REPORT
January 15, 2025

NYSERDA
Letchworth CSD

ZEV TRANSITION PLAN



wendel

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Section 1 Introduction



Introduction

Letchworth CSD and NYSERDA have obtained Wendel's services to conduct a study regarding the transition of the district's current diesel and unleaded gasoline school bus fleet to battery electric buses (BEBs) by 2035. The deliverables of the study include a transition plan providing the district a guide to transitioning the fleet based on current NYS mandates. Should the current mandates change, this plan will provide the necessary information for the district to adjust the plan accordingly.

Background

In April 2022, New York State's enacted 2022-2023 State Budget included a zero-emission mandate for NYS school buses. The mandate requires, in part, that by July 1, 2027, all new school bus purchases and leases must be zero-emission and that by July 1, 2035, all school districts must only operate and maintain zero-emission school buses. This mandate defines zero-emission school buses as a school bus that "is propelled by electric motor and associated power electronics and draws electricity from a hydrogen fuel cell or battery; or otherwise operates without direct emission of atmospheric pollutants." Zero-emission school buses are primarily battery electric at this time. Other zero-emission buses such as hydrogen fuel cell are in development but are not readily available commercially.

Letchworth CSD elected to prepare for these requirements by developing a transition plan that would provide the district with the planning tools and flexibility necessary to ensure a seamless transition to zero-emission. In March 2024, Letchworth CSD contracted with Wendel and NYSERDA through 4192 – P12 Schools: Flexible Technical Assistance Program in developing a transition plan that provides a path towards a fully battery electric bus (BEB) fleet by 2035. The program goal is to provide districts with a study that evaluates and recommends infrastructure upgrades that can be used to make informed decisions regarding design and implementation to reduce energy loads and assist in conversion to carbon free fuels. This transition plan can be used as a guide to the district in transitioning and implementing battery electric buses, hereinafter referred to as BEBs.

Scope of Work

The detailed scope of work can be found in Appendix D - Original Scope of Work and include the following major tasks:

Task 1: Project Kickoff and Status Meetings
Task 2: Existing Conditions Review
Task 3: Existing Route Energy Analysis
Task 4: Transition Planning:
Task 5: Final Report

Deliverables for each task above detailing the results and findings of the task are included in the appendices. This report is a summary of the findings of the individual letter reports generated from each task.

Note on Technology

BEB technology is emerging and rapidly changing. Electric bus battery capacities are increasing as this technology grows while battery sizes and weights continue to decrease due to charge density improvements. Supporting equipment, such as chargers, are also evolving in terms of charger sizes, an increase in features and improving energy efficiencies. As battery capacities increase, the need for larger chargers also increases to enable fully charging a larger battery in the same amount of time.

During cold weather, battery electric school buses face unique challenges when it comes to charging and performance. Low temperatures can significantly affect battery efficiency and charging speed, as cold weather slows down the electrochemical reactions within the battery cells. This can lead to longer charging times and reduced range per charge, impacting the BEB's operational capabilities. Additionally, extreme cold can cause batteries to temporarily lose some of their stored energy, further limiting performance. To mitigate these issues, bus operators need to monitor and manage charging schedules to optimize performance during cold weather conditions.

The recommendations in this report regarding bus battery capacities and charger sizes are based on the route analysis and conceptual charging strategies developed in Task 3, utilizing minimum required sizes, technology that is currently available as well as manufacturer recommendations. As BEB and charger technology evolves, superior bus capacities and charger configurations may become available. This superior equipment may be substituted for the equipment proposed in this report in order to increase efficiency or bus performance. If an increase in charger size is desired, Letchworth CSD should confirm compatibility and capacity with the vendor and their utility provider, prior to purchasing.

It should also be noted that at the time of this report, fire and building codes have not been updated to include recommendations for preventing or managing battery electric fires. Although the frequency of BEB fires is significantly less than their diesel counterparts, Lithium-Ion batteries burn much hotter than a diesel fire and are extremely difficult to extinguish. Wendel has developed a fire protection protocol for BEB fires and, working with insurance agencies and various state fire marshals, has obtained approval for implementation of this protocol where BEBs are stored and maintained. It is important to note that the local Authority Having Jurisdiction (AHJ) is the primary authority for approval of fire protection protocols. As the codes are updated to address battery electric fires the recommendations of this report should be reviewed and updated as necessary and/or required.

Section 2 Executive Summary

Executive Summary



Strategy, Goals & Constraints

Wendel developed a transition plan to provide the district with the planning tools and flexibility necessary to ensure a seamless transition to a fully BEB fleet. The goal of the transition plan is to provide a path towards a zero-emission bus fleet by 2035 by providing Letchworth CSD with a study that evaluates and recommends infrastructure upgrades that can be used to make informed decisions regarding design and implementation to reduce energy loads and assist in conversion to carbon free fuels. This transition plan can be used as a guide to the district in transitioning to a BEB fleet and implementing BEBs.

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

Wendel has identified the following constraints to transition to a fully BEB fleet:

- Vehicle range limitations
- Charging duration requirements
- Utility demand requirements
- Demand on facilities and operations
- Maintenance knowledge

Analysis Results

Wendel analyzed current bus route data and determined the anticipated energy requirements per route. The anticipated energy requirements per route were then used to determine minimum battery size requirements, charging requirements and charging durations necessary.

Bus Storage/ Charging Locations	Depot address after electrification:	5551 Jordan Rd, Gainesville, NY 14066
	Number of buses at this depot location:	25
	Number of proposed chargers at this location:	24
	Ownership of the depot:	District Owned
	Bus ownership:	District Owned

Table 1 Bus storage and charging locations summary

Wendel evaluated seven different bus manufacturers and five different charger sizes ranging from 24 kW to 360 kW. The analysis includes the review of battery capacities, charger levels, and outputs. Wendel has analyzed these bus manufacturers per the existing routes to determine the performance of each bus configuration. The district has stated that they would prefer to utilize Bluebird buses wherever possible, though the use of Lion and/or IC is okay if necessary. Thus, Wendel has utilized Bluebird as the basis of the investigation for the proposed electric buses. As of the date of this study, Bluebird currently does not offer electric Type-A buses over 88 kWh or electric Type-C buses over 155 kWh. Lion and IC were utilized for the buses requiring larger sizes.

	Bus Size based on District Preferred Manufacturer	Bus Type	Route Buses	Spare Buses	Total Buses	Total Proposed BEBs
Buses	168 kWh BEB	Type A	4	0	**4**	**4**
	210 kWh BEB	Type C	1	0	**1**	**1**
	315 kWh BEB	Type C	6	4	**10**	**10**
	No Current Replacement	Type A & Type C	10	0	**10**	**10**
			21	**4**	**25**	**25**

Table 2 Proposed Bus Summary

	Charger Size	Route Bus Chargers	Spare Bus Chargers	Total Chargers	Total Proposed Chargers	
Chargers	24 kW	5	1	**6**	**6**	Location: Bus Garage
	60 kW	11	1	**12**	**12**	
	120 kW	4	1*	**5**	**5**	
	180 kW	1	0	**1**	**1**	
		21	**3**	**24**	**24**	
	*This charger is proposed to be used as a 2:1 charger to charge (2) BEBs. See Charging Requirements section of this report in Section 4 Route Analysis for more information.					

Table 3 Proposed Charger Summary

Among the routes for the (21) route buses examined; it was determined that the routes for (10) of the buses cannot currently be performed by a BEB as BEBs do not currently have adequate battery capacity at the existing bus size to meet these route demands. Wendel recommends that these buses be converted to BEBs towards the end of the transition plan. This will allow for the development of larger battery capacities which may enable the district to implement BEBs without splitting the routes in the future.

Routes	Total Number of Route Buses:				21
	Percent of Route Buses that can be electrified with current technology based on their existing daily routes:				52%
	Buses that cannot be electrified with current technology				
	Bus	Bus Type	Minimum Bus Size (kWh)	Reason	Mitigation
	36	Type A	433	Bus Size does not currently exist	Wait for technology to become available
	37	Type A	381	Bus Size does not currently exist	Wait for technology to become available
	62 - Contracted Route	Type C	635	Bus Size does not currently exist	Wait for technology to become available
	73	Type C	427	Bus Size does not currently exist	Wait for technology to become available
	75	Type C	540	Bus Size does not currently exist	Wait for technology to become available
	76	Type C	408	Bus Size does not currently exist	Wait for technology to become available
	82	Type C	356	Bus Size does not currently exist	Wait for technology to become available
	88	Type C	364	Bus Size does not currently exist	Wait for technology to become available
	90	Type C	319	Bus Size does not currently exist	Wait for technology to become available
	91	Type C	436	Bus Size does not currently exist	Wait for technology to become available

Table 4 Buses with Route Issues

It should be noted that light duty student transportation vehicles such as vans were not included in the scope of this study and have been excluded from the above analysis.

Utility Requirements & Impacts

The projected power requirements for the charging of BEBs requires a new utility service feed from NYSEG and an additional transformer. This is based on the assumption that a charge management system is used. The utility has completed the feeder study and determined that they can support the project's anticipated required power to charge the electric fleet.

Peak Demand	Fully Connected Peak BEB Demand/ Load:	870.2 kVA
	Anticipated Peak BEB Demand/ Load:	759.0 kVA
District-side Infrastructure	The district will need a new 480V, three phase electric service fed from a new 1000kVA transformer. A new 1600A switchgear lineup will be required to feed (7) downstream charging switchboards. See Section 6 Concept Development & Phasing Plan for more information.	
Utility-side Infrastructure	The utility will need to extend a new three phase primary to the location of the new utility provided transformer to the southwest of the bus garage. Until the utility completes their study, the extent of the utility feeder work is unknown.	

Table 5 Utility Impact Summary

Phases & Costs

Wendel has estimated the capital cost to implement battery-electric buses and supporting charging infrastructure to achieve 100% zero-emissions bus operations by 2035. Transition plan phases were determined by the bus implementation/procurement schedule provided by Letchworth CSD. The bus implementation schedule in Figure 1 below determines when infrastructure is required per phase. The transition plan can be adjusted if Letchworth CSD decides to purchase buses at a rate that is different than the suggested procurement plan which can be found in Table 28 BEB Procurement Schedule in Section 6 Concept Development & Phasing Plan of this report. Based on this transition plan and bus implementation schedule, Letchworth CSD will be fully transitioned to a zero-emission battery electric fleet by 2035 through (3) proposed phases as seen below.

Letchworth CSD Anticipated Battery Electric Bus Procurement by Year

	Existing	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Total
BEB Bus Procurement Schedule	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**2**	**4**	**5**	**1**	**3**	**1**	**6**	**25**
168 kWh BEB	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**0**	**1**	**4**
Cumulative 168 kWh BEBs	0	0	0	0	0	0	0	0	0	1	2	3	3	4	
210 kWh BEB	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
Cumulative 210 kWh BEBs	0	0	0	0	0	0	0	0	0	1	1	1	1	1	
315 kWh BEB	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**2**	**2**	**2**	**0**	**0**	**1**	**0**	**10**
Cumulative 315 kWh BEBs	0	0	0	0	0	0	3	5	7	9	9	9	10	10	
Placeholder	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**1**	**0**	**2**	**0**	**5**	**10**
Cumulative Placeholder BEBs	0	0	0	0	0	0	0	0	2	3	3	5	5	10	
Total Battery Electric Bus Fleet Size	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**5**	**9**	**14**	**15**	**18**	**19**	**25**	**25**

Figure 1 Anticipated Battery Electric Bus Procurement by Year

Phase 1 (2028-2030) of implementation will require electrical upgrades including a new primary transformer, new power distribution equipment, primary cable trench from new service to power distribution equipment, power feeds and charging equipment for up to (9) chargers, and fire protection upgrades.

- Charging system infrastructure for Phase 1: **$1,924,000**
- Fire Protection infrastructure: **$2,564,000**
- Total Phase 1 estimated cost: **$4,488,000**

Phase 2 (2031-2032) of implementation will require electrical upgrades including power feeds and charging equipment for up to (6) additional chargers.

- Total Phase 2 estimated cost: **$810,000**

Phase 3 (2033-2035) of implementation will require electrical upgrades including power feeds and charging equipment for up to (9) additional chargers.

- Total Phase 3 estimated cost: **$1,933,000**

The total estimated cost of the transition construction is **$6,869,000 to $7,592,000**

The costs associated with the BEBs themselves are not included in the above costs per phase or in the cost estimates included in Section 7 Transition Plan Cost Estimates. Table 6 below shows the estimated costs of the proposed BEBs as of the date of this report. Costs may vary based on region, date of procurement, and customization of the buses including add-ons and warranties.

Make	Bus Type	Bus Size (kWh)	Estimated Cost per Bus
Lion	Type A	168	$308,000
IC Bus	Type C	210	$405,000
IC Bus	Type C	315	$475,000

Table 6 BEB Estimated Cost per Bus

Incentives and Grants

Leveraging financial incentives to fund BEBs and charging infrastructure can help with the transition from diesel or gasoline powered buses to BEBs. Grants, rebates, vouchers, and tax credits can help mitigate the higher upfront vehicle costs and infrastructure investments. Several State and federal programs offer funding opportunities for both BEBs and chargers. The following incentives are not guaranteed and are only applicable as of the date of this report. All information is from NYSERDA's Electric School Bus Guidebook[1], an online resource available to the public. Please contact your NYSERDA representative for more information including eligibility, program requirements, and application process.

EPA Clean Heavy-Duty Vehicles Grant Program – School Bus Sub-Program

Vehicle Type	EPA Cost Share Percentage of New Vehicle Price	Pre-Vehicle Funding-Cap (Vehicle + Infrastructure)
Battery-Electric School Bus	75%	$280,000

Table 7 EPA Clean Heavy-Duty Vehicles Grant Program – School Bus Sub-Program from NYSERDA's School Bus Guidebook

[1]NYSERDA. (2024, June). Retrieved from Electric School Bus Guidebook Guide 4: Financial Incentives: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/Electric-School-Bus/Financial-Incentives-for-Electric-School-Buses-and-Chargers.pdf

New York School Bus Incentive Program – School Bus Voucher

School Bus Type Base	Base Voucher	Priority District Bonus	Scrappage Bonus	V2G Add-on	Wheelchair Add-on
New Type A	$114,000	$28,500	$47,500	$9,500	$8,000
New Type C	$147,000	$36,750	$61,250	$12,250	$8,000
New Type D	$156,000	$39,000	$65,000	$13,000	$8,000
Repowered A	$105,000	$21,000	N/A	$7,000	N/A
Repowered C	$135,000	$27,000	N/A	$9,000	N/A

Table 8 NYSBIP School Bus Voucher from NYSERDA's School Bus Guidebook

Joint Utilities of New York Medium- and Heavy-Duty EV Make-Ready Pilot

Utilities may provide incentives up to 90% of the utility-side infrastructure costs and up to 50% of customer-side costs to qualifying projects. Customer-side incentives are subject to dollar per kW caps, which vary by utility.

Utility	Customer-Side Incentive Cap
Central Hudson	$658.36/kW
Con Edison	$980.76/kW
National Grid	$440.96/kW
NYSEG	$409.07/kW
Orange and Rockland	$592.77/kW
RG&E	$712.08/kW

Table 9 Make-Ready Pilot Incentives from NYSERDA's School Bus Guidebook

New York School Bus Incentive Program – Charging Voucher

Type	Base Voucher Amount	With Fleet Electrification Plan
Non-Priority District	$25,000	$55,000
Priority District	$35,000	$65,000

Table 10 NYSBIP Charging Voucher from NYSERDA's School Bus Guidebook

Environmental Impacts

Annual Savings		
Existing Bus Usage		
Total Fossil Fuel Usage[1]	62,877.3	Gallons/year
Existing Energy Usage	8,721.1	MMBtus/year
Proposed Bus Usage		
Electricity Usage	1,241,606.3	kWh/year
Proposed Energy Usage	4,236.4	MMBtus/year
Energy Savings		
Total Energy Savings	4,484.7	MMBtus/year
Total Equivalent CO2 Savings	484.9	Metric Tons of CO2 /year

1. Assumes an average school bus fuel economy of 7.5 mpg and a total school bus fleet mileage of 471,850 miles / year

Table 11 Annual Savings Summary

The switch to BEBs from diesel buses would save approximately 4,485 MMBtus of energy or a 51% reduction in energy consumption. This is equivalent to 485 Metric Tons of CO2 emissions per year.

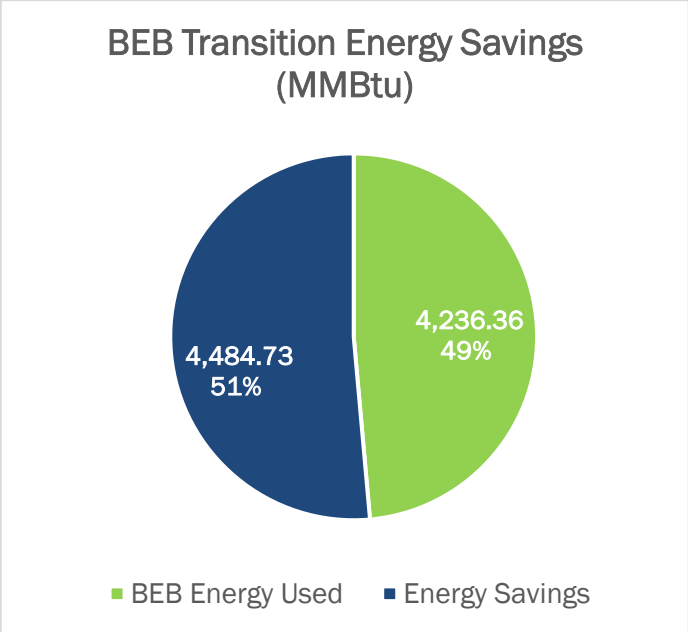


Figure 2 BEB Transition Energy Savings (MMBTU)

Section 3 Data Collection

DATA COLLECTION

Data collection plays a vital role in understanding, optimizing, and managing BEB transitions. It enables evidence-based decision-making, facilitates operational efficiency, and supports the successful integration of BEBs into existing school district systems.

Wendel submitted an RFI to Letchworth CSD after the NYSERDA application was submitted, to gather key data required to perform proper analyses. The requested data included:

- Bus Fleet Information – Fleet size (current and projected), bus replacement plan/schedule, preferred EV manufacturer, bus types/size
- Bus Schedules and Route Data – Detailed bus routes, departure and return times, operational hours, mileage, fuel consumption, operational contingency/resiliency plans.
- Bus Parking/Storage Arrangements – Indoor/Outdoor, location
- Fueling – current operational requirements for fueling
- Utility Data – Name of local utility, existing service size (kVA) and voltage, Utility contact
- Existing School Electrical Distribution Information – existing capacity, condition, expansion capability. Any as-built electrical site drawings (one-line distribution drawings)
- Existing Site Plan – CAD file of overall site plan
- Fleet maintenance data and historical cost

Received information can be found in Appendix F - Information Received from Client.

Bus Fleet Information

Bus fleet information is vital for effective planning, replacement strategies, and financial planning related to the transition of BEBs. It forms the foundation for a well-informed and successful BEB transition plan. Letchworth CSD provided a bus list containing (25) buses with their associated age, make, model, etc. Of these (25) buses, (21) are route buses, and (4) are spares. The district currently contracts out (1) of these (25) buses. Table 12 below shows the breakout of these buses by bus type and model number. The fleet consists of (19) Type C buses and (6) Type A buses. A full table with bus names and details can be found in Appendix F - Information Received from Client.

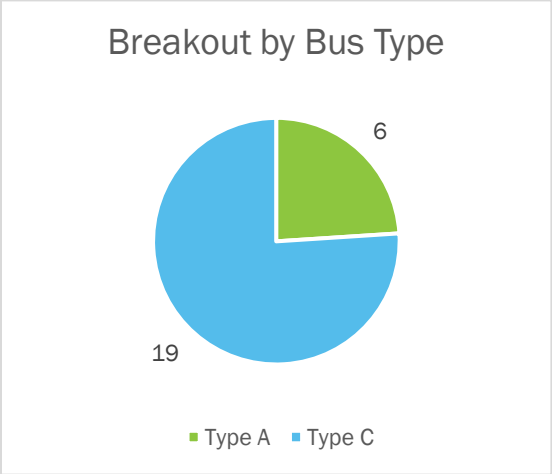


Figure 3 Bus Type Breakout

Vehicle Types & Quantities		
Bus Type	**Model Number**	**Quantity of Buses**
Type A	Chevrolet 3500 18 passenger w/c	1
Type A	Chevrolet 3500 24 passenger w/c	1
Type A	Chevrolet 3500 30 passenger	4
Type C	BlueBird Vision 65 passenger	19
Grand Total		***25***

Table 12 District Vehicle Types and Quantities

It should be noted that light duty student transportation vehicles such as vans were not included in the scope of this study and have been excluded from the above analysis.

Bus Schedules and Route Data

Vehicle schedules and route data for all buses was provided by Letchworth CSD. The data provides specific information on each individual route that is driven by Letchworth CSD's fleet of school buses. This data included departure and arrival times, total duration, and mileage for each route. Wendel included a 5% safety factor within the calculation, assuming there would be changes to routes. If route changes are greater than 5%, the changes can be addressed in detailed design. Each route duration includes 15 minutes after the bus is taken off the charger to account for energy utilization before the route. The duration and distance of the routes are essential to determine the energy requirements of each route, the viability of opportunity charging, and the bus battery size required.

The routes were then combined into "am" and "pm" routes. Each route group has a start and finish time, total duration, and total distance. Table 13 below shows a sample of the received routes broken up. The full table can be found in Appendix F - Information Received from Client.

AM & PM Route Schedule					
Vehicle Name	AM/PM	Total Distance (Miles)	Start Time	Finish Time	Duration (Minutes)
36	AM	123	5:45:00 AM	9:30:00 AM	225.00
36	PM	123	12:40:00 PM	4:25:00 PM	225.00
37	AM	109	6:15:00 AM	9:10:00 AM	175.00
37	PM	109	1:05:00 PM	3:40:00 PM	155.00
38	AM	33	6:30:00 AM	7:30:00 AM	60.00
38	PM	11	2:10:00 PM	2:40:00 PM	30.00

Table 13 Sample of Route Grouping

The following additional metrics were calculated to improve the accuracy of the analysis portion of the plan. Wendel calculated the deadhead distance and duration based on an assumption of 10% as approved by the district. Deadhead reflects the bus driving with no students onboard which will yield higher driving efficiencies.

- Active Distance (mi)
- Deadhead Distance (mi)
- Active Duration (Minutes)
- Deadhead Duration (Minutes)
- Resting Duration "On" (Minutes)
- Average Speed (mph)
- Time between AM/PM Routes

Data from previous studies was utilized to enhance the depth and comprehensiveness of the analysis. By leveraging the valuable insights and findings from these earlier investigations, Wendel was able to build upon existing knowledge and establish a stronger foundation for their study.

Section 4 Route Analysis

ROUTE ANALYSIS

Wendel analyzed the available bus route data for each route to determine the time and distance required for a bus to complete the routes. The analysis developed energy requirements per route and determined the minimum battery size requirements, charging requirements, and charging durations necessary per route.

Route Adjustments and Process

- Due to concerns that the district expressed regarding possible driver shortages and effects on bus run times and number of route buses needed, the district requested that (4) "Ghost Runs" be analyzed. These runs represent (4) possible additional runs that may be added to the district's current routes due to driver shortages. For the purposes of this study, Wendel has taken Spare Buses 20, 34, 39, and 59 and assigned them these "Ghost Routes". These "Ghost Routes" are assumed to be (2) AM routes, 6:30AM to 7:45AM, and (2) PM routes, 3:30PM to 4:45PM. Each route is assumed to have a total round-trip distance of 30 miles.

Utilizing the provided information from Letchworth CSD along with BEB data from previous studies[2], a route analysis was performed to determine the minimum and maximum kWh usage to satisfy each route. Wendel determined the energy associated with the routes to ensure the proposed bus and charger sizes meet the energy requirements of each route.

The route analysis does not consider extracurricular trips which may occur immediately before or after the routes. The proposed bus and charger sizes may not be able to meet the energy requirements of routes that have an additional extracurricular trip before or after. The route analysis also does not consider emergency closings, power outages, or any other unforeseen circumstances.

Calculations and Assumptions

The BEB efficiency inputs used in the analysis are shown in Table 14 BEB Efficiency Inputs and are derived from BEB performance data analyzed in previous studies that Wendel conducted as referenced in the paragraph above as well as EPA recommendations.

Battery efficiencies at worst case (High Battery Usage) and best case (Low Battery Usage) were determined by applying the EPA recommended range/efficiency impacts to the Original Equipment Manufacturers (OEM) Rated Efficiencies per BEB manufacture cut sheets. It was assumed a battery would experience within 20% of OEM rated efficiency at Low Battery Usage and within 50% at High Battery Usage. Best case usage assumes little/no HVAC usage, efficient regenerative braking, and/or an outdoor air temperature around 60-70°F. Worst case usage assumes extreme cold/heat, forgetting

[2] Previous studies include CT Transit Hamden Charging Model and CT Greater Bridgeport Transit Low/No Grant which aided in the assessment of charging scenarios to lead to better informed decisions on charging infrastructure, strategies, and operations.

to precondition while charging, traffic/long stops, and/or poor regenerative braking/aggressive driving.

The resting battery usage is associated with the time when a bus is "on" while waiting for its route to begin. A resting duration of 15 minutes before routes was assumed for all buses representing the time a bus is unplugged from the charger and is sitting waiting to begin its route. This time may be used for preconditioning or safety checks. The resting battery usage is attributed primarily to keeping the heater on. A usage of 20 kWh/hour was utilized as an assumption based on an average BEB heater size of 20 kW.

Deadhead battery usage is assumed to be more efficient based on the weight of a full bus compared to an empty bus along with an understanding that a bus with no students on it will not be making stops.

BEB Efficiency Inputs:

	Type A	Type B	Type C	Type D	
OEM Rated Efficiency	1.12	N/A	1.58	1.94	kWh per mile
Low Battery Usage	1.55	N/A	2.18	2.68	kWh per mile
Low Deadhead Battery Usage	1.24	N/A	1.74	2.14	kWh per mile
Resting Battery Usage (Heat only)	20.00	N/A	20.00	20.00	kWh per hour
High Battery Usage	2.48	N/A	3.48	4.29	kWh per mile
High Deadhead Battery Usage	2.19	N/A	3.08	3.79	kWh per mile

Table 14 BEB Efficiency Inputs

Analysis Assumptions:

- Maximum time bus is "on" and unplugged from charger before route start is 15 min.
- Heater energy usage is 20 kW at air temperatures below 10 Degrees Fahrenheit.
- Low battery usage represents best case usage with little/no HVAC usage at moderate OA Temperatures.
- High battery usage represents worst case usage with extreme cold/heat, traffic/ long stops.

