BUILDING A BETTER SOLAR ENERGY FRAMEWORK

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I. INTRODUCTION

The global threats of fossil fuel depletion and carbon dioxide emissions have led to a worldwide effort to combat these challenges through utilization of alternative sources of energy. Renewable energy technology, in particular, has experienced growth in several areas including biofuel, wind power, solar photovoltaic, and concentrating solar thermal power.[1] No renewable energy source is a perfect solution to the world's

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1. *See* PIKE RESEARCH, EXECUTIVE SUMMARY: SMALL WIND POWER: DEMAND DRIVERS

climate challenge. Biofuels could become a substitute to fossil fuels, but the resources needed to fully replace fossil resources are lacking.[2] Wind power is intermittent and lacking in energy potential.[3] Solar energy, though also a victim of intermittency due to inevitable setting of the sun and shading during cloudy weather, has immense energy potential and has benefitted from significant cost reductions.[4]

Solar technologies fall into four main categories: photovoltaic ("PV"), concentrating solar power ("CSP"), solar water heating, and solar space heating and cooling. This article will focus on the existing solar PV policies and frameworks of the United States and certain countries within Europe. Solar PV systems employ panels made of solar cells that capture sunlight and convert it into electricity.[5] Solar PV panels, otherwise known as solar PV modules, are "typically made from solar cells combined into modules that hold about 40 cells" and can be combined together to form a solar array, which can be further interconnected to form large utility-scale PV systems.[6] These systems easily represent the largest solar energy market in the world and can be installed across all market segments: residential, non-residential (commercial, non-profit, and government), and utility-scale.[7] Continued growth of solar PV technologies in the United States and Europe is dependent upon the regulatory, policy, and incentive frameworks present in states, communities, and municipalities.

Similar to countries in the Europe, the United States encounters barriers such as "complex solar installation permitting procedures [and] a lack of financing mechanisms for solar projects . . . ," but additionally suffers from restrictions on solar access, inadequate interconnection

AND BARRIERS, TECHNOLOGY ISSUES, COMPETITIVE LANDSCAPE, AND GLOBAL MARKET FORECASTS 2 (2011) [hereinafter PIKE REPORT], http://www.navigantresearch.com/wp-assets/uploads/2011/09/SWIND-11-Executive-Summary.pdf.

2. Vasilis Fthenakis et al., *The Technical, Geographical, and Economic Feasibility for Solar Energy to Supply the Energy Needs of the US*, 37 ENERGY POL'Y 387, 387 (2009).

3. Fthenakis et al., *supra* note 2; *What You Need To Know About Energy*, THE NAT'L ACADS. OF SCI., http://needtoknow.nas.edu/energy/glossary/ (last visited Mar. 19, 2014). Intermittent energy sources are "energy source[s] characterized by output that [are] dependent on the natural variability of the source rather than the requirements of consumers. Solar energy is an example of an intermittent energy source since it is only available when the sun is shining." *What You Need To Know About Energy*, *supra.*

4. Fthenakis et al., *supra* note 2.

5. *Solar Photovoltaic Energy Basics*, NAT'L RENEWABLE ENERGY LAB., http://www.nrel.gov/learning/re_photovoltaics.html (last updated May 18, 2012).

6. *Id.*

7. *See* SOLAR ENERGY INDUS. ASS'N ET AL, U.S. SOLAR MARKET INSIGHT REPORT: 2012 YEAR IN REVIEW 9 (2013) [hereinafter SOLAR MARKET INSIGHT 2012], http://www.seia.org/sites/default/files/resources/ZDgLD2dxPGYIR-2012-ES.pdf.

standards and net metering policies, shortage of a trained workforce, and a lack of support mechanisms for utility-scale projects.[8] While the federal government has enacted several policies and incentives to support the growth of solar technologies,[9] it lacks the ability to sufficiently combat some of these issues. Energy law in the United States is also primarily regulated at the state level or lower, which effectively makes each state a separate solar market[10] and affords state and local levels of government the responsibility of instituting policies and incentives that help eliminate barriers.

State and local governments can provide further incentive mechanisms than those already offered by the federal government in the form of tax rebates and feed-in tariffs,[11] among others. Advancement of solar technology can also be encouraged through solar access and solar rights laws, which ensure the availability of solar energy resources to individuals and companies and are important issues for state and local governments, where many different mechanisms are used to address solar access such as solar easements, ordinances, land use restrictions, homeowners' association rules, and permit requirements.[12] Additionally, solar PV technology can be encouraged at the state and local level through the comprehensive enactment of renewable portfolio standards ("RPSs"), interconnection standards, and net metering policies.[13] RPSs generally require utility companies to produce a certain amount of their electricity

8. *See* U.S. DEP'T. OF ENERGY, SOLAR POWERING YOUR COMMUNITY: A GUIDE FOR LOCAL GOVERNMENTS 10 (2d ed. 2011) [hereinafter SOLAR GUIDE FOR LOCAL GOVERNMENTS], http://www4.eere.energy.gov/solar/sunshot/resource_center/sites/default/files/solar-powering-your-community-guide-for-local-governments.pdf.

9. U.S. DEP'T. OF ENERGY, 2010 SOLAR TECHNOLOGIES MARKET REPORT 81–87 (2011) [hereinafter 2010 SOLAR TECHNOLOGIES MARKET REPORT], http://www.nrel.gov/docs/fy12osti/51847.pdf (listing the federal policies and incentives for solar PV, such as the Emergency Economic and Stabilizations Act of 2008 (EESA) and the American Recovery and Reinvestment Act (ARRA)).

10. John Edward Burns & Jin-Su Kang, *Comparative Economic Analysis of Supporting Policies for Residential Solar PV in the United States: Solar Renewable Energy Credit (SREC) Potential*, 44 ENERGY POL'Y 217, 217 (2012).

11. KARLYNN CORY, NAT'L RENEWABLE ENERGY LAB., RENEWABLE ENERGY FEED-IN TARIFFS: LESSONS LEARNED FROM THE U.S. AND ABROAD 3 (2009), http://www1.eere.energy.gov/wip/solutioncenter/pdfs/tap_webinar_20091028.pdf; *see* KARLYNN CORY ET AL., NAT'L RENEWABLE ENERGY LAB., FEED-IN TARIFF POLICY: DESIGN, IMPLEMENTATION, AND RPS POLICY INTERACTIONS 8 (2009), http://www.nrel.gov/docs/fy09osti/45549.pdf (providing an in-depth summary of United States feed-in tariff policy). Feed-in tariffs are renewable energy policies that typically guarantee project owners payments for renewable electricity they produce and provide access to the grid. CORY ,*supra*.

12. SOLAR GUIDE FOR LOCAL GOVERNMENTS, *supra* note 8, at 60–61.

13. *Id.* at 25–26, 81–91.

from renewable energy sources,[14] interconnection standards specify requirements for connecting solar technology systems to the grid,[15] and net metering allows individuals and companies to send extra electricity generated by solar technologies back to the utility network and receive credit for doing so.[16] State and local governments can also encourage solar technologies by streamlining the permitting process for the installation of solar technologies and doing more to support utility-scale projects.

In Part II, this article introduces the nature of solar energy production with an emphasis on the policy framework and infrastructure needed for solar production in the United States and Europe.[17] Part III discusses the viability of solar energy in the renewable energy sector and as a source of electricity.[18] Part IV examines foreign strategies, particularly those used in Germany and other countries within Europe that boast successful solar markets, to support the production of solar technology within the country.[19] This examination will include suggestions as to why Germany and other European markets have decreased certain solar incentives and how we can learn from their experience.[20] Part V will address the United States solar framework. Presented within this section will be examples of towns and municipalities with model solar access laws and other forms of support and recommendations for federal, state and local governments derived from our own experience and the experience of European countries.[21] The author argues that solar energy can be the most viable future source of renewable energy in the United States, Europe, and even abroad if other countries try to emulate these recommended practices. However, in the United States, this is dependent upon state and local governments being more proactive in enacting policies and incentives that increase the availability of solar technologies to residents and businesses. Doing so would eliminate various barriers to the continued growth of solar PV energy production. If these commitments are made, the United States can make a more concerted effort towards replacing fuel and coal with solar and other renewables as main sources of electricity, which will be a necessary step toward a climate change solution.

14. *Solar Carve-Outs in Renewables Portfolio Standards*, DSIRE SOLAR: DATABASE OF ST. INCENTIVES FOR RENEWABLES & EFFICIENCY (DSIRE) http://www.dsireusa.org/solar/solarpolicyguide/?id=21 (last visited Feb. 28, 2014).

