Comments of Ashley C. Brown[1]
Next Generation Solar Incentive Straw Proposal

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The Massachusetts Department of Energy and Resources (DOER) is to be commended for taking steps to revise and update the Massachusetts Solar Initiative. There is certainly good cause for the Department to do so. The dramatic decline in solar panels costs, the increased market penetration of distributed solar in the Commonwealth, the extension of federal tax credits, and the high costs of the existing SREC credits all suggest the need to revisit Massachusetts policies. In fact, costs associated with Massachusetts solar incentives are second only to California, among U.S. states.[2] Thus, both the cost/benefit ratio of the program and the sheer scale of the program merit the reviews that DOER has undertaken.

Beyond that, however, high subsidies may be having the opposite effect of what is intended—rather than making cheaper solar pv more available, these subsidies may themselves be keeping prices high. A 2014 analysis by NREL noted that the benchmark prices it modeled based on estimates of the different cost components of solar systems (plus a margin for profit) were significantly lower than actual reported prices being charged (for residential systems, reported prices were an average of 26% higher than the benchmark modeled pricing). Among the factors responsible for this "delta," NREL pointed to "inefficient pricing (i.e. value-based pricing)"—essentially, to solar installation companies charging what the market would bear, a

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[2] Consumer Energy Alliance, *Incentivizing Solar Energy: An In-Depth Analysis of U.S. Solar Incentives.* http://consumerenergyalliance.org/cms/wp-content/uploads/2016/09/Solar-incentive-report-FINAL.pdf

value which is higher when subsidies are more generous.[3] The 2015 MIT study, *The Future of Solar Energy,* also observed a "striking differential" between MIT's estimate of the cost of installing residential PV systems (even allowing for a profit margin) and the reported average prices for residential PV systems—actual prices for residential systems were approximately 150% of MIT's cost estimate—a difference between cost and price the MIT researchers did not observe for utility-scale installations.[4] Indeed, as documented in the NREL analysis and the MIT study, there is evidence now that the declining costs of solar panels, which have been quite dramatic in recent years, are not being passed through to consumers, enabling most of the benefits of declining panel costs to be retained by solar vendors, to the detriment of all consumers, solar and non-solar alike. Any solar incentive devised by DOER should recognize this trend and make certain that the incentives deployed do not reinforce it.

A recent study by Lawrence Berkeley National Labs found that out of four countries it compared to the U.S. (Germany, Japan, France, and Australia), the U.S. had the highest prices (per watt of capacity) for installed residential PV systems.[5] The reasons for these high U.S. prices are not fully understood—it is something more than market size, since the U.S. market is smaller than the solar pv market in some of the four other countries studied, but larger than others. A 2014 study aimed at better understanding variations in solar pv pricing, involving collaboration between researchers from Yale, Lawrence Berkeley National Laboratory, the

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[3] Feldman, David, Galen Barose, Robert Margolis, Ted James, Samantha Weaver, Naim Darghouth, Ran Fu, Carolyn Davidson, Sam Booth, and Ryan Wiser. "Photovoltaic System Pricing Trends." (September 22, 2014): 30. Available online at: http://www.nrel.gov/docs/fy14osti/62558.pdf

[4] *The Future of Solar Energy*, MIT Energy Initiative (2015): 86. Available online at http://energy.mit.edu/wp-content/uploads/2015/05/MITEI-The-Future-of-Solar-Energy.pdf

[5] Barbose, Galen and Naim Darghouth. *Tracking the Sun IX: The Installed Price of Residential and Non-Residential Photovoltaic Systems in the United States.* Lawrence Berkeley National Laboratory (August 2016):22-23. Available online at https://emp.lbl.gov/publications/tracking-sun-ix-installed-price

University of Wisconsin at Madison, and the University of Texas at Austin, found a revealing association that suggests that "In the short-run at least, policies that stimulate demand for PV may have the exact opposite of their intended effect, by causing prices to go up rather than down."[6] That is, RNM, by effectively shielding rooftop solar suppliers, from both robust competition and from cost-based regulation, may be removing a key incentive for rooftop solar installation companies to pass on declining costs to customers.[7]

