



10 November 2017

Fiscal and Management Control Board  
Massachusetts Bay Transportation Authority (MBTA)  
10 Park Plaza, Boston, MA 02116

**Re: Massachusetts Bay Transportation Authority (MBTA) should adopt binding targets for zero emission electric bus procurement**

Dear Honorable Members of the Fiscal and Management Control Board,

Thank you for your leadership in the last two years towards addressing some of the serious fiscal and operational challenges faced by the Commonwealth's transportation system. We understand that the Fiscal and Management Control Board (FMCB) is scheduled to discuss MBTA's *'Integrated Fleet and Facilities Plan'* in the coming weeks. In anticipation of this discussion, we would like to take the opportunity to provide input on the economic, environmental, and public health benefits of fleet electrification and ask that these factors be integrated into MBTA's strategic roadmap to restore MBTA revenue fleets and supporting maintenance facilities.

As part of our larger *'Clean Transportation of All'* campaign, Sierra Club is working on a range of policy, advocacy, and awareness initiatives to accelerate the adoption on zero emission electric buses (ZEBs), electric vehicles (EVs) and EV related infrastructure in Massachusetts. Last year, together with our EV coalition partners we sent [this](#) letter to Secretary Pollack urging that ***MBTA and transit authorities across the Commonwealth commit to incorporating 100 electric buses into our public transit fleets by 2019 and convert to all zero-emission electric bus purchases by 2030.*** This September, [19 Mayors in Massachusetts](#), including the Mayors of Boston, Cambridge, and Newton, where MBTA buses operate, called for swift action to support the electrification of our public transportation sector.

We are pleased to learn that five 60 ft. articulated electric buses are expected to be in operation on the Silverline in spring of 2018. The planned electric bus study is a step in the right direction. However, this is far short of what is needed to meet the state's climate goals and expand access to clean transportation. Much more needs to be done, and soon.

[Investing in electric buses is in line with MBTA's stated commitments](#)

The transportation sector in Massachusetts is responsible for 40% of all greenhouse emissions in the state. Reducing emissions from our transportation sector is critical to achieving our commitment to have 300,000 zero emissions vehicles on state roads by 2025. Faster integration of electric buses into our transit fleet is also consistent with reducing GHG emissions to 80 percent below 1990 levels by 2050 as required by the Global Warming Solutions Act.

As part of its Capital Investment Plan (CIP), MBTA has committed to prioritize projects that maximize environmental benefits with special consideration to environmental justice issues. In addition, this

September, MBTA issued \$370M in sustainability bonds to fund projects with environmental benefits ‘centered on the transition to a low-carbon, climate resilient and sustainable community’<sup>1</sup>.

Most of MBTA’s bus fleet is approaching its useful life of twelve years<sup>2</sup>. The impact of new buses put on the road with poor emission performance can persist for decades. This makes it crucial to ensure that the 100 bus replacements planned every year, as well as new bus procurements for fleet expansion, are all electric. Further, fleet electrification aligns with several of MBTA stated goals and priorities including reducing air pollution and carbon emissions, improving public health, addressing environmental justice issues and moving towards a zero-emission bus fleet.

### [Electric buses provide significant economic, public health and environment benefits](#)

Transit agencies across the country are committing to increasing the number of electric buses in their fleet. The Los Angeles Metro approved a plan to transition its fleet of over 2200 buses to electric by 2030. Two transit agencies in California, the Antelope Valley Transit Agency (AVTA) with a bus fleet of 85 and Foothill Transit with more than 300 buses have already committed to completely electric fleets by 2018 and 2030 respectively.

Seattle will be adding 120 electric buses over 3 years, Philadelphia announced it will add 25 electric buses to its fleet and Chicago has plans to buy 30 electric buses. Massachusetts has a total of 9 electric buses in operation at Worcester Regional Transit Authority (WRTA) and Pioneer Valley Transit Authority (PVRTA). Martha’s Vineyard Transit Authority (VTA) recently announced plans to go completely electric and are set to receive their first electric buses in the summer of 2018. We are disappointed that MBTA is not playing a leadership role on this front.

