NECHPI
NORTHEAST CLEAN HEAT AND POWER INITIATIVE

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Ms. Samantha Meserve
Deputy Director, Renewable and Alternative Energy Division
Massachusetts Department of Energy Resources
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Boston, MA 02114

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

Dear Ms. Meserve,

The Northeast Clean Heat and Power Initiative (NECHPI), as well as 2G Energy, Inc., AB Energy USA, LLC., Caterpillar, Inc., Cogen Power Technologies, Dalkia Aegis, EDF Group, Digital Energy Corp. / Advantage CHP, The E Cubed Company, LLC., Energy Spectrum, Inc., Gotham Energy 360, LLC., Kraft Power, RSP Systems, Solar Turbines, Tecogen, and Vergent Power Solutions, are 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.

NECHPI is a 501(c)6 non-profit corporation dedicated to accelerating the deployment of efficient clean heat and power applications in the Northeast. We provide consistent and evidence-based advocacy for distributed energy resources policy, as well as conferences and networking events that bring together top members of the CHP community. Our members include prominent CHP development firms, non-profit organizations, and regional utilities.

To summarize comments of NECHPI and its members companies, we:

- Laud 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;
- Express our avid support of MA DOER's Greenhouse Gas (GHG) reduction goals;
- Respectfully remind MA DOER that high efficiency, environmentally superior and economically advantageous CHP has historically delivered, and will deliver for years ahead, significant GHG reductions;
- 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;

- Recognize 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;
- Urge MA DOER to support a technology neutral approach to meeting the GHG reduction targets that our members strongly champion. 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;
- Stress the over-arching importance of 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);
- Note that MA DOER's assessments in this proceeding must 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, and;
- Advise MA DOER that zero carbon CHP is a DEFR that exists today. A variety of forms of renewable CHP run today, and with accelerated technology research, will deliver faster, better, cheaper zero carbon CHP options for decades to come.

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 CO_2 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.

As explained further below, CHP has the ability to efficiently and cost-effectively reduce emissions while providing ancillary services to the electrical grid including resiliency and reliability. Additionally, as the grid evolves to support additional renewables in furtherance of GHG reduction mandates, CHP can be leveraged to provide valuable grid services in applications that go beyond baseload power and to enable deeper renewable energy integration. Given the importance of CHP today, and the potential role of CHP in a clean energy future, we urge MA DOER to continue providing incentives for CHP facilities. Additionally, in any revisions to the current incentive structure, we recommend DOER adopt a technology-neutral framework that compensates technologies capable of cost-effectively reducing emissions with fair, measured, and verified payment for performance. Doing so is essential to realizing the greatest amount of carbon reduction in the fastest and least expensive manner in Massachusetts.

1. Changes to the Percentage Requirement and the Alternative Compliance Payment

We laud the DOER's decision to increase the ACP as well as to increase the percentage requirement. Revisions to the program increase the obligation of load serving entities to secure 7.5% of load initially in 2023. That requirement increases over time at 0.25% per annum. The policy commitment to increased electrification is sure to provide an additional stimulus to demand over time.

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

NECHPI and its member companies fully support GHG reduction goals of Massachusetts and avidly embrace 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. Instead, the guiding principle should be to create an incentive structure that rewards empirically verifiable GHG reductions, preferably in the most cost-effective manner.

NECHPI respectfully reminds MA DOER that high efficiency, environmentally superior, and economically advantageous CHP has historically delivered significant GHG reductions and will continue to do so for years ahead. CHP end users state that their confidence that CHP is beating the grid each and every day. Some further state that when it no longer does beat the grid that they will turn it off. This is exactly the type of behavior that the MA DOER ought to be incenting with its policy.

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

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.

Under the MA APS as it operates today there are a number of alternative qualifying technologies. Across this 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. MA DOER should perform the requisite analysis to determine which qualifying technologies are capable of delivering the most cost-effective reductions in GHG emissions. Accordingly, technologies that promote GHG reductions at the lowest societal cost should continue to be incentivized.

b. Ancillary and Uncompensated Benefits of CHP

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. For instance, in addition to reduced emissions, CHP provides a host of often uncompensated benefits. 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.

Furthermore, CHP has mitigated the impacts of many natural disasters and emergencies by keeping critical facilities operating and running with minimal interruption. CHP at multifamily buildings and campuses have historically provided heating/cooling/power support for vulnerable and low-income populations in time of emergencies, thereby partly mitigating the disproportionate impact that outages have on low-income populations. The operation of CHP during outages of extended duration permits vulnerable seniors, many of whom are unable to evacuate, to shelter in place.

CHP has also been used to meet distribution needs instead of spending ratepayer dollars on traditional grid infrastructure. For instance, 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, including a $1.2 billion substation upgrade. An ongoing Non-Wires Alternatives (NWA) program was built upon these foundational programs.

