COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC UTILITIES

Petition of NSTAR Electric Company	**)**	
d/b/a Eversource Energy for Approval of	**)**	**D.P.U. 21-90**
Phase II Electric Vehicle Infrastructure Program	**)**	

TRACK 1

DIRECT PANEL TESTIMONY OF

ELIZABETH A. STANTON

AND

JOSHUA R. CASTIGLIEGO

ON BEHALF OF

INTERVENOR GREEN ENERGY CONSUMERS ALLIANCE

D.P.U. 21-90 EXHIBIT GECA-ESJC-1

January 5, 2022

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I. INTRODUCTION

Q. Dr. Stanton, please state your full name, business name and address.

A. My name is Elizabeth A. Stanton. I am the Director and a Senior Economist at the Applied Economics Clinic. Our offices are located at 1012 Massachusetts Avenue, Arlington MA, 02476.

Q. What is your educational background?

A. I received a PhD in Economics from the University of Massachusetts-Amherst. Prior to that, I received my Master of Arts in Economics from New Mexico State University and a Bachelor of International Studies at the School for International Training in Brattleboro, Vermont.

Q. Please describe your professional experience.

A. I am the founder and Director of the Applied Economics Clinic ("AEC"), a non-profit consulting group. AEC provides expert testimony, analysis, modeling, policy briefs, and reports for municipalities and other public interest groups on the topics of energy, environment, consumer protection, and equity. AEC also provides training to the next generation of expert technical witnesses and analysts through applied, on-the-job experience for graduate students in related fields and works proactively to enhance diversity among the people who do our jobs today and in the future. As a researcher and analyst with two decades of professional experience as a political and environmental economist, I have authored more than 155 reports, policy studies, white papers, journal articles, and book chapters as well as more than 45 expert comments and oral and written testimony in public proceedings on topics related to energy, the economy, the environment, and equity. My articles have been published in Ecological Economics, Climatic Change, Environmental and Resource Economics, Environmental Science & Technology, and other journals. I have also published books, including Climate Change and Global Equity (Anthem Press, 2014) and Climate Economics: The State of the Art (Routledge, 2013), which I co-wrote with Frank Ackerman. I am also co-author of Environment for the People (Political Economy Research Institute, 2005, with James K. Boyce) and co-editor of Reclaiming Nature: Worldwide Strategies for Building Natural Assets (Anthem Press, 2007, with Boyce and Sunita Narain).

My recent work includes review and analysis of electric planning in several states, Integrated Resource Plan (IRP) and Demand-Side Management (DSM) planning review, analysis and testimony of state climate laws as they relate to proposed capacity additions, and other issues related to consumer and environmental protection in the electric sector. In my previous position as a Principal Economist at Synapse Energy Economics, I provided expert testimony in electric and gas sector dockets, and led studies examining environmental regulation, cost-benefit analyses, and the economics of energy efficiency and renewable energy. Prior to joining Synapse, I was a Senior Economist with the Stockholm Environment Institute's (SEI) Climate Economics Group, where I was responsible for leading the organization's work on the Consumption-Based Emissions Inventory (CBEI) model and on water issues and climate change in the western United States. While at SEI, I led domestic and international studies commissioned by the United Nations Development Programme, Friends of the Earth-U.K., and Environmental Defense

Fund, among others. My Curriculum Vitae is attached as D.P.U. 21-90 Exhibit GECA-ESJC-2.

Q. Have you ever testified before the Massachusetts Department of Public Utilities (DPU)?

A. Yes. I provided testimony in D.P.U. 14-86 (2014), D.P.U. 15-181 (2016), D.P.U. 16-05 (2016), D.P.U. 17-145 (2018), D.P.U. 17-172 (2018), D.P.U. 17-174 (2018), D.P.U. 17-175 (2018), D.P.U. 18-110 through D.P.U. 18-119 (2018), D.P.U. 18-150 (2019), D.P.U. 19-132 (2020) as well as in OADR 2011-025 & 026 before the Department of Environmental Protection.

