NET METERING IN THE COMMONWEALTH OF MASSACHUSETTS: A FRAMEWORK FOR EVALUATION

Paul J. Hibbard[1]

May 2015

EXECUTIVE SUMMARY

Overview

Local economic growth, fuel diversity, price risk management, and climate risk mitigation – these are why the Commonwealth of Massachusetts has supported net metering for distributed (mostly solar photovoltaic (PV)) generation over the past seven years. Some would have the state put on blinders and focus only on costs, but the cost information presented to-date by the electric companies is incomplete and misleading. While program costs are important, they can not be viewed in isolation – program analyses must consider both benefits and costs. Electricity and natural gas regulation and policy have always sought an appropriate and informed balance between public policy objectives and consumer impacts through a careful review of relevant evidence and thoughtfully-structured design of utility rates. Net metering is no different; the Commonwealth should continue to support and capture the benefits of expanding solar PV policies while at the same time conducting a DPU-lead investigation to establish net metering benefits and implement new rate designs to complement net metering that will allow solar PV to continue to grow in a fair and equitable manner.

Summary

In 2015 the Massachusetts Legislature created the Net Metering Task Force (NMTF, or Task Force) to, among other things, review the long-term viability of net metering, develop recommendations on programs to support the development of 1,600 MW of solar generation facilities, and make recommendations to encourage the continued expansion of solar generation in the Commonwealth.[2] The NMTF carried out extensive discussions and evaluations to inform the Legislature's consideration of the form of net metering and solar power incentives in the Commonwealth going forward. The Task Force's Final Report to the Legislature (Report), completed on April 30, 2015, provides a wealth of information and data on solar incentives, benefits and costs, and will be an invaluable resource for ongoing deliberations over the future of net metering and solar program incentives.

In an Introduction to the Report, Task Force Co-Chairs Burgess and O'Connor focus primarily on the cost and ratepayer impacts associated with net metering.[3] In their comments, the Co-Chairs

---

[1] Paul J. Hibbard is a Vice President with Analysis Group, Inc., and is a former Chairman of the Massachusetts Department of Public Utilities (DPU).

[2] Chapter 251 of the Acts of 2015 of the Massachusetts Legislature, *An Act Relative to Credit for Thermal Energy Generated with Renewable Fuels* (Chapter 251), Section 7(a).

[3] Co-Chair Dan Burgess was Acting Commissioner of the Department of Energy Resources; Co-Chair O'Connor is Chairman of the Department of Public Utilities.

highlight costs to non-participants in the program, relying in part on a set of indicative cost/ratepayer impact estimates provided by the distribution companies.[4] While the Co-Chairs' focus on moving towards a long-term, sustainable solution is appropriate, the analysis provided by the companies does not help in isolation; it is flawed and limited in important ways, and fails to assess the ratepayer and policy benefits of growth in distributed generation in Massachusetts.

The full scope of impact on ratepayers and on the people of the Commonwealth must be considered in order for the Legislature to determine the evolution of the solar program in Massachusetts. Absent this, the Legislature is left with the utilities' analysis, which is incomplete in scope and detail, and is misleading on its own. Of greatest concern, the various simplifications, assumptions, and omissions in the companies' analysis[5] tend to systematically ignore or understate net metering benefits, while overstating the utilities' presumed cost impacts on ratepayers. DPU needs to conduct an analysis and evaluate the full range of costs and benefits associated with solar PV and other net metering-eligible distributed resource options. Corrections and omissions from the utilities' calculations must be reviewed and repaired in a full evidentiary rate proceeding, which can provide the following:

- A corrected and complete representation of wholesale market benefits
    - Full valuation of exported (settled and unsettled) net metering quantities from all wholesale market values, and appropriate prices, correcting mistakes in the utilities' estimates:
        - Calculations should be based not on average locational marginal prices (LMP) (as used by the utilities), but rather LMPs during peak hours, and/or based on the profile of solar PV output, when prices (on average) are far higher than the average prices used in the companies' calculations. The companies' approach reduces net metering value by including in LMP benefit calculations the low-priced, nighttime hour LMPs that are not coincident with solar generation; and
        - Calculations need to capture the value of reduced capacity, transmission, ancillary service, and "uplift" payments by utility customers as a result of reducing the companies' portion of system load obligations;
    - Full valuation of price suppression impacts of net metered generation, including reduced host customer load and virtual net metering exports, correcting omissions in the utilities' estimates:
        - Suppression of LMPs – benefitting all electric customers in Massachusetts and the New England region – due to reduced net hourly load on the system in general, and reduced net hourly load in particular in high-priced/daily peak hours;
        - Suppression of Capacity and Ancillary Service (AS) needs and costs – benefitting all electric customers in Massachusetts and the New England

[4] See email from Chairman O'Connor describing information request put forth to Task Force member utilities, dated April 2, 2015.

