PORT OF OAKLAND

February 20, 2024

California Air Resources Board
1001 I Street
Sacramento, CA 95814

Re: Port of Oakland Comments on Proposed Amendments to Low Carbon Fuel Standard

Dear California Air Resources Board Staff:

The Port of Oakland (Port) appreciates the opportunity to review and comment on California Air Resources Board's (CARB) amendments to the Low Carbon Fuel Standard (LCFS). The Port is a public enterprise agency, operating a seaport, an airport (Oakland International Airport (OAK)), and commercial properties along the Oakland waterfront. The Seaport and the Airport are both essential transportation infrastructure serving the San Francisco Bay Area, the State of California, and the nation. The Port is also a public utility, providing electricity to both the Seaport and Airport.

OAK is in East Oakland, which has a mix of residential neighborhoods, heavy industrial land uses, and major transportation infrastructure. California's CalEnviroScreen tool identifies East Oakland as a pollution-burdened area with elevated levels of diesel particulate matter and other toxic air contaminants. In addition, the Council of Environmental Quality's Climate and Economic Justice Screening tool identifies East Oakland as a disadvantaged community. The Port requests that CARB include electric ground support equipment (eGSE) as a lookup pathway in the LCFS program. This would accelerate airport electrification, support the Port's transition to zero emission program, and further the goals of the LCFS program.

The Port incorporates zero emissions operations and climate resiliency considerations into its planning, management, development, and operations to support its zero emission goals, reducing air quality impacts to the environment and adjacent communities. The LCFS program allows entities that provide low carbon intensity fuel to generate credits and sell to high carbon intensity fuel producers and then invest the proceeds into projects that further reduce the carbon intensity of transportation fuel.

The Port has been participating in the LCFS program since 2019, generating credits for ocean-going vessel shore power, electric cargo handling equipment

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(eCHE), and electric light-duty, medium-duty, and heavy-duty vehicles at the Seaport and electric light-duty vehicle charging at the Airport. The Port generates about 5,800 credits per quarter.

In 2019, the Port initiated discussions with CARB on including eGSE in the LCFS program as a lookup pathway. Following recommendations from CARB, OAK and other California airports sponsored the California Airports Council (CAC) Environmental Working Group in hiring a consultant to develop an Energy Economy Ratio (EER) for eGSE using the same methodology that CARB used to develop the EER value for eCHE. CAC's consultant developed the EER and submitted the report to CARB in 2021 (see Attachment 1). Following multiple correspondences and meetings, CARB decided not to include an eGSE category in 2022 and encouraged individual airports to apply through the Tier 2 pathway process. However, the Tier 2 pathway process is long and labor intensive and requires annual verification. This has proven to be a barrier, which in turn has slowed the adoption of eGSE at airports.

It is noteworthy that Oregon's Department of Environmental Quality included eGSE in its LCFS equivalent, Clean Fuel Program using the data developed by California airports. Oregon Clean Fuel Program has similar goals of reducing fuel carbon intensity. More information can be found here: https://www.oregon.gov/deq/ghgp/cfp/pages/cfp-overview.aspx#:~:text=DEQ%20gradually%20lowers%20the%20amount,meet%20the%20annual%20reduction%20goal.&text=The%20Clean%20Fuels%20Program%20encourages,reduction%20goals%20for%20that%20year.

The Port respectfully requests that CARB reconsider including eGSE into the LCFS Program as a lookup pathway using the EER value that has already been developed and submitted. Inclusion of eGSE aligns with CARB's objectives to promote investment in disadvantaged communities and incentivizes more electric infrastructure and electric equipment. Including eGSE as a lookup pathway would further Port and State decarbonization goals and accelerate infrastructure upgrades that will continue improving air quality for the East Oakland community and other communities located near California airports.

We appreciate the opportunity to provide comments. Please contact me at 510-627-1198 if you have any questions.

