-day wind turbines.[332] At the other end of the spectrum, a tariff that is set too high will impose undue hardship on electricity ratepayers and undermine public support for renewables, as Spain's feed-in tariff for solar photovoltaics has demonstrated. The Spanish regulators chose to adopt rates similar to Germany's widely praised feed-in tariff, only to find out that, in reality, these rates were far too high in light of Spain's 60%-greater insolation as compared to Germany.[333] As a result, the Spanish tariff offered renewable energy investors windfall profits at the expense of ratepayers, eroding public support for renewables and eventually forcing the Spanish government to suspend its feed-in tariff.[334]

Feed-in tariff rate determination tends to follow one of two approaches. The value-based method aims to securitize the long-term benefits of renewable energy related to electricity transmission, energy security, public health, environmental conservation, etc.[335] The cost-based method aims to bridge the gap between current electricity market rates and the levelized cost of electricity generation from renewables, including a return on investment of 5%–10%.[336] I recommend setting the rates of a U.S. feed-in tariff

329 *See infra* Part VI.B.1.

330 *See infra* Part VI.B.2.

331 *See infra* Part VI.B.3.

332 MENDONÇA ET AL., *supra* note 39, at 57.

333 *Id.* at 58–59.

334 *See* Press Release, Council of Ministers of Spain, The Government Will Temporarily Suspend Premiums For New Special Regime Facilities (Jan. 27, 2012), http://www.minetur.gob.es/en-US/GabinetePrensa/NotasPrensa/2012/Paginas/npregimenespecial270112.aspx (last visited July 21, 2012).

335 Bull et al., *supra* note 245, at 53.

336 *Id.*; MENDONÇA ET AL., *supra* note 39, at 19.

according to the cost-based method.[337] The value-based method would run counter to the presently prevailing regime of American electricity rate regulation based on the cost of service.[338] Also, adopting a value-based approach for renewable energy technologies would require reconsidering the economic and environmental benefits of traditional fossil fuel technologies, including the present externalization of their environmental costs. While environmentally desirable, such a far-reaching reform of the electricity sector appears politically unlikely in the near future.[339] In contrast, the cost-based approach would allow for a reasonable U.S. feed-in tariff to be set by building on existing institutions and expertise. The Federal Energy Regulatory Commission and State Public Utility Commissions have long set electricity rates based on the cost of service for conventional power generation technologies.[340] Their vast regulatory experience and expertise can help determine the appropriate feed-in tariff rates for renewable energy technologies.

Going forward, vigilant regulatory oversight and frequent adjustments will be needed to ensure that the rates of a U.S. feed-in tariff keep up with cost improvements in renewable energy technologies. Growth in deployed capacity enables technology learning which, in turn, reduces generation costs and brings renewable energy technologies closer to grid parity.[341] Along the way, feed-in tariffs require constant monitoring and modification to keep investor returns reasonable and avoid windfall profits from tariffs that, for example, fail to decrease along with the tumbling prices of solar panels. Otherwise, a feed-in tariff that started out with appropriate rates may eventually become the victim of its own success. Following record deployment of 7.5 GW of new solar capacity in 2011 alone, Germany saw fit to reduce its tariff rates before the end of the scheduled review interval.[342]

---

337 For the one exception to this rule regarding the addition of a site-sensitive component to the U.S. feed-in tariff, see *infra* Part VI.B.2.

338 For further discussion of U.S. electricity rate regulation, see Tooraj Jamasb & Michael Pollitt, *Liberalisation and R&D in Network Industries: The Case of the Electricity Industry*, 37 RESEARCH POL'Y 995, 1003–05 (2008) (discussing electricity regulation in the U.S. and its effects on technological innovation); John W. Mayo & Joseph E. Flynn, *The Effects of Regulation on Research and Development: Theory and Evidence*, 61 J. BUS. 321 (1988) (examining the relationship between regulation and investment in research and development in the utility industry); MARK W. FRANK, THE IMPACT OF RATE-OF-RETURN REGULATION ON TECHNOLOGICAL INNOVATION 6–24 (2001) (discussing rate-of-return regulation and its development in the U.S.).