[5] See National Grid's Revised Net Metering and Solar Cost Analysis 4-23-15.xlsx and Eversource Energy Revised Net Metering and Solar Cost Analysis 4-23-15.xlsx.

region – due to reduced needs for new capacity and AS resource operation through lower peak monthly and annual load on the system;
        - Suppression of market prices for portfolio standard compliance – benefitting all electric customers in Massachusetts and the New England region – due to a reduced need to construct and operate grid-connected resources to meet state (and other states') renewable/clean portfolio standards; and
        - Suppression of market prices for emission cap compliance for all pollutants – benefitting all electric customers in Massachusetts and the New England region – due to suppression of emission allowance prices to meet regional emission cap requirements.
- A corrected and complete representation of distribution and local transmission customer benefits
    - Correction/adjustment of various simplifications and assumptions that tend to overstate the impacts or understate the benefits of net metering (e.g., the companies assume flat distribution and transmission costs over the study period);
    - Full valuation of general distribution customer cost reductions due to growing penetration of distributed resources, including:
        - Deferred and avoided distribution and local transmission investments and costs due to reduction load on the system – in general, to community/campus/office park installations, and/or otherwise located on specific feeders that are approaching the need for incremental system upgrade investments and expenses; and
        - Improved service quality for customers to the extent that community/ campus/office park installations are able to maintain electricity service during outages, or otherwise generally reduce System Average Interruption Duration (SAIDI) and System Average Interruption Frequency (SAIFI) values;
- Appropriate and reasonable valuation of benefits to ratepayers and all Massachusetts residents associated with items that are difficult to quantify, and/or are not directly reflected in electric rates
    - The local economic benefits (gross state product, jobs, tax revenues) that come from:
        - reducing the flow of Massachusetts businesses' and residents' energy dollars out of state to distant producers of fossil fuels; and
        - the localization of energy spending within the state due to contracting, construction, and (to some extent) equipment manufacturing occurring within the state for distributed generation installations;
    - Reductions in electricity price volatility, reduced dependence on outside resources, and increased system operational diversity through reducing the need for investment in and operation of natural gas-fired resources;

- The benefits of reducing the social and economic risks of climate change, as well as reducing the public health and environmental impacts of the air, water and solid waste impacts associated with fossil-fuel energy production; and
- The investment in advancing the commercialization and deployment of advanced energy technologies within the Commonwealth that can help the state achieve a diversity of economic, energy and environmental policy objectives.

As with *many* valuable public policy programs that one way or another involve the regulated utilities,[6] it is a mistake to focus myopically on the cost side of the ledger without a comprehensive review of program benefits. The Task Force Report and numerous analyses carried out across the U.S. demonstrate the depth of economic, fuel diversity, technological progress, climate, and other benefits that flow from the success of net metering. But while the programs have contributed to startling technical advances in solar PV systems over the past several years, the need for tailored rate mechanisms remains – failure to extend net metering may have dire consequences for an industry that has thrived in Massachusetts.[7]

In its deliberation the Legislature should recall the vision for the electric industry it adopted in 2008 with unanimous passage of the Green Communities Act (GCA). The overriding purpose of the GCA was to move away from energy imports that shift our consumers' dollars to out-of-state fossil-fuel providers, mitigate the price risk associated with the pricing volatility of natural gas, inject more of our energy dollars into the local economy, and do it in a way that helps address the social and economic risks of climate change in a manner consistent with Massachusetts' commitment to reduce greenhouse gases – in effect, part of an "all-of-the-above" strategy to address key economic, energy, and environmental objectives. And it has worked: a recent study found that first six years of GCA implementation results in $1.2 billion in net economic benefits to Massachusetts, more than 16,000 jobs, expansion of in-region generation by 2,800 megawatts (MW), and dramatic reductions in the need for generation from existing – or new – fossil-fuel fired power plants in New England.[8]

The success of net metering in the Commonwealth has produced large benefits for many towns/cities, businesses, and residents, and requires careful and ongoing review by DPU of distribution company customer rate designs. But the history of utility ratemaking is littered with changes in underlying cost drivers, industry structure, and policy objectives – changes that constantly shift the distribution of utility costs across rate classes, and across customers within rate classes. Regulators do not abandon critical programs with changes in underlying rate drivers; instead, the very purpose of ratemaking is to continuously review and adjust utility rates to meet

[6] By way of example, such utility programs include electric and gas service quality and restoration; the safety and integrity of (and leak detection for) natural gas distribution pipelines; targeted infrastructure development programs; economic development or business retention rates/policies; the collection of costs stranded due to utility restructuring; environmental remediation and reclamation of abandoned/retired utility assets/property; rate mechanisms to ensure the proper collection of health care and pension costs for retired industry workers; and cost mitigation and service protections for lower-income consumers.

[7] Task Force research demonstrates that in most continental U.S. states, solar PV continues to flourish *only* where supported by net metering and/or other targeted mechanisms enabling self-generation.

[8] Paul J. Hibbard, Susan F. Tierney, and Pavel G. Darling, *The Impacts of the Green Communities Act on the Massachusetts Economy*, March 4, 2014 (hereafter "Hibbard et. al. 2014"), pages 3-4.

customer needs in a way that is reasonably in line with public utility rate design principles and practice.

Net metering has generated positive economic, energy and climate risk benefits for Massachusetts. Rather than curtail that progress, net metering should be extended concurrent with a DPU investigation to establish the benefits of net metering, and evaluate rate design considerations and options.

