



**Massachusetts Bay  
Transportation Authority**

# MBTA Bus Fleet and Facility Update

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April 26, 2021

# Agenda

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- MBTA Bus Fleet and Facilities Goals
- Program Initial Steps
- Implementation Plan Going Forward (Financially Unconstrained)
  - Facilities
  - Fleet
- Funding Needs and Timeline



# Existing Bus Maintenance Facilities



**Nine maintenance garages house 1,150 buses, with a limit on expansion and zero facilities that accommodate a full BEB fleet.**

- 1904 – Quincy Opens (Streetcar)
- 1925 – Fellsway Opens, Quincy to Bus
- 1936 – Lynn Opens
- 1941 – Albany Opens
- 1975 – Cabot + Charlestown Open
- 1979 – North Cambridge Opens (ETBs)
- 2002 – Southampton Opens (60-ft only)
- 2004 – Arborway (temporary facility)

# Bus Transformation Goals: Fleet and Facilities

**MBTA does not view fleet and facility decisions in isolation – they are an integrated strategy, with the following goals:**

- **Convert the entire bus fleet to zero emissions technology** and implementation of associated facility investments in support of Commonwealth’s carbon reduction goals
- **Modernize all bus maintenance facilities** to accommodate zero emissions technology and improve conditions for our workforce to support their efforts to keep our service reliable for our passengers
- **Transition to a more uniform bus fleet replaced on a predictable, annual timetable** to reduce capital, maintenance, and operations costs in support of fleet reliability for our passengers
- **Allow for an increase in fleet size** to position the MBTA’s bus network redesign to meet the needs of growing ridership

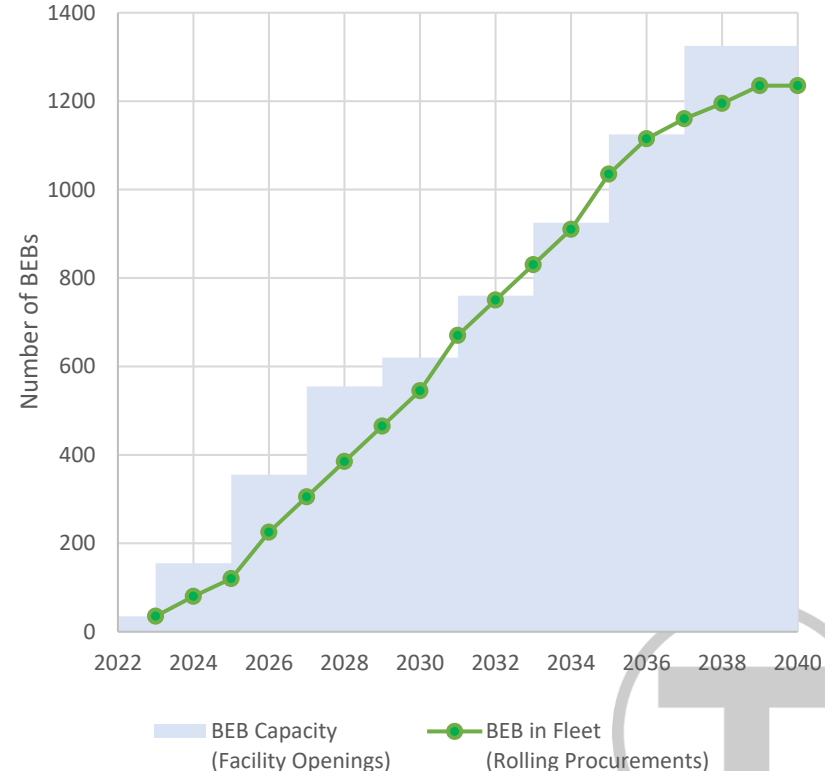
The goals for the MBTA’s Fleet and Facilities support the Bus Transformation’s overall aim to center rider benefits through focus on equity, service, reliability, and sustainability.



