Submitted via email to DGFWGmatters@iso-ne.com

February 23, 2018

RE: Joint Comments on ISO New England's Draft 2018 PV Forecast

Dear ISO New England:

The Sustainable FERC Project, Acadia Center, Conservation Law Foundation, Natural Resources Defense Council, and Sierra Club respectfully submit the following comments on the draft 2018 solar photovoltaic (PV) forecast, as presented to the Distributed Generation Forecast Working Group (DGFWG) on February 12.[1] We appreciate the opportunity to provide feedback on this important input to regional wholesale markets and planning processes at the ISO.

Capturing the full system contributions of clean energy resources is critical to ensuring prudent system planning and just and reasonable rates. Toward that end, we first wish to express our appreciation to the ISO for its recent implementation of forecast improvements to better account for behind-the-meter (BTM) PV's hourly contributions to peak load.[2] While discussions of these changes occurred outside the DGFWG, the improvements are relevant to the work of this group, and we commend the ISO for making them. As reported by the ISO, this improved accounting lowered FCA 12's net installed capacity requirement (ICR) by 335 MW,[3] thus reducing potential over-procurement of and overpayment for capacity resources.

In 2017, ISO-NE's PV forecast performed well in projecting near-term distributed PV installations in the region. In contrast to previous years where the year-ahead PV forecast significantly underestimated actual PV growth in the region – by between 28 and 66 percent each year – the 2017 forecast was accurate to within 5 percent of actual PV installations.

Forecasted vs. Installed Solar PV in New England (MWac)

	2014	2015	2016	2017	2018 Draft
ISO-NE Year-Ahead Forecast	246.5	324.3	449.6	497.9	392.5
Actual Installations	410.1	416.2	593.0	472.6	TBD
Difference	163.6	91.9	143.4	-25.4	TBD
% Difference	66%	28%	32%	-5%	TBD

As explained further below, however, while the 2017 PV forecast more accurately predicted near-term results than in previous years, the later years of that forecast, and the draft forecast in 2018, continue to be problematic. We are also concerned by proposed changes to this year's PV

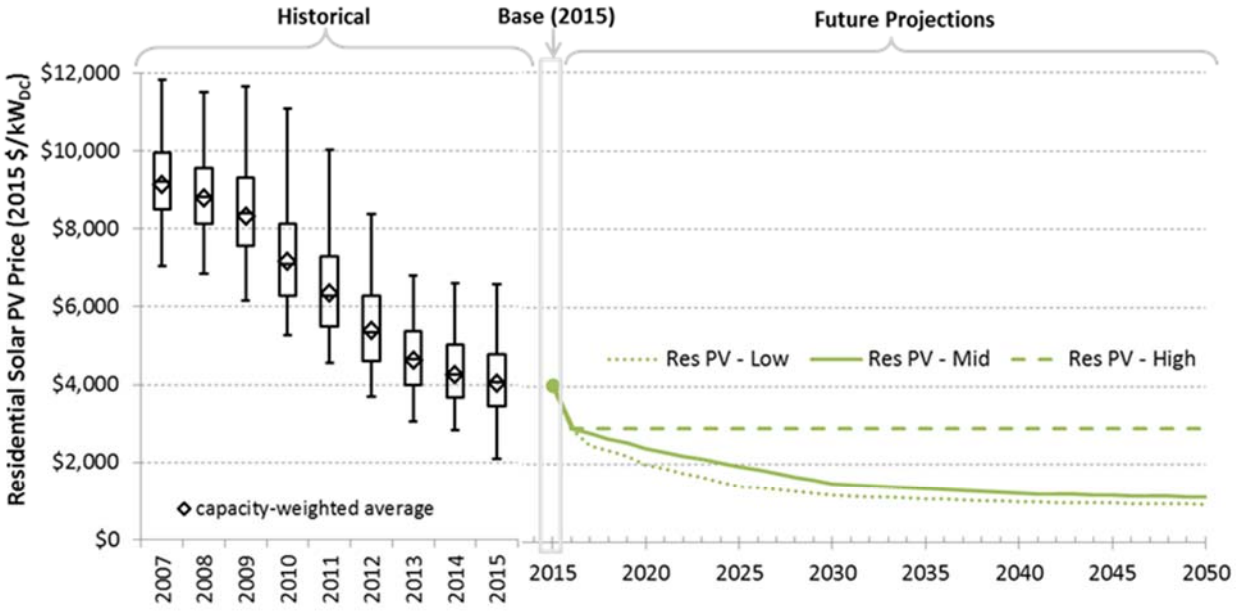
[1] ISO-NE, *Draft 2018 Photovoltaic (PV) Forecast* (Feb. 12, 2018), *available at* https://www.iso-ne.com/static-assets/documents/2018/02/dgfwg_2018feb12_draft2018forecast_final.pdf.
[2] *See* ISO-NE, *Modeling Behind the Meter (BTM) Photovoltaic (PV) in an Hourly Profile in the Installed Capacity Requirement (ICR) Calculations* (Sep. 19, 2017), *available at* https://www.iso-ne.com/static-assets/documents/2017/09/a6_behind_the_meter_pv_hourly_profile_methodology_in_icr_calculations.pdf.
[3] *Id*., at slide 16.

