



Samantha Meserve
Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

Dear Ms. Meserve:

The Massachusetts CHP Coalition, a group representing owners and operators of combined heat and power systems, is pleased to provide the Department with comments on its Straw Proposal for the Alternative Portfolio Standard.

In addition to these comments, we are also submitting two additional documents, one a report that compares the emissions of CO₂ by CHP systems with emissions from alternative technologies and the other a study of the economics of CHP systems based on data from 36 CHP systems located in Massachusetts.

We look forward to discussing the Straw Proposal with the Department in light of these documents.

Sincerely yours,

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Massachusetts CHP Coalition
Comments on DOER's Straw Proposal
for the
Alternative Energy Portfolio Standard

August 20, 2021

The Massachusetts CHP Coalition is pleased to submit these comments to the Massachusetts Department of Energy Resources (DOER) in the context of its review of regulations that implement the Alternative Energy Portfolio Standard (APS).^{1/} The comments are made in response to a document released by the DOER on July 20, 2021, entitled Alternative Energy Portfolio Standard Straw Proposal.^{2/} The presentation presents a series of proposals for changes to the APS regulations. DOER asked stakeholders to provide the agency with comments on those changes by August 20th.

The Massachusetts CHP Coalition is a group of companies that own, operate or represent users of combined heat and power (CHP) systems in Massachusetts.^{3/} Combined, these companies have many years, and countless hours, of experience in the evaluation, financing, installation and operation of CHP systems. Their CHP systems have produced millions of hours of heating, cooling, power generation and process steam for pharmaceutical product development and high technology manufacturing at facilities located throughout the Commonwealth.

These companies have invested in CHP systems because these systems have uniquely valuable characteristics. These characteristics have undoubtedly contributed to the decision to make CHP systems eligible for incentives through the APS when it was first enacted.

- One of those characteristics is that CHP systems are usually able to operate when the surrounding electrical grid is unable to deliver power. This makes them highly reliable and therefore particularly valuable to companies and organizations that cannot be vulnerable to what would otherwise be the disastrous consequences of extended power interruptions. These entities include hospitals, pharmaceutical companies, precision manufacturing facilities and others that all require continuous electrical power and/or heat. This in turn makes CHP systems uniquely valuable, if invisibly so, to the patients and customers of those companies who depend on them for life-saving care and essential materials.

^{1/} The APS regulatory program was established by legislation pursuant to Chapter 251 of the Acts of 2014 and Chapter 188 of the Acts of 2016. The most recent version of the APS regulations was finalized in 2019. The regulations can be found at <https://www.mass.gov/files/documents/2019/07/01/225%20CMR%2016%20APS%20Regulation%20CLEAN%20FINDAL%20%28060619%29.pdf>

^{2/} To view DOER's Straw Proposal, go to: <https://www.mass.gov/doc/aps-straw-proposal/download>

^{3/} The member companies of the CHP Coalition include the Associated Industries of Massachusetts, Encore, Erving Industries, Green Harbor Energy, Medical Area Total Energy Plant (MATEP), NextGrid Markets, Renew Energy Partners and Twin Rivers Technologies.

- Another unique characteristic of CHP systems is that they utilize their fuel at a higher rate of efficiency than any other comparable power generation systems. Other power generating systems rarely exceed 60% conversion of their fuel to usable energy. The remainder is wasted as unrecovered heat loss. CHP systems capture the heat that would otherwise be wasted and deploy it as usable heating and cooling of buildings, machinery and product manufacturing. The efficiency in the use of fuel by CHP systems often exceeds 80%. Despite the engineering and maintenance complexities of on-site generation of heat, cooling and power, these systems repay their owners in energy savings and provide consumers with highly efficient production of electrical and thermal energy.
- In addition, CHP systems deliver their heat and often their power to nearby locations for consumption, either entirely within the buildings or campuses where they are located or, through district energy systems, to adjacent communities with hundreds of consuming buildings. The distributed nature of CHP operations means that CHP systems deliver virtually all of the heat and power they produce. They avoid the inefficiency of the electrical grid which sacrifices 5% or more of the power it transmits due to losses from transmission lines over extended distances.
- Finally, as a result of these efficiencies, CHP systems also produce less pollution than other technologies that use fossil fuels to generate comparable amounts of heat and power.