### [Economic Benefits](#)

Even with higher upfront purchase costs, electric buses can be hundreds of thousands of dollars less expensive to fuel and maintain over its lifetime. Electric buses have 79% and 70% lower maintenance costs than new diesel and CNG buses respectively.<sup>3</sup> Investment in electric buses will dramatically reduce MBTA bus maintenance costs which according to MBTA’s own analysis is more than twice the national average for comparable transit systems<sup>4</sup>. In fact, each electric bus will save MBTA \$200,00 over its lifetime as compared to a diesel bus (*See Appendix A: Massachusetts Bay Transportation Authority Bus Cost Analysis*). These lifetime savings can be used to procure additional electric buses.

Electric bus technology has come a long way in the last decade. Bus ranges are increasing. There are now models that run 250-300 miles on a single charge. As the market for electric buses continues to grow, upfront costs will drop. Rapidly falling battery prices are expected to further drive down costs. A recent California Air Resources Board (CARB) study shows that every year the price premium for ZEBs decreases and, by 2022, they will be at cost parity with and continue to decrease as compared to diesel buses<sup>5</sup>.

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<sup>1</sup> [http://old.mbta.com/uploadedfiles/About\\_the\\_T/Financials/MBTA%20Sustainability%20Bond%20Framework.pdf](http://old.mbta.com/uploadedfiles/About_the_T/Financials/MBTA%20Sustainability%20Bond%20Framework.pdf)

<sup>2</sup> <https://d3044s2alrsxog.cloudfront.net/sites/default/files/fmcb-meeting-docs/reports-policies/2017-mbta-strategic-plan.pdf>

<sup>3</sup> Metrics derived from Argonne National Laboratory’s AFLEET Model (2017) and ZEB transit studies

<sup>4</sup> [https://www.mbta.com/uploadedfiles/About\\_the\\_T/Board\\_Meetings/pachecoreportwaiverreport2017v2.pdf](https://www.mbta.com/uploadedfiles/About_the_T/Board_Meetings/pachecoreportwaiverreport2017v2.pdf)

<sup>5</sup> [https://www.arb.ca.gov/msprog/bus/4thactwgmtng\\_costs.pdf](https://www.arb.ca.gov/msprog/bus/4thactwgmtng_costs.pdf)

Massachusetts spends an estimated \$11.6 billion on petroleum (EIA State Energy Data 2014). Accelerating a shift away from fossil fuels will keep oil money in state and help create jobs in EV charging infrastructure and maintenance.

#### Public Health and Environmental Benefits

MBTA routes that carry the highest volume of passengers often pass through low-income neighborhoods most dependent on the T, and hit hardest by air pollution. A recent study by the American Lung Association found that more than 109,000 asthma attacks, 220,000 lost work days and over 2,500 premature deaths are estimated to have resulted from passenger vehicle emissions in 2015 in Massachusetts and ZEV Program states.<sup>6</sup>

Electric buses offer the most consequential pollution reduction benefits and an opportunity to improve public health. Battery electric buses have no tailpipe emissions and provide significant reductions in NOx, carbon monoxide and particulate matter emissions. Electric buses emit 70 percent fewer greenhouse gases, and have four times the fuel efficiencies as compared to diesel and CNG buses.

#### The VW Settlement Funds provide MBTA with an opportunity to accelerate the transition to an electric fleet

Massachusetts will soon be receiving [\\$75M](#) in funding through the Volkswagen Environment Mitigation Trust Fund. These funds are available to invest in zero emission electric buses and states can spend up to 15% on charging infrastructure. The State will announce a lead agency (beneficiary) to supervise the distribution of settlement money by Dec 1, 2017. The Massachusetts Department of Environment Protection (MassDEP) is currently inviting [input](#) on how these funds can be used.

The Commonwealth should consider using these funds to establish a (i) no-interest loan program for transit agencies (ii) a continuing grant program for the procurement of electric buses or (iii) enhance EV purchasing power through coordinated group purchases with other states or regional entities.

The VW Settlement Funds provide MBTA with an opportunity to invest in clean transportation, especially in underserved communities that rely on public transportation and are most affected by the health impacts of air pollution. As one of the largest public transportation agencies in the country with over 1000 buses, MBTA is well positioned to lead on the switch to electric buses and can and should be doing much more.

