



CDTA COMMITTEE AGENDA
Strategic and Operational Planning Committee
Thursday, March 25, 2021 | 12:00 PM | Microsoft Teams Meeting

Committee Item	Responsibility
Call to Order	Mike Criscione
Ascertain Quorum	Mike Criscione
Agenda Approval	Mike Criscione
Approve Minutes of Thursday, February 18, 2021	Mike Criscione
Consent Agenda Items	
• Approve FY2022 Budget	Mike Collins
Administrative Discussion Items	
• Electric Bus Pilot	Chris Desany
Next Meeting: Thursday, April 22, 2021 at 12:00pm via Microsoft Teams and 110 Watervliet Ave.	
Adjourn	

Capital District Transportation Authority

Strategic and Operational Planning Committee

Meeting Minutes – February 18, 2021 at 12:00pm; via Microsoft Teams and 110 Watervliet Ave.

In Attendance: via MT- Jayme Lahut, Mark Schaeffer; at 110 – Mike Criscione, Pat Lance, Carm Basile, Amanda Avery, Lance Zarcone, Jon Scherzer, Jaime Watson, Vanessa Salamy; via MT – Chris Desany, Ross Farrell, Sarah Matrose, Thomas Guggisberg, David Williams, Sarah Matrose

Meeting Purpose

Regular monthly meeting of the Strategic and Operational Planning. Committee Chair Mike Criscione noted that a quorum was present. Minutes from the January 21, 2021 meeting were reviewed and approved.

Consent Agenda Items

Approve Route 50/Geyser Road Improvements -

- In 2020, the City of Saratoga Springs made upgrades to the intersection of New York State Route 50 and Geyser Road. The \$4M project included the construction of an adjoining trail, traffic signal, and pedestrian accommodations. In cooperation with the City, we found that it would be advantageous for the City to procure a contractor for the Geyser Road projects and have that contractor complete CDTA station work.
- The City agreed to bid and complete CDTA station work as designed. Work items would be managed and built by the winning bidder, and those costs would be reimbursed to the City upon completion. The City held an invitation for bids, and William J Keller & Sons Construction was awarded the contract.
- A sole source contract to the City of Saratoga Springs for the transit improvements at the intersection of Route 50 and Geyser Road with a value not to exceed \$100,000 will be recommended to the board for approval.

Administrative Discussion Items

FY2022 Budget Preparation Update -

- We continue to develop the FY2022 operating budget which was provided to the Committee. Current MRT is \$2.7 million over budget and customer revenue is \$11.6M under budget. Next year we are projecting a \$20 million decrease in customer revenue, STOA, and RRS receipts (combined).
- We have not used our federal assistance this year which we can carry over to next year, and we will receive \$28.4 million from another round of federal stimulus funds. We are budgeting wages to be flat. This will be accomplished by keeping service relatively level. We are budgeting a 3% increase for health care and an 8% increase in worker's compensation. We are providing for a modest increase in the professional services and maintenance services lines. Another increase is in the insurance line. Although fairly level for the past several years, the insurance market has been quite volatile this year.
- Our working budget currently shows a \$5.2 million deficit. Options to close the gap include using federal assistance that we did not use yet, and we are taking another look at expenses. We expect to present a balanced budget at the March meeting.

Next Meeting

Thursday, March 25, 2021 at 12:00pm via Microsoft Teams and at 110 Watervliet Ave.

Memorandum

March 25, 2021

To: Chairman, Strategic & Operational Planning Committee
Members, Strategic & Operational Planning Committee

From: Mike Collins, Vice President of Finance & Administration

Subject: FY2022 Operating and Capital Budget Recommendations

Summary

After many meetings and lots of committee input, the budget plan is ready for final review and adoption. I have attached a draft of the FY2022 operating and capital plans. As we work our way through the uncertainty of COVID-19, the impacts of the virus continue to present challenges. We have provided appropriate resources to safeguard employees and customers; and we have been aided by stimulus funds provided by the federal government.

The proposed operating plan is balanced at \$101 million with modest growth at 3.4%. The five-year capital plan provides a vision of potential projects and opportunities. The first year of the capital plan is funded at \$93.4 million with most of it supported by the Washington/Western BRT Small Starts Grant.

Revenue

We will have significant revenue challenges in FY2022 as we expect customer and rail station to be down significantly. We are also unsure of the level of state funding we will receive through the Operating Assistance program (STOA). These concerns have been discussed and our expectation is that although these may improve, we do not know when, and by how much. We will use federal stimulus funds to fund the anticipated shortfall. This is a key point – the stimulus funds are stop gap measures intended to get us through the next three years; they are not additional funds or new fund sources.

Receipts from the Mortgage Recording Tax (MRT) have been outstanding, and the local real estate market is extremely strong. However, it is prudent to expect a slowdown in the market, and we are budgeting modestly for MRT receipts.

We are budgeting \$7.3 million from the Federal 5307 program. As a reminder, this is capital money that we are “flexing” to operations. At the present time, we are budgeting STOA based on a \$4 million reduction in the Governor’s Executive Budget Request. As the Senate and Assembly introduce spending proposals, we will monitor the state budget proposals. Should there be a change in STOA levels, we will revise the budget accordingly.

Expenses

More than 70% of our expenses are related to wages and benefits. The wage line is tied to the amount of service we operate. There are no major expansions planned but we expect to build back a stronger network of service as we rebound from the pandemic. We will continue to expand FLEX and identify new partners for our Universal Access program. We are also negotiating a new collective bargaining agreement with our union that expires this June. The agreement covers wages, benefits, and a variety of work rules.



We are expecting an 8% increase in Worker’s Compensation due to Scheduled Loss of Use Awards along with higher weekly benefits as promulgated by the Workers’ Compensation Board. We do not control these benefit costs.

We are including increases for Professional and Maintenance Service. This will cover upgrades to telecommunications and information technology contracts. We are also modifying our General Insurance line because of significant increases to our commercial insurance lines this past year.

Capital Plan

The first year of our five-year Capital Plan focuses on development of the Washington/Western BRT Line. The plan includes \$11.5 million for 12 Gillig buses; 6 STAR buses; 6 Flex vehicles and 2 NX coach buses. It also includes funds for two lease payments, one of which will be paid off by the end of the year. Most of these bus purchases are funded through the New York State Capital Program.

The capital plan contains facility projects, like lift replacements; bus washers; LED light replacements and street amenities. It also includes an E-Scooter pilot program.

The five-year capital plan must be submitted to the state every year. Keep in mind that in years two through five, not all projects will be funded. Nevertheless, these potential projects include innovative concepts and initiatives and provides a broad road map for the future.

Recommendation

We recommend that the committee advance the budget to the full board for approval. The FY2022 Operating Plan totals \$100,992,742 and the Five-Year Capital Plan totals \$377,652,824.