Thank you,

Colleen Liang
Director of Environmental Programs and Planning

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Attachment 1

CAC Development of EER Values for eGSE In the California LCFS Program

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February 5, 2021

TO:	Arpit Soni, California Air Resources Board
	Jordan Ramalingam, California Air Resources Board
FROM:	Sarah Johnson, California Airports Council
SUBJECT:	Development of EER Values for eGSE in the California LCFS Program

Energy Economy Ratios for Electric Ground Support Equipment in the Low Carbon Fuel Standard

The California LCFS program allows owners of charging infrastructure or electric equipment to generate credits for many different equipment categories, including forklifts, on-road trucks, yard tractors, cargo handling equipment, and shore power for marine vessels. Electrified airside ground support equipment (eGSE) is not precluded from participation in the program. However, because no energy economy ratio (EER) for this equipment category exists in the LCFS regulation, there are only two mechanisms by which eGSE can generated credits; 1) use of a site-specific EER-adjusted Tier 2 pathway, or 2) use of an EER of 1.0 in lieu of an equipment-specific EER. Both options introduce burdens to eGSE fleets, limiting participation in the LCFS program. In fact, no eGSE currently generates LCFS credits. Given the sustainability efforts and commitments by airports and airlines in California, eGSE represent an important equipment category for further electrification of California's transportation sector.

The most effective way to include eGSE in the LCFS program is to establish one or more defensible EER values that can be added to the LCFS regulatory text and/or used in an EER-adjusted Tier 2 pathway without requiring site-specific data collection and verification of the EER on an ongoing basis.

Previous analyses have established EERs in one of two ways:

1. Predicting emissions based on the average speed of the equipment. This is the basis of EER values for electric on-road trucks and yard tractors.
2. Correlating average activity and engine loads to CO_2 emissions and fuel consumption. This is the methodology used to calculate EER values for the electric cargo handling equipment (eCHE) and electric ocean-going vessel (eOGV) categories. It is used for applications where average speed does not properly characterize engine performance because of significant changes in engine load at low- or zero-speed.

The approach to developing EERs for eGSE follows the same basic methodology as used by CARB staff for these other categories. The approach for eCHE and eOGV EER development is described in CARB Staff's Attachment D to the "Notice of Public Availability of Modified Text and Availability of Additional

Documents and Information," related to the 2018 Proposed Amendments to the Low Carbon Fuels Standard Regulation and to the Regulation on Commercialization of Alternative Diesel (Attachment D). These prior analyses referenced emissions inventories developed for the Port of Long Beach as the source of equipment activity data. The source of equipment activity data for this analysis is CARB's OFFROAD model.

A. Methods

1. eGSE Power Requirements

The OFFROAD model provides data on populations, fuel consumption, engine work, and load factors, for a wide range of GSE types. For this analysis, the engine efficiency for each GSE type and fuel combination is calculated from the OFFROAD model data as follows:

$$Efficiency_{type,fuel} = CF * \left(\frac{E_{fuel} * \sum_{ModelYear} \sum_{HP\ Bin} FuelUse}{LF_{type,fuel} * \sum_{ModelYear} \sum_{HP\ Bin} HPhr} \right)^{-1}$$

Equation 1. Calculation of Engine Efficiency for GSE by Equipment Type and Fuel

Where:

E_{fuel} is the energy density of the base fuel type (diesel, gasoline, or natural gas) in MJ/gallon on a lower heating value basis

FuelUse is the annual fuel consumption for each model year and HP bin combination in gallons/year

LF is the load factor for a particular combination of GSE type and fuel

HPhr is the total horsepower hour per year of activity reported by the OFFROAD model for each model year and HP bin combination, before applying the load factor. The OFFROAD model reports this value as "Horsepower_Hours_hhpy"

CF a conversion factor of 2.6845 MJ per hp-hr

Efficiency is the average thermodynamic efficiency of the engine

Currently, CARB's EER calculation methods assume no energy loss during battery charging or conversion of energy to useful work. To be consistent with prior calculation methods, it is similarly assumed that no losses occur for eGSE. Therefore, the inverse of conventional engine efficiency can be used to estimate EERs for each equipment type and fuel.

2. Application to Specific Ground Support Equipment

Table 1 presents the fuel consumption, activity, and load factors for each GSE type and fuel combination, as reported by the CARB OFFROAD model[1]. Note that the OFFROAD model data presented in ORION2017 does not contain data for portable diesel equipment (e.g., pre-conditioned air units, ground power units, generators). The OFFROAD2007 model does include information on portable diesel GSE, so average horsepower, activity, and load factors from OFFROAD2007 were used to calculate estimated EER values for these portable diesel equipment categories.

