

All-Electric Bus Program

New York, NY

Presentation to AEC
Advanced Energy Conference

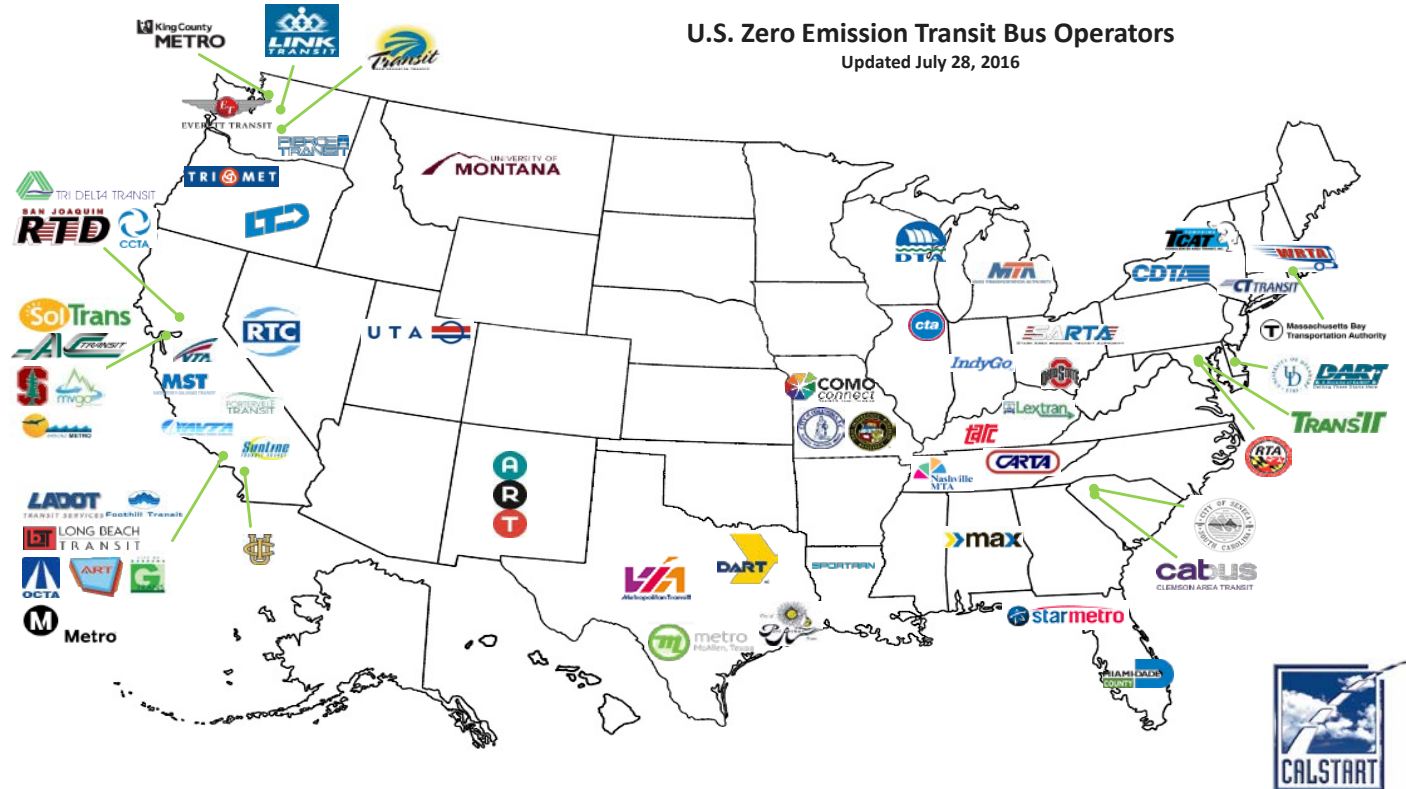
March 2018



Electric Buses are

- ❑ ZERO Emissions
- ❑ Quieter (inside and outside)
- ❑ Smoother Accelerating
- ❑ Growing rapidly worldwide, lowering vehicle costs
- ❑ *Not ZERO Impact*