Respectfully,



Emily Norton  
MA Chapter Director

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<sup>6</sup> <http://www.lung.org/local-content/california/documents/2016zeroemissions.pdf>

## Appendix A

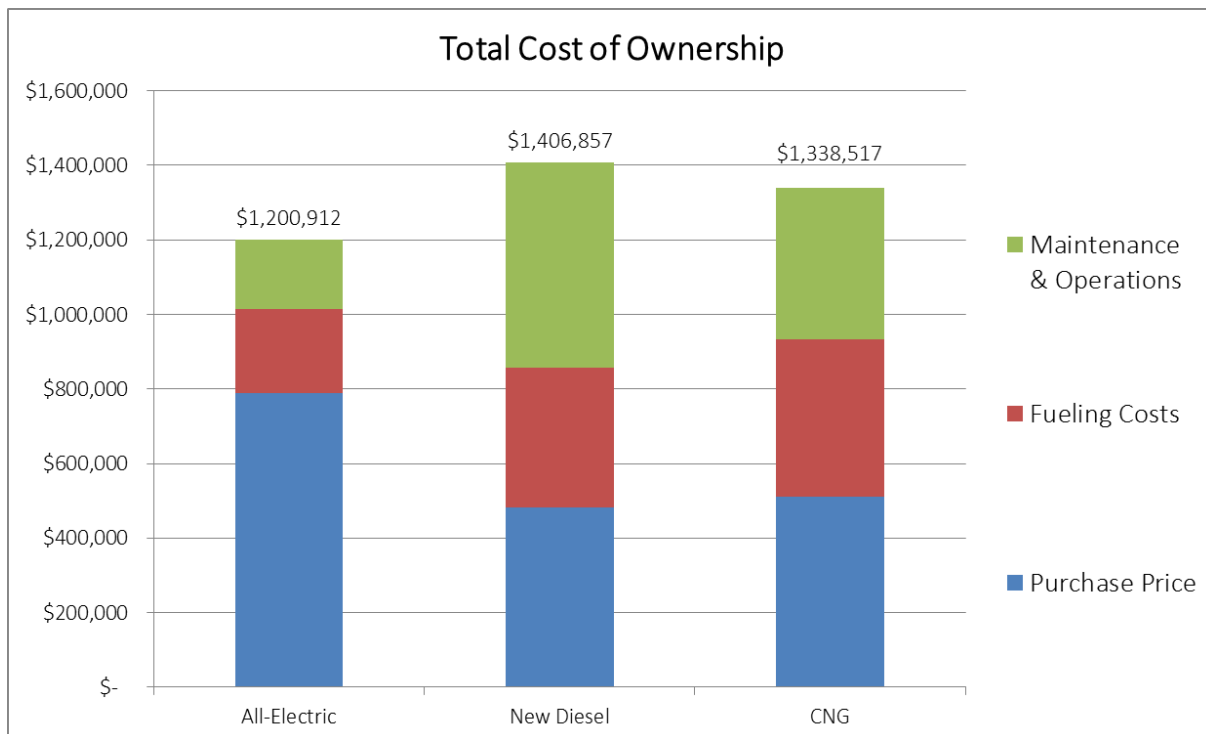
### Massachusetts Bay Transportation Authority Bus Cost Analysis

## Massachusetts Bay Transportation Authority (MBTA) Bus Cost Analysis

### Total Cost of Ownership

Despite their greater purchase price, current analysis using Argonne National Laboratory's AFLEET Model demonstrates that zero emission electric buses have a **total cost of ownership that is 15% lower than new diesel buses**. Maintenance costs for electric buses are between 70% and 79% lower than for compressed natural gas (CNG) and new diesel buses respectively, contributing to significant cost savings over the lifetime of a bus. Based on currently reported data, each all-electric bus will save MBTA over \$200,000 as compared to a new diesel bus purchase.

Moreover, as this electric bus technology continues to develop, all-electric bus up-front capital costs will continue to drop, whereas CNG and diesel bus capital cost trends are continually increasing.<sup>7</sup> In addition, although reliable, current publicly available data on hybrid diesel-electric buses are lacking, a lifecycle analysis using data compiled by the California Air Resources Board in 2016 shows that hybrid diesel-electric buses have a total cost of ownership of \$1,909,847, over \$700,000 greater than an electric bus.