Table 1. Fuel Consumption (MJ/yr), HP-hr per year, and Load Factors for eGSE Types

	Fuel (MJ/yr)			Total hp-hr/yr (LF not included)			Load Factors		
GSE Category	Gasoline	Diesel	Nat Gas	Gasoline	Diesel	Nat Gas	Gasoline	Diesel	Nat Gas
Aircraft Tug - Narrow Body	55,227,686	57,906,380	-	6,476,925	15,522,087	-	0.800	0.536	
Aircraft Tug - Wide Body	58,025,218	60,547,877	-	7,053,625	16,225,558	-	0.800	0.536	
Baggage Tug	535,547,053	35,645,686	82,486,005	88,920,205	13,816,546	16,767,370	0.550	0.369	0.550
Cargo Tractor	732,057,079	50,482,215	11,061,473	115,388,344	19,992,594	2,337,073	0.540	0.362	0.540
Belt Loader	127,667,994	19,316,500	7,850,987	23,263,275	8,218,157	1,763,607	0.500	0.335	0.500
Cargo Loader	40,238,884	61,869,997	8,030,818	7,333,617	26,532,597	1,774,959	0.500	0.335	0.500
Deicer	922,082	-	-	86,899	-	-	0.950		
Other GSE	13,741,179	137,540,964	10,200,874	2,254,423	58,122,833	2,367,755	0.500	0.335	0.500
Sweeper	1,175,750	-	214,934	204,078	-	51,082	0.510		0.510
Lift	45,515,173	19,211,856	1,224,001	8,257,030	8,161,388	268,275	0.500	0.335	0.500
Passenger Stand	16,601,705	664,036	32,226	2,656,129	236,128	-	0.590	0.395	0.590
Air Conditioner	16,911	47,290,564	-	-	8,204,232		0.750	0.750	0.750
Ground Power Unit	106,319,743	391,507,327	-	13,453,718	68,018,311	-	0.750	0.750	
Generator	5,996,704	588,458,336	-	649,485	98,545,126	-	0.780	0.780	
Air Start Unit	2,914,642	175,225,060	-	292,292	25,367,845	-	0.900	0.900	

[1] See attached supporting spreadsheets detailing OFFROAD model values and analysis.

EER values for eGSE were estimated by applying the values in Table 1 to the function in Equation 1. The EER for each equipment type and fuel is the inverse of the engine efficiency resulting from Equation 1. Combined EERs for each fuel type are calculated by weighting each GSE category EER based on Operating Hours per year, following the eCHE methodology.

GSE were grouped into two categories: Mobile and Portable, based on the primary fuel and type of GSE. Gasoline and spark-ignited natural gas and propane are the dominant fuel types for Mobile equipment while diesel is the dominant fuel type for Portable equipment. Consequently, the proposed EER for Mobile equipment is 4.2 and based on EERs for gasoline equipment. The proposed EER for Portable equipment is 2.9 and based on EERs for diesel equipment.

Table 2. Fuel Consumption and Calculated EER for eGSE Types

Group	GSE Category	Total Fuel Consumed (gal/yr)			EER		
		Gasoline	Diesel	Nat Gas	Gasoline	Diesel	Nat Gas
Mobile	Aircraft Tug - Narrow Body	476,800	430,627	-	4.0	2.6	n/a
Mobile	Aircraft Tug - Wide Body	500,952	450,271	-	3.8	2.6	n/a
Mobile	Baggage Tug	4,623,561	265,083	1,046,378	4.1	2.6	3.3
Mobile	Cargo Tractor	6,320,099	375,416	140,321	4.4	2.6	3.3
Mobile	Belt Loader	1,102,201	143,649	99,594	4.1	2.6	3.3
Mobile	Bobtail	664,424	54,966	22,159	4.1	2.6	3.4
Mobile	Cargo Loader	347,396	460,103	101,875	4.2	n/a	n/a
Mobile	Deicer	7,961	-	-	4.5	2.6	3.2
Mobile	Other GSE	118,632	1,022,838	129,403	4.2	n/a	3.1
Mobile	Sweeper	10,151	-	2,727	4.1	2.6	3.4
Mobile	Lift	392,948	142,871	15,527	3.9	2.7	n/a
Mobile	Passenger Stand	143,328	4,938	409	n/a	2.9	n/a
Portable	Air Conditioner	146	351,681		3.9	2.9	n/a
Portable	Ground Power Unit	917,895	2,911,485	-	4.4	2.9	n/a
Portable	Generator	51,772	4,376,131	-	4.1	2.9	n/a
Portable	Air Start Unit	25,163	1,303,079	-	4.0	2.6	n/a
				Mobile (Operating Hour Weighted)	**4.2**	2.6	3.3
				Portable (Operating Hour Weighted)	4.0	**2.9**	n/a

