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CLEAN AND INTELLIGENT ENERGY SOLUTIONS

LAS VEGAS, NV - LOS ANGELES, CA - MODESTO, CA - PORTLAND, OR

February 7, 2024

Public comment PAR1146.2

Benz Air Engineering Co, INC, (“BAE”) files these comments in response South Coast Air Quality Management District’s (SCAQMD) Initial Preliminary Draft of Rule 1146.2

About BAE

Having expertise in electrical generation and all aspects of steam, its generation and use, and driven by its vision of the affordable, reliable, net-zero carbon grid of the future, BAE has developed and commercialized a new steam generation technology – the hybrid Boiler Accessory – decarbonizing existing hard to electrify boilers and fluid heaters with renewable electrical power when available while providing local power at less than half the current grid heat rate. BAE’s boiler accessory offers a unique capacity and energy solution that simultaneously addresses the critical AND immediate need to reduce greenhouse gas and criteria pollutant emissions, while also providing a near-term use of excess renewable electric production.

Modular and scalable, BAE’s boiler accessory leverages existing hard-to-electrify emission sources as a heat and electrical energy sink, amplifying the carbon reduction of excess renewable electrical generation and firming California’s grid at half the carbon rate of the highest known efficient electric generation. Depending on the grid supply, BAE’s Boiler Accessory can utilize up to the limit of the existing facility's electrical supply to directly reduce greenhouse gas emissions from generating hot water or steam in a wide range of commercial and industrial applications. As the electrical grid transitions from periods of high renewable generation to generation supplied by traditional greenhouse gas emitting combined cycle generation and higher carbon single cycle sources such as fuel cells and linear generators, BAE’s flameless Boiler Accessory complements fluid heaters and boilers to provide the most efficient incremental use of fuel, resulting in a net heat rate of just 4000btu/kw/hr HHV – less than half the carbon intensity of any local generation technology such as linear generators. BAE’s inverter-based technology offers the widest range of valuable grid and environmental benefits including the fastest transition from consuming renewable electricity to generating ultra-low NOx and carbon emission electricity, the only known way to decarbonize hard-to-electrify emissions sources such as boilers while firming the grid at less than half the carbon footprint of microturbines, linear generators or fuel cells.

BAE’s commitment to developing cost-effective and maximal efficiency heat and power generation technologies that support our nearly overloaded electrical grid infrastructure and prioritize ultra-low greenhouse gas emissions implores our public response to the AQMD’s proposed regulation PAR 1146.2.

BAE provides the following comments on this preliminary draft of Rule PAR1146.2 Through these comments, we strongly recommend...

1. **AQMD EMISSION INVENTORY** analysis must include greater consideration for electrical service availability.
 - a. There are many areas within Southern California where there is insufficient electrical grid capacity to accommodate the added electrical load needed to electrify existing 1146.2 emission sources, precluding these sources from increasing their grid demand to accommodate the electrification of their 1146.2 equipment. This critical oversight must be accounted for in any **EMMISSION INVENTORY** analysis either through the inclusion of individually reported demand from inventoried facilities and/or grid demand capacity for substation localities via the U.S Energy Information Administration¹.
 - b. of the **EMISSION INVENTORY**, there requires a determination of Technology Readiness Level of the proposed zero NOx heat pump technology. While generating sub 180F hot water via heat pump technology is available, heat pump generation of higher temperature water does not exist. Indeed, the staff report acknowledges that the zero-emission technology is “continuing to develop”² citing a public relations article about AtmosZero doing a “pilot study” at New Belgium Brewing³. A pilot study is anything but a product that is available or deployable on the scale of PAR 1146.2.
2. The **EMISSION REDUCTIONS** must include the analysis of electrical grid heat rate – the average BTU/kw-hr of the electricity supplied via the electrical grid in order accurately to determine NOx reductions.
 - a. Whereas electrical generation in the spring, winter and fall afternoon hours is largely zero carbon and zero NOx, the afternoon and early night electrical generation supplying the electrical grid is anything but zero NOx. Until the electrical grid in Southern California is supplied solely by solar or other zero carbon means, zero emission water heating or steam production is a fallacy exactly counterintuitive to the proposed goals of the AQMD outlined in PAR 1146.2.
3. The PAR1146.2 staff report on **COST-EFFECTIVENESS** should include analysis of specific 1146.2 installations instead of fictional scenarios presented.
 - a. The **INCREMENTAL COST-EFFECTIVENESS of Electrical Panel Upgrade Cost** on Page 2-14 of the Staff Report “panel upgrade cost estimate of \$5,000”⁴ should be

¹ U.S.E.I.A

https://www.eia.gov/about/copyrights_reuse.php

²Preliminary Draft Staff Report PAR 1146.2 Presentation

<https://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/rule-1146-1146.1-and-1146.2/par-1146-2-preliminary-draft-staff-report-january-2024.pdf?sfvrsn=19>

³ Atmos

Zero, New Belgium Brewing

<https://www.craftbrewingbusiness.com/featured/new-belgium-brewing-continues-to-embrace-clean-tech-works-with-atmoszero-on-first-of-its-kind-electrified-boiler/>

⁴Preliminary Draft Staff Report PAR 1146.2 (Pg. 2-14)

reviewed and confirmed by a third party as it is far more likely to be the cost of getting an estimate for an electrical panel upgrade than the actual panel upgrade itself. A 600amp panel for the electrification of a 2mmbtu/hour steam boiler will be between \$50,000 to as much as \$200,000, depending on if there's utility service available AND the costs of the utility line/transformer upgrade. This possible deviation from 2022 AQMP estimates must be concretely falsified before any implementation of PAR 1146.2.

