The Poles of Power: Magnetic Bi-Directional Turn of the Meter

Steven Ferrey*

Electric power is created by charged particles moving between two electro-magnetic poles. So-called "net metering" is the most significant renewable incentive in the United States, recently being offered in forty-four states, recently reduced to forty-two states after Hawaii and Georgia withdrew additional net metering opportunities, although each kept their programs operational for all pre-existing net metering customers. Therefore, in this Article, all future references to state net metering will compare the entire base of forty-four states with some net metering customers in their states.[1] Of note, the states have implemented net metering with two opposite-policy poles. At one pole, two states have actually attempted to determine and set the net financial costs and benefits of the net metering transaction, and priced it accordingly (although missing a key element, examined below).[2] At the other pole, one state recently refused to recognize the value of a net metering transaction and set rates accordingly.[3] And in the space in the middle of the net metering charge between these two poles, are approximately forty net metering states that have inaccurately valued net metering at the retail power rate, which is, in most instances, not even in the correct rate zone.[4] Most of the states have not properly valued this transaction, as required by law, which affects power policy.

The law and precedent require that regulators set a precise cost-of-service value for every electricity sector transaction.[5] Every transaction falls within either state or federal regulatory authority. Public utility commissions in every state have done this since the 19th century when electricity was first harnessed and the power industry created.[6] More than 90% of the forty-four states that are promoting a switch from fossil fuels to more distributed renewable power have not set an objectively-based rate for net metering, despite its existence as a cost-subsidizing policy for two decades in some states.

Forty-four of the fifty states have enacted laws to implement net metering of electric power.[7] Renewable energy will absorb almost two-thirds of the spending on new power plants over the next twenty-five years, dwarfing spending on fossil fuels, as solar energy becomes the first choice for consumers.[8] This Article analyzes the two opposite poles to which policy in a few states have recently gravitated on net metering policies, and the bulk of states which have not set an objective rate. This Article highlights the applicable law, examines what has been done in key states, and analyzes what has been missed or sidestepped in the process.

Section I begins with an examination of how net metering operates differently in each of the forty-four states that have adopted it, making it the primary U.S. policy promoting distributed renewable power.[9] Section II analyzes the two poles along the spectrum of legal obligations for net metering. The positive pole, only reached by two of the forty-four net metering states, positively establishes the exact value for net metering transactions.[10] Section III examines where even these two pioneers have missed a step in determining the allocation of power consistent with state utility precedent, examined in detail.[11] The opposite pole, evidenced in one particular state, has moved in the oppositely charged policy direction and minimized the value of net metering.[12] These two alternatives are the polar extremes.

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1. *See* discussion *infra* Part I.
2. *See* discussion *infra* Section II.A.
3. *See* discussion *infra* Section II.B.
4. *See* discussion *infra* Part III.
5. *See* discussion *infra* Section II.D.3.
6. Steven Ferrey, The New Rules: A Guide to Electric Market Regulation 261–62 (2000) [hereinafter Steven Ferrey, The New Rules].
7. *See* discussion *infra* Section I.A.
8. Ehren Goossens, *Renewable Energy Expected to Draw Bulk of Spending for New Power Plants*, Bloomberg BNA Env't Rep. (June 23, 2015).
9. *See* discussion *infra* Section I.A.
10. *See* discussion *infra* Section II.A.
11. *See* discussion *infra* Section II.D.3.
12. *See* discussion *infra* Section II.C.

Section III analyzes those states between the two poles, which for years and even decades in some cases, have not set the value of these utility transactions. The Article drills down to examine three states now conducting ongoing proceedings designed to, but which may not, fulfill the legal obligation to objectively value the net metering transactions in their states.[13] There is extensive applicable law and precedent in every state that requires that electricity tariffs for every transaction over the electric grid track the costs and value of power transacted.

As distributed renewable power now becomes an increasingly significant part of the U.S. power grid, the law matters. Yet very few of the forty-four states changing the foundation of American power have tracked this value for solar power under law. This Article analyzes the polar extremes, and the legal confusion in between these policy poles.

I. Netting Net Metering

A. Basic Structure and Variations

Net metering is a state policy that allows retail electricity customers to receive credits on their utility bills for on-site renewable energy generation exported to the state's electric grid in excess of their electric load.[14] During times when energy is not being used by the customer but its renewable energy system is producing electricity, the net meter spins in reverse direction registering exported electricity to the utility.[15] Customers are given credit by the utility for every kilowatt-hour of electricity not used by the generating customer and instead exported to the utility.[16] By turning the meter backwards, and because only a single meter is used for each retail customer, net metering effectively compensates the generator at, or near, the full retail rate that the retail meter registers. The retail rate, conventionally used to compensate the utility for its costs of service rather than compensate the customer, includes approximately half of its charge attributable to transmission, distribution, taxes and other miscellaneous provisions for transferring the power itself.[17] The value received for that net metered power is an amount substantially above the utility's avoided cost[18] or the wholesale rate set by the Federal Energy Regulatory Commission ("FERC") or independent system operators ("ISOs") who manage the utility grids for approximately 60% of U.S. customers.

The net metered customer thus enjoys a free energy banking service and does not compensate the utility for using the grid to effectuate this energy banking, or for distribution investments made by the utility. The net metering customer uses the distribution grid twice, sending and later receiving power, and is never charged for either movement of its self-generated power over the grid. Any free services do not comport with legally applicable rate making principles and precedent.[19] For this transfer of their power to the grid, net metering generation customers pay no transmission and distribution charges even though they are using the distribution system. Net metering is an accounting convention applied to trading power that technically does not include a power sale, according to case decisions.[20]

The utilities credit and/or pay the net metering customer for the kilowatt hours ("kWh") of wholesale power received at a bundled retail rate, even though the utility could and does buy power elsewhere at a dramatically cheaper wholesale rate.[21] Therefore, the utility, and ultimately its customers who incur the pass-through of all net metering charges at retail value, is actually paying more—often triple or quadruple the price—for the net-metered power than it is paying for power produced elsewhere in the wholesale market. The utility is not soliciting the power, nor does it need it; it is providing a free power banking or trading service for the customer. For example, a net metering customer in Boston can be credited for approximately the current retail rate in Boston of 21 cents per kilowatt-hour ($0.21/kWh) for power which to the Buyer has a wholesale power value in the New England region, and in most other areas of the country, for the past seven years of approximately $0.04/kWh, plus or minus.[22] The utility is required to accept and credit or pay for this power whenever the distributed generation ("DG") unit produces it, rather than when the utility needs power to distribute to its customers. There is no advance notice required from the net metered customer as to when this power transfer of renewable energy will occur or for what duration, or any guarantee to prevent intermittent power generation.

Massachusetts is an order of magnitude more advanced on net metering compared to any of the other forty-three states which employ it. Massachusetts has "virtual net metering" that is more far-reaching than the other states because net metering credits can be transferred or sold to other customers in the utility service territory.[23] In Massachusetts, net metering participants are defined as producers belonging to

13. *See* discussion *infra* Sections III.A–C.
14. *See* Trevor D. Stiles, *Regulatory Barriers to Clean Energy*, 41 U. Tol. L. Rev. 923, 933 (2010).
15. *See id.*
16. *See id.*
17. *Id.* ("In effect, the customer uses excess generation to offset electricity that the customer otherwise would have to purchase at the utility's full retail rate."). As to whether electricity is a "good" or a "service" and how it should be treated under the law, *see* Steven Ferrey, The New Rules, *supra* note 6, at 211–31.
18. 16 U.S.C. § 824a2. For example, the wholesale price of energy in the six New England states for the past 7 years has traded at approximately $0.045/kWh. *See* Selectable Day-Ahead and Preliminary Real-Time Hourly LMPs, ISO-NE, http://www.iso-ne.com/isoexpress/web/reports/pricing/-/tree/lmp-by-node (last visited Sept. 1, 2016). The author's retail bill from Eversource, the owner of Boston Edison Company, during 2016 has averaged approximately $0.21-$0.25/kWh. If net metering, the credit value to such a retail customer would be at approximately the retail rate (at approximately 95% of the retail rate under Massachusetts law). *See* NSTAR Electric Co., *Net Metering*, https://www.eversource.com/Content/docs/default-source/rates-tariffs/163.pdf?sfvrsn=2 (last visited Sept. 1, 2016).
19. *See* discussion *infra* Section II.D.3.
20. Steven Ferrey, *Virtual "Nets" and Law: Power Navigates the Supremacy Clause*, 24 Geo. Int'l Envtl. L. Rev. 267, 273 (2012); *see also Glossary*, Dsire, http://www.dsireusa.org/glossary/ (defining "net metering") (last visited Sept. 1, 2016).
21. For example, the author's retail—or net metering—rate is $0.24/kWh, although abundant wholesale power is available for approximately $0.05/kWh.
22. *See Policies and Incentives by State*, Dsire, www.dsireusa.org (last visited Sept. 1, 2016).
23. 220 Mass. Code Regs. 18.05 (2016).

one of three classes based on type, size, and ownership of the renewable energy generating facility, and receive different credit amounts for their net metered power.[24] The distribution utilities are allowed to recapture all lost revenues associated with net metering from all other retail customers.[25]

Massachusetts has had net metering for three decades. Originally capped at a size of 60 kilowatts ("kW") per individual system in the 1980s, Massachusetts utility customers can now net meter up to 2 megawatts ("mW") per "unit" on any parcel of land, and up to 10 mW for any public generating facility off-taker of credits.[26] The net metering credits now earn a value close to the retail power rate.[27] Net metering customers can transfer or sell their net metering credits to any other customer of the utility in the same load zone.[28] Since 2008, Massachusetts has implemented a series of net metering caps on the total amount of net metered power, with periodic increases in several steps.[29] The state has now increased the percentage of each utility's peak load that can be net metered from 1% to 11%, with 5% of this allocated for private net metering credit off-takers and 6% reserved for public net metering off-takers.[30]

B. Individual and Program Limits

Many states have caps on the individual unit size, or cumulative amount, of net metering allowed in their states. The limits on net metered system size range from 1 mW in Indiana, to 80 mW in New Mexico,[31] and there is no limit in Arizona and Ohio.[32] In California, the maximum generation capacity is 1 mW, and the credits generated by a consumer or group of consumers electing to net meter are reverted back to the utility at the end of each year if they are not used.[33] In New York, there is a 2 mW cap on generation eligible for net metering, but this limit only applies to non-residential solar or wind projects, and residential solar and wind generators must stay below a 25 kW maximum.[34] So, while every state is different in the detail of its program, forty-four states have the most used policy for renewable energy and addressing climate change in the U.S.[35]

Other states limit the eligible generation per site to a modest electricity installed capacity, or to a percentage of actual host power demand and usage. This results in the unit not generating excess credits that it cannot itself use. Almost half the states have regulations that discourage, but do not ban, stand-alone distributed generation facilities (without significant host site load) by limiting size relative to host load or absolute size ceilings. Although most states have chosen to create individual system limits based upon a pre-determined size, a few states have chosen to limit customer facilities based upon a percentage of their annual energy use. Arizona (125%), Delaware (110%), and Colorado (125%), use these ranges to limit systems based upon the customer's actual demand for power. New Jersey and Ohio have no set limits on individual systems, but systems must be appropriately sized to meet the customer's demand. Nevada limits an individual system to the lesser of 1 mW or 100% of customer's load. While Rhode Island has an individual system limit of 5 mW, each system cannot be designed for greater than 100% of customer's demand based upon the last three years of energy use.[36]

And in fact, the nature of electric power, itself, is temporary. If not used within a nanosecond, it is lost as waste heat. There is no consensus as to whether sale of electricity is a sale of a good or of a service.[37] Power, in its intangible and inchoate form, is production and sale cloaked in legal protocols that may not comport with the physical world.[38]

Many states and the utilities that they have and regulate are at or near the limits established on total solar capacity allowed to participate under their net metering programs.[39] Nevada reached its cap of 235 mW for its net-metering program in 2015.[40] As Senior Editor to the MIT Technology Review, Richard Martin recently noted, several states are lowering their net meter credit values from something near the retail rate to something nearer the lower wholesale rate.[41]