3. Alternative Data Source Considered

Data from the Airport Cooperative Research Program, Report 149 (ACRP 149)[2] were also considered as an source of information to estimate EERs. ACRP 149 is "a guidance document that provides a potential update to the current set of default ground support equipment (GSE) fleet and activity data used for passenger and cargo aircraft and a protocol to improve the accuracy and consistency of data collection for airport GSE activity."[3] However, while ACRP 149 provides recommended load factors for emissions inventories, it does not provide values for equipment activity, rated engine horsepower, or fuel consumption. To implement the same methodology as described in Attachment D, values for rated engine horsepower and annual operating hours for each GSE type and fuel were taken from the OFFROAD model. Composite horsepower ratings for each GSE category were calculated on a population weighted basis across all fuel types using OFFROAD population values.

The relationship between CO_2 emissions factors and engine brake horsepower presented in Figure 1 of the Attachment D document was then used to calculate CO_2 emissions, implied diesel fuel consumption, and the resulting EERs. Results of this analysis are summarized in Table 3.

This approach is limited because the relationship between CO_2 and engine brake horsepower developed for diesel engines is applied to a composite of all fuel types described in the OFFROAD model. However, the resulting EERs for Mobile and Portable equipment are 4.1 and 2.9, respectively, and are nearly identical to the results from the previously described approach. This suggests that the EER values of 4.2 and 2.9 for Mobile and Portable equipment presented previously are reasonable, robust when using different approaches and data sources.

[2] National Academies of Sciences, Engineering, and Medicine 2015. Improving Ground Support Equipment Operational Data for Airport Emissions Modeling. Washington, DC: The National Academies Press. https://doi.org/10.17226/22084

[3] ibid

To: California Air Resources Board

Subject: Development of EER Values for eGSE in the California LCFS Program
Date: February 5, 2021

Table 3. Inputs and resulting EERs using ACRP 149 data combined with Attachment D methodology

Group	GSE Category	ACRP 149 Avg Load Factor	Rated HP - OFFROAD Composite	Avg HP	CO2 Emissions (g/bhp-hr)	Diesel Energy Consumption (MJ/kWh)	EER	Activity (hrs/year)
Mobile	Aircraft Tug - Narrow Body	0.43	132	57	706	12.7	3.5	166,868
Mobile	Aircraft Tug - Wide Body	0.43	279	120	560	10.1	2.8	80,594
Mobile	Baggage Tug	0.36	96	34	825	14.8	4.1	1,242,303
Mobile	Cargo Tractor	0.38	99	38	802	14.4	4.0	1,442,453
Mobile	Belt Loader	0.29	64	19	999	17.9	5.0	528,970
Mobile	Cargo Loader	0.29	105	30	857	15.4	4.3	356,627
Mobile	Deicer	0.54	93	50	733	13.2	3.7	934
Mobile	Other GSE	0.42	96	40	785	14.1	3.9	630,700
Mobile	Sweeper	0.51	51	26	899	16.2	4.5	4,964
Mobile	Lift	0.34	97	33	834	15.0	4.2	171,518
Mobile	Passenger Stand	0.32	104	33	834	15.0	4.2	24,628
Portable	Air Conditioner	0.55	172	95	602	10.8	3.0	47,570
Portable	Ground Power Unit	0.45	160	72	655	11.8	3.3	506,726
Portable	Generator	0.82	214	176	497	8.9	2.5	460,674
Portable	Air Start Unit	0.47	363	171	502	9.0	2.5	65,441
						Mobile (Operating Hour Weighted)	4.1	
						Portable (Operating Hour Weighted)	2.9	

B. Recommendations

The EERs shown in Table 2 represent a wide range of GSE types and fuels with contributions that vary in proportion to the overall activity and emissions. The dominant fuel and associated engine type combinations (spark-ignited vs compression-ignited) vary by group; defined here as Mobile and Portable groups. Thus, the final recommended EERs for eGSE are separated into the two equipment groups and weighted based on the operational hours reported in the OFFROAD model. Specifically, it is recommended that Mobile eGSE be assigned an EER of 4.2 and a gasoline baseline, while Portable eGSE be assigned an EER of 2.9 and a diesel baseline.

Finally, it should be noted that some airside equipment are already captured under other LCFS categories. For example, medium- and heavy-duty trucks, buses, light-duty cars and trucks, and forklifts already have established EERs. It is recommended that equipment in those categories continue to use the EERs already established.