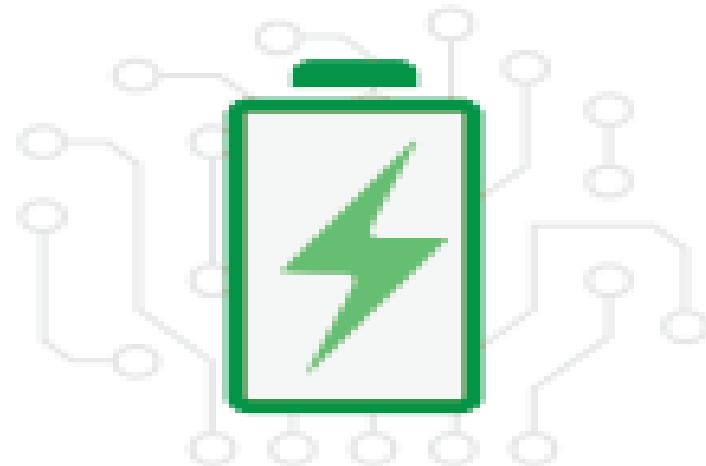


ANNAPOLEIS DEPARTMENT OF TRANSPORTATION
PRESENTS

"TOWARD A ZERO EMISSION BUS FLEET FOR ANNAPOLEIS TRANSIT"



**Annapolis City Council Work Session
June 22, 2021**

OUTLINE

- 1. Introduction**
- 2. Overview of Current Transit Bus Fleet**
- 3. Vehicle Replacement Plan & Cost**
 - (a) Fossil Fuel Vehicles**
 - (b) Battery Electric Bus Fleet**
 - (c) Cost Summary – Fossil Fuel vs Battery Electric**
- 4. Action Plan**
 - (a) Funding Scenarios**
 - (b) Charging Infrastructure**
 - (c) Training & Maintenance**
- 5. Zero Emission Vehicles: LOTS and OLTS**
- 6. FY 2022 – the year for first order for electric buses?**
- 7. Battery Electric Transit Bus Experience: The Case of Frederick County Transit**
- 8. Questions**

CURENT TRANSIT BUS FLEET (TABLE 1)

Counter	Bus #	Model Year	Vehicle Type	Current Mileage	Useful Life Miles	Useful Life-Years	Estimated Useful Life Remaining	
							Miles	Years
1	253	2005	30' Medium Duty	150,075	200,000	7	49,925	-3.4
2	256	2005	30' Medium Duty	163,214	200,000	7	36,786	-3.4
3	5209	2009	30' Heavy Duty	509,016	350,000	10	(159,016)	-1.2
4	5409	2009	30' Heavy Duty	479,266	350,000	10	(129,266)	-1.2
5	5211	2011	30' Heavy Duty	400,165	350,000	10	(50,165)	0.2
6	5311	2011	30' Heavy Duty	442,045	350,000	10	(92,045)	0.2
7	5411	2011	30' Heavy Duty	370,557	350,000	10	(20,557)	0.2
8	5511	2011	30' Heavy Duty	409,155	350,000	10	(59,155)	0.2
9	4311	2011	30' Heavy Duty Hybrid Trolley	269,193	350,000	10	80,807	0.3
10	1800	2018	26' Light Duty	90,001	150,000	5	59,999	2.3
11	1801	2018	26' Light Duty	109,626	150,000	5	40,374	2.3
12	1802	2018	26' Light Duty	113,750	150,000	5	36,250	2.3
13	1803	2019	26' Light Duty	78,584	150,000	5	71,416	3.2
14	1804	2019	26' Light Duty	47,952	150,000	5	102,048	3.2
15	1805	2019	26' Light Duty	79,231	150,000	5	70,769	3.2

30' HEAVY DUTY DIESEL BUS
(25 passenger seats)



LIGHT DUTY SMALL GASOLINE BUS
(CUTAWAY)
(16 passenger seats)



TABLE 2: VEHICLE REPLACEMENT PLAN – FOSSIL FUEL BUSES

Replacement, Expansion, or Refurbishment	Fleet Number	Vehicle Type	Estimated Total Project Costs in FY21 Prices				
			FY22	FY23	FY24	FY25	FY26
Replacement	5411	30' Heavy Duty	\$ 390,000				
Replacement	5511	30' Heavy Duty	\$ 390,000				
Replacement	5211	30' Heavy Duty		\$ 390,000			
Replacement	5311	30' Heavy Duty		\$ 390,000			
Replacement	4311	30' Heavy Duty			\$ 390,000		
Replacement	1801	Small Cutaway			\$ 91,231		
Replacement	1802	Small Cutaway				\$ 91,231	
Replacement	1800	Small Cutaway				\$ 91,231	
Replacement	1803	Small Cutaway				\$ 91,231	
Replacement	1805	Small Cutaway					\$ 91,231
Replacement	1804	Small Cutaway					\$ 91,231
Total Projected Vehicle Costs:			\$ 780,000	\$ 780,000	\$ 481,231	\$ 273,693	\$ 182,462