Succinctly stated, there is growing evidence that subsidies and cross-subsidies for rooftop solar are actually keeping prices higher than would be produced in a business environment where prices are disciplined by competition, or, in the absence of competition, by cost based regulation. It is that discipline, which protects both the public treasury and consumers, that has been notably absent in the current system of subsidies and cross-subsidies for distributed solar in Massachusetts. It is in this context that the actions of the legislature and the efforts of DOER to reduce the costs of solar energy are both timely and appropriate.

One further contextual note is quite important to the discussion of how DOER might best approach support for distributed solar resources in the Commonwealth. There is no intrinsic value in having distributed solar for the mere sake of having it. What makes it an attractive option, and desirable as a matter of public policy, are some of its attributes, namely its environmentally benign production of energy and its ability to enhance overall system benefits. Neither of those benefits, however, are inevitable results of the adoption of rooftop solar. As we know from recent German experience, a substantial shift to intermittent renewable resources

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[6] Gillingham, Kenneth, Hao Deng, Ryan Wiser, Naim Darghouth, Gregory Nemet, Galen Barbose, Varun Rai, and C.G. Dong. *Deconstructing Solar Photovoltaic Pricing: The Role of Market Structure, Technology, and Policy*. (December 2014): 20-21. Available online at: http://www.seia.org/sites/default/files/LBNL_PV_Pricing_Final_Dec%202014.pdf

[7] The failure to pass on declining input costs to customers is pricing behavior often considered to be characteristic of monopoly pricing.

does not assure a reduction in carbon emissions (indeed, in some years in Germany, the shift toward renewables was accompanied by an increase in emissions and increases in reliance upon coal).[8] The uncertainty about attaining desired carbon reduction is particularly acute in New England because intermittent solar, which produces energy off peak during most of the year, is almost certain not to displace high emitting plants.[9] We also know that distributed solar is a very high cost, and highly unreliable, way to reduce carbon emissions. That point was dramatically shown in a recent study that showed that every dollar invested in utility scale solar produced 22 times the amount of carbon emissions reduction that every dollar invested in rooftop solar achieved.[10] Given that rooftop solar constitutes a high cost, and highly uncertain, route to emissions reduction, the environmental social benefit sought is reduced, and subsidies, either through RECs/SRECs or cross subsidies in rates, ought to be reduced accordingly. Simply stated, the purpose of the subsidy is to obtain a social benefit, not simply more rooftop solar.

Other potential system benefits that can, at least in theory, be obtained from distributed solar are ancillary services (e.g. reactive power, voltage support) and contributions to system peak. Those benefits, to be obtainable, however, are entirely dependent on the time of energy production and circumstances on the grid at the location of the generating unit. To have a reasonable probability of obtaining those benefits, it is essential that appropriate technology be

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[8] *DW.Com*. "German CO2 Emissions Targets at Risk." (November 19, 2015). *Please see:* http://www.dw.com/en/german-co2-emissions-targets-at-risk/a-18862708

[9] Only 4% of the region's electric energy is generated by coal. Coal plants are baseload units, so they are rarely, if ever, displaced by solar units. Moreover, the few coal fired units in ISONE are slated for retirement in the not very distant future. Given that solar energy production is for the most part not coincident with peak in New England, older, perhaps "dirtier" peaking units will also not be displaced. Most likely to be displaced are low emitting natural gas fired plants, thus driving up the unit cost of reducing carbon emissions by the deployment of distributed solar.

[10] Calculated based on *Lazard's Levelized Cost of Energy Analysis-Version 9.0.* November 2015. Full report available online at https://www.lazard.com/media/2390/lazards-levelized-cost-of-energy-analysis-90.pdf

deployed with the solar panels, that the panel exposure be shifted from south facing to west facing, and that the siting of unit be subject to a careful planning process that identifies optimal sites for the panels. The subsidies that are provided should be carefully calibrated to achieve optimal system benefits rather than “willy-nilly” production of energy at random locations. It is useful to look at calibrating the level of subsidy in terms of these considerations.