Charging Variables	
Dead Head Miles	10%
Charging Rate Safety Factor	90%
Route Safety Factor	5%
Efficiency Safety Factor (Distance)	11%
Maximum Battery Level	90%
Anticipated Degradation	90%
Minimum Battery Level	10%

Table 15 Charging Variables

Utilizing the route data, inputs, and assumptions described in the paragraphs above, Wendel calculated the maximum kWh used for each route group with the following formula:

Maximum Energy Usage (kWh) Calculation:
*(Active Distance * High Battery Usage) + (Deadhead distance * High Deadhead Battery Usage) + (Resting Duration * Resting Battery Usage)*

Equation 1 Maximum Energy Usage

The graph in Figure 4 BEB Range in Cold Weather represents a real-world cold weather example of a BEB in Duluth Minnesota between January 2019 and December 2021[3]. This study performed by National Renewable Energy Laboratory (NREL) exhibits a range decrease of approximately 33% at times of temperatures below 30°F. The results of this case study align with Wendel's route analysis strategy and assumptions.

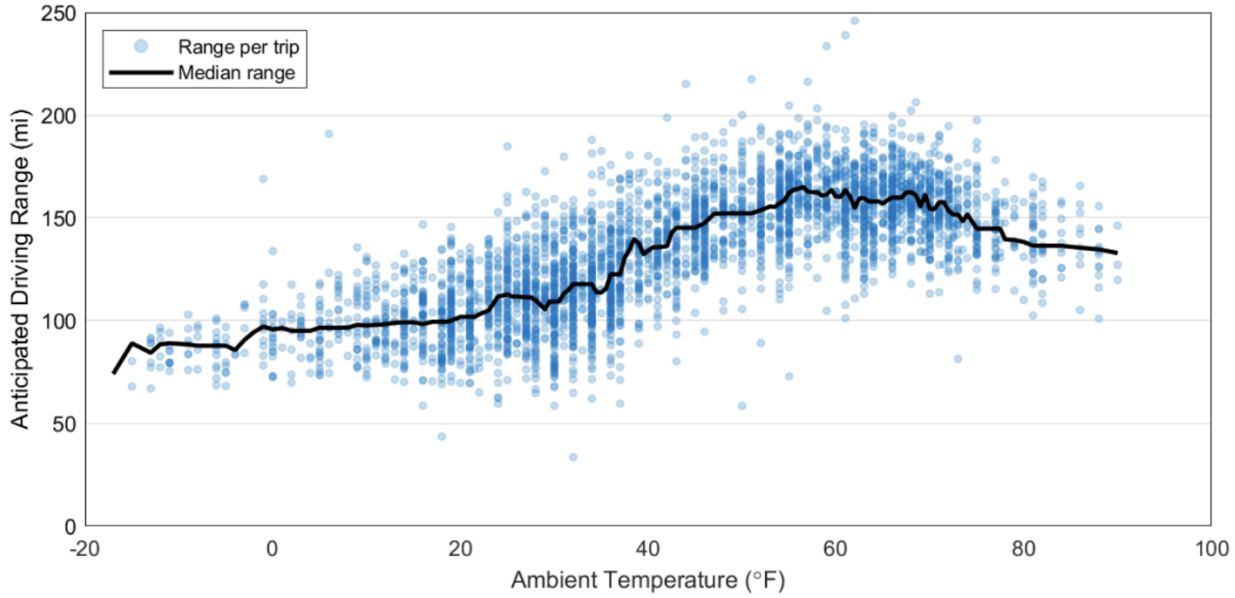


Figure 4 BEB Range in Cold Weather

Energy Requirements of Bus Routes

Wendel reviewed the route information provided by the district, a copy of the route schedule as received has been included in Appendix F - Information Received from Client. Due to concerns that the district expressed regarding possible driver shortages and effects on bus run times and number of route buses needed, the district requested that (4) "Ghost Runs" be analyzed. These runs represent (4) possible additional runs that may be added to the district's current routes due to driver shortages.

[3] Jeffers, Matthew, Leslie Eudy, Erik Bigelow, Greg Olberding, and Amy Posner. 2022. Duluth Transit Authority Battery-Electric Bus Evaluation. Golden, CO: National Renewable Energy Laboratory. NREL/ TP-5400-83038. https://www.nrel.gov/docs/fy22osti/83038.pdf.

For the purposes of this study, Wendel has taken Spare Buses 20, 34, 39, and 59 and assigned them these "Ghost Routes". These "Ghost Routes" are assumed to be (2) AM routes, 6:30AM to 7:45AM, and (2) PM routes, 3:30PM to 4:45PM. Each route is assumed to have a total round-trip distance of 30 miles. The route information was used to determine the times that buses would be departing and arriving at the bus garage where charging would take place. It was assumed that once a bus returns to the bus garage after its route, it would begin charging if it would not leave for its next route for another 30 minutes.

The route analysis utilizes the received route distances to develop the anticipated energy requirements per route and then uses those energy requirements to determines the minimum BEB battery size requirements. The analysis then determines the minimum charger size and charging durations necessary per route based on the minimum battery size requirements and the anticipated energy requirements.

Table 16 below shows the maximum energy usage calculated by the route analysis (refer to Equation 1 Maximum Energy Usage.)

Bus Number	Bus Type	Highest Route Distance (miles)	Highest Energy Usage (kWh)	Bus Number	Bus Type	Highest Route Distance (miles)	Highest Energy Usage (kWh)
20 - Ghost Run	Type A	30	82.34	78	Type C	55	210.52
34 - Ghost Run	Type A	30	82.34	80	Type C	57	210.43
36	Type A	123	311.49	81	Type C	48	184.55
37	Type A	109	273.98	82	Type C	68	256.27
38	Type A	33	88.15	86	Type C	53	196.27
39 - Ghost Run	Type A	30	82.34	87	Type C	55	208.28
59 - Ghost Run	Type C	30	113.66	88	Type C	71	262.08
62 - Contracted Route	Type C	125	456.96	89	Type C	43	164.62
73	Type C	83	307.33	90	Type C	61	229.87
75	Type C	103	389.01	91	Type C	84	313.58
76	Type C	82	293.74				

Table 16 Max Energy Usage by Bus

Battery Electric Bus Selection

The recommendations in this report regarding bus battery capacities and charger sizes are based on minimum requirements, utilizing technology that is currently available as well as manufacturers recommendations. Each school bus manufacturer has a different bus battery and charge configuration that they offer. Wendel analyzed seven manufacturers and bus types based on the existing routes to determine performance of each bus configuration.

Wendel evaluated the following list of electric buses based on their available battery sizes, vehicle to grid capabilities, and existing relationship with the district.

- Blue Bird
- BYD
- Collins
- Greenpower
- IC
- Lion
- Thomas

The district has stated that they would prefer to utilize Bluebird buses wherever possible, though the use of other manufacturers is okay if necessary. Thus, Wendel has utilized Bluebird as the basis of the investigation for the proposed electric buses. Bluebird currently does not offer electric Type-A buses over 88 kWh or electric Type-C buses over 155 kWh. Lion and IC were utilized for the buses requiring larger sizes. Table 17 below shows the BEB models and their OEM rated ranges as of the date of this report.

Bus Type	Manufacturer	Model	kWh	OEM rated Range (miles)	Seats
Type A	Bluebird	Bluebird Micro Bird G5	88	100	30
Type C	Bluebird	Bluebird vision	155	120	77
Type D	Bluebird	BlueBird All American RE	155	120	84
Type A	BYD	BYD Type A	156	105	30
Type D	BYD	BYD Type D	300	155	84
Type A	Collins	Collins Bus Magellan	127	105	24
Type A	Greenpower	Greenpower Nano Beast	118	150	24
Type D	Greenpower	Greenpower BEAST	194	140	91
Type C	IC	IC eCE	210	135	78
Type C	IC	IC eCE	315	200	78
Type A	Lion	Lion A	168	150	24
Type C	Lion	Lion C	210	155	77
Type D	Lion	Lion D	210	155	83
Type C	Thomas	Thomas Saf-T-Liner C2 Jouley	246	150	81
Type D	Thomas	Thomas Saf-T-Liner C2 Jouley	244	150	81

Table 17 BEB Models and OEM Rated Ranges as Of This Report Date

The route analysis utilizes the received route distances to develop the anticipated energy requirements per route and then uses those energy requirements to determines the minimum BEB battery size requirements. The minimum BEB battery size requirements do not take into account extracurricular trips which may occur immediately before or after the routes. The proposed minimum bus size may not be able to meet the energy requirements of routes that have an additional extracurricular trip before or after. The route analysis also does not consider emergency closings, power outages, or any other unforeseen circumstances. Table 18 below shows the minimum bus size required based on the maximum energy usage calculated by the route analysis.

Bus Number	Bus Type	Max Route Mileage (Miles)	Minimum Bus Size based on Max Energy Usage (kWh)	Minimum Bus Size Available Based on Current Manufacturers	Proposed Bus Size and Type Based on Preferred Manufacturer
20 - Ghost Run	Type A	30	114	118 kWh - Greenpower	168 kWh - Lion
34 - Ghost Run	Type A	30	114	118 kWh - Greenpower	168 kWh - Lion
36	Type A	123	433	No Current Replacement	No Current Replacement
37	Type A	109	381	No Current Replacement	No Current Replacement
38	Type A	33	122	127 kWh - Collins	168 kWh - Lion
39 - Ghost Run	Type A	30	114	118 kWh - Greenpower	168 kWh - Lion
59 - Ghost Run	Type C	30	158	210 kWh - IC	210 kWh - IC
62 - Contracted Route	Type C	125	635	No Current Replacement	No Current Replacement
73	Type C	83	427	No Current Replacement	No Current Replacement
75	Type C	103	540	No Current Replacement	No Current Replacement
76	Type C	82	408	No Current Replacement	No Current Replacement
78	Type C	55	292	315 kWh - IC	315 kWh - IC
80	Type C	57	292	315 kWh - IC	315 kWh - IC
81	Type C	48	256	315 kWh - IC	315 kWh - IC
82	Type C	68	356	No Current Replacement	No Current Replacement
86	Type C	53	273	315 kWh - IC	315 kWh - IC
87	Type C	55	289	315 kWh - IC	315 kWh - IC
88	Type C	71	364	No Current Replacement	No Current Replacement
89	Type C	43	229	315 kWh - IC	315 kWh - IC
90	Type C	61	319	No Current Replacement	No Current Replacement
91	Type C	84	436	No Current Replacement	No Current Replacement

Table 18 Minimum Bus Size Required by Bus

Proposed Bus Size Based on Preferred Manufacturer	Bus Type	Route Buses	Spare Buses	Total Proposed Buses
168 kWh - Lion	Type A	4	0	4
210 kWh - Lion	Type C	1	0	1
315 kWh - IC	Type C	6	4	10
No Current Replacement	Type A & Type C	10	0	10
		21	5	25

Table 19 Proposed Bus Battery Sizes Summary

The route analysis shows that the maximum energy usage of any one route would be 457 kWh which was associated with a Type C bus. Based on today's BEB technology, there is not currently a battery large enough to be able to perform this route. Among the routes for the (21) buses examined; it was determined that the routes for (10) of the buses cannot currently be performed by a BEB as BEBs do not currently have adequate battery capacity at the existing bus size to meet these route demands. Wendel recommends that these buses be converted to BEBs towards the end of the transition plan. This will allow for the development of larger battery capacities and/or improved technology which may enable the district to implement BEBs without splitting the routes in the future. Table 20 below shows the minimum BEB sizes needed to perform the routes as they currently are for these (10) buses.

Bus Number	Bus Type	Minimum Bus Size based on Maximum Energy Usage (kWh)	Notes
36	Type A	433	Bus size does not currently exist
37	Type A	381	Bus size does not currently exist
62 - Contracted Route	Type C	635	Bus size does not currently exist
73	Type C	427	Bus size does not currently exist
75	Type C	540	Bus size does not currently exist
76	Type C	408	Bus size does not currently exist
82	Type C	356	Bus size does not currently exist
88	Type C	364	Bus size does not currently exist
90	Type C	319	Bus size does not currently exist
91	Type C	436	Bus size does not currently exist

Table 20 Buses with BEB Transition Issues

The analysis shows that the maximum energy usage per route within current battery capacity constraints is 211 kWh which, according to the district preferred manufacturer, would require a 315 kW BEB. The anticipated energy usage for each route can be found in Appendix B.3 – Final Calculations and Models.

Extracurricular Trips

Extracurricular bus runs such as field trips and sports trips, though included in this study, were not included in the route analysis due to the unpredictable nature of these trips. For example, the buses that perform these trips vary as well as the start and end times of the trips and the mileage associated with them. It is recommended that the district use Table 21 below to determine whether their proposed electric buses will be able to complete the trips. The ranges listed assumes the buses are fully charged to their recommended capacity (90%).

It should be noted that unlike the student pick up / drop off routes, the buses performing extracurricular trips would have the ability to charge at either another school (assuming they have spare chargers) or public charging stations during the sporting / field trip event itself which can increase this range. The amount of additional range provided by these public charging stations would depend on the charger itself and cannot be estimated by Wendel.

The ranges listed in Table 21 were calculated using the assumptions listed for each case. The EPA and the Joint Office of Energy and Transportation states that BEBs may experience at or within 40%-60% of OEM rated efficiency on a "Worst Day" and at or within 10%-15% of OEM rated efficiency on an "Average Day." Thus, it was assumed a battery would experience 50% of OEM rated efficiency for the “Worst Case” and 15% of OEM rated efficiency for the “Average Case”.

Worst Case

- Full Bus
- Extreme Cold or Heat
- HVAC use during rest
- Bus has degraded to 90%
- Battery does not go below 10%
- Battery does not charge above 90%
- 11% Safety factor on efficiency

Average case

- Full Bus
- Moderate OA Temps
- No HVAC Use
- Bus has degraded to 90%
- never go below 10%
- Never charge above 90%
- 11% Safety factor on efficiency

Bus Type	Bus Size and Manufacturer	Worst Case Range (Miles)	Average Case Range (Miles)
Type A	88 kWh - Bluebird	28	52
Type A	156 kWh - BYD	31	54
Type A	127 kWh - Collins	31	54
Type A	118 kWh - Greenpower	44	78
Type A	168 kWh - Lion	45	78
Type C	155 kWh - Bluebird	36	59
Type C	196 kWh - Bluebird	36	59
Type C	282 kWh - BYD	53	88
Type C	210 kWh - IC	40	67
Type C	315 kWh - IC	61	101
Type C	210 kWh - Lion	46	78

Bus Type	Bus Size and Manufacturer	Worst Case Range (Miles)	Average Case Range (Miles)
Type C	246 kWh - Thomas	45	75
Type D	155 kWh - Bluebird	35	59
Type D	255 kWh - BYD	47	78
Type D	194 kWh - Greenpower	42	70
Type D	387 kWh - Greenpower	91	142
Type D	210 kWh - Lion	46	78
Type D	244 kWh - Thomas	45	75

Table 21 Allowable Range by Bus Size

Charging Requirements

Five charger sizes were reviewed and include a 24 kW DC charger, 60 kW DC charger (fast charger), 120 kW DC charger (fast charger), 180 kW DC charger (fast charger), and a 360 kW DC charger (fast charger). Charger recommendations are based on utilizing one charger per route bus to remain conservative. The district may choose to utilize higher kW chargers of at least twice the proposed size which would allow for the charging of two school buses per charger. This would decrease installation and overall charger costs. Another advantage of this approach would be if only one school bus is utilizing the two-port charger at any time, that BEB's required charging time would decrease as it would be able to take advantage of the full charger output.

Based on the route analysis, the proposed charging duration between AM and PM routes ranges from 1 hour and 32 minutes to 21 hours and 9 minutes. The largest charger size proposed is 180 kW. The charging durations for each route can be found in Appendix B.3 – Final Calculations and Models. Wendel has determined that the routes the district has provided will require (1) 180 kW charger, (5) 120 kW chargers, (12) 60 kW chargers, and (6) 24 kW chargers. Of the proposed chargers (1) 120 kW charger, (1) 60 kW charger, and (1) 24 kW charger are for spare buses. The (1) 120 kW spare charger is proposed to be used as a 2:1. It is assumed that spare buses are used only to replace out of service route buses or for extracurricular trips. The contracted bus would require (1) 60 kW charger and is included in the proposed charger quantities. The specific charger sizes and durations needed to charge by charger size can be found in Table 22 below for each of the (21) route buses.

Charger Size	Route Bus Chargers	Spare Bus Chargers	Total Proposed Chargers
24 kW	5	1	6
60 kW	11	1	12
120 kW	4	1	5
180 kW	1	0	1
24 kW	5	1	6
	21	3	24

Table 22 Proposed Charger Quantities

Bus Number	Time Between AM and PM Shifts	Minimum Charging Time Needed to Perform PM Route - 120 kW	Minimum Charging Time Needed to Perform PM Route - 60 kW	Minimum Charging Time Needed to Perform PM Route - 24 kW	Proposed Charger Size (kW)
20 - Ghost Run	7:30	0:45	1:31	3:48	24
34 - Ghost Run	7:30	0:45	1:31	3:48	24
36	2:55	2:50	5:41	14:12	120
37	3:40	2:32	5:04	12:41	120
38	6:25	0:18	0:37	1:32	24
39 - Ghost Run	7:30	0:45	1:31	3:48	24
59 - Ghost Run	7:30	1:03	2:06	5:15	24
62 - Contracted Route	No Midday Charging	No Midday Charging	No Midday Charging	No Midday Charging	60
73	4:58	2:49	5:39	14:08	120
75	1:55	2:28	4:56	12:22	180
76	4:40	2:43	5:26	13:35	120
78	5:25	1:56	3:53	9:44	60
80	6:54	1:56	3:53	9:44	60
81	5:20	1:42	3:25	8:32	60
82	5:19	2:22	4:44	11:51	60
86	4:52	1:49	3:38	9:05	60
87	5:14	1:55	3:51	9:38	60
88	5:21	2:25	4:51	12:07	60
89	5:11	1:31	3:02	7:37	60
90	5:10	2:07	4:15	10:38	60
91	5:07	2:21	4:42	11:46	60

Table 23 Minimum Charging Durations by Bus and Charger Size

These proposed charger sizes are based on selecting the smallest size charger needed out of the five charger sizes reviewed (24 kW, 60 kW, 120 kW, 180 kW, and 360 kW). It is recommended that the district look into limiting the number of different chargers sized to ease operations and ordering. Charger sizes procured that vary from the Required Charging Size should be greater in kW.

Energy and Environmental Impact

Annual Savings		
Existing Bus Usage		
Total Fossil Fuel Usage[1]	62,877.3	Gallons/year
Existing Energy Usage	8,721.1	MMBtus/year
Proposed BEB Usage		
Electricity Usage	1,241,606.3	kWh/year
Proposed Energy Usage	4,236.4	MMBtus/year
Energy Savings		
Total Energy Savings	4,484.7	MMBtus/year
Total CO2 Savings	484.9	Metric Tons/year

1. Assumes an average school bus fuel economy of 7.5 mpg and a total school bus fleet mileage of 471,850 miles / year

Table 24 Annual Savings Summary

A total annual mileage for Letchworth CSD's bus fleet was provided of 471,850 miles and an annual fuel consumption of 62,877 gallons of diesel. This fuel usage is based on an average school bus fuel economy of 7.5 mpg and a total school bus fleet mileage of 471,850 miles per year, and an assumption of 180 school days per year. This equates to approximately 8,721.1 MMBtus of associated existing energy usage per year. Based on the route modeling analysis and a review of the existing diesel bus performance, the switch to BEBs from diesel buses would save approximately 4,484.7 MMBtus of energy or a 51% reduction in energy consumption.

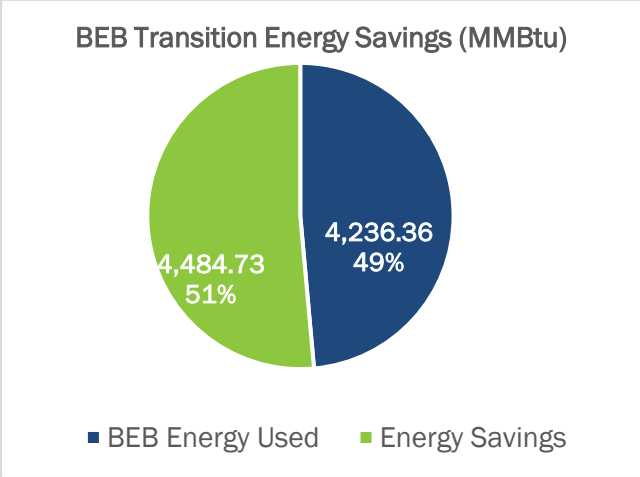


Figure 5 BEB Transition Energy Savings (MMbtu)

CONCEPTUAL CHARGING STRATEGY

Wendel developed a conceptual charging strategy for the fleet based on the bus route data collected and the route analyses developed in previous tasks. The goal of the conceptual charging strategy is to determine the smallest available battery size that meets the district's route needs and the associated electrical impact. The charging strategy identified the following items:

- Optimum charger size – assuming a 1 to 1 charger to dispenser configuration
- Anticipated peak demand
- Number, types, and sizes of chargers required to charge the fleet in the allotted time frames – assuming a battery degradation of 10%, a lower limit of 10% state of charge, and an upper limit of 90% state of charge. This is illustrated in Figure 6 below.

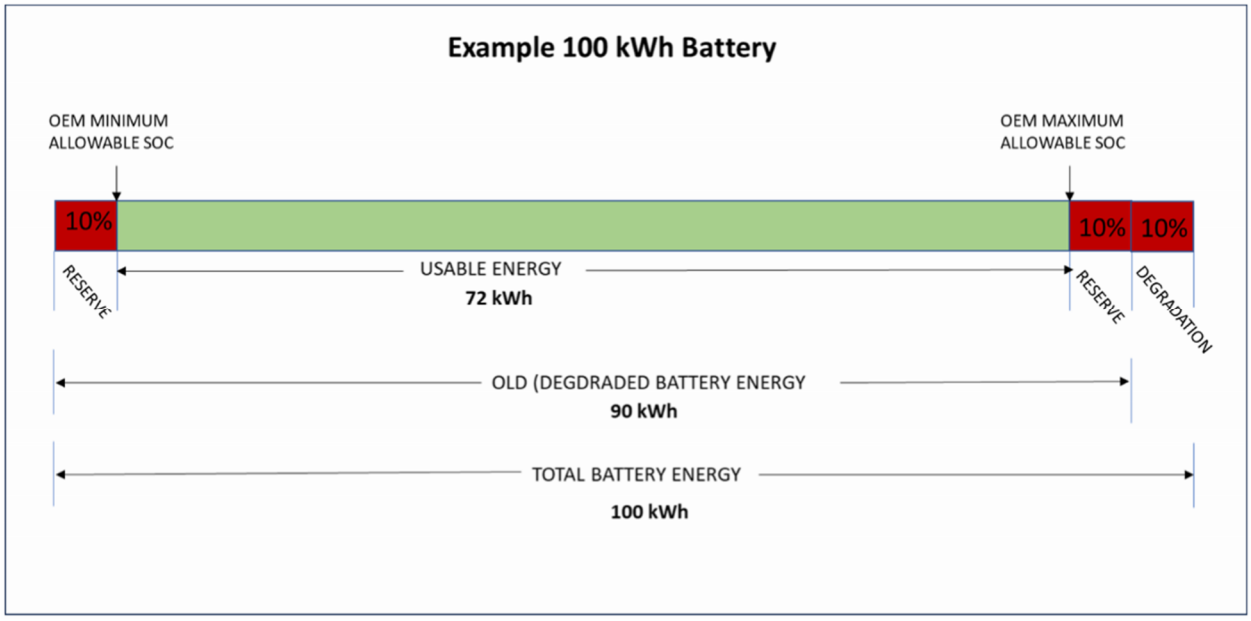


Figure 6 Illustration of Usable Battery

Charging Model Development Process:

An overview of the process Wendel utilized for the charging strategy modeling process is shown below:

Step 1 Analyze the route data and organize the data into numerical values that represent the times at which each bus that serves the associated route would depart and arrive at Letchworth CSD for a standard week.

Step 2 Develop a model reflecting when all (21) route buses **arrive and depart** Letchworth CSD over a winter month with an additional 15 minutes added to route durations representing the time after the bus is removed from the charger and before it leaves to begin each route.

Step 3 Develop a model reflecting bus **charge hours** for each hour of a 1-month period. This shows how many hours the bus has left to charge at any hour.

Step 4 Develop a weekly model reflecting the **battery state of charge** throughout the month. The 1-month period utilizes TMY3 (typical meteorological year) weather data based on region 7 for January – which is considered the coldest month of the year in NYS to simulate a representative year's coldest month.

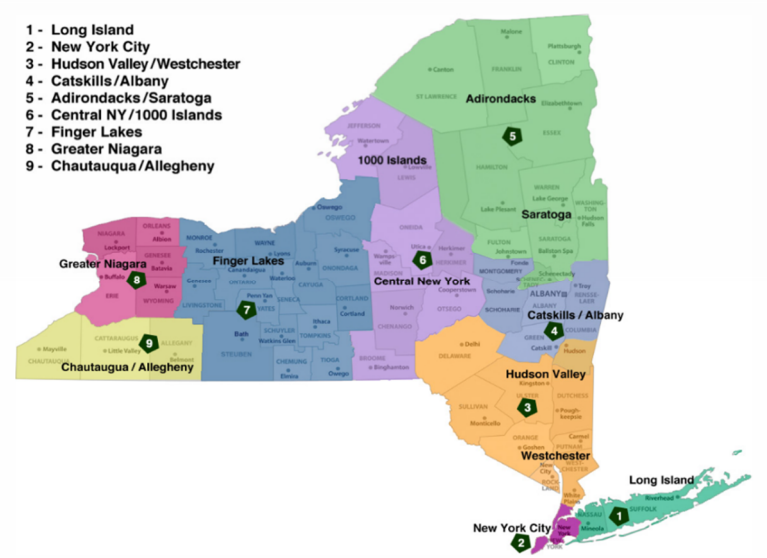


Figure 7 NYS Weather Regions

Step 5 Develop a 1-month model utilizing the state of charge model to reflect the charging of the battery throughout the week. This model shows the charging **impact on the battery** each hour throughout the 1-month period.

Step 6 Develop a 1-month model utilizing the impact on battery model to reflect the **impact on the facility (Facility Demand)** while charging. This model utilized an assumed charging efficiency to convert the impact on the battery to the actual impact on Letchworth CSD usage.

Battery Electric Bus Requirements

As stated by Letchworth CSD, all routes provided by the district are driven by (20) buses (Route Buses) and (1) contracted bus. The district also has (4) additional buses that are used as spares (Spare Buses) for a total fleet of (25) district buses. Using the route information provided and energy usage rates calculated in the route analysis, Wendel performed a charging analysis of all districts owned buses (excluding spare buses and contracted buses). This information can be found in Section 4 Route Analysis - Basis of Design.