Notwithstanding its popularity, net metering customers still comprise a small fraction of less than 1% of all energy consumers.[42] Although net metering customers depend on the grid in the same critical manner as do conventional customers, in a directional sense, they utilize the grid bilaterally.[43] When the customer demands more electricity than her generator produces–for example, on a cloudy, humid, sum-

24. 220 Mass. Code Regs. 18.02 (2016).
25. 220 Mass. Code Regs. 18.09 (2016).
26. *Id.*
27. 220 Mass. Code Regs. 18.05 (2016).
28. *See History of Solar in Massachusetts*, MassSolar, http://solarisworking.org/history (last visited Sept. 1, 2016).
29. *See What Is the Green Communities Act?,* Mass. Bus. for Clean Energy, http://www.mabizforcleanenergy.com/ma-supports-clean-energy/green-communities-act/ (last visited Sept. 1, 2016).
30. *See Massachusetts Net Metering*, Eversource, https://www.eversource.com/Content/nh/about/doing-business-with-us/builders-contractors/interconnections/massachusetts-net-metering (last visited Apr. 1, 2016). As of April 1, 2016, the percentage of each utility's peak load is 9%. *Id.*
31. *See Policies and Incentives by State*, *supra* note 22 (click on map of net metering by state).
32. *Net Metering: Policy Overview and State Legislative Updates*, Nat'l Conf. State Legislatures (Sept. 26, 2014), http://www.ncsl.org/research/energy/net-metering-policy-overview-and-state-legislative-updates.aspx.
33. *Id.*
34. *Id.*
35. Alabama, Idaho, Mississippi, South Dakota, Tennessee, and Texas are the only states without a mandatory state net metering program. Texas and Idaho have voluntary net metering programs. *See Net Metering: Policy Overview and State Legislative Updates*, *supra* note 32.
36. *Net Metering in Rhode Island*, National Grid, https://www9.nationalgridus.com/narragansett/business/energyeff/4_net-mtr.asp (last visited Sept. 1, 2016).
37. *Id.*; Steven Ferrey, The New Rules, *supra* note 6, at 211–30.
38. Steven Ferrey, The New Rules, *supra* note 6, at 211–30.
39. Richard Martin, *Battles Over Net Metering Cloud the Future of Rooftop Solar*, MIT Tech. Rev. (Jan. 5, 2016), http://www.technologyreview.com/news/545146/battles-over-net-metering-cloud-the-future-of-rooftop-solar.
40. *Id.*
41. *Id.*
42. *Participation in Electric Net-Metering Programs Increased Sharply in Recent Years*, U.S. Energy Info. Admin. (May 15, 2012), http://www.eia.gov/todayinenergy/detail.cfm?id=6270 (noting that as of 2010, net metering customers represented only 0.1% of all energy customers in the United States).
43. Steven Ferrey, *Virtual "Nets" and Law: Power Navigates the Supremacy Clause*, *supra* note 20.

mer day when the air conditioner is running but the sun is not shining–the meter runs forward.[44]

C. *Value of Excess Generation*

States vary in terms of their policies on unused net meter credits. Maine and Vermont both allow credits to be rolled over for twelve months from the date of creation, and thereafter if not used, they are extinguished and the revenue reverts to the utility at no compensation to the customer.[45] Excess California credits can be distributed virtually to other meters owned by the same entity on a time-of-use meter in the same service territory.[46] Some states allow the net-metered customer to convert credits to a cash payment to the generator.

California, Colorado, and Delaware allow customers to either roll over their credits indefinitely or take a cash payment at the end of the 12-month billing period.[47] In California, the credits generated by a net meter are reverted back to the utility at the end of each year if they are not used and if the customer makes no alternative decision; however, such alternative decision can be either to continue the credit or to take a cash payment.[48] Rhode Island has two options: utilities either opt to allow payments month-to-month or to have credits roll over month-to-month.[49] If they choose to have their credits roll over, then any unused credits after twelve months are taken by the utility with no compensation to the customer.[50] Massachusetts allows one to cash out credits (with no distribution component) for its Class III net metered facilities.[51]

The power surplus earned by the generating customer under net metering is credited in thirty-nine of the states at the retail rate, and in four states at the wholesale rate. Where the customer converts excess generation credits to cash, and in doing so gives up permanent title to the power to the utility, there is a transfer of rights to wholesale power. Twenty-three of the forty-four net metering states will pay a cash value to net-metered customers. Of the twenty-three states that have a payment option, seventeen of them offer payments at the avoided cost rate and six states offer higher rates. If paying avoided cost, the state is conceding that this is a sale of the power at wholesale by a Qualifying Facility under the Public Utility Regulatory Policies Act ("PURPA").[52] This is consistent with provisions under the Federal Power Act and PURPA.[53] Electricity, even though delivered over a tangible copper connection, has a virtual, intangible character.[54] It is clear that the states do not have the ability to set the price above avoided cost for such a wholesale power sale.[55]

Minnesota and Wisconsin offer renewable energy sources the option of getting paid for their excess generation at the utilities' retail rate. Rhode Island allows customers to get paid at a rate slightly less than the retail rate, but in excess of the avoided cost rate. Connecticut and Georgia allow customers with photovoltaic ("PV") systems to get paid at a higher rate than the avoided cost rate for net metering. Massachusetts also allows large Class III facilities to be paid, at the election of the utility, at a rate higher than avoided cost.[56]

II. Two Poles of Electricity

A. *The Positive Pole: The Value of Solar*

Two states, Minnesota and Maine, have recently completed an assessment of the value of distributed solar energy production for their electricity systems, along with a similar assessment by the municipal utility in Austin, Texas. These establish, correctly or incorrectly, an actual quantitatively determined value for net metering transactions.

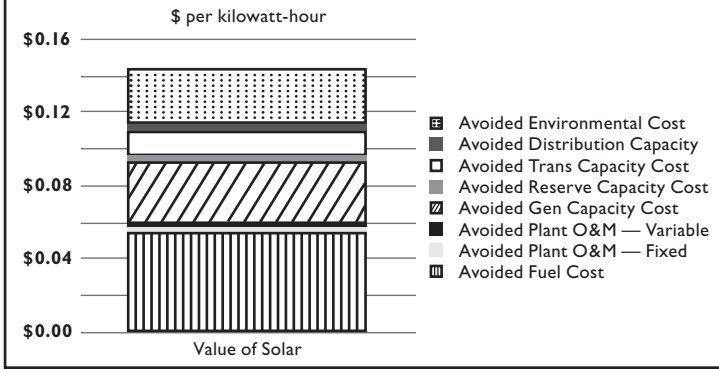
1. Minnesota

In 2014, the Minnesota Public Utilities Commission decided to create a value-for-solar formula to determine the value of consumer-generated solar energy net metered to the grid.[57] Under the commission's mandate, utilities may adopt the value-for-solar formula on a voluntary basis. Minnesota recognized that there is a real issue as to the net metering program and instead legislated alternatives.[58] Minnesota passed legislation in 2013 which allows Investor-Owned Utilities ("IOUs") to apply to the Public Utility Commission for a Value of Solar ("VOS") tariff.[59] The VOS calculation must take into account the following values of distributed PV: energy and delivery; generation capacity; transmission capacity; transmission and distribution line losses; and environmental value. Of note, this hypothetically accounts for less use of the power delivery system. Notably, however, it does not account for the added financial and environmental cost to the system to operate additional fast-start or spinning reserves to accommodate the intermittent supply of solar power. In fact, every study now conducted in every state omits this critical consideration.[60] See Figure 1.

Instead of robotically valuing PV-generated electricity at the customer retail rate, the Minnesota VOS tariff indepen-

44. *Id.*
45. Vt. Stat. Ann. tit. 30, § 219 (2016); *see also Maine Solar Power Information Page*, SolarPowerRocks.com (2016), https://solarpowerrocks.com/maine.
46. Cal. Pub. Util. Code § 2830 (West 2016).
47. *Id.*; Colo. Rev. Stat. § 40-2-127 (2016); H.R. 267, 145th Gen. Assemb., Reg. Sess. (Del. 2010).
48. Cal. Pub. Util. Code § 2830 (West 2016).
49. 39 R.I. Gen. Laws § 39-26.4-3 (2016).
50. *Id.*
51. 220 Mass. Code Regs. 18.05(4) (2016).
52. 16 U.S.C. § 824a (2006).
53. *Id.*
54. Steven Ferrey, *Inverting Choice of Law in the Wired Universe: Thermodynamics, Mass, and Energy*, 45 Wm. & Mary L. Rev. 1839, 1863–64 (2004).
55. 132 FERC ¶ 61047.
56. 16 U.S.C. § 824a-3 (2006).
57. *Database of State Incentives for Renewables & Efficiency*, DSIRE, http://www.dsireusa.org/support/glossary/ (last visited Sept. 1, 2016). The Commission considered the value of consumer-generated renewable energy to the utility, to ratepayers, to society, and to the environment.
58. Benjamin L. Norris et al., *Minnesota Value of Solar: Methodology*, Clean Power Research ii (Jan. 30, 2014), https://www.cleanpower.com/wp-content/uploads/MN-VOS-Methodology-2014-01-30-FINAL.pdf.
59. Minn. Stat. § 216B.164 subdiv. 10 (2013).
60. *See* discussion *infra* Section II.B.1.

Figure 1
Preliminary Minnesota Value of Solar Calculation



John Farrell, *Could Minnesota's "Value of Solar" Make Everyone a Winner?*, CleanTechnica (Mar. 17, 2014), https://cleantechnica.com/2014/03/17/minnesotas-value-solar-make-everyone-winner/ (compiling information electronically filed by Xcel Energy with the Minnesota Public Utilities Commission into the graph provided).

dently quantifies the value of distributed PV electricity.[61] The goal is to account for the real value of PV-generated electricity, such that both the utility and ratepayers would be indifferent to where the electricity comes from, either customer-owned PV or other conventional forms.[62] The Public Utilities Commission established a rate of approximately $0.11–0.15/kWh to developers of solar gardens, including compensation for transferred renewable energy credits.[63] Those figures, applicable retail rates ("ARR"), are paid to solar garden subscribers, who then pay developers managing their supply of PV power.[64]

The average VOS tariff is $0.12/kWh over the life of a locked-in contract of twenty-five years, while the ARR rate is subject to change.[65] Xcel Energy, Minnesota's largest utility, estimated a VOS tariff of $0.145/kWh, while its retail residential rate is $0.115/kWh.[66] Utilities will adopt this fixed plan because it provides more stability than credits afforded at a constantly shifting retail rate.[67] Under the Minnesota system, the tariff must remain at or above the retail rate for the first three years, but the utilities can thereafter recalculate the rate annually.[68] The Minnesota Public Utility Commission ("PUC") explicitly stated that utilities will not be required to include both a regulatory cost and the environmental externalities cost going forward.[69]

61. Norris et al., *supra* note 58, at ii.
62. *Id.* at 1.
63. Ken Paulman, *If "Value of Solar" Is Optional, Will Minnesota Utilities Adopt It?*, Midwest Energy News, Apr. 9, 2014, http://www.midwestenergynews.com/2014/04/09/if-value-of-solar-is-optional-will-minnesota-utilities-adopt-it/.
64. Frank Jossi, *Minnesota Regulators Side With Utility in Value-of-Solar Case*, Midwest Energy News, Aug. 7, 2014, http://www.midwestenergynews.com/2014/08/07/minnesota-regulators-side-with-utility-in-value-of-solar-case/.
65. *Id.*
66. *See* Paulman, *supra* note 63.
67. *Id.*
68. Anne Smart, *Value of Solar Tariffs (VOSTs) Are Value of Solar Taxes*, Alliance for Solar Choice (Mar. 28, 2014), http://www.huffingtonpost.com/anne-smart/value-of-solar-power-tariffs -_b_5051448.html.
69. In re Establishing an Estimate of the Costs of Future Carbon Dioxide Regulation on Electricity Generation Under Minn. Stat. § 216H.06, Minnesota Docket CI-07-1199 (Minn. P.U.C. Apr. 28, 2014). The Minnesota Public Utilities Commission also established a range of CO_2 (carbon dioxide) values that reflect future regulatory compliance costs. Starting in 2019, utilities will be required to include this cost range in their long-term plans. *Id.*