Bus agencies across the US are quickly testing or adopting Electric Buses



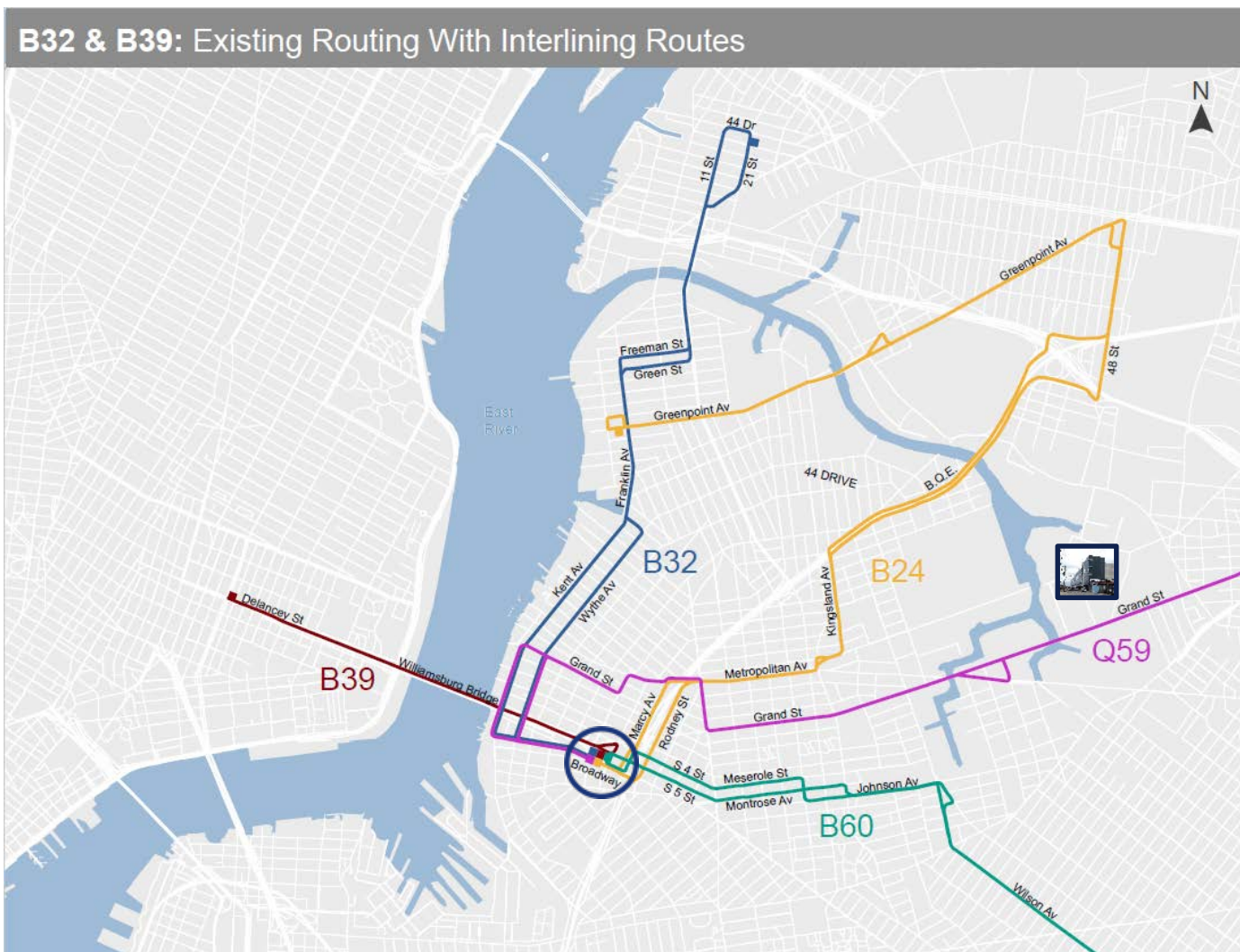
Extensive coordination with multiple stakeholders to successfully scale up Electric Bus deployments



Phase I: Test & Evaluate 10 buses
Phase II and Phase III: scale-up based on results

- **Phase I** - Lease **10** standard **40-foot buses & charging systems** from two separate vendors to start revenue service Quarter 1 2018
 - **Pilot Objectives**
 - Evaluate Various Battery Sizes
 - Depot vs. En-Route Chargers & Charging
 - Develop Requirements, Specifications & Standards
- **Phase II** – **60** buses including 15 articulated 60-foot buses
- **Phase III** – up to **???** buses

Brooklyn and Queens routes are ideal for testing AEB operation in medium average speed routes