Copy: Chief Executive Officer
Senior Staff
Director of Finance

**Capital District Transportation Authority
Draft FY2022 Operating Budget
March 9, 2021**

Revenue Item	FY2021 Budget	Budget to Budget Change	FY2022 Budget	% change
Mortgage Tax	\$11,250,000	\$0	\$11,250,000	0.0%
Customer Revenue	\$20,651,667	(\$12,182,667)	\$8,469,000	-59.0%
Advertising	\$1,292,500	\$0	\$1,292,500	0.0%
RRS and Facilities Income	\$3,651,631	(\$2,738,723)	\$912,908	-75.0%
Other	\$208,500	(\$100,000)	\$108,500	-48.0%
Federal Assistance	\$12,701,000	\$23,072,269	\$35,773,269	181.7%
State Operating Assistance	\$43,824,758	(\$5,354,658)	\$38,470,100	-12.2%
State Operating Assistance - NX	\$400,000	(\$100,000)	\$300,000	-25.0%
County Assistance	\$1,917,000	(\$479,250)	\$1,437,750	-25.0%
Grants	\$1,805,786	\$1,172,929	\$2,978,715	65.0%
Total Revenue	\$97,702,842	\$3,289,900	\$100,992,742	3.4%

Expense Item	FY2021 Budget	Budget to Budget Change	FY2022 Budget	% change
Wages	\$48,377,073	\$1,451,314	\$49,828,387	3.0%
FICA	\$3,419,662	\$102,591	\$3,522,253	3.0%
Health Benefits	\$10,651,352	\$319,540	\$10,970,892	3.0%
Workers' Comp	\$2,637,708	\$211,017	\$2,848,725	8.0%
Other Benefits	\$3,988,742	\$261,189	\$4,249,931	6.5%
Professional Services	\$3,889,745	\$300,000	\$4,189,745	7.7%
Materials and Supplies	\$1,686,346	\$150,000	\$1,836,346	8.9%
Miscellaneous	\$736,853	\$0	\$736,853	0.0%
Maintenance Services	\$3,015,258	\$100,000	\$3,115,258	3.3%
Purchased Transportation	\$6,665,359	\$0	\$6,665,359	0.0%
Utilities	\$1,011,000	\$20,220	\$1,031,220	2.0%
Fuel	\$5,669,108	(\$57,838)	\$5,611,270	-1.0%
Parts Tires Oil	\$4,870,870	\$172,905	\$5,043,775	3.5%
General Insurance	\$722,933	\$240,920	\$963,853	33.3%
Claims	\$360,833	\$18,042	\$378,875	5.0%
Total Expenses	\$97,702,842	\$3,289,900	\$100,992,742	3.4%

Revenue over Expense	\$0	\$0	\$0	
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Capital District Transportation Authority

FY2022 DRAFT Capital Plan

March 18, 2021

Project Name	Purpose	Type	2022
WWBRT	System Improvement	BRT	\$77,685,000
Bus Wash	Normal Replacement	Facilities	\$400,000
Mid-Sized Infrastructure	System Improvement	Facilities	\$340,620
Street Amenities (Shelter Program)	State of Good Repair	Facilities	\$250,000
Facilities Maintenance and Engineering	State of Good Repair	Facilities	\$200,000
General Renovations	State of Good Repair	Facilities	\$375,000
Preliminary Engineering - Facilities	State of Good Repair	Facilities	\$150,000
West Facility Design	System Improvement	Facilities	\$125,000
Park & Ride Lots	State of Good Repair	Facilities	\$75,000
RRS Enhancements	State of Good Repair	Facilities	\$60,000
Information Technology	Normal Replacement	Information Technology	\$446,115
UV Disinfecting System	System Improvement	Operating	\$825,000
VanPool	System Improvement	Operating	\$300,000
Car Share	System Improvement	Operating	\$200,000
Marketing iRide	System Improvement	Operating	\$200,000
E-Scooter Pilot Program	System Improvement	Operating	\$125,000
CDPHP Cycle! Update	System Improvement	Operating	\$80,000
Floor Sweeper	Normal Replacement	Operating	\$60,000
Bus Replacement Program - Rolling Stock	Normal Replacement	Rolling Stock	\$6,928,385
NX Commuter Bus Replacement	Normal Replacement	Rolling Stock	\$1,150,000
Fleet Financing 2012	Normal Replacement	Rolling Stock	\$930,000
Fleet Financing 2014	Normal Replacement	Rolling Stock	\$780,000
Flex Vehicles	System Improvement	Rolling Stock	\$710,000
STAR Buses	Normal Replacement	Rolling Stock	\$630,000
Non-Revenue Vehicles	Normal Replacement	Rolling Stock	\$300,000
Trolleys	System Improvement	Rolling Stock	\$175,000
Camera Install	System Improvement	Rolling Stock	\$170,000
Mid-Life Hybrid Replacement	State of Good Repair	Rolling Stock	\$150,000
Total Expense			\$93,820,120
	Note: Fund sources listed are for FY2022 Capital Plan	Section 5307	\$6,311,010
		Section 5339	\$2,420,725
		NYS Capital	\$7,103,385
		MultiModal Setaside	\$300,000
		Small Starts - WWBRT	\$60,889,000
		CDTA Match - WWBRT	\$15,796,000
		Other Match - WWBRT	\$1,000,000
		Unfunded	\$0

Capital District Transportation Authority
FY2022 DRAFT Capital Plan
March 18, 2021