Undoubtedly, CHP has demonstrated its ability to improve resiliency, mitigate the impacts of a disaster, provide reliability during grid outages all which delivering energy cost savings, greater efficiencies, and reduced emissions. Moreover, with the progression of time, CHP is becoming an ever more dynamic asset serving the grid while also enabling the penetration of higher levels of intermittent renewables. As the grid evolves, there is an increased need to ensure the stability and reliability of the electric power system. Importantly, according to the DOE, there is significant potential for CHP systems to support grid modernization by providing grid reliability, customer resilience, energy efficiency, locational value, affordability, and emissions reductions.

Given this potential, 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.

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.

3. Technology Neutrality

In all of its determinations NECHPI 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. NECHPI and its members 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.

4. 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. 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

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

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 CO_2 emissions presented in the Appendix to these comments.

CHP provides a significant CO_2 savings relative to current Massachusetts grid emissions. The NE-ISO Load-Weighted Marginal Unit (LMU) marginal emission rate for 2018 was 745 lbs. CO_2/kWh, and the eGRID Non-Baseload emissions rate for the ISONE, which is used to calculate CO_2 savings from Mass Save projects, is 931 lbs. CO_2/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. CO_2/kWh when accounting for offset boiler emissions. Using either 745 lbs. CO_2/kWh or 931 lbs. CO_2/kWh, CHP provides a significant CO_2 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 CO_2 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 CO_2 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 CO_2 annually, and 10MW of wind with an average capacity factor of 37.4% saved 24,501 tons of CO_2 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]

5. 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 can respond to the intermittency of renewable generation, and 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

[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
[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.

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%.

New engines and combustion turbines, available now and with several in operation, can run on 100% hydrogen. NECHPI member company 2-G energy has 8 to 10 hydrogen fueled engines running worldwide, and member company Caterpillar (CAT) has equipment with millions of operating hours on hydrogen. Capstone Microturbines are also currently able to run up to 10% hydrogen, and will be approved for 30% hydrogen blending in 2022, with ongoing 100% hydrogen pilots.

Other methods for achieving low or no GHG emissions with CHP include emissions capture and usage, as well as capturing and processing waste that would otherwise generate methane emissions. NECHPI member company AB Energy has CHP in greenhouses that sequester a large proportion of the CO2 emitted and utilize it to accelerate and support plant growth. Increased requirements for food recycling can be much more productively employed in a CHP context, using anaerobic digestors to generate biogas and fertilizer from the food waste, and using the biogas in CHP systems that support the digestion process and other on-site energy needs.

CHP is agnostic to the input fuel source, and low and no-carbon CHP exists today in many configurations with growing applications.

CONCLUSION

CHP systems participating in the APS program provide a suite of benefits to ratepayers. They reduce the emission of CO_2 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.

NECHPI and our member companies are 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.

Sincerely yours,

John Moynihan

John Moynihan
Chair, NECHPI Board of Director

Co-signed:

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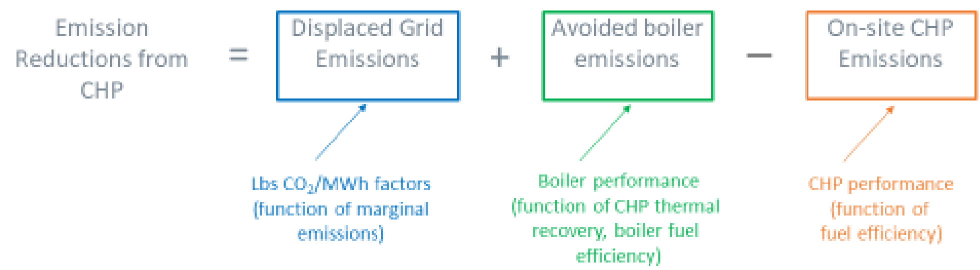
Appendix – Comparative CO_2 Emissions of CHP and ISONE

Calculating CHP CO_2 Emissions Impacts



Effective Electric Emissions $_{CHP}$ = (CHP CO_2 emissions (lbs/hr) – Displaced Boiler CHP Emissions (lbs/hr) / MW_{CHP}

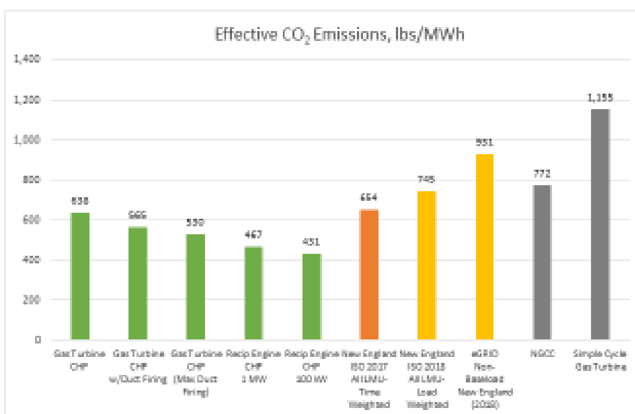
Natural Gas Combined Cycle:	770 - 850 lbs CO_2/MWh	
Recip Engine CHP:	430 - 550 lbs CO_2/MWh	(100% thermal utilization)
Gas Turbine CHP:	550 - 650 lbs CO_2/MWh	(100% thermal utilization)

