Institute *for*
Policy Integrity
NEW YORK UNIVERSITY SCHOOL OF LAW

September 10, 2018

Hon. Kathleen H. Burgess, Secretary
New York State Public Service Commission
Three Empire State Plaza
Albany, New York 12223-1350

VIA E-MAIL

Re: Case 18-E-0130 – In the Matter of Energy Storage Deployment Program

Dear Secretary Burgess:

Please find enclosed joint comments of Azure Mountain Power, Bloom Energy, the City of New York, Environmental Defense Fund, the Institute for Policy Integrity at New York University School of Law,[1] Natural Resources Defense Council, New York City Environmental Justice Alliance, and WattTime on Smart Dispatch and E Value to the New York State Department of Public Service and New York State Energy Research and Deployment Authority Staff.

We are grateful for your consideration of these comments. Please contact me if you have any questions.

Sincerely,

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Cc: Active Parties

[1] This document does not purport to present New York University School of Law's views, if any.

Comments on Measuring and Valuing Emissions Benefits of Energy Storage Systems

Introduction

In January 2018, Governor Cuomo announced a statewide energy storage target of 1,500 MW by 2025 to address the challenges of integrating and maximizing the benefits of clean renewable energy resources, and to "further New York's climate and clean energy leadership."[1] He directed state energy agencies and authorities to work together to explore a variety of policy options to meet this target.[2] In June 2018, the New York State Department of Public Service and the New York State Energy Research and Development Authority (collectively "Staff") released the New York State Energy Storage Roadmap ("Roadmap") outlining a series of recommended approaches to achieve the Governor's targets.[3] On July 17, 2018, Staff issued a notice inviting comments on the Roadmap.[4]

As discussed extensively in the Roadmap, energy storage systems will "serve many critical roles to enable New York's clean energy future" and undoubtedly be an important component of New York's electric system as envisioned by Reforming the Energy Vision.[5] We agree with Staff that energy storage, as well as other distributed energy resources with dispatch flexibility such as fuel cells, has the potential to support NY's efforts to achieve emission reductions and protect public health, eliminating the need for old and higher-emitting peaker plants, many of which are located in environmental justice areas.[6]

However, as Staff correctly recognizes, simply installing energy storage systems without providing the right operating signals is not sufficient to achieve these goals.[7] Net emission benefits of storage systems depend on how energy storage is operated, and the marginal emission rates at the time and location where these systems are charged and discharged. While proposed seasonal, on- and off-peak E values are a first step toward sending "more dynamic signal[s] to DERs to reduce carbon emissions,"[8] this design fails to provide adequate incentives for emissions reducing operation of energy storage systems. Hence, it does not accurately value their environmental and public health benefits. Because the proposed design uses actual marginal emission rates ("MERs") to roughly "shape" the "E" value but does not directly translate MERs

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[1] *Governor Cuomo Unveils 20th Proposal of 2018 State of the State: New York's Clean Energy Jobs and Climate Agenda*, New York State (Jan 2, 2018), https://www.governor.ny.gov/news/governor-cuomo-unveils-20th-proposal-2018-state-state-new-yorks-clean-energy-jobs-and-climate.
[2] *Id.*
[3] N.Y. St. Energy Storage Roadmap and Dep't of Pub. Serv. / N.Y. St. Energy Res. and Dev. Auth. Staff Recommendations (2018) [hereinafter "Roadmap"].
[4] N.Y. Pub. Serv. Comm'n, Notice Soliciting Comments and Announcing Technical Conferences (2018).
[5] *See* Roadmap, *supra* note 3, at 4.
[6] *Id* at 5.
[7] *See* Roadmap, *supra* note 3 § 4.1.4, at 31; *id.* at App. G.
[8] *Id* at 37.

into incentives for the operation of storage, it cannot accurately incentivize storage dispatch towards environmental and public health goals. Further, the proposed design does not allow the dispatch of storage systems based on real conditions affecting the grid and risks an increase in net emissions due to energy storage, similar to the outcome identified in California's Self Generation Incentive Program after several years of operation.

We suggest that, to ensure that the full potential of environmental and public health benefits of energy storage can be realized, Staff and the Commission should:

- Evaluate the net emissions of storage based on granular marginal emission rates;
- Apply marginal emission rates to update "E" values with higher temporal and locational granularity for application to dispatchable energy resources;
- Take advantage of recent advances in methods to calculate marginal emission rates that are developed for other states programs such as California's Self-Generation Incentives Program ("SGIP");
- Provide a real-time signal that enables and rewards storage operators for dispatching based on current grid emissions; and
- Expand the current scope of "E" Value to include the public health benefits of reducing local pollutants, particularly in environmental justice communities who are disproportionately burdened by polluting power plants.