Project Name	Purpose	Type	2023	2024	2025	2026	Total
Mid-Sized Infrastructure	System Improvement	Facilities	\$250,000	\$250,000	\$250,000	\$250,000	\$1,340,620
Street Amenities (Shelter Program)	State of Good Repair	Facilities	\$200,000	\$200,000	\$200,000	\$200,000	\$1,050,000
Facilities Maintenance and Engineering	State of Good Repair	Facilities	\$200,000	\$200,000	\$200,000	\$200,000	\$1,000,000
Preliminary Engineering - Facilities	State of Good Repair	Facilities	\$150,000	\$150,000	\$150,000	\$150,000	\$750,000
Lift Replacement	State of Good Repair	Facilities	\$200,000	\$200,000	\$200,000	\$200,000	\$900,000
Park & Ride Lots	State of Good Repair	Facilities	\$50,000	\$50,000	\$50,000	\$50,000	\$275,000
RRS Enhancements	State of Good Repair	Facilities	\$60,000	\$60,000	\$60,000	\$60,000	\$300,000
Schenectady Driver's Locker/Bathroom	State of Good Repair	Facilities	\$250,000	\$0	\$0	\$0	\$250,000
Schenectady Mechanic's Locker/Bathroom	State of Good Repair	Facilities	\$400,000	\$0	\$0	\$0	\$400,000
Schenectady Gas Tanks	System Improvement	Facilities	\$100,000	\$0	\$0	\$0	\$100,000
RRS Garage Repairs	State of Good Repair	Facilities	\$692,704	\$0	\$0	\$0	\$692,704
RRS Parking Upgrades	System Improvement	Facilities	\$500,000	\$0	\$0	\$0	\$500,000
Maintenance Training Room	System Improvement	Facilities	\$400,000	\$0	\$0	\$0	\$400,000
Fuel Management System	System Improvement	Facilities	\$970,000	\$0	\$0	\$0	\$970,000
Consolidated Operations Facility	System Improvement	Facilities	\$0	\$0	\$150,000,000	\$0	\$150,000,000
Downtown Albany Intermodal	System Improvement	Facilities	\$50,000,000	\$0	\$0	\$0	\$50,000,000
Information Technology	Normal Replacement	Information Technology	\$400,000	\$400,000	\$400,000	\$400,000	\$2,046,115
VanPool	System Improvement	Operating	\$300,000	\$300,000	\$300,000	\$300,000	\$1,500,000
Car Share	System Improvement	Operating	\$120,000	\$130,000	\$130,000	\$130,000	\$710,000
Marketing iRide	System Improvement	Operating	\$200,000	\$200,000	\$200,000	\$200,000	\$1,000,000
NX Commuter Bus Replacement	Normal Replacement	Rolling Stock	\$1,100,000	\$1,100,000	\$1,100,000	\$1,200,000	\$5,650,000
Fleet Financing 2014	Normal Replacement	Rolling Stock	\$780,000	\$780,000	\$0	\$0	\$2,340,000
Flex Vehicles	System Improvement	Rolling Stock	\$0	\$0	\$0	\$0	\$710,000
STAR Buses	Normal Replacement	Rolling Stock	\$570,000	\$570,000	\$570,000	\$600,000	\$2,940,000
Non-Revenue Vehicles	Normal Replacement	Rolling Stock	\$300,000	\$300,000	\$300,000	\$300,000	\$1,500,000
Mid-Life Hybrid Replacement	State of Good Repair	Rolling Stock	\$300,000	\$300,000	\$300,000	\$300,000	\$1,350,000
Electric Bus / Replacement Program	System Improvement	Rolling Stock	\$15,000,000	\$15,000,000	\$15,000,000	\$15,000,000	\$60,000,000
Vehicle Overhaul	State of Good Repair	Rolling Stock	\$300,000	\$300,000	\$300,000	\$300,000	\$1,200,000
Total Expense			\$73,792,704	\$20,490,000	\$169,710,000	\$19,840,000	\$377,652,824

Electric Bus Pilot Program One Year Later

*Strategic and Operational Planning
March 25, 2021*



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Electric Bus Pilot - Overview

- CDTA's first four electric buses were acquired from New Flyer in September 2019
- The board approved a contract with Center for Transportation and the Environment (CTE) for assistance with a pilot in December, 2019
- Electric bus fixed route service began on January 6, 2020
- Viriciti hardware was installed on February 11, 2020
- The purpose of the pilot is to evaluate the performance of the electric buses from a cost and operations perspective



NEW FLYER OF AMERICA



**CENTER FOR TRANSPORTATION
AND THE ENVIRONMENT**



Testing Pilot with CTE

- Planning meetings were held between December and January, 2020
- First monthly testing plan was delivered on January 30, 2020
- Testing began February 11, 2020
- Reports provided quarterly
- First Year Summary Report has been delivered



CENTER FOR TRANSPORTATION
AND THE ENVIRONMENT



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Buses

Four New Flyer Xcelsior XE40 buses

- 466 kWh capacity
- Advertised maximum range of 225 miles
- Officially in service as of January 6, 2020
- Supported by New Flyer Connect system
- Housed and charged in Albany



KILOWATT HOUR (kWh)
a unit of energy used or produced. This is what shows up on your bill.



KILOWATT (kW)
a measurement of capacity; how big your array is.



Energy



Erin Explains Energy



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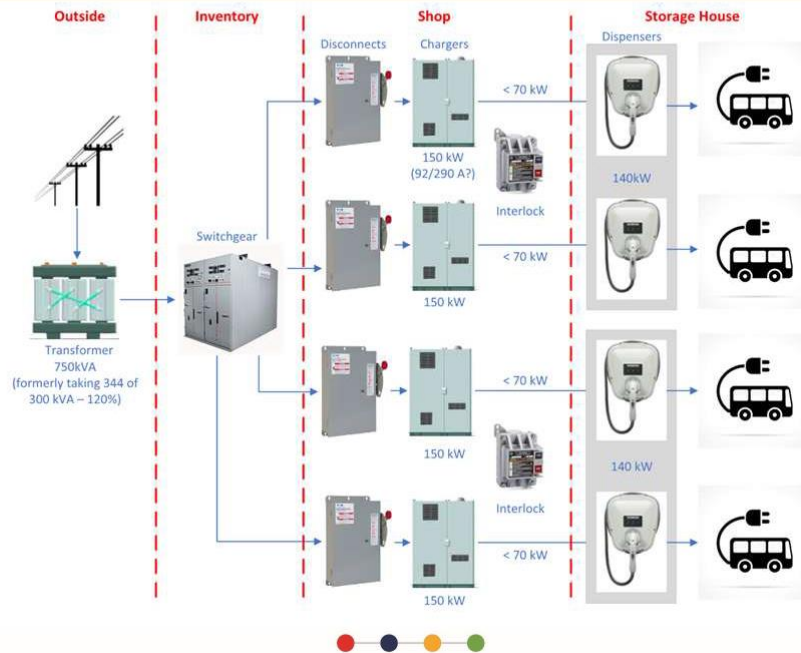
Chargers

Four Siemens RAVE Chargers

- Acquired in August, 2019
- 150 kW capacity
- Supported by Siemens MindSphere system
- Limited by National Grid to 70 kW and maximum two chargers at a time
- Located in Albany



Charging Flowchart



Viriciti Data Hubs

Four Viriciti data hub devices

- Installed on February 11, 2020
- Used as a third-party check on the accuracy of New Flyer and Siemens data and for reporting
- Collect a variety of metrics:
 - Energy regeneration, energy idled, state of charge, mileage, etc.
- Supported by the Viriciti portal



Pilot Results

- **Cost Management**
 - Managing peak demand
 - Seasonal fluctuation of fueling costs
 - Maintenance costs
 - Overall cost of ownership
- **Operational Management**
 - Bus availability
 - Charger availability
 - Charging management
 - Monthly mileage
 - Range factors



