

November 2, 2017

The Honorable Herb Wesson
President, Los Angeles City Council
Los Angeles City Hall
200 N. Spring St. #430
Los Angeles, CA 90012

RE: Support for Council File 17-0739 – Transitioning to a 100% Zero-Emission Bus Fleet

Dear President Wesson and Councilmembers:

The Union of Concerned Scientists commends the City Council for its leadership on clean vehicles and strongly supports LADOT's transition to a 100% zero-emission bus fleet by 2030 or earlier. Battery and fuel cell electric buses are proven technologies and provide significant reductions in air pollution and global warming emissions compared to diesel and natural gas buses.

In addition to transitioning to a 100% zero-emission bus fleet, the Union of Concerned Scientists supports commitments in the City Council's motion (1) to procure zero-emission buses from companies with strong labor standards, (2) to ensure electric buses are deployed first in communities with the most pollution, and (3) to integrate even greater amounts of renewable energy into LADOT's sources of electricity.

I. Electric bus technology is here and ready

As of last month, there were over 100 battery and fuel cell electric buses operating in California, with more than 300 additional zero-emission buses on order across the state. With this motion, LADOT would join six other transit agencies in California that have committed to 100% zero-emission bus fleets by 2030 or earlier, including LA Metro, which operates the second largest bus fleet in the country. An additional twenty transit agencies, including LADOT, have deployed or are in the process of deploying electric buses in their fleets.¹

The many electric buses operating abroad also points to the robustness of electric vehicle technology. One manufacturer alone has deployed more than 27,000 battery electric buses, which is nearly three times the total number of transit buses in California.² With this motion, the

¹ California Air Resources Board. 2017. Battery and Fuel Cell Electric Buses in California. Sacramento, CA. Online at <https://arb.ca.gov/msprog/ict/zbusmap.pdf>.

² Schenker, R. 2017. Letter to Los Angeles City Council Transportation Committee Chair Mike Bonin. October 24. Online at http://clkrep.lacity.org/onlinedocs/2017/17-0739_pc_1_10-24-17.pdf.

City Council and LADOT would show its leadership beyond the intent of the California Air Resources Board to achieve 100% zero-emission transit buses in the state by 2040.

The range of electric buses is great enough to meet transit agencies' demands. Major bus manufacturers offer battery electric buses with ranges from 150 to over 400 miles on a single charge.³ On-route fast charging is also an option to meet service needs if charging overnight does not suffice. Electric buses are also high performing, with similar if not better acceleration and ability to climb hills than combustion technologies.⁴

Fuel cell electric buses similarly have long ranges – over 200 miles per tank of hydrogen.⁵ Fuel cell buses operated by the Alameda-Contra Costa Transit District (AC Transit), have proven highly durable, with one bus logging 25,000 hours compared to the expected life of 4,000 hours.⁶ Fuel cell buses have also proven their ability to accelerate and climb hills. AC Transit recently drove a fuel cell bus 224 miles from Oakland to Reno over Donner Pass (7,057 feet elevation).⁷

II. Electric buses offer significant air quality and climate benefits on *today's* grid

Battery electric buses have zero-tailpipe emissions and fuel cell electric buses emit only small amounts of water, bringing significant air quality benefits to riders, bus drivers, and communities where the buses operate. Electric buses also have lower *life cycle* emissions than combustion technologies when accounting for emissions associated with electricity and hydrogen generation.

On today's grid in California, battery electric buses have 70% lower global warming emissions and 50% lower NO_x emissions than diesel and natural gas buses on a life cycle basis. And owing to California's requirement that at least 33% of hydrogen come from renewable resources,⁸ fuel

³ Ranges offered by leading battery electric bus manufacturers include: 426 miles (Proterra), 284 miles (New Flyer), and 161 miles (BYD). See (a) Proterra. 2017. Catalyst Vehicle Specifications Comparison. Online at www.proterra.com/products/40-foot-catalyst/ (b) New Flyer. 2017. Xcelsior CHARGE. Online at www.newflyer.com/buses/xcelsior-charge/ (c) BYD. 2017. K9 Electric Transit Bus. Online at www.byd.com/usa/bus/k9-electric-transit-bus/#specs.

