# Zero Emission Vehicle Transition Plan



wendel


Zero Emission Transition Plan Goals

Guiding Principles & Constraints

Route Analysis & Conceptual Charging Strategy

Utility Requirements

Phasing & Costs

Operations & Maintenance

Next Steps

Questions/ Discussions

wendel

# Zero Emission Vehicle Transition Plan Goals

- Provide path towards Zero Emission fleet by 2035 & ensure seamless transition
- Evaluate & recommend infrastructure upgrades
- Provide information to the District in order to make informed decisions regarding design/ implementation
- Reduction of energy loads and assist in conversion to carbon free fuels

wendel

# Guiding Principles

While Sweet Home school district's goal is to transition to zero-emission vehicles (ZEV) by 2035, Wendel utilized the following guiding principles to develop ZEV transition plans:

- No impact on student experience
- Limit constraints on operations
- Reduce implementation cost and complexity
- Minimize impact on workforce

# Constraints

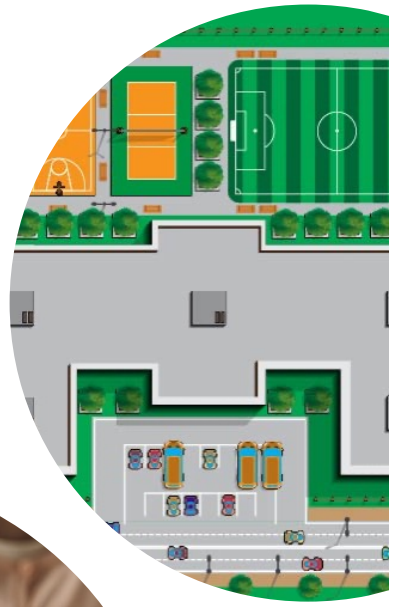
Vehicle range limitations

Charging duration requirements

Utility demand requirements

Demand on facilities and operations

Maintenance knowledge




# Scope of Work

The Zero Emission Vehicle Transition Plan Consisted of the Following Tasks:

- **TASK 1** – Project Kickoff and Status Meetings
- **TASK 2** – Data Collection
- **TASK 3** – Route Analysis
- **TASK 3a** – Optional Route Analysis
- **TASK 4** – Conceptual Charging Strategy
- **TASK 5** – Electric Utility Analysis
- **TASK 5a** – Vehicle-to-Grid Charging Analysis
- **TASK 6** – Concept Development and Phasing Plan
- **TASK 7** – Phasing Plan Estimates
- **TASK 7a** – O&M Costs

