Bloomenergy™

August 20, 2021

Via Electronic Mail

Hon. Patrick Woodcock
Commissioner
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

Re: Comments on the APS Straw Proposal

Dear Commissioner Woodcock,

On behalf of Bloom Energy, I write to provide comments and technical suggestions on DOER's recent Alternative Energy Portfolio Standard (APS) straw proposal, released on July 20, 2021. Thank you for providing the opportunity to comment, and for continuing the robust stakeholder engagement that has helped to shape the APS program over the years.

About Bloom Energy

Bloom Energy is a manufacturer of solid oxide fuel cell technology that utilizes an electro-chemical process to power non-combustion microgrids as well as advanced electrolyzer systems capable of converting renewable electricity into "green" hydrogen. Our solid oxide fuel cells and electrolyzers are designed in a modular fault-tolerant format that provides mission critical reliability with no downtime for maintenance. Bloom Energy has installed over 700 of its non-combustion solid oxide fuel cell systems for customers in thirteen U.S. states as well as in Japan, South Korea, and India. Our systems have proven resilient through outages caused by hurricanes, winter storms, earthquakes, forest fires, and other extreme weather and natural disasters.

APS Straw Proposal

As part of the 2020 review of the APS program, on October 30, 2020 DOER released an analytical program review conducted by Daymark Energy Advisors. The Department then solicited public comment on 12 specific questions, to which Bloom Energy and numerous other parties responded in comments submitted by December 4, 2020. On July 20, 2021, DOER released a straw proposal aimed at addressing the market imbalances identified in the Daymark report.

Both the Daymark report and the straw proposal rightly identify the oversupply issues caused by the large amount of combustion combined heat and power (CHP) and renewable thermal projects

developed under the program. As part of the strategy to address oversupply, the Department proposes to phase down the multiplier applied to all natural gas-powered technologies, beginning with 0.7 in 2023 and eliminating eligibility by 2030. Unfortunately, the Department fails to make a distinction between fuel cells and combustion CHP, which have very different emissions profiles, use cases, and co-benefits. The Daymark report – which focused on identifying systemic corrections to the APS program, not on the specific fuel sources of eligible technologies - also plainly highlights that these two technologies have had distinctly different impacts on the APS program. It also worth noting that according to the straw proposal 499.9 MW of natural gas combustion CHP capacity has been developed under the APS program; conversely, only 8.7 MW of fuel cell generation has been developed under APS since the technology became eligible in 2016. This clarifies that fuel cells, which provide a range of air quality and resiliency benefits, are not responsible for supply issues and do not have the ability to sway market dynamics in any way. Beyond the lopsided scale of deployments of both technologies, fuel cells and combustion CHP have fundamentally different uses and environmental impacts.[1]

Air quality benefits of non-combustion resources

Perhaps the most important difference between combustion CHP and fuel cells is that fuel cells are non-combustion electricity generators. Because they utilize an electrochemical process rather than combustion, fuel cells emit virtually zero local "criteria" air pollutants, such as NO_x, SO_2 and particulate matter (PM). The health benefits of reducing local air pollution can hardly be overstated – in fact, recent studies show that health impacts of these pollutants are even worse than previously believed, and disproportionally affect disadvantaged communities. Recent findings include:

- Combustion related air pollution may be as harmful to human lungs as smoking cigarettes;[2]

[1] Notably, fuel cells utilize natural gas for a fundamentally different reason than any other natural gas user. Other users of gas, including combustion CHP, burn natural gas to create electricity, most commonly in a combustion engine. Fuel cells utilize natural gas only in order to extract the hydrogen from it. This creates another important distinction between combustion CHP and non-combustion fuel cells. Fuel cells are in effect a down payment on the hydrogen economy because they are pre-positioned hydrogen generators, based on a technology platform that is already capable of utilizing renewable gases such as biogas and hydrogen.