2. Maine

In mid-2015, "Maine became the third jurisdiction in the United States to approve a VOS pricing for distributed solar generation."[70] A study performed for Maine calculated the 25-year levelized value of solar to the Maine utility grid at $0.337/kWh, which is notably above the retail rate in Maine of around $0.12/kWh or any other state.[71] The level of societal benefits is contested by some experts.[72]

This valuation by Maine means that solar energy priced below that $0.337/kWh mark would deliver net societal benefits and should be purchased as wholesale power by the utility. The statutorily mandated study's[73] menu is made up of thirteen cost-benefit factors in five categories. The first eight are avoided market cost, avoided generation capacity cost, avoided residential generation capacity cost, avoided natural gas pipeline cost, solar integration cost, transmission delivery, avoided transmission capacity cost, avoided distribution capacity cost, and voltage regulation.[74] The last five are societal benefits more commonly regarded as externalized factors but they are emerging as important parts of the solar value equation: net social cost of carbon, net social cost of sulfur dioxide ("SO_2"), net social cost of nitrogen dioxide and nitric oxide ("NO_x"), market price response, and avoided price uncertainty.[75]

The Maine study provides a calculated one-year value and a 25-year "levelized value" for Central Main Power ("CMP") customers. Avoided market costs are valued at $0.09/kWh for one year and at $0.138/kWh if "levelized" over a discounted 25-year term.[76] The societal benefits are valued at $0.092/kWh for one year and at $0.199/kWh over 25 years.[77] The combination of these numbers yields a one-year total value at $0.182/kWh and the 25-year value at $0.337/kWh,[78] as shown in Tables 4 and 5. Customers who put solar panels on

70. Arijit Sen, *Maine's Solar Bill and the Value-of-Solar Debate*, Climate Law Blog (Aug. 4, 2015), http://blogs.law.columbia.edu/climatechange/2015/08/04/maines-solar-bill-and-the-value-of-solar-debate/#sthash.mDAEgLB7.dpuf. "Governor Paul LePage had vetoed the legislation . . . Maine's Democrat-controlled House of Representatives overruled the veto 119 to 28, and the Republican-controlled Senate voted 32 to 3 to override the veto." *Id.* Austin, Texas in 2012 and Minnesota in 2014, were the first to attempt to determine the value of distributed solar generation to their systems. *Id.*
71. *Id.* The VOS was comprised of "13.8 cents per kWh for avoided market costs and 19.9 cents in terms of societal benefits ([ ]the social cost of pollutants, market price response, and avoided fuel price uncertainty). . . . The value of solar for the next year is lower than the levelized value for the next 25 years. The one-year value of solar was 18.2 cents per kWh, with the breakdown of avoided market costs and societal benefits was 9 cents per kWh and 9.2 cents per kWh, respectively." *Id.*
72. *See* discussion *infra* Section II.D.1 (noting Ashley Brown's article).
73. Maine Solar Energy Act, Me. Stat. tit. 34, §§ 3471–3474 (2014), http://www.mainelegislature.org/legis/bills/bills_126th/billtexts/SP064401.asp.
74. Benjamin L. Norris et al., *Maine Distributed Solar Valuation Study*, Me. Pub. Util. Comm'n 3–4 (Mar. 1, 2015), http://www.nrcm.org/wp-content/uploads/2015/03/MPUCValueofSolarReport.pdf.
75. *Id.*
76. *Id.* at 5–6.
77. *Id.*
78. *Id.*

their houses only receive a credit on their bill worth about $0.13/kWh.[79]

3. Austin, Texas

Austin, Texas, maintains a municipal utility that is not subject to either state regulation by the Texas PUC or federal regulation by FERC. Therefore, it is a much freer actor than investor-owned utilities. Austin Energy adopted a Value of Solar Tariff ("VOST") in 2012.[80] Instead of a traditional net-metering program where the customer's export energy is "netted" against her energy consumption, the customer receives a bill credit for the total energy his or her distributed energy produced during the entire billing period, and then repurchases everything consumed.[81] It does not net a single bill, but rather cumulates two distinct transactions in both directions over the interconnection of the home with the grid.

The Austin tariff deviates from the simplicity of net metering, in that the policy measures a customer-generator's total energy consumption separately from his distributed energy output to the grid.[82] In this type of system, the difference between the wholesale supply of power and the retail supply of power, and their separate costs, is recognized as distinct, and tends to be less generous to net meter customers and to extract a larger contribution toward common grid maintenance costs for the system as a whole.

The tariff values the non-financial aspects of distributed renewable energy based on an algorithm rather than on a retail or wholesale rate.[83] The algorithm incorporates avoided fuel costs of the utility, avoided capital costs of new generation construction, avoided transmission and distribution costs, fuel price hedging values, and the environmental benefits of renewable energy.[84] The City of Austin amends its value yearly to reflect current economic and non-economic values associated with distributed energy.[85]

In October 2012, the initial rate was set at $0.128/kWh. The 2014 rate was set even lower at $0.107/kWh and then increased in 2015 to $0.113/kWh. Of note, these rates are less high than the value afforded and adopted in some other jurisdictions.[86] They are above the cost of wholesale power, reflecting the external benefits of solar, but not as high as the retail rates or numbers in most net metering states.

B. What Is Overlooked in the State Valuation

An advocacy group did a meta-study analyzing eleven net metering studies on the value of solar power which had a median value of solar at $0.17/kWh, and a national average retail net metered tariff at $0.12/kWh.[87] This study concluded that the net metering price for solar banked with the grid, should be above what is now the typical net metering value set at the retail power price. None of the studies surveyed in this compilation, mention or quantify the additional financial and environmental costs of running or "ramping" more back-up power or the costs of storage of intermittent power.[88] It is not as if these costs are invisible; they are the elephant in the room, entirely a species of intermittent generation but not yet considered in some state evaluations.

1. Ramping

More renewable power changes the generation hardware necessary to maintain adequate resources and stability for the system. First, grid modifications, upgraded circuits and transformers, and expansion of the transmission and distribution infrastructure, is necessary to accommodate an increased percentage of renewables.[89] In Germany, their switch to more intermittent renewable generation already resulted in an additional one billion Euro cost, with tens of billions more of investment still required.[90]

Solar and wind power are intermittent sources of renewable energy with no ability to supply reliable capacity. The record U.S. annual wind capacity factor was 2014 at 33.9%. The U.S. Energy Information Administration ("EIA") says the median wind capacity over the past decade is 31%.[91] In the UK, the wind capacity factor ranged from a low of 21.5% in 2010 to a high 27.9% in 2013.[92]

Even at 20% wind penetration in a grid, there could be a 33-50% decline in the running of combined cycle fossil-fuel generation units.[93] Ramping and cycling is estimated to add $23/mWh to the delivered cost of wind energy.[94] With a lower capacity factor than wind, solar would experience a higher per mWh ramping charge than does wind power. This need for spinning reserve of traditional units would call on existing fossil-fired and other baseload units to "spin."

79. *Maine PUC's Solar Power Study Released Today Shows Enormous Benefits*, Nat. Resources Council of Me. (Mar. 3, 2015), http://www.nrcm.org/news/nrcm-news-releases/maine-puc-solar-power-study/.
80. Austin Energy Solar Rate Rider, Ordinance No. 20120607-055 (June 7, 2012) [hereinafter Austin Ordinance], http://austintexas.gov/edims/document.cfm?id=171787.
81. *Id.*
82. *Id.*; *see also* John V. Barraco, *Distributed Energy and Net Metering: Adopting Rules to Promote a Bright Future,* 29 J. Land Use & Envtl. L. 365, 390 (2014).
83. Austin Ordinance, *supra* note 80.
84. *Id*; *see also* Barraco, *supra* note 82, at 390.
85. Austin Ordinance, *supra* note 80.
86. *See* discussion *supra* Sections II.A.1, II.A.2.
87. Lindsey Hallock & Rob Sargent, *Shining Rewards: The Value of Rooftop Solar Power for Consumers and Society*, Envtl. Am. Res. & Pol'y Ctr. (2015), http://www.seia.org/sites/default/files/resources/EA_shiningrewards_Summer2015.pdf.
88. *See* discussion *supra* Sections II.A.3, II.A.1.
89. Lincoln Davies & Kirsten Allen, *Feed-In Tariffs in Turmoil*, 116 W. Va. L. Rev. 937, 1002 (2014).
90. *Id.* at 1004.
91. Planning Engineer & Rud Istvan, *True Costs of Wind Electricity*, Climate Etc. (May 12, 2015), http://judithcurry.com/2015/05/12/true-costs-of-wind-electricity/.
92. *Id.*
93. J. Nicolas Puga, *The Importance of Combined Cycle Generating Plants in Integrating Large Levels of Wind Power Generation*, 23 Electricity J. 33, 41 (2010), http://www.bateswhite.com/media/pnc/4/media.344.pdf.
94. Michael Giberson, *Assessing Wind Power Cost Estimates* 9 (Oct. 2013), http://instituteforenergyresearch.org/wp-content/uploads/2013/10/Giberson-study-Final.pdf.

As one redeploys existing fossil-fuel facilities to fill growing gaps created by intermittent power, there is an efficiency and environmental price which few state studies have recognized. Gas combined cycle units will experience higher heat rates, less efficient operation, greater maintenance expenses, and consequent unavailability.[95] Ramping fossil generation units can increase maintenance costs requiring earlier replacements of certain generation facility components.[96] European data illustrates that their shift from traditional coal unit operation to more operation of natural gas-fired combined cycle units, resulted in an increase in these units' operation & maintenance ("O&M") costs, outages, and less availability.[97]

There is a need for installation on the grid of more quick-start spinning reserve to respond to the constant intermittency of solar and wind generation and provide load-following generation.[98] This is a very large and often uncalculated cost to maintain reliability of the electric system, necessary if and only if, additional intermittent power is given first-priority to supply power.[99] The question so far not addressed in most of the studies or literature is who should pay for these additional costs to alter the power system, most capital-intensive sector of the U.S. economy.[100] There are two options for this cost allocation: (1) Allocate the cost of new quick-start ramping generation and/or power storage to the owners of intermittent power generation whose entrance to the market necessitates these investments; or (2) Allocate these costs to all consumers of power by raising all power rates.

The choice to date in U.S. states is to allocate these storage, ramping, and back-up supply costs to all consumers, rather than to the 1% of customers who now are generators of intermittent power responsible for necessitating these ramping and storage investments. Germany is far more advanced than the U.S. in deploying DG intermittent power: There are five times as many potential disruptions due to German grid instability caused in significant part by more intermittent generation, as four years before, raising the risk of blackouts. One grid operator requiring balancing adjusts of generation 1,009 times in 2013 to stabilize the grid, 209 times in 2010.[101] When solar is a significant part of the bulk generation supply, the stress on remaining generation units as they work to meet the steep increase from afternoon to evening loads will be exacerbated.[102] Adding a significant intermittent DG component increases the need for spinning reserve, increases the amount of fuel consumed to spin that reserve, increases system out-of-pocket fuel costs and emissions from greater fuel use per unit of power generated, and increases other marginal costs incurred to maintain a reliable power system.[103]

2. Energy Storage

Unlike all other forms of energy, moving electrons cannot be efficiently stored as electricity for more than a second before it is lost as waste heat.[104] Therefore, the supply of electricity must match the demand for electricity over the centralized utility grid on an instantaneous, constant, real-time, and ongoing basis, or else the electric system shuts down or expensive equipment is damaged.[105] Either too much or too little power causes system instability on a second-by-second basis.[106]

California has ordered its utilities to build each year additional significant storage capacity, which is to be billed to all utility consumers, who themselves do not supply intermittent power or require or utilize this storage of energy.[107] California has mandated energy-storage which requires each of its major regulated private utilities, PG&E Corp., Edison International's Southern California Edison, and Sempra Energy's San Diego Gas & Electric Co., to collectively buy 1.3 gigawatts of energy storage capacity by the end of 2020.[108] This will all be paid for by utility ratepayers in relation to how much power they purchase, but immunized from this charge is net metering of power.[109] This does not affect California's municipal utilities, including the Los Angeles Department of Water and Power, one of the largest municipal utilities in the U.S. New York is also looking for more storage to relieve congestion on transmission lines.