The charging analysis consisted of modeling battery life at each hour throughout the month of January to model conditions during the coldest month on average. This was done as low temperatures have

been shown to impact the efficiency of BEB batteries negatively. These models also determined the amount of charge delivered to the bus batteries for each hour throughout the month and the amount of charge delivered from the district for each hour throughout the month.

From these models, Wendel was able to confirm the quantity and sizes of buses required, assuming all buses would remain the same Type (Type A, Type C, etc.). Wendel utilized IC and Lion buses as the basis of the investigation for the proposed electric buses per the district's request.

Charger Requirements

The charging strategy focuses on charging for long periods of time at low charging speeds. The model shows the batteries' charging rate based on the duration of time to charge. The maximum single bus charging rate for any hour throughout the winter month was modeled to be 120 kW. A breakdown of the charging requirements is shown below:

- 2 Buses require between 100 kW and 120 kW of charge
- 1 Buses require between 60 kW and 80 kW of charge
- 4 Buses require between 40 kW and 60 kW of charge
- 7 Buses require between 20 kW and 40 kW of charge
- 7 Buses require less than 20 kW of charge

The breakdown above shows the variety of chargers that could be utilized by Letchworth CSD to charge the school bus fleet. Wendel used (5) charger sizes to reduce the operational impact on the school district when transitioning to BEBs.

Basis of Design

To provide a complete demand profile for all buses, the charging model assumes that the battery capacities needed for routes that are currently too long will become available in the future and that the largest charger size needed for that bus size would be used. Buses with route distances or charging requirements that are not feasible were excluded from this study. For this analysis, it was assumed that the maximum number of buses charging during peak time (mid-day) is (21) buses, this does not include the spare buses. This approach assumes that spare buses would be charged outside of mid-day peak hours.

The information in Table 25 below was calculated during the route analysis was used as the basis for the conceptual charging strategy model.

Bus	Bus Size (kWh)	Charger Size (kW)	Max AM Usage Rate (kWh / hr)	Max PM Usage Rate (kWh / hr)	PM Route Usage (kWh)
20 - Ghost Run	168	24	54.89	54.89	82.34
34 - Ghost Run	168	24	54.89	54.89	82.34
36	440*	120	77.87	76.74	306.97
37	390*	120	85.51	96.70	273.98
38	168	24	70.52	44.61	33.46
39 - Ghost Run	168	24	54.89	54.89	82.34
59 - Ghost Run	210	24	75.77	75.77	113.66
62 - Contracted Route	640*	60	107.52	0	0.00
73	430*	120	94.56	100.74	305.57
75	550*	155	60.63	91.09	267.20
76	410*	120	100.71	119.08	293.74
78	315	60	76.21	74.74	210.52
80	315	60	88.49	64.75	210.43
81	315	60	48.05	74.82	184.55
82	360*	60	98.53	85.90	256.27
86	315	60	89.92	115.45	196.27
87	315	60	55.44	70.60	208.28
88	370*	60	92.72	87.85	262.08
89	315	60	58.22	59.50	164.62
90	320*	60	81.05	72.59	229.87
91	440*	60	100.08	85.23	254.28

Table 25 Charging Strategy Inputs

*Bus size does not currently exist

State of Charge

Wendel assumed a battery degradation of 10%, a lower limit of 10% state of charge, and an upper limit of 90% state of charge. A weekly model reflecting the **battery state of charge** throughout the 5 weeks was completed based on these assumptions. As seen in Figure 8 below, none of the proposed bus battery's state of charge ever goes below 9% or above 81%.

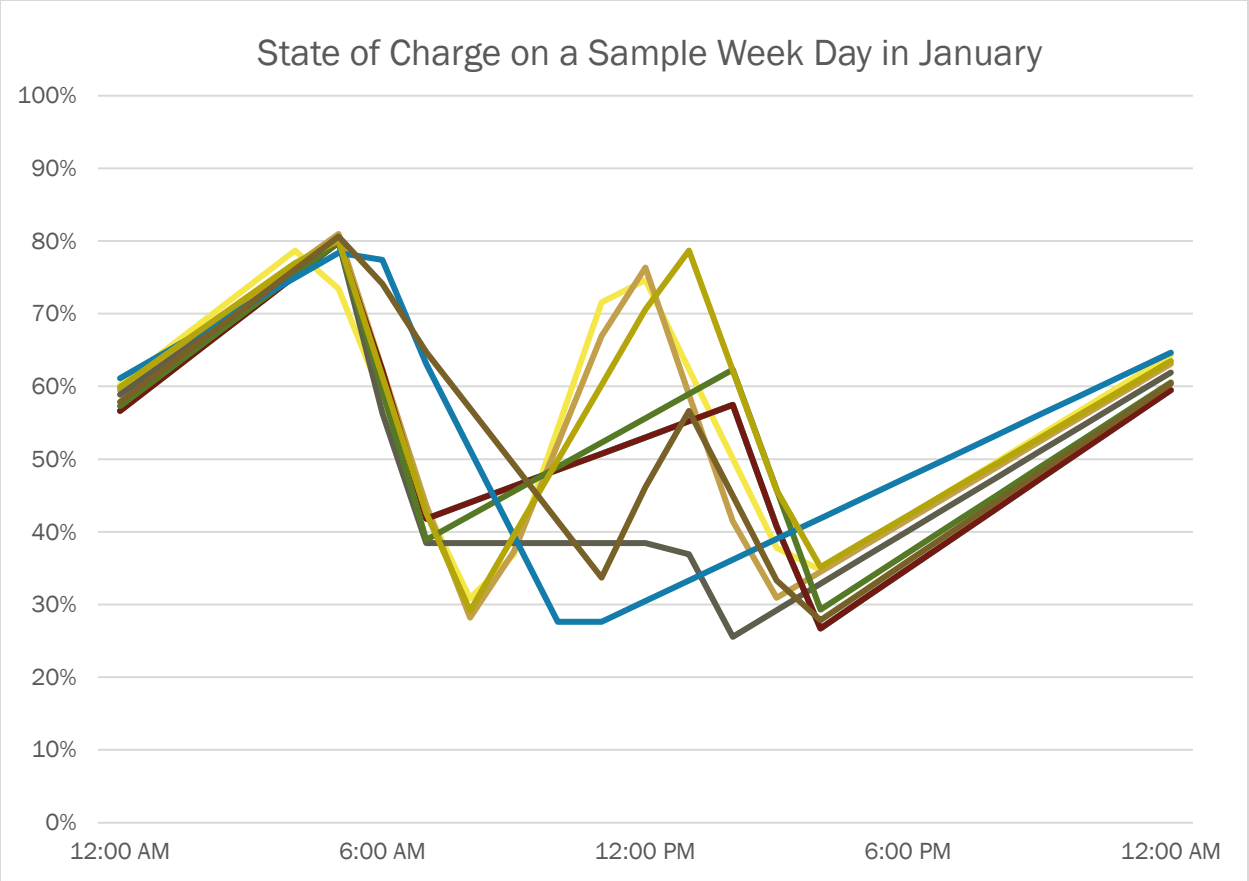


Figure 8 State of Charge on a Sample Weekday with Demand Reduction Implemented

Demand Impact

Demand is the power drawn from the utility at any one point in time, measured in kW. Peak demand is the maximum demand required from the utility, during the utilities peak demand period, over a one-month period and is also measured in kW. The peak demand is the cumulative demand of all loads connected to the utility transformer.

Not all buses will need a maximum charge rate from the charger to reach a full charge in the available time frame. Charging a bus at a reduced charge rate increases the life of the battery and reduces overall demand on the utility system. Demand reduction is evaluating the state of charge when the bus arrives back at the garage and determining the minimum charge level required to charge the bus in the allotted time, to ensure the bus is adequately charged when it needs to begin a new route. A charge management system should implement demand reduction, further details can be found in Section 5 Conceptual Charging Strategy - Charge Management section below. If demand reduction is implemented in every bus in the fleet, the overall utility demand will be greatly reduced, reducing utility demand charges, and extending the life of the batteries. The goal of demand reduction is to flatten

demand as much as possible, especially during peak hours. A model of what this might look like in terms of daily demand for Letchworth CSD can be seen in Figure 9 below.

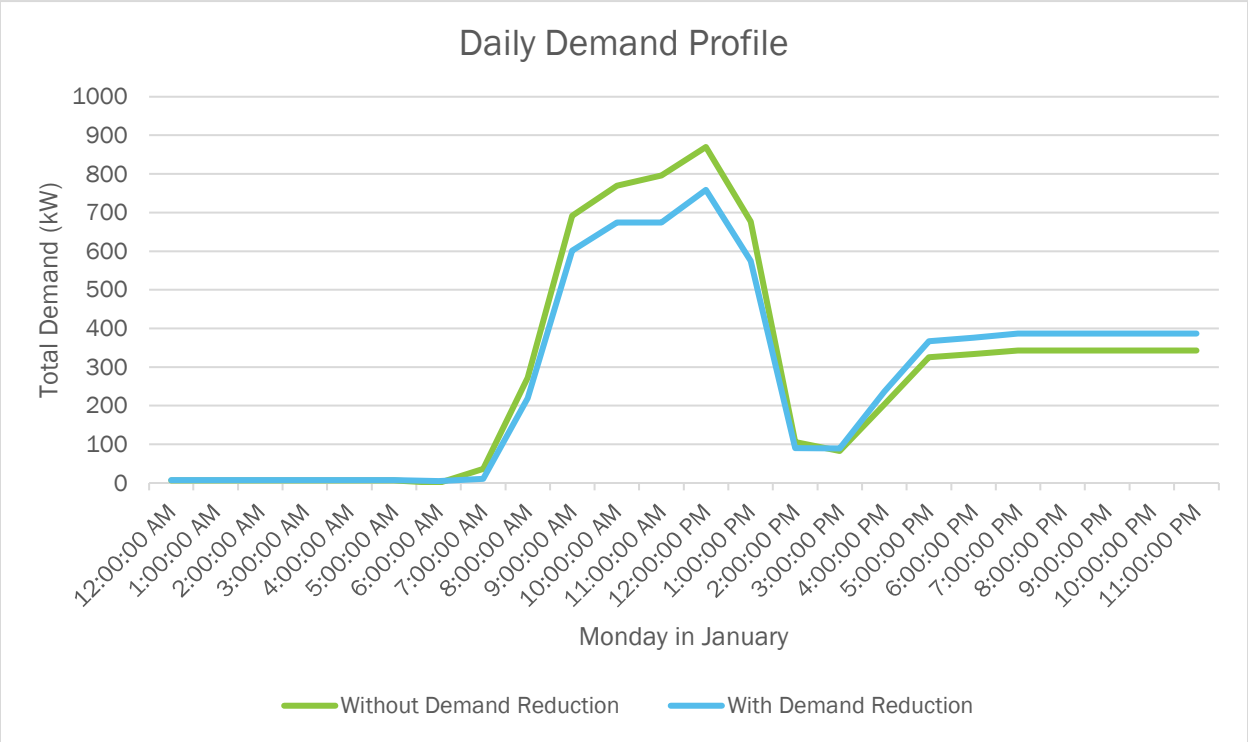


Figure 9 Daily Demand Profile at Maximum Peak Demand

**This demand profile represents the maximum daily demand based on the charging model. Demand Peaks fluctuate per day and may be lower than the above.*

The maximum combined bus electrical demand when all (21) route buses are converted to BEBs and utilize demand reduction strategies during a winter month was calculated to be 759.0 kW which occurs between 12 PM and 1PM Mondays. Before the demand reduction strategy was implemented, the peak demand was 870.2 kW which would occur between 12 PM and 1 PM on Mondays.

Based on the state of charge when the buses arrive back at the garage and the minimum charge level required to charge the bus in between AM and PM routes, Wendel modeled how demand reduction strategies would impact the district's proposed demand profile if implemented. It was determined that the implementation of this demand reduction strategy could yield savings of 111 kW of peak daily demand or 13%, resulting in utility cost savings of up to 20%. This highlights the importance of implementing a charge controller optimization strategy or a charge management system (CMS).

Before Demand Reduction		
Maximum combined bus electrical demand	870	kW
Day of Week Max Demand Occurs	Monday	
Time Max Demand Occurs Between	12:00 PM	1:00 PM

After Demand Reduction		
Maximum combined bus electrical demand	759	kW
Day of Week Max Demand Occurs	Monday	
Time Max Demand Occurs Between	12:00 PM	12:00 PM
Savings		
Demand Reduction	111	kW
Percent Demand Reduction	13%	

Table 26 Demand Summary

Figure 10 below shows the demand profile over a sample week in January with demand reduction strategies being implemented.

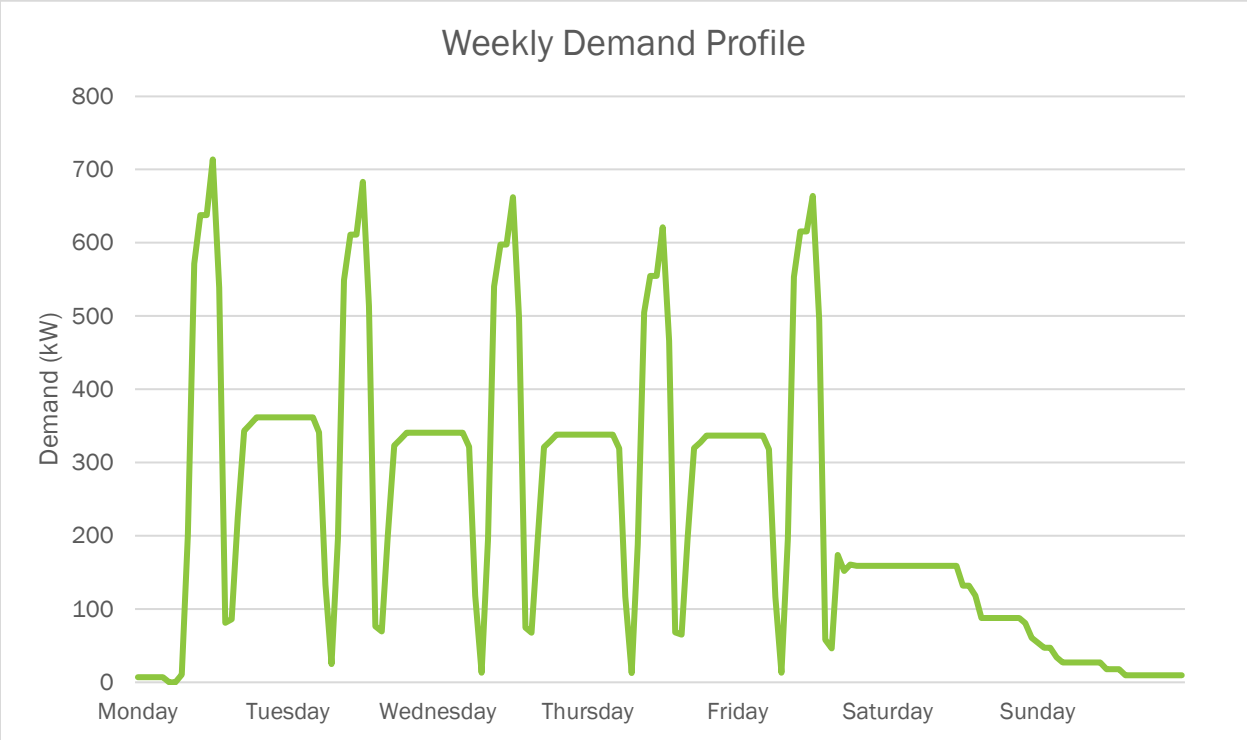


Figure 10 Weekly Demand Profile

Charge Management

Charge management[4] is an essential part of a successful BEB transition plan. Charge management will manage charging operations and energy management. An ideal charging strategy focuses on charging for long periods of time at low charging speeds while ensuring the buses are sufficiently charged to complete their routes. Lower charging rates help to keep a more consistent demand profile, a lower peak demand and extend battery life. Additional strategies like "on" and "off" peak charging can be added to the charging strategy as well to minimize the cost impact on the district.

A charge management system (CMS) is a software system that provides real time demand reduction analysis and automatically manages the fleet of chargers based on each of the BEB's needs. Charge management systems utilize bus telemetric data, route data, and battery data to perform their analysis. Today's systems can limit the overall utility demand to preset limits, based on the power distribution systems designed for charging.

Charge management systems are available through independent third-party suppliers, such as Mobility House, SYNOP, and BP Pulse. Some bus manufacturers also sell charge management systems.

Wendel strongly recommends implementing a charge management system for managing charging operations and energy management. An optimized charge management system which includes demand reduction strategies will also minimize the need for utility side infrastructure upgrades and facility electrical infrastructure upgrades. A peak demand reduction has been incorporated into the analyses and results of this study which mimics an optimized charge management system.

Alternatives

Charging Ports

Wendel's basis of design utilized a 1:1 ratio of chargers to buses, primarily for operational efficiency and flexibility. An alternative to the base charging strategy would be to utilize 2:1 charging for applicable buses. The district may choose to utilize higher kW chargers of at least twice the proposed size which would allow for the charging of two school buses per charger. This would decrease the number of chargers required and associated overall costs. Some disadvantages of utilizing a 2:1 charging strategy are that charger failures affect two buses instead of one and the operational challenges of specific buses to be parked in specific spots for charging. It is also important to note that many 2:1 chargers require both buses to be charged at the same rate simultaneously.

Limiting Unique Bus Models and Charger Sizes

The proposed BEBs are based on the smallest available sizes that meet the requirements determined by the route analysis and charging strategy. Though the district's preferred manufacturer is used as the basis of design, if the preferred manufacturer does not offer a bus with the necessary battery size and a different manufacturer does, that manufacturer's bus model is proposed. For example, Letchworth CSD's current preferred manufacturer is Bluebird, however Bluebird does not offer a Type

[4] Charge Management System – end to end software solution to manage EV charging operations & energy management.

C BEB over 155 kWh, or a Type A BEB over 88 kWh in battery size at the time of this study so IC and Lion were used as the recommended manufacturers.

Many manufacturers have a limited number of battery sizes available today which will likely change as technology becomes more readily available. It is recommended that the district try to limit the number of different manufacturers / models in its fleet to ease operations and ordering. This may be done by waiting for Bluebird to come out with a larger size bus meeting the criteria discussed in the next section and by selecting the largest proposed BEB sizes for each bus type instead of the smallest available size proposed in this study. Choosing a larger bus size may increase bus costs and increase peak demand. This should be taken into consideration during design.

Proposed charger sizes are based on selecting the smallest size charger needed out of the five charger sizes reviewed (24 kW, 60 kW, 120 kW, 180 kW, and 360 kW). It is recommended that the district investigate limiting the number of different charger sizes to ease operations and ordering. Charger sizes procured that vary from the Proposed Charger Size should be greater in kW than proposed.

Selecting a Bus varying from Proposed Bus Size

It is recommended that the district utilize Table 27 below when procuring their BEBs and to try to limit the number of different manufacturers / models in their fleet to ease operations and ordering. Buses procured that vary from the Proposed Bus Size and Type Based on Preferred Manufacturer should meet the following criteria:

1. Be greater in kWh than the Minimum Bus Size column.
2. Have an OEM rated efficiency less than or equal to the Maximum OEM Rated Efficiency column. This is equivalent to the bus size in kWh divided by the OEM stated range in miles.
3. Be able to accept a charge equal to or greater than the Minimum Charger Size column.

Bus Number	Bus Type	Minimum Bus Size (kWh)	Minimum Charger Size (kW)	Maximum OEM Rated Efficiency
20 - Ghost Run	Type A	114	12 kW	1.12
34 - Ghost Run	Type A	114	12 kW	1.12
36	Type A	433	117 kW	1.12
37	Type A	381	82 kW	1.12
38	Type A	122	11 kW	1.12
39 - Ghost Run	Type A	114	12 kW	1.12
59 - Ghost Run	Type C	158	17 kW	1.58
62 - Contracted Route	Type C	635	45 kW	1.58
73	Type C	427	68 kW	1.58
75	Type C	540	155 kW	1.58
76	Type C	408	70 kW	1.58
78	Type C	292	35 kW	1.58
80	Type C	292	34 kW	1.58
81	Type C	256	25 kW	1.58
82	Type C	356	50 kW	1.58

Bus Number	Bus Type	Minimum Bus Size (kWh)	Minimum Charger Size (kW)	Maximum OEM Rated Efficiency
86	Type C	273	37 kW	1.58
87	Type C	289	35 kW	1.58
88	Type C	364	54 kW	1.58
89	Type C	229	33 kW	1.58
90	Type C	319	48 kW	1.58
91	Type C	436	55 kW	1.58
Spare - 74	Type C	N/A	N/A	N/A
Spare - 74	Type C	N/A	N/A	N/A
Spare - 77	Type C	N/A	N/A	N/A
Spare - 79	Type C	N/A	N/A	N/A

Table 27 Bus and Charger Selection Criteria

Section 5 Electric Utility Analysis

ELECTRIC UTILITY ANALYSIS

Wendel has engaged with the district's electric utility provider, NYSEG, to get a better understanding of the utility's ability to provide the required power for the proposed transition to a BEB fleet. Wendel has provided NYSEG with the future load information the district will incur once the BEBs are implemented. Based on the developed energy requirements and charging strategy, Wendel has worked with the NYSEG to determine options for obtaining power.

A load projection analysis was performed by Wendel to determine the anticipated peak load of the BEBs. The following assumptions were used during this analysis.

- Anticipated peak charger load assume a load factor of 54% based on results of charging model with demand reduction implemented.
- Anticipated charger loads do not include the charging of spare buses which are assumed to charge outside of peak hours.
- Anticipated charger loads include a safety factor of 10%.

The following BEB charging load data has been produced for the anticipated peak load of the BEB chargers to be installed:

- Fully Connected Load – 1,546kVA
- **Anticipated Peak BEB Charger Load** – 785kVA

Total Anticipated Peak Load – 1,546 kVA

Based on this data, a new service feeding a new 480/277V 1000kVA transformer has been requested from NYSEG to supply power to all EV charging needs. The utility has been asked to provide information regarding their availability to supply the required power. Figure 11 below shows the available capacity the substation feeding Letchworth CSD is not available information from NYSEG's online map. This will remain unknown until a utility study has been completed by the utility company verifying the available capacity.

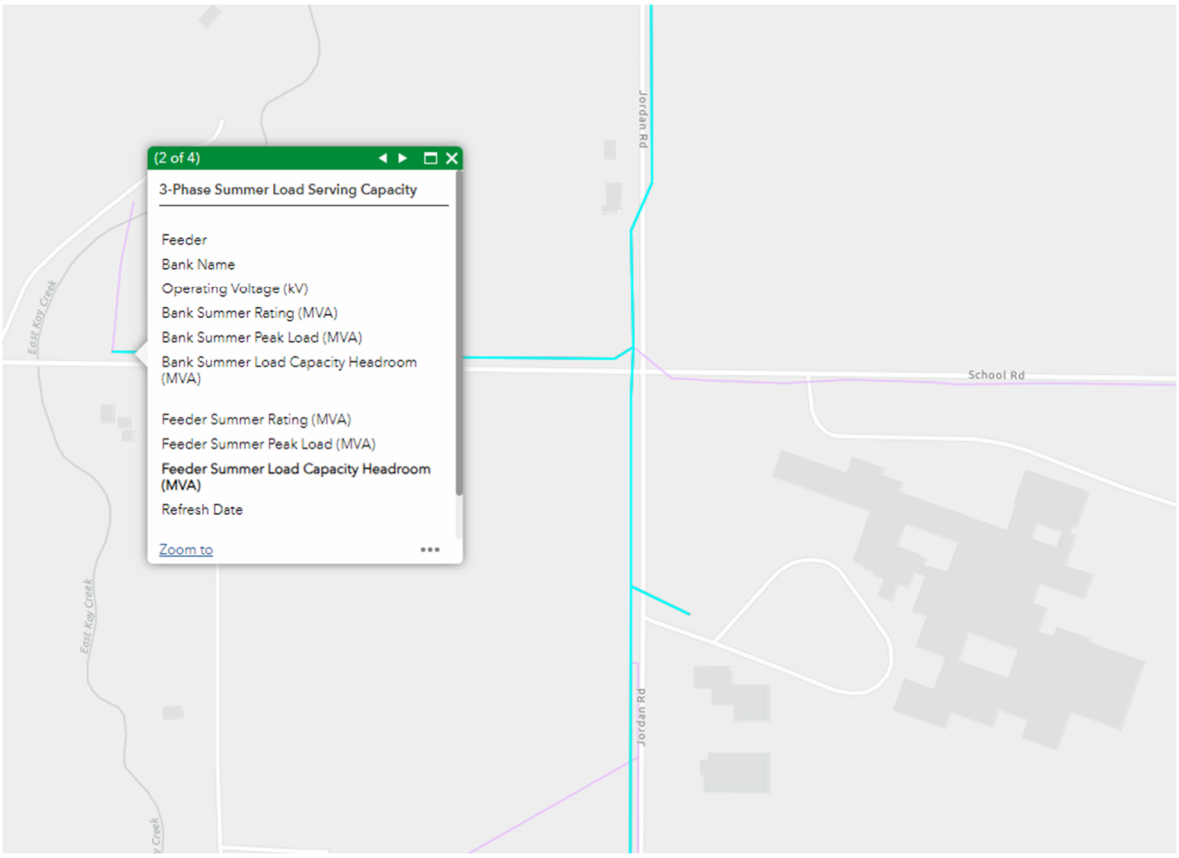


Figure 11 NYSEG Electrification Map

Anticipated peak loads were submitted to NYSEG and an assessment of the utility's ability to provide this power was requested.

At this time, the utility has not provided this assessment. Once the assessment is received a memo will be submitted to Letchworth CSD.

NYSEG has stated the overall costs of the utility upgrades cannot be calculated until the utility performs a design which will occur when Letchworth CSD is ready to install infrastructure and bring additional power to the site. The Utility has stated upgrades may take up to two years, dependent on what upgrades are needed.

Section 6 Concept Development & Phasing Plan

CONCEPT DEVELOPMENT & PHASING PLAN

The concept development and phasing plan is the culmination of the previous tasks in the study. The phasing plan incorporates several components and include:

1. Deadlines issued as part of the state mandate including:
    a. By July 1, 2027, all new school buses purchased and or leased must be zero-emission
    b. By July 1, 2035, all school buses on the road must be zero-emission
2. Letchworth CSD preferred BEB procurement schedule
3. On-site electrical distribution/charger equipment procurement and construction lead times
4. Utility service upgrade equipment and construction lead times
5. Availability of capital funding including state aid, school capital programs and grant funds

For the purposes of this report, it is assumed funding will be available when required for capital improvements and bus purchases.

Bus Procurement Schedule

Letchworth CSD currently has (25) school buses in its fleet. The projected BEB procurement schedule for Letchworth CSD can be found in Table 28 below.

