

Wind and Solar Power in the United States: Status and Prospects

Michael B McElroy and Xinyu Chen, *Member, IEEE*

Abstract—The United States has committed to reduce its greenhouse gas emissions by 26%–28% by 2025 and by 83% by 2050 relative to 2005. Meeting these objectives will require major investments in renewable energy options, particularly wind and solar. These investments are promoted at the federal level by a variety of tax credits, and at the state level by requirements for utilities to include specific fractions of renewable energy in their portfolios (Renewable Portfolio Standards) and by opportunities for rooftop PV systems to transfer excess power to utilities through net metering, allowing meters to operate in reverse. The paper discusses the current status of these incentives.

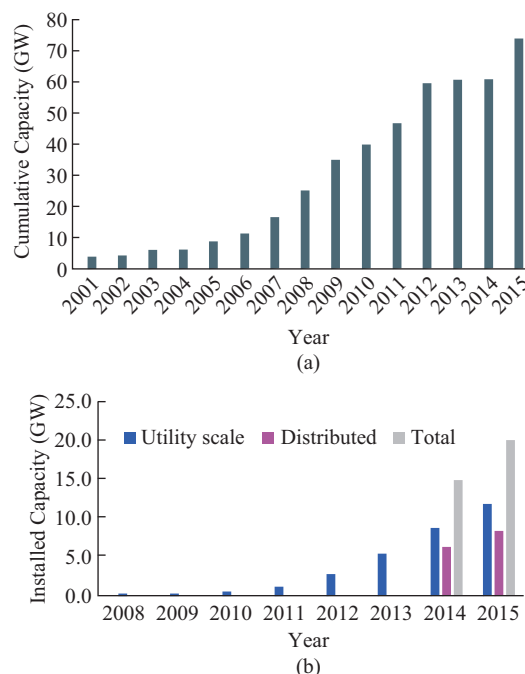
Index Terms—Incentives, net metering, renewable energy, renewable energy portfolio.

I. INTRODUCTION

THE immediate objective for US climate policy is to reduce emissions of greenhouse gases by 26% to 28% by 2025 relative to 2005. The longer-term objective targets a reduction of 83% by 2050 [1]. Meeting these objectives will require an important increase in the use of renewable sources of energy, notably wind and solar. This paper provides an account of the policy options that have been implemented in the US, at both the national and state levels, to advance this objective.

Investments in wind generating capacity have increased rapidly in the US in recent years. From a level of 1.6 GW in 1996, the total installed capacity for wind had risen to 74 GW by 2015 [2]. Growth in solar power capacity has been similarly impressive, although the take off in this case has developed more recently. Total installed PV capacity amounted to about 350 MW in 2006. By 2015 it had increased to 20 GW with 11.6 GW represented by utility scale systems, with 8.4 GW contributed by distributed (roof-top) sources [3]. Recent trends in investments in both wind and solar are indicated in Fig. 1.

An additional 1.7 GW of solar sourced electricity was available in 2015 in the form of concentrated solar power (CSP) [3]. Rather than converting sunlight directly to electricity, as is the



Source: Wind data from American Wind Energy Association [1]; solar data from EIA [2].

Fig. 1. The cumulative installed capacities of wind power (a) and solar PV (b) in United States.

case with PV, CSP functions by focusing sunlight to heat a fluid, employed the resulting energy to produce steam to fuel a conventional generation system. CSP systems are typically more expensive than PV alternatives. They have the advantage, though, that they have at least a limited ability to store energy and are capable thus of producing power even when the sun is not shining, at night for example.

Concurrent with the increase in investments in wind and solar capacities has been an important decline, in both instances, in capital costs. According to a report by Lazard [4], levelized costs of electricity (LCOE) generated using wind decreased by 61% over the past 6 years. The decrease for solar PV has been even more impressive, 82%. Onshore wind, even in the absence of subsidies, is already cost competitive with alternative sources including not just coal and nuclear but also natural gas despite historically low recent prices for the latter commodity.