wendel

# Route Analysis & Conceptual Charging Strategy

Analysis of current bus route data

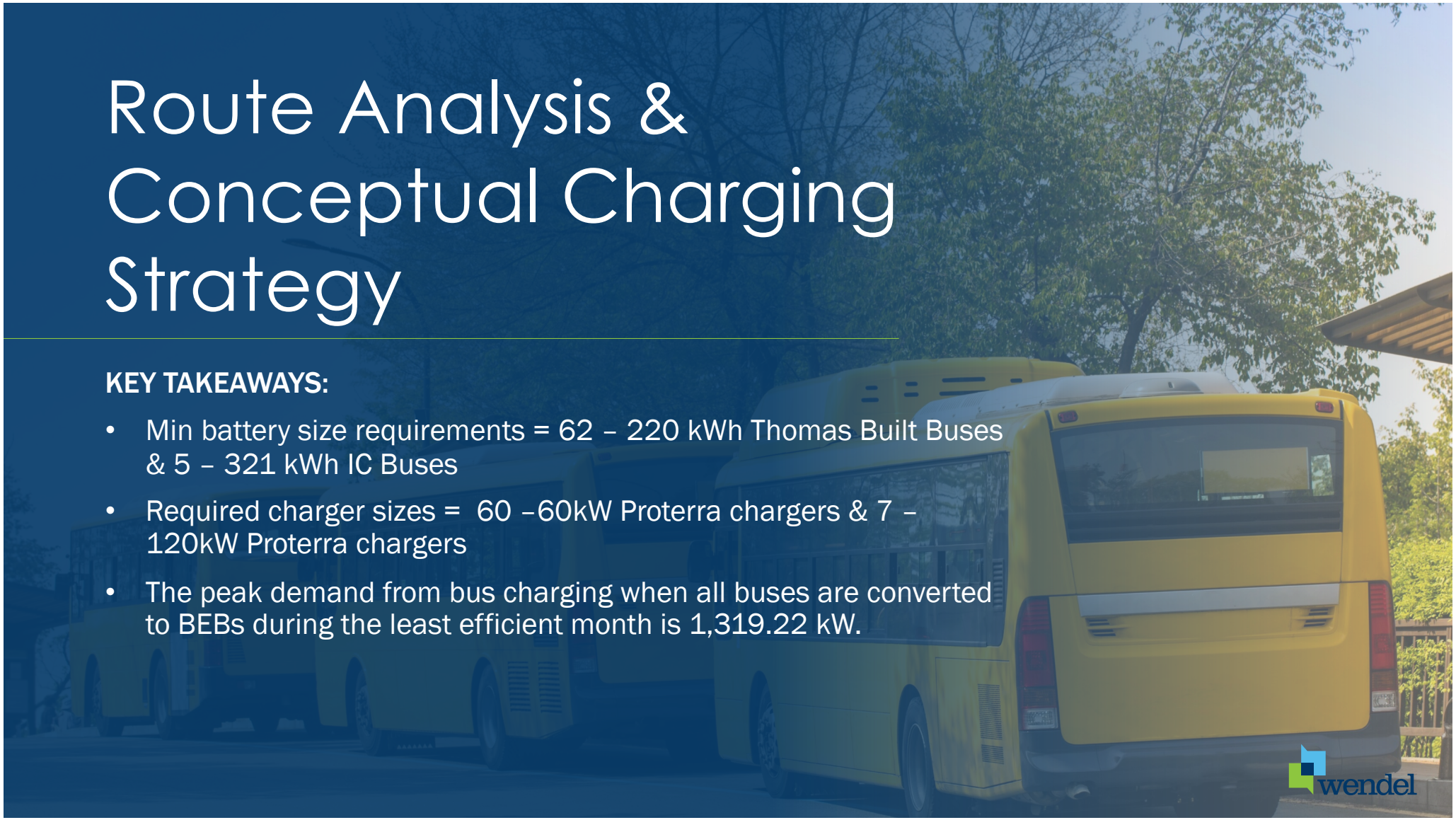
Development of charging model to determine:

- Anticipated energy requirements per route
- Charging requirements
- Minimum charging durations per route

Max energy usage 285.8 kWh

All routes provided by the district could be driven by 56 buses (11 buses as spare capacity)

# Route Analysis & Conceptual Charging Strategy



**KEY TAKEAWAYS:**

- Min battery size requirements = 62 – 220 kWh Thomas Built Buses & 5 – 321 kWh IC Buses
- Required charger sizes = 60 –60kW Proterra chargers & 7 – 120kW Proterra chargers
- The peak demand from bus charging when all buses are converted to BEBs during the least efficient month is 1,319.22 kW.

wendel

# Utility Requirements

- Charging battery electric buses requires additional power from the utility
- New service feed and additional transformer will be required from National Grid
- National Grid can supply the required power for this project
- There will be costs incurred by Sweet Home for utility side upgrades (up to 90% of these costs could be covered by Make Ready Programs)

wendel

# Phasing & Costs

- Transition plan phases determined by bus procurement schedule and includes 2027 & 2035 deadline dates

| | Existing | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Battery Electric Buses Procured | 0 | 0 | 3 | 8 | 9 | 9 | 8 | 6 | 6 | 6 | 4 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 67 |
| Battery Electric Bus Fleet Size | 0 | 0 | 3 | 11 | 20 | 29 | 37 | 43 | 49 | 55 | 59 | 63 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 |

- The bus procurement schedule above was the basis to determine when the phases for Sweet Homes electrical infrastructure upgrades would occur.