NET METERING IN MASSACHUSETTS: CONTEXT AND PURPOSE

Context

The expansion of net metering to its current form began with the Legislature's groundbreaking Green Communities Act legislation, passed unanimously by both chambers of the Massachusetts General Court and signed into law in July 2008. The GCA explicitly charted a new path to address fundamental energy sector challenges in the Commonwealth at a time of near-record high energy prices, and the expansion of net metering in both size and scope has been a central component of the success of the GCA. Since then, the Legislature has passed further provisions, including most recently in 2012, expanding the size of the net metering "caps" to three percent each for public (e.g., towns) and private (e.g., homeowner) installations.[9]

The most important purpose/implication of the GCA is a fundamental shift to demand reduction and local sourcing to diversify the state's energy supply. Major GCA provisions – including net metering – are geared to reducing the electricity consumed by businesses and residents, and increasing distributed generation across the Commonwealth.[10] This has the benefits of (1) reducing energy imports (e.g., the purchase of natural gas to fuel power plants) that shift our consumers' dollars to out-of-state fossil-fuel providers, (2) mitigating the risks associated with fossil fuel pricing volatility, (3) injecting more of our energy dollars into the local economy, and (4) doing this in a way that helps address the social and economic risks of climate change consistent with Massachusetts' commitment to reduce greenhouse gases.

And it has worked – a recent study found that the GCA produces a wide range of benefits from the perspectives of electricity price, resource/fuel diversity, and local economic impacts. Specifically, it found that the first six years of GCA implementation results over time in:

- $1.2 billion in net economic benefits to Massachusetts (including state and local tax revenues on the order of $155 million);
- More than 16,000 jobs (job years);

[9] The net metering caps set a maximum amount of annual generation eligible for service under the distribution company net metering tariffs at a percentage of distribution company annual sales.

[10] Other important provisions include expanding investment in cost-effective energy efficiency (EE) programs; implementing a "Green Communities" program to support towns' investments in local EE and distributed generation resources; requiring electric utilities to enter into long-term contracts for new grid-connected renewable power sources in the region; expanding the state's renewable portfolio standard (RPS) requirements; implementing pilot programs for the installation of smart meters; and allowing electric utilities to construct and own/operate solar PV systems.

- Expansion of in-region grid-connected and behind-the-meter generation by 2,800 megawatts (MW), virtually all indigenous renewable resources, with over 1,300 MW of that in Massachusetts;
- Delaying or avoiding altogether roughly 700 MW of new fossil-fueled (natural gas) resources;
- Reduction in generation by primarily fossil-fueled resources of nearly 69 terawatt-hours (TWh), with an increase in generation by renewables on the order of 55 TWh;
- Significant decreases in revenues for imported fossil fuel production accompanied by significant increases in revenues to in-state owners of renewable resources; and
- Reductions in air and water quality, and solid waste impacts, including emissions of carbon dioxide, mercury, nitrogen oxides, and sulfur dioxide.[11]

The success of the GCA is based on policies that at this time should be fairly evaluated and built upon. In particular, the electric companies either already have reached, or are approaching, the net metering caps. In 2015 the Massachusetts Legislature created the Net Metering Task Force to, among other things, review the long-term viability of net metering, develop recommendations on programs to support the development of 1,600 MW of solar generation facilities, and make recommendations to encourage the continued expansion of solar generation in the Commonwealth. Part of the Task Force's goal was to consider the going-forward role for net metering – that is, should the caps be increased by some percentage (as companies approach the limits), lifted altogether, or remain the same?

The NMTF carried out extensive discussions and evaluations to inform the Legislature's consideration of the form of net metering and solar power incentives in the Commonwealth. The Task Force's Final Report to the Legislature, completed on April 30, 2015, provides a wealth of information and data on solar incentives, benefits and costs, and will be an invaluable resource for ongoing deliberations over the future of net metering and solar program incentives.

In an Introduction to the Report, Task Force Co-Chairs Burgess and O'Connor focus largely on the presumed cost and ratepayer impacts associated with net metering. The Co-Chairs highlight costs to non-participants in the program, relying in part on a set of rough, indicative cost/ratepayer impact estimates provided by the distribution companies. While the Co-Chairs' focus on moving towards a long-term, sustainable solution is appropriate, the analysis provided by the companies does not help on its own; it is flawed and limited in important ways. Net metering rate impacts can not be viewed in isolation; absent a reasoned and combined quantitative and qualitative assessment of the programs costs and benefits, one cannot determine the best long-term, sustainable path for the growth of distributed generation in the Commonwealth.

The Purpose and Benefits of Net Metering in Massachusetts

A basic purpose of net metering is to address barriers to customers installing distributed generation (primarily renewable) resources on their property, and provide a mechanism by which suppliers of distributed resources can structure installation or leasing arrangements with homeowners. The commercialization of distributed resource options will expand the set of supply alternatives and

[11] Hibbard et. al. 2014, pages 3-5.

energy service choices available to retail electricity customers, increase competition at the wholesale and retail level, create jobs and deliver price, economic and environmental benefits to Massachusetts and New England.