In these comments, we narrowly focus on one section of the Roadmap:[9]

Section 4.1.4: Carbon Reductions Benefits and Shaping the E Value in the VDER Value Stack.

I. Evaluate the *net* emissions of energy storage based on granular marginal emission rates

The net effect of storage on emissions depends on the difference between the emission rates of marginal plants that supply electricity for charging and the emission rates of marginal plants that are displaced when systems discharge.[10] The emissions of the marginal unit can vary widely, depending on the time of day, location, fuel type, efficiency, and other grid constraints affecting the marginal unit. The marginal emissions can be zero when renewables are the marginal generator, but skyrocket if an oil-peaker plant is on the margin. Furthermore, marginal emission

[9] Some parties are also filing additional, individual comments on the Roadmap.
[10] *See* Richard L. Revesz & Burcin Unel, *Managing the Future of the Electricity Grid: Energy Storage and Greenhouse Gas Em*issions, 42 Harv. Envtl. L. Rev. 139 (2018); Madison Condon, Richard Revesz & Burcin Unel, *Managing the Future of Energy Storage*, Institute for Policy Integrity (Apr. 24, 2018), available at http://policyintegrity.org/publications/detail/managing-the-future-of-energy-storage.

rates vary by location based on grid operation and transmission constraints. If energy storage charges from the grid when marginal emission rates are high, and discharges from the grid when marginal emission rates are low, it will increase emissions.[11] And, ample academic work demonstrate this possibility using hourly and sub-hourly marginal emission rates.[12] Using average emission rates, or focusing only on emissions avoided during discharging periods, would lead to inaccurate results. Therefore, energy storage systems should be evaluated by analyzing at their *net* emissions, using the difference between the marginal emission rates during discharging period and the marginal emission rates during charging period.

In addition, there are energy losses associated with charging, discharging, and maintaining charge.[13] These "round-trip efficiency" losses vary depending on the technology, and can be quite high.[14] As a result, even if there is no difference in the marginal emission rates between charging and discharging periods, energy storage can increase emissions by simply increasing the amount of energy generation needed to serve the same amount of load.[15] Therefore, the net emissions impact of energy storage varies depending on where, when, and how it operates, and would require a thorough analysis using marginal operational emission rates.

II. Apply marginal emission rates to update "E" values for dispatchable energy resources by providing higher temporal and locational granularity to maximize the emission reductions benefits of energy storage

As Staff correctly notes, NYISO CO_2 MERs are well aligned with NYISO energy prices.[16] However, that alignment is not sufficient to ensure that energy storage systems are operated efficiently and that they do not increase emissions. The potential for energy storage to increase emissions also exists in New York.

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[11] Richard L. Revesz & Burcin Unel, *Managing the Future of the Electricity Grid: Energy Storage and Greenhouse Gas Emi*ssions, 42 Harv. Envtl. L. Rev. 139, 143 (2018).

[12] Eric S. Hittinger & Ines M. L. Azevedo, *Bulk Energy Storage Increases United States Electricity System Emissions*, 49 Envtl. Sci. & Tech. 3202 (2015); Joshua Graff Zivin, Matthew J. Kotchen & Erin T. Mansur, Spatial and Temporal Heterogeneity of Marginal Emissions: Implications for Electric Cars and Other Electricity-Shifting Policies 1 (2013); Duncan S. Callaway, Meredith Fowlie, & Gavin McCormick, *Location, Location, Location: The Variable Value of Renewable Energy and Demand-Side Efficiency Resources*, 5 J. Ass'n Envtl. & Resource Economists 39 (2017); Eric S. Hittinger & Ines M. L. Azevedo, *Estimating the Quantity of Wind and Solar Required To Displace Storage-Induced Emissions*, 51 Envtl. Sci.& Tech. 12988 (2017); Laura M. Arciniegas & Eric Hittinger, *Tradeoffs Between Revenue and Emissions in Energy Storage Operation*, 143 Energy 1 (2018); *Storing Solar Power Increases Energy Consumption and Emissions, Study Finds*, UTNews (Jan. 30, 2017), https://news.utexas.edu/2017/01/30/storing-solar-power-increases-energy-use-and-emissions.

[13] Revesz & Unel, *supra* note 11, at 166.

[14] *Id.*

[15] *Id.*

[16] *See,* Roadmap, *supra* note 3, at 36.

The variability in marginal emissions in NYISO CO_2 MERs rates creates the possibility for energy storage to increase net marginal emissions depending on its operation, especially when the round-trip efficiency of a particular system is low.[17] However, the Roadmap assesses energy storage based on monthly average emission rates for the entire NYISO region. And, measuring emissions using averages, even daily averages, is inaccurate and can obscure emission reduction benefits or costs of storage.