[2] Wang M, Aaron CP, Madrigano J, et al. Association Between Long-term Exposure to Ambient Air Pollution and Change in Quantitatively Assessed Emphysema and Lung Function. *JAMA.* 2019;322(6):546–556. doi:10.1001/jama.2019.10255;
Aubrey, Allison. Air Pollution May Be As Harmful To Your Lungs As Smoking Cigarettes, Study Finds. NPR. 13 August 2019. https://www.npr.org/sections/health-shots/2019/08/13/750581235/air-pollution-may-be-as-harmful-to-your-lungs-as-smoking-cigarettes-study-finds

- Particulate matter is the largest environmental health risk factor in the nation, and the resulting health impacts are borne disproportionately by economically-disadvantaged communities;[3]

- Combustion-related air pollution increases preterm birth risks.[4]

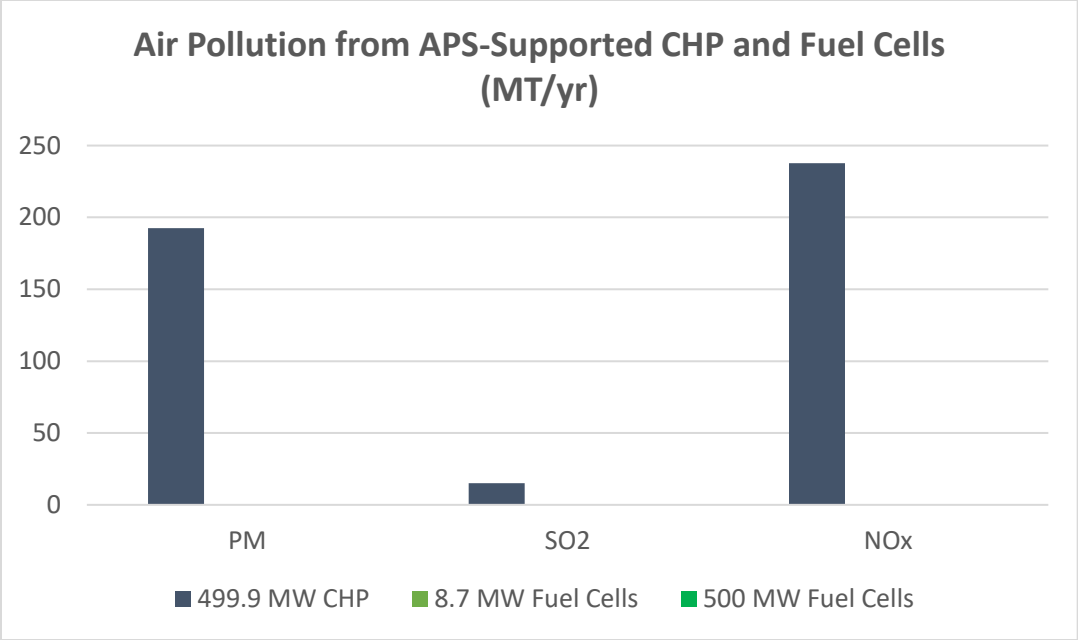
While these studies shed new light on the harm caused by local air pollution, the importance of reducing these pollutants has been acknowledged by Massachusetts policy for years. The APS program itself includes criteria pollutant emissions performance standards for certain generation units. The rationale for ensuring limits on these pollutants for systems supported by the APS program shows the program's commitment to a broad view that goes beyond a simple calculation of greenhouse gas emissions (which both fuel cells and combustion CHP also achieve). Simply put, the technologies that do not create local air pollution have greater value than those that do.

The graph below estimates the total quantity of PM, SO_2 and NO_x from both combustion CHP and non-combustion fuel cells supported by the APS program. It is undeniable that the total pollution caused by 499.9 MW of APS-supported combustion CHP is not comparable to the emissions from the 8.7 MW of fuel cells.[5] Given the non-emitting nature of fuel cells, the graph shows that even 500 MW – equal to the current deployment of CHP - would result in no increases in local air pollution over the current deployment of only 8.7 MW. Because these are local, rather than global, pollutants, the increased air pollution shown below directly harms air quality in the source's immediate vicinity. Importantly, fuel cells offset marginal combustion generation on the grid, reducing local air pollution emitted by those combustion sources, as well.