15. SOLAR GUIDE FOR LOCAL GOVERNMENTS, *supra* note 8, at 83.

16. *Id.* at 89.

17. *See infra* Part II.

18. *See infra* Part III.

19. *See infra* Part IV.

20. *See infra* Part IV.

21. *See infra* Part V.

II. AN INTRODUCTION TO THE NATURE OF SOLAR PRODUCTION

A. INFRASTRUCTURE REQUIREMENTS

Solar PV panels are made up of PV cells that are created by placing a positively charged semiconductor against a negatively charged semiconductor to create an electrical field.[22] The created PV cell from this "silicon sandwich" reacts to solar energy and produces an electrical charge.[23] These cells are made usable through PV panels that can be used alone or in groups depending on the desired system size.[24] Proper installation infrastructure is crucial to the long-term stability of solar PV production systems. Outside of large utility-scale systems, panels are mainly installed on rooftops in order to avoid possible shading from trees or other structures that would reduce the system's efficiency.[25] The systems are typically installed to maximize efficiency at all times of the year by being placed "at an angle that accommodates both the high summer sun and the low winter sun . . . ."[26] The installation site needs to be of sufficient size and structural integrity to support the system being installed and provide access for component installation and maintenance. It is also increasingly becoming practical for solar PV panel sites to be grid-connected—having the ability to send solar power via transmission lines to a utility company. When solar PV systems are connected to a local utility, it allows buildings and residences to gain credit for excess electricity produced by the system to be fed to the utility.[27]

Finally, systems must be built to withstand the "harshest real-world conditions" and be rigorously tested or they will not last.[28] There was no

22. *See* Gil Knier, *How do Photovoltaics Work?*, NASA SCIENCE, http://science.nasa.gov/science-news/science-at-nasa/2002/solarcells/ (last visited April 3, 2014).

> For solar cells, a thin semiconductor wafer is specially treated to form an electric field, positive on one side and negative on the other. When light energy strikes the solar cell, electrons are knocked loose from the atoms in the semiconductor material. If electrical conductors are attached to the positive and negative sides, forming an electrical circuit, the electrons can be captured in the form of an electric current -- that is, electricity. This electricity can then be used to power a load, such as a light or a tool.

Id.

23. *Construction of PV Panels*, SPECTRUM SOLAR, http://spectrumsolar.com/resources-construction-of-solar-panels.html (last visited Feb. 28, 2014).

24. *See id.*

25. *Making Photovoltaics Work*, SPECTRUM SOLAR, http://spectrumsolar.com/resources-making-photovoltaics-work.html (last visited Feb. 28, 2014).

26. *Id.*

27. *Making Photovoltaics Work*, *supra* note 25.

28. Marcelo Gomez, *Predictions for Solar Infrastructure in 2012: No Longer the Ugly*

standard governing the materials used to support PV panels until October 2010 when the International Code Council's Evaluation Service ("ICC-ES") adopted ICC-ES Acceptance Criteria AC 428—Acceptance Criteria for Modular Framing Systems Used to Support Solar Photovoltaic ("PV") Modules.[29] The purpose of AC 428 was to "establish requirements for modular framing systems used to support photovoltaic ("PV") modules.[30] AC 428 defines "how to comply with the International Building Code (IBC) for flush roof and ground mount applications . . . [and] sets the requirements for material, component and connection testing, strength and reporting."[31]

B. SOLAR POLICY FRAMEWORK

The policy framework present in an area is also crucial for solar PV installation because the technology is still not price competitive with conventional sources of electric power generation.[32] Laws can provide subsidies and tax incentives to help close this price gap and can require electric utilities to obtain a certain percentage of their energy supply from renewable energy sources. There are a mixture of policies used in the United States and Europe to close the price gap, some better suited for small-scale development and some that favor utility-scale projects. For example, at the residential and small-scale commercial level, U.S. citizens often run into zoning ordinances and restrictive covenants that may limit siting options or ban the use of solar PV all together,[33] thus creating the need for laws allowing residents and businesses to have access to sunlight or laws that preclude ordinances or restrictive covenants from restricting the use of solar technologies. Another policy issue is administrative and permitting requirements, which impact how quickly facilities can be sited.[34] Other policy concerns include the availability of incentive programs, such as feed-in tariffs and the adequate implementation of RPSs, interconnection

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Stepchild, RENEWABLE ENERGY WORLD (Jan. 6, 2012), http://www.renewableenergyworld.com/rea/news/article/2012/01/predictions-for-solar-infrastructure-in-2012-no-longer-the-ugly-stepchild.

29. *See* ICC EVALUATION SERVICE, ACCEPTANCE CRITERIA FOR MODULAR FRAMING SYSTEMS USED TO SUPPORT PHOTOVOLTAIC (PV) MODULES 2, ¶ 1.1 (2010), http://www.icc-es.org/Criteria_Development/1010-post/17_AC428_Combined.pdf.

30. *Id.*

31. Gomez, *supra* note 28; *See* ICC EVALUATION SERVICE, *supra* note 29, ¶ 1.2.

32. LEROY PADDOCK & DAVID GRINLINTON, GEORGE WASHINGTON UNIVERSITY, LEGAL FRAMEWORK FOR SOLAR ENERGY 8 (2009), http://solar.gwu.edu/Research/GW%20Solar%20Legal%20Framework%20Report_March2010.pdf.

33. *Id.* at 72.

34. *Id.* at 9.

standards, and net metering policies. These policy framework issues will be discussed more in Part V.

III. FUTURE VIABILITY OF SOLAR ENERGY

The solar PV market increased the fastest of all renewable technologies from 2006 to 2010[35] and has remained one of the fastest growing markets through 2013. In 2010, the United States added around 900 megawatts ("MW") of PV capacity, a 92% increase over additions in 2009.[36] The year 2011 was another strong year for solar PV as installations grew by 1,855 MW in 2011, resulting in a 109% increase from 2010.[37] PV installations then grew 76% in 2012 to reach 3,313 MW annually, resulting in the U.S. accounting for "11% of all global PV installations in 2012, its highest market share in at least fifteen years."[38] At the end of 2012, there was a cumulative of 7,221 MW installed capacity of solar PV operating in the United States,[39] a number that had already increased to over 10,000 MW of installed solar PV by the end of the third quarter of 2013.[40]

Growth in global solar PV installations has, in large part, been in direct response to increased affordability and financial incentives present in the solar market. Between 2012 and 2022, solar PV system prices in Europe are expected to fall from up to €2.31/W in the residential sector to as low as €1.30/W and from upwards of €1.70/W in the utility sector to as low as €0.92/W.[41] From 2007 to the end of 2012, the weighted-average system cost for solar PV systems in the United States has dropped from around $7.60/W to $3.01/W, including a large price drop from $4.10/W to $3.01/W that occurred during 2012 alone.[42] This price drop definitely

35. PIKE REPORT, *supra* note 1, at 1.

36. 2010 SOLAR TECHNOLOGIES MARKET REPORT, *supra* note 9, at 5.

37. SOLAR ENERGY INDUS. ASS'N,, U.S. SOLAR MARKET INSIGHT REPORT 2011 2 (2012) [hereinafter SOLAR MARKET INSIGHT 2011], http://www.seia.org/sites/default/files/resources/2011%20Q4%20SMI%20ES.pdf.

38. SOLAR MARKET INSIGHT 2012, *supra* note 7, at 3.

39. *Id.*

40. SOLAR ENERGY INDUS. ASS'N, U.S. SOLAR MARKET INSIGHT Q3 2013, 4 (2013) [hereinafter SOLAR MARKET INSIGHT 2013], http://www.seia.org/sites/default/files/oxD2AN8350 2013q3smies.pdf?key=59925375. By converting GW to MW (1 GW = 1,000 MW), 10,000 MW equals 10 GW.

41. EUR. PHOTOVOLTAIC IND. ASS'N, CONNECTING THE SUN: SOLAR PHOTOVOLTAICS ON THE ROAD TO LARGE-SCALE GRID INTEGRATION 18, fig.3 (2012) [hereinafter CONNECTING THE SUN], http://www.epia.org/fileadmin/user_upload/Publications/Connecting_the_Sun_Full_Report_converted.pdf.