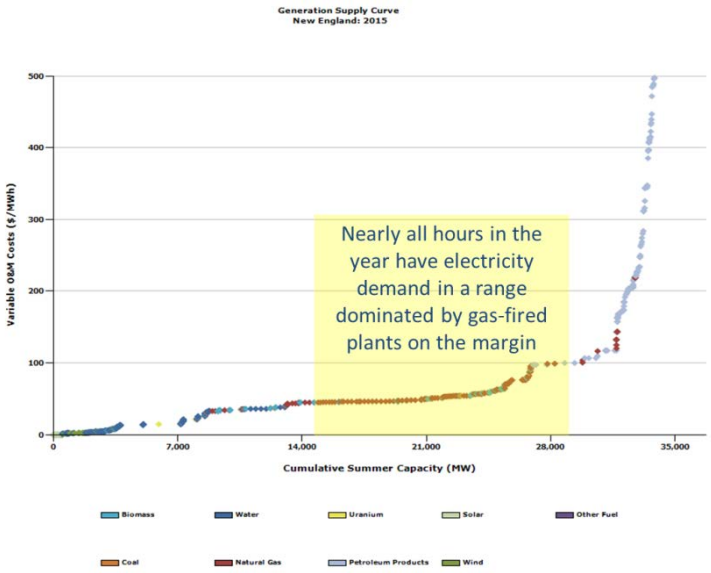
There are a number of benefits associated with the growth in distributed generation that derive from net metering (and other) policies. Some are direct cost reduction benefits to participants in the program. Others are cost reduction benefits to all ratepayers in Massachusetts – and New England – as a function of how expanded distributed generation affects electricity demand and supply/price outcomes in regional wholesale markets. Growth in distributed generation may also defer or avoid expenditures on distribution and transmission infrastructure that otherwise would be needed to meet growth in demand. Finally, there are a host of less tangible benefits, including economic benefits associated with greater local investment of energy dollars, and reduced costs to meet our climate policy and environmental objectives.

The last category is often the most cited benefit, because it is easy to intuitively understand how growth in solar PV (and other eligible distributed generation technologies) help reduce climate change risks, and help address the public health and environmental damage that comes from our state's electricity demand growth and "traditional" (largely fossil-fueled) supply infrastructure. But the less intuitive benefits of net metering (as well as other provisions of the GCA related to energy efficiency and renewable power growth) are tied to the influence of distributed generation on wholesale markets and utility costs, and the diversification and localization of the money Massachusetts ratepayers in effect invest in electric sector infrastructure. Wholesale market costs and utility costs are reduced through reduction in needed capacity and energy. Diversification reduces risks of prices and price volatility over a long period of time; localization displaces existing out-of-state energy supply with local economic activity.

To understand how profoundly the growth in local distributed generation can influence state- and region-wide electricity costs, it is helpful to consider how electricity prices are formed (and paid for) in New England. Prices for electricity supply flow from competitive market dynamics and the evolution of supply infrastructure. Competitive suppliers and power companies sell electricity to residents, businesses, municipal electric companies, and the distribution utilities (for default service) through marketing to individual customers, responses to utility solicitations, and bilateral negotiations with towns and businesses. The prices charged are determined by the price at which suppliers can purchase power in the regional New England wholesale electricity markets.[12] Power supplied in regional markets is, in turn, made available by power plants constructed and operated throughout the New England region, as well as (to a lesser extent) imports from Canada and New York.

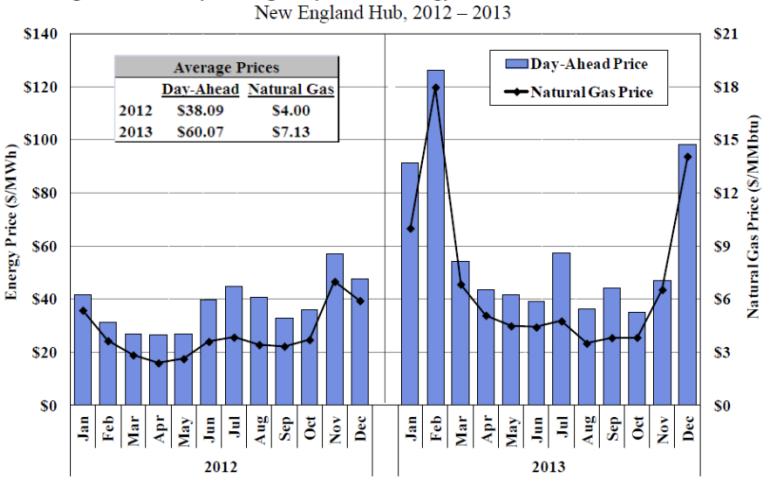
[12] This is true whether the customer is directly purchasing power at daily, weekly, or monthly wholesale prices, or the customer is obtaining all-requirements service for some period of time (such as in the utility default service procurements). In the latter case, prices are generally set based on expectations of prices in wholesale markets. Either way, the underlying driver of prices is wholesale market pricing.

