BATTERY COUNCIL INTERNATIONAL
ESSENTIAL ENERGY EVERYDAY

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Clerks' Office
Keith Roderick, Air Resources Engineer Staff Lead
David Chen, Advanced Emission Control Strategies Section Manager
California Air Resources Board
1001 I Street
Sacramento, California 95814

Submitted via: https://www.arb.ca.gov/lispub/comm/bclist.php

Subject: Battery Council International Comments on California Air Resources Board's Proposed Zero Emission Forklift Regulation.

Dear Mr. Roderick and Mr. Chen:

Battery Council International (BCI) appreciates this opportunity to comment on the California Air Resources Board's (CARB) proposed Zero Emission Forklift Regulation. BCI is a not-for-profit trade association formed to promote the interests of the North American battery industry. Our member companies are engaged in every facet of the industry, including lead battery manufacturers and recyclers, marketers and retailers, suppliers of raw materials and equipment, and expert consultants. Our members are committed to safe, responsible battery manufacturing and to sustaining the world's most successful circular economy.

BCI generally supports CARB's proposal to electrify the majority of California forklift fleets. Electric alternatives are already available for every class and type of internal combustion (IC) forklift, and the technologies are sufficiently mature to deliver the necessary levels of performance and reliability required by fleet operators. We agree that there are substantial environmental benefits associated with conversion from IC to zero emission (ZE) forklift fleets, and we submit that these benefits extend beyond the "tank to wheel" (TTW) criteria pollutant and greenhouse gas (GHG) emissions reduction benefits presented in the Initial Statement of Reasons (ISOR) for the proposed regulation. CARB's economic analysis also generally confirms industry total cost of ownership data indicating that cost savings over the service life of an electric forklift will more than offset the higher initial cost of conversion. Moreover, with regard to the feasibility of the proposed regulation, industry analytics presented by BCI to CARB in 2021 demonstrate that sufficient production capacity exists among lead

battery-powered forklift original equipment manufacturers alone to accommodate the California forklift fleet transition ahead of CARB's proposed schedule.[1]

We do have some concerns regarding shortcomings in CARB's evaluation of specific technologies, including in particular assumptions regarding life cycle costs and benefits of lead and lithium battery technologies, and CARB's forecast of the fleet technology mix through the implementation period of the proposed regulation. These features should be corrected to ensure that the rulemaking record does not establish a market bias for lithium battery-powered forklifts at the expense of lead battery-powered forklifts. BCI maintains that a truly performance-based and technology neutral approach will achieve the transition in the shortest possible timeframe and at the lowest possible cost.

CARB Should Recognize Advancements in Lead Battery Technology

CARB's discussion of technology advancements emphasizes the limitations of lead battery-powered forklifts and expresses the view that "even at current upfront prices, the potential operational savings provided by lithium-ion technology would make it the preferred solution for many fleets, especially for those that are space-constrained and operate multiple shifts."[2] The staff analysis of the technology mix over time assumes rapid growth in lithium-ion forklift sales, culminating in 100 percent of new battery-electric forklift sales by 2037.[3] These assumptions disregard significant advancements in lead battery designs that allow lead battery-powered forklifts to compete in a broader range of applications that are beyond the capabilities of historical flooded lead acid batteries.

The Consortium for Battery Innovation (CBI) previously provided information to CARB describing recent innovations in lead battery technology, including design enhancements that utilize more of the active material in the battery along with more efficient carbon electrodes, which also allow for a 46% reduction in battery weight. Some designs offer a 3-fold increase in deep cycle life (from 500 to 1,500 cycles), and improved recharge, charge acceptance and opportunity charging capabilities. In addition, the ability to charge modern lead batteries without removing them from the forklift also eliminates the need for battery changing infrastructure. In forklift applications, these attributes translate to a lower total cost of ownership and a more versatile forklift fleet.

CARB's limited analysis of the forklift technology mix through 2037 also disregards the reality that forklift fleet owners will choose technologies and battery chemistries that best fit the specific operational needs of their facilities.