42. *See* SOLAR ENERGY INDUS. ASS'N, U.S. SOLAR INDUSTRY YEAR IN REVIEW 2009 6 (2010), http://www.seia.org/sites/default/files/us-solar-industry-year-in-review-2009-120627093040-phpapp01.pdf; SOLAR MARKET INSIGHT 2012, *supra* note 7 at 10. The figures presented

played a role in the gains from 2010 to 2012, as shown by its correlation with impressive market growth in solar PV installations during those years. The global financial crisis of 2008 helped cause this price drop, but ultimately allowed the solar market to keep growing despite financial turmoil.[43] In addition, increased competition among manufacturers generated lower system prices, thus exerting "downward pressure" on the market and keeping system prices on the decline.[44] In fact, an European Photovoltaic Industry Association ("EPIA") report showed that "competitiveness of PV is approaching [quickly] in many European markets."[45] Since the report, production overcapacity has driven prices down faster than expected and thus brought some European countries close to price competitiveness without the help of financial mechanisms.[46]

The United States, despite significant price drops, does not yet enjoy such low prices as those in Europe. Thus, when financial mechanisms are allowed to expire, such as the case of American Recovery and Reinvestment Act of 2009 ("ARRA")[47] expiring at end of 2011 before being renewed through December 31, 2013,[48] or are in danger of being allowed to expire, such as the federal tax credit that has yet to be extended beyond 2016,[49] there is reasonable concern over funding of solar PV projects. In addition, natural gas, although not a renewable energy source, has been garnering serious consideration as the future main provider of electric power in the United States. Natural gas is described as the cleanest fossil fuel and benefits from being cheaper than solar PV[50] all while boasting prices that are still falling with the glut of shale gas on the market.[51] However, the fact remains that natural gas is still a hydrocarbon that produces significant carbon emissions, and production by hydro fracturing has been linked to groundwater contamination.[52]

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above were calculated by combining information from these two separate market reports.

43. SOLAR ENERGY IND. ASS'N, U.S. SOLAR MARKET INSIGHT 2ND QUARTER 2010 4 (2010), http://www.seia.org/research-resources/solar-market-insight-report-2012-q2.

44. *Id.*

45. CONNECTING THE SUN, *supra* note 41, at 10.

46. *Id.* at 17.

47. American Recovery and Reinvestment Act of 2009, 42 U.S.C. § 16516 (2012).

48. *See Renewable Electricity Production Tax Credit (PTC)*, DSIRE SOLAR, http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=US13F (last visited Mar. 1, 2014).

49. Emergency Economic Stabilization Act of 2008, 26 U.S.C. § 48(c) (2012).

50. *See* Brian Dumaine, *Will gas crowd out wind and solar?*, CNNMONEY (Apr. 17, 2012, 5:00 AM), http://tech.fortune.cnn.com/2012/04/17/yergin-gas-solar-wind/.

51. Russell Gold et al., *Glut Hits Natural-Gas Prices*, WALL ST. J., Jan. 12, 2012, at A.1.

52. *See* Rona Kobell, *EPA report links groundwater contamination to natural gas drilling*, BAY J. (Jan. 6, 2012), http://www.bayjournal.com/article/epa_report_links_groundwater_contamination_to_natural_gas_drilling.

Despite these concerns, recent forecasts predict 4.3 GW of new PV installations during 2013 across all market segments, representing a 29% growth over 2012, and a "28% compound annual growth rate ("CAGR") for the 2013-2016 period, down from 82% for the 2009-2012 period but more sustainable in the longer term."[53] The European Photovoltaic Industry Association ("EPIA"), in its 2012 Global Market Outlook report, said it best when it stated: "With proper policy support, balanced market development, and continued industry innovation, the world's most promising source of electricity can continue its remarkable growth rate over the short-, medium- and long-term, and even beyond."[54]

IV. ANALYSIS OF SUCCESSFUL EUROPEAN SOLAR FRAMEWORKS

In 2001, European countries began promoting renewable energy in order to combat pollution and meet targets set by the Kyoto Protocol.[55] Since the Kyoto Protocol, European countries have committed to "reducing greenhouse gas emissions to 80-95% below 1990 levels by 2050" in order to avoid irreversible climate change effects.[56] Over the last decade, EU countries have put into effect several different forms of financing: capital subsidies, tax credits, feed-in tariffs, net metering, and green tags, among others.[57] Germany's framework is the model example within Europe because it is superior to many other European countries in two key areas: 1) it provides a sustainable support mechanism (Germany's feed-in tariff); and 2) it streamlines administrative procedures and permitting processes.

Currently, feed-in tariffs prevail within the EU; Germany, Italy, Spain, and France, top producers of solar PV electricity within the EU, all utilize feed-in tariffs as a support mechanism for solar PV systems.[58] Germany is the world leader in the solar energy industry,[59] facilitated by

53. SOLAR MARKET INSIGHT 2012, *supra* note 7, at 2, 13.

54. EUR. PHOTOVOLTAIC IND. ASS'N., GLOBAL MARKET OUTLOOK FOR PHOTOVOLTAICS UNTIL 2016 64 (2012), http://www.epia.org/fileadmin/user_upload/Publications/Global-Market-Outlook-2016.pdf.

55. Luigi Dusonchet & Enrico Telaretti, *Economic analysis of different supporting policies for the production of electrical energy by solar photovoltaics in eastern European Union countries*, 38 ENERGY POL'Y 4011, 4011 (2010).

56. CONNECTING THE SUN, *supra* note 41, at 13.

57. A. Campoccia et al., *Comparative analysis of different supporting measures for the production of electrical energy by solar PV and wind systems: four representative European cases*, 83 SOLAR ENERGY 287, 288 T. 2 (2009).

58. *Id.* at 288–91.

59. *Solar Markets*, FOUR PEAKS TECHS., INC., http://solarcellcentral.com/markets_page.html (last visited Feb. 3, 2014).

"easy administrative and permitting procedures . . . [and] adequate financial support."[60] Germany's streamlined permitting processes have "driv[en] down the cost and wait-time associated with residential solar [technology systems]."[61] In fact, Germany has eliminated permitting for residential solar altogether, resulting in individuals being able to contact solar companies and have a system installed on the roof within a week.[62] The price difference between Germany's residential installations when compared to U.S. solar costs for residential systems is also staggering.[63] However, the "single most-important reason" for the success of solar energy in Germany is its feed-in tariff.[64]

Germany initially introduced the feed-in tariff program in 1990 to promote renewable energy and updated the program in 2004.[65] The feed-in tariff has survived three changes in government due to its "success in terms of installed capacity, manufacturing and job creation."[66] The program provides compensation for electricity produced by solar PV and includes tariffs for systems of all sizes.[67] George Washington University's Legal Framework for Solar Energy report summarizes Germany's feed-in tariff:

> The feed-in system allows two-way electricity traffic so that small-scale producers are able to feed electricity to the grid when they have a surplus, and receive electricity from the grid when they are in deficit, although there are limitations on this for large solar energy producers where intermittency of supply might destabilize the grid. Grid operators must allow, as a priority, connection to the grid of new installations generating electricity from renewable sources . . . . Grid operators are obliged to receive any renewable electricity offered, in preference to non-renewable energy. Unless it is economically unreasonable, grid operators are also obliged to "optimize, boost and

60. Campoccia et al., *supra* note 57, at 290.

61. Tom Jackson, *Follow Germany's Lead: Streamlined Permitting*, RENEWABLEENERGYWORLD.COM (Aug. 9, 2012), http://www.renewableenergyworld.com/rea/blog/post/2012/08/follow-germanys-lead-streamlined-permitting.

62. *Id.*; *see also* SUNRUN, THE IMPACT OF LOCAL PERMITTING ON THE COST OF SOLAR POWER 3 (2011), http://www4.eere.energy.gov/solar/sunshot/resource_center/sites/default/files/59b89d0ed01.pdf. France and Japan have also eliminated permitting for basic residential installations. SUNRUN, *supra*.

63. Barry Cinnamon, *Cut The Price of Solar in Half by Cutting Red Tape*, FORBES (July 5, 2012), http://www.forbes.com/sites/toddwoody/2012/07/05/cut-the-price-of-solar-in-half-by-cutting-red-tape/. This article provides a comparison of Germany's solar costs to U.S. costs for residential solar. *Id.* The chart suggests that Germany's solar costs for a residential system are about $8,000 while the price of a residential system in the U.S. is about $20,000. *Id.*

64. Judith Lipp, *Lessons for effective renewable electricity policy from Denmark, Germany and the United Kingdom*, 35 ENERGY POL'Y 5481, 5488 (2007).