# Integrated Fleet and Facility Strategy

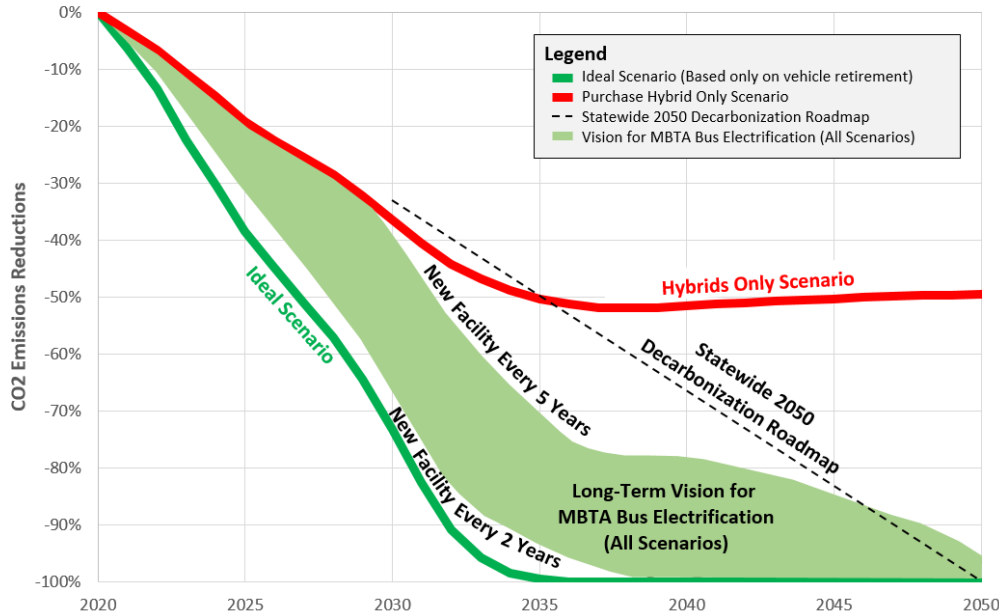
Achieving the Fleet & Facilities goals requires:

- **Approx. \$4.5B** invested in delivering a new bus facility every 2 -3 years to support the phased introduction of BEBs.
  - Requires continuation of **sustained, annual programming** for design/real estate (\$30 - 70M) and construction (\$300M+) starting in FY22
- **\$100 - 130M annually** to purchase 80 to 100 buses to replace buses at end of service life, technology (BEB or hybrid) pending facility capacity
  - Requires continuation of **sustained, annual programming** for bus procurements to maintain reliability and transition to BEB



# Bus Electrification Emissions Reduction Path

MBTA Bus Electrification Scenarios  
Bus Fleet Emissions Reductions



## Facility capacity acts as bottleneck

- Largest risks to plan are facility funding, utility capacity, and construction delays
- BEB technology has advanced to point where strategies are available (managed charging, auxilliary heaters) to allow for transition to begin today
- **Building facility capacity requires sustained, annual design/real estate/ construction funding in CIP**

# Prioritization of Initial Fleet and Facility Investments

To ensure continuity of reliable bus service for our customers, initial decisions have been driven by:

## ***Facility Obsolescence***

Problem: Facilities only able to accommodate oldest diesel fleet (2006-2009)

### **Albany**

Solution: Albany Garage Doors project (under construction) to address vertical clearance

Why?: Cost effective solution (\$2M) allowed for quick fix

### **Quincy**

Solution: Construct new Quincy facility (in 75% design)

Why?: Inability to rebuild in place; lack of quick fix made it priority for first BEB facility

## ***Fleet Age/Reliability/Flexibility***

Problem: Older boutique fleets in need of retirement

### **Silver Line Transitway Fleet**

Solution: Purchase enhanced electric hybrid fleet

Why?: Results of 2019/20 pilot, BEB constraints at Southampton, and NFI contract option make EEHs most cost effective choice for improving reliability and flexibility

### **North Cambridge Trolleybus Fleet**

Solution: Procurement of BEBs

Why?: Carhouse and routes can accommodate BEBs and availability of power make BEBs the most cost effective choice for improving reliability and flexibility

## Prioritization for Next Facility Investments

Now that critical facility obsolescence and fleet age/reliability issues have been addressed, sequencing of facility upgrades to be prioritized based on the following:

- **Transit Critical Communities** – Upgrade facilities with routes serving high percentages of households of color and low income households
- **Ridership** – Upgrade facilities with routes serving a greater share of MBTA bus ridership
- **Alignment with Fleet Plan** – Upgrade facilities to allow for continued homogenization of fleet
- **Swing Space** – In order to modernize our largest and most centrally located facilities (e.g. Charlestown) capacity elsewhere is needed to temporarily relocate those fleets

Where new locations will be necessary, siting decisions to consider deadhead mileage, land acquisition costs, land use, power availability, resiliency, roadway access





# Prioritization Criteria and Existing Facilities

Network	Facility	Capacity	Fleet Notes	% Total Fleet	% Bus Ridership (avg. weekly)	% Low Income Households along Routes	% Households of Color along Routes
<b>South</b>	Quincy	86	Exclusive Diesel*	8%	5%	28%	40%
<b>Southwest</b>	Arborway	118	Exclusive CNG	<b>10%</b>	<b>13%</b>	<b>35%</b>	<b>55%</b>
<b>North</b>	Fellsway	78	n/a	7%	5%	27%	32%
	Lynn	106	n/a	9%	8%	35%	42%
<b>West</b>	N. Cambridge	28	ETB Exclusive*	2%	3%	18%	28%
	Albany	148	Exclusive Diesel*	13%	5%	29%	38%
<b>Core</b>	Southampton	107	Exclusive Artic**	<b>9%</b>	<b>15%</b>	<b>42%</b>	<b>63%</b>
	Cabot	205	Partial CNG**	<b>18%</b>	<b>22%</b>	<b>39%</b>	<b>55%</b>
	Charlestown	263	n/a	23%	26%	25%	39%

\* Initial investments to address functional obsolescence and fleet replacement needs.