339 For a discussion of the political difficulties and conceptual challenges of internalizing the environmental costs of electricity generation from fossil fuels through emission pricing, see Mormann, *supra* note 31, 929–33.

340 *See, e.g.*, Joseph P. Tomain, *The Past and Future of Electricity Regulation*, 32 ENVTL. L. 435, 443–53 (2002).

341 Technology learning and cost-reduction varies by technology dependent upon the level of market maturity. Solar photovoltaics, for instance, has historically experienced cost reductions of 22% for every doubling of capacity. HEARPS & MCCONNELL, *supra* note 229, at 15. The cost of onshore wind energy facilities has come down by only 10% for every doubling of capacity. *Id.* at 26.

342 *See* Matthias Lang & U. Mutschler, *Bundesrat Clears Reduced German Solar Feed-in Tariffs*, GERMAN ENERGY BLOG, http://www.germanenergyblog.de/?p=9756 (last visited July 21, 2012). For critical reactions to Germany's record solar deployment in 2011, see Vera Eckert &

To account for the record deployment's achieved economies of scale and technology learning, the German government decided to reduce its tariff rates by up to 30% for utility-scale solar installations.[343]

Regulators should ensure the continued accuracy of payments under a U.S. feed-in tariff in two ways. First, the tariff should include a standard rate of degression that inspires and anticipates cost reductions due to technology advancements. The degression rate should vary according to the level of maturity of eligible technology strands, as less mature technologies tend to experience relatively greater technology improvements and cost reductions than their more mature counterparts.[344] To track these cost reductions as closely as possible, degression rates should be designed to lower tariff rates gradually; for example, in monthly intervals.[345] Second, the legislation for a U.S. feed-in tariff should establish a regime for periodic revision of tariff rates in case technology development is not fully reflected in the standard degression rate. Feed-in tariff veteran Germany, for instance, reviews its tariff rates at least once every four years.[346] As a relative novice to the feed-in tariff community, the Canadian province of Ontario has opted for a biennial review process.[347] In light of the limited experience with feed-in tariffs in the United States, tariff rates should be reviewed at least once every two years in the early stages of implementation. Over time, review intervals can be extended to account for greater experience and better accuracy of the technology development forecast reflected in the standard degression rates.

2. Structuring a Nuanced, Multi-Tiered Feed-In Tariff

To appeal to the broadest possible pool of investors and encourage investment in a wide range of renewables projects, a U.S. feed-in tariff should feature a nuanced, multi-tiered tariff structure that differentiates between technology strands, project sizes, and project sites.

Christoph Steitz, *Update 2-German Solar Boom Strengthens Critics of Subsidies*, REUTERS, Jan. 9, 2012, http://www.reuters.com/article/2012/01/09/grid-regulator-solar-idUSL6E8C90YL20120109 (last visited July 21, 2012).

343 *See* Lang & Mutschler, *supra* note 342. Such drastic cuts are often mistaken for proof of the expensive and wasteful nature of feed-in tariffs. My analysis suggests that, instead, they ought to be acknowledged as a tribute to the success at leveraging investment in renewable energy technologies that, in turn, fosters technology learning and cost reductions.

344 *See* MENDONÇA ET AL., *supra* note 39, at 49 (explaining that emerging technologies like solar photovoltaics with more rapidly declining generation costs should have higher degression rates).

345 In contrast to an annual degression rate, a monthly degression avoids boom-and-bust cycles that tend to occur before and after the tariff rates' annual reductions. *See, e.g.*, CLAIRE KREYCIK ET AL., NAT'L RENEWABLE ENERGY LAB., NREL/TP-6A20-50225, INNOVATIVE FEED-IN TARIFF DESIGNS THAT LIMIT POLICY COSTS 20–21 (2011), *available at* http://www.nrel.gov/docs/fy11osti/50225.pdf (noting that Oregon PUC rates more accurately reflected actual costs due to a bi-annual adjustment of rates, according to developer response).