forecast methodology – specifically the adoption of higher discount factors in the early years of the forecast – that could undermine the near-term accuracy of the 2018 forecast.

Our comments below focus on: (1) the continuing disconnect between the ISO's PV forecast trajectory and regional and national trends; (2) the ISO's proposed policy discount factors; (3) the ISO's proposed post-policy discount factors; (4) ensuring that the capacity contributions of PV resources are fully captured in ISO planning and markets; and (5) improving tracking of and reporting on forecast performance relative to observed results.

1. ISO's PV Forecast vs. Regional and National Trends and State Policy Requirements

In its draft 2018 PV forecast, as in previous iterations, ISO-NE continues to forecast that solar PV installations will grow more slowly in future years than they have in recent years. This defies the growth trends we have seen both in this region and nationally, the direction of state policies that continue to call for more solar PV, and expected economic trends. In its February 12 presentation to DGFWG stakeholders, the ISO stated that installed solar costs are "leveling off," suggesting that economic trends that have contributed to PV growth to date may not continue.[4] The National Renewable Energy Lab (NREL) does not share this outlook. As shown below, in its 2017 Annual Technology Baseline, NREL continues to project continued cost declines through 2050, including steady reductions between now and 2030.[5] Notably, NREL expects PV costs to continue to fall throughout the 2018 PV forecast period (2018-2027).



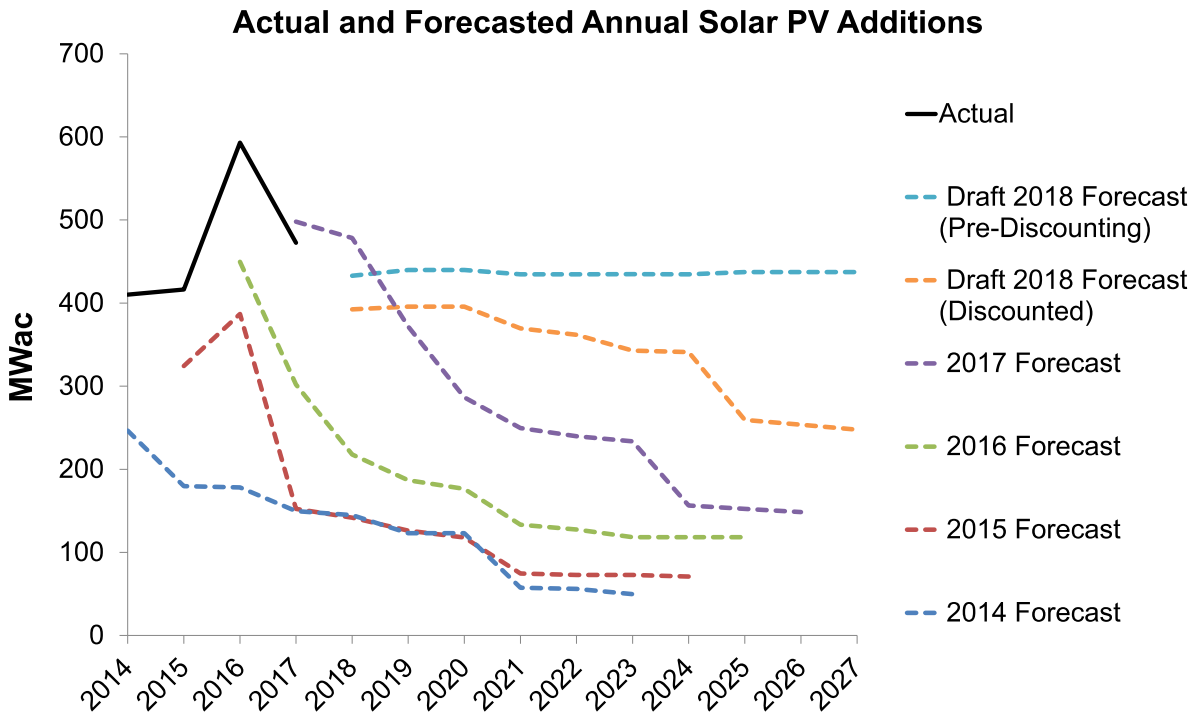
CAPEX (CAPital EXpenditures) historical trends, current estimates, and future projection for residential PV
Source: National Renewable Energy Laboratory Annual Technology Baseline (2017), http://atb.nrel.gov