\*\* Ability to absorb these fleets at other facilities as capacity expands.

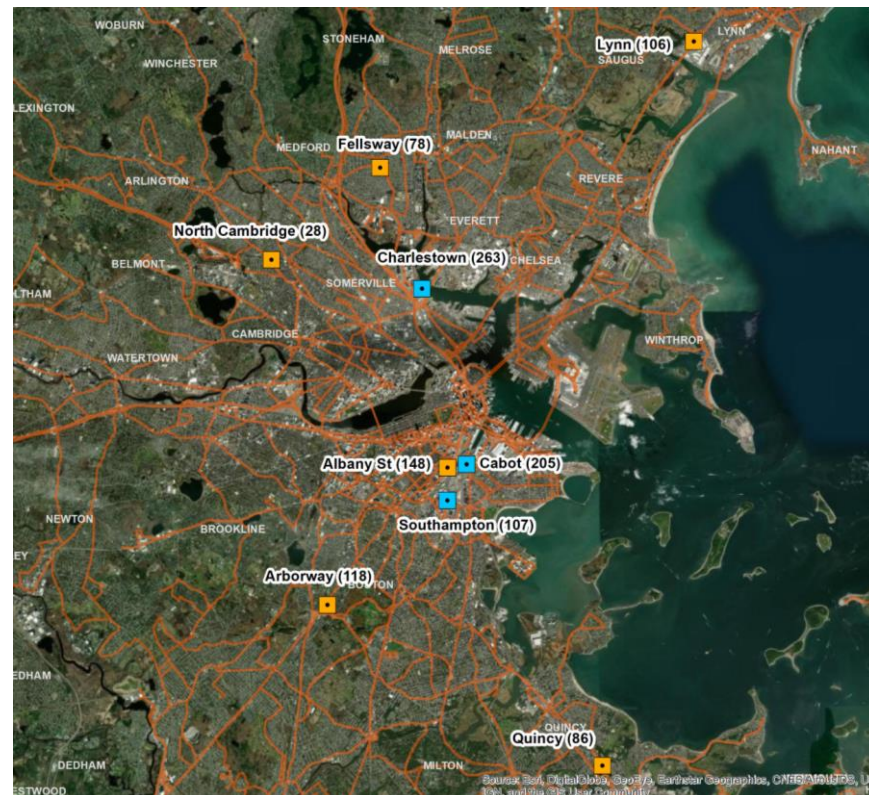


# Core Facilities – Approach

**Charlestown** (263 buses), **Cabot**, (205) and **Southampton** (soon to be 120 articulated buses) are the largest capacity and most centrally located facilities in the MBTA’s portfolio

## Assumptions/Considerations

- Plan assumes these facilities remain in place – although additional property may be necessary to expand existing footprints
- Need for capacity elsewhere to rebuild in place suggests these will be the last facilities modernized
- Opportunities to reassign routes from these garages as others are rebuilt and expanded will be explored throughout the program



# Arborway – Approach

Arborway (118 buses) was built as a temporary facility in 2004 and is the only facility dedicated exclusively to CNG buses

## Assumptions/Considerations

- Arborway ranks third among the MBTA's bus facilities for the percentage of populations served who are low income or minority; and its routes serve 13% of MBTA bus ridership, with 10% of the fleet
- Some constraints on redevelopment of the existing site by MOU with City of Boston
- New facility should be able to accommodate both a larger fleet (~200 buses) and a mix of 40' and 60' buses
- CNG fleet is due for replacement in 2028/29



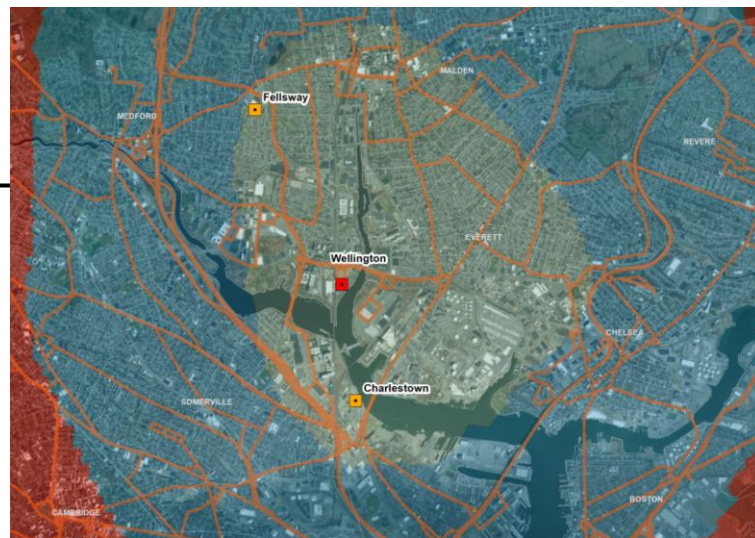


# Fellsway/Lynn – Approach

Fellsway (78 buses) and Lynn (105 buses) are smaller facilities, with Fellsway closed on Sundays and Lynn serving a mostly Lynn-oriented local network