These characteristics make CHP systems eminently deserving of the incentives awarded to them by the Commonwealth through the enactment of the law that created the APS when it was first enacted in 2014. Because most CHP systems utilize natural gas, they produce carbon emissions. Recent state legislation and policies have created new mandates to reduce carbon emissions throughout the state's economy.^{4/} Those mandates must be respected and fulfilled. A wide variety of technologies that reduce carbon emissions will need to be deployed in as short a timeline as possible to meet these requirements.

Given that there are many instances when carbon-free production of heat and power are infeasible and that CHP systems are the most efficient use of fossil fuels for heat and power production, CHP should remain a technology eligible to earn credits under the APS program. Moreover, the value of those credits should reflect the contributions CHP systems can and will make to the reliability of the state's energy supply while also helping to decrease carbon emissions. To that end, the study of emissions characteristics of CHP compared to alternative technologies submitted with these comments demonstrates that CHP systems can and should be an integral part of the Commonwealth's strategy for reducing carbon emissions over the next three decades.

For the last five years, since legislation expanded the eligibility of a number of new technologies to earn credits under the APS program, the value of APS credits has plummeted. This should

^{4/} Those targets are described in the State's recently released Clean Energy and Climate Plan for 2030 and Energy Pathways Decarbonization Roadmap to 2050.

have been no surprise since the supply of credits was dramatically increased during that time without any corresponding increase in the demand for these credits. As a result, owners and operators of CHP systems, along with owners of other APS-qualifying technologies, have seen the economics of their systems undermined. During this time frame, with few exceptions, the operation of CHP systems has been a losing proposition. For several years, the value of APS credits has been insufficient to contribute to recovering the costs of investment required to install CHP systems.

The benefits of using CHP systems (including carbon emission reductions) compared to other systems that could produce comparable amounts of heat and power clearly indicate that CHP systems should continue to be eligible to earn CHP credits for as long as they remain necessary and efficient. An economic analysis submitted with these comments demonstrates that the payback necessary to maintain existing CHP systems and incentivize development of new CHP systems that would reduce carbon emissions requires the ability to earn sufficient revenue from APS credits.

Provisions of the Straw Proposal Supported by the CHP Coalition

The Coalition is pleased that the DOER intends to revise the APS regulations. Judging by its Straw Proposal, the agency recognizes the need to increase the demand for APS credits. However, mere eligibility for the APS program alone is not sufficient to restore the economic viability of most APS-eligible technologies. For those technologies to maintain economic viability, demand for APS credits must be sufficiently strong to maintain an adequate market value for those credits well into the future. The Straw proposal contains several potential changes to the APS regulations that would achieve the necessary level of demand.

- The CHP Coalition strongly supports the DOER's proposal to increase the overall demand for APS credits by 2% beginning in January of 2023. This would raise the demand from 5.5% of retail sales of electricity in 2022 to 7.5% in 2023, with continued 0.25% increases in the years that follow. Beginning with the 2023 increase, greater demand should produce the material increase in the value of CHP credits so urgently needed by CHP owners and other APS market participants.
- The Coalition also supports the proposal to limit the number of credits available to be earned by the use of liquid biofuels to 460,000 credits per year. Since this fuel requires little or no upfront investment in new technology to generate APS credits, this limitation on its credit earning potential will help avoid having it capture a large portion of the newly created demand.
- The Coalition also supports the proposal to increase in the Alternative Compliance Payment (ACP) to \$40/MWh. This will increase market activity directed at compliance with the demand requirements rather than affording an inexpensive way for electric suppliers to comply with the demand requirements without purchase APS credits.

- In conjunction with an increase in demand for APS credits by 2% in 2023 and an increase in the ACP to \$40, the Coalition would support a reduction in the number of APS credits able to be earned by CHP to 70% of the MW hours the CHP unit actually operates. The impact of the demand increase and the ACP increase are likely to increase the market value of APS credits substantially compared to where they are today. With higher market prices for APS credits, Coalition members estimate that reducing the number of credits to 70% of the facility's total MWh of operation would still produce sufficient revenue to make their projects economically feasible.