Q. Have you testified in other jurisdictions?

A. Yes. I have submitted expert testimony and comments in public utility and other related dockets in District of Columbia, Florida, Illinois, Indiana, Louisiana, Michigan, Minnesota, New Hampshire, New York, Pennsylvania, Puerto Rico, South Carolina, and Vermont as well as several federal dockets, including in front of the U.S. EPA.

Q. Mr. Castigliego, please state your full name, business name and address.

A. My name is Joshua R. Castigliego. I am a Researcher at the Applied Economics Clinic. Our offices are located at 1012 Massachusetts Avenue, Arlington MA, 02476.

Q. What is your educational background?

A. I received a Master of Arts in Energy & Environment from Boston University and a Bachelor of Science in both Mathematics and Physics from Roger Williams University.

Q. Please describe your professional experience.

A. I have more than four years of professional experience in energy and climate research and analysis, with a focus on decarbonization and pollution mitigation. I have authored more than 15 reports, and have been published in *Waste Management*. Prior to joining the Applied Economics Clinic, I worked as a Research Fellow at Boston University's Institute for Sustainable Energy, where I led the analysis on the emissions impacts associated with Boston's waste management system to inform the City's decarbonization efforts as it works to achieve carbon neutrality by 2050 in the Carbon Free Boston report.

My recent work includes investigating the value of winter grid reliability, examining the net emissions savings benefit of a battery storage facility, and critiquing the over-procurement of PJM's capacity market. My Curriculum Vitae is attached as D.P.U. 21-90 Exhibit GECA-ESJC-3.

Q. Have you ever testified before the Massachusetts DPU?

A. No.

Q. On whose behalf are you submitting this testimony?

A. We are submitting this testimony on behalf of the Green Energy Consumers Alliance.

Q. What did the Green Energy Consumers Alliance ask you to examine in this testimony?

A. Green Energy Consumers Alliance asked us to examine a possible off-peak charging rebate for Eversource (the "Company") modeled on National Grid's methodology for its Off-Peak Charging Program as proposed in D.P.U. 21-91.

Q. Are you sponsoring any exhibits?

A. Yes. We are sponsoring the following exhibits:

- D.P.U. 21-90 GECA-ESJC-2 – Curriculum Vitae of Dr. Elizabeth A. Stanton.
- D.P.U. 21-90 GECA-ESJC-3 – Curriculum Vitae of Mr. Joshua R. Castigliego.
- D.P.U. 21-90 GECA-ESJC-4 – Workpaper A
- D.P.U. 21-90 GECA-ESJC-5 – Workpaper B

Q. What materials did you review in preparing this testimony?

A. Any document upon which we relied directly is cited in our testimony.

II. PURPOSE OF TESTIMONY

Q. What is the purpose of your joint testimony?

A. The purpose of our joint testimony is to examine a possible off-peak charging rebate for Eversource modeled on National Grid's methodology for its Off-Peak Charging Program as proposed in D.P.U. 21-91.

Q. Can you summarize your conclusions?

A. We find that National Grid's off-peak charging rebate provides an incomplete example to capture the full value that an Eversource off-peak charging program would provide. National Grid's methodology and resulting rebate values omit important benefits of off-peak charging including avoided transmission and distribution costs, avoided emissions and emission costs, avoided reliability costs, avoided costs due to induced price effects, and non-energy benefits. We provide evidence that including these benefits in a value for off-peak charging could result in a rebate of roughly 14 cents per kWh. We recommend that the DPU require Eversource to adopt a methodology for setting off-peak charging rebates that includes a complete set of benefits from this program.

III. BACKGROUND ON OFF-PEAK CHARGING PROGRAMS

Q. What is an off-peak charging program and what is its purpose?

A. An off-peak charging program—like the one offered by National Grid—provides an incentive in the form of per kWh charging rebates to encourage customers to charge their EVs during off-peak hours.

Q. Do any electric utilities in Massachusetts currently have an off-peak charging program?

A. Yes. National Grid's Phase II Off-Peak Charging Program (Program) was approved by the Massachusetts DPU in D.P.U. 18-150 for residential electric vehicles (EV) customers.

