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August 20, 2021

Ms. Samantha Meserve
Deputy Director, Renewable and Alternative Energy Division
Massachusetts Department of Energy Resources
100 Cambridge St #1020
Boston, MA 02114

RE: DOER's Straw Proposal for the Alternative Energy Portfolio Standard

Dear Ms. Meserve,

Dalkia Aegis Energy/ EDF Group is grateful for this opportunity to provide comments on the Alternative Energy Portfolio Standard (APS) review presently being conducted by the Massachusetts Department of Energy Resources (DOER). These comments are addressed to the Straw Proposal put forth by the DOER.

We are a 35-year Massachusetts-based CHP manufacturer/installer/developer of CHP systems throughout the Northeast, Mid-Atlantic, California, and some mid-western locations. We employ more than 100 people in MA and multiples of that number in Massachusetts via manufacturing and installing our systems, whether they be vendors, suppliers, or subcontractors. Recently, we completed a restoration of a 200-year-old paper mill in Holyoke, which was a toxic, brownfield site. We invested in this site to support our expanded CHP operations. It is now a clean, productive workplace contributing to the Holyoke and Massachusetts business communities and tax base.

In addition, we have installed and now maintain 100 CHP systems in the Commonwealth of Massachusetts, many of them relatively small, 35kW to 500kW. Of these one hundred systems, over a third are located at healthcare facilities, Housing Authority developments, Schools, Low-income housing, and other not-for-profits such as YMCA's and JCC's.

We are submitting our comments not only on our own behalf, but on behalf of these clients, which rely on the AEC market to supplement their savings and revenue streams.

To summarize our comments:

- We support MA DOER for changes in the Alternative Compliance Payment (ACP) and the increase in the APS percentage requirement that will support prices and reduce volatility;
- We are avid supporters of MA DOER's Greenhouse Gas (GHG) reduction goals;
- We would like to stress to MA DOER that high efficiency, environmentally superior and economically advantageous CHP has historically delivered, and will deliver for years ahead, significant GHG reductions;
- We ask that the MA DOER consider that CHP provides emissions reductions that promote GHG reduction goals often in a more cost-effective manner than other alternative qualifying technologies;
- We ask that MA DOER recognizes that CHP provides a host of uncompensated benefits, including resiliency for critical infrastructure, heating/cooling/power support for vulnerable and low-income populations in time of emergencies, reductions in transmission and distribution (T&D) capital and operating expenses, and facilitating the higher levels of penetration of intermittent renewables on the grid;
- We urge MA DOER to support a technology neutral approach to meeting the GHG reduction. It is imperative that MA DOER employ a framework that does not choose particular technologies, rather one that fairly rewards on the basis of measured, verified GHG reductions, based on today's realities and not on some anticipated future developments;
- We echo the support for over-arching fair, measured, and verified payment for performance, utilizing methodologies, protocols, and best practices as understood and accepted by unbiased, arms-length experts like the U.S. Environmental Protection Agency (US EPA);
- We recommend that MA DOER's assessments in this proceeding must take account of future needs for distributed energy flexible resources (DEFER) that will be essential to grid reliability and stability for years into the future, and;
- We wish to remind MA DOER that zero carbon CHP is a DEFER that exists today. A variety of forms of renewable-fueled CHP run today, and with accelerated technology research, will deliver faster, better, cheaper zero carbon CHP options for decades to come, once these fuel sources come available and online.

Appropriately designed CHP technologies and systems are tested, proven, reliable, and clean. The State of Massachusetts was a national innovator in the development of the Alternative Portfolio Standard that has rewarded high efficiency, environmentally superior energy technologies including CHP. The incentive structure for CHP in the APS was particularly well



designed and effective in promoting the public interest. Because it rewards systems more per kWh the higher their efficiency, it has driven installed systems to become more and more efficient. This has generated greater societal benefits through the reduction of CO₂ emissions and criteria pollutants, which is the goal of the APS. Any revision to the AEC market or APS eligibility should accurately account for the prior and ongoing achievements of program participants. We support many of the important structural changes to the AEC market in the DOER Straw Proposal, but also strongly urge the DOER not to abandon its methodology of rewarding CHP based on its actual performance.