December 3, 2020

Source: Entropy Research, LLC. Bruce Hedman December 1, 2020 Bruce Hedman [*bhedman.entropyresearch@gmail.com*](mailto:bhedman.entropyresearch@gmail.com)

CHP Continues to Reduce CO_2 Emissions in New England

- Natural gas CHP provides CO_2 emissions reductions when the effective electric CO_2 emissions from CHP (lbs/MWh) is lower than the marginal emissions from displaced grid electricity*
- Natural gas CHP has lower effective electric CO_2 emissions (lbs CO_2/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 CO_2 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 CO_2 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

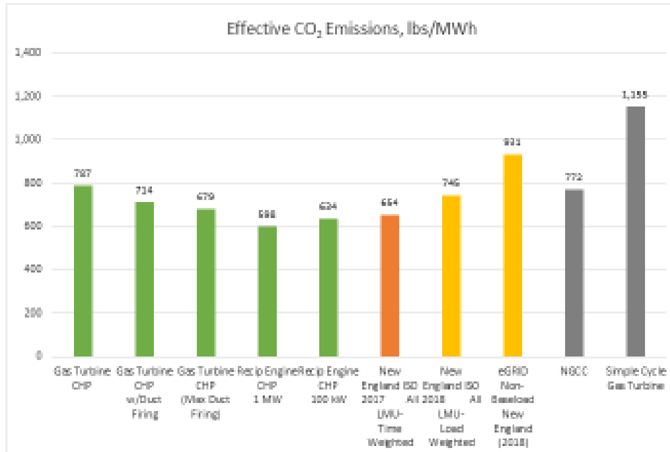
*Fuel and Carbon Dioxide Emissions Savings Calculation Methodology for Combined Heat and Power Systems, U.S. Environmental Protection Agency Combined Heat and Power Partnership, February 2015

December 3, 2020

Source: Entropy Research, LLC. Bruce Hedman December 1, 2020 Bruce Hedman [*bhedman.entropyresearch@gmail.com*](mailto:bhedman.entropyresearch@gmail.com)

CHP Effective CO_2 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 CO_2 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

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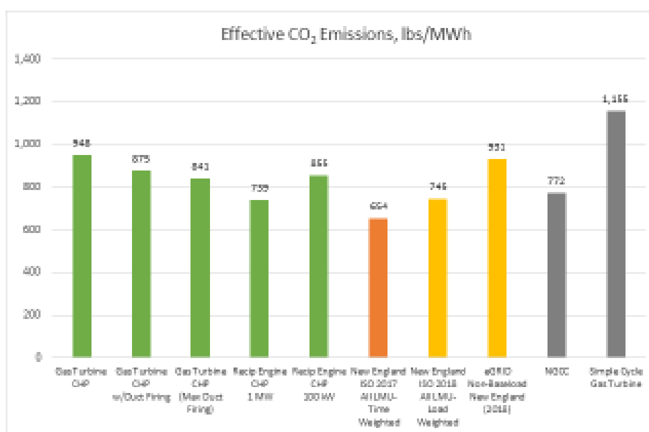
CHP Effective CO_2 Emissions – 50% Thermal Utilization

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



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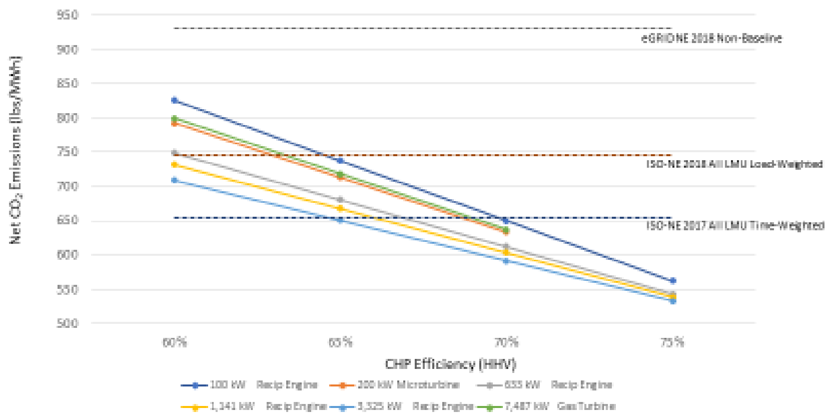
CHP Net Effective CO_2 Emissions vs CHP Efficiency



Effective CO_2 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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CHP Net Effective CO_2 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 LMU 2017 Time-Weighted	ISO-NE LMU 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%	826	793	749	732	709	800	654	745	931
	65%	738	713	680	668	650	718	654	745	931
	70%	650	633	612	603	592	637	654	745	931
	75%	562		543	539	533		654	745	931
	80%	474		474	474	474		654	745	931

Effective CO_2 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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