Q. Please describe National Grid's Off-Peak Charging Program.

A. The Program provides an incentive—in the form of per kWh charging rebates—to encourage customers to charge their EVs during off-peak hours. National Grid offers off-peak charging rebates of $0.03 per kWh for EV charging occurring during off-peak hours (9:00pm to 1:00pm) in Winter (October through May) and $0.05 per kWh for off-peak charging in Summer (June through September).

In its proposal for D.P.U. 18-150, National Grid noted that "residential customers receiving a rebate for a Level 2 charger in the EV Charging Program will be automatically enrolled in the Off-Peak Charging Rebate Program…"[1] with the option to opt out. Customers with existing Level 2 chargers can sign up to participate in the Program. National Grid stated that the Program's administrator will be in charge of "enrolling customers in the program, receiving and collecting charging session data from the charging and monitoring

[1] D.P.U. 18-150, Exhibit NG-RS-1 at 25, lines 19-20.

technology eligible for the program, managing a web portal for customers to view their activity and rebate amounts, both current and historical, and generating the rebate payments to customers. The Company anticipates offering customers payment options, which may include gift cards or credits on their electric bills."[2]

In D.P.U. 18-150, the Company stated that the Off-Peak Charging Program would be offered to a maximum of 11,000 participants.[3] National Grid launched the Program in October 2020[4] with an enrollment of over 500 residential customers.[5]

Q. Has National Grid proposed changes to its Off-Peak Charging Program?

A. Yes. In its initial D.P.U. 21-91 filing, National Grid is seeking approval from DPU to expand the scope of its Off-Peak Charging Program by (1) extending the Program through 2025 and (2) expanding the Program to include up to 1,000 additional fleet EVs.[6] The Company also proposes to revise the Program to include automated, flexible scheduling with the goal of shifting more charging off-peak while avoiding the occurrence of timer peaks (i.e., spikes in demand at the beginning or end of off-peak hours).[7]

Q. How did National Grid develop its off-peak charging rebates?

A. National Grid estimates its off-peak charging rebates as the difference between cost savings associated with charging off-peak versus on-peak (that is, on-peak costs less off-peak costs). Energy and capacity cost savings are summed together to calculate National Grid's

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[2] D.P.U. 18-150, Exhibit NG-RS-1 at 28, lines 1-5.
[3] D.P.U. 18-150, Exhibit NG-RS-1 at 28, lines 19-20.
[4] D.P.U. 21-91, National Grid's Response to Information Request GECA-NG-2-2(b)
[5] D.P.U. 21-91, Exhibit NG-EVPP-1 at 86, line 2.
[6] D.P.U. 21-91, Exhibit NG-EVPP-1 at 87, lines 1-6.
[7] D.P.U. 21-91, Exhibit NG-EVPP-1 at 86, lines 15-19.

off-peak rebates of $0.03 and $0.05 per kWh for Winter and Summer, respectively.[8] Importantly, for the purposes of calculating its off-peak charging rebate National Grid uses the assumption that in the absence of its Off-Peak Charging Program customers will charge their EVs on peak, and that with the Charging Program customers will charge their EVs off peak.

Q. Does Eversource offer an off-peak charging program?

A. No. In its initial filing, the Company states, "Additionally, National Grid's Phase III Program includes an off-peak rebate offering that Eversource has not included."[9]

Q. Has Eversource examined the feasibility of implementing off-peak charging rebates?

A. No. In its discovery response to GECA-ES-1-1, Eversource notes that "the Company has not conducted this analysis"[10] when asked about examining the feasibility of implementing off-peak charging rebates or other time-of-use based incentives.

Q. Does Eversource provide a rationale for why it has offered an off-peak charging program?

A. The Company states that it "recognizes that there are a variety of time varying solutions designed to respond to customer needs, incentivize EV adoption, influence beneficial charging behavior, and to provide benefits to all customers through grid efficiencies and

[8] D.P.U. 21-91, Exhibit NG-EVPP-1 at 92, line 11.
[9] D.P.U. 21-90, Exhibit ES-KB-1 at 36, lines 17-18.
[10] D.P.U. 21-90, Eversource's Response to Information Request GECA-ES-1-1(a)

provide more reliable, predictable, and pronounced peak load reductions; reducing the cost of infrastructure upgrades."[11]