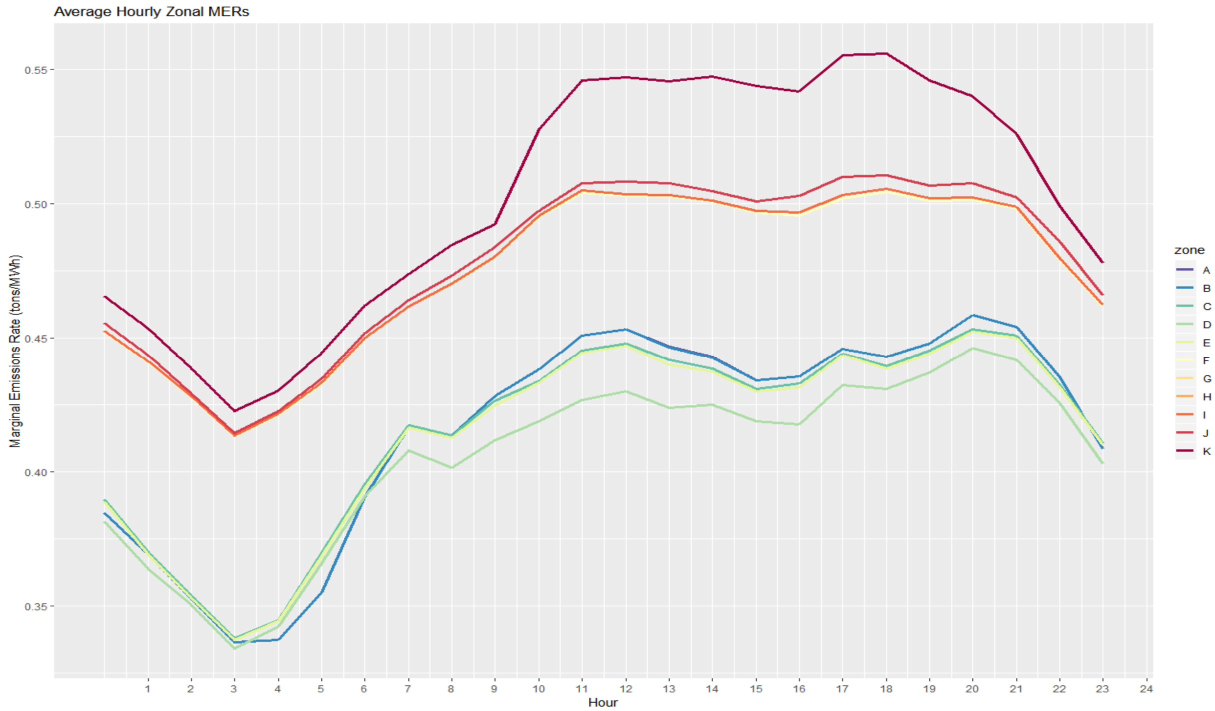
First, as can be seen in Figure 1, there is significant hourly variation even in the average hourly NYISO CO_2 MERs in New York. Emission rates, on average, increase significantly between the hours of roughly 10 a.m. and 9 p.m. In addition, because of the generation mix characteristics in New York, the hourly MERs have a wide range. The range for hourly marginal emission rates in 2015 was [0, 1.356], with a mean of 0.452 tons/MWh.[18] The range for hourly marginal emission rates in 2016 was [0, 1.616], with a mean of 0.448 tons/MWh.[19] Given this substantial variation, using a 4-hour peak E value for dispatchable technologies as suggested by Staff is not sufficiently granular to provide efficient incentives, and risks undervaluing the environmental and public health benefits of energy storage and other dispatchable DER systems.

[17] As mentioned above, round-trip efficiency is an also important in determining the net emissions impact of energy storage. The analysis in the Roadmap uses 85% as an estimate of round-trip efficiency, but SGIP analysis shows that the realized round-trip efficiency in California was much lower. *See* Itron & Energy + Env't Econ., 2016 SGIP Advanced Energy Storage Impact Evaluation, Figure 3-13 (2016) [hereinafter "SGIP Energy Storage Report"] http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442454964.

[18] NYISO MER data, NYISO, https://www.nyiso.com/public/committees/documents.jsp?com=bic_miwg_ipptf (Select the 03/19/2018 meeting date; then choose the link "MER Hourly 2015 – draft").

[19] NYISO MER data, NYISO, https://www.nyiso.com/public/committees/documents.jsp?com=bic_miwg_ipptf (Select the 03/19/2018 meeting date; then choose the link "MER Hourly 2016 – draft").

