



SEPTA'S SUSTAINABILITY PROGRAM & BATTERY ELECTRIC BUS DEPLOYMENT

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SEPTA at a Glance

- Multimodal “Legacy System”
- Created by PA State Legislature in 1964
- Philadelphia Region (Five Counties)
- 6th Largest in U.S.
- 1 Million Daily Riders (300 Million Annually)
- 2,800 Vehicles
- 9,500 Employees
- \$1.4B Operating Budget
- \$675M Capital Budget

BUSES



TRAINS



Award-Winning Sustainability Program



Governor's Award for
Environmental
Excellence



"BUDGET-NEUTRAL" PRINCIPLE FOR IMPLEMENTATION

ENERGY STORAGE



UTILITY-SCALE SOLAR POWER



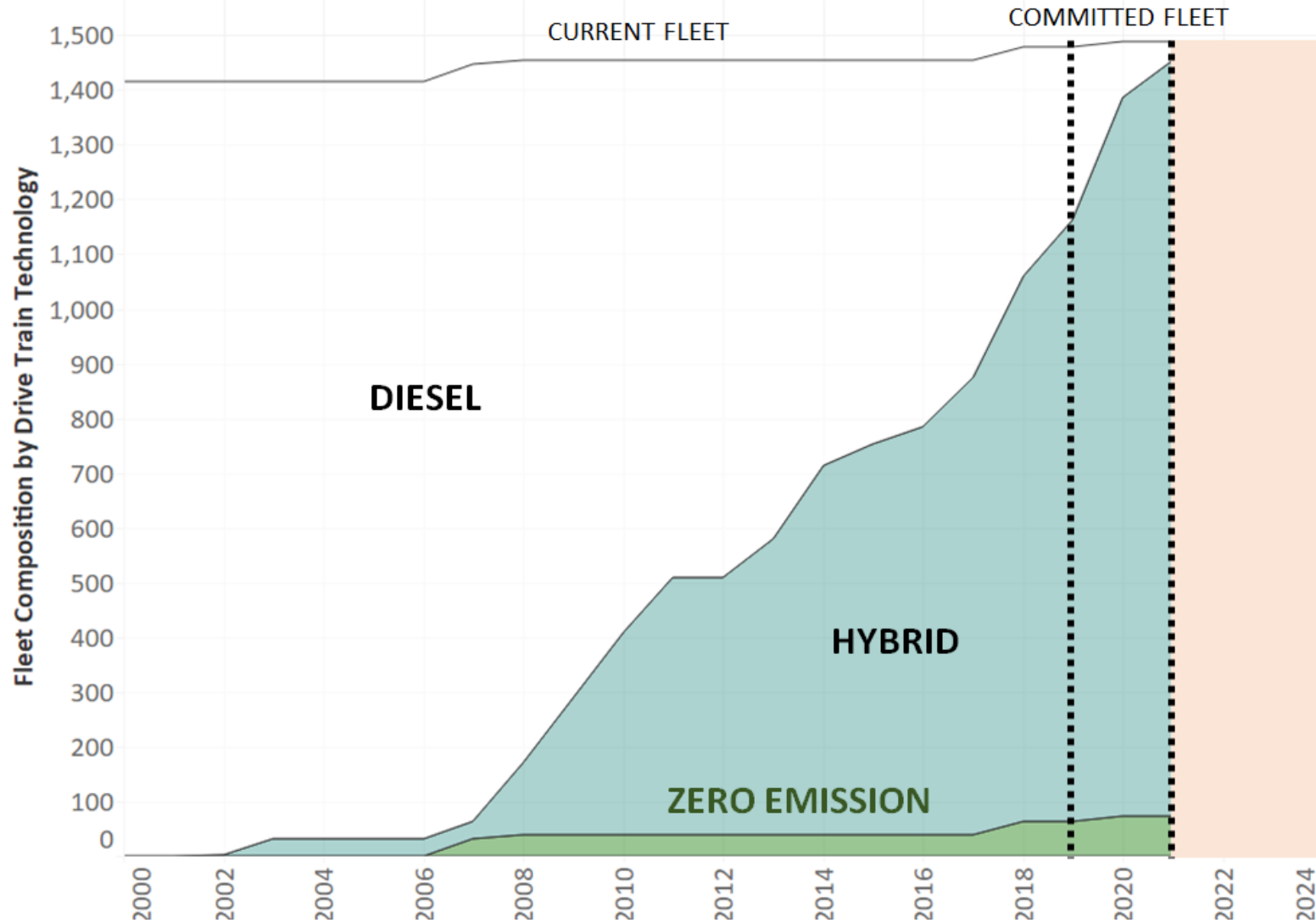
ROOFTOP SOLAR POWER



BATTERY-ELECTRIC BUSES



Bus Fleet Technology Trend



History of Zero Emission Buses @ SEPTA

- **2007:** 38 Trolley Buses (“Trackless Trolleys”) Procured
- **2012:** Fleet Technology Evaluation in Favor of Hybrid-Electric (& Potential of BEB)
- **2016:** FTA LoNo Grant Received for 25 Battery-Electric Buses (BEB) (Vendor: Proterra)
- **2017:** Change Order to Proterra for “Extended Range” Buses
- **2018 (Spring):** BEB Depot Charging Infrastructure Installed
- **2018 (Summer):** FTA LoNo Grant Received for 10 BEB (Vendor: New Flyer)
- **2018 (Fall):** BEB Readiness Planning Initiated with PECO + SEPTA Engineering, Facilities, Service Planning, Finance, Operations, Innovation
- **2019 (Summer):** Proterra Buses Delivered & Enter Revenue Operation

Why Battery-Electric Buses?

TRIPLE-BOTTOM-LINE BENEFITS

- **ENVIRONMENTAL:** Lower Greenhouse Gas (GHG) Emissions – A Climate Change Solution
- **SOCIAL:** Zero Tailpipe Emissions & Quieter Operation in Neighborhoods – An Equitable Solution
- **ECONOMIC:** Lower Operating (Fuel & Maintenance) Costs – A Financial Solution



Approach to Initial Deployment

- Large Enough Deployment (25) to Fully Understand Scalability Challenges
- Extended Range Buses with In-District Overnight Slow (50 kW) Charging
- Dedicated to Routes that are Short (3.5 miles), Flat & Close to the District
- Beginning Weekend Runs on Longer Routes to Test Range Capabilities



Key Challenges Encountered To-Date

- **1) COST:** Higher Upfront Cost of Vehicles & Net New Cost of Charging Infrastructure