Very large utility-scale storage is about 1.5 times the cost of gas generation as an alternative to storage.[110] Smaller-scale residential storage is more expensive.[111] Shifting daytime solar output into off-peak power through today's battery technolo-

95. Puga, *supra* note 93.
96. Wilson Rickerson et al., *Residential Prosumers—Drivers And Policy Options (Re-Prosumers)*, IEA Renewable Energy Tech. Deployment 52 (2014), http://iea-retd.org/wp-content/uploads/2014/06/RE-PROSUMERS_IEA-RETD_2014.pdf.
97. W. Edward Platt & Richard B. Jones, *The Impact of Carbon Trading on Performance: What Europe's Experience Can Teach North American Generators*, Power (Jan. 1, 2010), http://www.powermag.com/the-impact-of-carbon-trading-on-performance-what-europes-experience-can-teach-north-american-generators/.
98. *Id.*
99. ISO-NE and PJM ISO rules require all wind and solar power to be taken as initial supply whenever it is supplied to the grid without advance scheduling or bidding supply into the system. *See, e.g.*, ISO New England, Inc., Overview of New England's Wholesale Electricity Markets and Market Oversight (2014), https://www.iso-ne.com/pubs/spcl_rpts/2014/2014_market_overview_050614.pdf.
100. Randy T. Simmons et al., *The True Cost of Energy: Wind Final Report*, Strata 9 (July 2015), http://www.strata.org/wp-content/uploads/2015/07/Full-Report-True-Cost-of-Wind1.pdf.
101. Julia Mengewein, *German Push for Renewable Power Outlet Doubles Utilities Joining Balancing Market*, Bloomberg BNA Energy & Climate Rep. (July 25, 2014) (stating that, in Germany's balancing market auctions, winning bidders have been paid as much as 13,922 euros ($18,700) to pledge set aside 1 mW for balancing services provided on notice of 15 minutes, 5 minutes or 30 seconds).
102. *Id.*
103. *See* Puga, *supra* note 93; *see also* Goossens, *supra* note 8.
104. Steven Ferrey, Environmental Law: Examples & Explanations, Wolters Kluwer 568 (6th ed. 2013) [hereinafter Steven Ferrey, E&E].
105. Michael Bruch et al., *Power Blackout Risks*, CRO Forum 6 (Nov. 2011), https://www.allianz.com/v_1339677769000/media/ responsibility/ documents/position_paper_power_blackout_risks.pdf.
106. *Id.*
107. *California Public Utilities Commission Approves Pioneering Energy Storage Mandate*, Latham & Watkins LLP (Nov. 2011), http://www.cleanenergylawreport.com/energy-regulatory/california-public-utilities-commission-approves-pioneering-energy-storage-mandate/.
108. *Id.*
109. *Id.*
110. Willliam H. Carlile, *Utility-Scale Electricity Storage, Distribution Seen Likely to Benefit From Solar Technology*, Bloomberg BNA Env't Rep. (June 29, 2015).
111. *Id.*

gies is somewhat economically counterintuitive. Utilities and state regulators are already encouraging cheap "time of use" rates in the evening.[112] The battery does not improve the economics of solar, and solar does not improve the economics of the battery, compared to net metering rates available in the vast majority of states.[113]

With net metering as a regulatory option in at one time forty-four states, net metering substitutes for storage capacity: The utility provides the equivalent of free personal quasi-storage (in the form of instantaneously selling the power to another customer) for distributed generators, with costs passed on not to the beneficiary of the storage, but to non-net metering customers in the form of crediting retail prices for what substitutes for wholesale transactions.

C. The Other Pole: No recognized Net Contribution From DG Solar

1. Nevada

As in any energized field, there is a second pole. At the end of 2015, and the beginning of 2016, Nevada became this counter-charge to not set the true value for net metering transactions. 2015 legislation directed the Nevada Public Utility Commission to establish a new, separate tariff for rooftop solar customers.[114] Distributed solar units, which net meter, as of 2016, are assessed a higher flat monthly fee than are non-net-metering customers, on an increasing value, and the buy-back rate for excess supply of power is reduced:

> The base service charge is rising from $12.75 to $17.90 per month [a 40% increase] for southern Nevada solar customers and from $15.25 to $21.09 [a 38.2% increase] for northern Nevada customers. The changes also reduce the amount the utility pays to buy power back from rooftop solar panels, from 11 cents a kilowatt-hour to 9 cents [an 18.2% decrease] in southern Nevada and from 12 cents to 10.5 cents [a 12.5% decrease] in the north. The service charge will rise and the reimbursement will drop every year until 2020.[115]

The monthly service charge will continue to ratchet up, reaching a rate of $38.51 by Jan. 1, 2020.[116] The increase is a 40% jump over the prior 2015 rate for rooftop solar customers.[117] The current credit paid by the utility and its customers for surplus net metered power exported to the grid, which is approximately 11 cents/kWh,[118] would be reduced to about 9 cents/kWh, declining progressively over four years to 2.6 cents by Jan. 1, 2020.[119]

This illustrates the significant differential between net metering rates and the wholesale value of the power, which cannot be stored, to the buyer. The retail rate for electricity from regulated utilities in Nevada is 12.39 cents per kilowatt-hour purchased; the wholesale price for electricity in that region of the West averaged about two cents per kilowatt-hour—a 6:1 differential.[120] So, Nevada will credit net metered renewable power at approximately the wholesale power rate. This is the rate that the homeowner would earn if he sold the power, as a Qualifying Facility under PURPA, to the utility.[121] This is the homeowner's right if s/he so chooses, pursuant to federal law.[122] However, net metering is not the sale of power.[123] If it were, states would have no authority over it, as it would be a wholesale sale wholly within federal authority.[124]

After this decision, when the regulatory commission agreed to reconsider the order because of push-back from solar companies and solar system users, NV Energy, Warren Buffett's Nevada utility, proposed a grandfather clause provision to exempt existing customers with rooftop solar panels from the new rising fees.[125] Nevada regulators thereafter rejected the request to suspend new rates for rooftop solar customers.[126] Berkshire Hathaway's NV Energy Inc., which owns Nevada's two biggest utilities, sought the charges to offset revenue lost as solar-powered customers buy less power.

The correct price for net metered transactions is neither the retail rate at one pole of the spectrum, nor the avoided cost rate at the opposite pole. The correct rate associated with the net metered transactions is the net value of renewable net metered power to the utility system. Most net metering states afford the retail rate to net metering customer transactions,[127] which rate has nothing to do with the value or cost of this net metering transaction to the system.

A report to the Nevada PUC, found that net metering for systems installed between 2004 and 2016 would provide a benefit to non-solar owners of $36 million over the life of the systems.[128] This is an extremely small amount—$3 million per year, in a state with high solar insolation. In

112. Steven Huntoon, *That Old Musk Magic*, Pub. Util. Fort. (May 20, 2015), http://spark.fortnightly.com/fortnightly/old-musk-magic?page=0%2C1. Dominion Power offers a time-of-use option with a low off-peak rate of 4.8 cents/kWh and an on-peak rate of 17.4 cents/kWh. *Id.*
113. *Id.*
114. *Net Metering: Nevada*, Dsire, http://programs.dsireusa.org/system/program/detail/372 (last updated Jan. 14, 2016); Michael Graham Richard, *Sunny Nevada Is Killing the Solar Industry in the State With New Net-Metering Rules*, Treehugger (Jan. 4, 2016), http://www.treehugger.com/environmental-policy/sunny-nevada-killing-solar-industry-state-new-net-metering-rules.html.
115. *Id.*
116. Sean Whaley, *Nevada Net Metering Service Charge Hike Announced*, Las Vegas Rev.-J. (Dec. 31, 2015), http://www.reviewjournal.com/business/energy/nevada-net-metering-service-charge-hike-announced.
117. *Id.*
118. *Id.*
119. *Id.*
120. Martin, *supra* note 39.
121. Steven Ferrey, Law of Independent Power §§ 4:24, 7:1 (Thomson Reuters 38th ed. 2105).
122. *Id.*
123. MidAmerican Energy Company, 94 FERC ¶¶ 61340, 66263 (2001); MidAmerican Energy Co. v. Iowa Util. Bd., No. 99-1529 (Aug. 18, 2000).
124. Steven Ferrey, Law of Independent Power, *supra* note 121, § 5:9.
125. This would exclude homeowners who bought or leased rooftop solar systems before the rules were imposed January 1, 2016. Mark Chediak, *Buffett's Nevada Utility Wants Solar Rule Grandfathered*, Bloomberg (Jan. 25, 2016, 4:11 PM), http://www.bloomberg.com/news/articles/2016-01-25/buffett-s-nevada-utility-proposes-grandfathering-solar-rules.
126. Mark Chediak, *Nevada Regulators Deny Request to Halt Rooftop Solar Rules*, Bloomberg (Jan. 14, 2016, 8:38 PM), http://www.bloomberg.com/news/articles/2016-01-14/nevada-regulators-reject-request-to-halt-new-rooftop-solar-rules.
127. *See* discussion *infra* Part III.
128. *Id.*

Nevada, there are 14,832 interconnected net metering customers served by one major retail utility, Nevada Power Co. in Southern Nevada, and 2,423 customers served by Sierra Pacific Co. in Northern Nevada, both part of parent NV Energy.[129] "Others, however, have calculated that rooftop solar increases costs to the grid that surpass the value of the power."[130] Responding to the Nevada order, Professor Severin Borenstein stated that "net metering is an inefficient and opaque way to support the growth of low-greenhouse-gas technologies, and should be replaced with more direct and transparent subsidies."[131]

2. Arizona—Pending Change?

In Arizona, the proposals of state utilities have prompted an evaluation of distributed solar energy options. Tucson Electric Power Company ("TEP"), a major Arizona investor-owned utility, submitted an application to the Arizona Corporate Commission for regulatory approval of a new net metering rate applied to net metering customers requesting future net metering, that provides monthly bill credits for any excess energy produced at a reduced credit rate,[132] along with approval of a partial waiver of the Commission's existing rules applying to net metering.[133] Most of Arizona's electric utilities, including TEP, have now reduced or eliminated separate upfront cash incentives for solar DG systems. This step mitigates the Renewable Energy Standard ("RES")[134] surcharges paid by TEP's customers to cross-subsidize these installations.[135] The output from DG systems in TEP's service area already far exceeded the state's specified RES requirement for renewable generation.[136]

The utility claimed that, like many other utilities around the country and in Arizona, it has suffered a substantial rise in unrecovered fixed costs due to unrecovered distribution revenues through net metering.[137] Under the company's current rate design, "DG customers do not pay for all of the fixed [distribution] system costs that TEP incurs to serve them because a large portion of those costs are recovered through volumetric kWh charges" that DG customers do not incur.[138] The utility sought to establish that, according to the cost of service study performed in conjunction with TEP's 2012 rate case, the average fixed cost of providing any electric services to a residential customer was $55 per month even if the customer purchased no net amount of power.[139]

With charges based on a net volumetric service basis in most states, the only fixed non-volumetric portion of the "residential customer's bill is the $10 monthly customer charge, which only recovers about 18% of TEP's fixed costs to serve residential customers."[140] And the customer charge traditionally is set at a level sufficient to cover the monthly meter reading, billing and bill collection costs of a customer; and TEP, like many other utilities, relies predominately on volumetric sales and its inclining block rate design to recover the remaining 82% of its fixed costs.[141] While the company suffers an initial loss of revenues from net metering of customers by not recovering volumetric contributions for the fixed costs of operating and maintaining its grid, those costs are eventually shifted to and recovered from non-renewable ratepayers without net metering, whose rates rise correspondingly.[142]