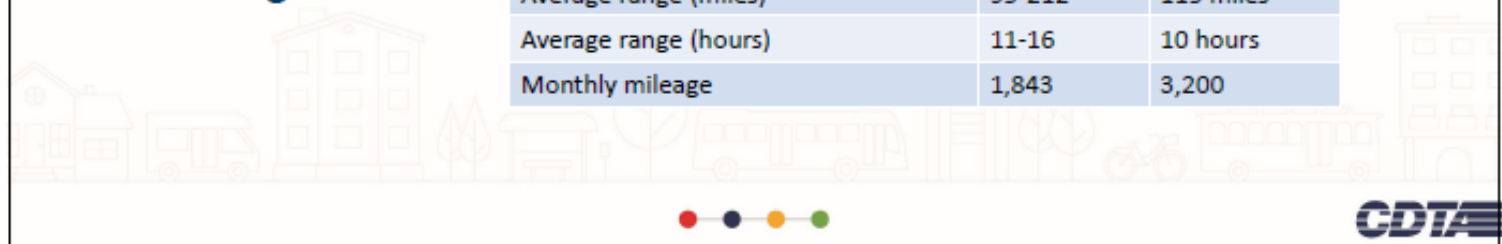
Electric Bus Pilot Performance Summary

Cost Management

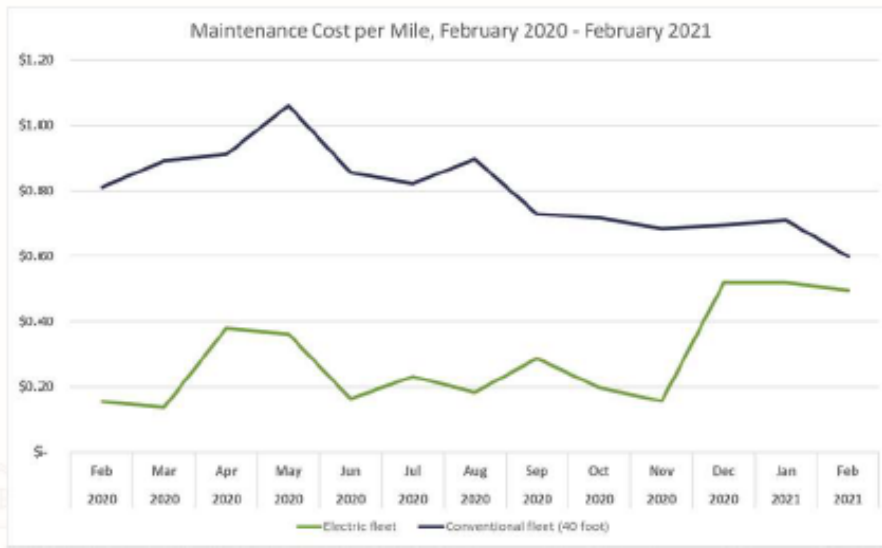
Performance Metric	Electric	Goal
Projected lifetime cost of ownership	\$1,347,816	\$1,054,034
Fueling cost per mile	\$0.21	<\$0.45
Maintenance cost per mile	\$0.27	<\$0.20

Operational Management

Performance Metric	Electric	Goal
Bus availability	90%	90%
Charger availability	99%	99%
Average range (miles)	95-212	115 miles
Average range (hours)	11-16	10 hours
Monthly mileage	1,843	3,200



Maintenance Costs

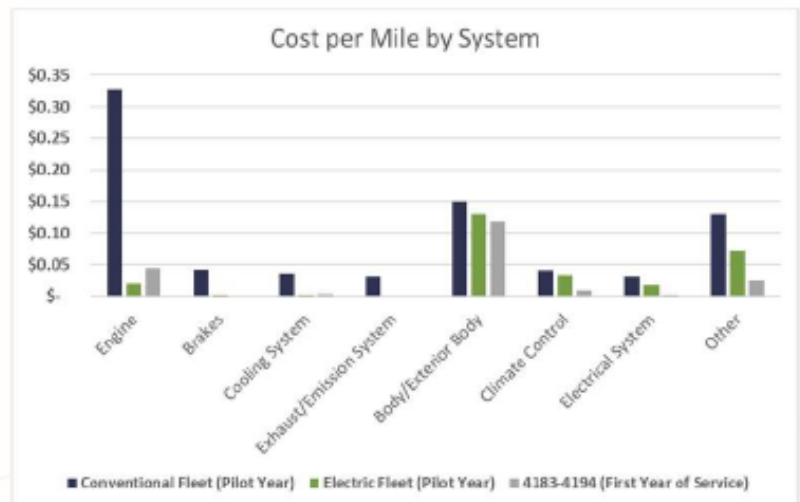


Conventional Fleet (40 foot) Feb 2020-Feb 2021	\$0.79
Electric Fleet Feb 2020-Feb 2021	\$0.27
4183-4194 (Acquired March 2019) First 12 months	\$0.20

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Maintenance Costs by System

- The electric buses by design are spared some maintenance costs, such as the exhaust and emission system
- Increased climate control costs relative to 4183-4194 point to room for improvement in New Flyer's build



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Energy Cost Per Mile

- Seasonal price fluctuation
- Calculating fuel costs and projecting fuel costs are different for electric and diesel
 - We cannot pre-buy electricity
- Different suppliers offer different billing structures
- The chargers share a utility meter with the Albany garage which saves us demand charges. As the fleet grows, we will lose this advantage



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Energy Cost – Demand Charges



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Energy Cost Monitoring

- Newly installed SATEC meter can monitor up to 12 chargers simultaneously
- Customized dashboarding to simplify billing calculations



CTE - Lifetime Cost of Ownership

- Projection of lifetime costs according to CTE
- Energy costs reflect higher demand charges from a larger fleet
- Maintenance for electric assumes a lifetime cost per mile 73% of diesel, based on NREL data. Not reasonable to extrapolate based on first year maintenance costs

	Diesel	Electric
Total Cost of Ownership	\$1,054,034	\$1,347,816
Buses	\$516,356	\$898,811
Energy	\$267,678 ¹	\$196,477
Maintenance	\$225,000 ²	\$177,528 ²
Mid-Life Overhaul	\$45,000	\$75,000
Net Cost per Mile	\$2.11	\$2.98
Assumed Lifetime Mileage	500,000	452,039 ³

1) Based on a 17% higher average diesel price over the next 12 years. A better result (keeping the price at \$2.12) would reduce this by \$40,000.
 2) Based on work order costs, which exclude some costs (some parts costs, benefits and about 33% to 50% of maintenance wages). If we add those costs, diesels add \$191,250 and electricians add \$150,898 to their maintenance cost, a \$40,000 advantage for electricians
 3) Based on 103 miles per day (20% battery degradation, 80% utilization, 1 charge per day and projected range of 129 miles)

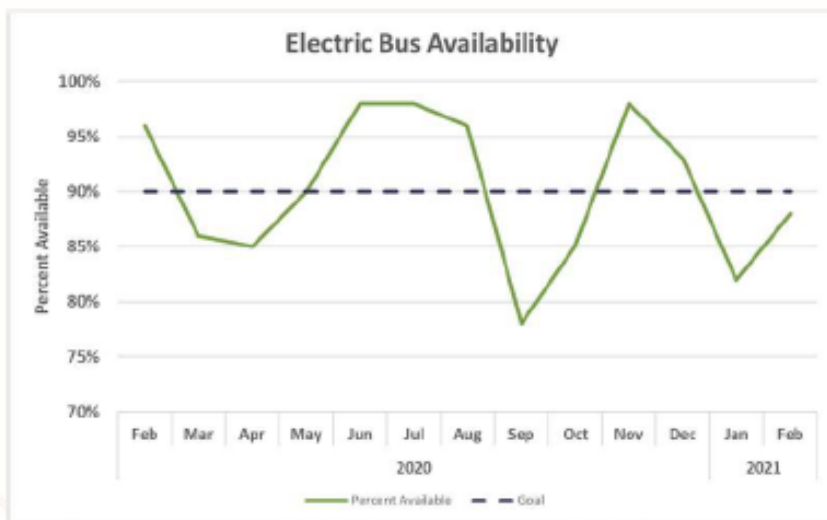


Pilot Results

- Cost management
 - Managing peak demand
 - Seasonal fluctuation of fueling costs
 - Maintenance costs
 - Overall cost of ownership
- Operational Management
 - Bus availability
 - Charger availability
 - Charging management
 - Monthly mileage
 - Range factors