Figure 1. Average Hourly Zonal Marginal CO_2 Emission Rates during 2015 and 2016[20]

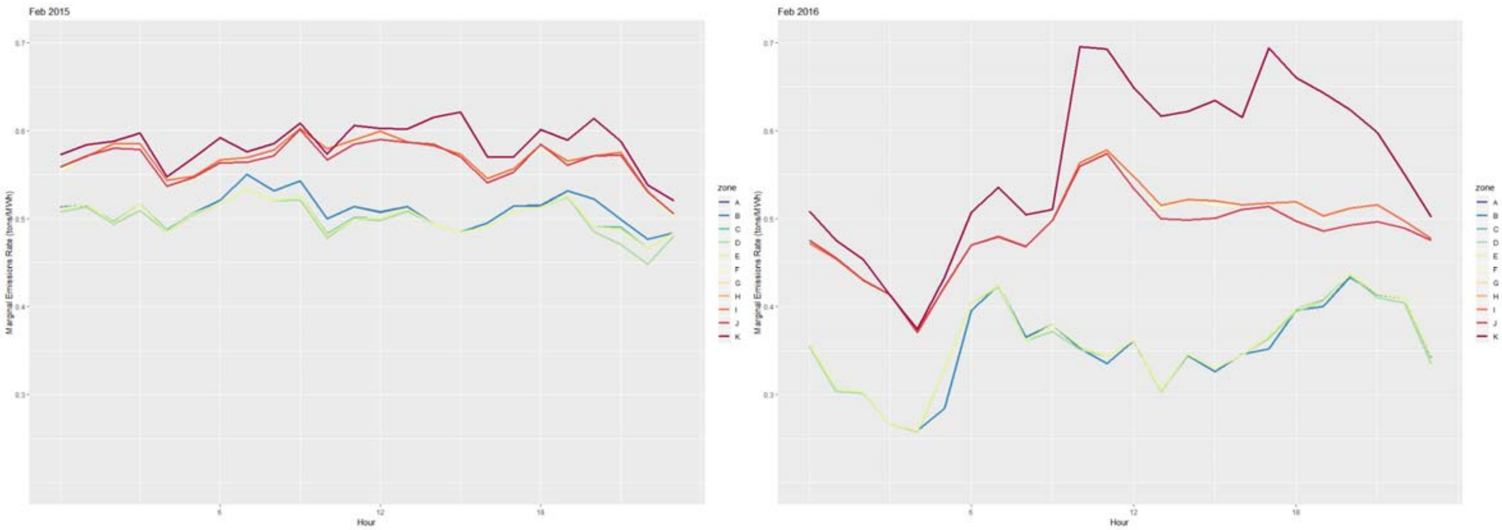


Second, as can be seen in Figure 1 above, there is a significant variation among the marginal emission rates of upstate zones, downstate zones, and Long Island. But, the uniform E value suggested by Staff does not reflect this locational variation. And, given that one of the key tenets of all VDER Value Stack stakeholder discussions to date has been *tying compensations directly to benefit*s, using an E value that is not locationally granular would fall short of achieving that goal.

Third, there is significant variation in MERs from one year to another, especially during the months that Staff determined as "peak." For example, Figure 2 below shows the average hourly zonal marginal CO_2 Emission rates in February 2015 (left panel) and in February 2016 (right panel.) Given this substantial variation, relying on historical rolling averages is not sufficient to ensure energy storage systems reduce emissions in real time, and can be accurately compensated for their E value. Such after-the-fact emissions data can be useful for evaluation, but more granular, real-time data is needed to optimize energy storage operations to realize their full value.

[20] The figure shows unweighted, hourly averages of NYISO marginal emission rates by zone over the entire period of data availability (2015-2016.)

Figure 2. Average Hourly Zonal Marginal CO_2 Emission Rates in February 2015 and in February 2016



It is important to note that a more temporally granular E value may be necessary only for energy storage and other dispatchable distributed energy resources. Because non-dispatchable distributed energy resources cannot respond to more granular signals in a meaningful way and adjust their patterns, a temporally more granular approach could add complexity without a corresponding benefit. Accordingly, we recommend providing distinct approaches for dispatchable and non-dispatchable resources.

Moreover, we focus here only on E value in the VDER Value Stack. While we believe that aspiring to a more granular approach is important with respect to the E value for dispatchable resources, our recommendation is not meant to preclude the use of less granular, simpler approaches to incorporate environmental benefits into other policies proposed in the Roadmap.