Williamsburg Bridge Plaza Brooklyn, New York



Charging Equipment: NEW Mast: Option C: Plain



Crosstown Manhattan routes are ideal for testing AEB operation in low average speed routes

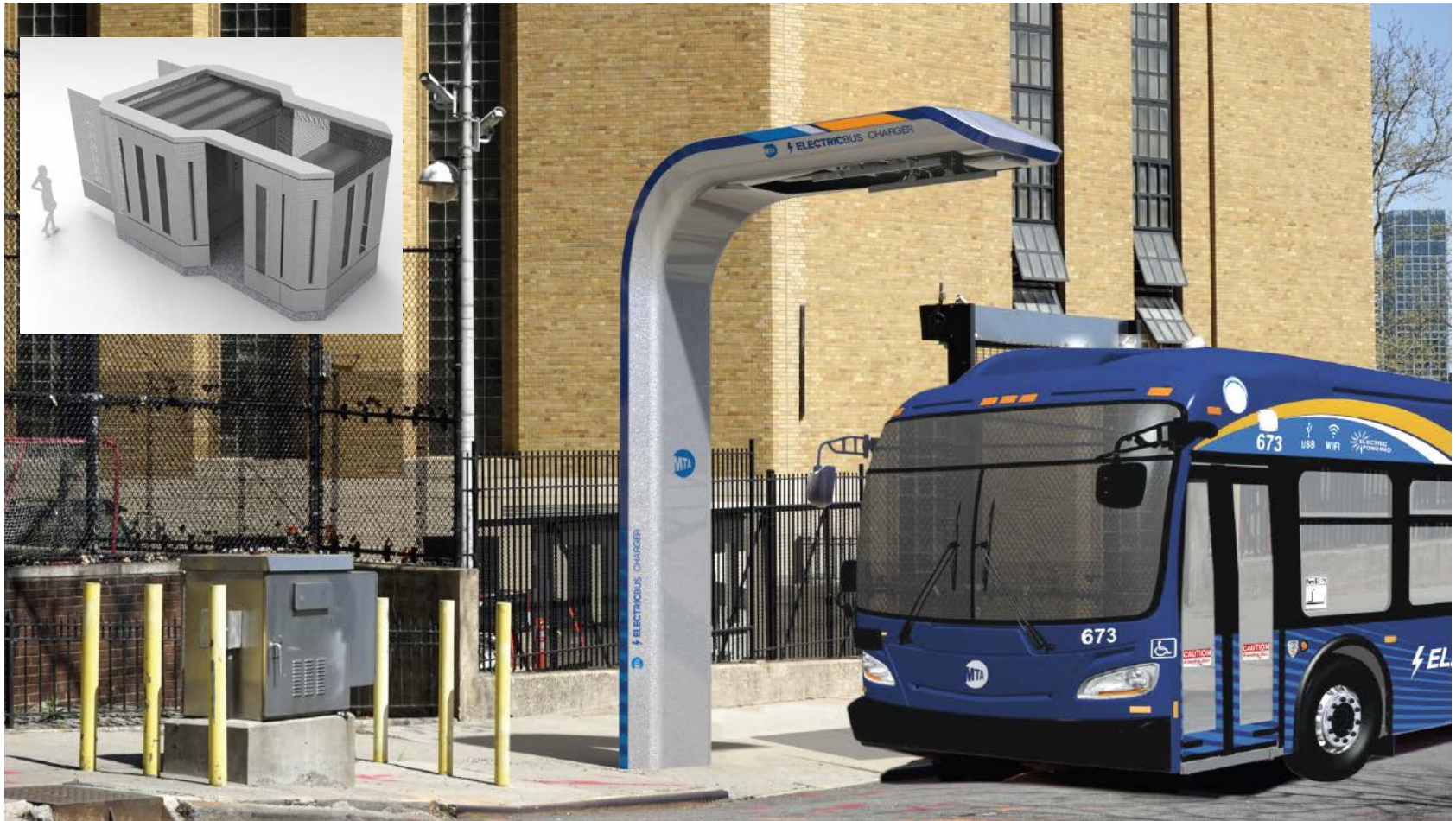


Siting charging equipment with minimal impact on streetscape (West Side of Manhattan)