Correct a Design Flaw in the APS Market

However, these changes, by themselves, will not correct for a fundamental flaw in the design of the APS credit market (and other markets like it). This flaw is the rigid nature of the demand for credits; it does not change in response to changes in supply, as normal markets do. The impact of the rigidity of that demand has been obvious in the collapse of APS credits prices in recent years when supply exceeded demand by even a small amount.

The increase in demand for APS credits that would occur in 2023, as presented in the Straw Proposal, would be only a temporary solution to this problem. It will give rise to higher prices for APS credits; higher prices for APS credits are likely to stimulate increases in supply. Before long the supply will equal or exceed demand once again, bringing with it another predictable collapse in APS credit prices.

DOER has recognized this problem in other incentive programs and taken action to address it. Boom and bust pricing of Renewable Portfolio Standard (RPS) credits caused by fluctuating supply and rigid demand contributed to the agency's decision to create the SMART program. And in the version of regulations recently promulgated for the Clean Peak Standard, DOER included a ratchet that automatically increases demand when the supply of credits equals or exceeds the supply.^{5/}

- **Recommendation #1:** The Coalition urges DOER to include a provision in the APS regulations that would increase demand for APS credits in the event that supply equals or exceeds demand. For example, as in the case of the Clean Peak Standard, the APS regulations could have a provision that automatically increases demand for APS credits in the following year when supply has equaled or exceeded demand over the course of the prior compliance year.

Use CHP's Ability to Earn APS Credits to Reduce Carbon Emissions

The CHP Coalition urges the DOER to build its CHP policy around the principle that CHP systems should be able to earn APS credits whenever they contribute to decreasing carbon emissions. The estimation of whether or not CHP reduces carbon emissions should be made by

^{5/} See Clean Peak Standard Regulations, 225 CMR 21.07 (1)(b), (2) and (3) as well as 225 CMR 21.08 (3), (4) and (5).

comparing the emissions from CHP operations to emissions that would occur from operation of alternative technologies needed to replace the CHP's production of heat and power.

This is a policy that DOER has previously recognized and adopted in the current regulation of the APS program. That regulation, promulgated in 2019, include a provision requiring each CHP system to demonstrate, at the time of applying for a Statement of Qualification for the APS program, that its carbon emissions will be less than those caused by use of power from the electrical grid.

...A Generation Unit that generates electricity shall not exceed a net site carbon dioxide emissions rate equal to the average emissions rate of the current average value for emitting locational marginal units as shown in the most recent ISO-NE Electric Generator Air Emissions Report ...[225 CMR 15.05 (1)(e)]

In essence, this means a CHP unit must emit less carbon than the power generating unit or units that would otherwise be called upon by ISO-NE to run to produce the power required; those units are known as the “marginal” units. It is a requirement consistent with emission reduction principle articulated above. It should ensure that CHP generating units produce fewer carbon emissions than would be produced by obtaining similar amounts of power from the electrical grid.

However, this provision is only a requirement at the time of the initial application for a unit to be qualified for the APS program. It does not influence the carbon emissions of the unit over time. As the marginal units available to the electrical grid become cleaner, that is, produce less carbon, the CHP unit isn't required to grow cleaner with them. The latter would be consistent with the goal of using CHP technology to reduce carbon emissions.

Yet, the Straw Proposal would continue to decrease the amount of credits CHP systems can earn from 70% of actual production in 2023 at a rate of 10% each year for seven years to arrive at 0% of actual production in 2030. These decreases in the ability of CHP systems to earn APS credits would occur without regard for whether the CHP is decreasing emissions or not. That is needlessly arbitrary and directly contrary to the principle articulated above. As the ability to earn APS credits is reduced, the owner/operator is discouraged from operating.