Note: Four (4) Heavy Duty 30' Buses are on order

TABLE 3: VEHICLE REPLACEMENT PLAN – BATTERY ELECTRIC BUSES

Replacement, Expansion, or Refurbishment	Fleet Number	Electric Vehicle Type	Estimated Total Project Costs Based on State of Georgia Contract				
			FY22	FY23	FY24	FY25	FY26
Replacement	5411	30' HD BYD K7M	\$ 526,875				
Replacement	5511	30' HD BYD K7M	\$ 526,875				
Replacement	5211	30' HD BYD K7M		\$ 526,875			
Replacement	5311	30' HD BYD K7M		\$ 526,875			
Replacement	4311	30' HD BYD K7M			\$ 526,875		
Replacement	1801	30' HD BYD K7M			\$ 526,875		
Replacement	1802	30' HD BYD K7M				\$ 526,875	
Replacement	1800	30' HD BYD K7M				\$ 526,875	
Replacement	1803	30' HD BYD K7M				\$ 526,875	
Replacement	1805	30' HD BYD K7M					\$ 526,875
Replacement	1804	30' HD BYD K7M					\$ 526,875
Total Projected Vehicle Costs:			\$ 1,053,750	\$ 1,053,750	\$ 1,053,750	\$ 1,580,625	\$ 1,053,750

NOTE: Cost of Battery Electric Bus excludes cost of charging stations

BYD 30' ELECTRIC TRANSIT BUS (K7M)



2 doors; 22 passenger seats

TABLE 4: SUMMARY OF REPLACEMENT COST (Tables 2 & 3)

Fiscal Year	Fossil Fuel (As Is)	Electric Bus	Difference
FY22	\$780,000	\$1,053,750	\$273,750
FY23	\$780,000	\$1,053,750	\$273,750
FY24	\$481,231	\$1,053,750	\$572,519
FY25	\$273,693	\$1,580,625	\$1,306,932
FY26	\$182,462	\$1,053,750	\$871,288
Total	\$2,497,386	\$5,795,625	\$3,298,239

ACTION PLAN – FUNDING SCENARIO A: “As Is” (Table 5)

Fiscal Year	FY22	FY23	FY24	FY25	FY26
Vehicle Type (Qty)	HD (2)	HD (2)	HD (1); LD (1)	LD (3)	LD (2)
Total Project Cost fossil bus	\$780,000	\$780,000	\$481,231	\$273,693	\$182,462
Fed/State Match @ 90%	\$702,000	\$702,000	\$433,108	\$246,324	\$164,216
Local Match @ 10%	\$78,000	\$78,000	\$48,123	\$27,369	\$18,246

HD - 30' Heavy Duty Diesel Bus

LD - 26' Light Duty Small Bus (Cutaway)

ACTION PLAN – FUNDING SCENARIO B: ELECTRIC BUS (TABLE 6)

FED/STATE MATCH @ 90% OF COST OF 30' HEAVY DUTY DIESEL BUS (\$390,000)					
Fiscal Year	FY22	FY23	FY24	FY25	FY26
Vehicle Type (Qty)	BE (2)	BE (2)	BE (2)	BE (3)	BE (2)
Total Project Cost	\$1,053,750	\$1,053,750	\$1,053,750	\$1,580,625	\$1,053,750
Fed/State Match	\$702,000	\$702,000	\$702,000	\$1,053,000	\$702,000
Local Match	\$351,750	\$351,750	\$351,750	\$527,625	\$351,750

BE - 30' Battery Electric Bus, BYD K7M; cost of charging infrastructure not included

ACTION PLAN – FUNDING SCENARIO: SUMMARY OF LOCAL MATCH (Table 7)

Fiscal Year	No. of Buses	A (As Is)	B (Electric Bus)
FY22	2	\$78,000	\$351,750
FY23	2	\$78,000	\$351,750
FY24	2	\$48,123	\$351,750
FY25	3	\$27,369	\$527,625
FY26	2	\$18,246	\$351,750
Total		\$249,739	\$1,934,625

Notes: Local match for electric buses excludes cost of charging stations.