1. High Efficiency, Environmentally Superior, Resilient CHP Demonstrably Delivers GHG Reductions.

Dalkia Aegis Energy fully supports GHG reduction goals of Massachusetts and avidly embraces the roadmap to statewide decarbonization across all sectors. For that very reason we urge that MA not abandon CHP as long as it continues to deliver measured, verified GHG reduction benefits. In its consideration of the future of the MA APS there should not be an arbitrary phase out of applications, systems and technologies that are demonstrably delivering GHG reductions.

We remind MA DOER that high efficiency, environmentally superior, and economically advantageous CHP has historically delivered and will for years ahead continue to deliver significant GHG reductions. CHP end users state with confidence that CHP is beating the grid each and every day. When and if this no longer becomes the case, then we support MA DOER making the appropriate adjustments to its program to reflect the diminished benefit of this technology. The guiding principle should be to create an incentive structure that rewards empirically verifiable GHG reductions and preferably capture those emissions in the most cost-effective manner.

a. CHP Often Meets GHG reduction goals in a Cost-Effective Manner

Under the MA APS as it operates today there are a number of alternative qualifying technologies. Across the spectrum of qualifying technologies there is a range of total societal cost of GHG reductions. This range can be determined with some significant precision based on empirically verifiable measurement and transparent methodology. We ask that in its deliberations the MA DOER promote GHG reduction goals with attention paid to the cost-effectiveness of the various qualifying technologies. In particular we would urge that technologies and systems delivering GHG reductions at an attractive price point not be abandoned prematurely and/or arbitrarily

b. Ancillary and Uncompensated Benefits of CHP



CHP provides a host of often uncompensated benefits. These benefits, while ancillary and not central to the objectives of this proceeding, should be recognized when the primary goal (GHG reductions) has been met. Properly designed and operated CHP provides resiliency for critical infrastructure. There are countless examples in MA, the Northeast, nationally and internationally of hospitals, colleges and universities, water / wastewater treatment plants and other recognized critical infrastructure sites implementing CHP as a resiliency measure. As MA anticipates and plans for greater frequency of adverse weather events the value of resiliency is undoubtedly increasing and that value accelerates at a greater rate into the future.

CHP at multifamily buildings and campuses have historically provided heating/cooling/power support for vulnerable and low-income populations in time of emergencies. The operation of CHP during outages of extended duration permit seniors to shelter in place and mitigates the disproportionate impact that outages have on low-income populations. Community heating and cooling centers, and ensures the operations of community heating and cooling centers,

More than a decade ago, in a series of nationally innovative pilots, the State of Massachusetts and the utilities experimented with the utilization of strategically located DERs to reduce T&D capital costs and operating expenses. Leveraging learnings from innovations in MA, RI and elsewhere, Con Edison developed the successful Brooklyn Queens Demand Management (BQDM) program to delay investments in the grid. An ongoing Non-Wires Alternatives (NWA) program was built upon these foundational programs. The CHP industry, its key upstream and downstream suppliers, and the US DOE, are in various ways pursuing product and process innovations making CHP an ever more flexible resource. With the progression of time CHP is an ever more dynamic asset serving the grid and enabling the penetration of higher levels of intermittent renewables.

When comparing alternatives of reasonable equivalence for meeting GHG reduction goals, MA DOER ought not to lose sight of the variability in significant positive ancillary benefits that are achievable across the various qualifying technologies.

1. Technology Neutrality

In all of its determinations, Dalkia Aegis urges that MA DOER employ a framework that supports a technology neutral approach to meeting the GHG reduction targets. Stated alternatively, a guiding principle should be incenting the desired outcomes, not choosing particular technologies or systems. We fully embrace the need to aggressively address the existential threat society faces with climate change. Essential to mitigating climate change is to fundamentally transform the generation, transmission, delivery and consumption of electric power and thermal energy in our buildings, offices, homes, factories and businesses. If CHP provides measured, verified GHG reductions that advance this imperative it should be

compensated. Some of the other technologies being promoted by MA DOER do not yet reduce CO₂ emissions because they operate on a grid which is demonstrably more carbon intense than CHP.