For TEP in Arizona, "a portion of the lost fixed costs from net metering are shifted to non-DG conventional customers through its Lost Fixed Cost Recovery Mechanism."[143] This system charge collects some of TEP's fixed system costs that go unrecovered when energy usage is reduced by commission-mandated energy efficiency and DG programs.[144] In 2015, the Lost Fixed Cost Recovery Mechanism ("LCFR") was expected to recover approximately $2.2 million, or 40% of fixed system costs that were not recovered from DG customers in 2014.[145] The rest of the costs are shifted to all other customers on a volumetric basis, generally with no itemization of the cause of these higher rates on customer bills. The utility contended that DG systems added since TEP's last test year rate order, through the end of 2014, resulted in approximately $7 million in annual subsidies that will be shifted to and paid by non-DG customers.[146]

The TEP application proposed a new tariff where DG customers would continue to receive a full retail rate offset for the energy they self-consume from their DG systems; new DG customers would pay the currently approved and applicable retail rate for all energy delivered by TEP.[147] New DG customers would be compensated for any excess energy their net metered systems produced and delivered to TEP with bill credits calculated using the Renewable Credit

129. Sean Whaley, *supra* note 116.
130. Martin, *supra* note 39.
131. *Id.*
132. Application of Tucson Electric Power Company for (1) Approval of a Net Metering Tariff and (2) Partial Waiver of the Net Metering Rules, Docket No. E-01933A-15-0100, at 1 n.1 (Arz. Corp. Comm'n Mar. 25, 2015) [hereinafter Application of Tucson Electric Power Company], https://www.tep.com/doc/renewable/TEP_ACC_Application_032015.pdf ("The Proposed 'Renewable Credit Rate' is the rate equivalent to the most recent utility scale renewable energy purchased power agreement connected to the Company's distribution system. The current Renewable Credit Rate would be $0.0584/kWh. The rate would apply to future DG Customers that qualify for the Commission's Net Metering Rules.").
133. *See id.* The utility contends that approximately 7900 of its residential customers have rooftop PV systems, and that it has received 600 applications in the first two and a half months of 2015. *Id.* at 3.
134. The Commission's Renewable Energy Standard rules were adopted in 2006, with net metering rules adopted in 2008; TEP's initial net metering tariff was approved in 2009. *Id.* at 2.
135. *Id.* at 4 (including a graph demonstrating that DG installations continue despite no upfront cash incentive).
136. Application of Tucson Electric Power Company, *supra* note 132, at 4. In 2015, the RES DG requirement for TEP is approximately 138,000 mWh, and the utility projects that in 2015 total generation from residential and non-residential DG systems will exceed the RES DG requirement by approximately 70% and will meet the RES DG requirement through 2017. *See id.* at 1 Ex. 5 (showing TEP's projected 2015 DG output of 229,894 mWh).
137. *Id.* at 5.
138. *Id.*
139. *Id.*
140. Application of Tucson Electric Power Company, *supra* note 132, at 5.
141. *Id.*
142. *Id.*
143. *Id.*
144. *Id.*
145. Application of Tucson Electric Power Company, *supra* note 132, at 5.
146. *Id.*
147. *Id.* at 7.

Rate.[148] The customers could then carry over unused bill credits to future months if they exceed the amount of their current TEP bill.[149] This proposed plan would see a typical customer with rooftop solar paying an increased fee of about $22 per month.[150]

The utility argues that this is more equitable because customers who generate their own energy with solar panels rely on the company's electrical system just as much as non-net metered customers. A TEP residential customer without solar panels pays an average of $117.60 monthly in electric bills, while a typical solar energy customer pays only $15 a month.[151] The TEP proposal would increase this figure from $15 a month to $37 a month.[152] This is still less than the utility's calculation of the monthly per customer share of maintaining the grid on an average *pro rata* basis.

TEP was not the only utility to ask for the Commission's approval for net metering cost shift solutions. The Arizona Public Service Company, ("APS"), Arizona's largest electric utility, requested a reset of the LFCR Adjustment.[153] APS claimed that for every 7,800 DG systems installed, the number installed in the two-year period after the November 2013 regulatory decision and November 2015,[154] a permanent cost shift between the 'haves' and 'have-nots' of approximately $126 million over a twenty-year period is created.[155] The utility also estimates that if the current pace of installations continues through mid-2017, close to $800 million in fixed costs will be shifted to and paid by customers without DG if no further steps are taken to reduce the cost shift.[156]

The utility calculates that under the current rate design, customers with DG avoid paying approximately $804 of the fixed *pro rata* system costs each year (or $67 per month), which is unfairly shifted to, and ultimately paid by, customers without DG.[157] Even though the commission at this time found that $3/kW per month (which would be $12 for a customer system of 4 kW) was a reasonable amount to charge, it instead set a lower $0.70/kW adjustment (or approximately $2.80 per month for a 4 kW system).[158] Regulators in Arizona, where the net metering debate has been sharpest, have declined so far to modify its program as regulators seek a compromise between utilities and solar advocates.

D. Law Requires Rates Reflecting Net Benefits and Costs

1. Benefits, Costs

There are a series of benefits of distributed energy generation, which are included in the value of solar determinations of states such as Maine or Minnesota:

- Increasing power system reliability with more independent points of generation.[159] Creating a reliable and appropriately more mixed generation supply diversity for the electric power system.[160]
- Putting less pressure on the use of the aging power distribution system by utilizing on-site private power rather than moving more power through the regulated power distribution system.[161]
- Avoided distribution line losses.

Some have estimated that distributed solar PV units that transact power back to the grid are valued cumulatively between $0.09 and $0.25 per kWh.[162] When combined with power sale revenues, the total value of solar PV benefits has been estimated to be higher than the leveled cost to install PV (e.g., $0.15 to $0.41/kWh in the U.S.).[163] Using solar PV systems can add on-peak day-time value to the power transmission users,[164] although this is dependent on a case-by-case locational determination of power flow.[165]

A recent article by Harvard's Ashley Brown, a former PUC commissioner in Ohio and director of Harvard's Energy Institute, disputes whether such benefits of distributed power are more imaginary that real in actual operation.[166] Brown's analysis concludes that there is a biased overstatement of

148. *Id.*
149. *Id.*
150. Tony Davis, *TEP Would Slice Rooftop Solar Rate Benefits*, Tucson (Mar. 25, 2015),http://tucson.com/business/tep-would-slice-rooftop-solar-rate-benefits/article_a3768767-0af7-5fa4-9a45-2cbb65de3c77.html.
151. *Id.*
152. *Id.*
153. Application of Arizona Public Service Company for Approval of Net Metering Cost Shift Solution, Docket No. E-01345A-13-0248, at 1 (Ar[z. Corp. Comm'n Apr. 2, 2015), http://www.azenergyfuture.com/getmedia/731941dd-3dbb-4510-ad9c-cf67ed5b3bda/Grid-Access-Charge-Motion-to-Reset_Docket.pdf ("In late 2013, the commission began addressing the fact that customers with DG do not pay their fair share for the use of the grid, by ordering customers who install rooftop solar to pay $0.70 per month for each kW of their solar system.").
154. Erin Carson & Janis Kreilis, Enerknol Research, States Seek New Net Metering Models to Address Balance in Distributed Generation 5 (2015), https://enerknol.com/wp-content/uploads/2015/11/EKR-PU-Arizona-Net-Metering-Reform-11-9-2015.pdf.
155. Application of Arizona Public Service Company, *supra* note 153, at 2.
156. *Id.*
157. *Id.* at 3.
158. *Id.* at 4-5; *see also History of Solar Issue*, Ariz.'s Energy Future, http://www.azenergyfuture.com/access-charge/history-of-solar-issue/ (last visited Sept. 1, 2016).
159. *See* Fed. Energy Reg. Comm'n, The Potential Benefits of Distributed Generation and Rate-Related Issues That May Impede Their Expansion 2–1 (2007), https://www.ferc.gov/legal/fed-sta/exp-study.pdf; *see also* Kristopher, *Distributed Energy Basics*, Democratic Underground (July 6, 2013, 7:37 PM), http://www.democraticunderground.com/112748526.
160. *Id.*
161. *See* Edward Kahn, *Avoidable Transmission Cost Is a Substantial Benefit of Solar PV*, 21 Electricity J. 41, 45 (2008).
162. Richard Perez et al., *Solar Power Generation in the U.S.: Too Expensive, or a Bargain?*, 39 Energy Pol'y 7290, 7294 (2011). The range of value that this article attaches to wholesale power is significantly above the average weighted price of wholesale power transactions in the last several years and uses the distributed power value in New York City, a location that is capacity constrained. *See* Steven Ferrey, Law of Independent Power, *supra* note 121, § 10:144.
163. Rickerson et al., *supra* note 96, at 43 (citing Perez et al., *supra* note 162, at 7294; *see also* Lena Hansen et al., A Review Solar PV Benefit & Cost Studies 22 (Rocky Mountain Inst. 2d ed. 2013)).
164. Kahn, *supra* note 161, at 45.
165. *See* Tom Tiernan, *Attention to Good Standby Rates Seen Key as Distributed Generation Plays Bigger Role*, Electric Util. Wk. 10 (Dec. 31, 2012), https://global.factiva.com. While increased solar PV installations sited near load centers can defer substation and grid system investments, they can increase two-way power flows and add grid management costs for voltage fluctuations and equipment overload. *Id.*
166. Ashley Brown & Jillian Bunyan, *Valuation of Distributed Solar: A Qualitative View*, 27 Electricity J. 27, 31–41 (2014).

hypothetical distributed benefits where implied benefits are overstated, no solar contribution at times of system stress, no capacity value, no capacity cost savings, benefits overstated as to solar contributing to system peaks, no distribution system savings, and high back-up costs caused.[167]

2. Cost-Shift

There is a phenomenon that is unappreciated to date. It is now known that there is a shift of expenses of the grid from net metered customers to all other customers under the conventional net metering policies. This occurs because (1) net metering customers do not pay distribution costs, transmission costs, stranded costs, or taxes which are part of the distribution and transmission fees in the utility bill. Moreover, (2) since these fees typically are assessed as part of a per-unit of retail power purchase, net metering customers typically dramatically reduce or eliminate their retail power purchases.

However, in addition to this micro-level shift of financial responsibility, there is also a macro-level shift among customer classes, shifting more of this additional cost of net metering to residential customers than to industrial and commercial customers. The portion of utility expenses paid by the industrial sector of customers is decreasing as a percentage.

This is partly a function of a decline of the industrial sector of the economy. The disappearing revenues from industrial companies results in a reallocation where industry customers now supply only 17% of electricity revenues to utilities.[168] The effect is that the total electric bill of the residential sector is now 2.7 times more than the total electric bill of the industrial sector. The commercial sector is now 2.2 times more.[169]

Consequently, there is more responsibility on the residential sector of the customer base. However, there also is a geographic tilt. Year-to-date, through October of 2015, customers in the South comprised exactly 50% of residential electric utility sales nationally.[170] The other three regions of the country, the Northeast, the Midwest, and the West, together accounted for the other 50% of residential sales.[171] The biggest shift of costs to the residential sector is occurring outside the South, where net metering is more prevalent and generous. This means that where the shift is occurring, there is a smaller residential base of sales over which to spread this shift.

3. The Law

A recent article argues for not increasing costs for distributed generation's operations because "the solar rooftop customer reduces the need to use the grid to *transmit* that amount of electricity."[172] Note the use of the key verb "transmit." When new metering is used, it is not just an accounting principle. It is use of the grid to "transmit" power, which is a power system transaction which must be priced by the regulatory commission under applicable law.