In addition, Eversource notes that "[t]he Company has proposed to use managed charging to actively integrate EV load management into its active demand portfolio, as the lowest cost to implement solution in the near term, while we work towards standards, solutions, and back-office systems that can enable time varying rates." [12]

IV. POTENTIAL ESTIMATES OF OFF-PEAK CHARGING REBATES FOR MASSACHUSETTS

Q. What are the benefits of off-peak charging?

A. Off-peak charging provides benefits that include, but are not limited to:

- **Avoided energy costs:** The difference between peak and off-peak energy costs.
- **Avoided capacity costs:** Charging EVs during off-peak hours reduces peak demand, which provides cost savings to the grid due to the reduced need to build and operate plants that serve peak load.
- **Avoided transmission and distribution costs:** The need for additional transmission and distribution investment is reduced as demand is shifted from peak to off-peak hours.
- **Avoided reliability costs:** Related to the avoided capacity benefit, shifting schedules to charge EVs during off-peak hours can improve grid reliability as more capacity will be made available when fewer EVs charging during the peak. New England utilities estimate reliability using the value of non-energy benefits

[11] D.P.U. 21-90, Eversource's Response to Information Request GECA-ES-1-1(c)
[12] D.P.U. 21-90, Eversource's Response to Information Request GECA-ES-1-1(c)

of avoided outages to residences and businesses—i.e., the value of lost load, (VOLL)—as a proxy for the cost of system-wide outages (see AESC 2021).[13]

- **Avoided costs due to induced price effects or "Capacity DRIPE":** Avoided demand reduction induced price effects (DRIPE) is a measure of the value of efficiency in terms of a reduction in wholesale prices seen by all customers in a given timeframe.
- **Avoided emissions and emission costs:** As fewer EV charge during peak hours, less generation from high-emitting peaker plants is required—which results in reduced greenhouse gas emissions and air pollution, and reduced costs of emission abatement.
- **Non-energy benefits**: Additional non-energy benefits of charging off-peak include: avoided power outages and less land used for power plants as the need for peaker plants is reduced.

Q. Is it possible to estimate the avoided energy costs associated with off-peak EV charging?

A. Yes. In its off-peak charging rebates, National Grid estimates the value of energy cost savings from off-peak EV charging.

Q. How does National Grid estimate the energy cost savings component of its off-peak rebate?

A. To estimate the value of energy cost savings from off-peak charging, National Grid uses ISO-New England's hourly load and cost data[14] from January 1, 2016 through December 31, 2017 by load zone for Massachusetts (i.e., Northeast, Southeast, West/Central).

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[13] AESC Study Group. May 2021. "Avoided Energy Supply Costs in New England 2021." Synapse Energy Economics. Available at: https://www.synapse-energy.com/sites/default/files/AESC%202021_20-068.pdf

[14] ISO-New England. "Energy, Load, and Demand Reports." *SMD Hourly Data [Excel]*. Available at: https://www.iso-ne.com/isoexpress/web/reports/load-and-demand/-/tree/zone-info

National Grid performs these calculations twice: once for real-time and once for day-ahead markets.[15] The hourly load and cost data can be combined across the three Massachusetts' load zones by calculating a simple, unweighted average (Alternatively, a weighted average can be calculated using a utility's zonal load shares).

Following National Grid's methodology, we calculate total energy demand and energy costs in the on-peak and off-peak periods, combining 2016-2017 data from ISO-New England to give a Massachusetts' average. The average energy price ($ per kWh) for each on-peak/off-peak period is estimated by dividing the total energy cost ($) by the total demand (MWh) and adjusting these values by a line loss factor of 5.0 percent.[16] As a final step, we average together the real-time and day-ahead results to arrive at final on-peak and off-peak energy prices.

The energy cost savings component of the off-peak charging rebate is estimated by calculating the difference between the on-peak and off-peak energy prices. This difference (or "delta") is $0.012 per kWh (see Table 1).[17]

Table 1. Avoided Energy Costs

Energy Cost Savings ($ per kWh)			
Peak/Off-Peak	**Real Time**	**Day Ahead**	**Average**
On-Peak	$0.045	$0.043	$0.044
Off-Peak	$0.032	$0.032	$0.032
DELTA	**$0.013**	**$0.011**	**$0.012**

Note: See D.P.U. 21-90 GECA-ESJC-4 Workpaper A for calculations.