III. Take advantage of recent advances in methods to calculate marginal emission rates that are developed for other states programs such as California's Self-Generation Incentives Program

California's Self-Generation Incentives Program ("SGIP") was designed to provide incentives for batteries. It launched with operational requirements such as cycling requirements, and a minimum round-trip efficiency of 66.5% over 10 years of operation.[21] No emissions-based

[21] *See*, SGIP Energy Storage Report, *supra* note 17, at 1-24.

operating requirements were put in place and the program inadvertently led to a net increase in CO_2 emissions.[22]

In 2015, California Public Utilities Commission ("CPUC") noted that "nearly all parties agree that SGIP generation projects displace generation from a combination of [natural gas generators]" when addressing the question of whether these projects avoid CO_2 emissions by reducing output from existing facilities operating on the margin.[23] In 2016, the program was evaluated using an operating marginal emissions model, with after-the-fact marginal emissions values derived from modeling conducted by Itron and E3.[24] This evaluation showed that SGIP-subsidized storage systems caused a net increase in emissions due to round trip efficiency losses and differences in marginal emission rates.[25] Storage dispatch had failed to take advantage of the fact that California's marginal emission rates can vary by as much as 30% even if only gas plants are on the margin, and even more during periods of renewables curtailment. Operating requirements built into the program, combined with existing rate structures, were not enough to cause carbon-reducing storage operations. In addition, simulations indicated that in many cases cycling requirements exacerbated the problem.[26]

This analysis confirmed that an increase in emissions due to energy storage was a real possibility, not just a mere theoretical problem, and the after-the-fact data in the SGIP Report provided a diagnostic tool to identify the problem of emissions increases. But, this type of modeling and data was not sufficient to solve the problem because the information was provided after the fact, whereas energy storage systems needed "right-now" signals to optimize their operations.

As a result, CPUC assembled a working group that consists of regulators, utilities, non-governmental organizations, and the storage industry to identify a solution to prevent increases in emissions in the future.[27] This working group *unanimously* agreed that the use of granular, real-time data is a necessary tool for storage developers to operate and evaluate systems.[28] The group recommended that CPUC adopt the use of a high-frequency, real-time marginal emissions signal to:

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[22] *Id.*
[23] Decision Revising the Greenhouse Gas Emission Factor to Determine Eligibility to Participate in the Self-Generation Incentive Program Pursuant to Public Utilities Code Section 379.6(B)(2) as Amended by Senate Bill 861 (2015) http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M156/K044/156044151.PDF.
[24] See, SGIP Energy Storage Report § 3.7, supra note 17.
[25] *Id.*
[26] *Id.*
[27] AESC, Inc for California Public Utility Commission, SGIP GHG Signal Working Group Final Report at 25, September 6, 2018, available at http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442457832 [Hereinafter "SGIP GHG Signal Report"].
[28] SGIP GHG Signal Report, *supra* note 27, at 10.

- Guide the operation of energy storage systems in a manner that is consistent with reducing emissions; and
- Allow for transparent ex-post M&V on storage systems that provides regular and useful feedback to storage operators. [29]

On September 6th, the CPUC Energy Division issued Self-Generation Incentive Program Greenhouse Gas Signal Staff Proposal ("CPUC Staff Proposal.") [30] In the proposal, CPUC Staff, based on the working group's final report, recommended that the program provide the real-time information necessary for storage operators to most effectively operate systems to reduce marginal emissions. [31] This real-time information will include a real-time, granular marginal emission rate in 5 minute and 15 minute intervals and a 72 hour ahead marginal emission rate prediction. [32] It will be provided on a platform to make the information easily accessible in real-time so that storage can be easily dispatched using the information.

IV. Provide a real-time signal that enables and rewards storage operators for dispatching based on current grid emissions

As the CPUC-required working group on SGIP found, storage systems that are accurately evaluated based on granular signals must also have those signals in real-time to make operational decisions based on that information. The working group determined that the technology to create a real-time marginal emission rate currently exists.[33] Consistent with the working group recommendations, CPUC Staff assessed that the signal could be available within four months of a formal ruling requiring the signal.[34] Accordingly, CPUC Staff, based on working group recommendations and their own analysis, proposed a greenhouse gas signal with the following features:

- A digitally-accessible, real-time, marginal GHG emissions factor for NP15 and SP15 CAISO zones, at 5-minute and 15-minute intervals, in units of kgCO2/kWh;

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[29] *Id.*
[30] Assigned Commissioner's Ruling Issuing Energy Division's Self-Generation Incentive Program Greenhouse Gas Signal Staff Proposal for Comments and Revising Comment Schedule, issued September 6, 2018, available at http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M225/K561/225561529.PDF. [Hereinafter "ACR on GHG Signal"]
[31] *See* Self-Generation Incentive Program Greenhouse Gas Staff Proposal, RM 12-11-005, ENERGY DIVISION, CALIFORNIA PUBLIC UTILITIES COMMISSION, September 6, 2018, available at http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M226/K705/226705393.PDF [Hereinafter "CPUC Staff Proposal."] [Note: CPUC Staff Proposal, as well as the other documents uses the term "emissions *factor*" when referring to "emission *rates.*"]
[32] *Id.*
[33] *See* SGIP GHG Signal Report, *supra* note 27.
[34] CPUC Staff Proposal, *supra* note 32, at 9.