Bus Availability



Overall Availability	90%
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Cause of Unavailability	Percent of Time
Failure	6.8%
Inspection, Preventive Maintenance	1.2%
Special Hold	1.1%
Training	0.8%
Installation	.1%



Charger Availability

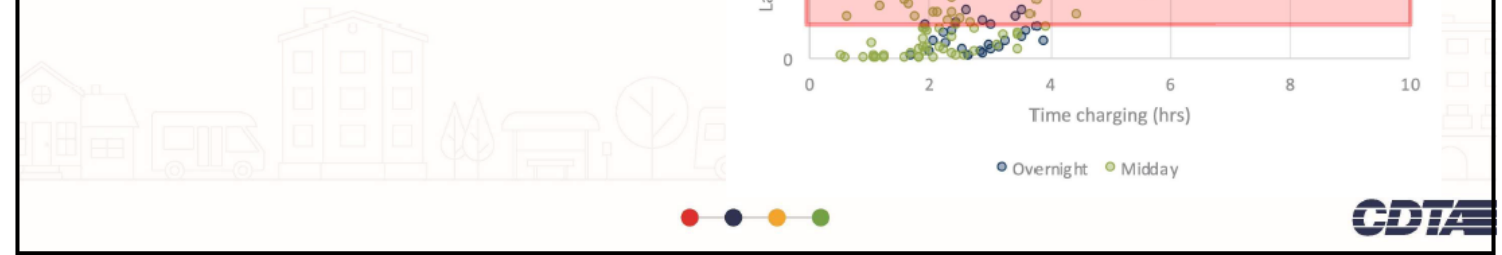
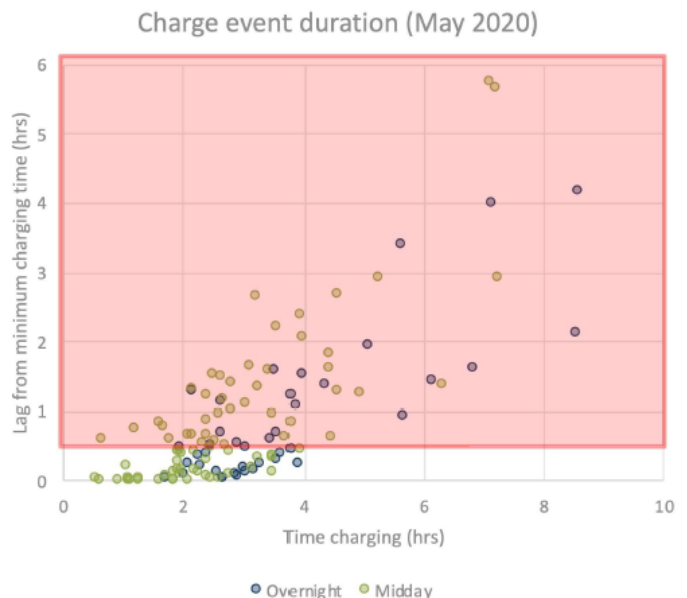
- One charger tripped a breaker, which CDTA was able to fix quickly
- Charger Three has been down since February 6. We are waiting on assistance from Siemens

Status	Days in effect	% of total
No error	1,458	99.5%
Error – CDTA fixed	1	0.1%
Error – Siemens assistance required	5	0.3%



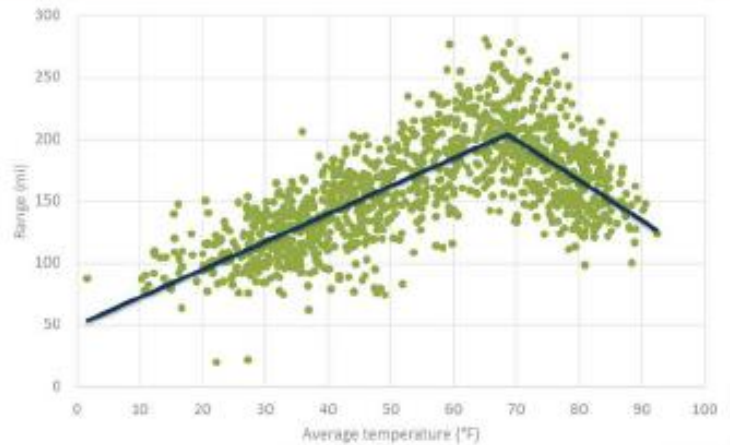
Charging Management

- Charging should be scheduled to accommodate pullout requirements while also avoiding peak demand charges as much as possible
- Efficient charging management will eventually require eliminating charge sessions in the red area
- During pilot, there may be several reasons this spread



Miles of Range by Temperature

- Our Electric buses rely on the battery for driving, heating and air conditioning, so our range decreases the more we run the HVAC
- Ideal temperature is 67 F, but is ultimately dependent upon the thermostat

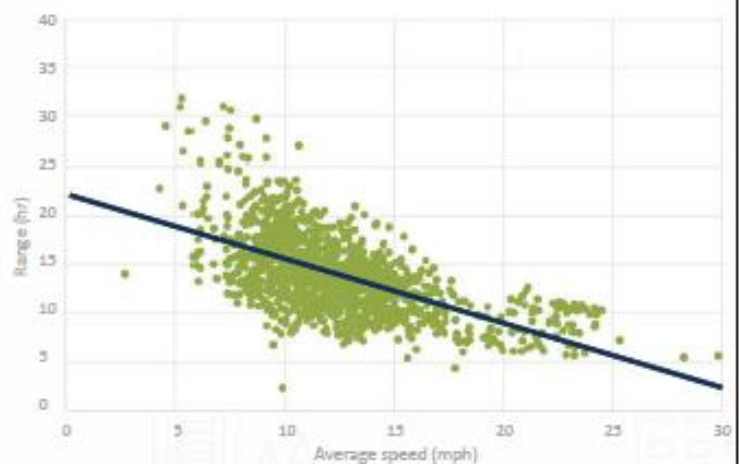


CDTA

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Hours of Range by Speed

- The faster the bus is driven, the more power it uses per hour for the motor
- Same rule applies to diesel buses, but their range is much higher and doesn't require monitoring
- An important factor but not as important as temperature. Most samples are clustered in the middle



CDTA

Ideal Performance

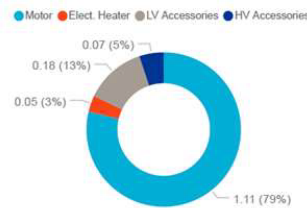
- May 5
- Routes 10 and 11
- 92 miles driven
- 10 hours
- 130 kWh used
- Potential range: 248 miles
- Potential duration: 26 hours