[3] Tessum et al. Inequity in consumption of goods and services adds to racial–ethnic disparities in air pollution exposure. *PNAS March 26*, 2019 116 (13) 6001-6006; first published March 11, 2019 https://doi.org/10.1073/pnas.1818859116

[4] Mendola, P. et al. *"Air pollution and preterm birth: Do air pollution changes over time influence risk in consecutive pregnancies among low-risk women?"* International Journal of Environmental Research and Public Health, 2019. https://www.nih.gov/news-events/news-releases/nih-study-suggests-higher-air-pollution-exposure-during-second-pregnancy-may-increase-preterm-birth-risk#:~:text=Pregnant%20women%20who%20are%20exposed,Environmental%20Research%20and%20Public%20Health.

[5] These calculations are for generic CHP systems based on publically available EPA data. See notes below chart for details.



CHP emissions calculations for SO_2 and NO_x were conducted using the EPA's CHP Energy and Emissions Calculator, Version 3.2 (June 22, 2020).
The EPA tool uses a default NO_x emission factor (EF) without after-treatment of 0.092 lbs/MMBtu. Available control technology can reduce NOx emissions by up to 90% - this graph assumed the best available control technology is applied to all CHP systems in Massachusetts and therefore show an EF of 0.0092 lbs/MMBtu. Note that actual emissions may be significantly higher.
This tool does not calculate PM; therefore, the calculation above uses an emission factor for reciprocating 4-stroke lean burn engines as a proxy. From EPA AP-42, Chapter 3 Section 2. https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-fifth-edition-volume-i-chapter-3-stationary-0

Across the country, climate and clean energy policy has rightly been undergoing a recalibration to more directly consider impacts on vulnerable populations and take a more holistic view of emissions reduction strategies. Overlooking the clear local air pollution benefits provided by non-combustion fuel cells, and arbitrarily subjecting the technology to the same assessment and phase-out as CHP, ignores the real health and community benefits of reducing local air pollution.[6]

Resiliency

Massachusetts currently lacks a dedicated microgrid program to support distributed energy resources that provide power through outages of the electric grid. In the current landscape, the APS program is the only mechanism in Massachusetts that specifically recognizes distributed energy resources that provide this critical benefit; removing the eligibility of fuel cell microgrids effectively eliminates state support for power resiliency during a time of increasing climate change-induced

[6] We note another important distinction between combustion CHP and fuel cells.

severe weather and a pandemic that has underscored our dependence on reliable, uninterrupted electricity. Currently, Bloom fuel cell microgrids protect over 100 sites around the world from power disruptions, including APS-supported microgrids at supermarkets, retail stores that provide supplies for storm recovery, and hospitals across the Commonwealth. In fact, Bloom fuel cell microgrids provided protection from outages on over 30 occasions in Massachusetts over the past two years alone. These projects enhance the resiliency of the communities in which they are located and provide a critical service as climate-induced severe weather increases in both frequency and severity.

The unfortunate reality is that commercial and industrial customers that require a resilient on-site power supply have only a limited set of feasible solutions. Removing support for non-combustion microgrids will have the inadvertent effect of increasing the deployment and run-time of dirty combustion diesel generators – a result that is in direct conflict with the effort to address environmental justice issues and local air pollution. A recent study by the Applied Economics Clinic found a minimum of nearly 2,000 backup diesel generators in Massachusetts with a total generating capacity of over 1.1 gigawatts.[7] These numbers only reflect those generators that are registered with MassDEP; it is quite possible that a sizeable number of additional generators remains unregistered. Further, the report found that fully 70% of registered diesel generators are located either in or within 0.5 miles of an environmental justice community. Using US EPA's Co-Benefits Risk Assessment (COBRA) screening tool, the report also estimates the annual health impacts of these generators to lead to 74 lost workdays, 20 additional respiratory cases, and an increase in healthcare costs of $5.6 to $12.7 million. Diesel generators are the dirtiest remaining electricity generation systems in Massachusetts, and eliminating support for the only non-combustion alternative for long-term backup power will ensure that they continue to release criteria and climate pollutants in growing quantities as climate-induced power outages become increasingly common.

