September 12, 2024

Liane Randolph, Chair
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Re: CARB research and policy on electric rail

Dear Chair Randolph,

We write to correct some inaccuracies and omissions in CARB's publications on zero-emission rail, including the Zero Emissions Rail Project Dashboard, the 2016 locomotive reports "Draft Technology Assessment: Freight Locomotives" and "Transitioning to a Zero or Near-Zero Emission Line-Haul Freight Rail System in California Operational and Economic Considerations, Final Report", and the 2024 "Feasibility Analysis: Zero Emission Train from the Port of Los Angeles to Barstow".

CARB has an important mission to reduce greenhouse gas emissions and improve air quality in California through regulation, policy and programming. For CARB to achieve the ambitious climate and air quality goals it must be informed by the best available information and research regarding its regulated industry and technology. Unfortunately, the Dashboard, Feasibility Analysis, and 2016 Reports demonstrate that CARB does not have access to the latest information about global zero emissions railways and rail technology. This seriously threatens CARB's ability to regulate and craft policy necessary to fight climate change and reduce particulate and other emissions.

The dashboard website makes the claim that only 28 overhead catenary system (OCS) electric rail projects exist in the world compared to 28 hydrogen and 36 battery-electric locomotive projects. This is effectively stating that hydrogen rail is at the same level of deployment as OCS, and that battery-electric locomotives are more common than OCS. Of the "zero emissions" trains and locomotives in operation today, over 99% of them are conventional OCS/third rail electrification, and battery and hydrogen technology combined is a fraction of one percent. This dramatically understates the situation and is misleading. Over 30% of the world's railroad track is electrified – a percentage that is growing every year.

Here are some of the biggest omissions from the dashboard, but this list is non-comprehensive:

- Indian Railways is 94% electrified with overhead catenary (aiming for 100% by the end of 2024), operating 10,238 freight and passenger locomotives over 67,547 mi of tracks. Meanwhile, the dashboard lists only one catenary project in Nagpur as "Delivery Started", even though India has electrified 25,000 miles of rail since 2014 and has had some electric trains since 1947.
- The only overhead catenary project listed for Japan in the dashboard is the Shinkansen. This ignores the fact that *in 2003,* Japan Railway Group operated a total of 22,499 overhead

catenary locomotives and EMUs in addition to the Shinkansen, with an additional 25,768 overhead catenary locomotives and EMUs operated by private companies, bringing the total number of overhead catenary vehicles operating in Japan for passenger service to 51,998. Similar numbers of electric trains are in operation today. Japan Railways Freight also operates a mixture of diesel and electric locomotives for freight operations.

- In Russia, the 5,758 mile Trans-Siberian Railway has been entirely electrified since 2002. In addition to passenger trains, the corridor transports 144 million tons of freight annually.
- South Africa's Sishan-Saldana (OREX) freight rail line is entirely electrified with overhead catenary and operates over 535 miles, hauling trains >2 mi long and up to 41,000 tons, heavier than American freight. It has been operating since 1976.
- Metra Electric and the South Shore Line are overhead catenary electric passenger rail lines in the Chicagoland area that together operate over 91 miles of track and served 5 million riders in 2022. This route has been electrified since 1926 and shares portions of the line with freight. Metra Electric operates 228 EMUs, while the South Shore line operates 90 EMUs.
- While the tracker includes the Acela, it ignores numerous other catenary electric passenger rail lines that operate on the Northeast Corridor, including Amtrak's Northeast Regional service (66 locomotives), Metro-North (945 catenary/3rd rail tri voltage EMUs), CT Rail Shore Line East pooled with Metro-North, SEPTA regional rail (351 EMUs + 15 locomotives), and New Jersey Transit (65 electric and 60 catenary-diesel dual mode locomotives along with 230 EMUs). The total number of locomotives/EMUs operating on the Northeast corridor is 1692 with current orders expected to grow that to over 1,800, rather than just the 20 high speed Acela locomotives listed in the table.
- RTD commuter rail in Denver operates 66 overhead catenary EMUs over 54.09 miles of track, with 7.9 million riders in 2022.
- It also omits one of the few actually operating hydrogen rail systems in the world: LVNG in Lower Saxony, Germany, which operated 14 hydrogen fuel cell passenger trains starting in 2022. Notably, this service is being discontinued due to poor performance, massive service disruptions caused by mechanical issues, and high costs, and the hydrogen trains will be replaced with a mix of catenary and battery-electric trains.
- The listed SBCTA H2 project is *not* zero-emissions as SBCTA will not be using green hydrogen.