The Brattle Consulting Group projects that the cost for electricity produced from utility scale PV in Colorado may be expected to range between 6.6 cents/kWh and 11.7 cents/kWh in 2019 [5]. Costs for residential rooftop systems are projected

Manuscript received September 29, 2016; revised October 22, 2016; accepted November 26, 2016. Date of publication March 30, 2017; date of current version January 13, 2017. This work was supported in part by Harvard Global Institute and the Ash Center of the Harvard Kennedy School of Government.

M. B. McElroy and X. Chen are with the John A. Paulson School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, 02138, USA (Corresponding author: M.B. McElroy, mbm@seas.harvard.edu, and X. Chen, xchen@seas.harvard.edu).

DOI: 10.17775/CSEEJPES.2017.0002

to be predictably higher, between 12.3 cents/kWh and 19.3 cents/kWh [5]. Adopting the lower end of the range estimated for the utility option, the Brattle analysis suggests that production from this source could also be competitive with alternatives in the not too distant future.

A significant portion of the expense for residential PV systems in the US, as much as \$4.50/W, is represented by what is referred to as soft cost, expenditures for customer acquisition (advertising), for permitting and for installation. The stated objective of the SunShot initiative of the US Department of Energy is to reduce these costs to 65 cents per watt by 2020 for residential systems, to 25 cents/W for businesses [1]. The overall target is to lower the total installed cost to \$1.5/W for residences, \$1.25/W for businesses [1]. Should these objectives be realized, distributed PV systems could also be competitive with alternatives, eliminating the need for policy-motivated, government-sponsored, subsidies.

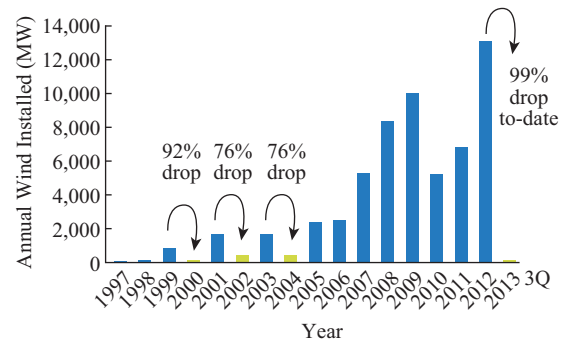
Incentives at the federal level promoting investments in wind and solar are discussed in Section II. Incentives at the state level are outlined in Section III. Summary conclusions are presented in Section IV.

II. FEDERAL INCENTIVES FOR RENEWABLES

Incentives at the federal level are based primarily on benefits conferred through the tax system. The growth in wind systems has been fueled primarily through what is referred to as a production tax credit (PTC). The primary subsidy for investments in the solar option is provided in the form of an investment tax credit (ITC).

The PTC provides a tax rebate for producers of electricity from wind, with credits extending typically for 10 years following the time when the wind facility first goes into service [1]. The PTC incentive has been allowed to expire 5 times and has been extended 5 times since it was first introduced in 1992. As discussed in [1], the result has been a boom-bust cycle for wind investments in the US as illustrated in Fig. 2. As indicated, the pace for investments in wind systems drops off significantly in years following expiration of the PTC. Uncertainty as to whether the authorization in place for 2012 would be extended through 2013 resulted, as indicated in the figure, in a precipitous drop in new starts for wind projects in 2013 [1]. Installations fell to a level as low as 70.6 MW during the first three quarters of 2013, a decrease of 96% with respect to the record-setting pace of the preceding year. As it turned out, the PTC was extended in January 2013 after a brief lapse [1]. The most recent extension was introduced in December 2015. It mandated a gradual phase down of the PTC post 2017. The PTC is authorized for 2016 at a level of \$0.023/kWh. The PTC for projects initiated in 2017 would be lowered by 20%, and for projects initiated in 2018 and 2019 by 40% and by 60% respectively. Following this schedule, the PTC for projects launched in 2019 would decrease to \$0.0092/kWh assuming 2016 currency values [6]. The 2015 legislation allows the value for the PTC to be adjusted annually to account for inflation.