Terminal for **M42** and **M50**, West 43rd Street, Manhattan, Circle Line

Siting charging equipment with minimal impact on streetscape (East Side of Manhattan)



Terminal for **M42** possibly **M50**, East 41st Street, Manhattan,
TBTA Queens Midtown Tunnel – Ventilation Tower

Charging Systems/Electrical



Design & Safety

- IEC
- SAE
- NFPA
- IEEE
- NEC
- Other standards

Phase I status and, Next Steps

- Board Reviewed/Approved
 - April 2017 – July 2017 (Brooklyn/Queens)
- NYC Public Design Commission Approved
- CD 30/60/90/100 Approved
- Contracts Awarded – Q3 2017
- Began Revenue Service Q1 2018
- Re-Engaging the Internal and External Stakeholders
- Design, Permit, ***Install & Commission On-Street Charging Systems***
- ***Evaluate future deployments***
- ***Evaluate potential to support Special Operations (such as L-Train Canarsie Tube Overhaul for NYCT Subway System)***



Our objectives are aligned, in reducing greenhouse gas (GHG) emissions

- Continue to improve air quality in the region and mitigate climate change
- Implement a 10 bus AEB pilot to gain knowledge and experience in New York operating environment
- Zero Emissions does not mean Zero Impact

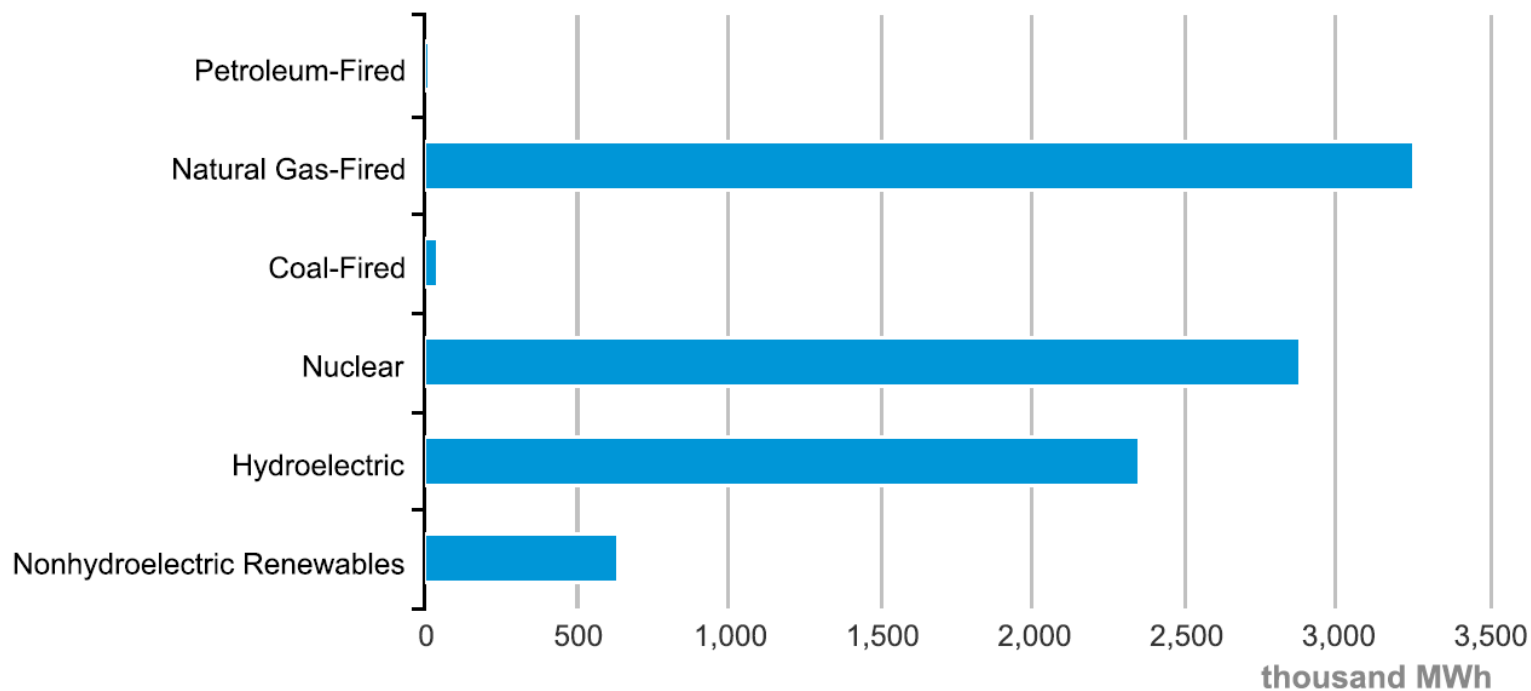
The image shows a screenshot of the New York State Department of Environmental Conservation website. The top navigation bar includes 'Services', 'News', 'Government', and 'Local'. The main content area features the title 'Executive Order No. 24 (2009) Establishing a Goal to Reduce Greenhouse Gas Emissions Eighty Percent by the Year 2050 and Preparing a Climate Action Plan'. Below the title, there are several paragraphs of text, including 'WHEREAS, an emerging scientific consensus recognizes that the increased concentration of carbon dioxide in the atmosphere, along with other heat-trapping greenhouse gasses, resulting from the combustion of fossil fuels and changes in land use, is contributing to global warming and climate change; and', 'WHEREAS, many scientists warn that unmitigated climate change is expected to result in significant adverse impacts to our communities, economy and environment; and', 'WHEREAS, according to the scientific assessments of the United Nations Intergovernmental Panel on Climate Change, and other work, substantial reductions in greenhouse gas emissions by mid-century are necessary to avoid the most dangerous effects of climate change; and', 'WHEREAS, the reduction of global warming and limitation of climate change effects requires a collaborative, international effort to reduce the emission of greenhouse gases around the globe; and', 'WHEREAS, New York and other states should work collaboratively with the federal government to develop and implement plans and policies that will achieve reductions in greenhouse gas emissions in the United States; and', 'WHEREAS, expanding and advancing energy efficiency and renewable energy projects will reduce greenhouse gas emissions and create new jobs; and', 