346 MENDONÇA ET AL., *supra* note 39, at 36.

347 For details on the Ontario review process with nearly 2,900 surveys, over 200 written submissions, and meetings with over 80 stakeholders see ONTARIO MINISTRY OF ENERGY, ONTARIO'S FEED-IN TARIFF PROGRAM: TWO-YEAR REVIEW REPORT (2012), *available at* http://www.energy.gov.on.ca/docs/en/FIT-Review-Report.pdf.

A technology-neutral feed-in tariff with one rate for all renewable energy technologies would likely trigger a run for the current least-cost technologies, such as biomass, hydro, and onshore wind.[348] Emerging technologies that still struggle with higher generation costs, such as solar photovoltaics, geothermal, or tidal energy, would not receive the necessary capital injection to achieve economies of scale.[349] In light of the magnitude of the required transformation to decarbonize our present carbon-intensive energy sector, it would be unwise to limit U.S. promotion of renewables to a few select technologies. Today's narrow focus may well drive up tomorrow's cost of renewables, as the necessary resources such as suitable sites for hydro and wind projects grow scarce.[350] In addition, a narrow focus may ignore the long-term growth potential for emerging technologies and thereby hurt the U.S. bid for leadership in the global battle over technology innovation. Following the international trend, a U.S. feed-in tariff should include a multi-tiered rate structure that accounts for the cost characteristics of eligible technologies and promotes investment in a broad portfolio of renewable energy technologies.

This multi-tiered rate structure should further differentiate among various renewables project sizes to account for their different cost characteristics. For instance, a small-scale project for a solar photovoltaics rooftop installation has a very different cost profile, and appeals to a very different type of investor, than a large-scale solar photovoltaics project in California's Mojave Desert.[351] The comparison between building-integrated distributed generation and large-scale projects in remote locations with superior renewable energy resource availability points to the utility of including site-differentiation in the U.S. feed-in tariff. A site-sensitive tariff structure would bring about transmission-related and other benefits of distributed generation as a result of reduced grid congestion, avoided system losses, deferred investments, and lowered emissions of environmental pollutants.[352]

3. Ensuring Compatibility with Existing Policies

Design and implementation of a U.S. feed-in tariff must reflect the existing policy framework for the deployment of renewable energy technologies. The interplay with other policies determines the feed-in tariff's ability to leverage the greatest possible investment in renewables at the

348 For a comparison of the generation costs of various renewable energy technologies, see EUROPEAN COMM'N, *supra* note 13, at 14.

349 *See* STERN, *supra* note 30, at 357–58 ("Many new technologies that could be used to reduce carbon emissions are not yet in widespread use. Trying to abate rapidly in the short term—when the capital in industries emitting greenhouse gases is fixed and technologies are given—can quickly become costly for firms, as the marginal cost of abatement is likely to rise sharply.").

350 *See* Mormann, *supra* note 31, at 937.

351 For ongoing efforts to securitize these and other project types to make them attractive for a broader range of investors see Schwabe et al., *supra* note 244.

352 Bull et al., *supra* note 245, at 55.

lowest possible cost to American ratepayers. Consideration of all potential overlap and interaction between a feed-in tariff and the existing panoply of federal, state, and local policies lies beyond the scope of this Article. However, a few key questions regarding the compatibility of a feed-in tariff with RPSs and tax credits deserve special attention. In light of the conceptual superiority of a feed-in tariff over the current tax credit regime,[353] tax incentive support for U.S. renewables should be phased out as the feed-in tariff goes online. Parallel use of both policies would not only drive up the overall transaction costs for investors, who draw on U.S. policy support to deploy renewable energy technologies, but it would also extend the burden that tax credits currently impose on the growing national budget deficit. Finally, concurrent use of both tax credits and a feed-in tariff would exacerbate the challenge of setting appropriate tariff rates, as the value of tax equity under the tax policy would add another component to the complex rate-setting process for feed-in tariffs.