2. Utilize Methodologies, Protocols and Best Practices of Trusted Experts

Fair, measured, and verified payment for performance is vital to realizing the greatest amount of carbon reduction in the fastest and least expensive manner in Massachusetts. Key to this is utilizing methodologies, protocols and best practices as understood and accepted by unbiased, arms-length experts like the U.S. Environmental Protection Agency (US EPA).

The US EPA Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State and Tribal Implementation Plans (SIPs and TIPs) provides overall guidance on how to estimate and account for emission reductions from energy efficiency and renewable energy policies and programs, including CHP, in their Clean Air Act plans. Specifically, Appendix I: Methods for Quantifying Energy Efficiency and Renewable Energy Emission Reductions provides a detailed discussion on the approach to quantify avoided or displaced electric generating unit emissions from energy efficiency and renewable energy programs and projects, including the use of the eGRID non-baseload factors as a first cut estimate of displaced marginal grid generation emissions.¹

Additionally, the US EPA provides additional and updated guidance on accounting for offset grid emissions in their publication Quantifying the Multiple Benefits of Energy Efficiency and Renewable Energy: A Guide for State and Local Governments. In particular, Part Two, Chapter Four provides methodology for quantifying the emissions benefits of energy efficiency and renewable energy programs and projects, including an introduction to AVERT as a more accurate approach to estimating displaced marginal generation emissions.²

Third, US EPA's June 2021 Fuel and Carbon Dioxide Emissions Savings Calculation Methodology for Combined Heat and Power Systems provides US EPA's guidance on calculating fuel and CO₂ emissions savings from CHP based on applying the guidance from the above three documents to CHP projects specifically.³ Please also see the calculations of CHP vs Grid CO₂ emissions presented in the Appendix to these comments.

¹ <https://www.epa.gov/statelocalenergy/quantifying-multiple-benefits-energy-efficiency-and-renewable-energy-guide-state>

² https://www.epa.gov/sites/production/files/2018-07/documents/mbg_2-4_emissionshealthbenefits.pdf

³ https://www.epa.gov/sites/default/files/2015-07/documents/fuel_and_carbon_dioxide_emissions_savings_calculation_methodology_for_combined_heat_and_power_systems.pdf

CHP provides a significant CO₂ savings relative to current Massachusetts grid emissions. The NE-ISO Load-Weighted Marginal Unit (LMU) marginal emission rate for 2018 was 745 lbs.

CO₂/kWh, and the eGRID Non-Baseload emissions rate for the NE ISO, which is used to calculate CO₂ savings from Mass Save projects, is 931 lbs. CO₂/kWh. According to a 2019 study by ICF, *As the Grid Gets Greener, Combined Heat and Power Still Has a Role to Play*, CHP emissions are estimated at 652 lbs. CO₂/kWh when accounting for offset boiler emissions. Using either 745 lbs. CO₂/kWh or 931 lbs. CO₂/kWh, CHP provides a significant CO₂ savings, and will until marginal grid emissions are drastically reduced.⁴

This savings relative to marginal grid emissions, combined with CHP's high-capacity factor, leads to significant CO₂ savings, even compared to the same MW of installed wind and solar. According to a study by Entropy Research, LLC. 10 MW of CHP with an 85% capacity factor can provide 33,533 tons of CO₂ savings compared to eGRID non-baseload emissions on an annual basis. For comparison, the same study found that 10MW of solar with an average capacity factor of 26.1% saved 17,159 tons of CO₂ annually, and 10MW of wind with an average capacity factor of 37.4% saved 24,501 tons of CO₂ annually. CHP can provide nearly double the carbon savings of solar and a 50% increase in savings compared to wind, for the same number of MW installed.⁵

3. It's Imperative to Take Account of the Mid to Long Term

In addition to the urgent need for immediate carbon emissions reductions, MA DOER's assessments in this proceeding must also take account of future needs for distributed energy flexible resources (DEFR) that will be essential to grid reliability and stability for years into the future. Zero carbon CHP is a DEFR that exists today, with a variety of forms of renewable CHP currently in operation. With accelerated technology research, the CHP industry will deliver faster, better, and cheaper on-demand zero carbon power sources for decades to come.