'WHEREAS, New York State has demonstrated leadership in this effort by undertaking actions such as:'. A list of actions follows, including 'Executive Order No. 7 (2008) Establishing a State Energy Planning Board and Authorizing the Creation and Implementation of a State Energy Plan; Executive Order No. 4 (2008) Establishing a State Green Procurement and Agency Sustainability Program; Creation of the Governor's Smart Growth Cabinet; Adoption of goals and policies for energy efficiency and green building technology in State buildings, and for the use of hybrids in State vehicles and buildings; Creation of the New York State Office of Climate Change in the New York State Department of Environmental Conservation; Participation in the Regional Growth/Green Initiative, a five-state cooperative effort to reduce greenhouse gas emissions from electric power plants by means of a cap and trade system; Creation of an Energy Efficiency Portfolio Standard, which is intended to reduce the State's electricity consumption by 15 percent below projected levels by 2015, complementing the State's System Risk Reduction Plan; the formation of a Nonwaste Energy Task Force and a Sea Level Rise Task Force; Collaboration with other northeastern and mid-Atlantic states on the development of a regional low carbon fuel standard; Establishment of a '45 x 17' initiative, which sets a goal to meet 45% of New York's electricity needs through improved energy efficiency and clean renewable energy by 2015; Adoption of regulations establishing greenhouse gas exhaust emission standards for motor vehicles; Enactment of legislation requiring new motor vehicles to bear labels disclosing information to consumers about vehicle greenhouse gas emissions; and Enactment of legislation establishing 'green' residential and State building programs.

Below the text is a large blue graphic with the text '#ONENYC' and 'IT'S CALLED #ONENYC'. To the right of the graphic is a collage of images related to the climate action plan, including a large green 'Y', a large yellow 'E', a large blue 'N', and various smaller images of people and nature. The text at the bottom of the graphic reads: 'and it's the plan for a strong and just city. Together with all New Yorkers, we're acting on our plan for growth, sustainability, resiliency, and equity. Will you be a part of it?'



Electricity to charge Electric Buses... Where does it come from?

New York Net Electricity Generation by Source, Apr. 2017



Source: Energy Information Administration, Electric Power Monthly



Some of the Project KPIs

- Project Stakeholders
 - Internal
 - External
- Inform Policy? Utility? Future Procurements?
 - Configurations
 - Specifications (APTA has Electric Buses in the new spec)
- Project Owner
- Project Funding Sources
- Project Schedule
- Align Project with State and Local Emission Goals
- Can project results help develop a Strategy for scaling up?



Thank you!

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