⁴ Chandler, S., J. Espino, and J. O'Dea. 2017. Delivering Opportunity: How Electric Buses and Trucks Can Create Jobs and Improve Public Health in California. Cambridge, MA and Berkeley, CA: Union of Concerned Scientists and The Greenlining Institute. Online at www.ucsusa.org/sites/default/files/attach/2016/10/UCS-Electric-Buses-Report.pdf. See Figure 12.

⁵ Eudy, L., M. Post, C. Gikakis. 2015. Fuel Cell Buses in U.S. Transit Fleets: Status 2015. NREL/TP-5400-64974. Golden, CO: National Renewable Energy Laboratory. Online at www.afdc.energy.gov/uploads/publication/fc_buses_2015_status.pdf.

⁶ AC Transit. 2017. AC Transit's Fuel Cell Program Breaks 25,000 Hour Operating Record. Online at <http://www.actransit.org/2017/07/11/fuel-cell-record-25k/>.

⁷ *Id.*

⁸ Ahtelik, G. 2009. California Regulations on Renewable Hydrogen and Low Carbon Technologies. Online at https://energy.gov/sites/prod/files/2014/03/f12/renewable_hydrogen_workshop_nov16_achtelik.pdf. See slide 6.

cell electric buses have 50% lower global warming emissions and 50% lower NO_x emissions than diesel and natural gas buses on a life cycle basis.⁹

The air quality and climate benefits of battery electric buses also apply for vehicles charged on LADWP's grid. Our analysis shows battery electric buses on LADWP's grid today have 60% lower global warming emissions than diesel and natural gas buses on a life cycle basis (see Attachment 1). Those benefits will increase as coal is phased out of LADWP's electricity portfolio by 2025 and as electricity from renewable energy increases to 55 percent by 2030.¹⁰

The emissions benefits of electric vehicles are due to the superior efficiency of electric drivetrains and the significant amount of renewable energy (29%) already on California's electric grid.¹¹ Depending on the route and vehicle speed, battery electric buses travel four to eight times as far as diesel and natural gas buses for the same amount of energy (i.e. miles per gallon equivalent).¹²

III. Concerns with natural gas and biomethane

While natural gas buses were a cleaner alternative to diesel thirty years ago in terms of NO_x and particulate matter, natural gas buses are not as good for air quality and climate change as today's battery and fuel cell electric buses.

New natural gas engines offer lower tailpipe NO_x emissions than current diesel and natural gas vehicles, however, these engines do not reduce the significant amount of NO_x emissions from natural gas extraction and delivery.¹³ Just as it is important to consider the life cycle impacts of electric vehicles, it is important to consider both tailpipe and "upstream" emissions from combustion vehicles and their fuels. And while new natural gas engines reduce tailpipe NO_x

⁹ Chandler, S., J. Espino, and J. O'Dea. 2017. Delivering Opportunity: How Electric Buses and Trucks Can Create Jobs and Improve Public Health in California. Cambridge, MA and Berkeley, CA: Union of Concerned Scientists and The Greenlining Institute. Online at www.ucsusa.org/sites/default/files/attach/2016/10/UCS-Electric-Buses-Report.pdf. See Figures 5 and 7.

¹⁰ Los Angeles Department of Water and Power. 2016. Power Integrated Resource Plan. Online at www.ladwp.com/cs/idcplg?IdcService=GET_FILE&dDocName=OPLADWPCCB562207&RevisionSelectionMethod=LatestReleased. See Figure ES-7.