Interaction with the Renewable Portfolio Standard

On slide 13 of the straw proposal, DOER lays out the proposed phase-out of these resources and notes that "CHP systems utilizing a renewable fuel will not be subject to the phase down." Presumably, the Department intended to include fuel cells in this exception for renewable fuels, although we request clarification on this point. Taken at face value, this appears to suggest that systems using renewable fuels such as eligible biogas, for example, would be able to continue generating AECs at the current level without being subject to the proposed phase-out. However, if these resources were to utilize eligible biogas they would already be eligible for the Massachusetts RPS program (and would also meet the emissions threshold under the Clean Energy Standard). In fact, the recent Phase II amendments to the Renewable Portfolio Standard specifically add a definition of

[7] "Assessment of Backup Diesel Generators in Massachusetts." Applied Economics Clinic, August 2021. This report was commission by Bloom Energy to gain a better understanding of the Massachusetts fleet of diesel generators. Attached as Appendix A.

eligible biogas that repeats verbatim the existing definition in the APS regulation. If this understanding is correct, what is the intended purpose of creating another market for resources that already qualify under RPS and CES? Historically, the MA RPS Class I market has been more lucrative than APS, and that trend appears likely to continue. In this case, it seems highly unlikely that any resources powered by eligible biogas would choose to participate in the APS market and would instead be driven to RPS. In practice, this would result in pushing combustion CHP and fuel cell technologies out of the APS program entirely, an outcome that is neither consistent with the statute nor a public policy interest in preparing the Commonwealth for climate-induced severe weather while avoiding impacts on human health and the environment from combustion-related air pollution.

Additional notes on the program review

The program review that began with the Daymark report is an important step in monitoring and, if needed, adjusting the APS program to ensure it continues to support alternative energy technologies. The Daymark report concluded that combustion CHP and renewable thermal systems were indeed contributing to significant oversupply in the AEC market. Notably, the report makes no such claim about fuel cells, nor does it suggest eliminating eligibility based on fuel type rather than technology type. The numerous clear distinctions between non-combustion fuel cells and combustion CHP, in terms of both air pollution impacts and effects on the APS program, warrant that any program changes acknowledge the differences between these two technologies. Non-combustion fuel cells decrease local air pollution, provide critical power resiliency, and have had no negative impact on the AEC market. For this reason, their eligibility in the APS program should not be overturned based on a false equivalency with combustion CHP.

Bloom is continuing to distinguish its fuel cells from any other user of natural gas. In fact, beginning in 2022, Bloom Energy will convert its global natural gas fleet to certified low-leak natural gas in order to prevent the release of methane emissions stemming from upstream gas production. Bloom has entered into a collaboration with MiQ, a non-profit partnership between RMI (formerly the Rocky Mountain Institute) and SYSTEMIQ, to streamline elements of the certified gas marketplace and educate stakeholders on the importance of natural gas supply chain responsibility. Certified natural gas differentiates gas production across a range of environmental, social and governance practices through a focus on verified methane performance and associated company practices. As part of this initiative, Bloom Energy is leveraging the work of two leading non-profit organizations, MiQ and Equitable Origin, which have built innovative standards and a joint registry system that enables the responsible sourcing of gas.

Finally, the straw proposal does not address whether the proposed eligibility phase-out would apply only to new projects or would retroactively diminish and then eliminate eligibility for existing projects. We note that eliminating eligibility for existing projects includes removing support for

microgrids that provide critical reliability needs in communities across the Commonwealth. The stakeholder community would greatly benefit from clarification on this point. We do support the proposed increase in in the standard as a tool for rebalancing supply and demand.

Thank you for the opportunity to comment on these important changes to the APS program. We greatly appreciate the transparency of these proceedings and encourage continued stakeholder engagement throughout the process. Please do not hesitate to reach out if you have any questions or require additional information as you consider a range of critical issues.

Sincerely,

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