The Investment Tax Credit (ITC) for solar power is “a federal tax credit claimed against the tax liability of residential and commercial and utility investors in solar energy prop-



Source: Data from American Wind Energy Association, 2014 [2].

Fig. 2. Annual installations of wind generated electricity in the US (MW) indicating the significant decrease in investments when continuity of the PTC was in question, notably in 2000, 2002, 2004 and 2013 (adapted from [1]).

erty” [7]. Currently both utility scale and distributed rooftop solar enjoy a tax credit equal to 30% of the total investment cost. This credit applies for projects that begin construction before the end of 2019. For projects that begin later, the credit is projected to decrease, falling for rooftop installations to levels of 26%, 22% and 0% in 2020, 2021 and 2023 respectively. For utility scale PV systems it is projected to decrease to 26% in 2020, dropping to 22% in 2021, continuing at a level of 10% post 2022 [8].

Wind projects are also eligible for the ITC. The ITC level for wind projects beginning construction before 2016 is 30%. The ITC for wind power will phase down to 12% in 2019. Wind producers could choose to avail of either the ITC or the PTC to finance their projects. Normally a wind project accessing superior wind resources would elect for PTC rather than the ITC, as the net present value would be larger in this case for PTC. For projects located in areas with less favorable wind conditions, ITC is often preferred for the same reason. The PTC incentivizes the wind producer to bid at even negative price in the wholesale market in order to realize the tax credit, which leads frequently to the negative clearing price during off-peak hours in a central area of the US, the mid-continent ISO for example.

III. STATE INCENTIVES FOR RENEWABLES

In addition to the incentives available at the national level as discussed above, important incentives are available also at the state level. California, for example, has as many as 183 regulations designed to promote deployment of renewables [9]. This section summarizes a range of incentives available at the state level. These include what are referred to as renewable portfolio standards, requirements mandating that specified fractions of the electricity marketed by utilities by specific dates must be derived from renewable sources. Additional incentives include net metering, the option to allow excess electricity produced at a specific installation to be transferred directly to the grid, by running the installation’s meter in reverse. What this means is that the installation is effectively selling power to the grid at the prevailing retail rate, avoiding charges that would otherwise be incurred to maintain the connectivity required to sustain this option. Rebates for renewable energy are available

in some states. A smaller number of states make use of an option that is more commonly applied in Europe and China, definition of a specific price for renewable energy, what is referred to as a feed-in tariff.

As summarized in Table I and illustrated in Fig. 3, renewable portfolio standards have been introduced in the US in

38 states, in addition to Washington, D.C., and in a number of overseas territories and protectorates including Guam, the Northern Mariana Islands, the US Virgin Islands and Puerto Rico. As indicated, not all of these standards are binding: some are simply aspirational. The standards are specified most commonly in terms of the percentage of power sold

TABLE I
RENEWABLE PORTFOLIO STANDARDS AND TARGETS [9]–[12]