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[1] BCI presentation to CARB, *Zero Emission Forklift Measure*, January 29, 2021.
[2] ISOR, page 29.
[3] Id., page 122.

CARB's analysis of battery technologies should recognize that recent advancements in lead battery technology will improve the fleet owner's return on investment for lead battery-powered forklifts relative to other forklift technologies.

CARB Should Evaluate Life Cycle Well-To-Wheel Emissions for Each Zero Emission Technology

BCI supports accelerating reductions of criteria and GHG "tank to wheel" (TTW) emissions, which CARB estimates in Table 13 of the ISOR.[4] However, the lack of upstream "well to tank" (WTT) emissions estimates masks important differences in life cycle emissions between ZE technologies and is a potential source of bias in CARB's projections regarding the forklift fleet technology mix over time. For example, the vast majority of raw materials for lithium-based battery technologies are extracted from virgin ore, whereas approximately 80% of the raw materials used in the manufacture of lead batteries are derived from recycled batteries. Greater reliance on secondary materials in lead battery manufacturing reduces emissions associated with raw material extraction and processing, such that a lifecycle "well to wheel" (WTW) estimate is likely to show an emissions reduction advantage for lead battery-powered forklifts.

CARB's Environmental Analysis Understates the Potential Impacts of Lithium Battery Technology

CARB's Environmental Analysis identifies the potential for an incremental increase in "mining and imports of lithium, lead, and other minerals from countries with raw mineral supplies,"[5] but it fails to account for the significant differences in raw material sourcing between lithium and lead batteries noted above. These differences are predominantly a function of a very mature lead battery recycling infrastructure that achieves a nearly 100 percent recycling rate compared to a nascent lithium battery recycling infrastructure that is capable of recycling less than 5% of end-of-life batteries. While it is reasonable to expect lithium battery recycling infrastructure to expand over time, the broad range and lack of uniformity of lithium battery chemistries create infrastructure compatibility challenges that will limit the economies of scale necessary to attract investment in lithium battery recycling and prevent lithium battery recycling from achieving current lead battery recycling rates.

Infrastructure limitations will also drive higher rates of lithium battery disposal at end of life. CARB acknowledges the potential for increased rates of disposal of lithium-ion batteries, but downplays the associated environmental impacts by citing statutory prohibitions against landfill disposal and asserting that used lithium ion forklift batteries are likely to be repurposed for a second life.[6] CARB states

[4] Id., pages 96-97.
[5] Id., page 104.
[6] Id., page 104: "The Proposed Regulation could result in increased rates of disposal of lithium-ion batteries and hydrogen fuel cells; however, disposal of these batteries would be subject to provision of California law, including, but not limited to, California's Hazardous Waste Control Law (Health and Safety Code, Division 20, Chapter 6.5; Cal. Code Regs., tit. 22, Division 4.5, Chapter 23), which restricts the disposal of used batteries to landfills. It is reasonably foreseeable that lithium-ion batteries would have a useful life at the end of vehicle life and are likely to be repurposed for a second life."

elsewhere in the ISOR that "the cost for lithium-ion battery recycling at the end of battery life is not included … because this cost is expected to be offset by the residual value of the battery" and that "light-duty vehicle lithium-ion batteries are already being repurposed for second life applications including stationary storage."[7] Yet CARB does not cite any evidence to support the conclusion that these factors will sufficiently mitigate the potential environmental impacts of lithium battery disposal.

Conclusion

Lead battery design innovations that reduce lead content, enhance energy output, cycle life and recovery from partial state of charge, combined with a more complete analysis of lifecycle emissions reductions for each ZE technology, and a more balanced assessment of the potential environmental impacts of each technology, is likely to inform a different technology mix over time than is currently forecast in the ISOR.

BCI appreciates CARB's consideration of our comments on the proposed regulation, and we look forward to further revisions in the ISOR and supporting analyses to properly characterize the potential contribution of lead battery technology in converting remaining IC-powered forklifts to ZE units. If you have any questions, please do not hesitate to contact me at rmiksad@batterycouncil.org.

Sincerely,

Roger Miksad

Roger Miksad
President & Executive Director
Battery Council International

[7] Id., page 140.