[4] *See* ISO-NE, *Draft 2018 Photovoltaic (PV) Forecast*, *supra* note 1, at slide 14.
[5] NREL (2017), "Annual Technology Baseline: Residential PV Systems," *available at* https://atb.nrel.gov/electricity/2017/index.html?t=sr (accessed Feb. 20, 2018).

The ISO also cites other potential sources of uncertainty, including import tariffs on PV cells and modules and the recent federal tax bill, that could raise PV costs.[6] These factors could affect PV adoption but so too will continued technology and process gains, continued state policy drivers for more PV, and other policies, such as the Regional Greenhouse Gas Initiative (RGGI), which New England states and their partners recently agreed to strengthen and extend through 2030. These other factors will push in the opposite direction – toward more PV.

We have previously requested that the ISO consider positive economic trends in PV that could lead to faster achievement of state policies and economic PV additions, in addition to policy-driven installation, particularly in later years of its forecast. However, the ISO has stated that its PV forecast is state policy-driven and that it has no current plans to consider non-policy economic drivers of PV growth. We continue to believe this is a weakness of the model, but in the absence of adding a more complete economic evaluation, the ISO's current approach appears to correct only for potential negative factors in PV growth while ignoring positive ones.

This results in a PV forecast that looks very little like the state policies it purports to reflect. As shown below (by the undiscounted draft 2018 forecast line), if the ISO's forecast were based only on state policies, it would project relatively constant future PV growth, with annual additions continuing at roughly the rate we have actually seen over the last four years.[7]



[6] ISO-NE, *Draft 2018 Photovoltaic (PV) Forecast*, *supra* note 1, at slide 16.

[7] In later years of the PV forecast, ISO-NE has made assumptions about continued solar growth beyond existing state policies. For example, in the draft 2018 forecast, the ISO has assumed additional PV growth in CT from 2022 and in MA from 2025 after certain policies in those states are set to expire. We discuss the forecast's post-policy assumptions later in these comments. *See id.*, at slides 26 and 29.

The PV forecast diverges from state policies because the ISO imposes "discount factors" across all years of its forecast model that result in significantly lower projected PV growth than state policies call for. This divergence is shown in the figure above by the gap between the discounted (i.e., the ISO's forecast) and undiscounted (i.e., the states' adopted policies) 2018 lines. In other words, the resulting forecast (the discounted 2018 forecast line) is significantly different, and always lower, than the starting point of state policies (the undiscounted 2018 forecast line).