Bus Number / Name	Proposed New Bus Size (kWh)	Proposed New Charger Size (kW)	Notes on Conversion Timing	Year Bus Procured (age)	Next Bus Replacement Year*	Proposed Conversion Year**
78	315	60		2022	2028	2028
Spare - 77	315	120	2:1 with 74	2022	2028	2028
Spare - 79	315	60		2022	2028	2028
80	315	60		2024	2029	2029
87	315	60		2024	2029	2029
81	315	60		2024	2030	2030
89	315	60		2024	2030	2030
90	Placeholder	60	Bus size does not currently exist	2024	2030	2030
91	Placeholder	60	Bus size does not currently exist	2024	2030	2030
39 - Ghost Run	168	24		2023	2031	2031
59 - Ghost Run	210	24		2017	2024	2031

62 - Contracted Route	Placeholder	60	Bus size does not currently exist	2017	2024	2031
86	315	60		2019	2025	2031
Spare - 85	315	24		2019	2025	2031
20 - Ghost Run	168	24		2016	2024	2032
38	168	24		2023	2033	2033
73	Placeholder	120	Bus size does not currently exist	2021	2027	2033
75	Placeholder	155	Bus size does not currently exist	2021	2027	2033
Spare - 74	315		2:1 with 77	2021	2027	2034
34 - Ghost Run	168	24		2015	2025	2035
36	Placeholder	120	Bus size does not currently exist	2019	2028	2035
37	Placeholder	120	Bus size does not currently exist	2021	2030	2035
76	Placeholder	120	Bus size does not currently exist	2022	2028	2035
82	Placeholder	60	Bus size does not currently exist	2024	2029	2035
88	Placeholder	60	Bus size does not currently exist	2024	2029	2035

**Next Bus replacement year is the year the district would typically replace the associated bus; these years were provided to Wendel by the district for reference. If next bus replacement year is before 2027, it is assumed the bus will be replaced with a diesel bus. Any buses with a replacement year after 2027 cannot be replaced with a new diesel bus per NYS Mandate.*
***This proposed BEB procurement schedule is subject to change based on client procurement.*

Table 28 BEB Procurement Schedule

Based on the proposed procurement schedule, the route analysis, and the charging strategy developed for Letchworth CSD, the projected charger load growth over time assuming demand reduction strategies are implemented can be found in Figure 12 below.

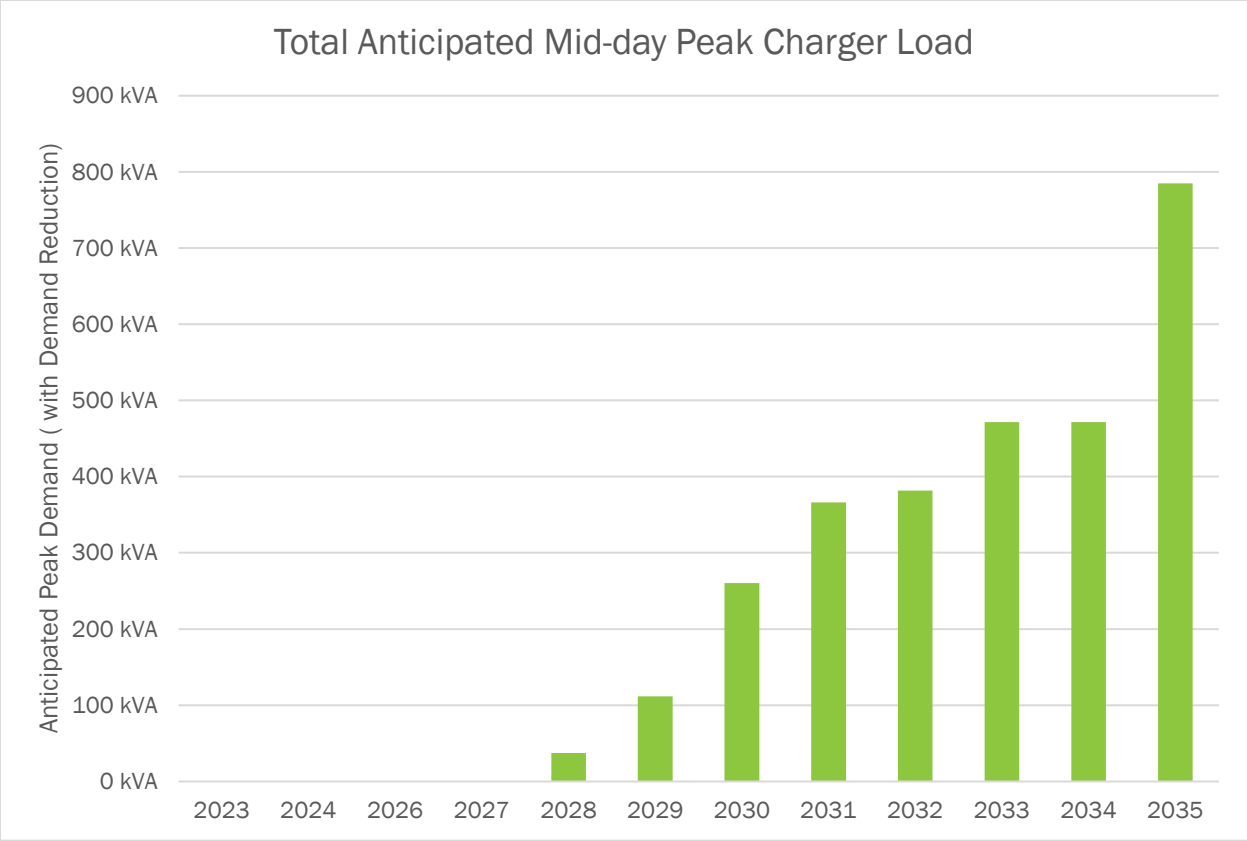


Figure 12 Total Anticipated Charger Peak Load

Phasing Plan

The proposed phasing plan for Letchworth CSD consists of three phases. The district can add buses at their preferred rate and the infrastructure will be available and ready to charge BEBs. The proposed equipment layout is included in Appendix C - Concept Development & Phasing Plan Drawings of this report.

Phase 1 (2028-2030)

Phase 1 incorporates several components necessary for the overall site development.

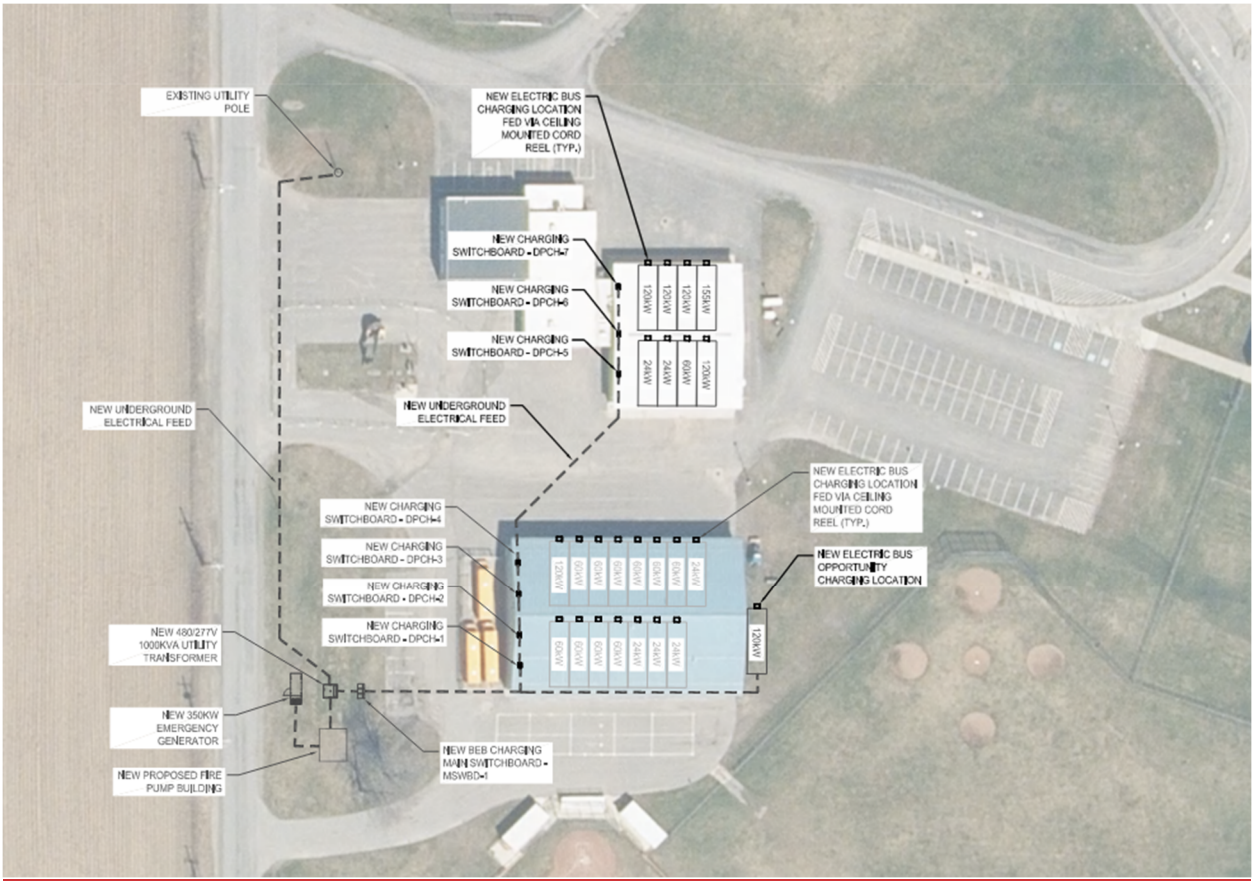


Figure 13 Phase 1 Site Layout

New utility transformer – The BEB charging infrastructure for Letchworth should be powered through a new utility service feed. The project requires a new pad mounted 1000 kVA transformer as seen on the Phase 1 Implementation layout in Appendix C - Concept Development & Phasing Plan Drawings of this report.

New power distribution equipment – There will be a 3000A main switchgear as well as (3) additional 400A sub fed switchboards to power the proposed chargers.

Primary cable trench from new service to power distribution equipment – An underground duct bank should be installed from the new transformer to the new electrical distribution equipment.

Power feeds and charging equipment for up to 9 new chargers – New power feeds should be installed to the bus storage garage. Eight 60 kW chargers and one 120 kW charger should be installed within the existing bus storage garage.

Fire protection system – The bus storage garage and maintenance facility should be provided with a fire sprinkler system to increase protection against battery electric bus fires. Since the campus is supplied by well water, this system will need to include an underground water storage tank with an external fire pump building located above it, containing a vertical fire pump. The fire pump building will be approximately 15' x 13' and is being proposed to be mounted atop the underground water storage so water can be drawn directly from the tank. We are proposing that this tank and pump building would be located in the grassy island near the road. This location will not impact the current bus parking and will be positioned well to utilize unused space for the footprint required for underground water storage. Water will be supplied from an underground tank, through a vertical pump, and underground to the facilities. The building location can shift during design if Letchworth CSD has a different preference, and security should also be considered during design since the building is outside of the fence line.

The new pumped supply will enter the eastern side of the south storage-only building, currently this space is used to store mini-buses, passenger vehicles, and grounds equipment. This side of the building has the most flexibility to accommodate the space required. The proposed 6-inch water main will continue north, past the dedicated risk & opportunity charging areas, and will enter the other indoor storage space on the eastern side. Due to the tight space confinements on the bus bays, the new pumped supply will enter the eastern bays that currently house grounds equipment. We propose that this supply will serve the bus storage bays and will be piped through the building over to the maintenance bays. In the design phase, head locations will need to be closely coordinated with existing equipment and systems to ensure full sprinkler coverage without obstructions. Where the room is larger than the area that needs to be protected, this system will be designed to protect 15 feet in all directions beyond the hazard. The new 6-inch main from the pump building and underground water storage, into both buildings will be approximately 600 feet. The area of the new sprinkler systems totals approximately 18,000 square feet total, between the maintenance and storage areas.

Electric fire pumps require an alternate source of power in case the primary (typically the utility) is lost. This alternate source of power is typically an emergency generator that would provide necessary backup power for the fire pump. The generator could be diesel, or potentially natural gas if preferred by Letchworth CSD and approved by the local AHJ. The generator would be located alongside the fire pump building to reduce the length of run for connection. A new fire pump electrical service would also be required to feed the fire pump building.

The actual sizes of the vertical fire pump and underground water storage tanks will be confirmed during the design. At this time, we expect the pump would likely be around 1500 gpm, 150 psi, and 200 hp, and roughly 150,000 gallons for the storage tank.

If space is available, best practice is to have a dedicated location outside for a bus that may have a maintenance or battery concern and needs to be evaluated. We would recommend that this dedicated

area have clearance of at least 15ft on each side of the bus from any other combustibles. If it catches on fire, it would be isolated and minimize risk. If a space like this is identified for this site, we would suggest providing a private fire hydrant within 50 feet, for fire department use. This hydrant could be served from the fire pump and significantly help in controlling a bus fire. At this location, one hydrant could be located outside of the pump building and two hydrants could be located in the eastern grassy area, which would allow the fire department flexibility depending on where the risk is.

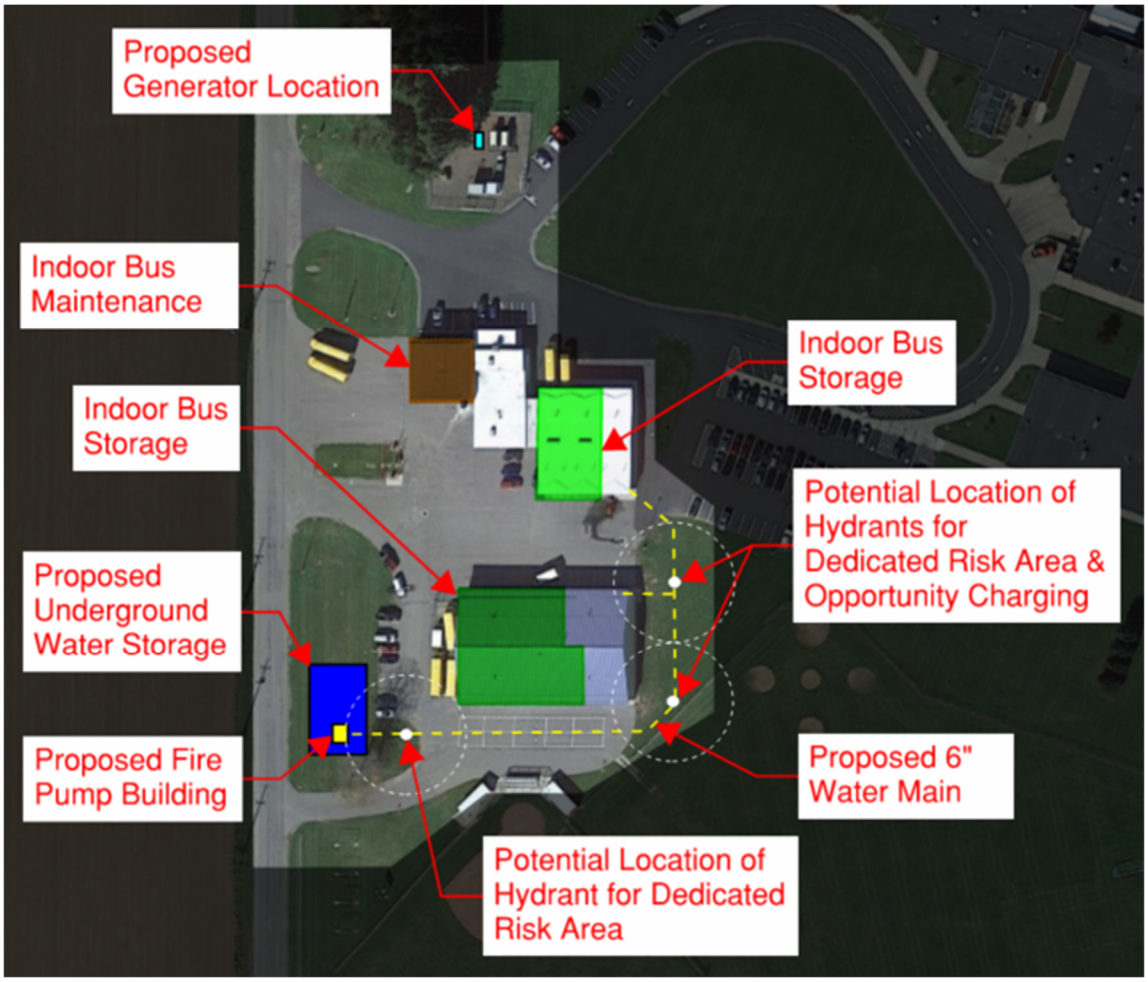


Figure 14 Fire Protection Plan Aerial View

Costs

- Charging system infrastructure for Phase 1: **$1,924,000**
- Fire Protection infrastructure: **$2,564,000**
- Total Phase 1 estimated cost: **$4,488,000**
  Detailed cost estimates are included in Section 7 Transition Plan Cost Estimates. Refer to this section for information regarding items included and excluded from these costs.

Phase 2 (2031-2032)

Phase 2 incorporates several additional components necessary to provide charging equipment for the proposed electrical bus fleet size.

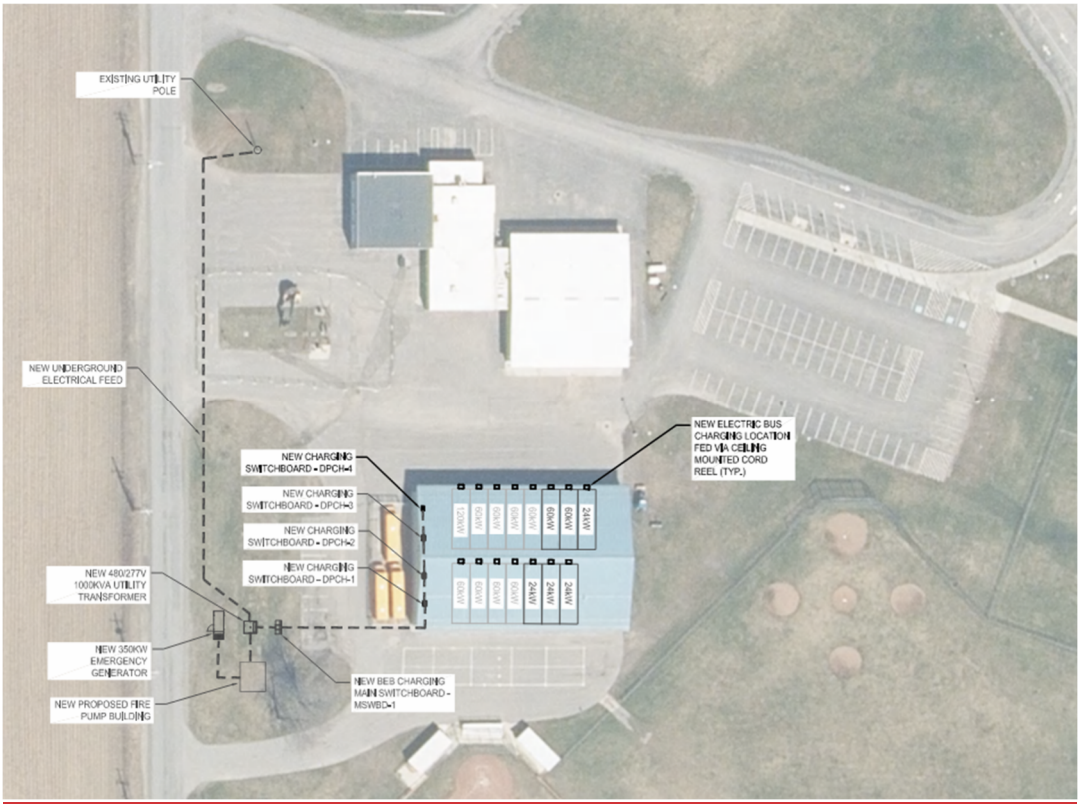


Figure 15 Phase 2 Site Layout

New power distribution equipment – There will be (1) additional 400A sub fed switchboard to power the proposed chargers.

Primary cable trench from new service to power distribution equipment – An underground duct bank should be installed from the new transformer to the new electrical distribution equipment.

*Power feeds and charging equipment for up to **(6) new chargers*** – New power feeds should be installed to the bus storage garage. (4) 24 kW chargers and (2) 60 kW chargers should be installed within the existing bus storage garage.

Costs

- Charging system infrastructure for Phase 2: **$810,000**
- Total Phase 2 estimated cost: **$810,000**
  Detailed cost estimates are included in Section 7 Transition Plan Cost Estimates. Refer to this section for information regarding items included and excluded from these costs.

Phase 3 (2033-2035)

Phase 3 incorporates several additional components necessary to provide charging equipment for the proposed electrical bus fleet size.

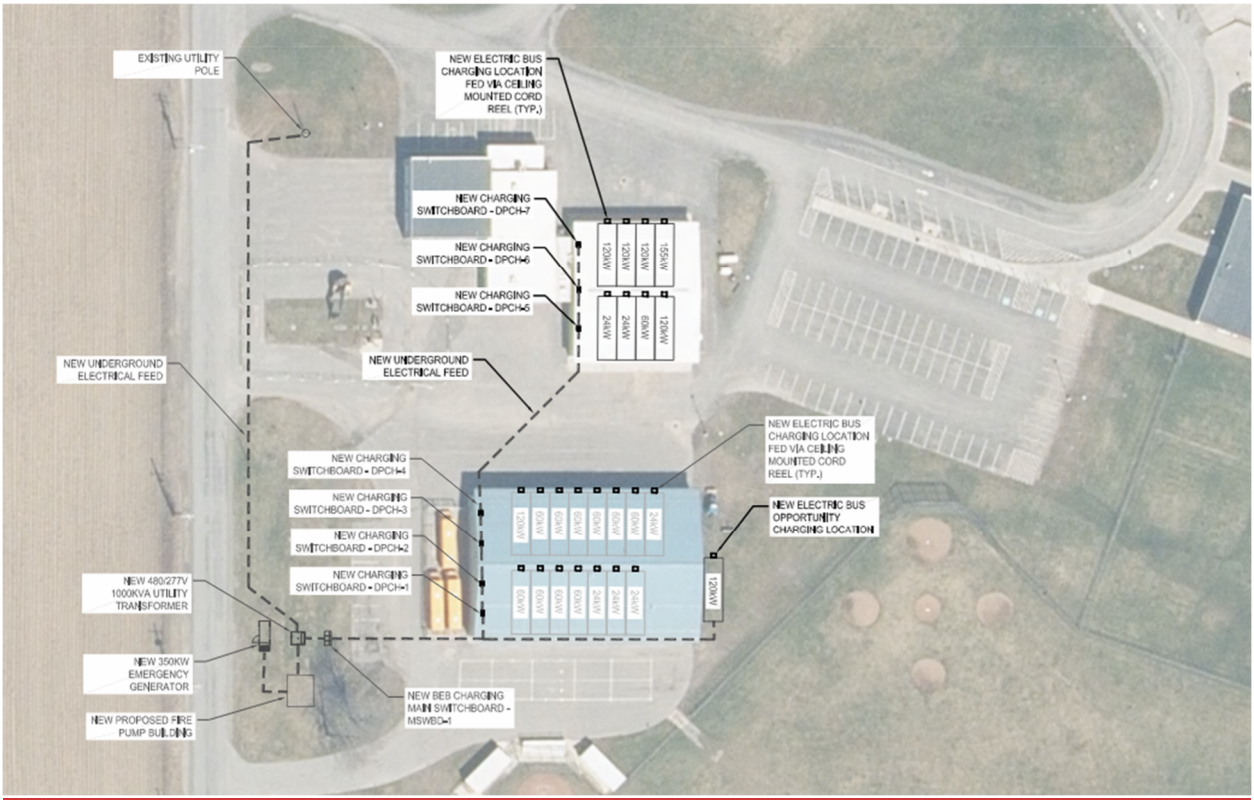


Figure 16 Phase 3 Site Layout

New power distribution equipment – There will be (3) additional 400A sub fed switchboards to power the proposed chargers.

Primary cable trench from new service to power distribution equipment – An underground duct bank should be installed from the new transformer to the new electrical distribution equipment.

Power feeds and charging equipment for up to ***(9) new chargers*** – New power feeds should be installed behind the cold storage building to the bus storage garage. (2) 24 kW chargers, (2) 60 kW chargers, (4) 120 kW, and (1)155 kW charger should be installed along the existing bus storage garage.

Costs

- Charging system infrastructure for Phase 3: **$1,933,000**
- Total Phase 3 estimated cost: **$1,933,000**
  Detailed cost estimates are included in Section 7 Transition Plan Cost Estimates. Refer to this section for information regarding items included and excluded from these costs.

The total estimated cost of the transition construction is **$6,869,000 to $7,592,000**

Fire protection approach

It is common industry belief that standard sprinkler protection for parking garages and maintenance areas is inadequate for battery electric school buses, and we agree. Since there are not currently code requirements for sprinkler protection of this scenario, we have developed a custom approach. Our approach on the Transit bus side has currently been reviewed and accepted by FM Global, State Fire Marshal's in CT, MA, and NY, CTDOT, and a variety of insurance companies. On the school bus side this approach has been recommended at several different districts as they move forward to BEB. Typically, the exterior shell of a school bus does contain a bit more metal than a transit bus, but many exterior parts like bumper, moldings, side mirror covers, and mud flaps are still made of plastic, which are quicker to catch if an adjacent bus is on fire. Additionally, to extend battery range, more and more buses are being constructed of lighter weight, alternative materials. We strongly recommend the same fire protection approach for all battery powered buses until NFPA releases specific code requirements. Due to the chemistry of lithium-ion batteries, it is nearly impossible to completely extinguish them once the chemical reaction has started. They can reignite for up to 24 hours in most cases. The current recommendation from NFPA for Lithium-Ion fires is large amounts of water to suppress the fire.

When buses are indicating warnings, damaged, or have problems, they are typically brought to maintenance. Although a bus may be left outside if the battery is a concern, maintenance is still a likely location for problems to occur. Additionally, maintenance areas are often equipped with portable chargers. This enhanced sprinkler coverage will allow the flexibility of locally charging any of the buses as well.

In all areas where battery electric school buses will be charged or maintained, we recommend providing a sprinkler system capable of 0.7 gallons per minute, per square foot (gpm/sf). Utilizing Control Mode Specific Application (CMSA) type sprinkler heads will require calculating the most remote 15 heads, to ensure the remaining system has adequate capacity. The shell of the bus prevents water from getting directly to the source of the fire. Additionally, batteries are usually located within a compartment that also prevents water from reaching. This sprinkler design approach has been developed to suppress an electric bus fire and prevent the fire from spreading to adjacent buses. This helps to protect the building and buy time for people to get out safely. It is also in place to contain the fire long enough for fire department to respond and take the proper measures from there.

The existing facility is composed of multiple buildings. Bus storage is split between two structures with maintenance being attached to one of them. Additionally, the building with maintenance also contains some ancillary offices and storage space. The water supply for the entire campus is fed via well. A typical well pump is not sufficient to provide sprinkler protection.