## Assumptions/Considerations

- Neither Fellsway nor Lynn can be modernized on site for even today's fleet size
- A new Fellsway should be sized to accommodate both a larger fleet (~200 buses) and a mix of 40' and 60' buses; ideal location near Wellington
- Six Lynn routes operate in the core and would be better out of a New Fellsway, and an expanded facility could absorb proximate Charlestown routes
- A new Lynn could be smaller (65 buses) but would need a new Fellsway in place first

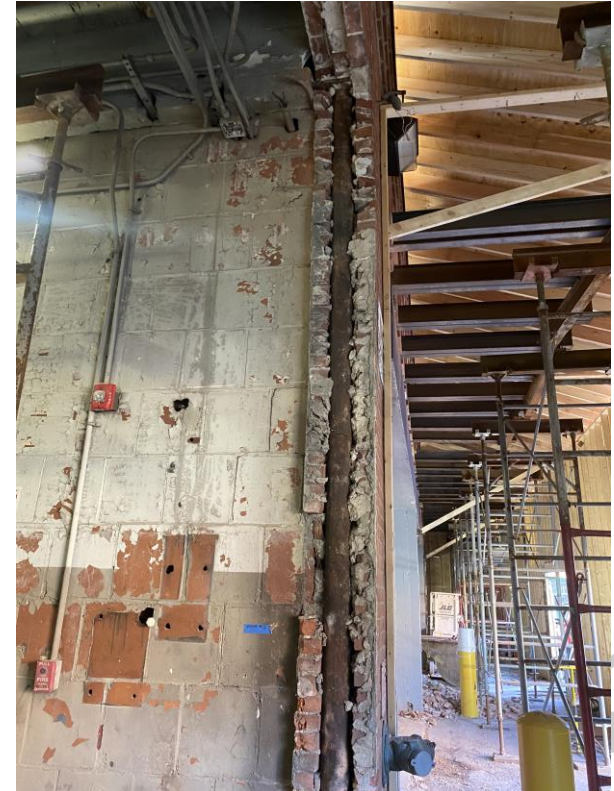


# Albany – Approach

Albany (128 buses) routes have experienced the most significant decline in ridership during the pandemic as many routes are express or serve lower density portions of the network

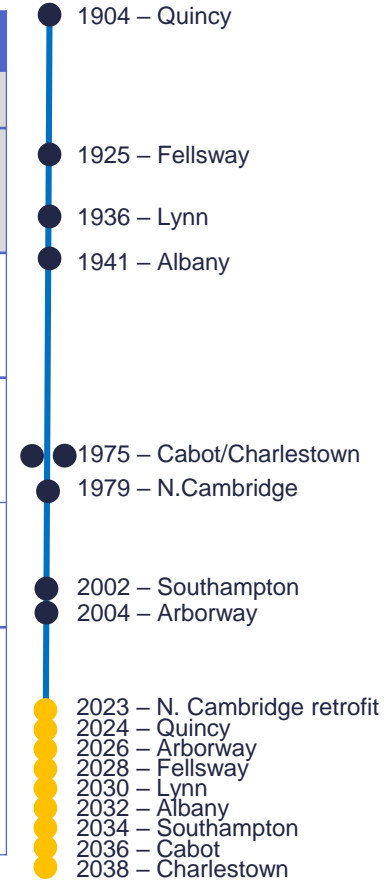
## Assumptions/Considerations

- Albany's central location means it will **play a critical role in the bus network** as other facilities are modernized in place; ongoing investments reflect its continued importance moving forward
- More than any other facility, Albany's long-term future needs will depend on post-pandemic ridership trends and the Bus Network Redesign process
- Given Albany's existing route assignments, a new facility could be as well or better located a few miles to the west