It is true that distributed solar PV growth in New England was lower in 2017 than it was in 2016 – a year in which PV growth spiked in the region, likely due to accelerated demand that year as customers and installers raced to beat a December 31, 2016 federal tax credit expiration that was subsequently extended. But the rate of PV growth was still higher in 2017 than in either 2014 or 2015. Given this, and the fact that New England states have continued to strengthen and extend their solar PV policies, there is little reason to believe that the rate of PV installation in this region has crested or that PV growth is beginning to taper off on the path toward steady future decline. Yet that is exactly what ISO-NE's draft 2018 PV forecast concludes and what previous ISO forecasts have also wrongly concluded.

The draft 2018 PV forecast projects that from 2018 to 2027, annual solar PV installations will be lower in New England than they have been in any of the previous four years and that, by the end of the 10-year forecast, annual PV growth will be roughly half of what we see today. We do not believe this is either a likely or a rational result, and we urge the ISO to modify its forecast to reflect both actual state requirements and continued expected economic gains in PV over the next decade. Our comments below provide specific suggested modifications to the forecast model.

2. The ISO Should Reduce or Eliminate Its Policy Discount Factors

No forecast will ever be completely accurate. However, last year's results suggest that continued refinements in the PV forecast methodology and the ISO's data collection efforts from Distribution Owners are paying off when it comes to its near-term forecast values. As the ISO noted at the February 12 DGFWG meeting, the 2017 forecast result for 2017 – which was within 5 percent of actual 2017 PV growth – was essentially correct. This is a major improvement over previous year-ahead projections that underpredicted PV growth by 28 percent or more.

Despite this improved and largely accurate result, in the draft 2018 PV forecast, the ISO proposes to change its methodology by applying policy discount factors of 10 percent in each of the first three years of the forecast, effectively projecting 10 percent lower PV growth in each of these years.[8] In previous years, we encouraged the ISO to eliminate policy discount factors in the forecast's early years because the year-ahead forecast widely diverged from and was consistently significantly below actual results. In 2017, for the first time, the ISO overpredicted PV growth, though this overprediction was small, at 5 percent. In perspective, the 5 percent over forecast for

[8] In the 2017 PV forecast, ISO-NE elected not to discount state PV policy growth in the first three years of the forecast (2017-2019). at 28. ISO-NE, *Final 2017 PV Forecast* (May 1, 2017), *available at* https://www.iso-ne.com/static-assets/documents/2017/05/2017_solar_forecast_details_final.pdf. In the draft 2018 PV forecast, ISO-NE has proposed to discount state policies by 10% in the first three years (2018-2020) and by 15% in subsequent years. ISO-NE, *Draft 2018 Photovoltaic (PV) Forecast*, *supra* note 1, at slide 25.

PV in 2017 resulted in assumed growth of only 25.4 MW more than was observed.[9] Notably, had the ISO applied its proposed 10 percent discount factor for 2018 in year 1 of the 2017 PV forecast, the result would have been a forecast that was still 5 percent off (this time lower than the actual number), not a forecast that was more accurate.[10] This suggests the proposed discount factors in the 2018 forecast may be more likely to introduce error than to improve accuracy.

Given the relatively small over forecast of PV growth in 2017, we believe it would be more prudent for the ISO to continue the approach, first adopted in the 2017 PV forecast, of not discounting state policies in the first few years of the forecast. This reflects the fact that, with the exception of 2017 when the forecast was within 5 percent of actual results, the rate of PV installations under state policies has consistently exceeded the ISO's expectations. It also reflects the possibility that the cause of the small over forecast in 2017 may simply have been year-to-year variability rather than a flaw in the model or a new trend in PV growth requiring correction.

The ISO argues that near-term uncertainty in PV growth justifies discounting the PV forecast to arrive at a lower result, but as we noted above, this assessment is premature and one-sided given countervailing trends that could also lead to continued or even accelerated PV growth. Moreover, even if the ISO is correct, directionally, about potential headwinds, its undiscounted draft PV forecast for 2018 of 432.8 MW is still 8.4 percent lower than the amount of PV New England added in 2017 (472.5 MW) and 27 percent lower than what the region added in 2016 (593 MW). Thus, it is entirely possible that the factors cited by the ISO will slow PV growth but that states will still achieve (or exceed) the lower state policy requirements ISO-NE has calculated for the region in 2018. Further discounting these lower state policy requirements requires an assumption of much stronger headwinds, which we do not believe the ISO has adequately supported, as well as the implicit assumption that states will continually fail to achieve their policy requirements.