By law, utility rates are designed to recover the cost of each commodity and service provided in any transaction in either direction across a utility interconnection. The system meters every transaction into the grid and every delivery and consumption from the grid. Because this is sale of an item through an individual customer meter, every consumer pays for what he or she consumes. Public utility law tracks the legal obligation to allocate costs and benefits of electricity service in a manner that is "fair and equitable," "not unduly preferential," "just and reasonable," and "non-discriminatory" among consumers.[173]

Each specific rate charged to consumers must be regulated by the state utility commission to be "just and reasonable."[174] The universal obligation imposed by federal and state laws on public utilities is to furnish service at set rates that will avoid undue or unjust discrimination among customers,[175] because "'[u]ndue' or 'unjust' discrimination among customers is prohibited."[176] Policy considerations, such as providing environmental incentives or discounting rates to certain segments of the customer base, must play a subsidiary role in the ultimate rate allocation among customer classes.[177] These principles are embedded in rate decisions of both FERC[178] and state energy regulatory commissions[179] and in principles that court review applies to actions of regulatory agencies.[180]

There is a requirement for rates to include both horizontal and vertical equity: "The principles of *horizontal equity* that 'equals should be treated equally,' and *vertical equity* that 'unequals should be treated unequally' . . . [is interpreted to mean] that equal . . . cost causers for the provision of a good or service should pay the same . . . prices."[181] Horizontal equity among different customer classes, based on cost of service, is a goal: It is illegal for a state to set rates that "grant any undue preference or advantage to any person or subject any person to any undue prejudice or disadvantage."[182] An electric power customer only needs to show substantial

167. *Id.*
168. Steve Mitnick, *Electricity's Revenues Down in 2015*, Pub. Util. Fort. (Feb. 8, 2016), http://us2.campaign-archive2.com/?u=885e77a4ab25dfc514b9e4332&id=484ae0ec27&e=90664aec32.
169. *Id.*
170. *Id.*
171. *Id.*
172. Charles J. Cicchetti & Jon Wellinghof, *Solar Battle Lines*, Pub. Util. Fort. (Dec. 2015), http://www.fortnightly.com/fortnightly/2015/12/solar-battle-lines?page=0%2C4&authkey=153bb49c0b7285ccc65a24fe12b0db75632e6e8862ea5b642590ab256bb68b19#sthash.C4a0LGXM.dpuf (emphasis added).
173. Paul Hibbard et al., *EPA's Clean Power Plan: States' Tools for Reducing Costs and Increasing Benefits to Consumers*, Analysis Grp. 29 (July 2014), http://www.analysisgroup.com/uploadedfiles/content/insights/publishing/analysis_group_epa_clean_power_plan_report.pdf.
174. 16 U.S.C. § 824d(a) (2012).
175. James C. Bonbright et al., Principles of Public Utility Rates 515, 559 (2d ed. 1988). If an electric plant is operating near full capacity, higher charges for on-peak versus off-peak would actually be required to avoid discrimination. *Id.* at 528.
176. Charles F. Phillips Jr., The Regulation of Public Utilities: Theory and Practice 434 (3d ed. 1993).
177. Bonbright et al., *supra* note 175, at 524.
178. Ala. Elec. Coop., Inc. v. FERC, 684 F.2d 20, 21, 27 (D.C. Cir. 1982).
179. Mich. Comp. Laws §§ 460.557(3), (4) (2015); *see also* Tex. Util. Code Ann. §§ 36.003(a), (b), (c) (West 2007).
180. *Ala. Elec. Coop., Inc.*, 684 F.2d at 27.
181. Bonbright et al., *supra* note 175, at 568.
182. 16 U.S.C. § 824d(b)(1) (2012).

vertical disparity in rates between customers of the same class in order to raise questions of discriminatory or preferential rates.[183] The rate charged to one group should not impose a cost burden derived from a different pricing policy of another group.[184]

Section 205 of the Federal Power Act prohibits utilities from granting any "undue preference or advantage to any person or . . . maintain[ing] any unreasonable difference in rates . . . either as between localities or as between classes of service."[185] FERC regulations specify that it is illegal to discriminate in rates between customers of the same class.[186] Utility rates should accurately reflect the cost of serving each customer class rather than the individual within that class.[187] There should be horizontal equity between different customer classes and vertical equity among customers of different amounts of electricity usage within the customer class.[188] The U.S. Supreme Court has refused to intervene in the pricing decisions for distributed renewable power made by state regulatory officials. The U.S. Supreme Court declined to review in 2016 a petition arguing that an Iowa power utility must pay wind turbines higher rates than what it pays to purchase electricity from other generators.[189] This rate was below the so-called PURPA "avoided cost" rate.[190] Therefore, there are not allowed under law to be any non-cost-based cross-subsidies among similarly situated customers. RPS and net metering each cross-subsidize one group of consumers by imposing the total program subsidy costs on other groups of the utility's consumers; utilities recoup costs from required discounts to a given class of customers through an invisible charge imposed on the utility bills of other classes of customers.[191] FERC regulations and orders specify that rates and tariffs, which discriminate in rates between customers of the same class, are not allowed.[192] So the question is whether the amount of cross-subsidy accurately and quantitatively reflects the value of the transaction. If so, it is consistent with precedent.

Each of these forms of subsidy redistributes income from one group of utility customers to another group. The ratemaking allocation is a zero-sum game: One class's gain is the other classes' increased costs, dollar for dollar. A public utility regulatory commission lacks the power to approve the collection of unjust, unreasonable, discriminatory, preferential, or prejudicial rates.[193] When contested, the majority of legal challenges to policies of differentiated or discounted rates have been based on the equal protection clause of the applicable state constitution.[194]

III. Between the Poles: A Failure to Act

Between these two poles of state action, set forth above, are different results. In the vast majority of the forty-four net metering states that have implemented net metering even if the program is now capped or closed, the retail rate is afforded for the non-retail net metering transaction. What is clear regarding forty-one of the forty-four net metering states is that the retail meter retail rate is not the cost of providing this net metering service. A net metering transaction uses the utility's distribution system twice—once when power is exported from the customer back to the utility and must be sold by the utility elsewhere immediately or lost as waste heat because electricity cannot be stored. The distribution system is used again as part of the same net metering transaction when the customer takes back not the same electricity—which only has a 'life' of a few seconds and has been long gone—but new electricity.[195]

However, there are three states that are engaged in larger evaluations of their regulated utility functions, in which the value of net metering should—but may or may not—be quantitatively evaluated and reset at the objective value.

A. New York—REV

In New York, the New York Public Service Commission ("NYPSC") launched a regulatory proceeding to reform the state's energy industry and regulatory practices.[196] This could eventually monetize the value of distributed renewable generation and net metering transactions, or not, depending on how things progress.[197] Of note, this rubric requires development of new pricing and tariffs for demand-response contributions, energy storage, and distributed resources, which if done correctly, would value the net costs and benefits of

183. Pub. Serv. Co. Ind. v. FERC, 575 F.2d 1204, 1212 (7th Cir. 1978), *aff'd sub nom.* City of Frankfort, Ind. v. FERC, 678 F.2d 699 (7th Cir. 1982).
184. Bonbright et al., *supra* note 175, at 568.
185. 16 U.S.C. § 824d(b) (2012).
186. *Pub. Serv. Co. Ind.*, 575 F.2d at 1212; Wis. Mich. Power Co., 54 Pub. Util. Rep. 3d (PUR) 321 (Fed. Power Comm'n 1964) ("Section 205 [of the Power Act] does not prohibit all rate distinctions but only rate discrimination as between customers of same class."); Steven Ferrey, The New Rules, *supra* note 6, at 26.
187. *See* Steven Ferrey, E&E, *supra* note 104, at 604; *see also Am. Elec. Power Serv. Corp.*, 67 FERC ¶¶ 61,168, 61,487 (1994).
188. *See* Steven Ferrey, E&E, *supra* note 104, at 583; *see also Am. Elec. Power Serv. Corp.*, 67 FERC ¶ 61,490 (explaining that the "focal point of claims of undue discrimination has changed from discrimination in the treatment of different customers to discrimination in the rates and services the utility offers third parties when compared to its own use of the transmission system").
189. Swecker v. Midland Power Coop., 807 F.3d 883 (2015), *cert. denied*, 136 S. Ct. 990 (2016).
190. For more information on avoided cost rates, see Steven Ferrey, Law of Independent Power, *supra* note 121, §§ 4, 7. An "avoided cost" rate is the cost that the purchasing utility, Midland, would avoid by not having to purchase that amount of energy from a different source. *Id.*
191. *See* Steven Ferrey, Law of Independent Power, *supra* note 121, § 10:17; Steven Ferrey, The New Rules, *supra* note 6, at 341.
192. *Pub. Serv. Co. Ind.*, 575 F.2d at 1212; Wis. Mich. Power Co., 54 Pub. Util. Rep. 3d (PUR) 321 (Fed. Power Comm'n 1964).
193. 73 B C.J.S. Public Utilities § 32 (2013).
194. Steven Ferrey, Law of Independent Power, *supra* note 121, § 10:17; *see also* Mountain States Legal Found. v. Pub. Utils. Comm'n, 590 P.2d 495, 496–97 (Colo. 1979); Re Cent. Me. Power Co., 26 Pub. Util. Rep. 4th (PUR) 388, 430 (Me. 1978); Pa. Pub. Util. Comm'n v. Phila. Elec. Co., 91 Pub. Util. Rep. 3d (PUR) 321, 373 (Pa. 1971).
195. *See* discussion *supra* Section II.B.2.
196. Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision, Order Instituting Proceeding, New York P.S.C. CASE 14-M-0101, Apr. 25, 2014.
197. *Id.* The policy objectives articulated by the NYPSC include: (i) enhanced customer knowledge and tools that will support effective management of their total energy bill; (ii) market animation and leverage of ratepayer contributions; (iii) system wide efficiency; (iv) fuel and resource diversity; (v) system reliability and resiliency; and (vi) reduction of carbon emissions. *Id.* at 2.

distributed generation, and assign the ancillary costs of electricity storage to the cost causers.[198]

Before it determined the net costs and benefits, New York increased the allowed amount of net metering accepted by its regulated utilities. Prompted by requests from several solar energy advocates, the NYPSC doubled, from 3% of each utility total system load to 6% of each utility total system peak load, the amount of the utility's retail sales which could be net metered annually.[199] State law established minimum net metering capacity purchases at just 1% of 2005 load, until 2013 when the cap was increased to 3%.[200] The order also bestows upon the Commission the authority to increase the renewable energy net metering minimum percentage as circumstances require.[201]

New York circumstances required it to increase the renewable energy net metering amount while still qualifying for the full retail rate, which has no relationship to the net value and cost of net metered power. The Commission conceded that net metering, while a boom for net metered customers, does impose further costs on utilities when (1) integrating the net metering generation into their distribution systems, (2) administering bills for net metered ratepayers, and (3) accounting for some revenues lost when a customer produces much more generation than they consume.[202] Thus, the Commission said, it must strike a proper balance ensuring that non-net metered customers are not forced to overly subsidize the program.[203]

B. California

California now is undergoing a required assessment of its substantial influx of intermittent distributed solar power development. In less than a decade, distributed solar power could cut demand for central power almost in half, but only at certain sunny times of the day, leaving other periods untouched. At U.S. latitudes, a solar panel can generate significantly less than 20% of its rated full capacity. It does not follow necessarily that fewer power plants would be needed, because for the vast majority of hours during the year, solar and wind projects do not generate, and other conventional power options must fill this gap.[204] If solar is part of the bulk generation supply, there is increased stress on remaining generation as it works to meet the steep increase in conventional demand from afternoon to evening loads.[205]

The projected growth for residential solar power can only make a limited contribution to serve the late afternoon major utility system demand peak, but has a huge impact on greatly displacing traditional mid-day "shoulder" loads between peak and off-peak times.[206] And the slope of the late afternoon peak becomes increasingly steep each successive year in terms of needing to ramp up massive amounts of additional conventional power very quickly as solar rapidly fades each afternoon. Steeply sloped curves of DG generation contribution can be difficult for a system, increasing the risk of overgeneration during the afternoon and increased need for hard ramping of fossil-fuel units in the afternoon just as demand is increasing and solar is stopping.[207]

California legislation enacted in 2013 required regulators to revisit the net metering program to ensure that solar customers pay an appropriate portion of utility grid costs. What was added is a new requirement that net metering customers must pay a one-time "non-bypassable" interconnection fee that can be as high as $150, which proceeds are used to fund low-income and energy efficiency programs.[208] California had an opportunity to determine the value of solar or other distributed power to its grid, but declined to do so. Instead, it continued net metering at full retail value.[209]

At the end of 2012, the state's three largest investor owned utilities had approximately 150,000 customers enrolled in net metering, totaling 1,300 mW of installed capacity.[210] Collectively these systems generated about 2,400 GWh of electricity during 2012.[211] In performing the cost-benefit analysis of net metering, the California Public Utility Commission compared the reduction in net energy metered shown on customer bills, which translates to utility revenues, to the reduction in utility costs from net metering.[212] The commission analysis found that net-metered generation resulted at that time in a net annual cost ranging between $79 million and $252 million, with the additional net costs subsidized by other ratepayers not participating in the net-metering program.[213] The com-

198. Elisa Wood, *Should New York Be Wary of Utility Monopolies in Distributed Energy?*, Microgrid Knowledge (Sept. 4, 2014), https://microgridknowledge.com/new-york-wary-utility-monopolies-rev/.