State	Requirement	State	Requirement
Alaska ^b	50% by 2025	New York	29% by 2015; 50% by 2030
Arizona	15% by 2025	North Carolina ^a	12.5% by 2021
California	33% by 2020, 50% by 2030	North Dakota ^b	10% by 2015
Colorado ^a	30% by 2020	Ohio	25% by 2026
Connecticut	27% by 2020	Oklahoma ^b	15% by 2015
Delaware	25% by 2025–2026	Oregon	25% by 2025, 50% by 2040
Hawaii	100% by 2045	Pennsylvania	18% by 2020–2021
Illinois	25% by 2025–2026	Rhode Island	14.5% by 2019, additional 1.5% each year until 38.5% by 2035
Indiana ^{b,c}	10% by 2025	South Carolina ^b	2% by 2021
Iowa ^a	105 MW for two utilities (enacted in 1983)	South Dakota ^b	10% by 2015
Kansas ^b	20% by 2020	Texas	10,000 MW by 2025
Maine	40% by 2017	Utah ^b	20% by 2025
Maryland	20% by 2022	Vermont	75% by 2032
Massachusetts	15% by 2020 and an additional 1% each year	Virginia ^{a,b}	15% by 2025
Michigan	10% by 2015, additional 500 MW required from two major utility companies	Washington	15% by 2020
Minnesota ^a	26.5% by 2025	Wisconsin	10% by 2015
Missouri ^a	15% by 2021	Washington, D.C.	50% by 2032
Montana	15% by 2015	Guam	25% by 2035
Nevada	25% by 2025	Northern Mariana Islands	20% by 2016
New Hampshire	24.8% by 2025	Puerto Rico	20% by 2035
New Jersey	24.5% by 2020	U.S. Virgin Islands	30% by 2025; up to 51% after 2025
New Mexico ^a	20% by 2020		

^aThe RPSs for these states are restricted to investor-owned utilities.

^bThese states have implemented renewable energy targets or goals which are not legally binding.

^cClean coal technology, such as combined heat and power, is eligible for this target.

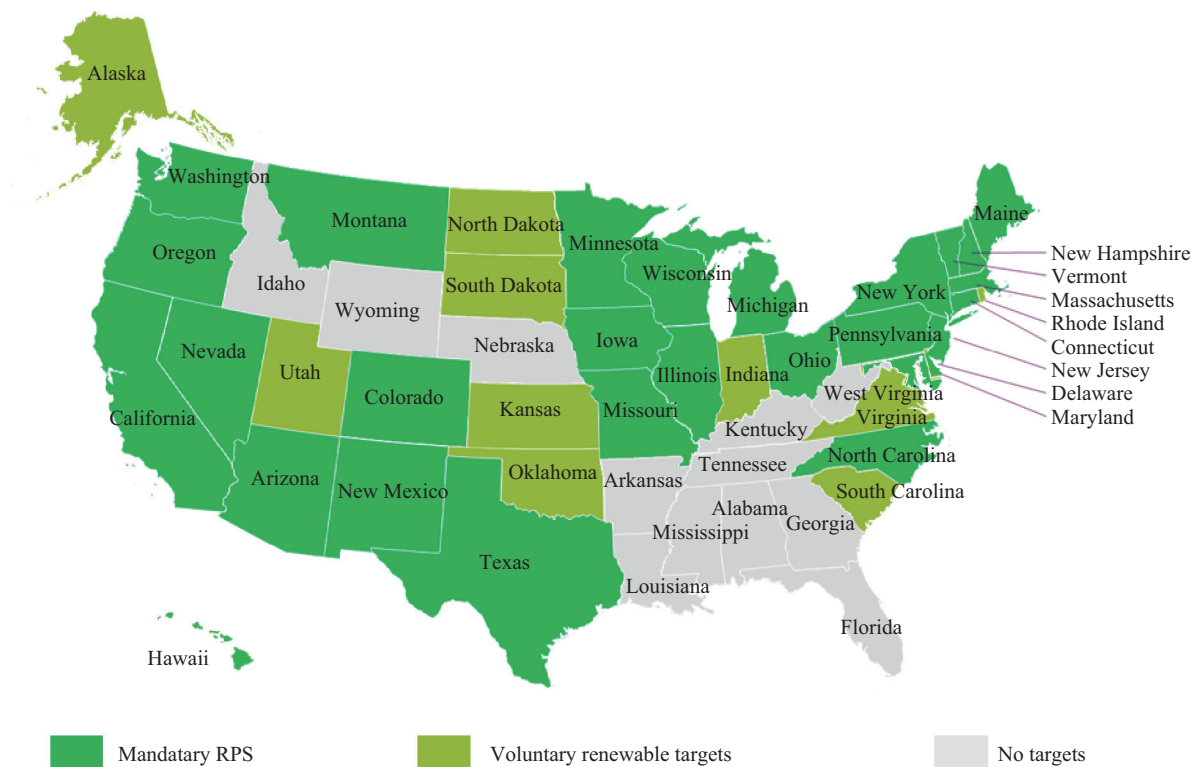


Fig. 3. States with a requirement for renewable portfolio standards (adapted from [10] and [11])