*The above proposed BEB procurement schedule is subject to change based on available funding.
**Sweet Home CSD anticipates procuring their first 3 BEBs through the NYS Truck Voucher Incentive Program (TVIP) in 2023 with delivery in mid to late 2024. The district has also applied for EPA grant.

wendel

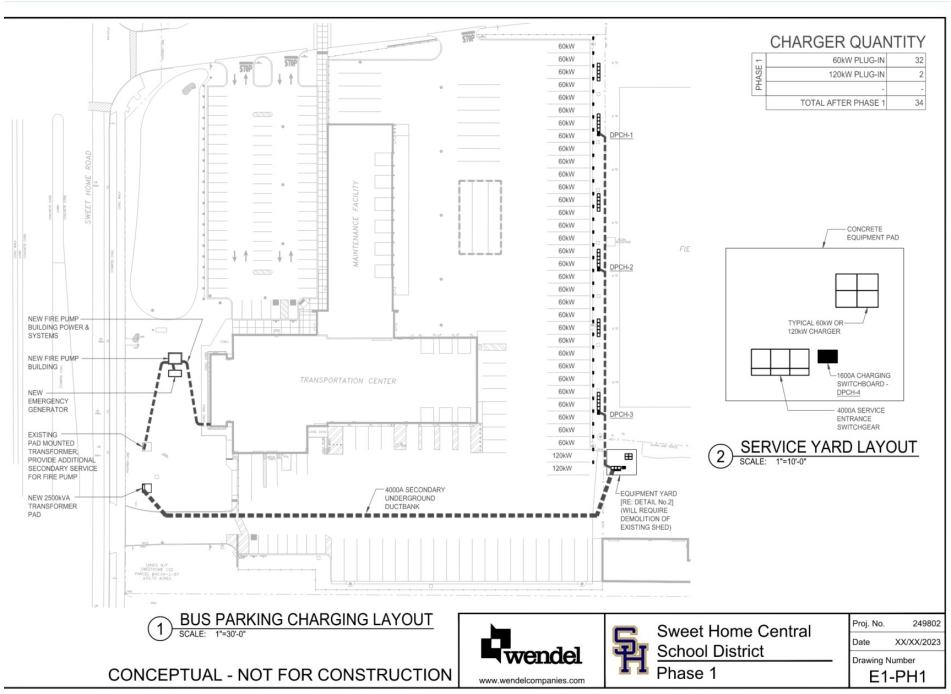
# Phasing & Costs

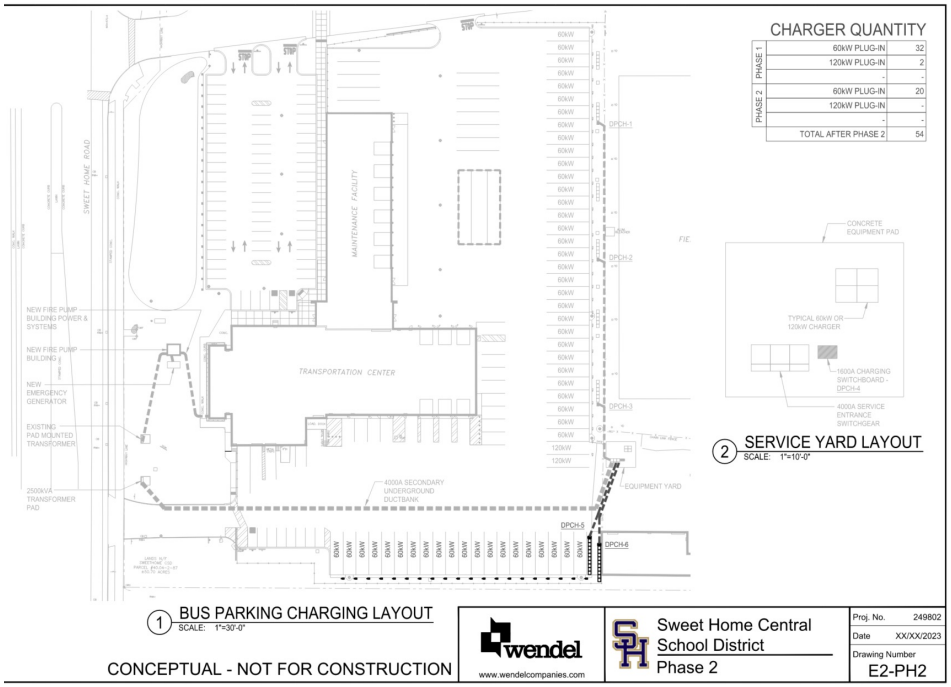
| | |
|---|---|
| **Temporary Charging Phase - $960,960** | •Phase 0 is the temporary charging phase for the three TVIP buses that are anticipated to be in use for the 2024 – 2025 school year |
| **Phase 1 - $5,690,540** | •New National Grid service required, primary cable trench from new service to power distribution equipment, power feeds, fire protection upgrades, and charging equipment required (34 60kW chargers). |
| **Phase 2 - $2,346,641** | •Additional Power feeds and charging equipment required (20 60kW Chargers). |
| **Phase 3 - $880,771** | •Additional Power feeds and charging equipment required (8 60 kW Chargers). |
| **Phase 4 - $1,229,365 (optional for spare buses)** | •Additional Power feeds and charging equipment required (5 120 kW Chargers). |