DATE	BUS	TRIP	MODEL	ESS CAPACITY	EV MAX SOC	EV MIN SOC
Tue, May 05, 2020	1903E	1	XE40	466 kWh	90.4%	5%

TRIP DETAILS

10:28 am Start Time	92.51 Mileage (miles)	83.20 SOC MAX (%)	1.41 Energy Consumption (kWh/mile)
08:12 pm End Time	58.53 Average Temperature (°F)	55.20 SOC MIN (%)	13.40 Energy Consumption (kWh/hour)
09:44:03 Duration	9.50 Average Speed (mph)	130.48 Energy Used (kWh)	

ENERGY CONSUMPTION BY SUB-SYSTEM (kWh/mile)



ROUTE



RANGE



Performance in Cold Weather

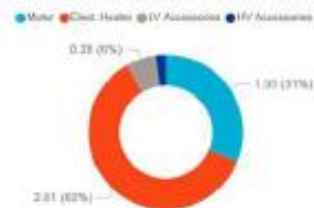
- Dec 30
- Route 1
- 76 miles driven
- 6.5 hours
- 330 kWh used
- Potential range: 81 miles
- Potential duration: 6.8 hours
- Main difference: heating

DATE	BUS	TRIP	MODEL	ESS CAPACITY	EV MAX SOC	EV MIN SOC
Wed, Dec 30, 2020	1903E	1	XE40	466 kWh	90.4%	5%

TRIP DETAILS

06:24 am Start Time	76.35 Mileage (miles)	92.40 SOC MAX (%)	4.32 Energy Consumption (kWh/mile)
12:54 pm End Time	35.65 Average Temperature (°F)	21.60 SOC MIN (%)	90.67 Energy Consumption (kWh/hour)
06:30:43 Duration	11.72 Average Speed (mph)	329.93 Energy Used (kWh)	

ENERGY CONSUMPTION BY SUB-SYSTEM (kWh/mile)