Overall, the dashboard is heavily biased towards new or recently completed projects, implying that zero-emissions rail technology is new and in development when in fact overhead catenary is a mature technology that is the foundation for entire countries' supply chains and transport networks. In contrast, the hydrogen projects listed on the dashboard genuinely are all prototypes or in testing. This implication is counter to CARB's own enforcement goals. By our count, there are over one thousand overhead catenary electric projects omitted from the dashboard representing tens of thousands of locomotives, over 100,000 electric multiple unit (EMU) trainsets, and over 200,000 miles of tracks. This website continues a disheartening trend of CARB research that is factually inaccurate and serves the interests of opponents of zero-emissions rail.

CARB's April 2024 Feasibility Analysis: Zero Emission Train from the Port of Los Angeles to Barstow does not fully analyze overhead catenary locomotives. The Cajon Pass has long been

regarded as an ideal use case for catenary due to the high traction requirements of the steep grades, and the report itself admits that overhead catenary would reduce the number of locomotives needed. By failing to gather comprehensive performance data on catenary, the report paints a false picture of battery and hydrogen fuel cell locomotives as the only option, and makes both of these immature technologies appear more ready by lack of comparison to a superior option.

CARB's 2016 reports on Zero Emissions Rail are also riddled with factual inaccuracies. These include:

- Claiming catenary locomotives do not have the power for the large loads of American freight trains based on fast, light European trains that operate under very different conditions, ignoring the aforementioned heavy freight trains in South Africa and elsewhere.
- Claiming catenary trains could have as low an efficiency as 30% with no evidence, when most analyses put the efficiency at 90%, far higher than diesel (36%), battery (66%), or fuel cell (25%) trains, greatly inflating the projected power requirements.
- Using a $50 million/route mile cost for overhead electrification, mistakenly using a cost estimate from Caltrain that includes signal upgrades and other upgrades unrelated to catenary infrastructure. Restricting only to overhead wire infrastructure brings Caltrain electrification costs down to $12.5 million/mile, still exceptionally expensive due to Caltrain's unique project management issues. Overhead electrification for CA HSR is expected to cost only $6 million/mile, and proposed reforms could bring down costs even further for future projects.
- Since the publication of the 2016 reports, these CARB publications have been cited repeatedly to oppose zero emissions rail. Notably, the American Association of Railroads, which is currently suing to overturn CARB's landmark In-Use Locomotive Rule, cites the reports in a 2020 fact sheet that has formed the basis of its talking points against the rule.

Advocates are taking on the responsibility to point out the short-sightedness of wasteful public investments in hydrogen trains. It is concerning that proven, effective and practical solutions are being ignored in favor of a "shiny new thing" promoted heavily by the oil and gas industry, that has no indication of being capable of performance, economics and safety needed for effective, frequent rail transportation. Hydrogen power does eliminate diesel smoke, but unless it uses 'green hydrogen' (100% sourced from renewable energy), it has very little value in addressing the climate crisis, and its own environmental problems and safety risks to neighboring communities. The energy required to produce and store green hydrogen requires three times more electricity than that needed to power a train from the grid. CARB's decisionmaking on regulation, programming and policy must be grounded in these facts.

CARB's repeated downplaying of the viability of overhead catenary, used in 30% of the world's railway, while hyping immature technology with serious flaws, ultimately undermines the agency's attempts to regulate railroad emissions. At best this encourages experimental pilots with low chance of success that delay full adaptation of zero emission technologies, and at

worst emboldens political opponents of CARB's rulemaking who seek to maintain the status quo for decades into the future. California's railside communities, which suffer every day from the nation's worst air quality, do not have decades to wait.

It is irresponsible to release public-facing educational sources and reports riddled with such inaccuracies. We politely request that CARB do the following:

- Update the Zero Emissions Rail Project dashboard to reflect the full global landscape of overhead catenary projects.
- Remove the 2016 locomotive reports from the CARB website, due to their factual inaccuracies and misleading conclusions (as detailed in a February 2024 white paper by RailPAC).
- Fully evaluate overhead catenary in future publications related to zero-emissions rail.

The report in the above link documents in more detail the past and present errors, omissions, and outright misinformation that CARB has been promoting in regard to zero-emissions rail technology.

Sincerely,
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Californians for Electric Rail

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Director of State Policy
Streets For All

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