**TOTAL All Phases – $11,108,277**

wendel

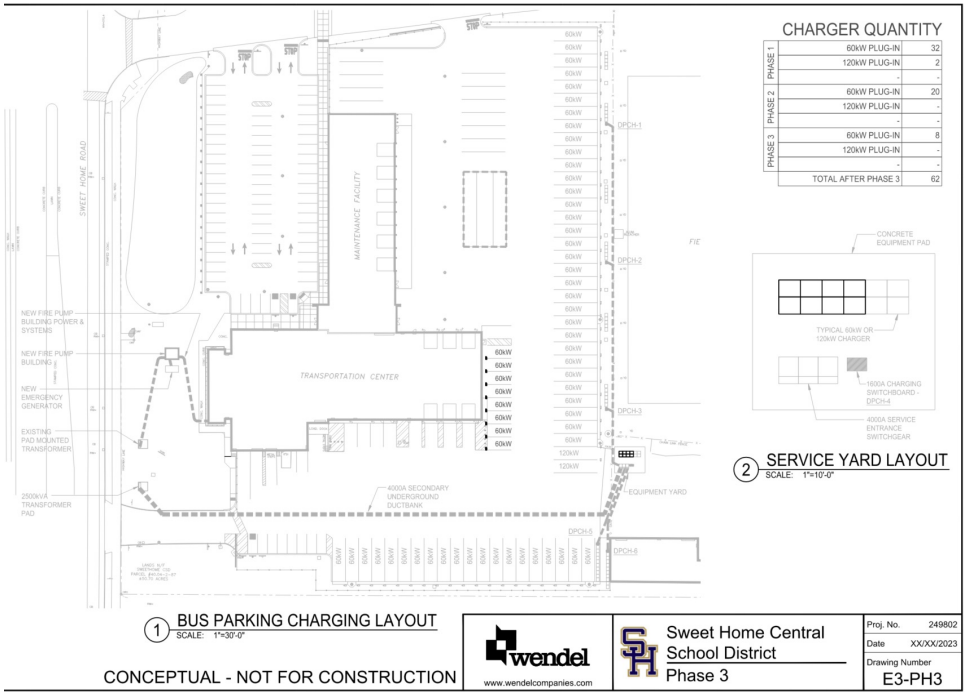
# Phasing & Costs

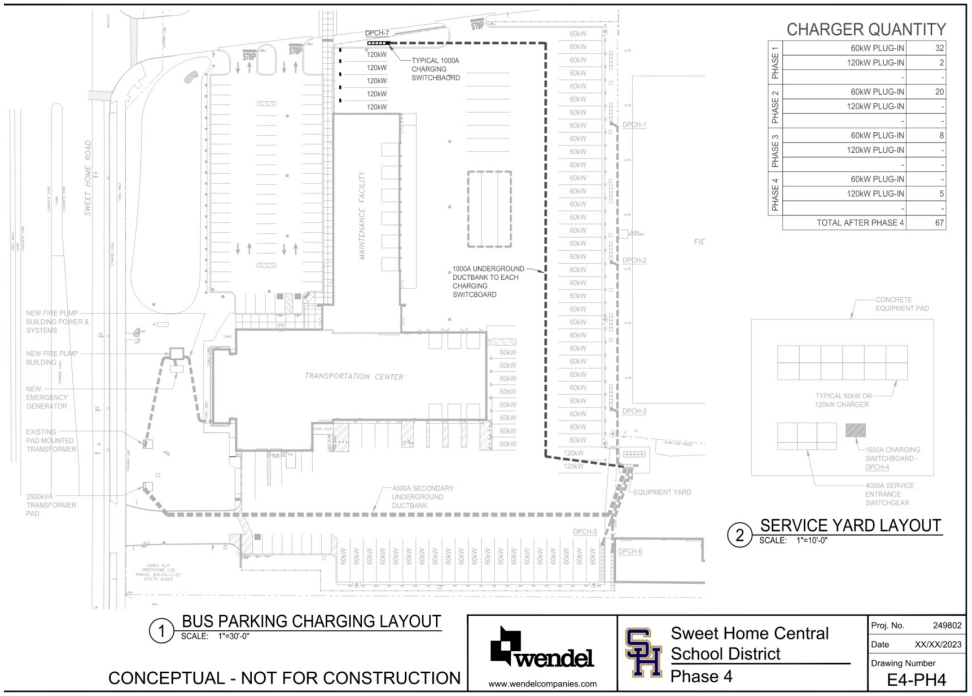



wendel

# Phasing & Costs




wendel

# Funding Opportunities

### Utility Make Ready Program:

The National Grid Make-Ready Program goal is to support the development of electrical infrastructure and equipment necessary to accommodate the implementation of EV's by reducing upfront utility related costs.