65. PADDOCK & GRINLINTON, *supra* note 32, at 17.

66. Lipp, *supra* note 64.

67. PADDOCK & GRINLINTON, *supra* note 32, at 17.

> expand" their grid systems if it is necessary to guarantee the purchase, transmission and distribution of the electricity generated by renewable energy technology. Grid operators then sell the electricity to transmission system operators for the same price. Transmission system operators sell on to utilities that, in turn, deliver to the consumers.[68]

The success of the feed-in tariff policy has led to it being actively promoted around the world,[69] including the United States where feed-in tariffs have started cropping up in state and local laws.[70] Despite the success of Germany's feed-in tariff, the country has decided to reduce its feed-in tariffs until the market price equals "grid parity."[71] In other words, the solar market expanded too quickly and out-paced the desired annual growth.[72] This led to higher costs on households as they were forced to bear the responsibility of subsidizing the unprecedented solar market growth.[73] Italy, another big EU market for solar PV, has also decided to cut tariffs for similar reasons.[74] Germany, however, is still experiencing significant market growth despite lower feed-in tariff incentives because the price of solar panels dropped in tandem with the incentives.[75]

The two strongest areas where the United States and countries abroad can gain experience from the more mature European solar markets include Germany's "easy administrative and permitting processes"[76] and its successful feed-in tariff program. Separately, these might help to overcome the common barriers of complex solar installation permitting procedures and lack of financing mechanisms for solar projects in the United States.

68. *Id.* at 18–19.

69. Lipp, *supra* note 64, at 5489.

70. *See, e.g.*, *Florida: Incentives/Policies for Renewables & Efficiency*, DSIRE SOLAR, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=FL77F [hereinafter *Gainesville Feed-In Tariff*] (stating that Gainesville "offers a solar feed-in tariff . . . [m]odeled on Germany's FIT").

71. *Solar Markets*, *supra* note 59.

72. *German Solar Installations Continue to Increase: Growth Despite Tariff Cuts*, SEEKING ALPHA (Nov. 2, 2012, 2:09 PM), http://seekingalpha.com/article/973791-german-solar-installations-continue-to-increase-growth-despite-tariff-cuts.

73. *See id.*

74. *Italy to Levy Carbon Tax, Cut Solar FiT in Wake of Record-Setting Growth*, CLEAN TECHNICA (Apr. 18, 2012), http://cleantechnica.com/2012/04/18/italy-to-levy-carbon-tax-cut-solar-fit-in-wake-of-record-setting-growth/.

75. Amanda H. Miller, *German solar market grows despite lower incentives*, CLEANENERGYAUTHORITY.COM (Sep. 11, 2012), http://www.cleanenergyauthority.com/solar-energy-news/german-solar-market-grows-despite-lower-incentives-091112.

76. Campoccia et al., *supra* note 57, at 290.

V. THE U.S. SOLAR FRAMEWORK

A. FEDERAL POLICIES AND INCENTIVES

Certain federal policies enacted between 2005 and 2009 have played an important role in the expansion of the solar PV market. The Energy Policy Act of 2005 ("EPAct")[77] increased the federal tax credit from 10% to 30% for nonresidential installations and extended the tax credit to residential installations.[78] Before the EPAct, no federal tax credit had been available for residential installations. The Emergency Economic Stabilization Act of 2008 ("EESA")[79] expanded the federal tax credit for the commercial and residential market segments,[80] extended the federal tax credit through 2016,[81] and eliminated the tax credit cap for residential solar PV systems.[82] The previously mentioned ARRA allows for cash grants in lieu of the federal tax credit for qualifying solar projects,[83] largely in response to the lack of available financing resulting from the 2008 financial crisis.[84] The ARRA also creates a separate tax credit for investments into renewable energy sources, which awards solar projects and manufacturers of solar technology billions of dollars in tax credits.[85]

B. LIMITATIONS OF FEDERAL SOLAR POLICIES

These federal policies played a large role in the solar market growth that occurred from 2009 through 2012; however, going forward, reliance upon federal policies and incentives as the impetus for growth of solar PV in the United States is unwise. Federal policies are susceptible to expiration or reduction, as evidenced by the previously mentioned ARRA grant program that was allowed to expire at the conclusion of 2011 and then renewed but only through December 31, 2013.[86] Also, the possibility

77. Energy Policy Act of 2005, Pub. L. No. 109–58, 119 Stat. 594 (2005).

78. *Id.* § 1335, 119 Stat. at 1033; *see* 26 U.S.C. § 25D (2012).

79. Emergency Economic Stabilization Act of 2008, Pub. L. No. 110–343, 122 Stat. 3765 (2008).

80. 26 U.S.C. §§ 25D; 48 (2012).

81. *Id.*

82. § 25D; *see* section 106 of the Emergency Economic Stabilization Act of 2008, 122 Stat. at 3814–17.

83. 26 U.S.C. § 48.

84. 2010 SOLAR TECHNOLOGIES MARKET REPORT, *supra* note 9, at 82.

85. 42 U.S.C. § 16516 (2012).

86. *See Renewable Electricity Production Tax Credit (PTC)*, *supra* note 48. *But see* Patricia E. Salkin, *The Key to Unlocking the Power of Small Scale Renewable Energy: Local Land Use Regulation*, 27 J. LAND USE ENVTL. L. 339, 341 (2012). The Salkin article mentions a state

of the federal tax credit not being extended beyond 2016 is looming on the horizon. While this is not a foregone conclusion, if the tax credit expires after 2016, fewer solar projects will be funded using federal incentives. State and local governments ought to be prudent and enact supportive policies and incentives in case this happens. Indeed, regardless of federal policies, these governments have the power to provide tax credits, grants, and favorable loans above and beyond those offered through federal programs.

Federal policy is also subject to the disposition of whatever administration is in office. The current state of the United States economy may cause the current, and perhaps future administrations to scale back federal policies and incentives that enable the growth of solar energy technologies. This type of reaction to economic concerns already has occurred in countries such as Germany and Spain, where various incentives have been cut or scaled-back to accommodate the struggling economy.[87] The financial crisis has also caused a number of projects to be delayed in Germany.[88] Many state and local governments are experiencing economic struggles of their own and may thus be reluctant to support solar development, but local governments can actually "boost their economies by partnering with solar market participants and supporting education and training programs."[89]

Finally, the federal government lacks jurisdiction over interconnection standards, net metering, and solar permitting. This means federal incentives and polices are largely unable to eliminate various common barriers such as complex solar installation permitting procedures, inadequate interconnection standards, and net metering policies. Each of these mechanisms are the responsibility of state and local governments, which also have the ability to enact solar access laws that provide citizens and businesses easier access to sunlight.

C. IMPORTANT ISSUES AT THE STATE AND LOCAL LEVEL

At the state and local level, two key strategies to enabling growth of the solar PV are eliminating barriers and ensuring that solar-related policy

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incentive program in New York that is now closed, thereby showing that states can also be unreliable in keeping these programs afloat. Salkin, *supra*, at 342.

87. *See* PIKE REPORT, *supra* note 1, at 2–3.

88. Michael T. Hatch, *The Role of Renewable Energy in German Climate Change Policy*, RENEWABLE ENERGY L. & POL'Y R. 141, 148 (2010).

89. SOLAR GUIDE FOR LOCAL GOVERNMENTS, *supra* note 8, at 97.

and regulatory frameworks are properly updated and streamlined.[90] In some regulatory areas, state and local governments have overlapping jurisdictional authority; other regulatory areas are exclusively the jurisdiction of local governments.[91] Initial financing and a lack of incentive programs is a major barrier, but as solar technology costs continue to decline, investors are taking notice, investing, and then planning to make a profit off the investment.[92] Recently adopted feed-in tariffs in states and municipalities have tried to help with the initial financing hurdle.[93]

In the residential and small-scale on-site commercial sectors, the lack of solar access and solar rights laws can be barriers because restrictive covenants and land use laws have the potential to prevent residents and businesses from installing solar technologies. Implementing "[s]olar access and solar rights laws encourage the adoption of solar energy by increasing the likelihood that properties will receive sunlight suitable for solar energy production, protecting the rights of property owners to install solar systems, and reducing the risk that systems will be shaded and compromised once installed."[94] Other important mechanisms for eliminating barriers to growth of solar technologies include: renewable portfolio standards ("RPSs"), interconnection standards, net metering rules, and simplified solar system permit requirements. The goal of this section is to identify barriers within policy, regulatory, and incentive frameworks that are in place and provide recommendations for making improvements within these frameworks that will eliminate market barriers and allow for growth of solar PV at the state and local level.

i. State and Local Level Incentive Programs

The possibility of losing federal incentives makes the institution of state and local level incentives very important because a lack of subsidies can leave solar technologies unable to compete with other forms of

90. *See id.* at 1–3.