[15] D.P.U. 21-91. National Grid's Response to Information Request, Attachment GECA-NG-1-2 [Excel]

[16] The line loss factor of 5.0 percent is an unweighted average of the line loss factors across Massachusetts' load zones (i.e., 5.4 percent for Northeast, 5.1 percent for Southeast, and 4.5 percent of West/Central).

[17] See D.P.U. 21-90 GECA-ESJC-4 Workpaper A for calculations.

Q. Is it possible to estimate the avoided capacity costs associated with off-peak EV charging?

A. Yes. In its off-peak charging rebates, National Grid estimates the value of capacity cost savings from off-peak EV charging.

Q. What does National Grid assume about annual EV electric usage and avoided EV demand from charging off-peak?

A. National Grid assumes that the average EV customer uses 3,000 kWh per year to charge their vehicle and that charging an EV off-peak versus on-peak results in an average avoided peak demand of 0.825 kW per vehicle.[18]

Q. How does National Grid estimate the capacity cost savings component of its off-peak rebate?

A. To estimate the value of capacity cost savings from off-peak charging, National Grid uses ISO-New England's 10th Forward Capacity Auction (FCA #10) clearing price for the 2019/2020 delivery years: $7.03 per kW-month.[19]

Following National Grid's methodology, we first estimate the annual capacity payment ($ per kW-year) by multiplying the FCA #10 clearing price ($7.03 per kW-month) by 12 months (adjusting to account for a loss factor of 8 percent and a reserve margin of 19 percent) to yield $108 per kW-year.[20]

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[18] D.P.U. 21-91, National Grid's Response to Information Request, Attachment GECA-NG-1-2 [Excel]

[19] ISO-New England. February 2016. "Finalized Capacity Auction Results Confirm 10th FCA Procured Sufficient Resources at a Lower Prices, for 2019-2020." Available at: https://www.iso-ne.com/static-assets/documents/2016/02/20160229_fca10_finalresults.pdf

[20] See D.P.U. 21-90 GECA-ESJC-4 Workpaper A for calculations.

We then estimate the annual avoided capacity costs by multiplying the annual capacity payment of $108 per kW-year by the assumed average avoided demand of 0.825 kW to yield $89 per year per vehicle. The annual avoided capacity cost is estimated on a per-kWh basis by dividing the $89 per year by 3,000 kWh—National Grid's assumed average annual usage for an electric vehicle—resulting in an avoided capacity cost of $0.030 per kWh (see Table 2).[21]

Table 2. Avoided Capacity Costs

	Clearing Price ($ per kW-Month)	Cost Savings ($ per kWh)
Capacity	$7.03	$0.030

Note: See D.P.U. 21-90 GECA-ESJC-4 Workpaper A for calculations.

Q. Is it possible to estimate the avoided transmission and distribution costs associated with off-peak EV charging?

A. Yes. In its proposed 2022-2024 Three-Year Energy Efficiency Plan, Eversource applies an avoided transmission cost of $99 per kW-year and an avoided distribution cost of $115 per kW-year to measures that reduce peak load.[22] (Note that we relied on the data contained in the "AESC" tab of Eversource's draft BCA workbook submitted to the Massachusetts Energy Efficiency Advisory Council in April 2021, which in turn relies upon values from the *2021 Avoided Energy Supply Cost* (AESC) study and therefore would not have changed in the Company's final 2022-2024 Three-Year Plan calculations as submitted in D.P.U. 21-128.)

[21] See D.P.U. 21-90 GECA-ESJC-4 Workpaper A for calculations.

[22] Eversource. April 30, 2021. "Statewide Draft Energy Efficiency Plan." *2022-24 Plan BC Model Electric – Eversource [Excel].* Available at: https://ma-eeac.org/wp-content/uploads/2022-24-Plan-BC-Model-Electric-Eversource-2021-04-30.xlsb

Charging EVs during off-peak hours also reduces peak load, and the inclusion of these avoided costs would increase Eversource's off-peak charging rebate. Following the methodology used for calculating avoided capacity benefit, we estimate an avoided transmission benefit of $0.027 per kWh and an avoided distribution benefit of $0.032 per kWh for a total transmission and distribution cost savings of $0.059 per kWh (see Table 3).