### EPA Clean School Bus Grants Program (CSB):

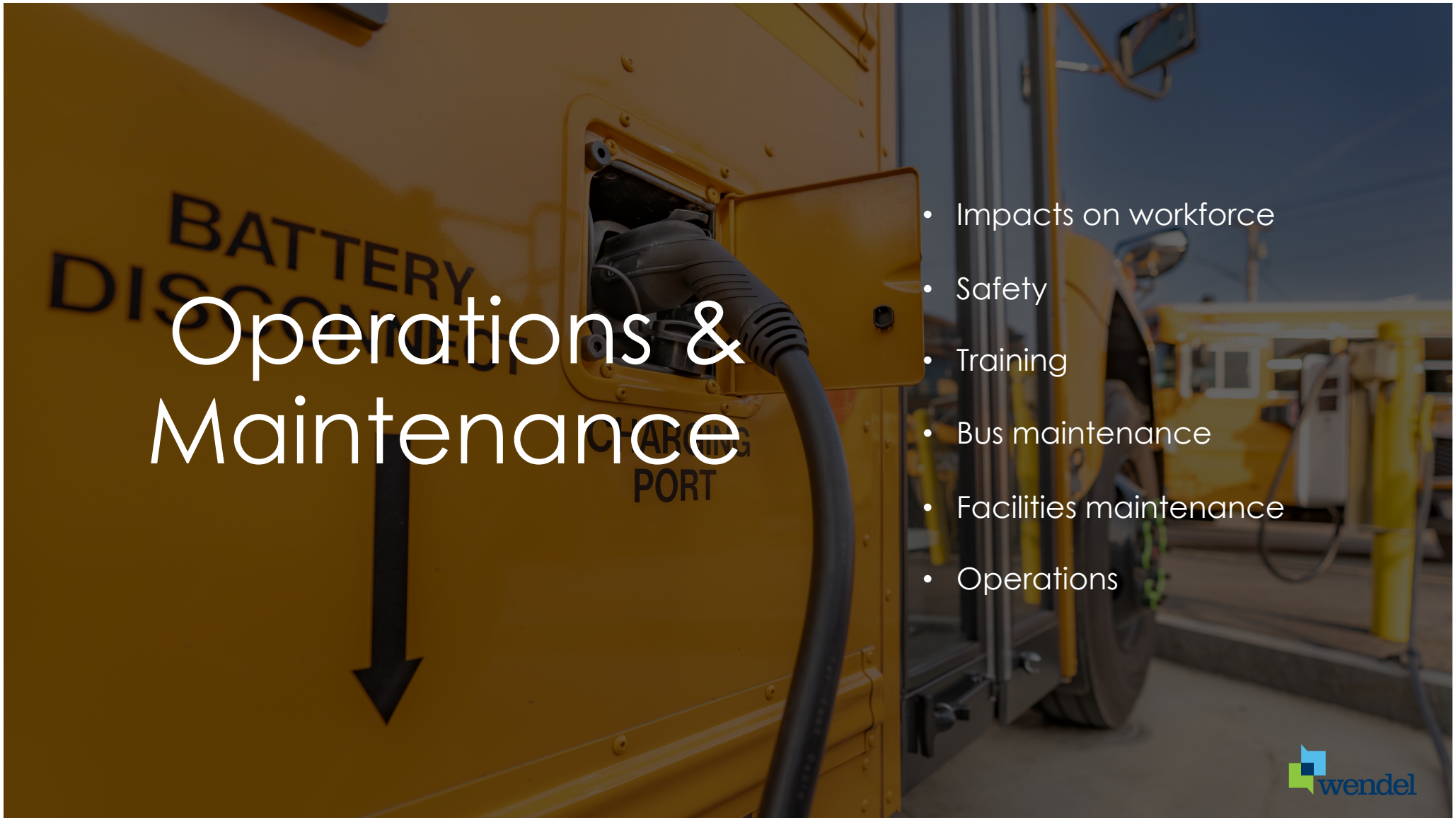
EPA's new Clean School Bus Program provides $5 billion over the next five years (FY 2022-2026) to replace existing school buses with zero-emission and low-emission models.

### Truck Voucher Incentive Program (TVIP):

New York State provides vouchers, or discounts, to fleets across New York State that purchase or lease medium- and heavy-duty zero-emission battery electric (BEV)

### Additional Funding:

NYSERDA is working with the State of NY to develop additional funding programs to assist with project implementation. It is anticipated that these new programs will become available in late 2023 or early 2024.




# Operations & Maintenance

- Impacts on workforce
- Safety
- Training
- Bus maintenance
- Facilities maintenance
- Operations