91. *See id.* at 3 (noting that states typically have jurisdiction over RPSs, net metering and interconnection, while local governments have exclusive jurisdiction over streamlining permitting processes).

92. *See* Mindy Lubber, *Investors are Making Money on Renewable Energy*, FORBES (Mar. 20, 2012, 9:46 AM), http://www.forbes.com/sites/mindylubber/2012/03/20/investors-are-making-money-on-renewable-energy/ (noting that companies such as Google, GE, and Prudential are making investments into large-scale solar energy projects that are producing returns with annual yields between 6% and 8%).

93. *See infra* Part V.C.i.

94. SOLAR GUIDE FOR LOCAL GOVERNMENTS, *supra* note 8, at 61.

energy.[95] Some states have already taken the initiative of implementing solar incentive programs to complement federal programs. Many of these initiatives take the form of tax credits, subsidies, or rebate programs.[96] The Illinois Renewable Energy Resource Solar and Wind Energy Rebate Program[97] offers rebates between $10,000 and $30,000 to homeowners, business, public agencies, and non-profit entities for the construction and use of solar and wind energy sources.[98] The State of Washington provides tax exemptions for machinery and equipment utilized in solar energy systems that generate less than ten kilowatts per year, as well as for labor costs related to installation.[99] In 2008, California enacted a feed-in tariff program that allows generators to enter into contracts with their utilities to sell electricity produced by small renewable energy systems.[100] The feed-in tariff also requires "[a]ll investor-owned utilities and publicly-owned utilities with 75,000 or more customers [to] make a standard feed-in tariff available to their customers."[101]

Local governments have also instituted various solar incentive programs. The cities of Gainesville, Florida, and Palo Alto, California, offer feed-in tariffs for solar PV systems, for example.[102] These programs, just like the state program in California, allow generators of renewable energy, whether they are individuals or businesses, to sell the electricity they produce back to utility companies[103] and were modeled off Germany's successful feed-in tariff program.[104] The program in Gainesville was not without flaws, however. When the tariff was launched in 2009, businesses

95. PADDOCK & GRINLINTON., *supra* note 32, at 8; *see also* TAYLOR-DEJONGH, FINANCING UTILITY-SCALE SOLAR PROJECTS IN THE UNITED STATES 3 (2010), http://www.taylor-dejongh.com/wp-content/uploads/2010/07/Financing-Utility-Scale-Solar-in-the-US.pdf (noting that "when utility-scale solar PV projects receive no subsidies, they are unable to compete with conventional combined-cycle gas turbine (CCGT) . . . at least under the current legislative environment in the United States.").

96. *See* Salkin, *supra* note 86, at 341–42.

97. *Illinois: Incentives/Policies for Renewables & Efficiency*, DSIRE (Sept. 20, 2013), http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=IL05F.

98. *Id.*

99. WASH. REV. CODE § 82.08.963 (2011).

100. CAL. PUB. UTIL. CODE § 399.20 (West 2013); *California: Incentives/Policies for Renwables & Efficiency*, DSIRE (Oct. 10, 2012), http://www.dsireusa.org/incentives/incentive.cfm ?Incentive_Code=CA167F.

101. *California: Incentives/Policies for Renewables & Efficiency*, *supra* note 100.

102. *California:* Incentives/Policies for Renewables & Efficiency, DSIRE (Dec. 18, 2012), http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA248F&re=1&ee=1 [hereinafter *City of Palo Alto Utilities*]; *Gainesville Feed-In Tariff, supra* note 70.

103. *See City of Palo Alto Utilities*, *supra* note 102; *Gainesville Feed-In Tariff, supra* note 70.

104. *See, e.g.*, *Gainesville Feed-In Tariff, supra* note 70 (stating that Gainesville "offers a solar feed-in tariff (FIT) . . . [m]odeled on Germany's FIT").

filled the project queue very quickly, shutting out residents who wanted to get in on the action.[105] The Gainesville program even suffered a similar issue to the one that ended up causing Germany to cut its feed-in tariff, but in Gainesville too many people flooded the queue instead of the solar market being flooded. The fact that the Gainesville feed-in tariff program reopened in 2013[106] likely indicates, however, that this issue was addressed or possibly even resolved. This reinforces the possibility that state and local governments are learning—to varying degrees—from the experience of more mature solar markets in Europe.

Feed-in tariffs are thus excellent choices for increasing demand for solar PV projects, but they must be moderated such that individuals or companies trying to take advantage of the tariffs do not flood local markets. If instituted properly, feed-in tariffs would help eliminate a common market barrier by providing an additional financing mechanism to parties interested in solar PV systems. Likewise, other incentive programs such as tax rebates and exemptions can be utilized at the state level to provide additional financing and increase demand for solar technologies.

ii. Land Use and Solar Access Laws

In the case of residential and smaller-scale commercial solar facilities, solar access remains a big issue in the United States. Property owners require access to sunlight and the right to install solar energy systems in order to take advantage of solar technologies. However, The United States has declined to recognize a common law right to sunlight.[107] The general law in effect in the United States is that a "landowner owns at least as much of the [air] space above the ground as he can . . . use in connection with the land,"[108] thus giving landowners the right to grant an easement within that space. These opinions reflected the sentiment of not wanting to hinder the development of land in the United States, which at the time was a rapidly developing country with an interest in promoting continued growth.[109]

105. Chad Smith, *Gainesville Plans to Make Solar Feed-in More Available*, GAINESVILLE SUN (July 2, 2010, 06:01 AM), http://www.gainesville.com/article/20100702/ARTICLES/100709937.

106. *Gainesville Feed-In Tariff*, *supra* note 70.

107. *E.g.*, Fontainebleau Hotel Corp. v. Forty-Five Twenty-Five, Inc., 114 So. 2d 357, 359 (Fla. Dist. Ct. App. 1959) (stating that there is no right at common law to sunlight absent "an easement or uninterrupted use and enjoyment for a period of 20 years").

108. Newark v. E. Airlines, Inc., 159 F. Supp. 750, 759 (D.N.J. 1958) (quoting United States v. Causby, 328 U.S. 256, 264 (1946)).

109. *See* Debbie Leonard & Denise Pasquale, *Legal Tools to Protect Access to Solar and Wind Resources*, 17 NEV. LAW. 14, 15 (2009).

In light of the common law limitations, other methods have emerged for protecting solar access. As of February 2013, forty states and the United States Virgin Islands have solar access laws that include a solar easement or solar rights provision, or both.[110] Solar easements are the most common type of solar access law at the state level with more than half of U.S. states authorizing their creation.[111] A solar easement allows owners of solar energy systems to secure access to sunlight from neighboring parties whose property could potentially restrict that access.[112] Solar rights laws protect residents and businesses by limiting or prohibiting restrictions that neighborhood covenants and/or local ordinances have on solar energy system installation.[113] Several states have enacted laws that prohibit restrictive covenants banning solar equipment,[114] while others also prohibit local governments from using zoning authority to restrict solar equipment.[115] Such bans on restrictive covenants have been questioned for possibly coming under threat of a takings claim requiring compensation, but scholars suggest these challenges would likely not be upheld because the public benefit of solar energy may outweigh the harm suffered by an individual owner.[116]

Under state zoning enabling legislation, many "[l]ocal governments . . . have the authority to adopt policies that support solar access and solar rights."[117] This is an important issue for local governments to address, even more so than state governments, because despite the growing support for renewable energy development at the state and local levels, many consumers still face common law, local ordinances, or homeowner association rules that prohibit, restrict, or drastically increase the cost of installing a solar energy system.[118] Property owners can run into restrictive covenants that include constraints on where solar panels can be located or outright prohibitions on installing solar technologies.[119] In response, local

110. *Solar Access Laws*, DSIRE SOLAR, http://www.dsireusa.org/solar/solarpolicyguide/?id=19 (last visited Mar. 2, 2014).

111. *Id.*

112. *Id.*

113. *Id.*

114. *See*, *e.g.*, ARIZ. REV. STAT. ANN. § 33-439(A) (2013); COLO. REV. STAT. § 38-30-168(1)–(2) (2013); FLA. STAT. § 163.04(1)–(2) (2013); N.M. STAT. ANN. § 3-18-32(B) (2013).