- An emissions factor signal calculated using the same heat rate-based methodology as in the most recent SGIP program evaluation report, but with updated parameters and data sources more suitable for real-time use.
    - This signal would provide the emissions per kWh for a natural gas-fired power plant producing energy at a price equaling the real-time (5-minute) CAISO Locational Marginal Price, if it faced input costs equal to the most recent publicly available data on gas prices, CO2 prices, and variable operating costs;
- For storage operation planning purposes, a 72 hour-ahead (updated hourly), month ahead (updated daily), and year-ahead (updated monthly) forecast.
- The GHG signal should be made available within four months of a Commission decision to allow program administrators and participants and the GHG signal provider sufficient time for implementation. [35]

CPUC Staff Proposal is currently open for public comment, and CPUC is expected to issue its final decision in early 2019. [36]

New York should take into account lessons learned in California and consider adopting an approach similar to the SGIP program that proposes the use of real-time marginal emissions to ensure that energy storage operators have the information and incentives required to include the emission impacts of their systems in their operational decisions. Because of the significant variation of MERs from one hour to the next, accurate assessment requires MERs of at least hourly granularity by dispatch authority. And, as California's experience shows, getting sub-hourly marginal emissions signals is not "almost impossible," as the Roadmap states.[37]

WattTime, a subsidiary of Rocky Mountain Institute and a nonprofit organization, conducted an assessment of marginal emissions in New York that showed variability of emissions in NY similar to that of California. But, because of the differences in California's grid operations and resource mix, the methodology adopted in California is not directly applicable in New York. In California, natural gas almost always provides marginal generation except during times of renewable curtailment. The marginal fuel mix in New York varies, meaning that the precise algorithm to measure New York marginal emissions would be slightly different. However, there are no technical obstacles to revising the method used in California to create and use marginal emission rates for New York.[38]

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[35] *Id*.
[36] ACR on GHG Signal, *supra* note 30.
[37] *See* Roadmap, *supra* note 3, at 35.
[38] The City of New York has not independently verified the WattTime assessment of marginal emissions in New York but nevertheless agrees that the methods being developed in California can serve as the starting point for creating and using marginal emission rates for New York.

Therefore, we recommend that the Commission direct Staff to work with stakeholders to develop these real-time marginal emissions rates and incentivize storage and DERs to dispatch based on their net emission impact, using that information. In addition, an E-value that more accurately reflects grid conditions can then be calculated by multiplying these marginal emission rates with the appropriate monetary value.[39] This "E" value, because it would reflect the net emission impact of energy storage by taking into account the marginal emission rate between charging and discharging times, would more accurately represent the true environmental and public health value of energy storage systems.[40]

V. Expand the scope of E value to better reflect the environmental and public health benefits of energy storage and all other distributed energy resources

A. The proposed shaped E value focuses on only CO_2, and hence underestimates the potential environmental and public health value of energy storage systems and other distributed energy resources

Staff proposed a shaped E value based only on CO_2 emissions. But, because energy storage systems, and other distributed energy resources, can help avoid emissions of pollutants in addition to CO_2, designing an E value based only on CO_2 would undervalue their environmental and public health benefits. As a result, such an E value would not be sufficient to incentivize the level of deployment necessary to meet New York's goals. In addition, it would fail to reflect the location-specific impacts of local pollutants, and hence would not incentivize operational patterns necessary to fully realize the environmental and public health benefits of these systems. In other words, storage will fail to accomplish the goal of "stor[ing] and dispatch[ing] energy when and where it is most needed," as stated in the Roadmap.[41] In addition, integrating all state and federally regulated air pollutants, especially the Environmental Protection Agency's criteria air pollutants, in the E value is especially important to help avoid pollution that disproportionally affects environmental justice communities who are particularly vulnerable to adverse health effects from local pollutants.[42] While the valuation of regulated pollutants does not comprehensively capture the breadth of benefits that energy storage can have for environmental justice communities, it is a vital step towards addressing the energy sector's statewide legacies of environmental injustice. The inclusion of local pollutants in the E Value can help incentivize projects that can swiftly displace the most polluting generators – particularly peaker plants –

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[39] *See* Jeffrey Shrader, Burcin Unel, & Avi Zevin, *Valuing Pollution Reductions*, Institute for Policy Integrity (Mar. 23, 2018), http://policyintegrity.org/publications/detail/valuing-pollution-reductions. [Hereinafter "DER Externality Report"]. Also, *see* Jeffrey Shrader et al., Value of Distributed Energy Resources – E/EJ Value Informal Subgroup – Track 1 and 2 Report (2018) [Hereinafter "Subgroup Report"] http://policyintegrity.org/documents/DER_Vlue_Stack_E_Value_Report_07.09.18.pdf.