Careful consideration of the emission profile of technologies that would be installed or, in the case of the electric grid, relied upon to produce a comparable amount of heat and power would show that, in most cases, those alternatives would produce more emissions than operation of a CHP system. For example, according to the CHP emissions study conducted for the Coalition and attached to these comments, efficient CHP currently provides, and will continue to provide for some time, CO₂ emission reductions when compared to the use of the electric grid for replacement electricity combined with a boiler to produce usable thermal energy. As more carbon-free renewable resources are added to the grid, the system-wide average rate of CO₂ emissions will decrease. However, for many years to come, likely even decades, the marginal units that replace the power that CHP generates will be fossil-fueled natural gas for the majority of the hours of the year. From that perspective, phasing out the ability to earn APS credits on a

predetermined schedule runs the real risk of increasing CO2 emissions over time rather than decreasing them.

Given the state's carbon reduction goals and CHP's ability to avoid increases in carbon emissions, the overarching policy for the APS program should be to capture CHP's potential benefits by providing incentives to reduce and eliminate carbon emissions from CHP systems. The policy should not be to eliminate those incentives. In addition, the policy should incentivize opportunities to reduce emissions from CHP systems through the use of carbon free fuels, such as renewable natural gas or hydrogen.

- **Recommendations #2:** The Coalition urges DOER to forgo the use of predetermined reductions in the ability of CHP systems to earn credits. Instead, the Coalition urges DOER to maintain the ability to earn credits at 70% of actual operations for any CHP unit that continues to emit less CO2 than marginal units on the grid. If the agency were to obtain information from ISO-NE that updated the marginal emissions level of the electric grid periodically, say annually or perhaps even quarterly, it could then require CHP units to demonstrate that their emissions remained below that level in order to remain eligible to earn APS credits at 70% of actual production. This would ensure that the operation of CHP systems continue to reduce carbon emissions, relative to electric grid, in order to earn APS credits.

Furthermore, CHP units have the potential to reduce their carbon emissions even compared to their own operation on natural gas by converting to partial or complete reliance on zero-carbon fuels, for example, renewable natural gas or hydrogen. Yet, the Straw Proposal does not make clear what would be the treatment of CHP systems that convert to carbon-free fuel, such as renewable natural gas or hydrogen. If the proposal was to align additional reduction of emissions with a corresponding increase in the ability to earn APS credits, the policy would be exactly aligned with the Commonwealth's carbon reduction goals.

- **Recommendation #3:** The CHP Coalition urges DOER to consider ways to tie the ability of CHP to earn APS credits to the reduction of emissions in the future through conversion of CHP systems to cleaner fuels. For example, conversion to the use of non-fossil fuels could be rewarded with increases in the ability to earn credits for more than 70% of actual operation. Complete elimination of fossil fuel use could be rewarded with ability to earn credits for 100% of actual operation.

Studies of CHP Emissions and Economics

To support the recommendations in these comments, the CHP Coalition, with assistance from the Associated Industries of Massachusetts Foundation (AIM Foundation)^{6/}, funded two studies that are included with these comments. One is a comparison of the carbon emissions of CHP to other

^{6/} The Associated Industries of Massachusetts Foundation, Inc. is a Section 501(C)(3) tax-exempt organization under the Internal Revenue Code established by Associated Industries of Massachusetts (AIM) to develop in-depth, non-partisan analysis of public policy issues.

technologies with comparable output. The other is an analysis of the economics of 36 CHP systems in Massachusetts and the role that APS credits play in enabling them to achieve economic viability. The findings from these studies are briefly summarized below.

A Comparison of CO2 Emissions from CHP with Alternative Technologies

On behalf of the CHP Coalition, the AIM Foundation retained Frontier Energy, Inc. to undertake a comparative analysis of CHP emissions.^{7/} That analysis includes the following findings.