Since the existing facility does not currently have a sprinkler system and is on well water, a water storage tank will need to be installed to have the required volume of water on hand to supply a sprinkler system. The code requires this type of system to run for a minimum of ninety (90) minutes. Based on the system demand, we know the approximate flow of the fire pump and can calculate the amount of water that must be on-hand. This calculation requires a volume of approximately 135,000 gallons. However, the suction pipe is likely to be located a minimum distance from the bottom, making some

of the water in the tank unusable. Therefore, nominally, the tank will likely be in the 150,000-gallon range to supply 135,000 gallons of 'usable' water.

Tanks can be constructed to go above ground or below ground. In this area of the country, we typically recommend a below ground tank. An above ground tank would require insulation, and a heater to ensure the water does not freeze. Continuously heating the water just adds to unnecessary energy usage. A below ground tank can be designed and installed to not freeze, eliminating the need for insulation and heat. Additionally, since the tanks are usually quite large, the underground approach does not take up as much usable real estate.

With the water being underground and not under pressure, a vertical fire pump will be required to draw the water up above grade, and then pressurize it to provide the adequate system demand. A fire pump house could be located directly above a portion of the tank, and only this small building will need to be kept heated. Water will be drawn up from the tank, flowed through the pump, and then back underground to the facilities being protected.

Maintenance of the fire protection system is critical to ensure longevity and performance during time of need. Ongoing compliance with NFPA 25 will be essential for the entire sprinkler system.

Schedule

A preliminary schedule was developed as a guide for the implementation of Phase 1 of the transition plan. This preliminary schedule is heavily impacted by current supply chain issues associated with electrical equipment, particularly electrical switchgear. The current lead time for switchgears is estimated to be 20 months.

Phase 1 Preliminary Schedule

Milestone description	Months	1 Year												2 Years												3 Years												4 Years	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
Utility Service																																							
Utility Design	2																																						
Transformer Delivery	12																																						
Utility Distribution Construction	6																																						
Site Design and Construction																																							
Phase 1 Detailed Design & SED Review	5																																						
Bid and Award Construction Package	1.5																																						
Order Main Switchgear, Switch Boards, and Chargers	1																																						
Switch Boards and Chargers Delivery	12																																						
Switchgear Delivery	20																																						
Construction	14																																						
Testing																																							
Commission Chargers Switchgear and Switch Boards	1																																						

Figure 17 Phase 1 Preliminary Construction Schedule

Section 7 Transition Plan Cost Estimates

Transition Plan Cost Estimates

Wendel has developed a high-level opinion of probable costs to implement the transition plan described in the previous section. Estimates from previous studies were utilized as the basis of the transition plan cost estimate and scaled for Letchworth CSD. The estimates include the phased implementation costs of the following major items:

1. Electrical equipment and installation costs for the utility interface
2. Bus charging system distribution equipment and installation costs including switchgear, panelboards, wiring
3. Charger and dispenser and installation costs
4. Associated sitework and civil costs
5. Other costs associated with a transition, an addition, renovations, etc.

The following items were excluded from the estimates:

1. School District portion of any estimated charges for the utility to upgrade the system to provide the power required to the site for bus charging
2. Utility fees
3. Construction Management (CM) fees.
4. Phasing costs within each phase
5. Costs of the BEBs themselves
6. Chargers, equipment, and all other costs associated with the charging of the district's non school bus vehicles.

The estimated costs for the proposed BEBs themselves can be found in Table 29 below. These costs were acquired in the Spring of 2024 and may vary based on region, bus supplier, warranty option selected, and bus customization / add-ons. These costs do not include escalation.

Make	Bus Type	Bus Size (kWh)	Estimated Cost per Bus
Blue Bird	Type A	88	$300,000
BYD	Type A	156	$343,000
Greenpower	Type A	118	$273,000
Lion	Type A	168	$308,000
Blue Bird	Type C	155	$428,000
BYD	Type C	282	$464,000
IC Bus	Type C	210	$405,000
IC Bus	Type C	315	$475,000
Lion	Type C	210	$367,000
Thomas Built	Type C	246	$425,000
Blue Bird	Type D	155	$454,000
BYD	Type D	255	$465,000

Make	Bus Type	Bus Size (kWh)	Estimated Cost per Bus
Greenpower	Type D	194	$424,000
Lion	Type D	210	$392,000

Table 29 Estimated BEB Costs

Incentives and Grants

Leveraging financial incentives to fund BEBs and charging infrastructure can help with the transition of diesel or gasoline powered buses to BEBs. Grants, rebates, vouchers, and tax credits can help mitigate the higher upfront vehicle costs and infrastructure investments. Several State and federal programs offer funding opportunities for both BEBs and chargers. The below incentives are not guaranteed and are only applicable as of the date of this report. All information is from NYSERDA's Electric School Bus Guidebook[5], an online resource available to the public. Please contact your NYSERDA representative for more information including eligibility, program requirements, and application process.

EPA Clean Heavy-Duty Vehicles Grant Program – School Bus Sub-Program

Vehicle Type	EPA Cost Share Percentage of New Vehicle Price	Pre-Vehicle Funding-Cap (Vehicle + Infrastructure)
Battery-Electric School Bus	75%	$280,000

Table 30 EPA Clean Heavy-Duty Vehicles Grant Program – School Bus Sub-Program from NYSERDA's School Bus Guidebook

New York School Bus Incentive Program – School Bus Voucher

School Bus Type Base	Base Voucher	Priority District Bonus	Scrappage Bonus	V2G Add-on	Wheelchair Add-on
New Type A	$114,000	$28,500	$47,500	$9,500	$8,000
New Type C	$147,000	$36,750	$61,250	$12,250	$8,000
New Type D	$156,000	$39,000	$65,000	$13,000	$8,000
Repowered A	$105,000	$21,000	N/A	$7,000	N/A
Repowered C	$135,000	$27,000	N/A	$9,000	N/A

Table 31 NYSBIP School Bus Voucher from NYSERDA's School Bus Guidebook

[5]NYSERDA. (2024, June). Retrieved from Electric School Bus Guidebook Guide 4: Financial Incentives: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/Electric-School-Bus/Financial-Incentives-for-Electric-School-Buses-and-Chargers.pdf

Joint Utilities of New York Medium- and Heavy-Duty EV Make-Ready Pilot

Utilities may provide incentives up to 90% of the utility-side infrastructure costs and up to 50% of customer-side costs to qualifying projects. Customer-side incentives are subject to dollar per kW caps, which vary by utility.

Utility	Customer-Side Incentive Cap
Central Hudson	$658.36/kW
Con Edison	$980.76/kW
National Grid	$440.96/kW
NYSEG	$409.07/kW
Orange and Rockland	$592.77/kW
RG&E	$712.08/kW

Table 32 Make-Ready Pilot Incentives from NYSERDA's School Bus Guidebook

New York School Bus Incentive Program – Charging Voucher

Type	Base Voucher Amount	With Fleet Electrification Plan
Non-Priority District	$25,000	$55,000
Priority District	$35,000	$65,000

Table 33 NYSBIP Charging Voucher from NYSERDA's School Bus Guidebook

Opinion of Probable Construction Cost

Project Name: Letchworth CSD BEB Study
Project Owner: Letchworth Central School District
Project Location: Letchworth, NY
Wendel Project Number: 630801.01.009
Phase: Schematic Design
Date: August 23, 2024

Division	Description	Total				
	Phase 1 BEB Total	$	1,923,865			
		Range $	1,827,672	to	$	2,020,059
	Phase 2 BEB Total	$	809,542			
		Range $	769,065	to	$	850,019
	Phase 3 BEB Total	$	1,933,241			
		Range $	1,836,579	to	$	2,029,903
	Fire Protection Total	$	2,563,564			
		Range $	2,435,386	to	$	2,691,742
	Project Total	$	7,230,212			
	Project Total Range	$	6,868,701	to	$	7,591,723

Assumptions/Exclusions:
Excludes any CM fees.
Includes an allowance for the underground storage tank.
Includes hangers and reels for overhead EVD's.
Assumes the 24kW units to be complete units. These will be mounted on a support structure and fed with AC power.
All primary, secondary and power/data runs to the EVD are concrete encased.
Includes CAT6 cable and 6-strand fiber from the BCS to each EVD. All will be terminated and tested.
Includes pavement removal and repair.
Excludes any phasing costs within each phase.
Each phase is escalated based on the approximate date of construction.

Opinion of Probable Construction Cost

Project Name: Letchworth CSD BEB Study
Project Owner: Letchworth Central School District
Project Location: Letchworth, NY
Wendel Project Number: 630801.01.009
Phase: Phase 1 - BEB
Date: August 23, 2024

DIVISION	DESCRIPTION	QTY	UNIT	UNIT COST	UNIT OF MEASURE	SUBTOTAL	DIVISION SUBTOTAL
26 00 00	**Electrical**						
	Primary to Pad						**$130,990**
	5" GRC	20	LNFT	$ 160.00	E	$ 3,200	
	5" PVC	740	LNFT	$ 49.50	E	$ 36,630	
	5" Locknut	4	EA	$ 3,715.57	C	$ 149	
	5" Plastic Bushing	4	EA	$ 2,882.46	C	$ 115	
	5" Cut & Thread	2	EA	$ 314.81	E	$ 630	
	5" Galvanized Coup	2	EA	$ 7,369.92	C	$ 147	
	5" PVC Term Adpt	4	EA	$ 4,520.99	C	$ 181	
	5" PVC Coup	6	EA	$ 3,911.84	C	$ 235	
	5" PVC-40 Elbow	4	EA	$ 29,898.85	C	$ 1,196	
	5"x3" Base Spacer	36	EA	$ 1,760.97	C	$ 634	
	1/8" Poly Pull Line	1,000	LNFT	$ 509.79	M	$ 510	
	#4/0 Stranded Bare Copper Wire	100	LNFT	$ 18,221.28	M	$ 1,822	
	3/4"x10' Copper Ground Rod	5	EA	$ 135.42	E	$ 677	
	5" GRC 90D Elbow-48" Radius	2	EA	$ 894.69	E	$ 1,789	
	Cadweld	5	EA	$ 66.13	E	$ 331	
	Transformer Pad/Curb/Crushed Stone	1	EA	$ 5,462.50	E	$ 5,463	
	Pipe Bollard	16	EA	$ 761.88	E	$ 12,190	
	Power Manhole	1	EA	$ 4,025.00	E	$ 4,025	
	Concrete Ductbank (per ft)	360	LNFT	$ 169.63	E	$ 61,067	
	Pad to MSWBD-1						**$41,523**
	4" PVC	120	LNFT	$ 1,600.80	C	$ 1,921	
	4" Locknut	6	EA	$ 2,798.76	C	$ 168	
	4" PVC Term Adpt	6	EA	$ 3,778.73	C	$ 227	
	4" PVC Coup	6	EA	$ 3,070.90	C	$ 184	
	4" PVC-40 Elbow	6	EA	$ 18,867.76	C	$ 1,132	
	4"x3" Base Spacer	15	EA	$ 1,411.15	C	$ 212	
	#3/0 THHN CU Stranded Wire	150	LNFT	$ 7,646.87	M	$ 1,147	
	#600MCM THHN CU Stranded Wire	600	LNFT	$ 22,480.03	M	$ 13,488	
	#4/0 Stranded Bare Copper Wire	100	LNFT	$ 18,221.28	M	$ 1,822	
	3/4"x10' Copper Ground Rod	6	EA	$ 135.42	E	$ 813	
	Cadweld	6	EA	$ 66.13	E	$ 397	
	Switchgear Pad	1	EA	$ 4,456.25	E	$ 4,456	
	Pipe Bollard	6	EA	$ 1,000.00	E	$ 6,000	
	Concrete Ductbank (per ft)	20	LNFT	$ 169.63	E	$ 3,393	
	MSWBD-1 1200A Switchboard-N3R (install)	1	EA	$ 6,164.00	E	$ 6,164	
	MSWBD-1 to DPCH-1,2 & 3						**$129,375**
	400A PVC Feeder	300	LNFT	$ 148.05	E	$ 44,415	
	400A EMT Feeder	240	LNFT	$ 193.64	E	$ 46,474	
	4" PVC Elbow	6	EA	$ 125.00	E	$ 750	
	4" EMT Elbow	12	EA	$ 236.00	E	$ 2,832	
	#4/0 Stranded Bare Copper Wire	200	LNFT	$ 18,221.28	M	$ 3,644	
	3/4"x10' Copper Ground Rod	12	EA	$ 135.42	E	$ 1,625	
	Cadweld	12	EA	$ 66.13	E	$ 794	
	Switchgear Pad	3	EA	$ 4,456.25	E	$ 13,369	
	DPCH-1 400A Main Switchboard-N1 (install)	1	EA	$ 5,157.75	E	$ 5,158	
	DPCH-2 400A Main Switchboard-N1 (install)	1	EA	$ 5,157.75	E	$ 5,158	
	DPCH-3 400A Main Switchboard-N1 (install)	1	EA	$ 5,157.75	E	$ 5,158	
	MDP to BCS (incl 24kW)						**$75,421**
	100A EMT Feeder	1,260	LNFT	$ 51.68	E	$ 65,117	
	200A EMT Feeder	130	LNFT	$ 79.26	E	$ 10,304	
	BCS to EVD DC Power						**$34,148**
	2" EMT	360	LNFT	$ 1,584.00	C	$ 5,702	
	2" EMT Elbow	18	EA	$ 10,645.55	C	$ 1,916	
	2" SS Steel Conn	18	EA	$ 3,178.35	C	$ 572	

Opinion of Probable Construction Cost

Project Name: Letchworth CSD BEB Study
Project Owner: Letchworth Central School District
Project Location: Letchworth, NY
Wendel Project Number: 630801.01.009
Phase: Phase 1 - BEB
Date: August 23, 2024

DIVISION		DESCRIPTION	QTY	UNIT	UNIT COST	UNIT OF MEASURE	SUBTOTAL	DIVISION SUBTOTAL
		2" SS Steel Cplg	45	EA	$ 2,495.56	C	$ 1,123	
		2" Plastic Bushing	18	EA	$ 789.92	C	$ 142	
		2" Conduit Hanger w/Bolt	45	EA	$ 2,604.76	C	$ 1,172	
		3/8" Thrd Rod-10Ft	9	EA	$ 12,720.59	C	$ 1,145	
		3/8" Hex Nut	135	EA	$ 588.87	C	$ 795	
		Flange Beam Clamp for 3/8" Thrd Rod	45	EA	$ 2,643.23	C	$ 1,189	
		3/0 2kV DLO RHW Cable	850	LNFT	$ 13,449.61	M	$ 11,432	
		350kcmil 2kV DLO RHW Cable	425	LNFT	$ 21,079.27	M	$ 8,959	
		BCS to EVD Aux. Power						**$8,781**
		1" EMT	360	LNFT	$ 977.21	C	$ 3,518	
		1" SS Steel Conn	18	EA	$ 952.06	C	$ 171	
		1" SS Steel Cplg	45	EA	$ 804.95	C	$ 362	
		1" Plastic Bushing	18	EA	$ 594.37	C	$ 107	
		1" Conduit Hanger w/Bolt	45	EA	$ 1,563.77	C	$ 704	
		3/8" Thrd Rod-10Ft	9	EA	$ 12,720.59	C	$ 1,145	
		3/8" Hex Nut	135	EA	$ 588.87	C	$ 795	
		Flange Beam Clamp for 3/8" Thrd Rod	18	EA	$ 2,643.23	C	$ 476	
		#12 THHN CU Solid Wire	1,500	LNFT	$ 1,002.24	M	$ 1,503	
		BCS to EVD Data						**$20,577**
		2" EMT	360	LNFT	$ 1,584.00	C	$ 5,702	
		2" EMT Elbow	18	EA	$ 10,645.55	C	$ 1,916	
		2" SS Steel Conn	18	EA	$ 3,178.35	C	$ 572	
		2" SS Steel Cplg	45	EA	$ 2,495.56	C	$ 1,123	
		2" Plastic Bushing	18	EA	$ 789.92	C	$ 142	
		2" Conduit Hanger w/Bolt	45	EA	$ 2,604.76	C	$ 1,172	
		3/8" Thrd Rod-10Ft	9	EA	$ 12,720.59	C	$ 1,145	
		3/8" Hex Nut	135	EA	$ 588.87	C	$ 795	
		Flange Beam Clamp for 3/8" Thrd Rod	45	EA	$ 2,643.23	C	$ 1,189	
		CAT6 Cable	500	LNFT	$ 931.50	M	$ 466	
		6-Strand GOF MM OM3 Fiber	500	LNFT	$ 1,152.68	M	$ 576	
		Terminate CAT6	18	EA	$ 27.31	E	$ 492	
		Fiber Termination	108	EA	$ 38.64	E	$ 4,173	
		Fiber Test	54	EA	$ 15.53	E	$ 839	
		Test CAT6	9	EA	$ 30.48	E	$ 274	
		BCS Equipment install, pads, bollards						**$79,674**
		60kW BCS/EVD/reel/ (install)	8	EA	$ 8,688.00	E	$ 69,504	
		120kW BCS/EVD/reel/ (install)	1	EA	$ 10,170.00	E	$ 10,170	
		BCS Equipment Cost						**$448,224**
		BCS 60kW Equipment (incl dispenser)	8	EA	$ 47,500.00	E	$ 380,000	
		BCS 120kW Equipment (incl dispenser)	1	EA	$ 68,224.00	E	$ 68,224	
		Distribution Equipment						**$195,000**
		Distribution Equipment allowance	1	LS	$ 195,000.00	LS	$ 195,000	
31 00 00		**Earthwork**						**$0**
		Ex/backfill included in ductbank line item	-	SF	$ 18.00	E	$ -	
32 00 00		**Site Improvements**						**$22,540**
		Hydroseeding	5,000	SF	$ 3.50	E	$ 17,500	
		Paving	56	SY	$ 90.00	E	$ 5,040	
		Subtotal Construction Cost						$1,186,253
	10%	General Conditions					$ 118,625	
	15%	General Contractor OH&P					$ 177,938	
	10%	Construction Contingency					$ 118,625	
	10%	Design Contingency					$ 118,625	
	8%	Escalation (to end of 2025)					$ 94,900	
	0%	Phasing					$ -	
		Subtotal					$ 628,714	$1,814,967
	6%	Soft Costs (A/E Fees)						$108,898
		Phase 1 BEB Total						$1,923,865

Opinion of Probable Construction Cost

Project Name: Letchworth CSD BEB Study
Project Owner: Letchworth Central School District
Project Location: Letchworth, NY
Wendel Project Number: 630801.01.009
Phase: Phase 2 - BEB
Date: August 23, 2024

DIVISION	DESCRIPTION	QTY	UNIT	UNIT COST	UNIT OF MEASURE	SUBTOTAL	DIVISION SUBTOTAL
26 00 00	**Electrical**						
	MSWBD-1 to DPCH-4						**$79,809**
	400A PVC Feeder	100	LNFT	$ 148.05	E	$ 14,805	
	400A EMT Feeder	190	LNFT	$ 193.64	E	$ 36,792	
	4" PVC Elbow	2	EA	$ 125.00	E	$ 250	
	4" EMT Elbow	3	EA	$ 236.00	E	$ 708	
	#4/0 Stranded Bare Copper Wire	75	LNFT	$ 18,221.28	M	$ 1,367	
	3/4"x10' Copper Ground Rod	5	EA	$ 135.42	E	$ 677	
	Cadweld	5	EA	$ 66.13	E	$ 331	
	Concrete Ductbank (per ft)	90	LNFT	$ 169.63	E	$ 15,267	
	Switchgear Pad	1	EA	$ 4,456.25	E	$ 4,456	
	DPCH-4 400A Switchboard-N1 (install)	1	EA	$ 5,157.00	E	$ 5,157	
	DPCH-3 & DPCH-4 to BCS						**$39,748**
	100A EMT Feeder	350	LNFT	$ 51.68	E	$ 18,088	
	50A EMT Feeder	570	LNFT	$ 38.00	E	$ 21,660	
	BCS to EVD DC Power						**$10,048**
	2" EMT	80	LNFT	$ 1,584.00	C	$ 1,267	
	2" EMT Elbow	4	EA	$ 10,645.55	C	$ 426	
	2" SS Steel Conn	4	EA	$ 3,178.35	C	$ 127	
	2" SS Steel Cplg	12	EA	$ 2,495.56	C	$ 299	
	2" Plastic Bushing	4	EA	$ 789.92	C	$ 32	
	2" Conduit Hanger w/Bolt	12	EA	$ 2,604.76	C	$ 313	
	3/8" Thrd Rod-10Ft	3	EA	$ 12,720.59	C	$ 382	
	3/8" Hex Nut	36	EA	$ 588.87	C	$ 212	
	Flange Beam Clamp for 3/8" Thrd Rod	12	EA	$ 2,643.23	C	$ 317	
	3/0 2kV DLO RHW Cable	120	LNFT	$ 13,449.61	M	$ 1,614	
	350kcmil 2kV DLO RHW Cable	240	LNFT	$ 21,079.27	M	$ 5,059	
	BCS to EVD Aux. Power						**$2,299**
	1" EMT	80	LNFT	977.21	C	781.77	
	1" SS Steel Conn	4	EA	952.06	C	38.08	
	1" SS Steel Cplg	12	EA	804.95	C	96.59	
	1" Plastic Bushing	4	EA	594.37	C	23.77	
	1" Conduit Hanger w/Bolt	12	EA	1,563.77	C	187.65	
	3/8" Thrd Rod-10Ft	3	EA	12,720.59	C	381.62	
	3/8" Hex Nut	36	EA	588.87	C	211.99	
	Flange Beam Clamp for 3/8" Thrd Rod	12	EA	2,643.23	C	317.19	
	#12 THHN CU Stranded Wire	300.00	LNFT	868.43	M	260.53	
	BCS to EVD Data						**$4,971**
	2" EMT	80	LNFT	$ 1,584.00	C	$ 1,267	
	2" EMT Elbow	4	EA	$ 10,645.55	C	$ 426	
	2" SS Steel Conn	4	EA	$ 3,178.35	C	$ 127	
	2" SS Steel Cplg	12	EA	$ 2,495.56	C	$ 299	
	2" Plastic Bushing	4	EA	$ 789.92	C	$ 32	
	2" Conduit Hanger w/Bolt	12	EA	$ 2,604.76	C	$ 313	
	3/8" Thrd Rod-10Ft	3	EA	$ 12,720.59	C	$ 382	
	3/8" Hex Nut	36	EA	$ 588.87	C	$ 212	
	Flange Beam Clamp for 3/8" Thrd Rod	12	EA	$ 2,643.23	C	$ 317	
	CAT6 Cable	150	LNFT	$ 931.50	M	$ 140	
	6-Strand GOF MM OM3 Fiber	150	LNFT	$ 1,152.68	M	$ 173	
	Terminate CAT6	4	EA	$ 27.31	E	$ 109	
	Fiber Termination	24	EA	$ 38.64	E	$ 927	
	Fiber Test	12	EA	$ 15.53	E	$ 186	
	Test CAT6	2	EA	$ 30.48	E	$ 61	
	BCS Equipment install, pads, bollards						**$43,846**
	24kW BCS/EVD/reel/ (install)	4	EA	$ 6,617.50	E	$ 26,470	
	60kW BCS/EVD/reel/ (install)	2	EA	$ 8,688.00	E	$ 17,376	

Opinion of Probable Construction Cost

Project Name: Letchworth CSD BEB Study
Project Owner: Letchworth Central School District
Project Location: Letchworth, NY
Wendel Project Number: 630801.01.009
Phase: Phase 2 - BEB
Date: August 23, 2024

DIVISION		DESCRIPTION	QTY	UNIT	UNIT COST	UNIT OF MEASURE	SUBTOTAL	DIVISION SUBTOTAL
		BCS Equipment Cost						**$167,000**
		BCS 24kW Equipment (incl dispenser)	4	EA	$ 18,000.00	E	$ 72,000	
		BCS 60kW Equipment (incl dispenser)	2	EA	$ 47,500.00	E	$ 95,000	
		Distribution Equipment						**$30,000**
		Distribution Equipment Allowance	1	Allow	$ 30,000.00	E	$ 30,000	
31 00 00		**Earthwork**						**$0**
		Incl in ductbank		SF	$ 32.00		$ -	
32 00 00		**Site Improvements**						**$35,100**
		Paving	390	SY	$ 90.00	E	$ 35,100	
33 00 00		**Utilities**						**$0**
		Subtotal Construction Cost						$412,821
	10%	General Conditions					$ 41,282	
	15%	General Contractor OH&P					$ 61,923	
	10%	Design Contingency					$ 41,282	
	10%	Construction Contingency					$ 41,282	
	40%	Escalation (to end of 2029)					$ 165,128	
	0%	Phasing					$ -	
		Subtotal					$ 350,898	$763,718
	6%	Soft Costs (A/E Fees)						$45,823
		Phase 2 BEB Total						$809,542

Opinion of Probable Construction Cost

Project Name: Letchworth CSD BEB Study
Project Owner: Letchworth Central School District
Project Location: Letchworth, NY
Wendel Project Number: 630801.01.009
Phase: Phase 3 - BEB
Date: August 23, 2024

