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Electric Buses for the NFTA

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Abstract
This brief discusses many reasons that the NFTA should invest in using electric buses. After explaining the differences in bus technologies, it details numerous environmental, public health, and economic benefits of electric buses. The brief closes with case studies to show how other cities and counties across the world are beginning to use electric buses.

Keywords
economic development, environment, transit, health, buffalo

PARTNERSHIP FOR THE PUBLIC GOOD

This policy brief was drafted by Zachary Persichini, a student at the University at Buffalo School of Law.

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A NEW ECONOMY FOR PEOPLE & PLANET
CROSSROADS COLLECTIVE

Policy Brief

Electric Buses for the NFTA

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As climate change pushes society to find new transportation methods, the Niagara Frontier Transportation Authority is taking important steps toward sustainability, applying for grant funding to purchase a number of electric buses.[1] As detailed in this brief, the sooner the NFTA makes the transition, the better. With lower lifetime costs and zero emissions, electric buses will help Western New York fight climate change and make the community a healthier place to live.

The world has begun converting to electric buses. In 2017, there were roughly 385,000 electric buses in operation, representing 13 percent of all buses.[2] Almost all of these buses are in China, however. In the United States, only some 360 out of 70,000 buses were electric in 2017.[3] But the picture is changing fast. In October 2017, 13 cities around the world pledged to buy only electric buses by 2025.[4] In the United States, New York City's 5,700 buses will be all-electric by 2040. Los Angeles, which has the second-largest bus fleet, will convert all 2,300 buses to electric by 2030. San Francisco, with 1,100 buses, will only purchase electric buses by 2025 and be all-electric by 2035.[5]

Switching to electric buses has many positive impacts, including zero tail-pipe emissions that decrease climate change impacts and improve air quality for residents, lower operating costs for fuel and maintenance, reduce noise, and create jobs.

Technology of Electric Buses

There are three main electric bus technologies on the market today.[6]

Battery Electric Buses

These buses have a battery pack and an electric motor instead of the traditional fuel tank and engine. The battery is the vehicle's sole source of power, which means it must be recharged, often times from the electric grid. Maintenance costs can be as low as 20% that of conventional buses and the electricity used to power them can cost less than diesel.

Hybrid Electric Buses

These buses have both an electric motor and an internal combustion engine. Thus, the bus can use gasoline for portions of its mileage and electricity for other portions. There are two primary categories of hybrid electric vehicle buses: parallel hybrids and series hybrids. Parallel hybrids use both the electric motor and the engine to move the vehicle, while series hybrids have engines that can generate electricity for the motor as well as move the vehicle.

Fuel Cell Electric Buses

These types of buses contain a fuel cell system powered by hydrogen that generates the electricity used to power the vehicle. The electricity, along with heat and water vapor, are the only byproducts of fuel cells.

All of the types of buses have been proven to work in the "daily grind" of transit systems. However, the fuel cell electric vehicle buses offer critical advantages, including longer range, better cold weather performance, superior hill climbing ability, and faster "refueling."[7] The fuel cell buses would be more equipped to take on a one-for-one replacement of CNG bus routes. The problem with implementation is that they are more expensive to purchase than the other types of electric buses, thus creating the need for a cost-benefit analysis.

The three main types of electric buses on the market today are **battery** electric, **hybrid** electric, and **fuel cell** electric.

Batteries and Charging

As opposed to overhead electric bus wires, new electric bus technology focuses on lithium-ion and iron-phosphate batteries that can be recharged from central stations prior to beginning each route.[8]

Generally, there are two options when it comes to charging electric bus batteries: overhead charging stations and plug-in depot chargers.[9] The plug-in depots are and look what they sound like; they plug into the bus when there is a break (if at the depot) or at the end of a bus route. Overhead charging stations enable 24-hour circulator route charging. These charging stations can be installed at curbside pullouts, transit centers, or bus stops. Most overhead charging stations allow for assisted docking capabilities allowing the bus to connect to the charger without any input from the bus driver.

Environmental Benefits

In the United States, the transportation sector accounts for about 27% of all greenhouse gas emissions nationally, and diesel vehicles are a major culprit. Buses burn a tremendous amount of diesel fuel; for example, an average bus in Washington D.C. gets 3.76 miles per gallon.[10] Electric buses are, on average, 60% more energy efficient than diesel buses. Each zero emission bus is able to eliminate almost 1,700 tons of CO2 over its lifetime (usually about 12 years), which is the equivalent of taking about 27 cars off the road. A study from Columbia University showed that if New York City were to convert its fleet of buses to electric, it would save almost 500,000 metric tons of CO2 per year.[11]

A zero emission bus can **eliminate almost 1,700 tons of carbon dioxide** over 12 years.