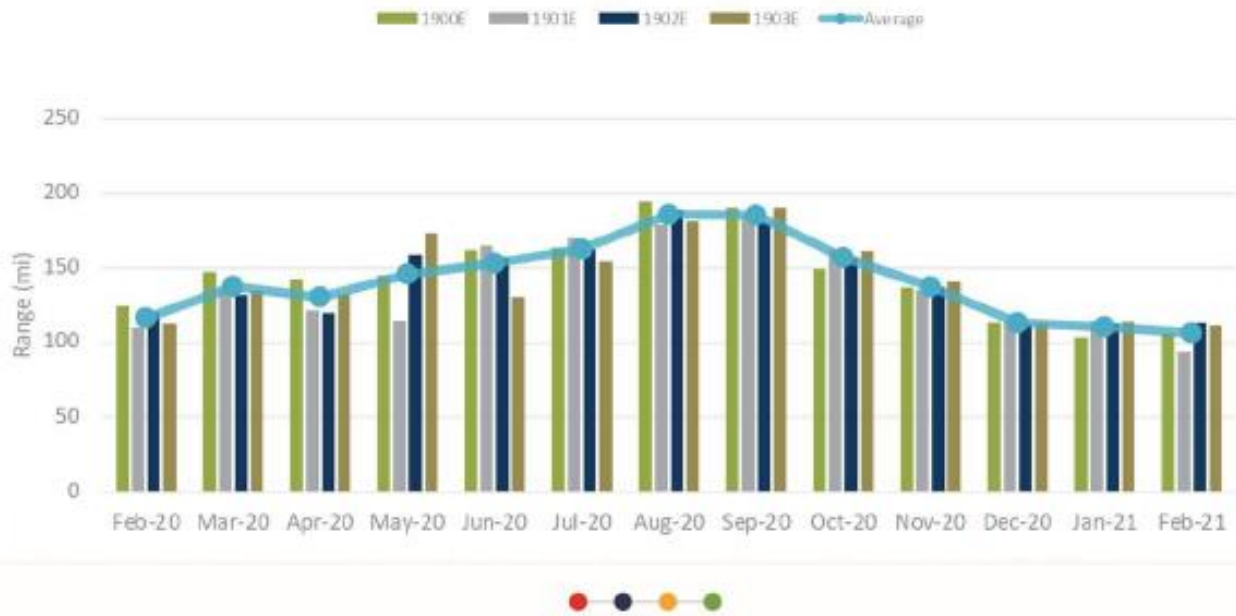
ROUTE



RANGE

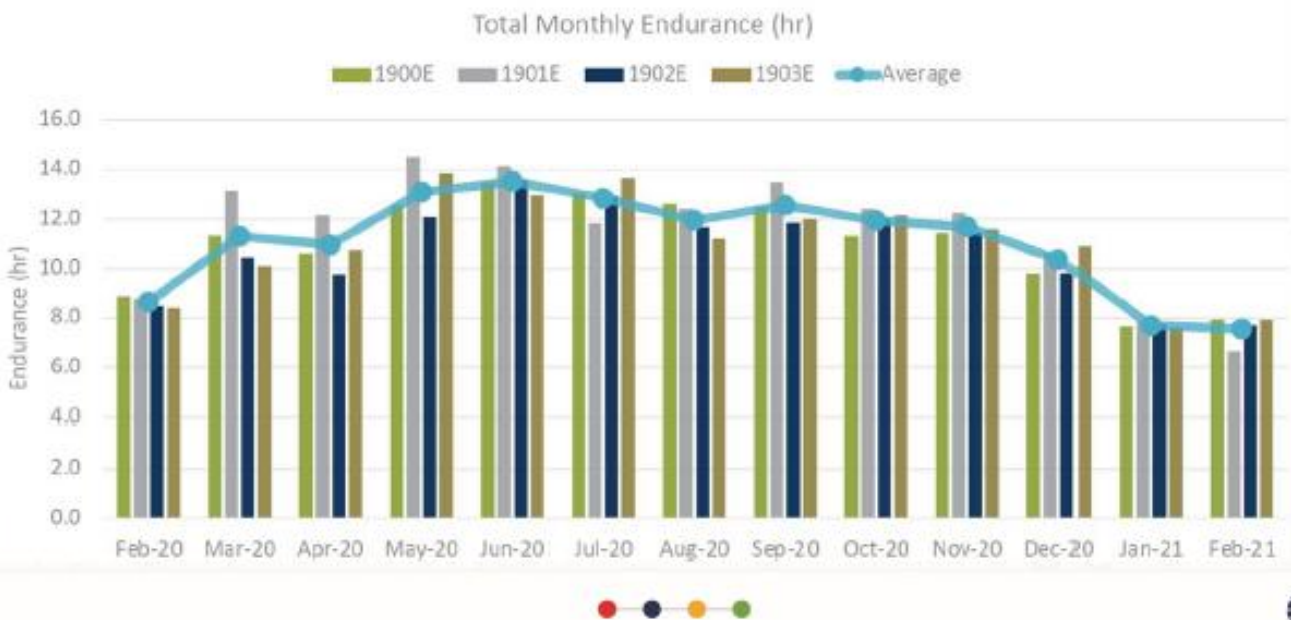


Averaged Projected Range by Bus



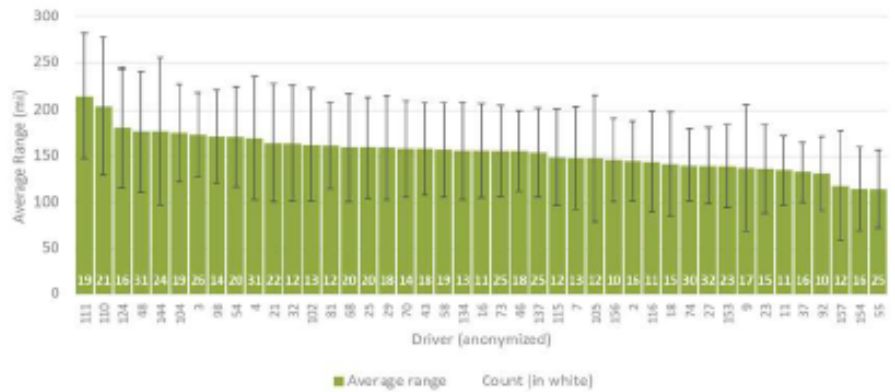
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Averaged Projected Endurance by Bus



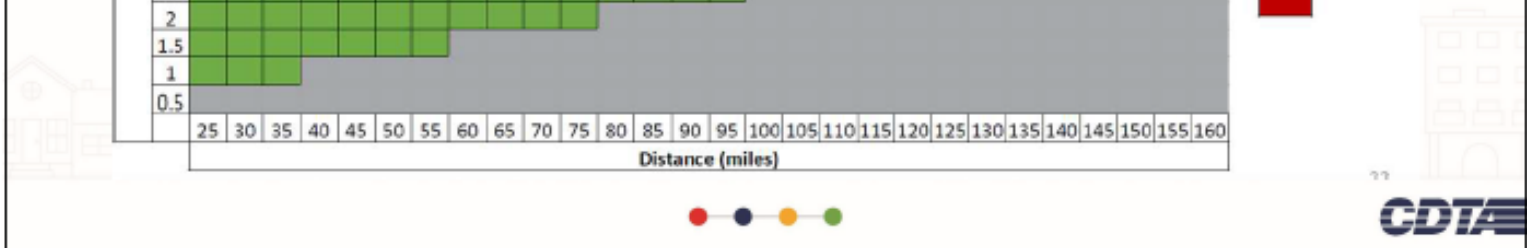
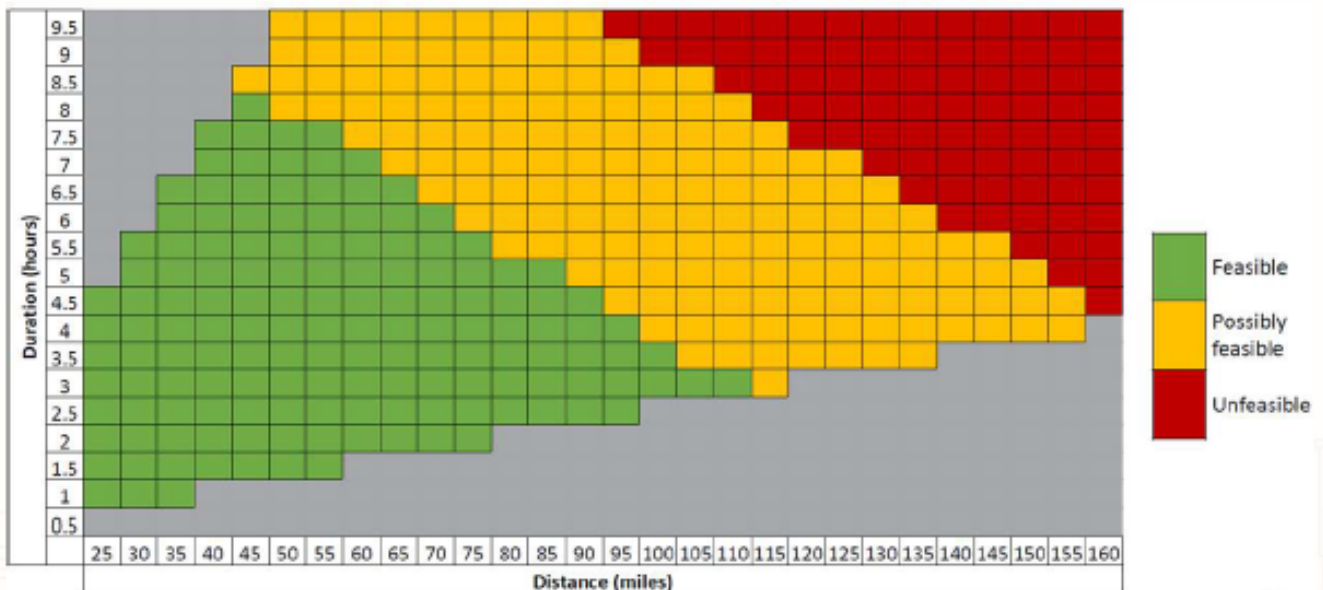
Range – Driver Influence

- Not yet enough samples to control for bias in data from route, temperature, etc.
- Primary driver factor is regenerative braking, which can save as much as 40% of energy used
- Viriciti provides daily reports on regenerative braking



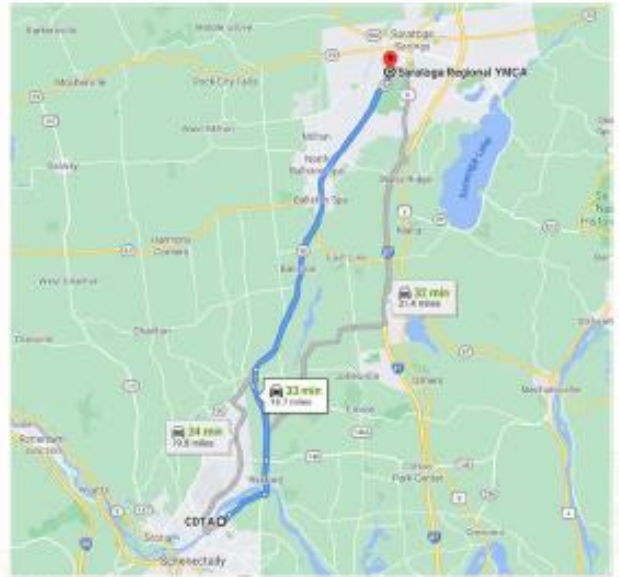
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Block Feasibility at 20° F



Scheduling

- Long blocks will have to be broken up
- Long deadheads are less tolerable with limited range
- Breaking up blocks creates more deadhead, compounding the problem
- More time spent charging in winter means our effective fleet size fluctuates seasonally, which may restrict scheduling