199. *Recent Rulings From New York*, 4207 PUR Util. Reg. News 6 (Feb. 6, 2015); *see also Key Documents*, DPS—Reforming the Energy Vision, http://www3.dps.ny.gov/W/PSCWeb.nsf/All/C12C0A18F55877E785257E6F005D533E (last visited Nov. 16, 2016).

200. *Id.*

201. As it had found previously when raising the net metering purchase limit from 1% to 3%, the Commission in the instance case determined that as more solar projects are constructed, demand for the associated capacity likewise will increase. Therefore, in order to maintain momentum for solar power, as well as other forms of renewable energy, the cap on net metering must keep pace with additional self-sited installations. *See* N.Y. Pub. Serv., Proceeding on Motion of the Commission as to the Policies, Requirements and Conditions for Implementing a Community Net Metering Program, No. 15-E-0082 (Oct. 16, 2015), http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7b7E6BB87C-3A85-4A22-B24F-45D9E645CF41%7d.

202. *Id.*

203. *Id.*

204. *See generally* Planning Engineer, *More Renewables? Watch Out for the Duck Curve*, Climate Etc. (Nov. 5, 2014), http://judithcurry.com/2014/11/05/more-renewables-watch-out-for-the-duck-curve/.

205. *See id.*; discussion *supra* Sections II.B.1, III.C.

206. *See* Planning Engineer, *supra* note 204.

207. *See id.*

208. Carolyn Whetzel, *California Extends Payments for Rooftop Solar Customers*, Bloomberg BNA, Jan. 28, 2016, http://www.bna.com/california-extends-payments-n57982066706/.

209. The decision was made in a 3–2 vote by the Commission. PUC Commissioner Michael Florio stated: "I understand that the solar industry was feeling nervous" after Nevada, and "[t]here was zero chance that California would do something like Nevada." Florio said the revised proposal provides a benefit the solar industry didn't need, especially after Congress extended the investment tax credit. *Id.*

210. Ehren Seybert et al., *California Net Energy Metering Ratepayer Impacts Evaluation*, Cal. Pub. Util. Commission 4 (Oct. 2013), http://www.cpuc.ca.gov/NR/rdonlyres/75573B69-D5C8-45D3-BE22-3074EAB16D87/0/NEMReport.pdf.

211. *Id.*

212. Energy & Envtl. Econ., Inc., California Net Energy Metering (NEM) Draft Cost-Effectiveness Evaluation 3 (Sept. 26, 2013).

213. *Id.* at 20–21, 82.

mission related that such costs would reach between $370 million and $1 billion per year by 2020 under existing California DG build-out goals.[214] Such costs notwithstanding, the commission commented that the study also indicated that net-metering customers "appear to be paying slightly more than their full cost of service."[215]

If the total installed capacity in California of solar generation qualifying for net metered reached 2,550 mW by 2017, as projected, the total cost per year would rise to approximately $137 million in 2020.[216] The projected rate would then be $0.168 per kilowatt-hour in 2020, with an average rate impact of $0.00064 per kilowatt-hour.[217] The California utilities disagreed, projecting a revenue loss up to $1.4 billion in lost revenues.[218] The utilities in California also estimated that if these costs were spread evenly among the 7.6 million traditional customers, each customer would experience an average annual increase of $185 in electricity costs.[219]

Proposed changes in California include a plan to eventually start charging customers $10/month to cover the basic costs of service.[220] The three California utilities now employ a four-tier rate structure in which customers using the most electricity pay an average of $0.34/kWh, more than double the $0.14/kWh average rate for residential consumers that consume the least electricity.[221] The average wholesale electricity price in California for the first half of 2013 was $0.0424/kWh, while the retail price in October 2013 was $15.71/kWh for retail customers and about $0.01/kWh less for commercial customers and about $0.04/kWh less for industrial customers, but the retail residential price later rose to $0.1767/kWh.[222]

Therefore, when the utilities are paying solar customers the full retail price, they are paying almost 400% more than they would for energy from other sources.[223] Net metering customers in California are paying 81% of their full cost of service.[224] If so, utilities are losing 19% of the cost-of-service on average from each net metering customer, causing the utilities to pass these losses on to remaining customers in the form of higher bills. The California legislature directed the state's Public Utility Commission to come up with a new program by 2017 that ensures non-solar customers are not unfairly burdened by having to pay for the grid.[225]

C. Massachusetts Net Metering Revaluation

Current Governor Baker proposed a change to Massachusetts' net metering program after he took office in 2015. Massachusetts has the most far-reaching net metering program of all the forty-four states.[226] He proposed differentiating how net metering would be treated before or after achieving the state's solar energy target. The legislature had raised the caps on the amount allowed for net metering from its original 1% of each utility's peak load successively until it was 11% of peak load, divided between a private and public credit off-taker subset.[227] The net metering caps, which had been filled repeatedly, when the legislation was enacted are expanded again for additional net metering units for private customers the percentage shall not exceed 7% of the distribution company's peak load; and the capacity of net metering facilities of a municipality or other governmental entity shall not exceed 8% of the distribution company's peak load.[228] So 15% of all demand for power could be net metered up from the original 1% and current 11%.[229] The eventually enacted legislation raised the cap to 15% of each electric utility's highest historic 15-minute peak load amount, with 7% of this total for private net metering off-takers and 8% for public off-takers.[230] This 15% of peak load cap represents approximately double

214. *Id.* at 20.
215. Order Instituting Rulemaking Regarding Policies, Procedures and Rules for the California Solar Initiative, Decision No. 14-03-041, Rulemaking 12-11-005, at 3, Mar. 27, 2014 (Cal. P.U.C.). The CPUC explained that one of the key drivers of the magnitude of any cost impact is what generation is measured: all of the net metered generation, or only the electricity generated that is exported to the grid. *Id*.
216. Energy & Envtl. Econ., Inc., *supra* note 212, at 74.
217. *Id.* at 5–6, 78–79. This study estimates that the net total through 2008 is approximately $20 million per year. If the average retail rate for electricity in California at the time was $0.144 per kilowatt-hour, net metering costs as indicated in the E3 study have an average impact of one one-hundredth of one cent per kilowatt-hour. *Id.* The goal of achieving 12,000 mW of installed local renewable energy by 2020 would also add to cost of net metering. *Id.* If net metering qualifying installations rise to over 5000 mW by 2020, using E3's conservative assumptions, cost per year would be roughly $269 million with an average rate impact of roughly one-tenth of one center per kilowatt-hour. *Id.*
218. Diane Cardwell, *Utilities Confront Fresh Threat: Do-It-Yourself Power*, N.Y. Times, July 26, 2013.
219. *Id.*
220. *California May Adopt Time-of-Use Electric Rates*, Argus (Apr. 23, 2015, 5:49 PM), http://www.argusmedia.com/News/Article?id=1027978. California Assembly Bill No. 327 modifies the utility rate structures for residential residents, and allows utilities to flatten the higher prices per kilowatt-hour that heavy residential power users pay for marginal amounts of electricity used on a month-by-month basis, and in turn allows the utilities to potentially charge flat monthly fees to all residential customers. One of the major reforms of the bill is that it allows the CPUC to consider flattening the rate structure and lowering high-end costs that could ultimately lead to lower reimbursement rates for rooftop solar residents. The current system ranges from about 13 cents per kWh for lower tiers to 33 cents per kWh for upper tiers with spikes in past years up to as high as 50 cents per kWh. Jeff St. John, *AB327: The Dark Side for California Solar*, Greentech Media (Sept. 4, 2013), http://www.greentechmedia.com/articles/read/ab-327-the-dark-side-for-california-solar. Second, the bill also allows utilities to impose flat monthly fees on utility bills to offset fixed operational costs. The bill sets the cap for these fees at $10 per month. While this clearly would affect the cost benefits for solar customers, it is worth noting that this would at least ensure that solar customers would be paying something, perhaps the cost of grid maintenance and transmission. *See* Chris Meehan, *Malicious Bill in California Gets a Rooftop Solar-Friendly Makeover*, Solar Reviews (Sept. 4, 2013), http://www.solarreviews.com/news/california-bill-gets-rooftop-solar-friendly-090413/.
221. *California May Adopt Time-of-Use Electric Rates*, *supra* note 220.
222. Ronald Hankey et al., Electric Power Monthly With Data for April 2016, U.S. Energy Info. Admin. tbl. 6.2B (July 2016), http://www.eia.gov/electricity/monthly/pdf/epm.pdf; *see also* U.S. Energy Info. Admin., Electric Power Monthly With Data for November 2013 tbl. 5.6A (Jan. 2014), www.eia.gov/electricity/monthly/current_year/january2014.pdf.
223. *California Public Utilities Commission Report on Net Metering*, Inst. for Energy Res. (Oct. 23, 2013), http://instituteforenergyresearch.org/analysis/california-public-utility-commission-cpuc-report/#_ftnref4.
224. *Id.*
225. Ker Than, *As Solar Power Grows, Dispute Flares Over U.S. Utility Bills*, Nat'l Geographic (Dec. 24, 2013), http://news.nationalgeographic.com/news/energy/2013/12/131226-utilities-dispute-net-metering-for-solar/.
226. *See* discussion *supra* Section I.A.
227. S.B. 1979, 2016 Leg. Serv., 2nd Sess., Ch. 75 (Mass. 2016).
228. *Id.*
229. *See* discussion *supra* Section I.A.
230. Mass. Gen. Laws ch. 359, § 29 (2010).

that amount (30%) of average utility load, and is one of the highest net metering caps in the United States.

The affected state utilities and Associated Industries of Massachusetts argued that the lost revenue from this net metering program, the most permissive in the country, was being invisibly added to the bills of all retail consumers as an increased distribution charge when, as a generation component, it had nothing to do with the *distribution* of power to these consumers.[231] Throughout this entire phase, the state Department of Public Utilities never made any quantification of the value of solar projects to the system.

Revision to net metering was enacted in April 2016. Of most importance, under the new proposal, the state utility regulatory agency would be empowered to create a fair tariff for net metering transactions.[232] As proposed, after the state target of 1600 mW of solar power is met, which was supposed to take the state from April 2016 until 2020, additional net metering units would not receive the generous (near retail value) net metering credits, but credits at a reduced 60% value.[233] Smaller units of typical rooftop size continue indefinitely to realize the traditional full-credit value, as do "public" solar net metering facilities (those facilities with a public entity "host customer" and all public entity off-takers of the credits), then-existing solar net metering facilities, and wind and anaerobic digester net metering facilities.[234] However, the supposed 4-year extension of net metering from April 2016–2020 for one of two of the state's large utilities was totally subscribed by summer 2016.

D. Retail Rates Are Not the Correct Net Metering Rate

The California Public Utility Commission Division of Ratepayer Advocates criticized the rapid escalation in California ratepayer costs to achieve the state Renewable Portfolio Standard ("RPS") mandate.[235] The cost of RPS compliance exceeded the cost of generating the power.[236] Spain, which handsomely cross-subsidizes renewable energy generation, now pays almost 1% of its GDP in subsidies for renewables, which is more than it spends on higher education.[237]

Consumers traditionally are charged for electric service as a function of the quantity of power purchased rather than for a set package or use of services based on fixed costs. When fixed utility grid costs are allocated to a smaller volume of sales, remaining in service increases retail electricity costs.[238] NRG Energy noted that more distributed solar and wind power is forcing utilities to spread their increasing fixed costs over fewer customers, therefore increasing the cost of service to remaining customers.[239]

State governments receive significant taxes embedded in typical utility bills and local governments receive property taxes on utility poles and wires, whose value could be decreased as a lesser amount of power flowing through them.[240] Regulated utility companies pay taxes based on net income and on gross receipts.[241] As self-generation and competition absorbs more power creation and supply, both utility gross receipts and state tax receipts decline correspondingly.