- b. The AQMD 2022 Air Quality Management Plan (Dec 2, 2022) states the following – page 8-17:
 - i. "...many buildings will likely need additional electrical panel upgrades and other infrastructure to support the increased electrical load needed to power the replacement appliances. These infrastructure upgrades can be far more costly than the cost of replacing gas appliances."⁵
 - c. PAR 1146.2 staff report fails to include the cost associated with utility charges for upgraded service. Assuming the local utility grid has capacity, the upgrade from the line transformer to the newly upgraded panel could be more than the newly powered equipment and the electrical panel upgrade combined.
4. Any **Incremental Cost Effectiveness Equation, Energy Input Method** must include theoretical Coefficient of Performance (COP).
- a. The theoretical COP of a heat pump serves as a check of heat pump manufacturers advertised COP – as any advertised COP cannot exceed that of theoretical as dictated by the temperature of the cold and hot heat sinks. (The pilot study of AtmosZero COP of 329F steam given sub-zero heat supply cannot exceed 2.39)⁶
 - b. **Incremental Cost Effectiveness** calculation as presented in PAR 1146.2 is incomplete in that the stated COP relies solely on that provided by vendors rather than actual temperature and mass flow of all hot water and boiler demand scenarios.

Discussion:

California needs three times more power capacity to reach 100% clean energy by 2045. An initial analysis suggests the goal is technically feasible but only with a sustained high pace of construction: 6 GW annually for the next 25 years⁷. PAR 1146.2 imposes significant complications toward that goal as the electrification of 1146.2 sources adds to a significantly overloaded Southern California electric grid. Concurrently, the electrification of the transportation sector has exposed the severe shortage of electrical transmission.

<https://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/rule-1146-1146.1-and-1146.2/par-1146-2-preliminary-draft-staff-report-january-2024.pdf?sfvrsn=19>

⁵ The AQMD 2022 Air Quality Management Plan. Dec 2, 2022 (pg. 8-17)

<https://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/final-2022-aqmp/final-2022-aqmp.pdf?sfvrsn=16>

⁶ Ibid: AtmosZero, New Belgium Brewing

⁷ CalMatters Race to Zero (pt. 1)

<https://calmatters.org/environment/2023/01/california-electric-cars-grid/#:~:text=California's%20target%20to%20build%20at,gigawatt%20of%20wind%20per%20year.>

The requirement of electrifying 1146.2 sources is conceived in ignorance of the State's clean energy plan, in that the additional load on the grid falls within the same time frame where Southern California utilities grid demand approaches that of available supply⁸. The electrification of the heavy truck transportation sector alone doubles the existing grid demand of 60 gigawatts.

I recognize that the AQMD has no interest in facilitating the State's clean energy goals, however efforts to reduce NOx emissions via electrification of 1146.2 sources irrefutably depends on electricity being available and cheap, both of which are unreasonable assumptions.

Where does Electricity come from: As stated earlier, PAR1146.2 incorrectly assumes that the electrification of 1146.2 sources is zero carbon. Assuming the latest SCE electrical heat rate of 8000btu/kw-hr alongside the location of these incremental fossil fueled peaker plants within AQMD jurisdiction AND that such peaker plants have an emission rate of 2.5ppm corrected to 15% O2, *the electrification mandated by PAR 1146.2 may actually increase basin NOx emissions.*

Conclusion:

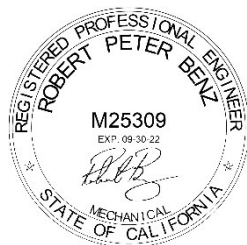
Should the AQMD fail to consider these critical oversights and implement PAR1164.2 without significantly greater adherence to: 1) the reality of rapidly approaching grid overload in the State of California, 2) in-depth facility-level costs for Types 1 & 2 Boiler and Pool Heater electrification *beyond abstraction*, and 3) emissions sourcing and generation coincident to boiler and pool heater electrification on the scale of PAR 1146.2; electrical infrastructure, industrial function, carbon emissions and, most counterintuitively, *even the NOx emissions targeted by the proposed regulation* may be irreversibly worsened.

In support for the well-being of residents and businesses in southern and greater California AND our necessary commitment to reducing toxic and greenhouse gas emissions BAE implores that these comments be taken into consideration before implementation of the potentially harmful and dangerous PAR 1146.2.

Thanks
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⁸ California ISO

<https://www.caiso.com/TodaysOutlook/Pages/demand.html>