[40] *See* DER Externality Report, *supra* note 33.

[41] *See* Roadmap, *supra* note 3, at 4.

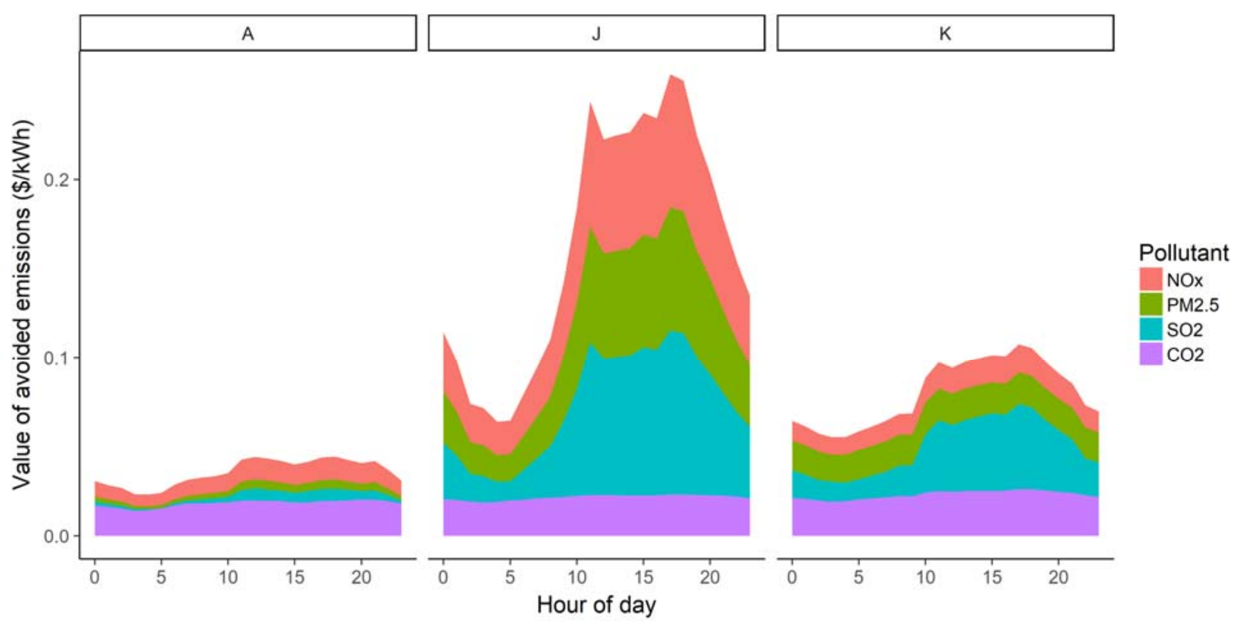
[42] *See* DER Externality Report, *supra* note 33.

concentrated in low-income communities and communities of color, and can stop perpetuating decades of environmental health burdens.

As the work of the informal VDER E/EJ Value Subgroup ("Subgroup") demonstrates, the environmental and public health value of avoiding emissions of local pollutants is significant, and at times even higher than the CO_2 value.[43] Figure 3 below shows the Subgroup's estimates of hourly E values for SO_2, $PM_{2.5}$, and NOx, as well as CO_2 for three representative zones of the New York's grid, using inferences from NYISO CO_2 MERs and monetary values calculated by the Environmental Protection Agency's Co-Benefits Risk Assessment (COBRA) model.[44]

The average value of avoided emissions is about 3.6 cents in Zone A. In Zone J, where New York City is located, values are vastly higher at 16.2 cents per kWh, largely due to the high population density. In Zone J, only 2.2 cents of this value comes from avoiding CO_2 emissions, with the rest coming from avoiding other pollutants. In Zone K, Long Island, the value is 8.0 cents per kWh. Similar to Zone J, only 2.3 cents of this value comes from avoiding CO_2 emissions, with the rest of the value coming from avoiding other pollutants.