to retail customers by utilities that must be supplied from renewable sources, specified as fractions of the total number of kilowatthours marketed by these entities. RPS targets are defined on a state by state basis and influenced often by considerations of local politics. California, for example, is committed to increase this requirement to a level of 33% by 2020, rising to 50% by 2050. The target for New York State was set at 29% for 2015, climbing to 50% by 2030. Hawaii, topping the list in terms of the ambition of commitments, has announced that 100% of the electricity consumed in that state by 2045 should be derived from renewable sources. The target for Massachusetts is 15% by 2020, increasing 1% each year thereafter. Two states, Texas and Iowa, have elected to specify their renewable portfolio standards in terms of requirements for installed renewable capacity rather than kilowatthours. The mandate for Texas was defined as 10 GW by 2025, a target that has already been achieved. The standard for Iowa, introduced in that state's Alternative Energy Law in 1983, requires a capacity of 105 MW to be supplied by the state's investor owned utilities. Michigan decreed that 10% of its electricity should be derived from renewable sources by 2015, placing a further condition mandating additions of renewable capacity on two of the state's largest utilities, DTE and Consumer, 500 MW in each case [9], [10].

The procedures adopted for application of renewable portfolio standards can vary across different jurisdictions. Taking the New England Independent System Operator (NEISO) as an example, when a utility company generates a given number of MWhs of electricity, an electronic certificate recording this production is registered in a database, the New England Power Pool (NEPOOL) Generation Information System (GIS) [13]. If this production of MWhs is generated from a renewable source, the certificate will be identified further as a Renewable Energy Certificate (REC). Power generating entities within NEISO are obliged to maintain a sufficient number of RECs to meet their obligations for renewable energy. If they are unable to meet their requirements by generation within their system, they must purchase sufficient numbers of RECs either from other entities within NEISO or from organizations external to NEISO in order to satisfy their obligation. Otherwise, they will be subject to a penalty proportional to the size of the deficit. For utilities based in Massachusetts, the penalty, defined as an Alternative Compliance Payment (ACP), is imposed by the Massachusetts Department of Energy. The level of this ACP was set at \$66.99/MWh in 2016 [14]. By way of comparison, the current (2016) REC price is fluctuating around \$50/MWh.

In practice, the specific rules for renewable portfolio standards vary from state to state. The definition of eligible renewable energy sources, the lifetime (banking time), and the geographical requirements of REC can differ significantly across different states. Given this complexity, the trading of RECs is restricted largely to relatively narrow geographical areas. RECs generated from certain kinds of renewable energy technologies (e.g. wind power) are actively transacted within the New England and PJM regions. Ohio, as another example, requires that half of its RECs must be generated within the state boundary. For many states, a special quota for solar power is required and the price for solar REC is usually higher than

the price for regular RECs.

As indicated at the outset, net metering is a mechanism that allows both commercial and residential customers to sell electricity generated in situ in excess of demand back to the grid by essentially running their meters in reverse. Under this arrangement, they are compensated for the power they deliver to the grid at the prevailing retail rate. There are two components to the retail price: the cost for the utility to generate the relevant electricity and the cost to deliver it to the customer. The expense for delivery accounts typically for about 40% of the total cost - lower in some regions, higher in others.