# Operations & Maintenance Cost Comparison

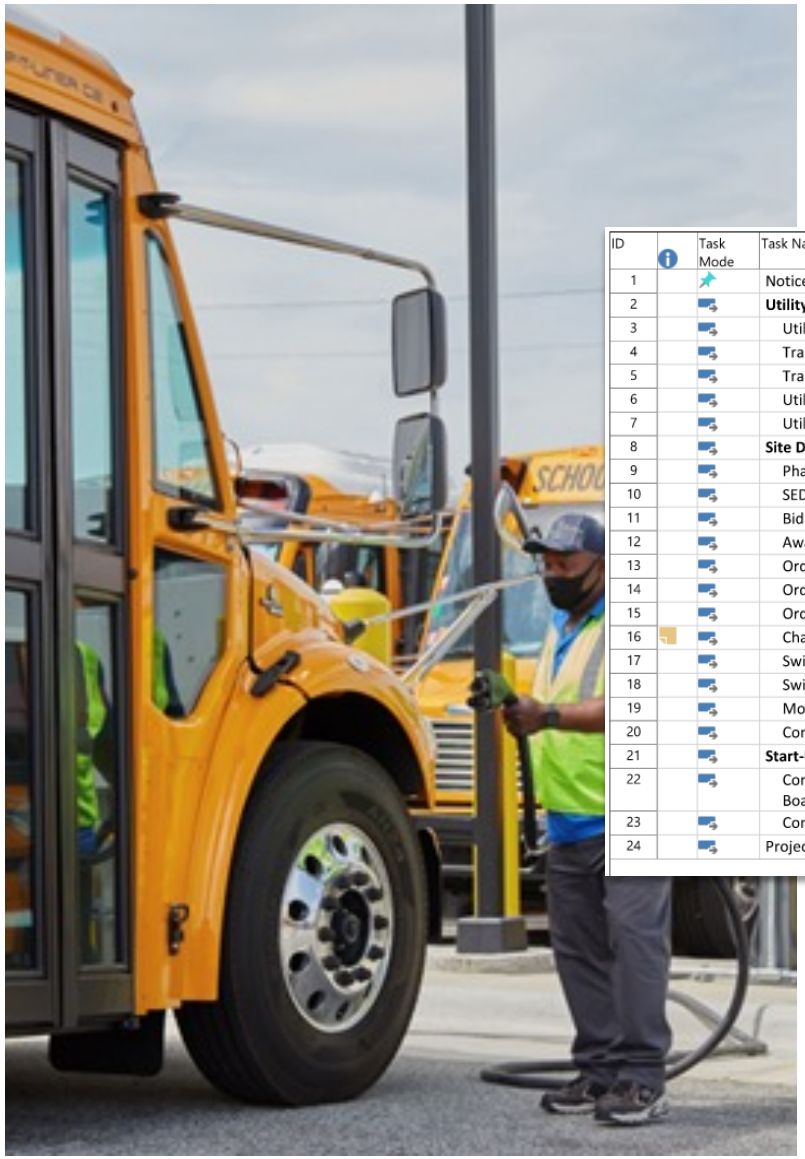
| Maintenance Costs Diesel VS Battery Electric School Bus | | 10 Yrs | | Annual |
|---|---|---|---|---|
| Bus Maintenance Savings | $ | 1,586,828 | $ | 158,683 |
| Fuel System Maintenance Savings | $ | 150,000 | $ | 15,000 |
| Battery Replacement | $ | (354,667) | $ | (35,467) |
| EV Charger Maintenance | $ | (536,000) | $ | (53,600) |
| Charge Management | $ | (448,000) | $ | (44,800) |