Under 'As Is', FY 24 – One (1) large bus and one (1) light duty small bus; FY 25 and FY 26 - light duty small buses

ACTION PLAN - DIVERSIFY SOURCES OF GRANTS

LOW-NO EMISSION GRANT

Overview

- Provides funding for the purchase or lease of zero-emission and low-emission transit buses as well as acquisition, construction, and leasing of required supporting facilities
- Administered by Federal Transit Administration (FTA)
- FTA issues notice of funding opportunity in February and applications are due in April
- Possibility of round two in 2021?

LOW-NO EMISSION GRANT

Grant Type

- Competitive program, open to all state and local government transit agencies

Eligible Applicants

- Direct or designated recipients of FTA grants
- States, local governmental authorities and Indian Tribes
- Eligible projects in rural (non-urbanized) areas must be submitted as part of a consolidated state proposal; Indian Tribes exempted from this requirement
- States and other eligible applicants also may submit consolidated proposals for projects in urbanized areas

LOW-NO EMISSION GRANT

Eligible Activities

- Purchasing or leasing low- or no-emission buses
- Constructing or leasing facilities and related equipment (including intelligent technology and software) for low- or no-emission buses
- Acquiring low- or no-emission buses with a leased power source
- Constructing new public transportation facilities to accommodate low- or no-emission buses
- Rehabilitating or improving existing public transportation facilities to accommodate low- or no-emission buses

LOW-NO EMISSION GRANT

Match (Federal)

- Leasing or purchasing a transit bus: not to exceed **85%** of total transit bus cost
- Leasing or acquiring low- or no-emission bus-related equipment and facilities: **90%** of the net project cost.

OTHER GRANTS

FEDERAL/STATE DEPARTMENTS OF ENERGY GRANTS?