# Facility Modernization Implementation Plan (Unconstrained)

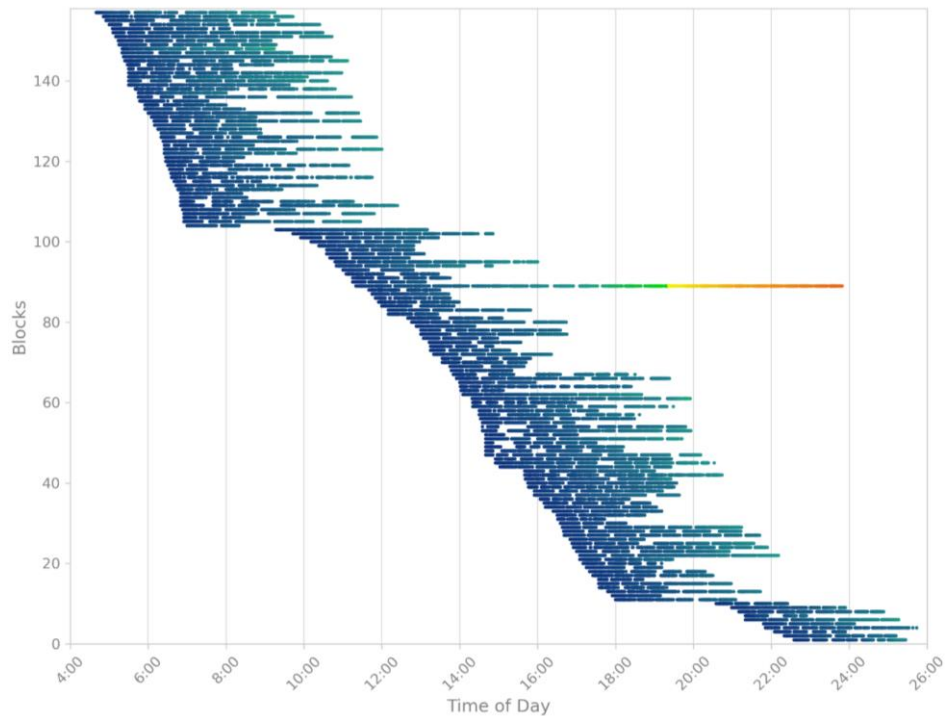
Facility	Status	Timeline	Capacity	Fleet/ Routes to Transition to BEB
<b>Quincy</b>	In progress	Opening Q4 2024	120	Quincy
<b>N Cambridge Retrofit</b>	In Design – \$23M Construction Funding Needed FY22	Construction 2022 - 23	35	North Cambridge
<b>Arborway</b>	Next Priority – \$30M Design Funding Needed FY22	Design 2021-2024 RE Acquisition? 2022-23 Construction 2024-26	200	Arborway Partial Cabot Partial Southampton
<b>Fellsway</b>	Next Priority – Design Funding Needed FY23	Design 2023-2026 RE Acquisition? 2024-25 Construction 2026-2028	200	Fellsway Partial Lynn (E Boston/Chelsea Routes) Partial Charlestown
<b>Lynn</b>	Next Priority – Design Funding Needed FY24	Within next 10 years * once larger Fellsway in place	65	Remaining Lynn
<b>Albany</b>	Future Phase	10+ years	TBD, pending demand	Remaining Fleet (including North Cambridge)
<b>Southampton</b>				
<b>Cabot</b>				
<b>Charlestown</b>				



# Quincy BEB Strategy – Full Fleet Converted by 2025

**MBTA plans to open facility with 45 BEBs, transition remaining buses in Year 2 (2025).**

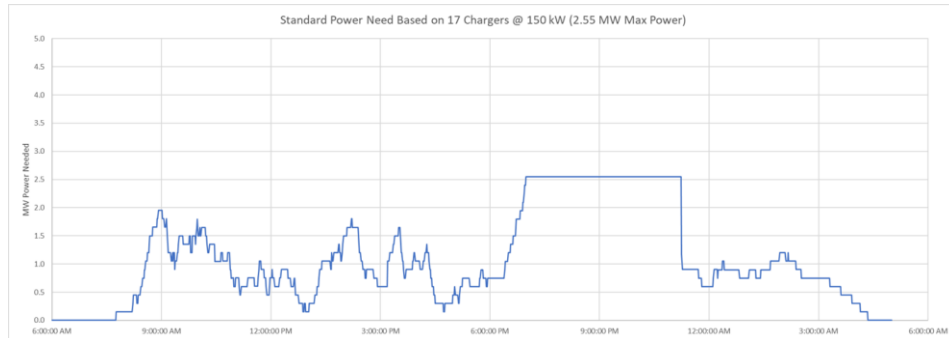
Block Plot for Year 1 - Winter



No additional buses and only 1 block cut (schedule shift) required, when using:

- Long range batteries
- Depot only charging
- Supplemental heaters

Charge management allows for capping peak load.



# Bus Facility Modernization Real Estate Strategy

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MBTA property evaluation must be done in ways that do not disadvantage current property owners or the Authority's own bargaining position. While details of sites under consideration may not be shared, they fall into two categories:

- **\$25M in no regrets investments** – where adjacent parcels are likely to be necessary to expand facilities in place, MBTA Real Estate is prepared to initiate the acquisition process
- **Targeted areas for new facilities** – where it is impractical to rebuild in site, analyses have been conducted to identify the geography within which deadhead mileage and operating cost impacts can be minimized

**Evaluation of parcels** – scans of non-residential properties (or groupings of properties) for internal (Bus Ops, Real Estate) review focused on a number of criteria – resiliency, roadway access, surrounding land use, equity, topography, size, projected cost to acquire, etc.