| Fuel Savings | $ | 1,379,030 | $ | 137,903 |
| Total Savings | $ | 1,777,191 | $ | 177,719 |
| **Per Bus** | **$** | **31,736** | **$** | **3,174** |

wendel

# Diesel vs. BEB Energy Costs

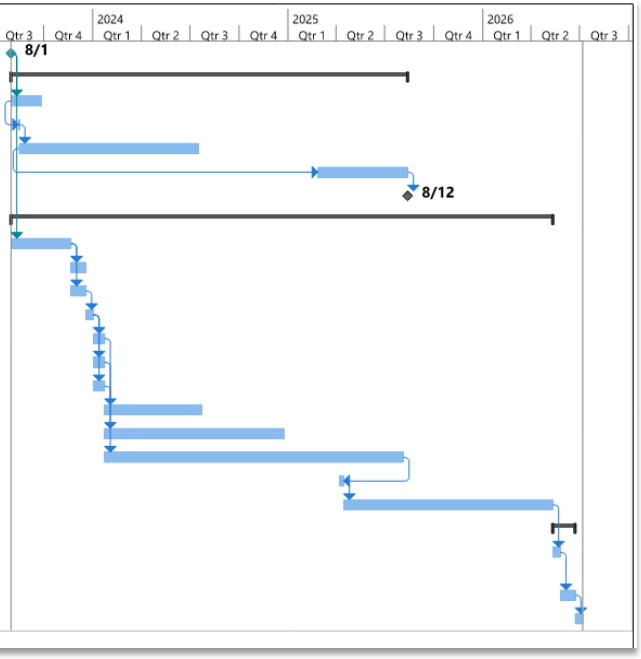
| 56 Diesel Bus Energy Analysis | | |
|---|---|---|
| Route Data | 640,673 | Miles |
| Bus Efficiency | 6.1 | Mpg |
| Total Gallons | 105,028.35 | Gallons |
| Energy Used | 14,428.90 | MMBtu |
| Diesel Cost | $ 3.6404 | Per Gallon |
| **Total Cost** | **$ 382,347.00** | |