Figure 3. Hourly Zonal Environmental Value Stack Using High COBRA Damages[45]



[43] *See* Subgroup Report, *supra* note 33.
[44] See the Subgroup Report for details on the exact methodology and data used, the limitations of this study, and suggestions for improving the accuracy of these estimates. *See*, Subgroup Report, *supra* note 33.
[45] See the Subgroup Report for details of calculations. *See*, Subgroup Report, *supra* note 33, at 27.

B. The same methodology suggested above for granular CO_2 emission rates can, and should, be used for local pollutants to calculate a more accurate E Value for all distributed energy resources

As discussed in its Report, the Subgroup inferred the fuel-type mix of marginal generators using CO_2 MERs to get order-of-magnitude estimates, but it was not able to provide more accurate estimates due to data limitations.[46] As a result, the Subgroup recommended that more accurate methods for calculating displaced generation might be desirable to further REV.[47]

While the methodology used in California to calculate more granular emission rates is currently applied only to CO_2 emissions, the same methodology can be extended to calculate marginal emission rates for other pollutants as well.[48] And, to enable New York's vision of a clean, smart, and decentralized grid, the Commission should follow this path and expand the E value to include other pollutants using such temporally and locationally granular methodologies to incentivize the most efficient type of resource to be deployed where and when it is most beneficial to New York's grid.

Again, it is important to note that this E Value should be more granular than suggested in the Roadmap. Figure 3 above highlights the need for more locational evaluation of emission reductions. Deploying an energy storage system, or any other DER, in Zone A would have a different effect on emissions than deploying the same system in Zone J. Disregarding this variation in potential benefits, and paying the same "average" E value to all systems would significantly undervalue systems in high value locations such as New York City.

Similarly, ignoring the temporal variation would lead to significant inefficiency. Figure 4 below shows the Daily E Value Stack calculated by the Subgroup using 2016 data. As can be seen from the figure, there is significant variation between days, and the peaks are orders-of-magnitude higher than most days. Paying energy storage systems only a slightly higher E value during peak season/periods would fall short of providing sufficient value for energy storage systems, or any other distributed energy resource, that can help avoid these peak times. A higher temporal granularity to the E value would allow energy storage systems to capture this value, and, therefore, provide economically efficient incentives for dispatch on such damaging days.

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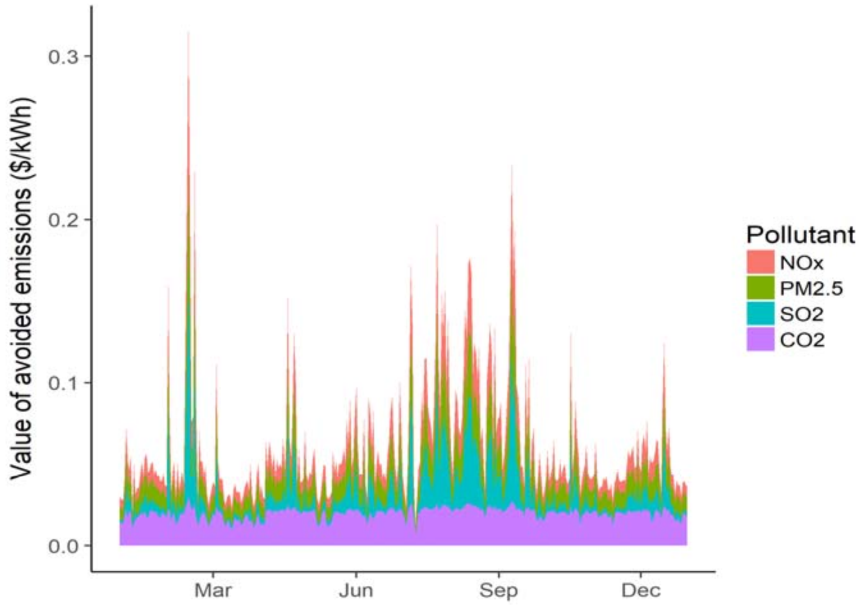
[46] *See,* Subgroup Report, *supra* note 33, at 5-6.
[47] *Id.*
[48] The high frequency, real time CO_2 emission signal being used in California is developed based largely on WattTime's methods, which uses public data available from grid operators and environmental agencies. The WattTime method can also support SO_2 and NO_X and the WattTime team is working on expanding the method to other pollutants.

Figure 4. Daily Environmental Value Stack Using High COBRA Damages[49]



Conclusion

We appreciate the opportunity to file these comments. We look forward to continued collaboration with Staff to ensure that energy storage policies are designed in a manner that would achieve emission reductions to combat climate change and to protect public health.

Respectfully submitted,

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[49] See Subgroup Report for details and limitations of calculations. *See*, Subgroup Report, *supra* note 33.

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