Massachusetts and New England are increasingly concentrated in electricity supply, with reliability and price implications. In terms of wholesale market pricing, it is – and for many years will be – almost entirely determined by the price of natural gas delivered to New England's gas-fired power plants. This is because market prices are set hourly by the price offer of last power plant operated to meet electrical demand in the region.[13] And in *almost all* hours of the year, the last – or "marginal" – power plant is fueled by natural gas. See Figure 1,[14] which shows illustratively that in the vast majority of hours in the year, the marginal unit operated is a natural gas-fired power plant. Thus, as the price of natural gas goes, so goes the price of electricity. See Figure 2.[15]



Net metering and other GCA policies help increase supply diversity, reduce the quantity required from regional markets, and reduce dependence on natural gas. Reducing our dependence on natural gas generation tempers the impact on Massachusetts' ratepayers of the inherent volatility and occasional extreme price swings associated with natural gas-fired electricity generation.[16] In effect, expanded development of solar PV hedges against expected and unexpected changes in natural gas pricing. More directly, it specifically reduces the amount of new gas-fired generation and new transmission infrastructure constructed to meet customer loads. This is because ISO

Figure 1: Monthly Average Day-Ahead Energy Prices and Natural Gas Prices
New England Hub, 2012 – 2013



[13] All power plants submit offer prices for each hour of the day. The New England Independent System Operator then schedules the operation of power plants to meet hourly load in order of lowest-price to highest-price resources, to identify the lo west possible "clearing price" – or LMP – in each hour.

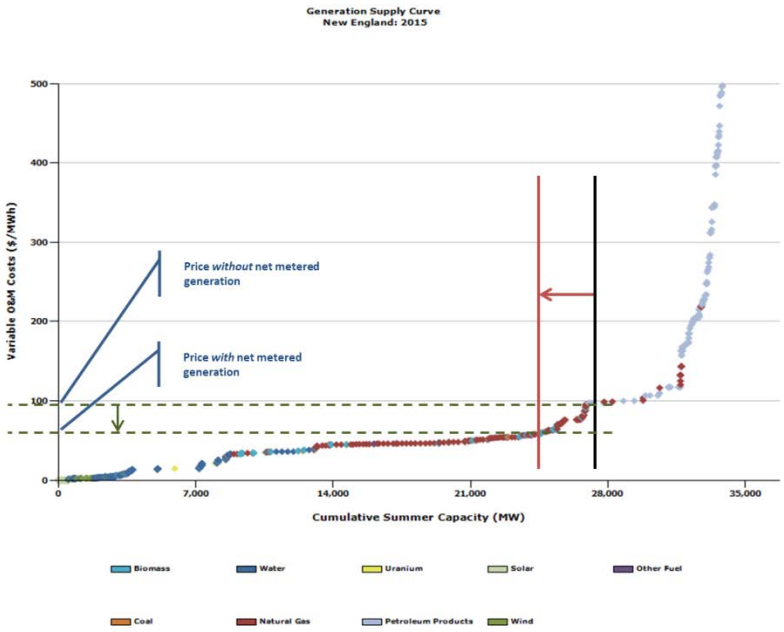
[14] Figure 1 source: SNL Financial.

[15] Figure 2 source: David B. Patton, Pallas Lee VanSchaick, and Jie Chen, *2013 Assessment of the ISO New England Electricity Markets*, June 2014, Figure 1.

[16] This was particularly clear this past winter, as fall procurements for basic service in Massachusetts realized market pricing that reflected expectations of extremely high natural gas – and thus electricity – pricing in the state over the winter.

New England is currently working with stakeholders to reflect expected development of behind the meter generation in the forecasts it uses to identify the quantity of new power plants sought in the regional capacity market, and the need for new transmission projects. Expanded development of solar PV thus will reduce the costs to the region's consumers associated with new supply and transmission infrastructure needed to meet current and future demand for electricity.

The overall reduction in power needed from wholesale markets will also suppress prices in wholesale energy markets in many hours of the year. Figure 3 represents this conceptually using the same illustrative New England supply curve from Figure 1. The black vertical line represents the regional network load in a single hour *absent* the distributed generation installed due to net metering policies. The red vertical line represents what that regional network load is *with* the distributed generation. Thus, in this hour (and many hours throughout the year), the price charged to *all customers* in Massachusetts and New England is lower than it would have been without the distributed generation operating due to net metering. Notably, New England's highest load values – where the supply curve gets steeper (and potential energy price savings higher) are generally during the day, when the sun is up; meaning that the energy price suppression effect is weighted towards those hours with the greatest potential for reduced prices.



A corollary to the benefits of diversifying away from fossil fuels and towards distributed generation is a fundamental shift in the way consumers' energy purchase dollars flow (or do not flow) back into the local economy. Currently, the vast majority of electricity is generated in power plants owned by companies based in other states, through the combustion of fuels mined/extracted, processed, and transported from far outside the New England region. This means that the money we spend on electricity supply comes out of the pockets of Massachusetts businesses and residents, and flows largely to entities and activities outside of New England. In short, Massachusetts energy dollars predominantly benefit the economies of other states.