¹¹ California Energy Commission. 2017. California Energy Commission: Tracking Progress. Sacramento, CA. Online at www.energy.ca.gov/renewables/tracking_progress/documents/renewable.pdf. See Figure 1.

¹² Eudy, L. and M. Jeffers. 2017. Foothill Transit Battery Electric Bus Demonstration Results: Second Report. NREL/TP-5400-67698. Golden, CO: US Department of Energy. Online at www.nrel.gov/docs/fy17osti/67698.pdf.

¹³ O'Dea, J. 2017. The Promises and Limits of Biomethane as a Transportation Fuel. Cambridge, MA: Union of Concerned Scientists. Online at www.ucsusa.org/sites/default/files/attach/2017/05/Promises-and-limits-of-Biomethane-factsheet.pdf.

emissions, they offer little benefits for the climate compared to existing natural gas vehicles (roughly 7% lower global warming emissions).¹⁴

In the context of natural gas, it is important to address biomethane – natural gas derived from fugitive sources of methane such as landfills, dairy manure, and wastewater treatment facilities. Because of its impact on climate change, it is important to reduce and capture fugitive methane, however, there is limited availability of this fuel.

If all the fugitive methane from landfills, dairy manure, and wastewater in California was captured, there would be enough biomethane to meet approximately 3 percent of California’s demand for natural gas across all sectors.¹⁵ Today, nearly all biomethane used in California comes from out-of-state landfills.¹⁶ Applications such as transit buses, where electrification is a viable option today, should not be prioritized for the limited amount of biomethane available.

Because of the chemical similarity between biomethane and natural gas (i.e., 95-98% methane), the tailpipe emissions of carbon dioxide, methane, nitrogen oxides, particulate matter, etc. are identical for vehicles fueled by biomethane as those fueled by natural gas from fossil fuels. Similarly, the public health risks of leaks and combustion while transferring, storing, and delivering biomethane are also the same as natural gas.

The climate benefits of biomethane come solely from displacing fugitive emissions from landfills, dairy manure, and wastewater treatment facilities. The benefits of this fuel can also be realized if biomethane is used to generate electricity or hydrogen for electric vehicles. Due to the greater efficiency of battery and fuel cell electric vehicles, using biomethane for these applications results in even lower emissions than using the fuel for natural gas vehicles.

The bottom line is that battery electric buses running on today’s grid in California produce less global warming emissions and less NO_x than natural gas buses, even those with a low NO_x engine fueled with biomethane from landfills. As the grid gets cleaner, emissions from battery electric buses will be even lower.

IV. Electric buses are cost competitive with combustion technologies today

Battery electric buses are also cost competitive today with diesel and natural gas vehicles over the life of the bus.¹⁷ Despite higher upfront purchase costs, significant savings in maintenance and fueling lead to similar, if not lower, total costs of ownership.

¹⁴ *Id.*

¹⁵ *Id.*

¹⁶ California Air Resources Board. 2016. LCFS Pathway Certified Carbon Intensities. Sacramento, CA. Online at www.arb.ca.gov/fuels/lcfs/fuelpathways/all-composite-pathways-110216.xlsx.

¹⁷ (a) California Air Resources Board. 2017. Fifth Innovative Clean Transit workgroup meeting. Online at https://arb.ca.gov/msprog/ict/meeting/mt170626/170626_wg_pres.pdf. See slides 40-42. (b) King County

With state incentives, the total cost of ownership for battery electric buses can even be lower than combustion technologies. These incentives include the Low Carbon Fuel Standard (LCFS), which provides approximately \$9,000 per electric bus per year at current LCFS credit values.¹⁸ As sources of electricity in California become cleaner, electric buses will generate greater revenue for transit agencies under the LCFS for the same credit value.