Diesel buses produce many other harmful pollutants as well. In fact, diesel-powered vehicles account for two thirds of all particulate matter emissions in the United States.[12] Over its lifetime, each electric bus can eliminate 10 tons of nitrogen oxide and 350 pounds of diesel particulate matter.[13]

Figure 1: Pollution from diesel buses

Public Health Benefits

Disease and Illness

Traffic pollution causes increased rates of many diseases, including asthma, heart disease, lung cancer, depression, anxiety, obesity, pre-eclampsia.[14] Emissions from road transportation lead to 53,000 premature deaths each year. Reduction in harmful emissions will reduce incidents of illness and respiratory disease, which have been valued at $55,000 annually per bus.[15]

Reduced emissions would benefit those most impacted by pollution, including low income communities and communities of color.[16] Approximately 12 percent of black adults in Erie County suffer from asthma (compared to 10 percent of whites), and the county has some of the highest asthma rates in the country for children under 17.[17] Asthma rates are significantly higher in the low-income neighborhoods on the east and west sides of Buffalo, where air pollution levels are high.[18] On the west side, over 45 percent of residents report that at least one person in their household has a respiratory illness or asthma.[19] Reducing diesel emissions will also decrease heart and lung diseases, which in turn lowers hospital costs and costs associated with work absence.[20]

Erie County has some of the **highest asthma rates** in the country.

Noise Reduction

Electric buses result in noise reduction in all aspects of operation, including:[21]

- Exterior cruise-by noise,
- Take-off noise (what is heard when standing at a bus stop),
- Idling noise.

Noise has many significant negative impacts on health, including sleep disturbance, cardiovascular disease, and cognitive performance of schoolchildren.[22] Noise can also inhibit real estate development, shopping, and other generators of revenue for cities.

Economic Benefits

A 2017 study by Carnegie Mellon University researchers found that battery-electric buses are already cost-competitive with CNG and hybrid diesel buses. For cities that receive federal capital funding, the CMU study found, electric buses are already the lowest cost option, since their power and maintenance costs are lower.[23] Even without federal funding, Bloomberg New Energy Finance predicts that electric buses will reach parity with diesel by 2025 or 2030, as battery costs fall from 28% of the bus price to 8%.[24]

When a full cost-benefit analysis is done, including the public health, environmental and social costs of diesel buses, electric buses are already the far cheaper option.

Answering Objections

Recharging stations are required and some fear this may potentially cause delays. However, many buses have fast-charging capabilities such as Proterra's overhead chargers, which "deliver 12-15 miles per every 5 minutes of charging, enabling 24/7 vehicle operation."[25] For those that don't like the appearance of the recharging stations, they could be combined with public art.

There are also fears that electric buses will not be able to operate well in cold weather climates. Recently the city of St. Albert in Canada purchased 3 electric buses from BYD.[26] This was a clear

Battery-electric buses are the **lowest cost option** for cities that receive federal capital funding.

vote of confidence in the notion that the buses can perform in extreme weather situations as temperatures in St. Albert can get as low as -35C in the winters.

Figure 2: An electric bus in snowy weather

Electric Buses in Other Cities

Chicago, Illinois[27]

Chicago entered electric buses into its fleet in 2014. The electric buses in the fleet were funded via the Department of Transportation's Transportation Investments for Greenhouse Gas and Energy Reduction (TIGGER) II and Clean Fuels grant programs and a Congestion Mitigation and Air Quality (CMAQ) grant from the Chicago Metropolitan Agency for Planning.

Nashville, Tennessee[28]

Nashville bought seven electric buses from Proterra in 2014 to serve the free Music City circuit. The Nashville MTA won a federal Clean Fuels grant and received local matching funds from the city.

Park City, Utah[29]

Park City recently became the first mountain resort community in the country and the first city in the state to operate a zero emission bus system. The buses arrived due to a sales tax increase and $3.9 million in federal grant money.

Louisville, Kentucky[30]

In 2015, Louisville introduced a zero emission bus that would overtake the diesel-powered trolley system along three separate streets. The all-electric system (10 buses and 2 charging stations) is part of an $11 million investment, most of that coming from federal and state grants (and $500,000 coming from Louisville Metro).

Foothill Transit, Greater Los Angeles County, California[31]

In 2016, Foothill Transit announced a plan for an all-electric bus fleet by 2030. The plan includes replacing the 300 buses in Foothill's fleet. Foothill Transit started with 15 electric buses on one of its lines, creating the first fast-charge, all electric bus line in the nation. The

electric buses they use can recharge fully in 10 minutes and have a range of about 35 miles.

Antelope Valley Transit Authority, Northern Los Angeles County, California[32]

The AVTA awarded a contract to BYD for the purchase of 85 electric buses over the next five years. This agreement will result in the complete electrifying of its fleet and it was the first transit system with the stated goal of "100% Green in 2018."

Los Angeles, California[33]

The Metropolitan Transit Authority has begun plans to eliminate emissions from its bus fleet by 2030 through the purchase of more than 2,300 buses. As part of the first step towards this goal, there is a $138 million proposal on the table that will provide for the purchase of 95 buses along two lines (and the installation of needed infrastructure).

Electric buses have been introduced in cities across the U.S., from Chicago to Louisville to L.A.

Figure 3: An electric bus in Los Angeles

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