First, in regard to location, solar dg units are simply sold wherever willing buyer or lessee can be found. There is no consistent pattern or predictability to location. Thus, the kind of dense concentration of units, or optimization of locations on the grid that would likely lead to system benefits, is lost. In fact, there is a substantial likelihood that the continuation of random siting, based on commercial happenstance and little else, will actually cause the system to not only lose benefits, but actually incur costs to accommodate the new interconnections. It makes no sense to provide a subsidy that encourages sub-optimal, often costly, installations, when tying the subsidy to optimizing locations and density is far more likely to produce system benefits. Some electric utilities, notably Consolidated Edison and Southern California Edison, are working to put such plans in operation. If there is going to be a subsidy provided, then it should be done in accordance with the probabilities of achieving system or societal benefits. To do otherwise runs the risk of squandering scarce public resources. Thus the availability, or at least the size of the solar incentive ought to be directly related to the probability of the unit providing system benefits.

Second, providing a subsidy regardless of the direction of the solar panels is a counterproductive incentive. South facing panels will generate the most kilowatt hours, but, as noted above, they are almost entirely produced off peak. The New England peak, during three seasons of the year, is at dusk or after dark, when there is no solar production. In the summer, demand peak begins in the late afternoon, when there may be some marginal peak coincidence. Westward exposure would expand that period of coincidence between peak demand and solar production. That not only would improve the economics of solar production, but would also have the environmental benefits of not having to ramp up as much fossil fueled, emissions producing energy production to compensate for the declining production of solar energy. Thus, the incentives should be targeted to encourage western rather than southern exposure to the sun.

In regard to technology that would enhance the social and system values of solar dg units, incentives should include elements that would encourage the deployment of storage and smart inverters. Storage, such as batteries, would make solar dispatchable and thereby optimize its export into the grid. That dispatchability would enable system operators to optimize the utilization of solar energy.[11] Thus, solar incentives should be targeted in ways that encourage the coincident deployment of solar panels and storage. Failing to do this reduces the overall efficiency and social benefit that the incentive would otherwise provide.

One other technology that enables optimization of rooftop solar is installation of smart inverters. Such devices enable solar units to be utilized in ways that improve overall efficiency in the operation of the grid, by increasing the likelihood that solar units will provide grid enhancing ancillary services.

The Department should also focus on providing price discipline in the rooftop solar market. That would remedy the problem noted above, that declining costs are not being passed on to consumers, or, in the case of publicly funded subsidies, to the taxpayers. Thus, the Department should deploy competitive mechanisms, such as auctions or other forms of bidding arrangements, in order to assure that the Commonwealth is not supporting out of market prices

[11] Storage capability would also do away with a preference for western exposure to the sun, because storing off peak energy allows solar produced energy to be exported on peak.

and is getting the maximum value for its expenditures. In a similar vein, competition should assure that as costs decline, the “need” for the incentive also declines and that this decline is fully captured in the levels of subsidies provided. Indeed, it needs to be recognized that whatever subsidies are provided, they are short term, in the sense that subsidies should only be in place if distributed solar energy needs an economic boost to be fully competitive in the marketplace. Maintaining a subsidy for an economically viable technology is not only a waste of money, but is an impediment to the full economic sustainability of solar energy.

In summary, the solar incentives provided by DOER should meet the following criteria:

1. DOER makes an explicit determination that solar requires a subsidy;
2. Incentives should be subject to sunset requirements so as not to be a permanent crutch;
3. Incentives should be designed to maximize the social and system benefits that are obtainable and not simply to blindly, rather than strategically, encourage solar energy;
4. Incentives must be designed in a way that fully disciplines prices and is mindful of declining costs (e.g. competitive procurement mechanisms).

Thank you for the opportunity to submit these comments.