Net metering (and other GCA) policies redirect a portion of such dollars to companies and activities within Massachusetts and the greater New England region. More of our money is instead spent locally for solar company solicitation/procurement of customers and locations, the purchase of needed hardware and (to some extent) equipment, distribution, installation, maintenance, and customer interactions, all within the Commonwealth. As those additional revenues are spent within the state, they generate additional economic activity, increased tax revenues, formation of local companies, and more employment for Massachusetts residents.

Finally, in addition to reducing the need for new power plants and transmission projects, an increase in distributed generation has the potential to defer or avoid investments the distribution companies might otherwise have to make to meet service quality standards and/or address load growth on distribution system feeders. This potential benefit is particularly difficult to sort out, as it is highly location- and time-specific, and requires a clear understanding of the nature of the interaction of distributed power sources with the operation of the distribution system in the area. With some specific analysis of particular weak points on a company's system, it may be possible to establish a quantitative estimate of this benefit.

RATE MECHANISMS AND NET METERING COSTS

The up-front cost to install distributed generation is a barrier to installation for most customers, even as the levelized cost of electricity for such systems continues to look more and more favorable relative to grid-based energy. Net metering (along with other policies, such as the solar renewable energy credit (SREC) program) is aimed at reducing these barriers to entry, and facilitating the broader integration of grid-parity distributed resources over time in part through the fair valuation of energy exported to the grid. This is accomplished through specific and evolving rate-making mechanisms that apply to customers that install eligible distributed generation.

To establish net metering, the companies proposed and the DPU approved net metering "tariffs" for each electric company.[17] Under the Massachusetts net metering tariffs, customers can install generation behind the electric company's meter (i.e., on-site), reduce the amount of energy (and associated costs) for electric company service, and get credit from the company for energy "exported" on to the distribution system (i.e., when on-site generation exceeds consumption).

When a host customer's distributed generation resource is producing energy consumed on-site, it reduces the total amount of monthly consumption on the customer's bill, and thus the amount the customer must pay for electric service. When the amount generated exceeds the host customer's consumption, energy is "exported" to the grid. Under Massachusetts' net metering law and DPU regulations, such exported energy can be used as a credit against other customers' bills.

In the end, distribution companies should be – and are – provided the opportunity to collect from ratepayers their costs of service approved by the DPU, and are allowed to adjust rates as needed ensure they collect approved costs over time. Rates are often set based on approved costs ($) and expectations of customer consumption by rate class (kWh) – in cents per kWh.[18] Thus, if it turns out that some customers consume less than expected or pay less for the amount consumed – e.g. through installation of distributed generation on-site that reduces consumption, and through the

[17] Electric company rates for different rate classes are established through DPU review and approval of "tariffs" for service, proposed by the companies. For example, the "R1" tariff contains the basic rates charged by companies for service to residential customers that do not heat with electricity. The net metering tariff contains the terms and conditions of net metered service, including, e.g., the formula for calculation of "net metering credits" that can be assigned to other customer accounts when net metered generation exceeds the consumption of the "host" customer (the customer with the distributed generation installed on-site).

[18] Company costs are also collected through charges based on customer peak monthly demand (i.e., $/kW), and through fixed charges, particularly for larger commercial and industrial customers. However, for residential and smaller commercial customers a larger portion of revenues is collected through volumetric ($/kWh) charges.

transfer of excess net metering credits (from exports) to other customers – companies will not recover their approved costs through rates as originally structured. In this case, the company will subsequently adjust rates through a rate "reconciliation" proceeding at the DPU, to make up the difference. The difference would generally result in an increase in the volumetric rate ($/kWh) sufficient to recover the shortfall based on going-forward expectations of load. Over time this means that the amount collected from some customers (e.g., those with net metered facilities) will be less than originally expected, and the amount collected from others, more. This is similar in structure to rate adjustments for other rate mechanisms (past and current) that have focused on meeting public policy needs (e.g., low-income programs, bad debt recovery, economic development incentives, and energy efficiency programs). However, in the case of distributed generation (as with energy efficiency), overall costs for *all* customers are mitigated through price suppression in wholesale markets and reduced investment and operating costs to maintain transmission and distribution service.

The Legislature will no doubt hear a lot in the coming months about the estimated cost and rate impacts of net metering. This is not surprising; a focus on rate impacts and rate design is consistent with the function and objectives of utilities and utility regulation, and the level and distribution of costs are important considerations that need to be addressed through proper rate design. But this focus, in isolation, falls short. The DPU needs to fully evaluate the program's costs and benefits in order to determine next steps.

This approach has always been relied on over the years, for *many* valuable economic and public policy programs that one way or another involve the regulated utilities. It is a fallacy to view utility rates as pure, perfect, or 100 percent consistent with all textbook principles of utility rate making. The real world is far more complex; tailored rate mechanisms are an appropriate, informed, deliberated, necessary and familiar element of public utility regulation and policy, and have been used over time for a number of key programs including, for example:

- Costs associated with the preparation for and restoration of service after storm-related power outages, and incentive/penalty mechanisms for long-term service quality obligations;
- Various mechanisms to promote and ensure the safety and integrity of natural gas distribution pipelines, and to address failures to comply with pipeline maintenance and safety responsibilities;
- Targeted rate mechanisms to fund concentrated infrastructure development programs (e.g., to replace aging distribution or transmission system infrastructure, and to replace aging corroded natural gas pipeline infrastructure);
- Special economic development or business retention rates/policies, to reduce the costs of doing business in Massachusetts in order to retain economic activity and jobs;
- Dedicated charges to collect the costs of generation assets stranded by the comprehensive restructuring of the electric industry;
- Supplemental charges to recover costs for the remediation of environmentally contaminated (e.g., superfund) gas/electric property;
- Rate mechanisms to ensure the proper collection of health care and pension costs for retired industry workers;
- Charges to allow for the collection of legitimate costs incurred by utilities but not collected from customers (e.g., leaked natural gas commodity costs, theft, and bad debt); and

- Mechanisms dedicated to ensure service protections, reduce debt and mitigate energy costs for lower-income customers.