| 56 Electric Bus Energy Analysis | | |
|---|---|---|
| Route Data | 640,673 | Miles |
| Bus Efficiency | 2.83 | kWh/Mile |
| Total kWh | 1,811,362.55 | KWh |
| Energy Used | 6,180.94 | MMBtu |
| Electric Cost | $ 0.1350 | Per kWh |
| **Total Cost** | **$ 244,444.00** | |



# Next Steps

| ID | Task Mode | Task Name | Duration | Start | Finish |
|---|---|---|---|---|---|
| 1 | | Notice to Proceed | 0 days | Tue 8/1/23 | Tue 8/1/23 |
| 2 | | **Utility Service** | **531 days** | **Tue 8/1/23** | **Tue 8/12/25** |
| 3 | | Utility Design | 8 wks | Tue 8/1/23 | Mon 9/25/23 |
| 4 | | Transformer Order | 1 day | Tue 8/15/23 | Tue 8/15/23 |
| 5 | | Transformer Delivery | 12 mons | Wed 8/16/23 | Tue 7/16/24 |
| 6 | | Utility Distribution Construction | 6 mons | Wed 2/26/25 | Tue 8/12/25 |
| 7 | | Utility Service Energized | 0 days | Tue 8/12/25 | Tue 8/12/25 |
| 8 | | **Site Design and Construction** | **725 days** | **Tue 8/1/23** | **Mon 5/11/26** |
| 9 | | Phase 1 Detailed Design | 4 mons | Tue 8/1/23 | Mon 11/20/23 |
| 10 | | SED Review | 4 wks | Tue 11/21/23 | Mon 12/18/23 |
| 11 | | Bid Construction Package | 4 wks | Tue 11/21/23 | Mon 12/18/23 |
| 12 | | Award Construction Package | 2 wks | Tue 12/19/23 | Mon 1/1/24 |
| 13 | | Order Main Switchgear | 3 wks | Tue 1/2/24 | Mon 1/22/24 |
| 14 | | Order Switch Boards | 3 wks | Tue 1/2/24 | Mon 1/22/24 |
| 15 | | Order Chargers | 3 wks | Tue 1/2/24 | Mon 1/22/24 |
| 16 | | Charger Delivery | 26 wks | Tue 1/23/24 | Mon 7/22/24 |
| 17 | | Switch Board Delivery | 12 mons | Tue 1/23/24 | Mon 12/23/24 |
| 18 | | Switchgear Delivery | 20 mons | Tue 1/23/24 | Mon 8/4/25 |
| 19 | | Mobilization | 1 wk | Tue 4/8/25 | Mon 4/14/25 |
| 20 | | Construction | 14 mons | Tue 4/15/25 | Mon 5/11/26 |
| 21 | | **Start-Up and Commissioning** | **30 days** | **Tue 5/12/26** | **Mon 6/22/26** |
| 22 | | Commission Switchgear and Switch Boards | 2 wks | Tue 5/12/26 | Mon 5/25/26 |
| 23 | | Commission Chargers | 1 mon | Tue 5/26/26 | Mon 6/22/26 |
| 24 | | Project Close-out | 2 wks | Tue 6/23/26 | Mon 7/6/26 |




- Temporary Charging Phase Design and Implementation
- Detailed Design

wendel


QUESTIONS?
DISCUSSIONS
wendel

# Thank you


**John Havrilla, PE**
Director of Alternative Fuels
jhavrilla@wendelcompaines.com

**Adam Kaufman, EIT, M. Eng, CEM**
Energy Services
Akaufman@wendelcompanies.com

**Danielle Wink, PMP**
Project Manager
dwink@wendelcompanies.com

www.wendelcompanies.com