California's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) provides \$95,000 towards the purchase of zero-emission transit buses 30 feet and longer (\$110,000 if operated in a disadvantaged community).¹⁹ In the state budget recently signed into law by Governor Brown, at least \$35 million in HVIP funding will be used specifically for zero-emission transit buses.²⁰

Higher incentives of \$150,000 per bus (\$165,000 if operated in a disadvantaged community) have also been recently proposed by the California Air Resources Board for battery electric buses longer than 40 feet. Incentives of \$300,000 per bus (\$315,000 if operated in a disadvantaged community) have been recently proposed for fuel cell electric buses.²¹

Recent contracts awarded by LA Metro show that the purchase cost of battery electric buses is approaching that of low NO_x natural gas buses. Metro's contracts show pre-tax prices of \$686,000 for battery electric buses compared to \$621,000 for natural gas buses.²²

Metro. 2017. Feasibility of Achieving a Carbon-Neutral or Zero-Emission Fleet. Online at http://kingcounty.gov/~media/elected/executive/constantine/news/documents/Zero_Emission_Fleet.ashx?la=en. See Figure 14.

¹⁸ California Air Resources Board. 2016. Draft Discussion Topics on Costs Transit Agency Workgroup Meeting. Sacramento, CA. Online at www.arb.ca.gov/msprog/bus/wg201601cost.pdf. See page 1.

¹⁹ California Air Resources Board. 2017. Implementation Manual for the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) and Low NO_x Engine Incentives Administered Through HVIP. Sacramento, CA. Online at www.californiahvip.org/wp-content/uploads/2017/09/FY-16-17-Final-2-HVIP-Implementation-Manual-05262017.pdf. See Table 4.

²⁰ California Legislature (Assembly Bill 134). 2017. Budget Act of 2017. Online at https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB134. See §1.2(b)(2).

²¹ California Air Resources Board. 2017. [Draft Fiscal Year 2017-18 Funding Plan for Clean Transportation Incentives](http://www.arb.ca.gov/msprog/aqip/fundplan/1718_draft_funding_plan_workshop_100417.pdf). Sacramento, CA. Online at www.arb.ca.gov/msprog/aqip/fundplan/1718_draft_funding_plan_workshop_100417.pdf. See Table I-17.

²² (a) Los Angeles County Metropolitan Transportation Authority. 2017. Sixty Zero Emission 40' Transit Bus Contract. Online at <https://boardagendas.metro.net/board-report/2017-0304/>. Note, sales tax in Los Angeles County increased to 9.25% in July 2017. (b) Los Angeles County Metropolitan Transportation Authority. 2017. 295 Forty Foot CNG Transit Bus Contract. Online at <https://boardagendas.metro.net/board-report/2016-0988/>. Note, sales tax in Los Angeles County was 8.75% before July 2017.

On behalf of our 85,000 supporters in California, the Union of Concerned Scientists thanks the City Council for being a leader on clean vehicles, air quality, and climate change. I am more than happy to discuss any of our work in further detail.