- **2) ELECTRICAL SUPPLY:** Limited Capacity, No Redundancy of Grid Feeds into District & Issues with Utility Tariff Structure
- **3) DISTRICT OPERATIONS & LOGISTICS:** Limited Space for Chargers, Implications of Dedicated Parking Spots, Scheduling Constraints

NEW SUBSTATION REQUIRED FOR POWER CAPACITY



Key Challenges Encountered To-Date

- **4) VEHICLE MAINTENANCE & PERFORMANCE:** Weight of Buses Leading to Ride Quality Issues, Uncertain Range Limitations in Extreme Weather, Fleet Size/Spare Ratio Requirements
- **5) DATA & IT SYSTEMS:** Acquiring Performance Data, Lack of System Integration Between Bus/Chargers, Limitations on “Smart Charging”
- **6) MANAGING EXPECTATIONS:** SEPTA Replaces Approximately 100 Buses Per Year, Full Fleet Over a 15-year Lifecycle

BUS PERFORMANCE SUMMARY AUGUST & SEPTEMBER 2019

Week of Date	kWh per Mi	Implied Range (Mi)	MPGe
July 28, 2019	2.65	133.3	14.34
August 4, 2019	2.73	132.5	14.25
August 11, 2019	2.62	135.8	14.60
August 18, 2019	2.67	133.7	14.39
August 25, 2019	2.57	142.0	15.27
September 1, 2019	2.58	143.0	15.38
September 8, 2019	2.57	139.4	15.00
September 15, 2019	2.50	141.8	15.25
September 22, 2019	2.51	141.7	15.24
September 29, 2019	2.57	138.9	14.94

VS. HYBRID-ELECTRIC MPG: ~3.50-4.00

Next Steps

- **CONTINUE READINESS MASTER PLANNING:** Focus on Scalability of Charging Infrastructure, with Innovative Alternatives
- **EVALUATE WINTER PERFORMANCE:** Peers Are Reporting Significant Range Reduction
- **COORDINATE WITH ELECTRIC UTILITY:** Who Pays for Supply Infrastructure? How Will We Ensure it is Resilient?
- **DETERMINE FUTURE PROCUREMENT STRATEGY:** How/When to Integrate BEBs at Scale? Bus Must Be Able to Last 15 Years

DEPOT	# OF BUSES	SPARE ELECTRIC CAPACITY (MW)	BEB CAPACITY NOW	ADDED MW CAPACITY NEEDED FOR FLEET CONVERSION
ALLEGHENY	123	1.5	12	6.7
CALLOWHILL	193	1.5	13	11.3
COMLY	185	1.0	9	10.0
FRANKFORD	146	0.7	4	7.8
FRONTIER	99	1.5	18	5.5
G'TOWN	37	1.0	12	1.9
MIDVALE	312	3.8	30	17.2
SOUTHERN	228	2.0	2 more	11.7
VICTORY	176	1.0	5	8.3
TOTAL	1499	14.0 MW	105 BEB	80.4 MW

Key Takeaway: Let's Walk Before We Run

THIS...



...BEFORE THIS





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