DIVISION	DESCRIPTION	QTY	UNIT	UNIT COST	UNIT OF MEASURE	SUBTOTAL	DIVISION SUBTOTAL
26 00 00	**Electrical**						
	MSWBD-1 to DPCH-5, 6, 7						**$171,097**
	400A PVC Feeder	660	LNFT	$ 148.05	E	$ 97,713	
	400A EMT Feeder	180	LNFT	$ 193.64	E	$ 34,855	
	4" PVC Elbow	12	EA	$ 125.00	E	$ 1,500	
	4" EMT Elbow	9	EA	$ 236.00	E	$ 2,124	
	#4/0 Stranded Bare Copper Wire	200	LNFT	$ 18,221.28	M	$ 3,644	
	3/4"x10' Copper Ground Rod	12	EA	$ 135.42	E	$ 1,625	
	Cadweld	12	EA	$ 66.13	E	$ 794	
	Switchgear Pad	3	EA	$ 4,456.25	E	$ 13,369	
	DPCH-5 400A Main Switchboard-N1 (install)	1	EA	$ 5,157.75	E	$ 5,158	
	DPCH-6 400A Main Switchboard-N1 (install)	1	EA	$ 5,157.75	E	$ 5,158	
	DPCH-7 400A Main Switchboard-N1 (install)	1	EA	$ 5,157.75	E	$ 5,158	
	BCS Feeders (incl 24kW)						**$93,244**
	200A EMT Feeder	890	LNFT	$ 79.26	E	$ 70,541	
	200A PVC Feeder	60	LNFT	$ 56.65	E	$ 3,399	
	100A EMT Feeder	300	LNFT	$ 51.68	E	$ 15,504	
	50A EMT Feeder	100	LNFT	$ 38.00	E	$ 3,800	
	BCS to EVD DC Power						**$37,369**
	2" EMT	360	LNFT	$ 1,584.00	C	$ 5,702	
	2" EMT Elbow	12	EA	$ 10,645.55	C	$ 1,277	
	2" SS Steel Conn	12	EA	$ 3,178.35	C	$ 381	
	2" SS Steel Cplg	42	EA	$ 2,495.56	C	$ 1,048	
	2" Locknut	12	EA	$ 794.49	C	$ 95	
	2" Plastic Bushing	12	EA	$ 789.92	C	$ 95	
	2" Conduit Hanger w/Bolt	45	EA	$ 2,604.76	C	$ 1,172	
	3/8" Thrd Rod-10Ft	9	EA	$ 12,720.59	C	$ 1,145	
	3/8" Hex Nut	135	EA	$ 588.87	C	$ 795	
	Flange Beam Clamp for 3/8" Thrd Rod	45	EA	$ 2,643.23	C	$ 1,189	
	3/0 2kV DLO RHW Cable	440	LNFT	$ 13,449.61	M	$ 5,918	
	350kcmil 2kV DLO RHW Cable	880	LNFT	$ 21,079.27	M	$ 18,550	
	BCS to EVD Aux. Power						**$9,032**
	1" EMT	360	LNFT	$ 977.21	C	$ 3,518	
	1" SS Steel Conn	12	EA	$ 952.06	C	$ 114	
	1" SS Steel Cplg	42	EA	$ 804.95	C	$ 338	
	1" Locknut	12	EA	$ 602.37	C	$ 72	
	1" Plastic Bushing	12	EA	$ 594.37	C	$ 71	
	1" Conduit Hanger w/Bolt	45	EA	$ 1,563.77	C	$ 704	
	3/8" Thrd Rod-10Ft	9	EA	$ 12,720.59	C	$ 1,145	
	3/8" Hex Nut	135	EA	$ 588.87	C	$ 795	
	Flange Beam Clamp for 3/8" Thrd Rod	45	EA	$ 2,643.23	C	$ 1,189	
	#12 THHN CU Stranded Wire	1,250	LNFT	$ 868.43	M	$ 1,086	
	BCS to EVD Data						**$17,700**
	2" EMT	360	LNFT	$ 1,584.00	C	$ 5,702	
	2" EMT Elbow	12	EA	$ 10,645.55	C	$ 1,277	
	2" SS Steel Conn	12	EA	$ 3,178.35	C	$ 381	
	2" SS Steel Cplg	42	EA	$ 2,495.56	C	$ 1,048	
	2" Locknut	12	EA	$ 794.49	C	$ 95	
	2" Conduit Hanger w/Bolt	45	EA	$ 2,604.76	C	$ 1,172	
	3/8" Thrd Rod-10Ft	9	EA	$ 12,720.59	C	$ 1,145	
	3/8" Hex Nut	135	EA	$ 588.87	C	$ 795	
	Flange Beam Clamp for 3/8" Thrd Rod	45	EA	$ 2,643.23	C	$ 1,189	
	CAT6 Cable	500	LNFT	$ 931.50	M	$ 466	
	6-Strand GOF MM OM3 Fiber	500	LNFT	$ 1,152.68	M	$ 576	
	Terminate CAT6	12	EA	$ 27.31	E	$ 328	
	Fiber Termination	72	EA	$ 38.64	E	$ 2,782	

Opinion of Probable Construction Cost

Project Name: Letchworth CSD BEB Study
Project Owner: Letchworth Central School District
Project Location: Letchworth, NY
Wendel Project Number: 630801.01.009
Phase: Phase 3 - BEB
Date: August 23, 2024

DIVISION	DESCRIPTION	QTY	UNIT	UNIT COST	UNIT OF MEASURE	SUBTOTAL	DIVISION SUBTOTAL
	Fiber Test	36	EA	$ 15.53	E	$ 559	
	Test CAT6	6	EA	$ 30.48	E	$ 183	
	BCS Equipment install, pads, bollards						**$76,236**
	24kW BCS/EVD/reel (install)	2	EA	$ 6,617.50	E	$ 13,235	
	60kW BCS/EVD/reel (install)	2	EA	$ 8,688.00	E	$ 17,376	
	120kW BCS/EVD/bollard/base (install)	4	EA	$ 9,025.00	E	$ 36,100	
	155kW BCS/EVD/bollard/base (install)	1	EA	$ 9,525.00	E	$ 9,525	
	BCS Equipment Cost						**$482,796**
	BCS 24kW Equipment (incl dispenser)	2	EA	$ 18,000.00	E	$ 36,000	
	BCS 60kW Equipment (incl dispenser)	2	EA	$ 47,500.00	E	$ 95,000	
	BCS 120kW Equipment (incl dispenser)	4	EA	$ 68,224.00	E	$ 272,896	
	BCS 155kW Equipment (incl dispenser)	1	EA	$ 78,900.00	E	$ 78,900	
	Distribution Equipment Allowance						**$90,000**
	Distribution Equipment Allowance	1	LS	$ 90,000.00	E	$ 90,000	
31 00 00	**Earthwork**						**$0**
	Incl in ductbank		SF	$ 32.00		$ -	
32 00 00	**Site Improvements**						**$8,370**
	Paving	93	SY	$ 90.00	E	$ 8,370	
33 00 00	**Utilities**						**$0**
	Subtotal Construction Cost						$985,844
10%	General Conditions					$ 98,584	
15%	General Contractor OH&P					$ 147,877	
10%	Design Contingency					$ 98,584	
10%	Construction Contingency					$ 98,584	
40%	Escalation (to end of 2029)					$ 394,338	
0%	Phasing					$ -	
	Subtotal					$ 837,968	$1,823,812
6%	Soft Costs (A/E Fees)						$109,429
	Phase 3 BEB Total						$1,933,241

Opinion of Probable Construction Cost

Project Name: Letchworth CSD BEB Study
Project Owner: Letchworth Central School District
Project Location: Letchworth, NY
Wendel Project Number: 630801.01.009
Phase: Schematic Design
Date: August 23, 2024

GSF 18000

DIVISION	DESCRIPTION	QTY	UNIT	UNIT COST	UNIT OF MEASURE	SUBTOTAL	DIVISION SUBTOTAL
03 00 00	**Concrete**						**$ 11,470**
	FP Building Footing	5	CY	$ 450.00	E	$ 2,250	
	8" FP Building SOG	240	SF	$ 28.00	E	$ 6,720	
	Fire Pump/Jockey Pump Base	1	LS	$ 2,500.00	E	$ 2,500	
07 00 00	**Thermal and Moisture Protection**						**$7,370**
	Gutter and downspout	1	LS	$ 650.00	E	$ 650	
	Roofing System	240	SF	$ 28.00	E	$ 6,720	
08 00 00	**Openings**						**$0**
	Double Door - HM w/hardware (incl in Lakelands quote)	-					
09 00 00	**Finishes**						**$20,160**
	Insulated FRP wall (FT ply, studs/rigid insulation)	750	SF	$ 20.00	E	$ 15,000	
	Insulated FRP Ceiling (FT ply, studs/rigid insulation)	240	SF	$ 21.50	E	$ 5,160	
12 00 00	**Special Construction**						**$619,107**
	Fire Pump Building (quoted by Lakelands, set and assembled)	1	EA	$ 78,680.00	E	$ 78,680	
	Earthwork For FP Building	1	LS	$ 10,000.00	E	$ 10,000	
	150,000 gallon UG water storage tank	1	Allow	$ 528,000.00	E	$ 528,000	
	2" HDPE feed piping for storage tank	450	LNFT	$ 2.37	E	$ 1,067	
	HDPE weld	15	EA	$ 24.00	E	$ 360	
	Misc. Valves, etc for tank	1	LS	$ 1,000.00	E	$ 1,000	
21 00 00	**Fire Suppression**						**$516,000**
	RX System	18,000	SF	$ 1.50	E	$ 27,000	
	Fire Suppression System	18,000	SF	$ 11.00	E	$ 198,000	
	Backflow preventor,piping,valves,etc.	1	LS	$ 18,500.00	E	$ 18,500	
	Fire Pump	1	EA	$ 265,000.00	E	$ 265,000	
	Core/Sleeve/Seal	1	LS	$ 2,500.00	E	$ 2,500	
	Testing and certification	1	LS	$ 5,000.00	E	$ 5,000	
26 00 00	**Electrical**						**$268,611**
	3/4" GRC	40	LNFT	$ 873.76	C	$ 350	
	1/2" Steel Flex	18	LNFT	$ 535.67	C	$ 96	
	3/4" Plastic Bushing	6	EA	$ 217.21	C	$ 13	
	3/4" Cut & Thread	3	EA	$ 25.50	E	$ 77	
	3/4" 1-Hole Strap	5	EA	$ 521.48	C	$ 26	
	4" Sq Box/2-1/8"D/Comb KO	1	EA	$ 3,475.20	C	$ 35	
	#12 THHN CU Stranded Wire	222	LNFT	$ 692.80	M	$ 154	
	2-1/2" GRC	30	LNFT	$ 3,945.56	C	$ 1,184	
	2-1/2" PVC	520	LNFT	$ 1,107.72	C	$ 5,760	
	2-1/2" EMT Elbow	4	EA	$ 14,960.35	C	$ 598	
	2-1/2" Locknut	12	EA	$ 1,477.93	C	$ 177	
	2-1/2" Plastic Bushing	4	EA	$ 1,161.62	C	$ 46	
	2-1/2" Cut & Thread	2	EA	$ 150.94	E	$ 302	
	2-1/2" Galvanized Coup	4	EA	$ 4,162.76	C	$ 167	
	2-1/2" PVC Term Adpt	4	EA	$ 2,776.62	C	$ 111	
	2-1/2" PVC Coup	2	EA	$ 2,151.02	C	$ 43	
	2-1/2" PVC-40 Elbow	2	EA	$ 11,516.10	C	$ 230	
	2"x3" Base Spacer	65	EA	$ 1,389.30	C	$ 903	
	#6 THHN CU Stranded Wire	605	LNFT	$ 2,094.37	M	$ 1,267	
	#3/0 THHN CU Stranded Wire	2,440	LNFT	$ 7,646.87	M	$ 18,658	
	400A/3P 4WSN 600V HD Fus Safety Sw-Nema1	1	EA	$ 3,167.84	E	$ 3,168	
	400A 600V RK5 Time Delay Fuse	3	EA	$ 222.91	E	$ 669	
	#10 THHN CU Stranded Wire	594	LNFT	$ 891.56	M	$ 530	
	#4 THHN CU Stranded Wire	30	LNFT	$ 2,418.86	M	$ 73	
	#2 THHN CU Stranded Wire	185	LNFT	$ 3,416.40	M	$ 632	
	#4/0 THHN CU Stranded Wire	120	LNFT	$ 8,581.72	M	$ 1,030	
	#4/0 Stranded Bare Copper Wire	75	LNFT	$ 15,537.50	M	$ 1,165	
	20A Spec Grade SP Toggle Switch	1	EA	$ 3,013.20	C	$ 30	
	4" Sq 1G Toggle Sw Raised Cover	1	EA	$ 1,364.77	C	$ 14	
	3/4"x10' Copper Ground Rod	4	EA	$ 110.10	E	$ 440	
	CT Cabinet/Meter Socket	1	EA	$ 3,312.00	E	$ 3,312	

Opinion of Probable Construction Cost

Project Name: Letchworth CSD BEB Study
Project Owner: Letchworth Central School District
Project Location: Letchworth, NY
Wendel Project Number: 630801.01.009
Phase: Schematic Design
Date: August 23, 2024

GSF 18000

DIVISION		DESCRIPTION	QTY	UNIT		UNIT COST	UNIT OF MEASURE		SUBTOTAL	DIVISION SUBTOTAL
		Jockey Pump Connection	1	EA	$	498.53	E	$	499	
		Fire Pump Connection	1	EA	$	1,063.75	E	$	1,064	
		EMGen 150kW (install)	1	EA	$	4,848.00	E	$	4,848	
		150kW Emergency Generator	1	EA	$	113,850.00	E	$	113,850	
		Red Scotchlok Wirenuts (#18-10)	18	EA	$	3,339.78	M	$	60	
		Cadweld	4	EA	$	49.80	E	$	199	
		Generator Pad	1	EA	$	2,202.00	E	$	2,202	
		Concrete Ductbank (per ft)	520	EA	$	176.04	E	$	91,541	
		Pipe Bollard	6	EA	$	761.88	E	$	4,571	
		Fixture Type SW4	2	EA	$	299.11	E	$	598	
		Fixture Type WP1	1	EA	$	1,419.17	E	$	1,419	
		100 Amp Surf Panel-Nema 1	1	EA	$	6,500.00	E	$	6,500	
31 00 00		**Earthwork**								**$4,778**
		Excavation	910	LF	$	5.25	E	$	4,778	
32 00 00		**Site Improvements**								**$20,400**
		Hydroseeding	1,200	SF	$	3.50	E	$	4,200	
		Paving	180	SY	$	90.00	E	$	16,200	
33 00 00		**Utilities**								**$92,400**
		Fire Hydrants/Fire Loop	1	EA	$	92,400.00	E	$	92,400	
		Subtotal Construction Cost								$1,560,295
	10%	General Conditions							$156,029	
	15%	General Contractor OH&P							$234,044	
	5%	General Contractor OH&P on Sub-Contractor							$31,206	
	10%	Construction Contingency							$156,029	
	10%	Design Contingency							$156,029	
	8%	Escalation (to end of 2025)							$124,824	
		Subtotal						$	858,162	$2,418,457
	6%	Soft Costs (A/E Fees)							$145,107	
		Maintenance Building Fire Suppression								$2,563,564

Section 8 Appendix

Appendix A – Abbreviations

ABBREVIATIONS

Abbreviation	Definition
AHJ	Authority Having Jurisdiction
BEB	Battery Electric Bus
CAD	Computer Aided Design
CSB	Clean School Bus
CSD	Central School District
DC	Direct Current
ECM	Energy Conservation Measure
EPA	Environmental Protection Agency
kV	Kilo Volt
kVA	Kilo Volt Ampere
kW	Kilo Watt
kWh	Kilo Watt hour
Li-NMC-G	Lithium Nickel Manganese Cobalt Oxides
MAX	Maximum
MIN	Minimum
MMBtu	One Million British Thermal Units
MPG	Miles Per Gallon
MT CO2e	Metric Tons of Carbon Dioxide Equivalent
MVA	Mega Volt Ampere
MW	Mega Watt
N/A	Not Applicable
NFPA	National Fire Protection Agency
NYS	New York State
NYSERDA	New York State Energy Research & Development
O&M	Operation & Maintenance
OAT	Outdoor Air Temperature
OEM	Original Equipment Manufacture
PON	Program Opportunity Notice
RFI	Request for Information
SOC	State of Charge
TVIP	Truck Voucher Program
V2G	Vehicle to Grid
V2V	Vehicle to Vehicle

Appendix B - Deliverables

Appendix B.1 - Minutes

Letchworth – ZEV Transition Plan Client Kickoff

AGENDA

Date: 5/21/24
Time: 10:00am
Place: Virtual
Project: Letchworth ZEV Transition Plan NYSERDA P-12 Schools: Flexible Technical Assistance Program - PON #4192
Wendel Project #630801

TOPICS FOR DISCUSSION:

1. Introduction of Team Members
    a. Letchworth CSD
        i. Todd Campbell
    b. NYSERDA
        i. Vinny Riscica – NYSERDA PM
        ii. Austin Daily – NYSERDA PM
    c. Wendel
        i. John Havrilla — Director of Alt Fuels
        ii. Danielle Wink — Project Manager
        iii. Katie Eckam — Energy Engineer
        iv. Chris Barkley — Energy Engineer
        v. Brian Fanning — Energy Engineer
        vi. Nicole Everett — Project Admin

2. Overview of NYSERDA FlexTech PON 4192
    a. Application
    b. Grant funding
        i. 75% NYSERDA cost share, 25% district share
    c. NYSERDA role

3. Goals and Objectives
    a. NYS requirements
    b. Fleet transition plan – provide the district with roadmap to implementing battery electric buses
    c. Charging infrastructure options

4. Review Task Work Order Plan
    a. Review scope
        i. Project Kickoff & Status Meetings
        ii. Existing Conditions Review
        iii. Data Collection and Existing Conditions Review
            1. Review of data received by the district
            2. Site visits

Letchworth – ZEV Transition Plan Client Kickoff

iv. Existing Route Energy Analysis
    1. Determine energy requirements per route
    2. Determine basis of design for chargers, minimum battery requirements, and charging durations
    3. Conceptual Charging Strategy
        a. Identify anticipated peak demands based on smallest battery available
        b. Provide charging profile

v. Transition Planning
    1. Electric Utility Analysis
        a. Work with utility to determine ability to support the power
        b. What upgrades they need to make
    2. Concept Development & Phasing
        a. Provide phasing concept plans
        b. Operational recommendations – to be discussed with the districts
    3. Estimates

vi. Final Report

5. Schedule

Task	Submission to Client
Task 1 - Kickoff	5/21
Task 2 - Data Collection & Infrastructure Review	Site visits TBD
Task 3 - Existing Energy Consumption Analysis	7/11
Task 4 - Transition Planning	8/23
Task 5 – Draft Report	8/30

6. Discuss Request for Information
    a. Information Still Needed
    b. Questions on Received Information
    c. Route and Bus Information

7. Administrative
    a. Site visit check-in protocol
    b. Progress meetings
        i. Meeting to be scheduled 7/15 to review task 3
        ii. Meeting to be scheduled 8/26 to review task 4
    c. Monthly billing – being addressed directly with GV BOCES

8. Open Forum

Letchworth – ZEV Transition Plan Client Kickoff

9. Action Items

Letchworth CSD Concepts & Phasing Call

Wed, Sep 4, 10:00 AM - 11:00 AM

https://wendelco.zoom.us/j/89362472574

Link to Outlook Item

Invitation Message

Participants (9)

Nicole Everett (Meeting Organizer)

neverett@wendelcompanies.com (Meeting Organizer)

Danielle Wink (Accepted Meeting)

Katherine E. Eckam

Jonathan Metzger (Accepted Meeting)

Novak, John (Accepted Meeting)

Campbell, David (Accepted Meeting)

Christopher Barkley (Accepted Meeting)

Bangert-Drowns, Mike (NYSERDA)

Notes

Transition Planning Meeting

a. Concepts based on task 3 info

1. Utility analysis
    a. Capacity availability from the utility, waiting to hear back for their confirmation
    b. Submit draft report with information we have
2. Review of concepts
    a. Phase 1
        i. New feed to new service transformer
        ii. Emergency generator - diesel is preferred
        iii. Fire pump building
        iv. 60 kW - 8 chargers
        v. 120 kW - 1 charger

2. Phase 2
    a. 24kW - 4
    b. 60kW - 2
3. Phase 3
    a. 24kW - 2
    b. 60kW - 2
    c. 120 kw - 4
    d. 155 kW - 1
    e. Includes opportunity charger
4. Cost of chargers
    a. 60 47K
    b. 120 68K
5. Next steps
    a. Draft report to be submitted 9/18
    b. Wendel to follow up with utility
    c. Wendel to submit drawings and estimates

Appendix B.2 – Task Memos

*** Please note that information within the Task Memos may differ from the report and Final Calculations / Models. This is part of the iterative process.**

MEMO

To:	David Campbell, John Novak – Letchworth CSD
	Vincent Riscica, Austin Daily – NYSERDA
From:	John Havrilla, Danielle Wink, Katie Eckam, Chris Barkley, Jonathan Metzger – Wendel
Date:	July 9, 2024
RE:	Letchworth CSD: Task 3: Existing Route Energy Analysis

Letchworth CSD and NYSERDA has contracted with Wendel to perform a Zero Emissions Vehicle Transition plan utilizing NYSERDA's FlexTech program to evaluate the impact of a transition to zero emission vehicles for their bus fleet. This memo reports on the route analysis and conceptual charging strategy model portion of the Zero Emission Vehicle Transition plan.

Wendel reviewed the route information provided by the district, a copy of the route schedule as received has been included in this memo. Per the District's request, (8) "ghost runs" to be performed by (4) buses were added to the analyses to represent the routes that would be added should the district revert from their current double run system. A route distance of 30 miles and a duration of 75 minutes were assumed for each. Existing spare buses were used to model these hypothetical routes as well as the contracted route which the district may be responsible for again in the future. These routes and their associated buses can be found below:

District Route Number / Route Name	Bus Number	Bus Type	Route Start Time	Route End Time	Total Route Distance (Miles)
Ghost1	20 - Ghost Run	*Type A*	6:30:00 AM	7:45:00 AM	30
Ghost1	20 - Ghost Run	*Type A*	3:30:00 PM	4:45:00 PM	30
Ghost2	39 - Ghost Run	*Type A*	6:30:00 AM	7:45:00 AM	30
Ghost2	39 - Ghost Run	*Type A*	3:30:00 PM	4:45:00 PM	30
Ghost3	34 - Ghost Run	*Type A*	6:30:00 AM	7:45:00 AM	30
Ghost3	34 - Ghost Run	*Type A*	3:30:00 PM	4:45:00 PM	30
Ghost4	59 - Ghost Run	*Type C*	6:30:00 AM	7:45:00 AM	30
Ghost4	59 - Ghost Run	*Type C*	3:30:00 PM	4:45:00 PM	30
CONTRACTED RUN AM	62 - Contracted Route	*Type C*	7:00:00 AM	11:00:00 AM	125

The route information was used to determine the times that buses would be departing and arriving at the bus garage where charging would take place. It was assumed that once a bus returns to the bus garage after it's route, it would begin charging as long as it would not leave for its next route for another 45 minutes.

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The route analysis utilizes the received route distances to develop the anticipated energy requirements per route and then uses those energy requirements to determines the minimum battery electric bus (BEB) battery size requirements. The analysis then determines the minimum charger size and charging durations necessary per route based on the minimum battery size requirements and the anticipated energy requirements.

Existing Bus Data	
Route Buses	20
Spare Buses	4
Contracted Buses	1
AM Routes	33
PM Routes	31
PM2 Routes	0
Total Number of Routes	64

Wendel evaluated seven different bus manufacturers and five different charger sizes ranging from 24 kW to 360 kW. The analysis includes the review of battery capacities, charger levels, and outputs. Wendel has analyzed these bus manufacturers per the existing routes to determine the performance of each bus configuration. The District has stated that they would prefer to utilize Bluebird buses wherever possible, though the use of Lion and/or IC is okay if necessary. Wendel has utilized Lion and IC as the basis of the investigation for the proposed electric buses. Bluebird currently does not offer electric Type-A buses over 88 kWh or electric Type-C buses over 155 kWh. Lion and IC were utilized for the buses requiring larger sizes.

The route analysis shows that the maximum energy usage of any one route would be 457 kWh which was associated with a Type C bus. Based on today's BEB technology, there is not currently a battery large enough to be able to perform this route. Among the routes for the (21) buses examined, it was determined that the routes for (10) of the buses cannot currently be performed by a BEB as BEBs do not currently have adequate battery capacity at the existing bus size to meet these route demands. These buses have been differentiated in this task as being labeled "No replacement" or "Bus size does not currently exist." Wendel recommends that these buses be converted to BEBs towards the end of the transition plan. This will allow for the development of larger battery capacities which may enable the district to implement BEBs without splitting the routes in the future. The *Bus Sizes Do Not Currently Exist* table found below shows the minimum BEB sizes needed to perform the routes as they currently are for these (10) buses.

Bus Sizes Do Not Currently Exist			
Bus Number	Bus Type	Minimum Bus Size based on Maximum Energy Usage (kWh)	Notes
36	Type A	433	Bus size does not currently exist
37	Type A	381	Bus size does not currently exist
62 – Contracted Route	Type C	635	Bus size does not currently exist
73	Type C	427	Bus size does not currently exist
75	Type C	540	Bus size does not currently exist
76	Type C	408	Bus size does not currently exist
82	Type C	356	Bus size does not currently exist
88	Type C	364	Bus size does not currently exist
90	Type C	319	Bus size does not currently exist
91	Type C	436	Bus size does not currently exist

The analysis shows that the maximum energy usage per route within current battery capacity constraints is 226 kWh which, according to the district preferred manufacturer, would require a 315 kW BEB. The anticipated energy usage for each route can be found in the attached spreadsheet. A summary of the BEB sizes required to meet these energy usages can be found in the table below.

Proposed Bus Battery Sizes					
Bus Size*	Bus Type	Route Buses	Spare Buses	Contracted Buses	Total Proposed Buses
168 kWh – Lion	Type A	4	0	0	**4**
210 kWh - IC	Type C	1	0	0	**1**
315 kWh – IC	Type C	6	4	0	**10**
Bus size does not currently exist	Type A & Type C	9	0	1	**10**

**Based on District Preferred Manufacturer.*

Five charger sizes were reviewed and include a 24 kW DC charger, 60 kW DC charger (fast charger), 120 kW DC charger (fast charger), 180 kW DC charger (fast charger), and a 360 kW DC charger (fast charger). Charger recommendations are based on utilizing one charger per route bus in order to remain conservative. The district may choose to utilize higher kW chargers of at least twice the recommended size which would allow for the charging of two school buses per charger. This would decrease installation and overall charger costs. Another advantage of this approach would be if only one school bus is utilizing the two port charger at any time, that bus's required charging time would decrease as it would be able to take advantage of the full charger output. Charger recommendations are based on utilizing one charger per school bus in order to remain conservative.

Based on the route analysis, the proposed charging duration between AM and PM routes ranges from 1 hour and 32 minutes to 21 hours and 9 minutes. The largest charger size proposed is 180 kW. The charging durations for each route can be found in the attached spreadsheet. Wendel has determined that the routes the district has provided will require (1) 180 kW charger, (5) 120 kW chargers, (12) 60 kW chargers, and (6) 24 kW chargers. Of the proposed chargers (1) of the 24 kW chargers, (1) of the 60 kW chargers, and (1) of the 120 kW chargers are for spare buses. The (1) spare 120 kW charger is proposed to be used as a 2:1. It is assumed that spare buses are used only to replace out of service route buses or for field trips and sports trips. The contracted bus would require (1) 60 kW charger and is included in the proposed charger quantities.