Sincerely,

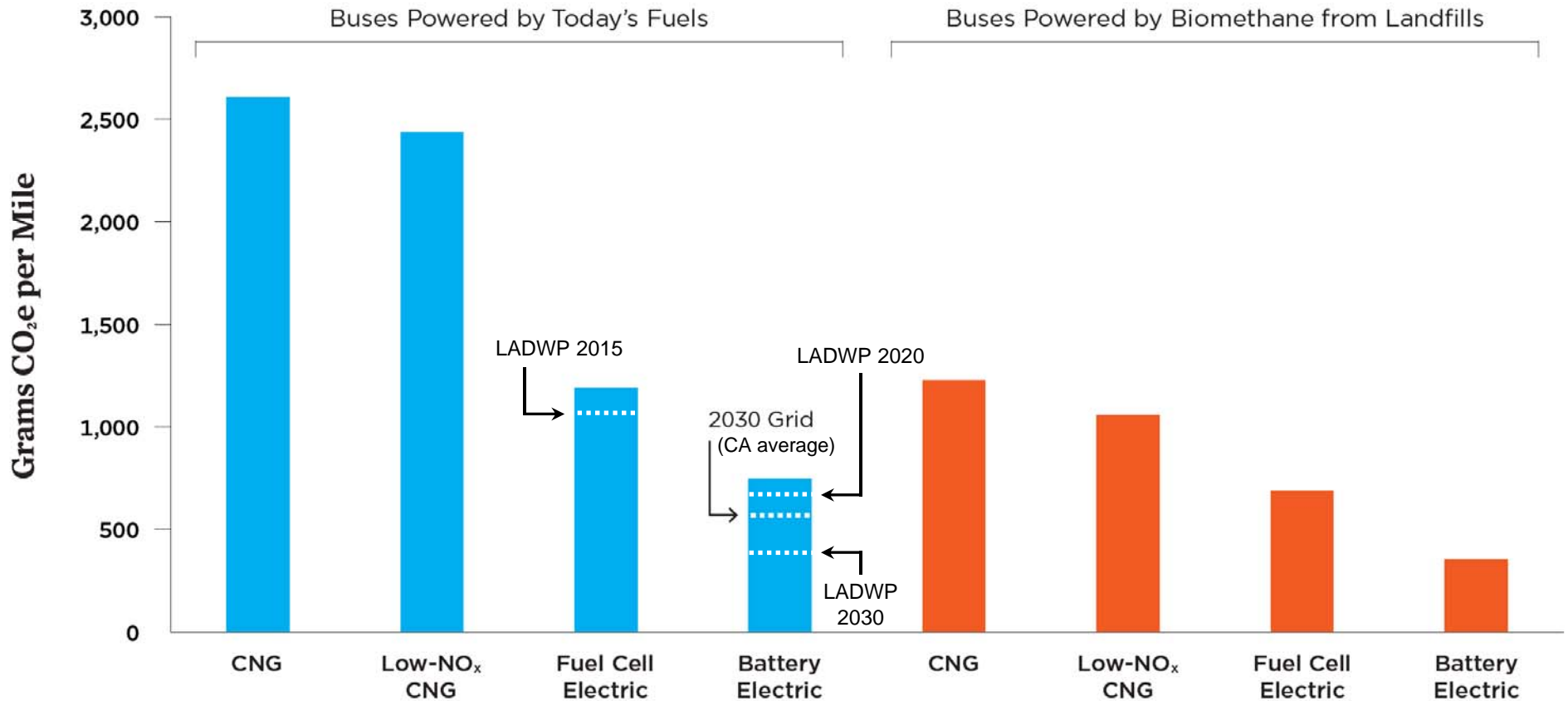


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Attachments:

- (1) Life Cycle Global Warming Emissions from Transit Buses, by Vehicle and Fuel Type, Adapted for LADWP

Life Cycle Global Warming Emissions from Transit Buses, by Vehicle and Fuel Type



Notes: CO₂e stands for carbon dioxide equivalent. Bus-related emissions are a representative example of emissions from other heavy-duty vehicles. Electricity emissions are based on the 2016 grid mix in California; hydrogen emissions assume 33 percent is generated using renewable energy (per Senate Bill 1505). Biomethane emissions are based on landfill gas, as it is the predominant source of biomethane consumed in California (CARB 2017b). The dashed line indicates emissions from a battery electric bus using an estimate of California's grid mix in 2030; it assumes 50 percent of electricity comes from renewable energy (per Senate Bill 350) and 50 percent of electricity comes from natural gas power plants. This represents a conservative estimate of California's future sources of electricity. Life cycle emissions include those from fuel production ("upstream") and fuel consumption ("tailpipe").

Adapted from Figure 3 of O'Dea, J. 2017. *The Promises and Limits of Biomethane as a Transportation Fuel*. Cambridge, MA: Union of Concerned Scientists. Online at <http://www.ucsusa.org/sites/default/files/attach/2017/05/Promises-and-limits-of-Biomethane-factsheet.pdf>