Table 3. Avoided Transmission and Distribution Costs

	Avoided Cost ($ per kW)	Cost Savings ($ per kWh)
Transmission	$99	$0.027
Distribution	$115	$0.032
TOTAL	**$214**	**$0.059**

Note: See D.P.U. 21-90 GECA-ESJC-4 Workpaper A for calculations.

Q. Is it possible to estimate the avoided reliability costs associated with off-peak EV charging?

A. Yes. In its draft 2022-2024 Three-Year Energy Efficiency Plan, Eversource applies a total avoided reliability cost of $31 per kW-year in 2022 to measures that reduce peak load.[23] Charging EVs during off-peak hours also reduces peak load, and the inclusion of this avoided cost would increase Eversource's off-peak charging rebate. Following the methodology used for calculating avoided capacity benefit, we estimate a reliability benefit of $0.008 per kWh (see Table 4).

[23] Eversource. April 30, 2021. "Statewide Draft Energy Efficiency Plan." *2022-24 Plan BC Model Electric – Eversource [Excel]*. Available at: https://ma-eeac.org/wp-content/uploads/2022-24-Plan-BC-Model-Electric-Eversource-2021-04-30.xlsb

Table 4. Avoided Reliability Costs

	Avoided Cost ($ per kW)	Cost Savings ($ per kWh)
Reliability	$31	$0.008

Note: See D.P.U. 21-90 GECA-ESJC-4 Workpaper A for calculations.

Q. Is it possible to estimate the avoided capacity DRIPE costs associated with off-peak EV charging?

A. Yes. In its draft 2022-2024 Three-Year Energy Efficiency Plan, Eversource utilizes a total avoided capacity DRIPE cost of $50 per kW-year in 2022 for measures that reduce peak load.[24] Charging EVs during off-peak hours also reduces peak load, and the inclusion of this avoided cost would increase Eversource's off-peak charging rebate. Following the methodology used for calculating avoided capacity benefit, we estimate a capacity DRIPE benefit of $0.014 per kWh (see Table 5).

Table 5. Avoided Capacity DRIPE Costs

	Avoided Cost ($ per kW)	Cost Savings ($ per kWh)
Capacity DRIPE	$50	$0.014

Note: See D.P.U. 21-90 GECA-ESJC-4 Workpaper A for calculations.

Q. How does off-peak EV charging provide an emissions reduction and related cost benefit?

A. Off-peak EV charging shifts energy use from peak to off-peak times. Off-peak charging times have a lower grid emissions rate than on-peak charging rates per ISO-New

[24] Eversource. April 30, 2021. "Statewide Draft Energy Efficiency Plan." *2022-24 Plan BC Model Electric – Eversource [Excel]*. Available at: https://ma-eeac.org/wp-content/uploads/2022-24-Plan-BC-Model-Electric-Eversource-2021-04-30.xlsb

England.[25] Shifting energy use from peak to off-peak times both lowers Massachusetts emissions and lowers the marginal abatement costs associated with those emissions.[26]

Q. Is it possible to estimate the emission reduction from off-peak EV charging?

A. Yes. Both ISO-New England[27] and AESC[28] provide estimates of peak and off-peak grid emissions. The on- and off-peak periods used by ISO-New England and AESC do not, however, align perfectly with expected EV charging. For this reason, we apply a different methodology—developed by AEC for use in battery storage permitting applications with the DPU—that allows for emission rate estimation for specific periods (e.g., charging and discharging, peak and off-peak, etc.).

In essence, our method estimates a difference in the emission rates associated with EV charging under two different scenarios:

(1) **No planning**: In this counterfactual, Eversource does not plan for EV charging and charging occurs on peak. In this scenario, the addition to peak load from charging is served by marginal generating resources (that is, the next least expensive resource available to run in the event of higher load) and the relevant emissions rate is the on-peak marginal emissions rate.