Renewable Natural Gas (RNG) and hydrogen are both currently in use by existing CHP systems, and many of the natural gas-fueled CHP systems in production are readily convertible to these low and no-carbon fuels. Existing installed CHP systems can use hydrogen in current configurations up to 15%. With minor tuning modifications, these already installed systems can use hydrogen up to 40 to 50%, once these fuel sources come available and online.

⁴ https://www.icf.com/-/media/files/icf/white-paper/2019/icf_chp_has_a_role_to_play_august_2019_web_wp.pdf

⁵ Please see the calculations of CHP vs Grid CO₂ emissions presented in the Appendix to these comments.



CONCLUSION

CHP systems participating in the APS program provide a suite of benefits to ratepayers. They reduce the emission of CO₂ and other criteria pollutants, as well as providing on-site electric and thermal resiliency. CHP is a tested, proven, economic, reliable and clean technology that, importantly, exists today and is readily deployable. Utilizing renewable and low carbon CHP can be done, because it has been done, and does not require incubation or development to be implemented at scale.

Dalkia Aegis Energy is committed to supporting Massachusetts' GHG reduction goals, and support many of the changes to the APS in DOER's Straw Proposal. Changes in the Alternative Compliance Payment (ACP) and the increase in the APS percentage requirement that will support prices and reduce volatility, furthering the investment in and deployment of clean power and heating technologies. If deployed in a technology-agnostic manner that provides compensation based on performance and real emissions reductions, Massachusetts can continue to realize GHG reductions and quickly accelerate their rate of reduction.

We respectfully urge that any reductions in AEC credits for CHP be directly tied to a proportionate decrease in its value vis-à-vis carbon intensity relative to the grid, or other important benefits conferred by this technology.

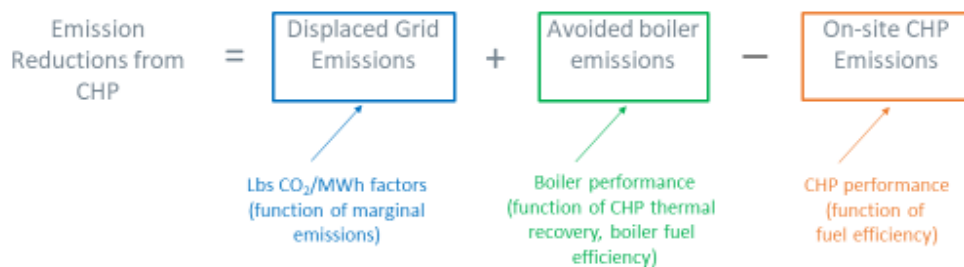
Sincerely yours,

Lee Vardakas

President
Dalkia Energy Solutions

Appendix – Comparative CO₂ Emissions of CHP and NE ISO

Calculating CHP CO₂ Emissions Impacts



$$\text{Effective Electric Emissions}_{\text{CHP}} = (\text{CHP CO}_2 \text{ emissions (lbs/hr)} - \text{Displaced Boiler CHP Emissions (lbs/hr)}) / \text{MW}_{\text{CHP}}$$

Natural Gas Combined Cycle: 770 - 850 lbs CO₂/MWh

Recip Engine CHP: 430 - 550 lbs CO₂/MWh (100% thermal utilization)

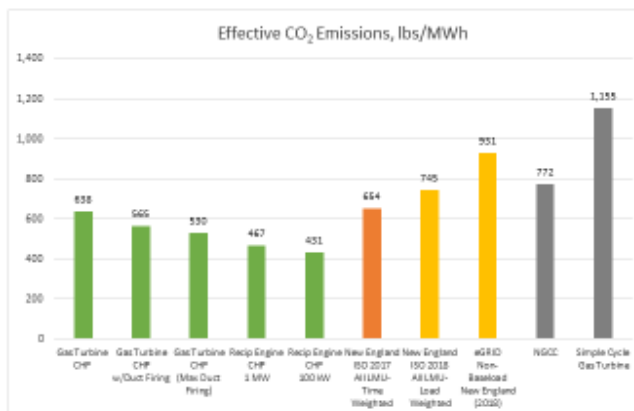
Gas Turbine CHP: 550 - 650 lbs CO₂/MWh (100% thermal utilization)