Source: Argonne National Laboratory's AFLEET Model (2017); fuel and electricity costs adjusted for Boston, MA

The total cost of ownership is derived from Argonne National Laboratory's AFLEET Model (2017). Fuel prices are adjusted for the Boston, Massachusetts region. Model inputs are populated using averages of fuel economy and maintenance costs reported directly by transit agencies from the years 2014 to 2017.

<sup>7</sup> California Air Resources Board. (2016) *Total Cost of Ownership to Advance Clean Transit*. Presentation Prepared for the 4th Meeting of the Advanced Clean Transit Working Group. <[https://www.arb.ca.gov/msprog/bus/4thactwgmtng\\_costs.pdf](https://www.arb.ca.gov/msprog/bus/4thactwgmtng_costs.pdf)>

## Maintenance & Fuel Costs

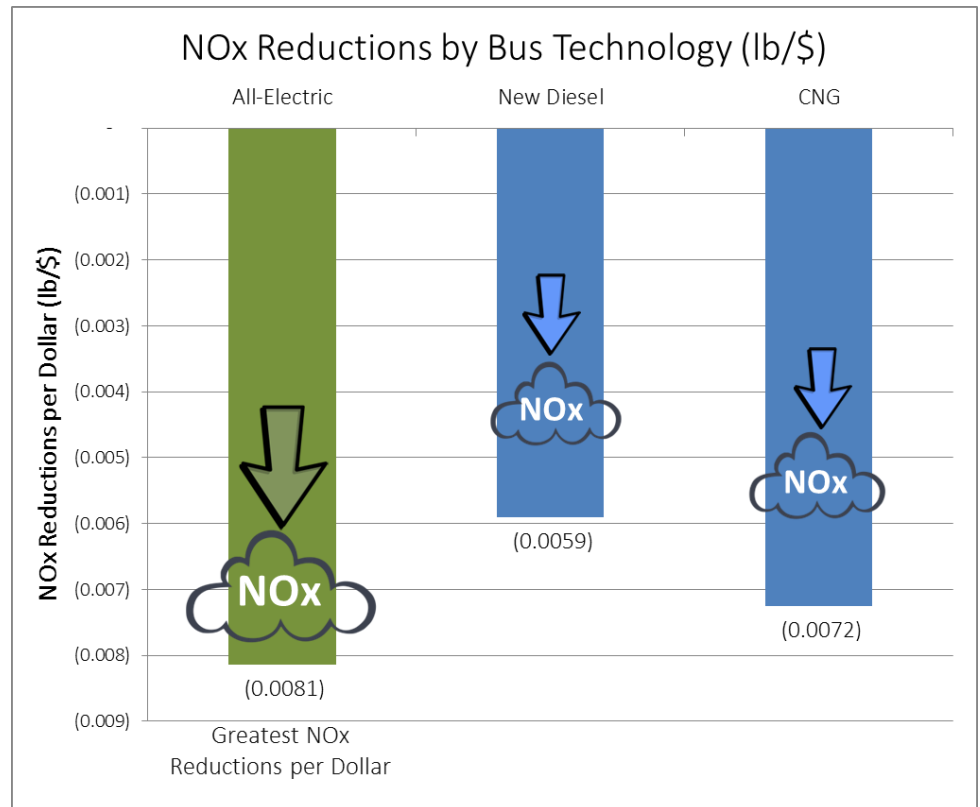
According to the MBTA's own analysis of its bus maintenance activities, the MBTA's costs on a per-vehicle-mile basis were more than twice the national average for comparable transit systems (those with more than 100 buses and an average fleet age of at least 9 years).<sup>8</sup>

	Fuel Economy (MPGDE)	Maintenance & Repair (\$/mi)
<b>Electric</b>	<b>19.44</b>	<b>\$0.17</b>
Diesel	4.16	\$0.80
CNG	3.87	\$0.56