115. *See*, *e.g.*, CAL. GOV'T. CODE § 65850.5(a) (West 2013); IND. CODE § 36-7-2-8(b) (2013); N.M. STAT. ANN. § 3-18-32(A) (2013).

116. *See* Sara C. Bronin, *Solar Rights*, 89 B.U. L. REV. 1217, 1234 n. 66 (citing Joel S. Goldman, *Constitutionality of Section 714 of the California Solar Rights Act*, 9 ECOLOGY L.Q. 379, 391–404 (1981)).

117. SOLAR GUIDE FOR LOCAL GOVERNMENTS, *supra* note 8, at 60.

118. *Id.*

119. *Id.* at 61; THOMAS STARRS ET AL., BRING SOLAR ENERGY TO THE PLANNED

governments can enact proactive solar easements such as a solar access permit structure, which automatically imposes a solar easement when property owners receive a permit to install solar technologies.[120] But permitting structures would likely result in more substantial takings challenges if property owners can prove the permit reduced their property value and the government did not compensate them for this reduction.[121]

Despite this concern, states like Wisconsin have adopted a permitting system for solar access, which will grant such permits if the system will not impermissibly interfere with the use of land and the benefits outweigh the burdens.[122] Additionally, a Colorado court found the holder of a solar access permit could enforce his permit against other property owners.[123] By balancing the rights of property owners against facilitating access to solar energy systems, state and local governments are walking a very fine line. At the very least, through an additional local measure, even though this would only affect new constructions, local governments can specify zoning setbacks so homes and buildings are constructed in such a way that it would be unlikely to shade neighboring roofs.[124]

One example of a local government enacting its own solar access law, which includes a combination of several solar access tools, is the city of Ashland, Oregon.[125] The law states that the purpose "is to provide protection of a reasonable amount of sunlight from shade from structures and vegetation whenever feasible to all parcels in the City"[126] and includes provisions dealing with issues such as solar setback,[127] performance standards,[128] vegetation removal,[129] and the permitting process.[130] Solar

COMMUNITY: A HANDBOOK ON ROOFTOP SOLAR SYSTEMS AND PRIVATE LAND USE RESTRICTIONS 13 (n.d.), http://abcsolar.com/pdf/CC+Rs_and_solar_rights.pdf.

120. SOLAR GUIDE FOR LOCAL GOVERNMENTS, *supra* note 8, at 60–61.

121. Bronin, *supra* note 116, at 1241–42; *see Penn Cent. Transp. Co. v. City of New York*, 438 U.S. 104, 124 (1978). *Penn Central* is the case most likely to be used to determine if there was a taking. It established a three-factor test to weigh takings cases that has been the standing for determining if a taking has occurred outside of per se takings and takings involving exactions of real property. *Penn Cent. Transp. Co*., 438 U.S. at 124.

122. WIS. STAT. § 66.0403(5)(a)(1), (3) (2012).

123. Arndt v. City of Boulder, 895 P.2d 1092, 1097 (Colo. App. 1994).

124. SOLAR GUIDE FOR LOCAL GOVERNMENTS, *supra* note 8, at 61.

125. ASHLAND, OR., MUN. CODE § 18.70 (2013); *see also* COLLEEN MCCANN KETTLES, SOLAR AM. BD. FOR CODES & STANDARDS, A COMPREHENSIVE REVIEW OF SOLAR ACCESS LAW IN THE UNITED STATES 22–29 (2008), http://www.solarabcs.org/about/publications/reports/solar-access/pdfs/Solaraccess-full.pdf.

126. ASHLAND, ORE., MUN. CODE § 18.70.010.

127. ASHLAND, ORE., MUN. CODE § 18.70.040.

128. ASHLAND, ORE., MUN. CODE § 18.70.050.

129. ASHLAND, ORE., MUN. CODE § 18.70.070.

130. ASHLAND, ORE., MUN. CODE § 18.70.100.

access laws at the local level, such as the one present in Ashland, can serve as model examples for local governments that have existing ordinances or rules that restrict solar access.

A large majority of states, including Massachusetts and New Mexico, have enacted their own solar access or solar rights laws. Massachusetts' solar access law, for instance, provides for a solar easement and a solar access permit, among other things, and voids restrictions against the use of solar energy.[131] Although it is impressive that forty states have enacted either solar access or solar rights laws,[132] these are basic solar laws that every state needs to make available. Not only should solar access or solar rights laws be enacted in every state but they should also be made more comprehensive. In a recent article, Jamie France proposes a comprehensive solar access law for the state of Texas.[133] The proposal included: 1) establishing a broad right to access sunlight on one's property; 2) creating an expansive definition of solar device; 3) eliminating pre-existing and future restrictions on deeds; 4) restricting neighbors from obstructing existing solar energy systems; 5) curbing homeowners' association power; and 6) requiring local and city governments to protect solar rights through zoning.[134] Moreover, the article convincingly argues that such a comprehensive solar access law is superior to solar easements, which are the most popular type of solar access law.[135]

One worry is that such a comprehensive solar access law would be subject to takings claims, but concerning the proposal to restrict neighbors from obstructing existing systems, litigants have actually had some success asserting that interference with an already existing use of sunlight amounts to a private nuisance.[136] However, between establishing a broad right to access sunlight and eliminating pre-existing deeds, this certainly seems like a situation where a solar access law would be subject to various challenges,

131. MASS. GEN. LAWS ch. 184, § 23C (2013); MASS. GEN. LAWS ch. 187, § 1A (2013); *see also Massachusetts: Incentives/Policies for Renewables and Efficiency*, DSIRE (Dec. 17, 2012), http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=MA02R&re=0&ee=0.

132. *Solar Access Laws*, *supra* note 110.

133. *See generally* Jamie E. France, *A Proposed Solar Access Law for the State of Texas*, 89 TEX. L. REV. 187 (2010); *Texas: Incentives/Policies for Renewables & Efficiency*; DSIRE (Apr. 22, 2013), http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=TX33R. Since the publication of France's article, Texas has passed a solar access law at the state level. *Texas Solar Rights*, *supra*.

134. France, *supra* note 133, at 197–200.

135. *Id.* at 201–03.

136. *See, e.g.*, Tennessee v. 889 Assocs., Ltd., 500 A.2d 366, 370 (N.H. 1985); Prah v. Maretti, 321 N.W.2d 182, 189–91 (Wis. 1982).

including a substantial takings claim.[137] A more moderate comprehensive solar access law that draws from those present in states such as Massachusetts and New Mexico and cities such as Ashland, Oregon would incentivize residents and businesses to install solar technologies and allow them to be relatively certain that they will be safe from challenges by neighbors, homeowners' associations, state and local governments, or the courts. Doing so would also streamline what has become an important issue for both state and local governments and erase the need to use multiple mechanisms to address solar access.

iii. Renewable Portfolio Standards

Renewable portfolio standards, which generally require utility companies to produce a certain amount of their electricity from renewable energy sources,[138] are often enacted in conjunction with incentive programs such as solar renewable energy certificates (SRECs)[139] and are another important mechanism for increasing demand for solar technologies.[140] Typically, RPSs are statewide policies but a number of local jurisdictions have enacted their own RPSs in states without a comprehensive RPS.[141] As of March 2013, twenty-nine states, Washington D.C., and two territories have RPSs;[142] sixteen of those states and Washington D.C. have RPSs with solar and/or distributed generation provisions.[143] California's RPS, for example, is one of the strongest in the United States and targets electrical utilities having 33% of their retail sales derived from eligible renewable energy resources by 2020.[144] In the solar energy context, New Mexico,

137. *See, e.g.*, Madison v. Graham, 126 F. Supp. 2d 1320, 1323–1324 (D. Mont. 2001) (explaining the tests used to determine a substantial takings claim).

138. *Solar Carve-Outs in Renewables Portfolio Standards*, *supra* note 14.

139. *See* LORI BIRD ET AL., NAT'L RENEWABLE ENERGY LAB., SOLAR RENEWABLE ENERGY CERTIFICATE (SREC) MARKETS: STATUS AND TRENDS 1 (2011), http://apps3.eere.energy.gov/greenpower/pdfs/52868.pdf; *SREC FAQS*, SOLSYSTEMS, http://www.solsystemscompany.com/what-are-srecs (last visited Mar. 2, 2014). Solar renewable energy certificates (SRECs) are tradable credits that are issued when a solar electric system generates a certain amount of electricity. *SREC FAQS*, *supra*. These credits can then be sold or traded to electrical utilities or energy suppliers who need to meet an RPS. *Id.*

140. SOLAR GUIDE FOR LOCAL GOVERNMENTS, *supra* note 8, at 23–26.

141. *Id.* at 26.