Net metering has always been a dedicated rate mechanism designed – in combination with other market-based policy mechanisms – to support the growth and commercialization of distributed generation in the Commonwealth. The growth in distributed generation as a result of these policies is both a major economic and energy policy success for Massachusetts, and cause for a new, comprehensive review with an eye towards long-term sustainability. The DPU has demonstrated time and again the capability to develop proper rate mechanisms to implement the Legislature's energy policy designs in a way that fits within the general rate making construct of the Commonwealth, and the current circumstance is no different.

THE WAY FORWARD: A PROPER EVALUATION OF BOTH BENEFITS AND COSTS

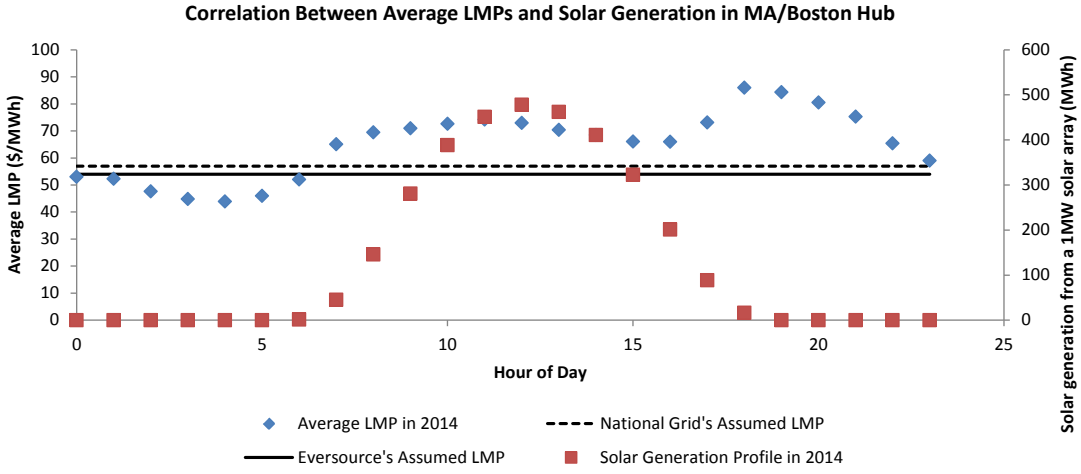
Very little happens in the world of utility rate making that does not either explicitly or implicitly involve an evaluation of both costs and benefits. For example, approval of a gas utility's infrastructure replacement program – involving accelerated investment in and accelerated recovery of major infrastructure projects – does not happen without a review of the benefits of such investment from the perspectives of public health and safety for all of the Commonwealth's citizens (e.g., avoiding explosions) as well as benefits to ratepayers (avoided costs associated with lost gas). Similarly, evaluation of the cost effectiveness of energy efficiency programs recognizes – and quantifies – the price suppression and emission reduction benefits of such programs affecting all ratepayers and the residents of the entire state. In the case of net metering, there are numerous benefits discussed in part above, and identified by the Task Force, to be reviewed and considered in the rate design process.

The full scope of impact on ratepayers and on the people of the Commonwealth – benefits included – must be considered in order for the Legislature to determine the evolution of the solar program in Massachusetts. Absent this, the Legislature is left with the utilities' simplified spreadsheet analyses, which are incomplete in scope and detail, misleading, contain calculational and methodological flaws, and have not been investigated or confirmed. Of greatest concern, the various simplifications, assumptions, and omissions in the companies' analyses[19] tend to systematically ignore or understate net metering benefits, while overstating the estimated cost impacts on ratepayers. DPU needs to conduct an analysis and evaluate the full range of costs and benefits associated with solar PV and other net metering-eligible distributed resource options. Corrections and omissions from the utilities' calculations must be reviewed and repaired in a full evidentiary rate proceeding, which can provide the following:

- A corrected and complete representation of wholesale market benefits
    - Full valuation of exported (settled and unsettled) net metering quantities from all wholesale market values, and appropriate prices, correcting mistakes in the utilities' estimates:

[19] See National Grid's Revised Net Metering and Solar Cost Analysis 4-23-15.xlsx and Eversource Energy Revised Net Metering and Solar Cost Analysis 4-23-15.xlsx.