For all of the reasons above, we urge the ISO to maintain last year's approach of not discounting state policy requirements in the early years of the forecast rather than its proposed approach of assuming growth is 10 percent lower than state policy trajectories. Consistent with our comments above regarding the problematic longer-term forecast trajectory, we also urge the ISO to consider eliminating, or significantly reducing, the 15 percent policy discount factors that it applies to years 4 through 10 of the forecast. New England states have consistently exceeded the ISO's projections of solar PV growth while continuing to both achieve and strengthen their PV policies over time. Given these trends, we believe the ISO's undiscounted forecast, which reflects state policy requirements, is a more likely depiction of the future.

3. The ISO Should Reduce or Eliminate Its Post-Policy Discount Factors

As in previous PV forecasts, ISO-NE also applies "post-policy" discount factors to reflect uncertainty in state policies that are slated to end before the end of the 2018 PV forecast period in 2027. In the 2018 forecast, post-policy discounts are applied to CT and MA, the two states in

[9] Assuming a PV summer peak capacity value of 40 percent of nameplate (or lower), the effect of overpredicting PV growth in 2017 by 5 percent was presumably even smaller – perhaps 10 MW or less – on net ICR.

[10] The 2017 forecast projected PV growth of 497.9 MW in 2017, compared to actual growth of 472.5 MW. If it had been discounted by 10 percent, the forecast for 2017 would have been 448.1 MW, or 5 percent too low. *See* ISO-NE, *Draft 2018 Photovoltaic (PV) Forecast*, *supra* note 1, at slide 12.

which the ISO identified specific PV policies set to expire before 2027.[11] We acknowledge and appreciate the challenge of predicting what state policymakers will do to incentivize PV resources beyond what they have already adopted. However, we encourage the ISO to adopt a different post-policy approach than it has in the draft 2018 PV forecast.

The history of PV policies to date in New England has largely been that states with ambitious policies have continued to extend and strengthen them, or have adopted new policies, that continue to drive resource growth in the region. Further, while specific future state PV policies may be impossible to predict, it is clearly the case that New England states have adopted climate policies and targets (including legally binding ones) that will require further growth in clean energy resources, both during the 2018 PV forecast period (2018-2027) and in future years. Solar PV will not meet this entire need, but it will contribute. As addressed earlier, PV costs, including for smaller, distributed, and behind-the-meter systems, such as rooftop solar, also continue to fall and NREL projects they will continue to do so.[12] While the ISO's PV forecast does not model or account for economic growth of PV beyond what state policies require, it is reasonable to assume that growth in PV under state policies will be supplemented by economic additions in the future, spurred by PV cost gains and cost gains in complementary technologies like energy storage.

Given the history of states strengthening their PV policies, state climate laws on the books, and the expected continuation of favorable cost trends, we believe an assumption that state policies will continue to drive similar levels of PV growth, beyond existing policy end dates, represents a reasonable approximation of future PV growth. Because states may also accelerate PV adoption under state policies, assuming constant growth into the future is not an outer boundary, but rather an assumption that states will at least maintain the status quo. Such continued rates of PV growth beyond state policy end dates are reflected in the ISO's undiscounted PV forecast, but the ISO then applies discount factors of between 35 percent and 50 percent to arrive at a final forecast.

We encourage the ISO to use the undiscounted post-policy values in its PV forecast. To the extent the ISO believes, however, that it is prudent to discount state policies after current policy end dates, we encourage the ISO to use lower discount factors than currently proposed. Discounts of 35 to 50 percent from current policy values reflect significant reductions in future PV growth that do not appear consistent with achieving state climate priorities. Combined with the ISO's use of policy discount factors for years in which states have adopted PV policies, these post-policy discounts lead to substantial reductions in forecasted PV growth. To the extent the forecast is used to inform long-term planning, we are concerned the ISO's current assumptions will lead planners and stakeholders to underestimate the amount of future clean energy resources on the system, which will contribute to an inaccurate picture of future system needs.