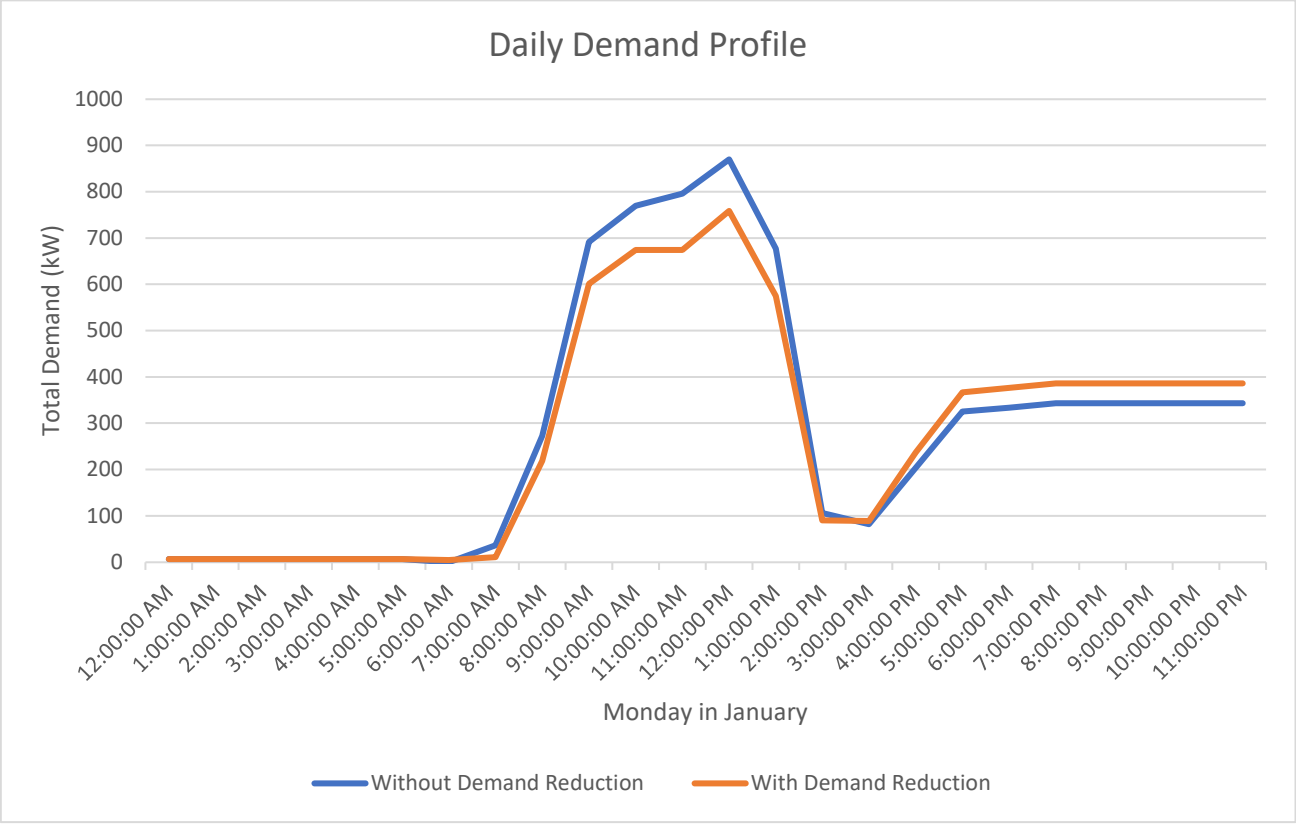
Proposed Charger Quantities				
Charger Size	Route Bus Chargers	Spare Bus Chargers	Contracted Bus Chargers	Total Proposed Chargers
24 kW	5	1	0	**6**
60 kW	10	1	1	**12**
120 kW	4	1	0	**5**
180 kW	1	0	0	**1**

Wendel developed an hourly charging model using the minimum bus size required, proposed charger sizes, and route energy requirements determined during the route analysis. The model provides additional insight on the energy impacts of the BEB fleet on the district as well as charger infrastructure required when converting to BEBs. The basis of the model utilized chargers which can charge from 24 kW to 360 kW. In order to provide a complete demand profile for all buses, the charging model assumes that the battery capacities needed for routes that are currently too long will become available in the future and that the largest charger size needed for that bus size would be used. For this analysis, it was assumed that the maximum number of buses charging during peak time (mid-day) is (21) buses, this does not include the spare buses.

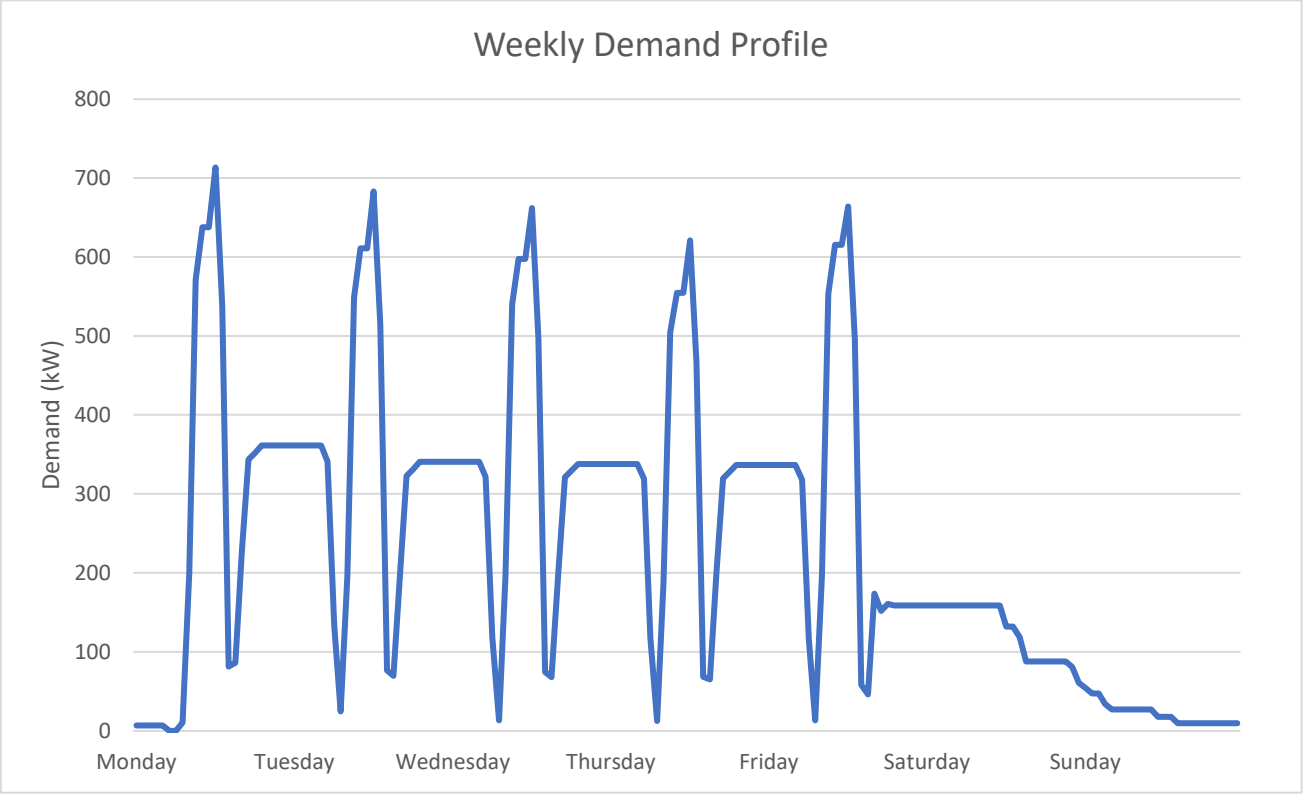
The model calculates the energy usage, the battery capacity, and the amount of charge delivered to each bus for each hour throughout a winter month. The charging strategy focuses on charging for long periods of time at low charging speeds which simulates best practices. A demand reduction strategy model was also developed which limits the charge being delivered to the buses during peak hours (mid-day) to the amount of charge needed to perform the remaining routes.

The maximum single bus charging rate for any hour throughout the winter month was calculated to be 139 kW. The maximum combined bus electrical demand when all (21) route buses are converted to BEB's during a winter month is 759 kW which occurs between 12:00 pm and 1:00 pm Mondays. Before the demand reduction strategy was implemented, the peak demand was 870.2 kW which would occur between 12:00 pm and 1:00 pm Mondays. This 111.3 kW demand reduction will yield utility cost savings over the year, which highlights the importance of implementing a charge controller optimization strategy.

See charts below outlining the demand profiles and max single bus charging rates below:



**Demand peaks fluctuate per day and may be lower than the above*


Weekly Demand Profile
Demand (kW)
800
700
600
500
400
300
200
100
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday

Appendix B.3 – Final Calculations and Models

Letchworth CSD

Route Analysis Calculation

Date. 9/9/24

Task Summary		
Bus Data		
Minutes before Bus Route Begins that Bus is removed from Charger	15	Minutes
Minutes after Bus Route ends that Bus is back on Charger	0	Minutes
District Preferred Manufacturer:	Bluebird	
Number of AM Routes	33	
Number of PM Routes	31	
Number of PM2 Routes	0	
Total Number of Routes	64	
Duration Based		
Maximum Route Energy Usage	457.0	kWh
Maximum Proposed Bus Size	315.0	kW
Maximum Proposed Charger Size	154.9	kW
Minimum charging duration between AM and PM	1:32	Hours: Min
Maximum charging duration between AM and PM	21:09	Hours: Min
Proposed Charger Quantites [3]		
Quantity of 180 kW DC Chargers	1	
Quantity of 120 kW DC Chargers	5	
Quantity of 60 kW DC Chargers	12	
Quantity of 24 kW DC Chargers	6	
Proposed Route Bus Quantities [2]		
Quantity of Lion Type A 168 kWh Buses	4	
Quantity of IC Type C 210 kWh Buses	1	
Quantity of IC Type C 315 kWh Buses	6	
No Replacement	10	
Proposed Spare Bus Quantites [1]		
Quantity of IC Type C 315 kWh Buses	4	

1. Assumes Spare Buses will be replaced with largest EV bus size corresponding with Bus Type and district preferred manufacturers

2. Includes Routes that are performed by Contracted Buses

3. Includes Chargers for Contracted Buses

Project Name: Letchworth CSD
Task: Route Analysis Calculation
Date: 9/9/2024

BEB Efficiency Table							
	Type A			Type B	Type C	Type D	
OEM Rated Efficiency	1.12				1.58	1.94	
Low Battery Usage[1]	1.55			N/A	2.18	2.68	kWh per mile
Low Deadhead Battery Usage	1.24			N/A	1.74	2.14	kWh per mile
Resting Battery Usage (Heat only)	20.00			N/A	20.00	20.00	kWh per hour
High Battery Usage[2]	2.48			N/A	3.48	4.29	kWh per mile
High Deadhead Battery Usage	2.19			N/A	3.08	3.79	kWh per mile

Manufacturer	Include?
Bluebird	Yes
BYD	No
Collins	No
Greenpower	No
Lightning eMotors	No
Lion	Yes
Motiv	No
IC	Yes
Thomas	No

Charging Variables	
Dead Head Miles	10%
Charging Rate Safety Factor	90%
Route Safety Factor	5%
Efficiency Safety Factor (Distance)	11%
Maximum Battery Level	90%
Anticipated Degradation	90%
Minimum Battery Level	10%
Low Temp Power Factor (kW)	0

Notes:
1. Best Case Usage with little/no HVAC usage at Moderate OA Temperatures.
2. Worst Case Usage with extreme cold/heat,traffic/ long stops

			ROUTE INFORMATION																
			AM								PM								
FORMULA INDEX		AVG	1	111.45	23.57	23.93		50.09	12.00	27.38	5:25	1	94.62	23.25	26.53		45.48	13.42	28.58	#DIV/0!
		MAX	3	318.24	45.00	95.21		112.50	59.30	37.37	7:30	2	137.43	30.00	109.76		64.20	60.00	42.19	0:00
		MIN	0	42.55	15.00	3.90		23.40	1.72	17.43	1:55	0	26.45	15.00	3.55		9.70	1.30	22.00	0:00
Line #	Bus Type	Bus	Number of AM Routes	AM Active Run Time (Min)	AM Resting Time (Min)	AM Deadhead Run Time (Min)	AM Between Shift Not Charging / Not On (Min)	AM Active Distance (Miles)	AM Deadhead Distance (Miles)	AM Average Speed (mph)	Time Until Next Shift	Number of PM Routes	PM Active Run Time (Min)	PM Resting Time (Min)	PM Deadhead Run Time (Min)	PM Between Shift Not Charging / Not On (Min)	PM Active Distance (Miles)	PM Deadhead Distance (Miles)	PM Average Speed (mph)	Time Until Next Shift2
1	Type A	20 - Ghost Run	1	67.50	15.00	7.50	0.00	27.00	3.00	24.00	7:30	1	67.50	15.00	7.50	0.00	27.00	3.00	24.00	-
2	Type A	34 - Ghost Run	1	67.50	15.00	7.50	0.00	27.00	3.00	24.00	7:30	1	67.50	15.00	7.50	0.00	27.00	3.00	24.00	-
3	Type A	36	1	142.68	15.00	82.32	0.00	78.00	45.00	32.80	2:55	1	115.24	15.00	109.76	0.00	63.00	60.00	32.80	-
4	Type A	37	1	79.79	15.00	95.21	0.00	49.70	59.30	37.37	3:40	1	85.75	15.00	69.25	0.00	60.30	48.70	42.19	-
5	Type A	38	1	42.55	15.00	17.45	0.00	23.40	9.60	33.00	6:25	1	26.45	15.00	3.55	0.00	9.70	1.30	22.00	-
6	Type A	39 - Ghost Run	1	67.50	15.00	7.50	0.00	27.00	3.00	24.00	7:30	1	67.50	15.00	7.50	0.00	27.00	3.00	24.00	-
7	Type C	59 - Ghost Run	1	67.50	15.00	7.50	0.00	27.00	3.00	24.00	7:30	1	67.50	15.00	7.50	0.00	27.00	3.00	24.00	-
8	Type C	62 - Contracted Route	1	216.00	15.00	24.00	0.00	112.50	12.50	31.25	-	0	-	-	-	-	-	-	-	-
9	Type C	73	2	146.34	30.00	13.66	5.00	75.00	7.00	30.75	4:58	2	115.70	30.00	36.30	0.00	63.20	19.80	32.77	-
10	Type C	75	3	318.24	45.00	20.76	1.00	95.20	7.80	17.95	1:55	2	121.75	30.00	13.25	11.00	64.20	6.80	31.64	-
11	Type C	76	1	107.90	15.00	52.10	0.00	55.30	26.70	30.75	4:40	1	89.69	15.00	43.31	0.00	55.30	26.70	36.99	-
12	Type C	78	2	85.44	30.00	19.56	0.00	36.60	8.40	25.70	5:25	2	129.91	30.00	6.09	3.00	52.50	2.50	24.25	-
13	Type C	80	2	85.21	30.00	16.79	4.00	44.30	8.70	31.20	6:54	2	80.03	30.00	64.97	20.00	37.00	20.00	27.74	-
14	Type C	81	2	83.99	30.00	9.01	12.00	24.40	2.60	17.43	5:20	2	87.96	30.00	7.04	23.00	44.60	3.40	30.42	-
15	Type C	82	2	111.35	30.00	4.65	0.00	60.50	2.50	32.60	5:19	2	128.92	30.00	14.08	6.00	61.30	6.70	28.53	-
16	Type C	86	1	80.11	15.00	13.89	0.00	37.50	6.50	28.09	4:52	1	76.33	15.00	10.67	0.00	46.50	6.50	36.55	-
17	Type C	87	2	105.28	30.00	40.72	0.00	31.00	12.00	17.67	5:14	2	105.59	30.00	17.41	24.00	47.20	7.80	26.82	-
18	Type C	88	2	114.41	30.00	24.59	0.00	57.60	12.40	30.21	5:21	2	109.56	30.00	39.44	0.00	52.10	18.90	28.53	-
19	Type C	89	2	105.10	30.00	3.90	18.00	37.28	1.72	21.28	5:11	2	96.40	30.00	19.60	20.00	35.70	7.30	22.22	-
20	Type C	90	2	105.89	30.00	16.11	13.00	51.20	7.80	29.01	5:10	2	137.43	30.00	22.57	0.00	52.40	8.60	22.88	-
21	Type C	91	2	140.26	30.00	17.74	0.00	74.50	9.50	31.87	5:07	2	115.70	30.00	23.30	10.00	56.60	11.40	29.35	-
22	Type C	Spare - 74	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
23	Type C	Spare - 77	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
24	Type C	Spare - 79	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
25	Type C	Spare - 85	0	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-

Charger Size	Charger kW
X-Large	180
Large	120
Medium	60
Small	24

Project Name: Letchworth CSD
Task: Route Analysis Calculation
Date: 9/9/2024

FORMULA INDEX			AM						
		AVG	203.37	134.27	1:14	1:51	3:43	9:19	
		MAX	456.96	285.16	2:49	4:13	8:27	21:09	180
		MIN	0.00	53.02	0:12	0:18	0:37	1:32	24
Line #	Bus Type	Bus	AM High Energy Usage (kWh)	AM Low Energy Usage (kWh)	AM Min Charging Duration Hrs Needed to Perform PM Route (XLarge)	AM Min Charging Duration Hrs Needed to Perform PM Route (Large)	AM Min Charging Duration Hrs Needed to Perform PM Route(Medium)	AM Min Charging Duration Hrs Needed to Perform PM Route (Small)	Required Charging Size (kW)
1	Type A	20 - Ghost Run	82.34	53.02	0.02	0:45	1:31	3:48	24
2	Type A	34 - Ghost Run	82.34	53.02	0.02	0:45	1:31	3:48	24
3	Type A	36	311.49	190.48	1:53	2:50	5:41	14:12	120
4	Type A	37	270.79	163.09	0.07	2:30	5:00	12:32	120
5	Type A	38	88.15	55.75	0.01	0:18	0:37	1:32	24
6	Type A	39 - Ghost Run	82.34	53.02	0.02	0:45	1:31	3:48	24
7	Type C	59 - Ghost Run	113.66	72.43	0.03	1:03	2:06	5:15	24
8	Type C	62 - Contracted Route	456.96	285.16	0.12	4:13	8:27	21:09	24
9	Type C	73	307.33	194.67	0.08	2:49	5:39	14:08	120
10	Type C	75	389.01	247.54	0.07	2:28	4:56	12:22	180
11	Type C	76	293.74	180.42	0.08	2:43	5:26	13:35	120
12	Type C	78	171.46	109.48	0.04	1:35	3:10	7:56	60
13	Type C	80	200.58	127.63	0.05	1:51	3:42	9:17	60
14	Type C	81	108.11	71.01	0.03	1:00	2:00	5:00	24
15	Type C	82	239.77	153.31	0.06	2:13	4:26	11:06	60
16	Type C	86	163.36	102.82	0.04	1:30	3:01	7:33	60
17	Type C	87	162.63	103.27	0.04	1:30	3:00	7:31	60
18	Type C	88	261.17	164.78	0.07	2:25	4:50	12:05	60
19	Type C	89	152.35	98.83	0.04	1:24	2:49	7:03	60
20	Type C	90	222.90	141.75	0.06	2:03	4:07	10:19	60
21	Type C	91	313.58	198.10	0.07	2:21	4:42	11:46	60
22	Type C	Spare - 74	0.00	-	-	-	-	-	-
23	Type C	Spare - 77			-	-	-	-	-
24	Type C	Spare - 79			-	-	-	-	-
25	Type C	Spare - 85			-	-	-	-	-

Project Name: Letchworth CSD
Task: Route Analysis Calculation
Date: 9/9/2024

FORMULA INDEX			PM							Results				
		AVG	160.75	126.38	1:14	1:51	3:43	9:18			4:27	188.71	268.80	
		MAX	306.97	191.10	1:53	2:50	5:41	14:12	24	180	21:09	456.96	315.00	
		MIN	0.00	22.70	0:12	0:18	0:37	1:32	24	0	1:32	0.00	168.00	
Line #	Bus Type	Bus	PM High Energy Usage (kWh)	PM Low Energy Usage (kWh)	PM Min Charging Duration Hrs (XLarge)	PM Min Charging Duration Hrs (Large)	PM Min Charging Duration Hrs (Medium)	PM Min Charging Duration Hrs (Small)	Required Charging Size (kW) 2	Proposed Charger Size based on Maximum Usage (kW)	Mid-Day Charging Duration	Full Day High Energy Usage (kWh)	Proposed Battery Size based on Maximum Usage (kWh)	Proposed Bus Manufacturer / Size
1	Type A	20 - Ghost Run	82.34	53.02	0:30	0:45	1:31	3:48	24	24	3:48	82.3	168	Lion
2	Type A	34 - Ghost Run	82.34	53.02	0:30	0:45	1:31	3:48	24	24	3:48	82.3	168	Lion
3	Type A	36	306.97	185.61	1:53	2:50	5:41	14:12	24	120	2:50	311.5	#N/A	#N/A
4	Type A	37	273.98	166.53	1:41	2:32	5:04	12:41	24	120	2:30	274.0	#N/A	#N/A
5	Type A	38	33.46	22.70	0:12	0:18	0:37	1:32	24	24	1:32	88.2	168	Lion
6	Type A	39 - Ghost Run	82.34	53.02	0:30	0:45	1:31	3:48	24	24	3:48	82.3	168	Lion
7	Type C	59 - Ghost Run	113.66	72.43	0:42	1:03	2:06	5:15	24	24	5:15	113.7	210	IC
8	Type C	62 - Contracted Route	0.00	-	-	-	-	-	-	60	21:09	457.0	#N/A	#N/A
9	Type C	73	305.57	191.10	1:53	2:49	5:39	14:08	24	120	2:49	307.3	#N/A	#N/A
10	Type C	75	267.20	169.63	1:38	2:28	4:56	12:22	24	180	Charger Size Error	389.0	#N/A	#N/A
11	Type C	76	293.74	180.42	1:48	2:43	5:26	13:35	24	120	2:43	293.7	#N/A	#N/A
12	Type C	78	210.52	135.03	1:17	1:56	3:53	9:44	24	60	3:10	210.5	315	IC
13	Type C	80	210.43	131.60	1:17	1:56	3:53	9:44	24	60	3:42	210.4	315	IC
14	Type C	81	184.55	118.62	1:08	1:42	3:25	8:32	24	60	5:00	184.5	315	IC
15	Type C	82	256.27	162.82	1:34	2:22	4:44	11:51	24	60	4:26	256.3	#N/A	#N/A
16	Type C	86	196.27	123.38	1:12	1:49	3:38	9:05	24	60	3:01	196.3	315	IC
17	Type C	87	208.28	132.61	1:17	1:55	3:51	9:38	24	60	3:00	208.3	315	IC
18	Type C	88	262.08	164.10	1:37	2:25	4:51	12:07	24	60	4:50	262.1	#N/A	#N/A
19	Type C	89	164.62	105.42	1:00	1:31	3:02	7:37	24	60	2:49	164.6	315	IC
20	Type C	90	229.87	145.95	1:25	2:07	4:15	10:38	24	60	4:07	229.9	#N/A	#N/A
21	Type C	91	254.28	160.67	1:34	2:21	4:42	11:46	24	60	4:42	313.6	#N/A	#N/A
22	Type C	Spare - 74	0.00	-	-	-	-	-	-	120	-	0.0	315	IC
23	Type C	Spare - 77	0.00	-	-	-	-	-	-	0	-	0.0	315	IC
24	Type C	Spare - 79	0.00	-	-	-	-	-	-	60	-	0.0	315	IC
25	Type C	Spare - 85	0.00	-	-	-	-	-	-	24	-	0.0	315	IC

Minimum Required Electric Bus Sizes

Bus Number	Bus Type	Full Day High Energy Usage (kWh)	Minimum Bus Size based on Maximum Energy Usage (kWh)	Minimum Bus Size Available Based on Current Manufacturers	Proposed Bus Size and Type Based on District Preferences	Recommended Charger Size Based on Currently Available Technology	Charger Size Needed Based on Minimum Bus Size
20 - Ghost Run	Type A	82.34	114	118 kWh - Greenpower	168 kWh - Lion	24 kW	12 kW
34 - Ghost Run	Type A	82.34	114	118 kWh - Greenpower	168 kWh - Lion	24 kW	12 kW
36	Type A	311.49	433	#N/A	#N/A	120 kW	117 kW
37	Type A	273.98	381	#N/A	#N/A	120 kW	82 kW
38	Type A	88.15	122	127 kWh - Collins	168 kWh - Lion	24 kW	11 kW
39 - Ghost Run	Type A	82.34	114	118 kWh - Greenpower	168 kWh - Lion	24 kW	12 kW
59 - Ghost Run	Type C	113.66	158	210 kWh - IC	210 kWh - IC	24 kW	17 kW
62 - Contracted Route	Type C	456.96	635	#N/A	#N/A	60 kW	45 kW
73	Type C	307.33	427	#N/A	#N/A	120 kW	68 kW
75	Type C	389.01	540	#N/A	#N/A	180 kW	155 kW
76	Type C	293.74	408	#N/A	#N/A	120 kW	70 kW
78	Type C	210.52	292	315 kWh - IC	315 kWh - IC	60 kW	35 kW
80	Type C	210.43	292	315 kWh - IC	315 kWh - IC	60 kW	34 kW
81	Type C	184.55	256	315 kWh - IC	315 kWh - IC	60 kW	25 kW
82	Type C	256.27	356	#N/A	#N/A	60 kW	50 kW
86	Type C	196.27	273	315 kWh - IC	315 kWh - IC	60 kW	37 kW
87	Type C	208.28	289	315 kWh - IC	315 kWh - IC	60 kW	35 kW
88	Type C	262.08	364	#N/A	#N/A	60 kW	54 kW
89	Type C	164.62	229	315 kWh - IC	315 kWh - IC	60 kW	33 kW
90	Type C	229.87	319	#N/A	#N/A	60 kW	48 kW
91	Type C	313.58	436	#N/A	#N/A	60 kW	55 kW
Spare - 74	Type C	0.00	0	155 kWh - Bluebird	315 kWh - IC	120 kW	0 kW
Spare - 77	Type C	0.00	0	155 kWh - Bluebird	315 kWh - IC	0 kW	0 kW
Spare - 79	Type C	0.00	0	155 kWh - Bluebird	315 kWh - IC	60 kW	0 kW
Spare - 85	Type C	0.00	0	155 kWh - Bluebird	315 kWh - IC	24 kW	0 kW

Letchworth CSD

BEB Charging Model

Date. 9/9/24

Task Summary[1]		
Bus Data		
Route Buses	20.0	Buses
Spare Buses	4.0	Buses
Contracted Buses	1.0	Buses
Type A Bus Basis of Design	Lion	
Type C/D Bus Basis of Design	IC	
Minimum Charger Size Used	0	kW
Maximum Charger Size Used	155	kW
Before Demand Reduction		
Maximum combined bus electrical demand	870.2	kW
Day of Week Max Demand Occurs	Monday	
Time Max Demand Occurs Between	12	13
Maximum single bus charging rate for any hour	139	kW
After Demand Reduction		
Maximum combined bus electrical demand	759.0	kW
Day of Week Max Demand Occurs	Monday	
Time Max Demand Occurs Between	12	13
Maximum single bus charging rate for any hour	120	kW
Route buses requiring between 100 kW and 120 kW of charge	2	
Route buses requiring between 80 kW and 100 kW of charge	0	
Route buses requiring between 60 kW and 80 kW of charge	1	
Route buses requiring between 40 kW and 60 kW of charge	4	
Route buses requiring between 20 kW and 40 kW of charge	7	
Route buses requiring less than 20 kW of charge	7	
Results		
Demand Reduction Savings	111.3	kW
Peak Load Factor	54%	
Overnight Load Factor	26%	
Proposed Charger Quantites		
Quantity of 24 kW DC Chargers	6	
Quantity of 60 kW DC Chargers	12	
Quantity of 120 kW DC Chargers	5	
Quantity of 180 kW DC Chargers	1	
No Replacement	0	
Proposed Route Bus Quantities		
Quantity of Lion Type A 168 kWh Buses	4	
Quantity of IC Type C 210 kWh Buses	1	
Quantity of IC Type C 315 kWh Buses	6	
No Replacement	10	
Proposed Spare Bus Quantities		
Quantity of IC Type C 315 kWh Buses	4	