Note: The MBTA must comply with the Federal Transit Administration's property acquisition process to preserve opportunities for federal funding





# Funding Status of Facility Investments



## Quincy/N. Cambridge

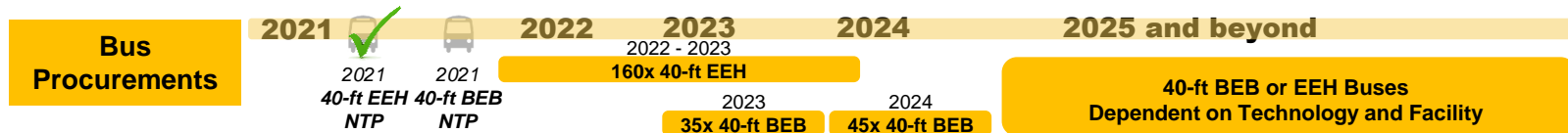
- ✓ Funding currently programmed for in-process Quincy and North Cambridge final design
- ✓ FY22 CIP preview includes funding to keep Quincy on schedule
- FY22 CIP preview does not include funding for North Cambridge

## Next Priorities

- ✓ Funding available to advance remaining facilities to 15% design
- ✓ Remaining bus modernization funding in the current CIP is dedicated to interim improvements or for targeted real estate acquisitions (<\$30m for RE)
- Funding needed for Arborway design (\$30M), real estate (TBD, depends on decision to stay or relocate) in **FY2022**; construction FY2024/5 (TBD)
- Funding needed for Fellsway design (\$30M), real estate (TBD) in **FY2023**; construction FY2025/6 (TBD)
- Overall program – fleet and facilities – represents a multi-billion dollar and decade plus investment strategy



# MBTA Vehicle Procurement Strategy



MBTA to continue to modernize fleet and reduce emissions with 80 to 100 new buses per year. Parallel contracts\* give flexibility to adjust EEH/BEB ratio, determined by facility BEB charging capacity:

- Enhanced Electric Hybrid contract (estimated per vehicle cost: \$750k - \$850k)**
  - Initial 160 base order delivery in 2022 and 2023, with options (unprogrammed) for up to 300 additional buses \*\*
- Battery Electric Bus contract (estimated per vehicle cost: \$850k - \$1.1m)**
  - Initial 80 base order to be delivered in 2023 and 2024, with options (unprogrammed) for up to 380 additional buses\*\*
  - Delivery of first vehicles targeted for 2023, timed to North Cambridge and Quincy opening