To illustrate the dilemma posed by net metering, consider the following illustrative example. A householder or commercial entity has an annual requirement for 100 units of electricity. They have two options to meet this demand: they could invest in a concentration of rooftop mounted PV panels sufficient to meet this demand on an annual basis; or they could purchase what they need from the local utility. Suppose that the rooftop system is capable of meeting 100% of the demand on an annual basis but with a deficit in winter offset by a surplus in summer. Suppose that the winter deficit required to be balanced by the summer excess amounts to 50 units. The householder/commercial entity in this case would purchase 50 units of electricity from the utility in winter, transferring an equivalent 50 units back to the utility by running his/her meter in reverse in summer. Assuming that the retail price was the same in summer as in winter, the income received by the utility for deliveries in winter would be effectively cancelled by the charges incurred for receipts in summer. The utility would be obligated to provide effectively a subsidy to the PV owner by making available at zero cost the infrastructure needed to facilitate the two-way transfer of power between the utility and the homeowner/commercial entity. The loss of income to the utility required to support this infrastructure would have to be made up by a surcharge on other customers of the utility. The PV owner is the beneficiary thus of a subsidy at the expense of customers who have elected not to invest in PV systems on the roofs of their properties. Effectively, the PV owner is rewarded for the electricity generated in situ at the prevailing utility retail rate, which is significantly higher than at the cost incurred otherwise by the utility to generate the power delivered to other customers.

The growth in recent years in distributed PV generated power in the US has been due in no small measure to entry into the market of third-party brokers, companies serving as intermediaries between households interested in installing PV systems but reluctant to pay the upfront cost, and utilities seeking to acquire at least a fraction of the resulting power in order to meet their requirements as mandated under the renewable portfolio protocol. One of us (MBM) had personal experience of how this might work. He made an arrangement with one of these companies to install PV panels on the roof of his house. The panels would be owned, monitored and maintained by the company, which in turn would have the right to take advantage of all prevailing subsidies and to dispose of excess power by selling RECs as realized into the prevailing market. The contract allowed MBM to cut his electricity

bill in half, powerful demonstration of the significance of the subsidies available from the combination of renewable portfolio requirements and the option for net metering.

As indicated in Fig. 4, net metering programs are currently in place in 44 states and in the District of Washington D.C [15]. Voluntary net metering opportunities have been introduced by a number of utilities in Texas, South Carolina and Idaho. A number of states, as indicated in the figure, have expanded the net metering option to apply not just to residential and commercial establishments but also to utility scale installations [15]. With growth in the PV market have come increasing questions as to the long-term viability of the net metering option. It is clear that operators of distributed PV systems will be required eventually to pay for their use of the power distribution systems maintained, financed, and operated by the utilities. A key question concerns the magnitude of these charges and how they should be assessed. Current policies are under review in a number of states. California elected to continue with the present arrangement. Arizona, on the other hand, revised its current policy to impose a monthly surcharge proportional to their installed capacity on operators of distributed systems electing to continue to take advantage of the net metering option [16].

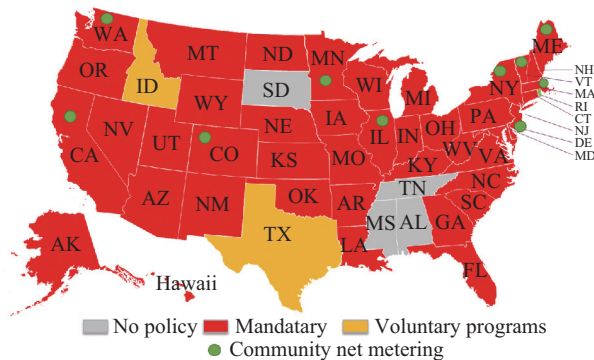


Fig. 4. States with Net Metering Programs (adapted from [15])

Subsidies in the form of rebates are available in a number of states to encourage commitments to small-scale renewable projects. They are offered either in the form of cash refunds or cost discounts. As of 2008, these subsidies were available for investments in solar PV in as many as 25 states, in 17 states for investments in wind [17]. A summary of these programs is available in the Database of State Incentives for Renewable Energy (DSIRE) [9]. As an example, the Commonwealth Solar Program of Massachusetts offered rebates of between \$0.25 and \$1.70 per watt DC for investments in solar systems in 2010 up to a limit of \$3500 [18].