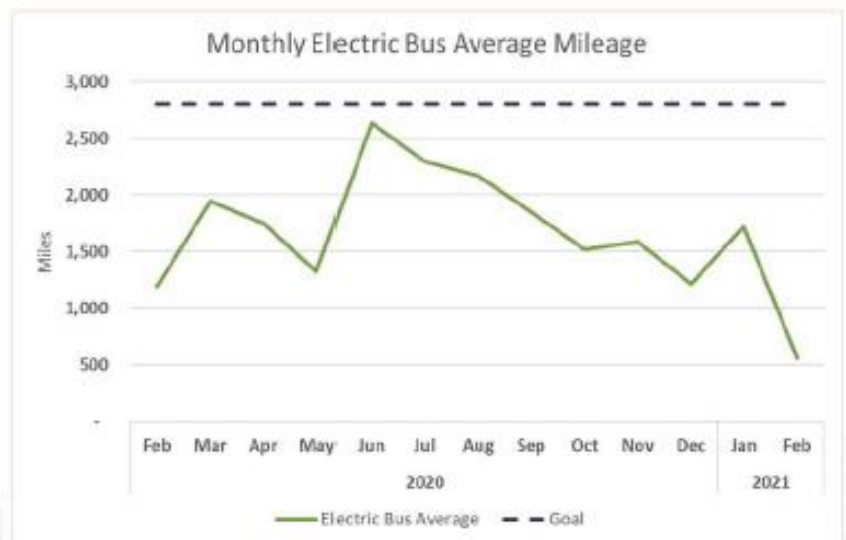


Deadhead to Saratoga Springs: 19 miles →
Breaking up a block of route 451 creates 38 more miles of work



Monthly Mileage Per Bus

- More focus required on full utilization of electric buses
- Holds for training and parts orders partially responsible
- Faster chargers will put buses back on the road quicker



Vehicle Assignment

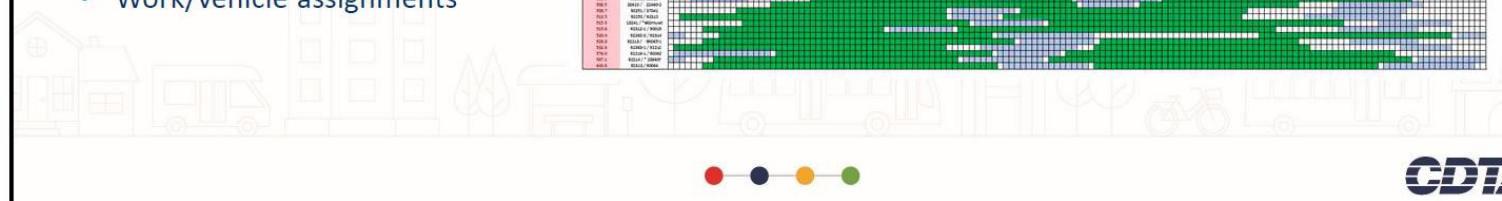
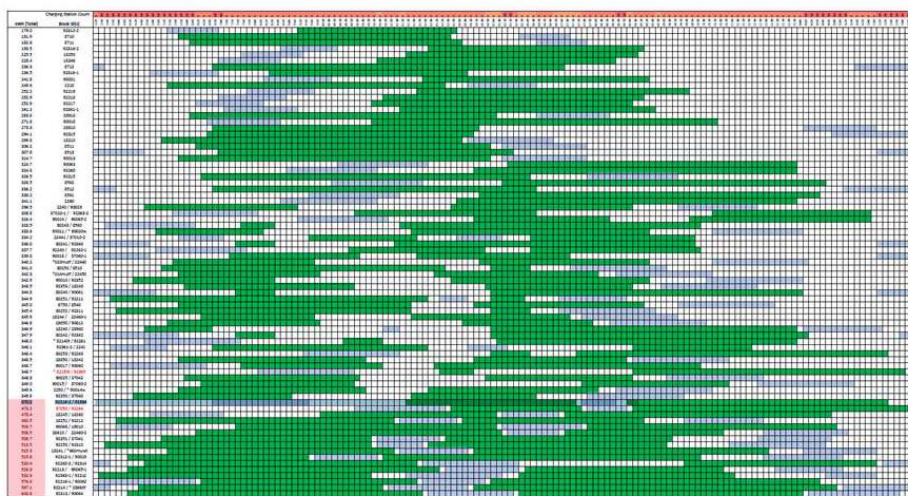
- Should supervisors assign electric buses dynamically? Or should electric bus assignment be built strictly into the pick?
- How do we manage vehicle assignment when no two buses are the same, due to battery degradation and different bus builds?
- How do we make sure the bus we need is at the front of the garage when we need it for pullout?



Electrification Plan

We are working with engineers to produce a plan to accommodate electrification, with the following in mind:

- Cost
- Utilities
- Service expansions
- Right-sized vehicle and charger fleet
- Changes to scheduling
- Work/vehicle assignments



Fuel and Tailpipe Emissions Reductions

Annualized



*GHG consists of Carbon Dioxide (CO₂), Methane (CH₄), and Nitrous Oxide (N₂O).



Fuel and Tailpipe Emissions Reductions

Annualized



=

CARBON REMOVED FROM THE AIR BY



Fuel and Tailpipe Emissions Reductions

Annualized



CDTA

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Key Takeaways

- Reliability and operator feedback rate very high (after one year)
- BEB "fuel cost per mile" is lower than diesel, but there's more to the story....



CDTA

Key Takeaways

- Preliminary lifetime TCO estimates for BEBs exceed diesel by as much as 20%
 - Does not include cost of chargers and infrastructure and mid-life costs are still a question
- Difficult to estimate cost of energy
 - Historically, we pride ourselves on the ability to provide “budget certainty” by pre-purchasing diesel
 - Fueling costs are subject to seasonal changes, our infrastructure, and our behavior
 - Going forward, who is responsible for budgeting energy costs? Fueling patterns now have a direct impact on bottom line
- 100% electrification will require a net increase in the overall number of vehicles in fleet
- Temperature, speed and driver behavior are major factors of range – which ones can we control?
- Planning/scheduling will need to incorporate limitations of assets into service plan
- Work and vehicle assignments will require tighter controls (*...and many other operational considerations*)

What is the goal of electrification? Reduce carbon footprint? Reduce “costs”?



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Next Steps

- Continue Pilot
 - SATEC meters
 - Four more BEBs in November
- Identify objectives/goals/priorities for the organization
 - Including success criteria and failure scenario(s)
- Complete Sage Engineering report and evaluate garage upgrades
- Consider getting assistance from firms that specialize in this work
- Keep abreast with Grid and NYPA programs and take advantage if possible
- Revisit conversations with New Flyer to discuss future of technology
 - Bus capacity, chargers, etc.
- Revisit charger conversation – is our current setup still the only option available?
- Look at rapid chargers (in-service, or depot-based)
- Develop energy consumption methodology
- Bring planning/scheduling deeper into the conversation
- Look at paratransit electrification specifically