- In the near term, at least through 2026, high performing CHP systems will provide emissions reductions compared to traditional grid and boiler systems, regardless of the grid emissions model to which they are compared.
- In the long run, through 2050, depending on the emissions reductions actually achieved by the grid in the decades to come, CHP systems may provide emissions reductions throughout that period compared to emissions caused by reliance for replacement heat and power on conventional heating systems and on the electric grid.
- Moreover, for facilities with pressure steam needs and/or pressing reliability requirements, such as hospitals, critical manufacturing, academic or industrial campuses, and district energy, CHP will provide the most efficient and lowest carbon emission option using fossil fuel. (For many of these applications, on-site solar electricity production, combined with heat pumps, which would have lower carbon emissions, have siting and operational constraints that make them infeasible.)
- In the not-too-distant future, emissions reductions can be achieved with even greater certainty and in greater quantities by substituting low or zero-carbon fuels for natural gas at CHP facilities. Direct procurement of renewable natural gas or other zero-carbon fuels would enable individual CHP systems to reduce CO2 emissions to zero.
- Finally, a comparison of marginal grid emissions with CHP emissions on an hourly basis through the year will show that the marginal grid emissions rate is usually higher than the CHP emissions rate throughout the year. Indeed, the example presented at the conclusion of this report shows that, over the 8,760 hours in a year, the CHP emissions rate was lower than the marginal grid emissions rate 95% of the time.

The study recommends that the basis for comparison of emissions impacts from the electric grid be the marginal emission rate as reported for New England by ISO-NE. That report identifies the

^{7/} Frontier Energy, Inc., *A Study of CO2 Emissions from CHP Systems and Comparable Alternatives in Massachusetts*, August 19, 2021.

emissions of the next most economical resource on the grid that would replace the power lost by curtailment of a CHP unit throughout the year. Compared to this standard, CHP facilities are cleaner than that replacement power a majority of the hours of the year.^{8/}

The Role of APS Credits in the Economics of CHP systems in Massachusetts

On behalf of the CHP Coalition, the AIM Foundation also retained Frontier Energy, Inc. to undertake an analysis of CHP economics.^{9/} That analysis includes the following findings.

- In the case of typical CHP systems in Massachusetts, capital costs are approximately \$5,000/kW for reciprocating engines and \$6,500/kW for turbines.
- Average operating costs for CHPs range from \$178/kW-year for reciprocating engines and \$147/kW-year for turbines.
- Discussions with CHP owners reveal that, to approve an investment in a CHP system, most organizations require their investment be paid back through savings compared to the alternative technologies in 5 years or fewer.
- APS credits are a crucial revenue stream to bring projects to or below the 5-year payback threshold. Depending on their market value, they can accelerate payback by 1 to 2 years.
- Few projects are approved with paybacks longer than 5 years. Those that do gain approval typically involve other site specific considerations such as operational urgency of reliable power supply 24/7/365 (such as hospitals). Their economic acceptability still depends heavily on the revenue from the monetizing of APS credits.

Conclusion

At this time, and for years to come, there will be many hours during the year when CHP systems are and will remain the least carbon emitting technology able to produce needed heat and power in particular situations. Even assuming changes to the state's carbon emission policies over the next decade, it will likely be a number of years before the carbon emissions caused by use of power from marginal units of the regional electric grid would be less than the emissions caused by use of a CHP system during a majority of the hours of the year. Likewise, the replacement of CHP with new on-site boilers that use natural gas will cause increases in carbon emissions when operated without capturing waste heat and converting it to usable thermal energy.

At the same time, there will remain many circumstances when use of heat pumps and/or solar generating technology will be practically impossible due to site constraints and/or performance requirements. The replacement of the usable heat generated by CHP systems, in many situations such as hospitals, large manufacturing facilities and large office buildings where heat pumps are

^{8/} Ibid, pp. 32ff.

^{9/} See Energy Tariff Experts, Inc., *The Economics of Combined Heat & Power Systems in Massachusetts*, August 12, 2021

infeasible, can only be accomplished using technologies that cause more carbon emissions than technologies, such as natural gas boilers, that would provide a comparable amount of usable heat.

As the emission and economic reports attached here demonstrate, APS incentives can and should be used to reduce carbon emissions in the near term. Maintaining the ability for CHP systems to earn APS credits can and should be used to incentivize those emissions reductions. Whenever the emissions from CHP are lower than feasible alternative technologies, the power produced by CHP should retain the ability to earn APS credits. Moreover, APS incentives can and should be structured to encourage conversion of CHP systems that use natural gas to systems that use low carbon fuels. Over time, incentives structured this way would drive the CO₂ emissions from CHP systems down and contribute substantially to achieving the Commonwealth's goal of net zero CO₂ emissions by 2050.