142. *Renewable Portfolio Standard Policies*, DSIRE (Mar. 2013), http://www.dsireusa.org/documents/summarymaps/RPS_map.pdf.

143. *Renewable Portfolio Standard Policies with Solar/Distributed Generation Provisions*, DSIRE SOLAR (Mar. 2013), http://www.dsireusa.org/documents/summarymaps/Solar_DG_RPS_map.pdf [hereinafter RPS Solar Provisions].

144. MICHAEL MENDELSOHN ET AL., NAT'L RENEWABLE ENERGY LAB., UTILITY-SCALE CONCENTRATING SOLAR POWER AND PHOTOVOLTAICS PROJECTS: A TECHNOLOGY AND MARKET OVERVIEW 1 (2012), http://www.nrel.gov/docs/fy12osti/51137.pdf (noting that

Arizona, Maryland, Colorado, Delaware, and the District of Columbia each target "2% or greater (of the state's electricity . . .) to be generated by solar or distributed energy [sources]".[145] Two other states (Maryland and New Mexico) have renewable portfolio goals with solar and/or distributed generation provisions,[146] which are similar to RPSs but are not legally binding and thus not as effective in driving solar energy development.[147] RPS policies can be effective for the growth of both solar PV because development is skewed toward large-scale utility projects when attempting to satisfy RPS requirements, but some states have designed RPSs to provide additional support to smaller on-site installations.[148] Ultimately then, in order to be most effective, several elements of an RPS should be present: 1) states must commit to an RPS instead of renewable portfolio goals, otherwise the policies will be less effective because they are non-binding; 2) an RPS should be enacted in conjunction with an incentive program so solar energy is more affordable for utility companies; 3) RPSs should establish explicit solar set-asides, such as those present in Colorado and Arizona,[149] among others; and 4) RPSs should encourage systems of all sizes.[150] If implemented in this way, RPSs can effectively combat barriers to continued solar technology development, such as limited financing, through incentive programs connected to RPSs, and lack of customer awareness, by requiring utility companies to have solar set-asides and thus raise their awareness and understanding of the technologies.

iv. Interconnection Standards

Inadequate interconnection standards represent another barrier that can be addressed at the state and local level. "Interconnection standards specify the technical, legal and procedural requirements that customers and

"California's RPS, the most robust in the United States, . . . require[s] 33% of renewable generation from its investor-owned utilities"); *see also California: Incentives/Policies for Renewables & Efficiency*, DSIRE (Oct. 2013), http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CA25R& re=1&ee=0.

145. *Solar Carve-Outs in Renewables Portfolio Standards*, *supra* note 14.

146. *Id.*

147. *See* SOLAR GUIDE FOR LOCAL GOVERNMENTS, *supra* note 8, at 25.

148. *Id.*

149. *Arizona: Incentives/Policies for Renewables & Efficiency,* DSIRE (July 17, 2013), http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=AZ03R&re=1&ee=1; *Colorado: Incentives/Policies for Renewables & Efficiency*, DSIRE (June 25, 2013), http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=CO24R&re=0&ee=0.

150. *See Solar Carve-Outs in Renewables Portfolio Standards*, *supra* note 14 (providing a list of best practices for promoting solar energy through RPS); *see also* SOLAR GUIDE FOR LOCAL GOVERNMENTS, *supra* note 8, at 26.

utilities must abide by when a customer [wishes] to connect a [solar energy] system to the grid."[151] It has become more important for states to enact comprehensive interconnection standards or modify existing policies as grid-connected solar PV systems continue to increase in market share over off-grid solar PV systems.[152] Forty-three states, Washington D.C., and Puerto Rico have adopted interconnection standards as of February 2013.[153] Of the many states that have enacted interconnection standards, Virginia and Maine offer two of the most comprehensive and efficient interconnection standards in the United States.[154] One determinate factor setting these states apart is specification of different levels of review for solar technology systems of varying sizes and complexity.[155] Multiple levels of review are important for allowing an abbreviated interconnection process for smaller solar technology system owners and larger solar energy systems that do not export electricity to grid.[156] By streamlining interconnection standards in this way, states can take a significant step towards "defining an appropriate process for grid connection that reduces unnecessary transaction costs while maintaining business and safety standards."[157] Additionally, Maine's interconnection standards are based on the Interstate Renewable Energy Council's ("IREC") model interconnection standards,[158] which provide states with a list of best practices for the implementation of these standards.[159] IREC models exist for both interconnection standards and net metering rules,[160] thus offering an additional resource for states to consult when updating or enacting interconnection standards or net metering rules.

151. *Interconnection Standards*, DSIRE, http://www.dsireusa.org/solar/solarpolicyguide/?id=18 (last visited Feb. 18, 2014).

152. 2010 SOLAR TECHNOLOGIES MARKET REPORT, *supra* note 9, at 6 (noting that grid-connected solar PV increased in market share from 61% in 2007 to 82% in 2010).

153. *Interconnection Standards*, *supra* note 151.

154. *Id.*

155. *Id.*

156. SOLAR GUIDE FOR LOCAL GOVERNMENTS, *supra* note 8, at 82–83.

157. *Id.* at 83.

158. *Interconnection Standards*, *supra* note 151.

159. INTERSTATE RENEWABLE ENERGY COUNCIL (IREC), MODEL INTERCONNECTION PROCEDURES 1 (2009), http://irecusa.org/wp-content/uploads/2010/01/IREC-Interconnection-Procedures-2010final.pdf

160. *See* INTERSTATE RENEWABLE ENERGY COUNCIL (IREC), NET METERING MODEL RULES 1 (2009) [hereinafter NET METERING MODEL RULES], http://irecusa.org/wp-content/uploads/2009/10/IREC_NM_Model_October_2009-1.pdf.

v. Net Metering

Net metering involves "a billing method that credits solar system owners for electricity exported onto the electricity grid," and is generally a state-level matter established through legislation.[161] As of March 2013, forty-three states, Washington D.C., and four territories have adopted net metering policies.[162] Many states have modified their existing policies to accommodate expanding solar markets: California and Utah "increased the aggregate capacity limit for net metering due to the rapidly growing popularity of grid-tied solar[;]" a handful of states, including California, now allow meter aggregation "for multiple systems at different facilities on the same piece of property owned by the same customer[;]" and many other states now allow customers to carry excess electricity generation credits to the next billing period.[163] However, since 2009, only Alaska has established a new net metering policy[164] despite how important they have become since grid-connected systems started dominating the market.[165] States without net metering policies discourage solar technology development by not granting customers compensation for sending excess solar electricity back to a grid and by making customers purchase a battery storage system if they want to store excess electricity for future use.[166] Additionally, states that have already enacted net metering rules, even those that have recently modified their net metering policies, do not have optimal rules in place. For example, some states recently increased their aggregate system capacity limits but the IREC recommends no aggregate system capacity limit.[167] As grid-connected systems have started dominating the market, solar energy demand and investments into solar technologies will increase if every state enacts comprehensive net metering

161. SOLAR GUIDE FOR LOCAL GOVERNMENT, *supra* note 8, at 87–88.

162. *Net Metering*, DSIRE, http://www.dsireusa.org/solar/solarpolicyguide/?id=17 (last visited Mar. 2, 2014).

163. *Id.*

164. *See Alaska: Incentives/Policies for Renewables & Efficiency*, DSIRE (Sept. 24, 2012), http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=AK03R&re=1&ee=0; *West Virginia: Incentives/Policies for Renewables & Efficiency*, DSIRE (April 22, 2013), http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=WV03R&re=1&ee=0.

165. *See* 2010 SOLAR TECHNOLOGIES MARKET REPORT, *supra* note 9, at 6 (noting that, by interconnection status, grid-connected PV systems made up 82% of the market share in 2010 when compared to off-grid PV systems).