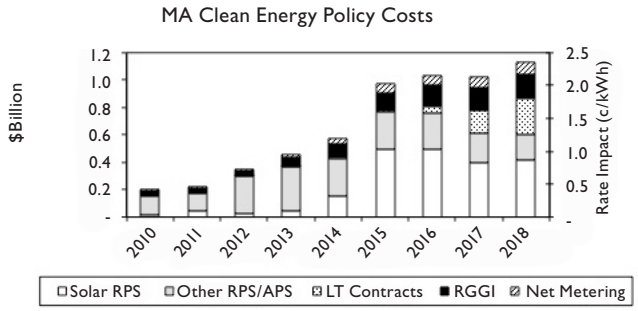
On the East coast, the large investor-owned utility company National Grid estimated that its net metering costs would more than triple by the end of 2015, to $0.93/month.[242] Utilities in California estimate that net metering may result in as much as $1.4 billion a year in lost revenue, which will have to be added to the bills of non-net-metering customers.[243] The California Public Utility Commission reported that by 2020, net metering could cost non-solar electricity customers $370 million to $1.1 billion per year.[244] San Diego Gas & Electric Company declared that net metering provided an "unfair and unsustainable subsidy" of approximately $34 from each other customer to net metering customers.[245]

As set forth above,[246] there also are additional real costs associated with necessary greater amounts of spinning reserve and back-up power, which impose additional costs on maintenance of system reliability that were not there before.[247] National Grid estimated the cost of $3.95/month per residential customer to pay for the Massachusetts RPS program was expected to rise by $1/month by 2015.[248] Utilities are ordered

231. *See* E-mail from Robert A. Rio, Senior Vice President & Counsel, Associated Indus. of Mass., to Susan Leavitt, Exec. Assistant, Mass. Dep't of Energy & Res. (Sept. 9, 2009), http://www.mass.gov/eea/docs/doer/renewables/solar/aim-robert-rio.pdf.
232. H.B. 3724, 189th Sess. (Mass. 2015).
233. *Id.* ("[H]owever, (i) net metering facilities of a municipality or other governmental entity, and (ii) eligible recipients of credits from community shared net metering, as defined by the department of energy resources pursuant to section 11J of chapter 25A, shall receive a credit equal to the basic service kilowatt-hour charge in the ISO-NE load zone where the customer is located."). *See* S.B. 1979, 2016 Leg. Serv., 2nd Sess., Ch. 75 (Mass. 2016).
234. *Id.*
235. Geoffrey Craig, *Renewable Costs of California's Three Big Utilities Soared Last Year, CPUC Data Shows*, Electric Util. Wk. 18 (Feb. 13, 2012).
236. *Id.*
237. Davies & Allen, *supra* note 89, at 975.
238. Jeff McMahon, *Steven Chu Solves Utility Companies' Death Spiral*, FORBES, Mar. 21, 2014, http://www.forbes.com/sites/je ffmcmahon/2014/03/21/steven-chu-solves-utility-companies-death-spiral/; *see also* Herman Trabish, *California PUC President: The Utility Death Spiral Is "Last Year's Hype,"* Greentech Media (Jan. 29, 2014), http://www.greentechmedia.com/articles/read/The-Utility-Death-Spiral-is-Last-Years- Hype-California-PUC- President.
239. Andrew Engblom, *NRG CEO: Distributed Generation a "Mortal Threat" to Utilities*, SNL Energy (Mar. 22, 2013).
240. *See* Steven Ferrey, Law of Independent Power, *supra* note 121, §§ 10:78-10:86.
241. Sheldon Silver, The Electric Industry in New York, Assemb. Standing Comm. on Energy tbl. 3 (1996), http://assembly.state.ny.us/Reports/Energy/199710/#III.%20FACTORS%20AFFECTING%20ELECTRICITY%20 (regulated utility companies pay taxes based on net income and on gross receipts. Taxes imposed on utilities include the 9A Corporate franchise Tax, the Gross Receipts Tax and the Sales/Use Tax. There also can be local taxes including business income/gross receipts taxes, sales taxes and property taxes); *see also* Marilyn Marks Rubin, *A Guide to New York State Taxes: History, Issues and Concerns* (Feb. 2011), http://pjsc.magikcms.com/Tax%20guides/StateGuideWeb.pdf.
242. Bruce Mohl, *The Back Story: Green Energy Costs Raising Concerns*, Commonwealth Mag., Aug. 8, 2013, http://commonwealthmagazine.org/environment/004-green-energy-costs-rasing-concerns/.
243. Diane Cardwell, *On Rooftops, a Rival for Utilities*, N.Y. Times, July 26, 2013, at B1.
244. Than, *supra* note 225.
245. Lisa Weinzimer, *Consumer and Solar Groups Pan SDG&E's Planned Surcharge, Saying It May Be Illegal*, Elec. Util. Wk., Nov. 21, 2011, at 18.
246. *See* discussion *supra* Section III.C.
247. *See* Puga, *supra* note 93, at 34–35.
248. Mohl, *supra* note 242.

Figure 2

- Incremental costs of clean energy policies is material portion of rates
- RPS requirements continue to grow in all states



Estimated 2015 RPS Rate Impacts

	RPS Component (c/kWh)
MA	1.6
CT	0.75
NH	0.60

James Daly, *Restructuring Roundtable: New England Electric Rates and Market Drivers*, Northeast Util. (Nov. 21, 2014), http://www.raabassociates.org/Articles/Daly%20Presentation%20Final%2011.21.14.pptx.

by state regulators to be the agents of this change, and in most states the costs of these significant cross-subsidies are not revealed on the customers' bills, as is the breakdown of the other detailed components of electricity cost (the power commodity, transmission, distribution, stranded costs, etc.).[249] The costs estimated by Eversource Utilities are displayed in Figure 2.[250]

Distributed renewable energy subsidies through the miscalculation of distributed power rates have recently been cut in Belgium, Germany, Greece, Italy, Spain, and the United Kingdom.[251] Idaho sought to lower the amount paid to net-metering facilities in the state, to avoid a significant cross subsidization of one customer group by another group of participating and non-participating net-metering customers.[252] Virginia introduced legislation to allow Dominion Virginia Power to collect a standby charge from customers with net-metered systems larger than 10 kW.[253] There have also been proposals on net-metered tariff changes in Arizona and Georgia.[254]

IV. The Spinning Direction of Future Meters

Use of renewable energy continues to grow rapidly in the U.S. Electricity generated from distributed renewable energy technologies during calendar year 2013, which included the largest renewable energy source of conventional hydropower, represented 13% of total U.S. electricity consumption, which was an increase from 9% in 2005.[255] In 2012, wind energy was the most deployed new U.S. electricity generation capacity, contributing 43% of all new electric generation.[256] Wind energy provided 4.3% of U.S. power supplies in 2013.[257] In the approximately 5 years between 2009 and 2015, the increase in U.S. wind generation tripled, while solar generation grew by 2000 percent."[258] This growth has not abated, the global expenditure on renewable energy is forecast to grow to $460 billion per year by 2030.[259]

Net metering is the primary subsidy for renewable energy in the United States. There are two poles of state net meter action. In the middle of the few states at either pole, in approximately forty of the forty-four net metering states, state regulatory commissions have miss-assigned net metering transactions a value as if they were a retail sale of power. One can argue whether this overcompensates the 1% of net metering customers at the expense of the other 99% of customers, or the opposite. Nonetheless, it is incontrovertible that this retail meter retail rate is not the cost of providing this service.

A net metering transaction uses the utility's distribution system twice—once when power is exported from the customer back to the utility and must be sold by the utility elsewhere immediately or lost as waste heat because electricity cannot be stored.[260] The distribution system is used a second time as part of the same net metering transaction at a later date when the customer takes back not the same electricity—which only has a 'life' of a few seconds and has been long gone[261]—but new electricity produced. For this usage of the capacity of the distribution system twice to move different electrons into and out of the distribution grid at two different times, the net metering customer pays for neither. By consuming the re-transmission of credited net metered power, net metering customers are not accessed any distribution

249. *See, e.g.*, NSTAR monthly bill (on file with author).
250. James Daly, *Restructuring Roundtable: New England Electric Rates and Market Drivers*, Northeast Util. (Nov. 21, 2014), http://www.raabassociates.org/Articles/Daly%20Presentation%20Final%2011.21.14.pptx.
251. Steve Goreham, *Lessons From Europe: Recipe for a High-Cost Energy System*, Communities Digital News, May 26, 2015, http://www.commdiginews.com/business-2/economic-politics/lessons-from-europe-recipe-for-a-high-cost-energy-system-42285/#8xCV2TmKmxZzK3XS.99.
252. Idaho Pub. Util. Comm'n, Idaho Power Company's Application for Authority to Modify Its Net Metering Service and to Increase the Generation Capacity Limit, Case No. IPC-E-12-27, Order No. 32767 (Mar. 25, 2013), http://www.puc.idaho.gov/fileroom/cases/elec/IPC/IPCE1227/ordnotc/20130325NOTICE_OF_SCHEDULE_ORDER_NO_32767.PDF.
253. *Net Metering*, DSIRE (Dec. 1, 2015), http://programs.dsireusa.org/system/program/detail/40.
254. *See Standby & Fixed Cost Charges and Net Energy Metering Debates: Current Status (Aug. 2014)*, N.C. Clean Energy Tech. Ctr., http://nccleantech.ncsu.edu/wp-content/uploads/State-Status-of-NEM-Standby-+-Fixed-Cost-Charge-Debates_V2.pdf.
255. Clean Power Plan, 80 Fed. Reg. 64,695 (Oct. 23, 2015) (to be codified at 40 C.F.R. pt. 60) [hereinafter Clean Power Plan] (citations omitted).
256. *Energy Dept. Reports: U.S. Wind Energy Production and Manufacturing Reaches Record Heights*, U.S. Dep't of Energy (Aug. 6, 2013, 8:00 AM), http://energy.gov/articles/energy-dept-reports-us-wind-energy-production-and-manufacturing-reaches-record-highs.
257. *Id.*
258. Clean Power Plan, *supra* note 255.
259. *Id.* (citing *Global Renewable Energy Market Outlook*, Bloomberg New Energy Fin. 1 (Nov. 6, 2011), http://bnef.com/WhitePapers/download/53).
260. *See* discussion *supra* Section II.B.2.
261. *Id.*

costs for this power delivered to them. So the distribution service is provided for free to net metered customers—twice, and the shifting of these costs is made to all other customers who still consume traditional power.

While net metering is the most used renewable energy subsidy in the U.S., it still only benefits approximately 1% of U.S. consumers. The transmission network, which was recognized by engineers as the most important engineering feat of the 20th century,[262] still must be maintained for there to be delivery of electricity. Utility rates are a zero-sum game: The cost of this usage of the distribution system is shifted to all other customers of the utility.

The job of state utility commissions is to set the price associated with any transactions between their regulated utilities and their retail customers in the state. They do this by setting rates for power, distribution, transition costs caused by system change, renewable energy charges, energy efficient charges, and taxes added to utility bills. The convenient use of the retail rate for net metering bears no relationship whatsoever to the transaction that occurs with net metering. Forty-two of the forty-four states which have implemented net metering, at one time or another, have not done this. Now, two states have recognized and remedied the omissions,[263] with a few more states potentially following behind.[264] The value of the net metering transaction needs to be determined and ordered as the correct rate for net metering.[265]

States will totally avoid legal challenges if they base their net metering or other transaction values and rates on a quantitatively determined on-the-record net value of solar (or other renewable power) to their systems and grids. Legal precedent creates an affirmative obligation for states to establish cost-based tariffs and orders for any determinations. Most net metering states still need to undertake this cost-tracking regulatory exercise to set a value-of-solar or value-of-net-metering rate.

262. Mason Willrich, *Electricity Transmission Policy for America: Enabling a Smart Grid, End to End*, 22 Electricity J. 77, 77 (2009)

263. *See* discussion *supra* Section II.A.
264. *See* discussion *supra* Section II.C.
265. *See* discussion *supra* Sections III.A, III.B, III.C.