An investment in zero-emission vehicles will dramatically reduce this figure. As highlighted above, all-electric bus maintenance and repair costs are 79 and 70% lower than the maintenance and repair costs for new diesel and CNG respectively.<sup>9</sup> Moreover, all-electric buses are fueled by regionally generated electricity, which has demonstrated far more reliable pricing as compared to diesel oil and natural gas.<sup>10</sup>

## NOx Reductions (lb/\$)

Specific to the Volkswagen Settlement, agencies are instructed to demonstrate their anticipated NOx reductions as a result of their state's environmental mitigation transportation investments. Many agencies are in search of the investment that results in the greatest NOx lb/\$ ratio, but they are only considering the upfront purchase costs in these calculations. If the total lifetime costs are considered, **the bus technology with the greatest NOx lb/\$ ratio is a zero-emission bus.**



## Electric Transit Bus Studies

Eudy, L., & Post, M. (2015). [American Fuel Cell Bus Project Evaluation: Second Report](#) (No. NREL/TP--5400-64344). National Renewable Energy Lab.(NREL), Golden, CO (United States).  
<https://www.nrel.gov/docs/fy15osti/64344.pdf>

<sup>8</sup> [https://www.mbta.com/uploadedfiles/About\\_the\\_T/Board\\_Meetings/pachecoreportwaiverreport2017v2.pdf](https://www.mbta.com/uploadedfiles/About_the_T/Board_Meetings/pachecoreportwaiverreport2017v2.pdf)

<sup>9</sup> Metrics derived from Argonne National Laboratory's AFLEET Model (2017) and ZEB transit studies

<sup>10</sup> <https://www.afdc.energy.gov/fuels/prices.html>

- Eudy, L., & Jeffers, M. (2017). [\*Foothill Transit Battery Electric Bus Demonstration Results: Second Report\*](#) (No. NREL/TP-5400-67698). National Renewable Energy Laboratory (NREL), Golden, CO (United States).
- Eudy, L., & Post, M. (2015) [\*Zero Emission Bay Area \(ZEBA\) Fuel Cell Bus Demonstration Results: Fourth Report\*](#). <<https://www.nrel.gov/docs/fy15osti/63719.pdf>>
- J. Aber (2016) [\*Electric Bus Analysis for New York City Transit\*](#). Columbia University, New York, NY, Rep. Available at: [www.columbia.edu](http://www.columbia.edu)
- Metro, F. P. K. C. (2017) [\*King County Metro Battery Electric Bus Demonstration—Preliminary Project Results\*](#). National Renewable Energy Laboratory. [https://www.afdc.energy.gov/uploads/publication/king\\_county\\_be\\_bus\\_preliminary.pdf](https://www.afdc.energy.gov/uploads/publication/king_county_be_bus_preliminary.pdf)

#### **Literature Reviews & Presentations:**

- California Air Resources Board (ARB). (2016) [\*Advanced Clean Transit Program – Literature Review on Transit Bus Maintenance Cost\*](#) (Discussion Draft). Prepared for the 3<sup>rd</sup> Meeting of the Advanced Clean Transit Working Group. <[https://www.arb.ca.gov/msprog/bus/maintenance\\_cost.pdf](https://www.arb.ca.gov/msprog/bus/maintenance_cost.pdf)>
- California Air Resources Board (ARB). (2016) [\*Advanced Clean Transit – Battery Cost for Heavy-Duty Electric Vehicles\*](#) (Discussion Draft). Prepared for the 3<sup>rd</sup> Meeting of the Advanced Clean Transit Working Group. [https://www.arb.ca.gov/msprog/bus/battery\\_cost.pdf](https://www.arb.ca.gov/msprog/bus/battery_cost.pdf)
- California Air Resources Board (ARB). (2016) [\*Total Cost of Ownership to Advance Clean Transit\*](#). Presentation Prepared for the 4<sup>th</sup> Meeting of the Advanced Clean Transit Working Group. <[https://www.arb.ca.gov/msprog/bus/4thactwgmtng\\_costs.pdf](https://www.arb.ca.gov/msprog/bus/4thactwgmtng_costs.pdf)>

#### **Additional Resources:**

- Live Tracking of King County Metro’s Electric Buses: <http://energy.proterra.com/KCM/>
- Proterra’s Electric Bus Spec Sheet: <https://www.proterra.com/performance/fuel-economy/>