- Research grant opportunities

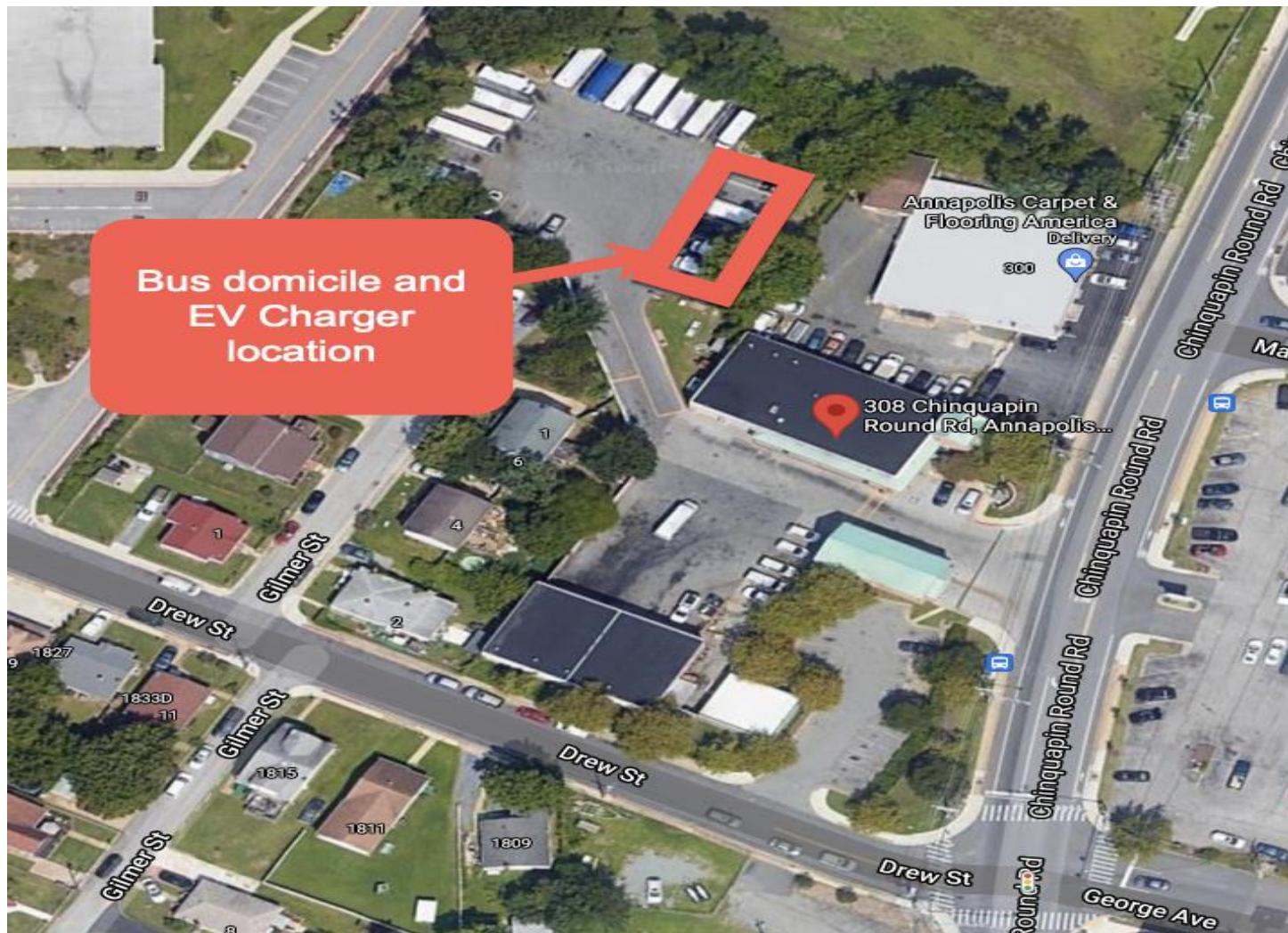
‘REGULAR’ TRANSIT CAPITAL GRANT

- Continue grant application through MDTO MTA Annual Transportation Plan

ACTION PLAN – CHARGING INFRASTRUCTURE

- Utilize existing electrical grid:
 - Will likely require upgrade
 - New transformer and electrical boxes will be required
- Exploring the option of BGE supporting the To The Meter (TTM) infrastructure
- Cost of charging infrastructure
 - Frederick County paid \$175,000 for 10 stations
 - Low-No emission grant pays up to 90%
- A generator will be required to address potential power outages

POTENTIAL LOCATION OF CHARGING STATIONS AT ADOT



ACTION PLAN – TRAINING & MAINTENANCE

Bus Operators

- no coasting through intersections
- shutting the bus off
- parking & sequencing needed for charging

Maintenance

- high voltage systems
- all electric accessories
- specialized PPE
- Retooling of existing maintenance facility? Yes

First Responders (police, fire fighters, etc.)

- how to disable and access electric bus in emergency
- battery fires

Towing Companies

ZERO EMISSION VEHICLES (ZEV): LOTS AND OLTS

LOTS is Locally Operating Transit System (LOTS) operating in the State of Maryland

- 23 LOTS in Maryland
- e.g. Annapolis Transit

OLTS is the Office of Local Transit Support within MDOT MTA

- Provides a variety of technical assistance services to the Local Operating Transit Systems (LOTS) operating in the State of Maryland. These include:
 - Federal and State Regulatory Compliance**
 - Management, Planning, Training**
- OLTS team is in the beginning stages of planning for a ZEV state contract for LOTS
- Goal is to award a contract in FY 2023

FY 2022 – THE YEAR FOR FIRST ORDER FOR ELECTRIC BUSES?

BATTERY ELECTRIC BUS PROCUREMENT Preliminary Estimates

TABLE 8A: PROJECT COST

Description	Unit Price	Quantity	Total Cost
BYD 30' Battery Electric Bus (K7M)	\$526,875	2	\$1,053,750
Charging Station (5-10 stations)	\$175,000	1	\$175,000
Total			\$1,228,750

FY 2022 – THE YEAR FOR FIRST ORDER FOR ELECTRIC BUSES?

BATTERY ELECTRIC BUS PROCUREMENT Preliminary Estimates

TABLE 8B: PROJECT FINANCING

Description	Amount
Federal/State Capital Grants	\$702,000
Required Local Match	\$78,000
Local "Overmatch"	\$448,750
Total Local Match	\$526,750
Total	\$1,228,750

Note: Federal/State match of 90% and Required Local match of 10% of the cost of a 30' diesel bus (\$390,000)

BATTERY ELECTRIC TRANSIT BUS EXPERIENCE

The Case of Frederick County Transit

Five battery electric buses entered service in 2016

Fuel savings in 4.5 years

- **\$397k savings vs diesel**

Maintenance costs and savings

- **To date, \$770k savings vs diesel**

BATTERY ELECTRIC TRANSIT BUS EXPERIENCE

The Case of Frederick County Transit

Problems

- Growing pains are to be expected with new technology, especially for early adopters. Realistic range does not yet meet diesel ability
- Various modules that control the system can and have failed, but are being replaced with more robust units
- Experience a fire on one of the electric buses while in service.
- Early batteries do not handle extreme temperatures well, so care must be taken to avoid battery failure due to temperature extremes. Newer battery technology should solve this problem.

Not committed to purchasing more electric buses until they truly are direct replacements for a diesel bus (being able to operate a full days' worth of service: 18 hours and 250-300 miles)