If the ISO continues to apply post-policy discount factors, we also recommend that the ISO modify the ways in which these factors are applied. The current approach, first introduced in the 2017 forecast, of using a post-policy discount factor that begins at a lower level and rises over time makes more sense than the ISO's previous approach of applying a single, higher post-policy discount factor across all years. However, we believe it would make more sense to implement

[11] *Id*., at slide 26.
[12] NREL (2017), "Annual Technology Baseline: Residential PV Systems," *supra* note 2.

the lower end of this range in the first year after a state's current policies expire, rather than fixing the post-policy discount factors in time, with no relation to the timing of state policies.

For example (as shown in the tables below): Using the ISO's proposed post-policy discount factors in the draft 2018 forecast (without endorsing these specific numbers), the lower-bound, 35 percent post-policy discount factor would kick in in CT in 2022, the first year following the end of certain PV policies, rather than the 41.7 percent discount that the ISO currently applies to CT in 2022 in its draft forecast. Similarly, in MA the 35 percent discount would kick in in 2025, rather than the ISO's current application of a 46.7 percent discount to MA in 2025.

Post-Policy Discount Factors Applied to CT: As Proposed by ISO-NE and Alternative Approach

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Draft 2018 Forecast	*N/A*	*N/A*	*N/A*	*N/A*	41.7%	43.3%	45.0%	46.7%	48.3%	50.0%
Alternative Approach	*N/A*	*N/A*	*N/A*	*N/A*	35.0%	36.7%	38.3%	40.0%	41.7%	43.3%

Post-Policy Discount Factors Applied to MA: As Proposed by ISO-NE and Alternative Approach

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Draft 2018 Forecast	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	46.7%	48.3%	50.0%
Alternative Approach	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	35.0%	36.7%	38.3%

We believe such an approach would better reflect uncertainty without assuming that states with longer-term PV policy commitments (such as MA) will more precipitously drop their support for PV in the years after their current policies expire. To the contrary, given MA's strong support for PV, we would argue the state is *less likely* to pull support for this resource upon the expiration of current policies and thus if a post-policy discount is applied to MA, it should be a smaller one.

4. Energy-only PV Resources

We remain concerned that the capacity contributions of energy-only PV resources (EORs) are not captured in the ISO's calculation of net ICR for the FCM, which may result in over-procurement of non-PV capacity resources.[13] While we understand that the specific use of the PV forecast in determining net ICR is the purview of other stakeholder committees, such as the Power Supply Planning Committee (PSPC) and the NEPOOL Reliability and Participants Committees, we continue to request that the ISO, through the DGFWG and its annual PV forecast, provide information that would better inform discussions in those committees.

[13] *See, e.g.*, Joint Comments on ISO New England's Draft 2016 PV Forecast (Mar. 9, 2016), *available at* https://www.iso-ne.com/static-assets/documents/2016/03/joint_draft2016pvforecast_comments.pdf; Joint Comments on ISO New England's Draft 2017 PV Forecast (Mar. 14, 2017), *available at* https://www.iso-ne.com/static-assets/documents/2017/04/jnt_draft2017pvfForecast_comments.pdf.

Specifically, we request that the ISO provide estimates of energy and peak load reductions (or estimates of contributions toward meeting peak capacity) from distributed PV resources, by state and PV resource category (as categorized by the ISO in the forecast – i.e., FCM resources, non-FCM EORs, and BTM PV) across the forecast period. In its 2017 PV forecast, ISO-NE provided estimated annual energy from PV by state in GWh, which appears to include all three categories of PV resources lumped together, as well as estimated summer peak load reductions by state in MW for BTM PV only.[14] We request that the ISO report energy values for all three categories of PV in its forecast separately by category. For peak load, we request that the ISO provide:

- For BTM PV: the same information on estimated peak load reductions from these resources that the ISO has provided in previous forecasts;
- For FCM resources: estimates of FCM qualified capacity across the forecast period; and
- For non-FCM EORs: estimates of (1) peak load reductions *if* these resources were classified as BTM PV and (2) estimates of FCM qualified capacity *if* these resources participated in the FCM (to the extent these values are different) across the forecast.