The potential interplay between feed-in tariffs and RPSs raises even more complex questions. At the outset, regulators must decide whether both policies are intended to compete with one another, or whether they conceive of the feed-in tariff as the driver to achieve the renewables targets set by RPSs.[354] If both policies are to compete with one another, then renewable energy investors could be given a choice between selling their power output and RECs on their respective wholesale and certificate markets or, instead, claiming the feed-in tariff payments. In this case, feed-in tariff legislation should ensure that, in exchange for tariff payments, local utilities receive ownership of a renewable electricity generator's RECs to avoid double dipping.[355]

Alternatively, a U.S. feed-in tariff could simply take the place of the current tax credit support for renewables. In this scenario, renewable energy investors would try to recover their cost and make a reasonable profit by selling their power in exchange for feed-in tariff payments and continuing to sell their RECs on the certificate market. However, I strongly advise against this second option and urge the adoption of a U.S. feed-in tariff as the principal driver to achieve RPS targets according to the first scenario. Both empirical data and this Article's "soft-cost" factor analysis suggest that the REC market's risks and uncertainties discourage investment in renewable energy technologies.[356] Accordingly, a feed-in tariff should be embraced as a chance to limit the investor risk of deploying renewables at scale. Such tandem use of a feed-in tariff and RPSs would by no means render REC trading and the associated competitive forces moot. Rather, certificate

---

353 *See supra* Part V.D.

354 Originally, the literature erroneously viewed RPSs and feed-in tariffs as two mutually exclusive policy instruments, but has since come to embrace the possibility that both may, in fact, work in tandem. *See* Rickerson et al., *supra* note 70; Davies, *supra* note 44, at 83 (noting that RPSs and feed-in tariffs "can work hand-in-glove").

355 In the present regulatory framework, such an automatic transfer of RECs would be difficult as the treatment of a state-issued REC is subject to state law and varies across different state RPS regimes. Davies, *supra* note 44, at 1364.

356 *See supra* Parts III.D, V.D.

trading could take place among utilities to ensure that they meet their respective RPS mandates. For instance, if a utility administered the feed-in tariff to such success that it received more RECs than necessary to prove compliance with its RPS mandate, the surplus certificates could be sold to another less successful utility. The profits derived from these inter-utility certificate trades could serve to recover the selling utility's feed-in tariff payments and, hence, reduce the tariff's cost to the utility's ratepayers. Renewable energy investors and project developers are wary of REC-related risk, especially when it exposes them to markets they are unfamiliar with.[357] Electric utility companies, in turn, are well experienced with these markets and, therefore, represent the better bearer of REC-related risk.

VII. CONCLUSION

To serve as a catalyst for private-sector investment, policies to deploy renewable energy technologies require more than just a minimum level of financial remuneration. Such remuneration is a necessary—but by no means sufficient—condition to deployment success. In addition, deployment policies must have a positive impact on a variety of criteria that determine a policy's investor appeal. This Article has condensed these criteria to a framework of investment-based, market-based, and behavioral "soft-cost" factors. A qualitative analysis of the primary policies used to promote renewable energy deployment explains their vastly different policy performance as the result of their ability, or inability, to favorably impact these "soft-cost" factors. The results point to feed-in tariffs as the policy with the greatest conceptual capacity to leverage investment in the deployment of renewable energy technologies.

In his 2012 State of the Union address, President Obama pledged not to cede the clean energy industry to China or Germany "because we refuse to make the same commitment here."[358] Both China and Germany support their surging clean energy industries with feed-in tariffs. It is time, indeed, that the United States make the same commitment and adopt the very policy that has propelled its competitors to become leaders in the Race to Renewables. It is time to adopt a feed-in tariff that has the ability to cost-effectively enhance the investor appeal of renewable energy in the United States.

357 *See* Lüthi & Prässler, *supra* note 101, at 4889–90; Bürer & Wüstenhagen, *supra* note 14, at 4999.

358 Barack Obama, President of the United States, State of the Union Address (Jan. 24, 2012), *available at* http://www.whitehouse.gov/the-press-office/2012/01/24/remarks-president-state-union-address (last visited July 21, 2012).