December 3, 2020

Source: Entropy Research, LLC. Bruce Hedman December 1, 2020 Bruce Hedman
bhedman.entropyresearch@gmail.com

CHP Continues to Reduce CO₂ Emissions in New England

- Natural gas CHP provides CO₂ emissions reductions when the effective electric CO₂ emissions from CHP (lbs/MWh) is lower than the marginal emissions from displaced grid electricity*
- Natural gas CHP has lower effective electric CO₂ emissions (lbs CO₂/MWh) than both the ISO New England 2018 All LMU Load Weighted and eGRID New England 2018 Non-Baseload emissions factors (two approaches to estimating the marginal emissions from displaced grid power)
- CHP's high effective electric efficiency and high operational capacity factors leads to significant CO₂ emissions reductions on an annual basis
- CHP is the most efficient method of generating electricity with natural gas; CHP's efficiency and resilience advantages will remain as the natural gas infrastructure decarbonizes
- RNG/hydrogen fueled CHP can decarbonize facilities that need dispatchable on-site generation for resilience, and industrial processes that will be difficult to electrify



Effective CO₂ emissions based on CHP performance from DOE Technology Fact Sheets (2017) and EPA eGRID 2020 (2018 data) national average T&D losses of 4.88% (T&D loss credit applied to CHP output); Assumes CHP thermal displaces an 80% efficient on-site natural gas boiler

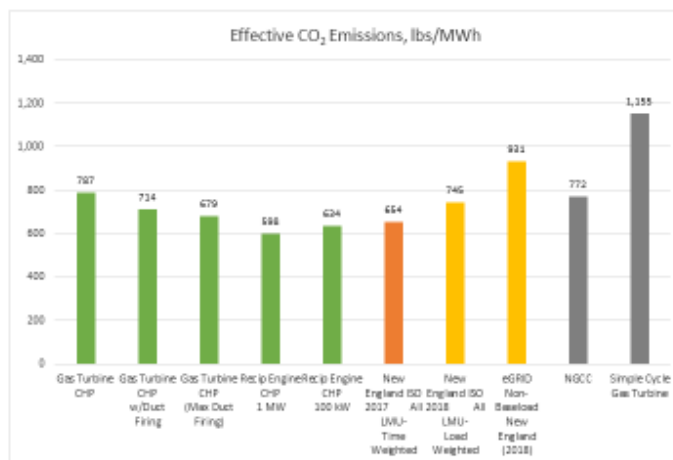
*Fuel and Carbon Dioxide Emissions Savings Calculation Methodology for Combined Heat and Power Systems, U.S. Environmental Protection Agency Combined Heat and Power Partnership, February 2015

December 3, 2020

Source: Entropy Research, LLC. Bruce Hedman December 1, 2020 Bruce Hedman
bhedman.entropyresearch@gmail.com

CHP Effective CO₂ Emissions – 75% Thermal Utilization

- 7.5 MW Gas Turbine CHP efficiency: 60% (unfired)
- 1 MW Recip Engine CHP efficiency: 70%
- 100 kW Recip Engine CHP efficiency: 70%



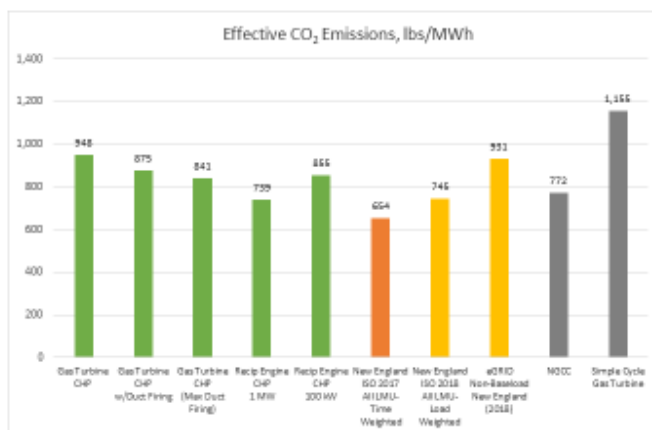
Effective CO₂ emissions based on CHP performance from DOE Technology Fact Sheets (2017) and EPA eGRID 2020 (2018 data) national average T&D losses of 4.88% (T&D loss credit applied to CHP output); Assumes CHP thermal displaces an 80% efficient on-site natural gas boiler