Feed-in tariffs are widely used as an incentive for investments in renewable energy in Europe and China. These take the form in Germany of guaranteed prices for the electricity generated by such investments over their anticipated operational lifetime. Applications of the feed-in tariff option have been more limited in the US, available currently in only seven states. As an example, the state of Washington, which does not have an electricity market, offers a tariff of 15 cents/kWh for solar, increasing to 54 cents/kWh if the solar facility is

manufactured within the state [19]. The feed-in tariff option may overlap and complement existing renewable portfolio standards. The feed-in tariff option effectively secures the long-term investment return for wind and solar projects. Under the renewable portfolio standard, the price for RECs responds more timely to changes in both wholesale market prices and costs for renewable technologies, while introducing greater uncertainty for the long term investments. There is evidence that both policies have been effective globally in promoting the deployment of wind power [20].

IV. CONCLUDING REMARKS

Power generation and transportation are responsible for the dominant sources of greenhouse gas emissions in the US, 38% and 34% respectively in 2013. Meeting President Obama's commitments for reductions in emissions both in the near and long term will require a shift in energy from the current reliance on fossil fuels to a much greater emphasis on zero carbon alternatives such as wind and solar. We outlined here the variety of policies that have been introduced in the US at both the federal and state levels to encourage this transition. Particularly impressive is the breadth of support that has developed at the state level: incentives are available in one form or another in as many as 47 states in addition to Washington D.C. The exceptions are Alabama, Mississippi and Tennessee, states that enjoy relatively cheap prices for electricity at the retail level, ranking respectively 34, 35 and 45 on the roster of overall state prices, a list headed not surprisingly by Hawaii [1]. The reluctance of these states to take steps to reduce their dependence on greenhouse gas emitting fossil fuels may reflect a level of skepticism on the part of their citizenry and political representatives as to the reality and/or importance of the threat posed by human-induced climate change.

REFERENCES

- [1] M. B. McElroy, *Energy and Climate: Vision for the Future*. Oxford, UK: Oxford University Press, 2016, ch. 15.
- [2] American Wind Energy Association, AWEA U.S. Wind energy facts at a glance. [Online]. Available: <http://www.awea.org/Resources/Content.aspx?ItemNumber=5059>
- [3] US. Energy Information Administration. Electric power monthly. [Online]. Available: <http://www.eia.gov/electricity/monthly/>
- [4] Lizzard Company. (2015, Nov.). Lizard's leveled cost of energy analysis-version 9.0. [Online]. Available: <https://www.lazard.com/media/2390/lazards-levelized-cost-of-energy-analysis-90.pdf>
- [5] B. Tsuchida, S. Sergici, B. Mudge, W. Gorman, P. Fox-Penner, and J. Schoene. (2015, Jul.). Comparative generation costs of utility-scale and residential-scale PV in Xcel Energy Colorado's service area. The Brattle Group. [Online]. Available: http://brattle.com/system/publications/pdfs/000/005/188/original/Comparative_Generation_Costs_of_Utility-Scale_and_Residential-Scale_PV_in_Xcel_Energy_Colorado%27s_Service_Area.pdf?1436797265
- [6] Department of Energy. Renewable electricity production tax credit (PTC). [Online]. Available: <http://energy.gov/savings/renewable-electricity-production-tax-credit-ptc>
- [7] Solar Energy Industry Association. Solar investment tax credit (ITC). [Online]. Available: <http://www.seia.org/policy/finance-tax/solar-investment-tax-credit>
- [8] Department of Energy. Business energy investment tax credit (ITC). [Online]. Available: <http://energy.gov/savings/business-energy-investment-tax-credit-itc>
- [9] Database of State incentives for renewables & efficiency. [Online].