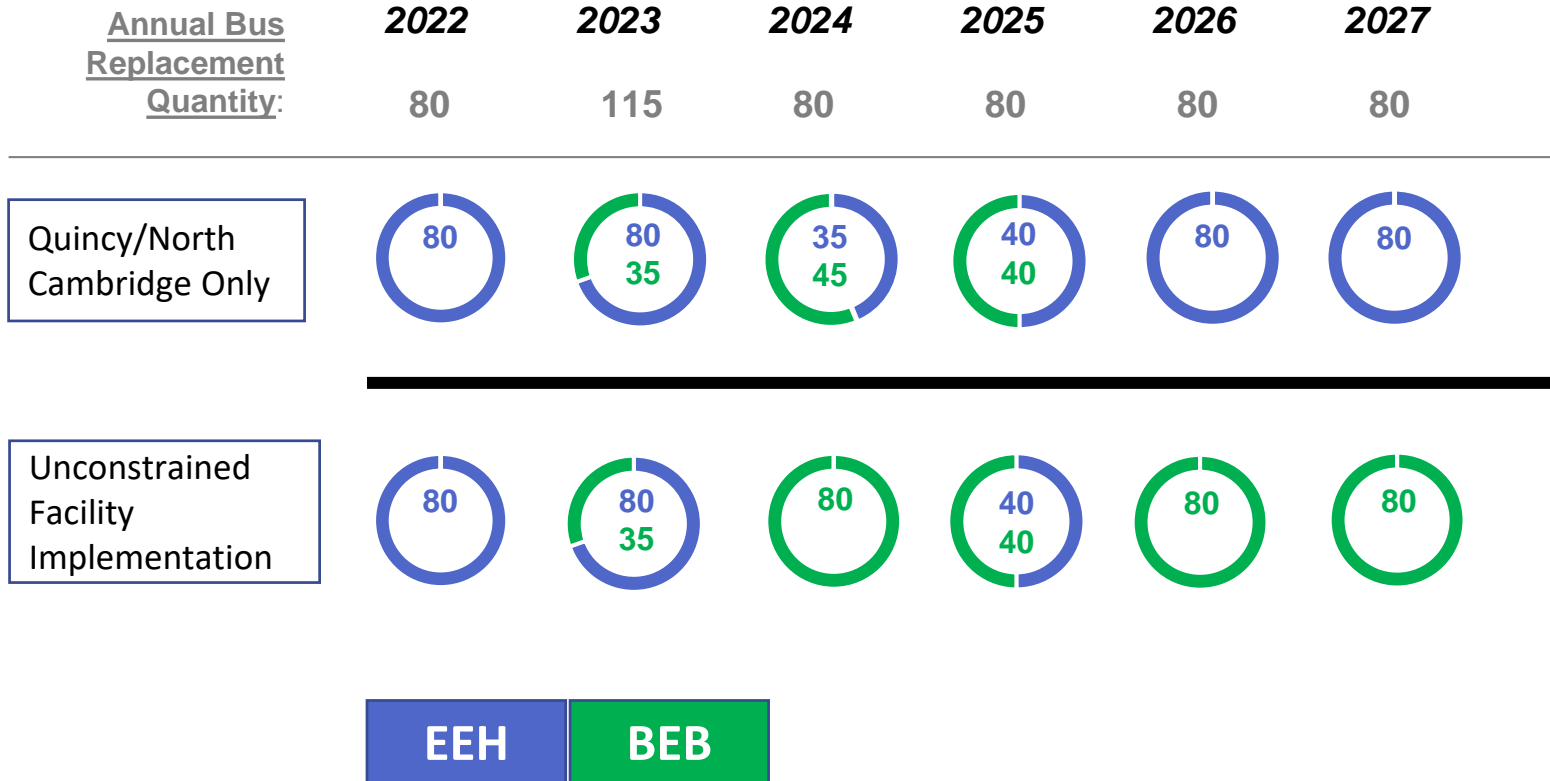
The pace of MBTA bus facility modernization efforts will govern the pace of bus electrification.

\* MBTA Vehicle Engineering strategically plans each FTA-approved bus procurement contract - maximum 5 year duration

\*\* Bus procurement options total 80-100 annually and will be split between the two available contracts



# Vehicle Purchase Options



# Fleet and Facilities Timeline

Investment Type	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
Facilities	Quincy Real Estate (FY21); Quincy Final Design (FY22)	Quincy Construction - \$305M, Included in FY22 CIP Preview			Quincy Opens				
		North Cambridge Final Design and Construction - \$23M, Unprogrammed		North Cambridge Opens					
		15% Design Arborway Programmed	Final Design Arborway- \$25-35M, Unprogrammed (needed FY22)		Construction Arborway- Approx. \$400M, Unprogrammed		Arborway Opens		
				Concept Design Facility #3 Programmed	Final Design Facility #3 - \$25-35M, Unprogrammed		Construction Facility #3 - Approx. \$400M Unprogrammed		
Fleet		Retire 32 DMA fleet , replace with 45 60-ft EEHs							
		310 Diesel buses retire (Includes 86 buses at Quincy - requires new facility) Replace with 160 EEHs							
			ETB Trolleybuses retire Replace with 35 BEBs for N. Cambridge and 45 for Quincy						
						60 Ft Fleet retire (requires new facility) Replace with BEBs			
								CNG Fleet retire (requires new facility) Replace with BEBs,	
				Purchase BEBs or EEHs, dependent on facilities					

# Takeaways

MBTA is prepared to move aggressively towards a zero emissions bus fleet, as part of a coordinated strategy of maintenance facility modernization investments and annual bus procurements.

- New Quincy BMF can proceed on schedule and open at the end of 2024 as a BEB facility **with the approval of the FY22 as previewed** (partial fleet in year one and full BEB fleet in year two)
- Proposed facility investment strategy (with new facilities coming on line every two years) would result in an 80% reduction in MBTA bus emissions by 2032 – **only 0 -15% design is currently programmed in the CIP**
- While FTA guidance on vehicle retirements could represent a constraint, this schedule could be made more aggressive by advancing up to three facilities concurrently – **only 0 -15% design is currently programmed in the CIP**
- With continued, annual investment in bus procurements, the MBTA is positioned to maintain a 7.5 year average fleet age through the replacement of 80 to 100 buses per year – BEBs as facility upgrades allow; or hybrids replacing diesels if facility investments do not keep pace