[25] ISO-New England. March 2021. "2019 ISO New England Electric Generator Air Emissions Report." *System Planning.* Available at: https://www.iso-ne.com/static-assets/documents/2021/03/2019_air_emissions_report.pdf, Table 5-3
[26] AESC Study Group. May 2021. "Avoided Energy Supply Costs in New England 2021." Synapse Energy Economics. Available at: https://www.synapse-energy.com/sites/default/files/AESC%202021_20-068.pdf, Chapter 8
[27] ISO-New England. March 2021. "2019 ISO New England Electric Generator Air Emissions Report." *System Planning.* Available at: https://www.iso-ne.com/static-assets/documents/2021/03/2019_air_emissions_report.pdf
[28] AESC Study Group. May 2021. "Avoided Energy Supply Costs in New England 2021." Synapse Energy Economics. Available at: https://www.synapse-energy.com/sites/default/files/AESC%202021_20-068.pdf

(2) **Planning**: In this scenario, Eversource plans for EV charging by means of an off-peak charging program. EV load is expected and Eversource is ready to meet that load with generation that is compliant with Massachusetts climate regulations (e.g., Renewable Portfolio Standard, Clean Energy Standard, Clean Peak Standard). The relevant emissions rate is the off-peak average emissions rate.

Thus, charging during on-peak hours adds unplanned marginal generation and emissions, while charging during off-peak hours adds planned average generation and emissions. We estimate the difference in emissions rates using hourly generation data by resource type from ISO-New England's *Operations Reports for Dispatch Fuel Mix*[29] for the 2020 calendar year to estimate marginal and average emission rates for specific time periods. Using this period-specific method we find a difference in on-peak versus off-peak emission rates of 88.3 kg CO_2 per MWh (see Table 6).[30]

Table 6. On- and Off-Peak Emissions Rates and Avoided Emissions Values

Emissions Savings (kg CO_2 per MWh)		
On-Peak Emissions Rate	Off-Peak Emissions Rate	Emission Savings
412.3	324.0	88.3

Note: See D.P.U. 21-90 GECA-ESJC-5 Workpaper B for calculations.

[29] ISO-New England. 2020. *Operations Reports: Dispatch Fuel Mix*. Available at: https://www.isone.com/isoexpress/web/reports/operations/-/tree/gen-fuel-mix
[30] See D.P.U. 21-90 GECA-ESJC-5 Workpaper B for calculations.

Q. Is it possible to estimate the avoided costs associated with the emissions reduction from off-peak EV charging?

A. Yes. AESC 2021 develops avoided greenhouse gas emission values that are applied in the Massachusetts energy efficiency program administrators draft 2022-2024 plan. Table 7 shows the 2021 Winter and Summer peak and off-peak avoided greenhouse gas emission values used in the draft 2022-2024 plan,[31] the emission rates assumed in AESC 2021,[32] and the inferred $184 per short ton CO_2 (or $203 per metric ton CO_2).[33] (This value, when calculated using AESC's illustrative 15-year levelized average emission cost is $125 per short ton.)

Table 7. Avoided CO_2 Emissions Costs by Season

	Winter		Summer	
	On-Peak	Off-Peak	On-Peak	Off-Peak
Non-Embedded CO_2 Costs (2021$ per kWh)	$0.0695	$0.0728	$0.0717	$0.0735
CO_2 Marginal Emissions Rates (lb per MWh)	756	791	779	799
Avoided CO_2 Emissions Cost ($ per short ton)	**$184**	**$184**	**$184**	**$184**
Avoided CO_2 Emissions Cost ($ per metric ton)	**$203**	**$203**	**$203**	**$203**

Note: See D.P.U. 21-90 GECA-ESJC-5 Workpaper B for calculations.

[31] Eversource. April 30, 2021. "Statewide Draft Energy Efficiency Plan." *2022-24 Plan BC Model Electric – Eversource [Excel]*. Available at: https://ma-eeac.org/wp-content/uploads/2022-24-Plan-BC-Model-Electric-Eversource-2021-04-30.xlsb

[32] AESC Study Group. May 2021. "Avoided Energy Supply Costs in New England 2021." Synapse Energy Economics. Available at: https://www.synapse-energy.com/sites/default/files/AESC%202021_20-068.pdf, Table 80

[33] See D.P.U. 21-90 GECA-ESJC-5 Workpaper B for calculations.