Available: <http://www.dsireusa.org/>

- [10] J. Durkay. (2016, Dec.). State renewable portfolio standards and goals. [Online]. Available: <http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx>
- [11] G. Barbose. (2013, Nov.). Renewables portfolio standards in the United States: A status update. Lawrence Berkeley National Laboratory. [Online]. Available: https://emp.lbl.gov/sites/all/files/rps_summit_nov_2013.pdf
- [12] Score one for ALEC: West Virginia is first state to repeal a renewable energy standard. [Online]. Available: <http://programs.dsireusa.org/system/program/detail/5505>
- [13] Metropolitan Area Planning Council (MAPC). (2013, Oct.). Massachusetts renewable portfolio standard. [Online]. Available: http://www.mapc.org/system/files/bids/Massachusetts%20Renewable%20Portfolio%20Standard_0.pdf
- [14] Alternative compliance payment rates. [Online]. Available: <http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/rps-aps/retail-electric-supplier-compliance/alternative-compliance-payment-rates.html>
- [15] NCSL. (2016, Nov.). State net metering policies. [Online]. Available: <http://www.ncsl.org/research/energy/net-metering-policy-overview-and-state-legislative-updates.aspx>
- [16] Compromise in Arizona defers a solar power fight. *The New York Times*. [Online]. Available: http://www.nytimes.com/2013/11/16/business/energy-environment/compromise-in-arizona-defers-a-solar-power-fight.html?_r=1
- [17] National Renewable Energy Laboratory. Renewable energy rebates. [Online]. Available: http://www.nrel.gov/tech_deployment/state_local_governments/basics_rebates.html
- [18] Common wealth solar II. [Online]. Available: <http://www.masscec.com/commonwealth-solar-ii>
- [19] National Renewable Energy Laboratory. Feed-in tariffs. [Online]. Available: http://www.nrel.gov/tech_deployment/state_local_governments/basics_tariffs.html
- [20] C. G. Dong, "Feed-in tariff vs. renewable portfolio standard: An empirical test of their relative effectiveness in promoting wind capacity development," *Energy Policy*, vol. 42, pp. 476–485, Mar. 2012.



Michael B. McElroy received his B.S. and Ph.D. degrees in Applied Mathematics at Queen's University, Belfast, Northern Ireland in 1960 and 1962 respectively. Since 1970, he has been Gilbert Butler Professor of Environmental Studies at Harvard University. He is the author of more than 250 journal articles, 3 books, 3 edited books and more than 30 articles in *Nature* and *Science*. His research interests include atomic physics, planetary science, atmospheric chemistry, climate science, global climate change mitigation, power and energy science and policy, and the challenges posed for sustainable development in China. At Harvard, he heads up the China Project, which has collaborated for more than 20 years with colleagues in China to advance this last objective.

He is a Fellow of the American Academy of Arts and Science, the American Association for the Advancement of Science, the American Geophysical Union, and Royal Irish Academy of Arts and Science. He has served at Harvard University as Director of the Center for Earth and Planetary Sciences, as founding Director of the Center for the Environment and as founding Chair of the Department of Earth and Planetary Sciences and for 10 years as a member of the China Council for International Cooperation on Environment and Development, a body constituted in 1992 to advise the Chinese Premier on these important interconnected issues.



Xinyu Chen (M'14) received the B.S. and Ph.D. degrees in electrical engineering from Tsinghua University, Beijing, China in 2009 and 2014 respectively.

He was an exchange Ph.D. student at Harvard University in 2012. From 2015 to 2016, he was a Post-Doctoral Researcher at Harvard University. Since 2016, he has been a Lecturer with Harvard University. His research interests include power system operation and planning, multi-energy system optimization, renewable energy integration and energy policy.