- Calculations should be based not on average locational marginal prices (LMP) (as used by the utilities), but rather LMPs during peak hours, and/or based on the profile of solar PV output, when prices (on average) are far higher than the average prices used in the companies' calculations.[20] Figure 4 illustrates this point by plotting the average LMP and solar generation profile for each hour in MA/Boston Hub. The actual LMPs during solar peak hours are much larger than the companies' assumption of constant LMPs. The companies' approach reduces net metering value by including in LMP benefit calculations the low-priced, nighttime hour LMPs that are not coincident with solar generation; and
- Calculations need to capture the value of reduced capacity, transmission, ancillary service, and "uplift" payments by utility customers as a result of reducing the companies' portion of system load obligations;



- Full valuation of price suppression impacts of net metered generation, including reduced host customer load and virtual net metering exports, correcting omissions in the utilities' estimates:
  - Suppression of LMPs – benefitting all electric customers in Massachusetts and the New England region – due to reduced net hourly load on the system in general, and reduced net hourly load in particular in high-priced/daily peak hours;[21]
  - Suppression of Capacity and Ancillary Service (AS) needs and costs – benefitting all electric customers in Massachusetts and the New England

[20] See solar generation profile from the NREL System Advisor Model (SAM), available at https://sam.nrel.gov/.

[21] *See for example* Public Service Department, *Evaluation of Net Metering in Vermont Conducted Pursuant to Act 99 of 2014*, Section 3, November 7, 2014, http://publicservice.vermont.gov/sites/psd/files/Topics/Renewable_Energy/Net_Metering/Act%2099%20NM%20Study%20Revised%20v1.pdf.

region – due to reduced needs for new capacity and AS resource operation through lower peak monthly and annual load on the system;[21]

- Suppression of market prices for portfolio standard compliance – benefitting all electric customers in Massachusetts and the New England region – due to a reduced need to construct and operate grid-connected resources to meet state (and other states') renewable/clean portfolio standards; and
- Suppression of market prices for emission cap compliance for all pollutants – benefitting all electric customers in Massachusetts and the New England region – due to suppression of emission allowance prices to meet regional emission cap requirements.

- A corrected and complete representation of distribution and local transmission customer benefits
  - Correction/adjustment of various simplifications and assumptions that tend to overstate the impacts or understate the benefits of net metering (e.g., the companies assume flat distribution and transmission costs over the study period);
  - Full valuation of general distribution customer cost reductions due to growing penetration of distributed resources, including:
    - Deferred and avoided distribution and local transmission investments and costs due to reduction in load on the system – in general, to community/ campus/office park installations, and/or otherwise located on specific feeders that are approaching the need for incremental system upgrade investments and expenses;[21] and
    - Improved service quality for customers to the extent that community/ campus/office park installations are able to maintain electricity service during outages, or otherwise generally reduce System Average Interruption Duration (SAIDI) and System Average Interruption Frequency (SAIFI) values;
- Appropriate and reasonable valuation of benefits to ratepayers and all Massachusetts residents associated with items that are difficult to quantify, and/or are not directly reflected in electric rates
  - The local economic benefits (gross state product, jobs, tax revenues) that come from:
    - reducing the flow of Massachusetts businesses' and residents' energy dollars out of state to distant producers of fossil fuels; and
    - the localization of energy spending within the state due to contracting, construction, and (to some extent) equipment manufacturing occurring within the state for distributed generation installations;

- Reductions in electricity price volatility, reduced dependence on outside resources, and increased system operational diversity through reducing the need for investment in and operation of natural gas-fired resources;
- The benefits of reducing the social and economic risks of climate change, as well as reducing the public health and environmental impacts of the air, water and solid waste impacts associated with fossil-fuel energy production;[22] and
- The investment in advancing the commercialization and deployment of advanced energy technologies within the Commonwealth that can help the state achieve a diversity of economic, energy and environmental policy objectives.

Net metering has generated positive economic, energy and climate risk benefits for Massachusetts. By virtue of the success of the program, it is becoming a force for fundamental change in the way customers meet their energy needs – a change that fosters the development of advanced energy technologies, diversifies our energy supply, alters our energy spending from out-of-state transfers of wealth to in-state, local economic benefits, and helps the Commonwealth accomplish numerous other important economic, energy, and public health objectives.

Massachusetts is far from alone in the need to continuously adapt rate and regulatory mechanisms to the reality of a fundamental change in the economics of distributed generation and other energy supply and demand technologies. Many states are exploring ways to continue or promote – rather than stem – the growth in these technologies, while addressing the distributional impacts such technological change has on utility cost recovery mechanics. The Task Force's Report contains a wide range of information and options considered in the literature and by other states to allow for such growth in a manner that is fair and equitable for all consumers. Rather than curtail the progress that Massachusetts has made, it needs to continue to grow alongside a deliberative process to accomplish these multiple objectives. Net metering should be extended concurrent with a DPU investigation into the benefits of net metering and the role of various rate designs and options in order to determine the long term path for continued growth of distributed generation in the Commonwealth.

[22] *See* Intergovernmental Panel on Climate Change, *Renewable Energy Sources and Climate Change Mitigation: Summary for Policy Makers and Technical Summary*, Chapter 9, 2012, https://www.ipcc.ch/pdf/special-reports/srren/SRREN_FD_SPM_final.pdf.