Multiplied by the average emission reduction of 88.3 kg CO_2 per MWh as calculated above, the result is an avoided greenhouse gas emissions benefit of $0.018 per kWh (see Table 8).[34]

Table 8. Avoided Emissions Costs

Emissions Cost Savings		
Emission Savings (kg CO_2 per MWh)	Avoided Emissions Cost ($ per metric ton CO_2)	Cost Savings ($ per kWh)
88.3	$203	$0.018

Note: See D.P.U. 21-90 GECA-ESJC-5 Workpaper B for calculations

Q. Based on your analysis, what are the total rebate values associated with the benefits of an off-peak charging program?

A. Our testimony identifies several benefits of off-peak charging and provides preliminary valuations as a demonstration that it is possible to assign values to these benefits:

- **Energy cost reduction:** 1.2 cents per kWh
- **Capacity cost reduction:** 3.0 cents per kWh
- **Transmission cost reduction:** 2.7 cents per kWh
- **Distribution cost reduction:** 3.2 cents per kWh
- **Reliability cost reduction:** 0.8 cents per kWh
- **Capacity DRIPE cost reduction:**1.4 cents per kWh
- **Emissions cost reduction:** 1.8 cents per kWh

[34] See D.P.U. 21-90 GECA-ESJC-5 Workpaper B for calculations.

Summing these estimates together provides an illustrative rebate value of 14.1 cents per kWh.

V. POTENTIAL REVENUE SOURCE FOR FUNDING CHARGING REBATES

Q. What potential revenue sources could Eversource leverage to fund an off-peak charging program?

A. All Eversource customers are charged a System Benefit Charge, or energy efficiency fee, on their bills of $0.00250 per kWh[35] to fund the utility's energy efficiency programs. In addition, Eversource collects an energy efficiency reconciling factor (EERF) charge, which is designed to cover the estimated incremental costs of the Company's proposed energy efficiency programs for the year. The EERF charge is updated every year and varies by customer group. The current EERF charge for Eversource's residential customers is between $0.01464 and $0.02579 per kWh depending on the service area.[36] Together these two fees amount to between $0.01714 and $0.02829 per kWh.

Charging of electric vehicles, therefore, contributes between $0.01714 and $0.02829 per kWh to fund energy efficiency programs in Massachusetts. At an average usage of 3,000 kWh per year, each electric car is generating between $51.42 and $84.87 per year that may be one potential revenue source for funding charging rebates.

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[35] Eversource. June 2021. "Summary of Electric Service Delivery Rates." *Residential R-1.* Available at: https://www.eversource.com/content/docs/default-source/rates-tariffs/ema-greater-boston-rates.pdf

[36] Eversource. June 2021. "Summary of Electric Service Delivery Rates." *Residential R-1.* Available at: https://www.eversource.com/content/docs/default-source/rates-tariffs/ema-greater-boston-rates.pdf

VI. RECOMMENDATIONS

Q. Are you recommending a specific off-peak charging rebate for Eversource?

A. No. The calculations we present in this testimony are illustrative and meant to (1) model avoided energy and capacity costs based on National Grid's off-peak charging rebate methodology (which omits important benefits of off-peak charging), and (2) offer an illustrative methodology for inclusion of other benefits in the rebate value including avoided transmission and distribution costs, avoided emissions and emission costs, avoided reliability costs, avoided costs due to induced price effects, and non-energy benefits.

Q. What is your recommendation with regards to a potential Eversource off-peak charging rebate?

A. Eversource should calculate an off-peak rebate value. We offer an illustrative method for doing so in this testimony. In the absence of a rebate, EV owners are currently being overcharged for the energy used to charge their vehicles; correcting the rebate value would eliminate a cross-subsidy from EV owners to non-EV owners while at the same time providing an incentive to adopt critical emission reductions in the transportation sector.

VII. CONCLUSION

Q. Does this conclude your testimony?

A. Yes.