December 3, 2020

Source: Entropy Research, LLC. Bruce Hedman December 1, 2020 Bruce Hedman
bhedman.entropyresearch@gmail.com

CHP Effective CO₂ Emissions – 50% Thermal Utilization

- 7.5 MW Gas Turbine CHP efficiency: 50% (unfired)
- 1 MW Recip Engine CHP efficiency: 59%
- 100 kW Recip Engine CHP efficiency: 56%

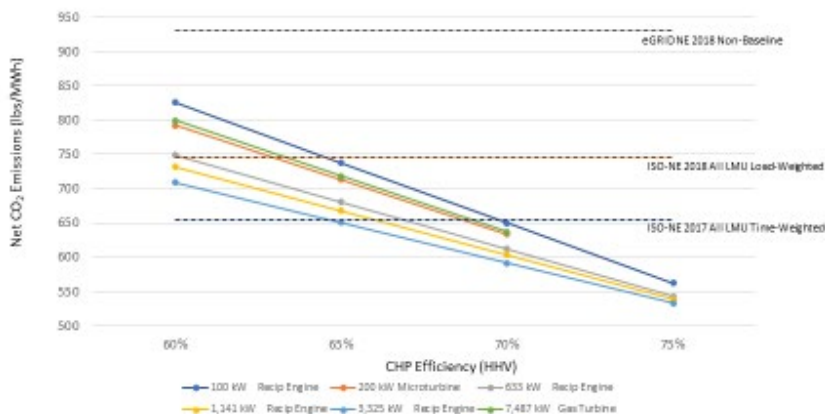


Effective CO₂ emissions based on CHP performance from DOE Technology Fact Sheets (2017) and EPA eGRID 2020 (2018 data) national average T&D losses of 4.88% (CHP loss credit applied to CHP output); Assumes CHP thermal displaces an 80% efficient on-site natural gas boiler

December 3, 2020

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CHP Net Effective CO₂ Emissions vs CHP Efficiency



Effective CO₂ emissions based on CHP performance from DOE Technology Fact Sheets (2017) and EPA eGRID 2020 (2018 data) national average T&D losses of 4.88%; Assumes CHP thermal displaces an 80% efficient on-site natural gas boiler

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bhedman.entropyresearch@gmail.com

CHP Net Effective CO₂ Emissions vs CHP Efficiency

Effective CO ₂ Emissions Rate (lbs/MWh)									
	100 kW Recip Engine	200 kW Microturbine	633 kW Recip Engine	1,141 kW Recip Engine	3,325 kW Recip Engine	7,487 kW Gas Turbine	ISO-NE LUMU 2017 Time- Weighted	ISO-NE LUMU 2018 Load- Weighted	eGRID NE 2018 Non- Baseload
CHP Electric Output, kW	100	200	633	1,141	3,325	7,487			
Electric Efficiency (HHV), %	27.0%	29.8%	34.5%	36.8%	40.4%	29.2%			
Thermal Output, MMBtu/hr	0.67	0.90	2.78	4.32	10.67	36.3			
Net Overall Efficiency (HHV), %	60%	626	793	749	732	709	600	654	745
	65%	738	713	680	668	650	718	654	745
	70%	630	633	612	603	592	637	634	745
	75%	562		543	539	533		654	745
	80%	474		474	474	474		654	745

Effective CO₂ emissions based on CHP performance from DOE Technology Fact Sheets (2017) and EPA eGRID 2020 (2018 data) national average T&D losses of 4.88%. Assumes CHP thermal displaces an 80% efficient on-site natural gas boiler

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