# Appendix

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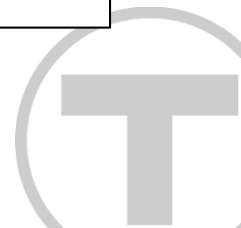
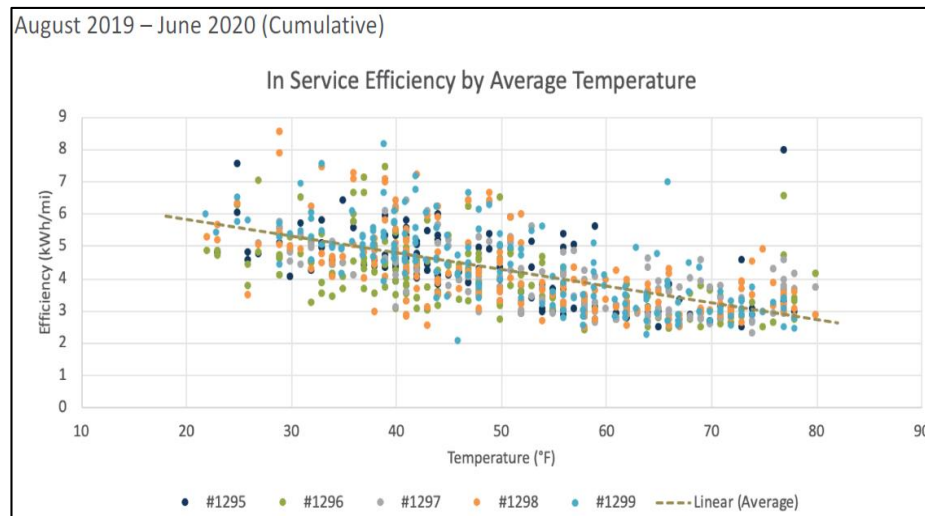
# Southampton BEB Cold Temperature Performance

Range limitations are a major concern for the current BEB fleet – MBTA only has three depot chargers

- 60-110 mile range with full charge (brand new battery, temperature / route dependent)
- Range decreases as battery degrades
- 40%+ range reduction in cold temperatures

Temperature	Max Range (full charge)
20° F	60 mi
30° F	65 mi
60° F	90 mi
70° F	110 mi

***\*Limited low temperature data due to mild 2019/20 winter. BEB performance during colder winter will result in further reduced range.***



## OCS vs BEB Considerations for Routes 71/73

- **Lifecycle Costs:** ETBs have lower upfront costs than BEBs, but upgrades and maintenance of overhead catenary system (OCS)/traction power system add significant costs to lifecycle costs
- **Infrastructure Costs:** Existing traction power system (substations, etc.) in need of replacement within 9 – 12 years (MBTA Systemwide Power Report) and OCS is beyond design life, in need of incremental replacement
- **Operating Costs:** BEBs could rely exclusively on midday/overnight depot charging given existing schedule for Routes 71/73. Cost of electricity can be lower for BEBs than ETBs despite higher overall electricity consumption through avoiding peak periods and demand charges (with charge management)
  - On-board diesel heaters could help extend the BEBs range in winter months, reducing operating and capital costs
- **Maintenance Costs:** OCS and traction power system requires routine maintenance in public ROW
- **Alignment with Fleet Plan:** BEBs bring N. Cambridge in line with systemwide fleet to improve service reliability and flexibility (planned/unplanned disruptions on Routes 71/73, supporting replacement shuttle service), and reduce capital and operating costs (parts replacements, spare ratio, etc.)





# Bus Facility Modernization Power Strategy

**MBTA is advancing our transition to battery electric bus technology strategically to ensure that transforming our fleet does not impact the service experienced by our riders.**

**Utility Coordination** – MBTA has met regularly with both National Grid and Eversource over the past year to both plan for battery electric bus charging needs at Quincy and North Cambridge, and discuss other (existing and potential) locations for BEB facilities

**Charging Strategies** – Analysis of long-range battery buses (relying primarily on depot charging) and short-range battery buses (relying on a combo of depot and in-route layover charging) points to depot charging as the best approach for Quincy and North Cambridge

- *Expectation is that in-route charging will have a role as more of the fleet is converted*

**Battery Range Concerns** – After Southampton BEB pilot, auxiliary heaters give MBTA greatest confidence in converting fleet without increasing operating cost of fleet size, but final decision has not been made

**Backup Power** – Replacing full facility charging capacity during power outages will be challenging but can be managed at Quincy and North Cambridge.

- *At larger, busier facilities, or in the event of regional blackouts, bus service as a mobility option could be significantly compromised*



# Vehicle Procurements

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- Immediate need:
  - Replace 310 (2006-2009) diesel buses - age, reliability, condition, emissions
  - Replace 28 ETBs (2004) - age, reliability, condition
- Phase 1 Action – two 5-year contracts
  - EEH contract (base 160 buses) – solicited Feb 2021
  - BEB contract (base 80 buses) – to be solicited Summer 2021
  - Contractual options allow flexibility for Authority to:
    - **Do nothing** (continue purchasing EEH)
    - **Aggressively build charging facilities** (purchase BEBs) – Unconstrained