166. SOLAR GUIDE FOR LOCAL GOVERNMENTS, *supra* note 8, at 87.

167. NET METERING MODEL RULES, *supra* note 160, at 3 & n.3 (suggesting that electricity providers should "not limit the cumulative, aggregate generating capacity of net-metered systems in any manner").

policies or if states with existing policies make the effort to conform to the model net metering rules offered by the IREC. Such action by states would help eliminate inadequate net metering rules as a common market barrier to solar technology development.

vi. Administrative and Permitting Procedures

Another common barrier to obtaining solar technologies is overly cumbersome administrative and permitting requirements and delays associated with being granted permits.[168] As discussed earlier, one of the reasons Germany has experienced success in the solar energy market is through simplified permitting procedures.[169] In the United States, reasonable permitting requirements "can serve as a useful tool for local governments to ensure public safety and track installations in their communities."[170] However, customers frequently have to spend a considerable amount of money on fees and often have to go through a series of inspections while waiting weeks to have the systems installed.[171] In response to these issues, the permitting process can be simplified and streamlined at the state and local levels to encourage solar technology development. "Clearly defined requirements, expedited processing . . . and the option to submit paperwork online" are just a few ways permitting can be streamlined.[172] San Jose, California, Portland, Oregon, and Madison, Wisconsin provide examples of how permitting processes can be modified. San Jose "grants electrical permits for PV systems over the counter and requires building permits only for rooftop installations that meet certain criteria."[173] Portland "allows residential PV installers to submit permit applications online and trains designated permitting staff in solar installations."[174] In addition, "Madison . . . amended city laws to comply with state statutes that make it illegal to forbid PV systems in historic districts."[175] Using Germany and cities like Portland as examples, local governments can save themselves significant time and money by

168. *See* SOLAR GUIDE FOR LOCAL GOVERNMENTS, *supra* note 8, at 10; 2010 SOLAR TECHNOLOGIES MARKET REPORT, *supra* note 9, at 88.

169. Campoccia et al., *supra* note 57, at 290.

170. SOLAR GUIDE FOR LOCAL GOVERNMENTS, *supra* note 8, at 67.

171. Jackson, *supra* note 61.

172. SOLAR GUIDE FOR LOCAL GOVERNMENTS, *supra* note 8, at 67.

173. 2010 SOLAR TECHNOLOGIES MARKET REPORT, *supra* note 9, at 89; *see also Solar Permits and Fees*, SANJOSECA.GOV, http://www.sanjoseca.gov/index.aspx?nid=1505 (last visited Mar. 2, 2014).

174. 2010 SOLAR TECHNOLOGIES MARKET REPORT, *supra* note 9, at 89.

175. *Id.*

simplifying permitting requirements and processes, and could pass those savings on to customers. This would help eliminate the common barrier of overly cumbersome permitting procedures and demonstrate local support for solar technologies, thus increasing investments and demand for solar technologies, and contributing to solar market growth, particularly in the solar PV area.

vii. Additional Support Mechanisms and Recommendations

Other, less significant state and local level support mechanisms can contribute to the growth of solar PV technologies. Local governments can help alleviate the economic strains of supporting solar energy development by recruiting solar manufacturing companies to stimulate solar-related economic and job creation opportunities and by developing a trained workforce. Securing investments from solar energy companies generally requires the availability of various incentives and supportive policies, such as those discussed earlier,[176] among other critical requirements solar manufacturers want present when deciding where to locate a new facility.[177] If investments from solar energy companies are secured, communities will see their economies grow as a result of expanded workforces and new sources of revenue. A report released in November of 2012 by The Solar Foundation found that, as of September 2012, the U.S. solar industry employed 119,016 solar workers, a 13.2% employment growth rate over the past twelve months.[178] Data on the number of firms that expect to add jobs also yielded an expected 17% growth in employment over a twelve-month period beginning in September 2012.[179] This provides an additional reason for economically struggling communities to attract solar manufacturers because solar-related jobs are being created at much higher rates than overall employment opportunities.[180]

As data from The Solar Foundation shows, employment in the solar energy field will continue to grow, thus solar projects will require additional skilled workers to "install, maintain, and service solar energy

176. *See supra* Part V.C.i.

177. *See* SOLAR GUIDE FOR LOCAL GOVERNMENTS, *supra* note 8, at 98–99.

178. THE SOLAR FOUNDATION, NATIONAL SOLAR JOBS CENSUS 2012 5 (2012), http://thesolarfoundation.org/sites/thesolarfoundation.org/files/TSF%20Solar%20Jobs%20Census%202012%20Final.pdf.

179. *Id.* (noting that "[o]ver the next 12 months, nearly 45% of solar firms expect to add jobs, while fewer than 4% expect to cut workers, yielding a 17% growth in employment").

180. *See id.* An employment growth of 17% is expected in the solar industry during the twelve-month period, while overall employment in the U.S. economy is expected to grow by only 1.5% during that time. *Id.*

systems."[181] Training programs, such as the Institute for Sustainable Power Quality ("ISPQ") standard, raise installer competency and customer satisfaction levels, which can help drive demand for solar installations.[182] Solar workforce and training programs are very important components for developing solar industries and would combat shortages of trained workers in the solar industry, a common barrier to the growth of solar markets.

State and local governments also need to provide more incentives to utility-scale projects. State and local level policies and incentive programs lack adequate support for utility-scale technologies, despite utility-scale solar being a large and growing segment of the United States solar industry. The second quarter of 2012 "was the largest quarter in the history of the U.S. market for utility installations"[183] and thus it could be the case that existing federal and state programs will provide adequate financial support going forward, but the long term uncertainty involved with federal subsidies can be a barrier to exploiting the true potential of utility-scale solar projects.[184] Utility-scale solar projects are also primarily driven by state RPSs that provide solar set-asides,[185] the issue being that only sixteen states and Washington D.C. have RPSs with solar and/or distributed generation provisions.[186] This means the majority of states lack a primary mechanism for prompting utility-scale solar projects. One obvious solution is for more states to include solar provisions in their RPSs and put in place mandatory solar set-asides, which would encourage utility companies to invest in utility-scale solar projects.

VI. CONCLUSION

Solar energy has already proven to be a viable future source of electricity in both Europe and United States as evidenced by the mature and thriving solar markets in countries like Germany and the sustainable market forecast for solar PV within the United States. But the United States needs to demonstrate a concerted effort to making solar energy a primary source of electricity. State and local governments have already shown they can handle the responsibility of enacting policies that support solar PV growth. Each mechanism of support for solar technology has one or more model

181. SOLAR GUIDE FOR LOCAL GOVERNMENT, *supra* note 8, at 103.
182. *See id.* at 104–05.
183. *Solar Market Insight Report 2012 Q2*, SOLAR ENERGY IND. ASS'N, http://www.seia.org/research-resources/solar-market-insight-report-2012-q2 (last visited Mar. 2, 2014).
184. TAYLOR-DEJONGH, *supra* note 95, at 4.
185. *Id.*
186. *Solar Carve-Outs in Renewables Portfolio Standards*, *supra* note 14.

examples, either as policies enacted by states or cities that have taken the initiative and achieved good results,[187] or provided by agencies or online databases.[188] Federal policies and incentives will continue being relied upon, especially as solar technology prices continue to drop and allow for entire projects to be funded by federal incentives. However, because of reliability concerns and important issues that are out of the control of the federal government, more responsibility for enabling the growth of solar energy production should be handled at the state and local level. Even besides the inability of federal policies and incentives to address certain barriers, they lack the immediacy of state and local policies and incentives that establish a more concrete intent to make solar technologies more available to residents and businesses.

This article thus draws a few conclusions: 1) within the United States, state and local governments need to take the initiative in providing for the support of solar technologies in order to ensure solar PV growth; 2) in both the U.S. and Europe, solar energy is a viable future source of electricity; and 3) if the U.S. and other countries follow some of these recommendations, they will be laying the foundation of a more successful solar PV framework.

187. *See* Smith, *supra* note 105. For example, the Gainesville feed-in tariff may have had some initial issues, but it has also been called a "resounding success." *Id.*

188. *See*, *Interconnection*, IREC, http://www.irecusa.org/regulatory-reform/interconnection/ (last visited Feb. 13, 2014); *Issues and Policies*, SOLAR ENERGY IND. ASS'N, http://www.seia.org/policy/distributed-solar/net-metering (last visited Feb. 13, 2014); *Solar Carve-Outs in Renewables Portfolio Standards*, *supra* note 14. The IREC interconnection and net metering models along with the DSIRE solar database are just some examples that list best practices for mechanisms that support solar technology growth. *Interconnection*, *supra*; *Issues and Policies*, *supra*; *Solar Carve-Outs in Renewables Portfolio Standards*, *supra*.