With respect to estimating these values from non-FCM EORs, if the ISO does not believe it has sufficient data to estimate energy and peak load contributions from non-FCM EORs, we request that the ISO provide estimates for these resources by treating them, for purposes of calculation, as BTM PV resources (i.e., by using the same assumptions for non-FCM EORs as the ISO uses for BTM PV), for which ISO-NE has shown the ability to calculate both energy and peak load reduction values. We further request that the ISO provide information on:

- The differences (if any) that the ISO believes exist between the energy and peak load reduction characteristics of BTM PV resources and non-FCM EORs in the region, including whether any differences exist between the operations of BTM PV resources and non-FCM EORs in ways that are believed to affect their capacity contributions; and
- The drivers of non-FCM EORs are in the region and why these PV resources are neither participating in the FCM currently nor acting as BTM PV, either of which would have a recognized capacity contribution.

Providing this information will better enable stakeholders in the DGFWG and other committees to understand whether the failure to account for the capacity contributions of non-FCM EORs in the net ICR has a potentially material effect on the ICR. To the extent the data suggest that not accounting for non-FCM EORs does materially affect calculations of net ICR, we encourage the ISO to explore ways to account for peak load reductions from non-FCM EORs, much as the ISO recently took steps, on its own initiative, to correct the under-accounting of BTM PV's hourly contributions to peak load. Alternatively, we request that the ISO explore ways to enable these non-FCM EORs to participate in the FCM by determining, in conversation with the resource owners and the DGFWG, what road blocks currently exist to their participation in the FCM and how these road blocks might be overcome.

To the extent possible, as part of its annual draft PV forecast, it would also be helpful if the ISO could provide an estimate of how projected PV quantities in future years will be distributed between FCM resources, non-FCM EORs, and BTM PV. Currently, the ISO only provides this

[14] *See* ISO-NE, *Final 2017 PV Forecast*, *supra* note 8, at slides 59-60.

breakdown as part of its final PV forecast, which prevents stakeholders from being able to effectively comment on (or ask questions about) this important aspect of the forecast.

5. Tracking PV Forecast Performance

Finally, we request that ISO-NE annually provide information to DGFWG stakeholders on how its PV forecasts have performed relative to actual results, similar to the figures and analysis the ISO provided to Energy-Efficiency Forecast Working Group (EEFWG) stakeholders on its energy efficiency (EE) forecast this year.[15] The ISO has provided some comparative information in its draft 2018 PV forecast, but we encourage the ISO to provide additional detail and formalize forecast comparisons and evaluation as part of both its annual EE and PV forecasts. The information provided on the EE forecast this year provides a good model.

It would be most useful if the ISO could provide this information at the same time as when it releases its draft PV forecast or, if possible, prior to release of the draft forecast. For example, the ISO provided stakeholders with its recent EE forecast assessment prior to release of its draft 2018 EE forecast, as part of an EE forecast model design web conference last fall.

Thank you for considering our comments, and please let us know if you have any questions.

Sincerely,

Bruce Ho
Senior Advocate
Sustainable FERC Project
bho@nrdc.org

Jamie Howland
Director, Climate and Energy Analysis Center &
Director, Energy Efficiency and Demand Side Initiative
Acadia Center

Jerry Elmer
Senior Attorney
Conservation Law Foundation

Jackson Morris
Director, Eastern Region
Climate & Clean Energy Program
Natural Resources Defense Council

Josh Berman
Senior Attorney
Sierra Club

[15] *See* ISO-NE, *2018 Energy-Efficiency Forecast Model Design and Methodology* (Oct. 20, 2017), *available at* https://www.iso-ne.com/static-assets/documents/2017/10/eefwg_modeldesign_v3.pdf, at slides 4-14.