Project Name: Letchworth BEB Study
Building: Letchworth CSD 9/9/2024
Date: 7/9/2024

Bus Data	
Minutes before Bus Route Begins that Bus is removed from Charger	15 Min
Minutes after Bus Route ends that Bus is back on Charger	0 Min

		Charging Schedule												
FORMULA INDEX		First Route					Second Route				Third Route			
Line #	Bus	On Charger AM	Off Charger AM	Bus Leaves Station AM	Bus Arrives at Station AM	On Charger R1	Off Charger R2	Bus Leaves Station R2	Bus Arrives at Station R2	On Charger R2	Off Charger R3	Bus Leaves Station R3	Bus Arrives at Station R3	On Charger R3
1	20 - Ghost Run	12:00 AM	6:15 AM	6:30 AM	7:45 AM	7:45 AM	3:15 PM	3:30 PM	4:45 PM	4:45 PM	N/A	N/A	N/A	
2	34 - Ghost Run	12:00 AM	6:15 AM	6:30 AM	7:45 AM	7:45 AM	3:15 PM	3:30 PM	4:45 PM	4:45 PM	N/A	N/A	N/A	
3	36	12:00 AM	5:30 AM	5:45 AM	9:30 AM	9:30 AM	12:25 PM	12:40 PM	4:25 PM	4:25 PM	N/A	N/A	N/A	
4	37	12:00 AM	6:00 AM	6:15 AM	9:10 AM	9:10 AM	12:50 PM	1:05 PM	3:40 PM	3:40 PM	N/A	N/A	N/A	
5	38	12:00 AM	6:15 AM	6:30 AM	7:30 AM	7:30 AM	1:55 PM	2:10 PM	2:40 PM	2:40 PM	N/A	N/A	N/A	
6	39 - Ghost Run	12:00 AM	6:15 AM	6:30 AM	7:45 AM	7:45 AM	3:15 PM	3:30 PM	4:45 PM	4:45 PM	N/A	N/A	N/A	
7	59 - Ghost Run	12:00 AM	6:15 AM	6:30 AM	7:45 AM	7:45 AM	3:15 PM	3:30 PM	4:45 PM	4:45 PM	N/A	N/A	N/A	
8	62 - Contracted Route	12:00 AM	6:45 AM	7:00 AM	11:00 AM	11:00 AM	N/A	N/A	N/A		N/A	N/A	N/A	
9	73	12:00 AM	5:57 AM	6:12 AM	8:57 AM	8:57 AM	1:55 PM	2:10 PM	4:42 PM	4:42 PM	N/A	N/A	N/A	
10	75	12:00 AM	6:05 AM	6:20 AM	12:00 PM	12:00 PM	1:55 PM	2:10 PM	4:36 PM	4:36 PM	N/A	N/A	N/A	
11	76	12:00 AM	5:45 AM	6:00 AM	8:40 AM	8:40 AM	1:20 PM	1:35 PM	3:48 PM	3:48 PM	N/A	N/A	N/A	
12	78	12:00 AM	6:30 AM	6:45 AM	8:30 AM	8:30 AM	1:55 PM	2:10 PM	4:29 PM	4:29 PM	N/A	N/A	N/A	
13	80	12:00 AM	6:35 AM	6:50 AM	8:36 AM	8:36 AM	3:30 PM	3:45 PM	6:30 PM	6:30 PM	N/A	N/A	N/A	
14	81	12:00 AM	6:35 AM	6:50 AM	8:35 AM	8:35 AM	1:55 PM	2:10 PM	4:08 PM	4:08 PM	N/A	N/A	N/A	
15	82	12:00 AM	6:25 AM	6:40 AM	8:36 AM	8:36 AM	1:55 PM	2:10 PM	4:39 PM	4:39 PM	N/A	N/A	N/A	
16	86	12:00 AM	7:15 AM	7:30 AM	9:04 AM	9:04 AM	1:56 PM	2:11 PM	3:38 PM	3:38 PM	N/A	N/A	N/A	
17	87	12:00 AM	6:00 AM	6:15 AM	8:41 AM	8:41 AM	1:55 PM	2:10 PM	4:37 PM	4:37 PM	N/A	N/A	N/A	
18	88	12:00 AM	6:00 AM	6:15 AM	8:34 AM	8:34 AM	1:55 PM	2:10 PM	4:39 PM	4:39 PM	N/A	N/A	N/A	
19	89	12:00 AM	6:22 AM	6:37 AM	8:44 AM	8:44 AM	1:55 PM	2:10 PM	4:26 PM	4:26 PM	N/A	N/A	N/A	
20	90	12:00 AM	6:15 AM	6:30 AM	8:45 AM	8:45 AM	1:55 PM	2:10 PM	4:50 PM	4:50 PM	N/A	N/A	N/A	
21	91	12:00 AM	5:55 AM	6:10 AM	8:48 AM	8:48 AM	1:55 PM	2:10 PM	4:39 PM	4:39 PM	N/A	N/A	N/A	

Project Name: Letchworth BEB Study
Building: Letchworth CSI 9/9/2024
Date: 7/9/2024

NYS Region: Region 7

Route Info		
Deadhead Miles	10%	
Minutes before Bus Route Begins that Bus is removed from Charger	15	Minutes
Minutes after Bus Route ends that Bus is back on Charger	0	Minutes

Charging Rates		
Minimum Battery Level	10%	
Maximum Battery Level	90%	
Anticipated Degradation	90%	
Charging Rate Safety Factor	90%	
Low Temp Power Factor (kW)	0	

Charger Factors		
Preheating /Precooling in Bus Station Energy	0.5	kWh
Precooling Temp	70	Degrees F
Preheating Temp	40	Degrees F
Minimum Charging for Demand Reduction Safety Factor	10%	
Grid to Charger Efficiency	88%	

Route Analysis Results

Bus	Bus Size (kWh)	Charger Size (kW)	Max AM Usage Rate (kWh / hr)	Max PM Usage Rate (kWh / hr)	Max PM2 Usage Rate (kWh / hr)	PM Route Usage (kWh)	PM2 Route Usage (kWh)	Notes[1]
20 - Ghost Run	168	24	54.89	54.89	0.00	82.34	0.00	
34 - Ghost Run	168	24	54.89	54.89	0.00	82.34	0.00	
36	440	120	77.87	76.74	0.00	306.97	0.00	Bus size does not currently exist
37	390	120	85.51	96.70	0.00	273.98	0.00	Bus size does not currently exist
38	168	24	70.52	44.61	0.00	33.46	0.00	
39 - Ghost Run	168	24	54.89	54.89	0.00	82.34	0.00	
59 - Ghost Run	210	24	75.77	75.77	0.00	113.66	0.00	
62 - Contracted Route	640	60	107.52	0	0.00	0.00	0.00	Bus size does not currently exist
73	430	120	94.56	100.74	0.00	305.57	0.00	Bus size does not currently exist
75	550	155	60.63	91.09	0.00	267.20	0.00	Bus size does not currently exist
76	410	120	100.71	119.08	0.00	293.74	0.00	Bus size does not currently exist
78	315	60	76.21	74.74	0.00	210.52	0.00	
80	315	60	88.49	64.75	0.00	210.43	0.00	
81	315	60	48.05	74.82	0.00	184.55	0.00	
82	360	60	98.53	85.90	0.00	256.27	0.00	Bus size does not currently exist
86	315	60	89.92	115.45	0.00	196.27	0.00	
87	315	60	55.44	70.60	0.00	208.28	0.00	
88	370	60	92.72	87.85	0.00	262.08	0.00	Bus size does not currently exist
89	315	60	58.22	59.50	0.00	164.62	0.00	
90	320	60	81.05	72.59	0.00	229.87	0.00	Bus size does not currently exist
91	440	60	100.08	85.23	0.00	254.28	0.00	Bus size does not currently exist
Spare - 74	315	120	-	-	0	0.00	0.00	
Spare - 77	315	0	-	-	0	0.00	0.00	
Spare - 79	315	60	-	-	0	0.00	0.00	
Spare - 85	315	24	-	-	0	0.00	0.00	

1. This model assumes that the battery capacities needed for routes that are currently too large will become available and the largest charger size needed for that bus size would be used. Note that these bus sizes **do not** currently exist.

wendel

Project Name: Letchworth BEB Study

Building: Letchworth CSD

Date: 7/9/2024

Description: Represents times when bus could be charging Mid-Day (1 or 2)

Days of Week to Exclude:
Saturday
Sunday

Hour Number	Timestamp	Outside dry-bulb temp (F)	Day of the Week	Hours (0-23)	Hours (1-24)	20 - Ghost Run	34 - Ghost Run	36	37	38	39 - Ghost Run	59 - Ghost Run	) - Contracted Rou	73	75	76	78	80	81	82	86	87	88	89	90	91	Buses in Station
1	1/1 0:00	28	Saturday	0.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1/1 1:00	28	Saturday	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1/1 2:00	29	Saturday	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1/1 3:00	29	Saturday	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1/1 4:00	29	Saturday	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1/1 5:00	29	Saturday	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1/1 6:00	29	Saturday	6	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	1/1 7:00	29	Saturday	7	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	1/1 8:00	30	Saturday	8	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	1/1 9:00	30	Saturday	9	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	1/1 10:00	30	Saturday	10	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	1/1 11:00	30	Saturday	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	1/1 12:00	30	Saturday	12	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	1/1 13:00	30	Saturday	13	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	1/1 14:00	30	Saturday	14	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	1/1 15:00	30	Saturday	15	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	1/1 16:00	30	Saturday	16	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	1/1 17:00	30	Saturday	17	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	1/1 18:00	30	Saturday	18	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	1/1 19:00	30	Saturday	19	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	1/1 20:00	31	Saturday	20	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	1/1 21:00	31	Saturday	21	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	1/1 22:00	30	Saturday	22	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	1/1 23:00	30	Saturday	23	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	1/2 0:00	29	Sunday	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	1/2 1:00	29	Sunday	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	1/2 2:00	29	Sunday	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	1/2 3:00	29	Sunday	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	1/2 4:00	29	Sunday	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	1/2 5:00	30	Sunday	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	1/2 6:00	30	Sunday	6	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	1/2 7:00	30	Sunday	7	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	1/2 8:00	30	Sunday	8	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	1/2 9:00	30	Sunday	9	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	1/2 10:00	30	Sunday	10	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	1/2 11:00	31	Sunday	11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	1/2 12:00	31	Sunday	12	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	1/2 13:00	31	Sunday	13	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	1/2 14:00	31	Sunday	14	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	1/2 15:00	31	Sunday	15	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	1/2 16:00	30	Sunday	16	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	1/2 17:00	30	Sunday	17	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	1/2 18:00	29	Sunday	18	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	1/2 19:00	28	Sunday	19	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	1/2 20:00	28	Sunday	20	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	1/2 21:00	27	Sunday	21	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	1/2 22:00	27	Sunday	22	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	1/2 23:00	26	Sunday	23	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	1/3 0:00	26	Monday	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	1/3 1:00	25	Monday	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	1/3 2:00	25	Monday	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	1/3 3:00	24	Monday	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	1/3 4:00	23	Monday	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	1/3 5:00	23	Monday	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	1/3 6:00	22	Monday	6	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	1/3 7:00	22	Monday	7	8	1	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
57	1/3 8:00	22	Monday	8	9	1	1	0	0	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	16
58	1/3 9:00	22	Monday	9	10	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	19
59	1/3 10:00	22	Monday	10	11	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	19
60	1/3 11:00	22	Monday	11	12	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	20
61	1/3 12:00	22	Monday	12	13	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	20
62	1/3 13:00	21	Monday	13	14	1	1	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	18
63	1/3 14:00	21	Monday	14	15	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5
64	1/3 15:00	20	Monday	15	16	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5
65	1/3 16:00	19	Monday	16	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	1/3 17:00	17	Monday	17	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	1/3 18:00	16	Monday	18	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	1/3 19:00	16	Monday	19	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	1/3 20:00	15	Monday	20	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	1/3 21:00	15	Monday	21	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	1/3 22:00	13	Monday	22	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	1/3 23:00	11	Monday	23	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	1/4 0:00	9	Tuesday	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	1/4 1:00	9	Tuesday	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	1/4 2:00	10	Tuesday	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	1/4 3:00	10	Tuesday	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	1/4 4:00	9	Tuesday	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	1/4 5:00	7	Tuesday	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	1/4 6:00	6	Tuesday	6	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	1/4 7:00	8	Tuesday	7	8	1	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
81	1/4 8:00	11	Tuesday	8	9	1	1	0	0	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	16
82	1/4 9:00	13	Tuesday	9	10	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	19
83	1/4 10:00	15	Tuesday	10	11	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	19
84	1/4 11:00	17	Tuesday	11	12	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	20
85	1/4 12:00	19	Tuesday	12	13	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	20
86	1/4 13:00	19	Tuesday	13	14	1	1	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	18
87	1/4 14:00	18	Tuesday	14	15	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5
88	1/4 15:00	18	Tuesday	15	16	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5
89	1/4 16:00	18	Tuesday	16	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	1/4 17:00	18	Tuesday	17	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91	1/4 18:00	18	Tuesday	18	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	1/4 19:00	18	Tuesday	19	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93	1/4 20:00	18	Tuesday	20	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94	1/4 21:00	18	Tuesday	21	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	1/4 22:00	18	Tuesday	22	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	1/4 23:00	18	Tuesday	23	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

wendel

Project Name: Letchworth BEB Study

Building: Letchworth CSD

Date: 7/9/2024

Description: Represents times when bus could be charging Mid-Day (1 or 2)

Days of Week to Exclude:
Saturday
Sunday

Hour Number	Timestamp	Outside dry-bulb temp (F)	Day of the Week	Hours (0-23)	Hours (1-24)	20 - Ghost Run	34 - Ghost Run	36	37	38	39 - Ghost Run	59 - Ghost Run	) - Contracted Rou	73	75	76	78	80	81	82	86	87	88	89	90	91	Buses in Station
97	1/5 0:00	18	Wednesday	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
98	1/5 1:00	19	Wednesday	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99	1/5 2:00	19	Wednesday	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	1/5 3:00	20	Wednesday	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	1/5 4:00	19	Wednesday	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
102	1/5 5:00	18	Wednesday	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103	1/5 6:00	17	Wednesday	6	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	1/5 7:00	20	Wednesday	7	8	1	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
105	1/5 8:00	23	Wednesday	8	9	1	1	0	0	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	16
106	1/5 9:00	26	Wednesday	9	10	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	19
107	1/5 10:00	26	Wednesday	10	11	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	19
108	1/5 11:00	27	Wednesday	11	12	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	20
109	1/5 12:00	27	Wednesday	12	13	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	20
110	1/5 13:00	26	Wednesday	13	14	1	1	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	18
111	1/5 14:00	26	Wednesday	14	15	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5
112	1/5 15:00	25	Wednesday	15	16	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5
113	1/5 16:00	24	Wednesday	16	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
114	1/5 17:00	23	Wednesday	17	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115	1/5 18:00	22	Wednesday	18	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
116	1/5 19:00	21	Wednesday	19	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
117	1/5 20:00	21	Wednesday	20	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
118	1/5 21:00	20	Wednesday	21	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
119	1/5 22:00	20	Wednesday	22	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	1/5 23:00	19	Wednesday	23	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
121	1/6 0:00	19	Thursday	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
122	1/6 1:00	19	Thursday	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
123	1/6 2:00	19	Thursday	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
124	1/6 3:00	19	Thursday	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
125	1/6 4:00	18	Thursday	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
126	1/6 5:00	16	Thursday	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
127	1/6 6:00	15	Thursday	6	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
128	1/6 7:00	15	Thursday	7	8	1	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
129	1/6 8:00	15	Thursday	8	9	1	1	0	0	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	16
130	1/6 9:00	15	Thursday	9	10	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	19
131	1/6 10:00	18	Thursday	10	11	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	19
132	1/6 11:00	20	Thursday	11	12	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	20
133	1/6 12:00	23	Thursday	12	13	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	20
134	1/6 13:00	23	Thursday	13	14	1	1	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	18
135	1/6 14:00	24	Thursday	14	15	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5
136	1/6 15:00	24	Thursday	15	16	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5
137	1/6 16:00	23	Thursday	16	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
138	1/6 17:00	21	Thursday	17	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
139	1/6 18:00	20	Thursday	18	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140	1/6 19:00	21	Thursday	19	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
141	1/6 20:00	22	Thursday	20	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
142	1/6 21:00	23	Thursday	21	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
143	1/6 22:00	25	Thursday	22	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
144	1/6 23:00	28	Thursday	23	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
145	1/7 0:00	30	Friday	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
146	1/7 1:00	31	Friday	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
147	1/7 2:00	31	Friday	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
148	1/7 3:00	32	Friday	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
149	1/7 4:00	31	Friday	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150	1/7 5:00	30	Friday	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
151	1/7 6:00	29	Friday	6	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
152	1/7 7:00	31	Friday	7	8	1	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
153	1/7 8:00	33	Friday	8	9	1	1	0	0	1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	16
154	1/7 9:00	35	Friday	9	10	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	19
155	1/7 10:00	34	Friday	10	11	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	19
156	1/7 11:00	34	Friday	11	12	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	20
157	1/7 12:00	33	Friday	12	13	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	20
158	1/7 13:00	32	Friday	13	14	1	1	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	18
159	1/7 14:00	31	Friday	14	15	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5
160	1/7 15:00	30	Friday	15	16	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5
161	1/7 16:00	29	Friday	16	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
162	1/7 17:00	29	Friday	17	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
163	1/7 18:00	28	Friday	18	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
164	1/7 19:00	26	Friday	19	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
165	1/7 20:00	25	Friday	20	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
166	1/7 21:00	23	Friday	21	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
167	1/7 22:00	23	Friday	22	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
168	1/7 23:00	23	Friday	23	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

wendel

Project Name: Letchworth BEB Study

Building: Letchworth CSD

Date: 7/9/2024

Description: Percent of Hour on Charger

Days of Week to Exclude:
Saturday
Sunday

Hour Number	Timestamp	Outside dry-bulb temp (F)	Day of the Week	Hours (0-23)	Hours (1-24)	20 - Ghost Run	34 - Ghost Run	36	37	38	39 - Ghost Run	59 - Ghost Run	62 - Contracted Route	73	75	76	78	80	81	82	86	87	88	89	90	91	Buses in Station
1	1/1 0:00	28	Saturday	0.0	1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
2	1/1 1:00	28	Saturday	1	2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
3	1/1 2:00	29	Saturday	2	3	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
4	1/1 3:00	29	Saturday	3	4	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
5	1/1 4:00	29	Saturday	4	5	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
6	1/1 5:00	29	Saturday	5	6	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
7	1/1 6:00	29	Saturday	6	7	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
8	1/1 7:00	29	Saturday	7	8	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
9	1/1 8:00	30	Saturday	8	9	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
10	1/1 9:00	30	Saturday	9	10	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
11	1/1 10:00	30	Saturday	10	11	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
12	1/1 11:00	30	Saturday	11	12	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
13	1/1 12:00	30	Saturday	12	13	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
14	1/1 13:00	30	Saturday	13	14	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
15	1/1 14:00	30	Saturday	14	15	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
16	1/1 15:00	30	Saturday	15	16	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
17	1/1 16:00	30	Saturday	16	17	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
18	1/1 17:00	30	Saturday	17	18	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
19	1/1 18:00	30	Saturday	18	19	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
20	1/1 19:00	30	Saturday	19	20	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
21	1/1 20:00	31	Saturday	20	21	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
22	1/1 21:00	31	Saturday	21	22	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
23	1/1 22:00	30	Saturday	22	23	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
24	1/1 23:00	30	Saturday	23	24	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
25	1/2 0:00	29	Sunday	0	1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
26	1/2 1:00	29	Sunday	1	2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
27	1/2 2:00	29	Sunday	2	3	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
28	1/2 3:00	29	Sunday	3	4	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
29	1/2 4:00	29	Sunday	4	5	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
30	1/2 5:00	30	Sunday	5	6	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
31	1/2 6:00	30	Sunday	6	7	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
32	1/2 7:00	30	Sunday	7	8	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
33	1/2 8:00	30	Sunday	8	9	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
34	1/2 9:00	30	Sunday	9	10	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
35	1/2 10:00	30	Sunday	10	11	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
36	1/2 11:00	31	Sunday	11	12	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
37	1/2 12:00	31	Sunday	12	13	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
38	1/2 13:00	31	Sunday	13	14	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
39	1/2 14:00	31	Sunday	14	15	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
40	1/2 15:00	31	Sunday	15	16	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
41	1/2 16:00	30	Sunday	16	17	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
42	1/2 17:00	30	Sunday	17	18	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
43	1/2 18:00	29	Sunday	18	19	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
44	1/2 19:00	28	Sunday	19	20	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
45	1/2 20:00	28	Sunday	20	21	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
46	1/2 21:00	27	Sunday	21	22	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
47	1/2 22:00	27	Sunday	22	23	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
48	1/2 23:00	26	Sunday	23	24	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
49	1/3 0:00	26	Monday	0	1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
50	1/3 1:00	25	Monday	1	2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
51	1/3 2:00	25	Monday	2	3	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
52	1/3 3:00	24	Monday	3	4	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
53	1/3 4:00	23	Monday	4	5	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
54	1/3 5:00	23	Monday	5	6	100%	100%	50%	100%	100%	100%	100%	100%	95%	100%	75%	100%	100%	100%	100%	100%	100%	100%	100%	100%	92%	21
55	1/3 6:00	22	Monday	6	7	25%	25%	0%	0%	25%	25%	25%	75%	0%	8%	0%	50%	58%	58%	42%	100%	0%	0%	37%	25%	0%	14
56	1/3 7:00	22	Monday	7	8	25%	25%	0%	0%	50%	25%	25%	0%	0%	0%	0%	0%	0%	0%	0%	25%	0%	0%	0%	0%	0%	6
57	1/3 8:00	22	Monday	8	9	100%	100%	0%	0%	100%	100%	100%	0%	5%	0%	33%	50%	40%	42%	40%	0%	32%	43%	27%	25%	20%	16
58	1/3 9:00	22	Monday	9	10	100%	100%	50%	83%	100%	100%	100%	0%	100%	0%	100%	100%	100%	100%	100%	93%	100%	100%	100%	100%	100%	19
59	1/3 10:00	22	Monday	10	11	100%	100%	100%	100%	100%	100%	100%	0%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	19
60	1/3 11:00	22	Monday	11	12	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	20
61	1/3 12:00	22	Monday	12	13	100%	100%	42%	83%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
62	1/3 13:00	21	Monday	13	14	100%	100%	0%	0%	92%	100%	100%	100%	92%	92%	33%	92%	100%	92%	92%	93%	92%	92%	92%	92%	92%	19
63	1/3 14:00	21	Monday	14	15	100%	100%	0%	0%	33%	100%	100%	100%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	7
64	1/3 15:00	20	Monday	15	16	25%	25%	0%	33%	100%	25%	25%	100%	0%	0%	20%	0%	50%	0%	0%	37%	0%	0%	0%	0%	0%	10
65	1/3 16:00	19	Monday	16	17	25%	25%	58%	100%	100%	25%	25%	100%	30%	40%	100%	52%	0%	87%	35%	100%	38%	35%	57%	17%	35%	20
66	1/3 17:00	17	Monday	17	18	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	20
67	1/3 18:00	16	Monday	18	19	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%	100%	100%	100%	100%	100%	100%	100%	100%	21
68	1/3 19:00	16	Monday	19	20	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
69	1/3 20:00	15	Monday	20	21	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
70	1/3 21:00	15	Monday	21	22	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
71	1/3 22:00	13	Monday	22	23	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
72	1/3 23:00	11	Monday	23	24	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
73	1/4 0:00	9	Tuesday	0	1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
74	1/4 1:00	9	Tuesday	1	2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
75	1/4 2:00	10	Tuesday	2	3	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
76	1/4 3:00	10	Tuesday	3	4	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
77	1/4 4:00	9	Tuesday	4	5	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
78	1/4 5:00	7	Tuesday	5	6	100%	100%	50%	100%	100%	100%	100%	100%	95%	100%	75%	100%	100%	100%	100%	100%	100%	100%	100%	100%	92%	21
79	1/4 6:00	6	Tuesday	6	7	25%	25%	0%	0%	25%	25%	25%	75%	0%	8%	0%	50%	58%	58%	42%	100%	0%	0%	37%	25%	0%	14
80	1/4 7:00	8	Tuesday	7	8	25%	25%	0%	0%	50%	25%	25%	0%	0%	0%	0%	0%	0%	0%	0%	25%	0%	0%	0%	0%	0%	6
81	1/4 8:00	11	Tuesday	8	9	100%	100%	0%	0%	100%	100%	100%	0%	5%	0%	33%	50%	40%	42%	40%	0%	32%	43%	27%	25%	20%	16
82	1/4 9:00	13	Tuesday	9	10	100%	100%	50%	83%	100%	100%	100%	0%	100%	0%	100%	100%	100%	100%	100%	93%	100%	100%	100%	100%	100%	19
83	1/4 10:00	15	Tuesday	10	11	100%	100%	100%	100%	100%	100%	100%	0%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	19
84	1/4 11:00	17	Tuesday	11	12	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	20
85	1/4 12:00	19	Tuesday	12	13	100%	100%	42%	83%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
86	1/4 13:00	19	Tuesday	13	14	100%	100%	0%	0%	92%	100%	100%	100%	92%	92%	33%	92%	100%	92%	92%	93%	92%	92%	92%	92%	92%	19
87	1/4 14:00	18	Tuesday	14	15	100%	100%	0%	0%	33%	100%	100%	100%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	7
88	1/4 15:00	18	Tuesday	15	16	25%	25%	0%	33%	100%	25%	25%	100%	0%	0%	20%	0%	50%	0%	0%	37%	0%	0%	0%	0%	0%	10
89	1/4 16:00	18	Tuesday	16	17	25%	25%	58%	100%	100%	25%	25%	100%	30%	40%	100%	52%	0%	87%	35%	100%	38%	35%	57%	17%	35%	20
90	1/4 17:00	18	Tuesday	17	18	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	20
91	1/4 18:00	18	Tuesday	18	19	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%	100%	100%	100%	100%	100%	100%	100%	100%	21
92	1/4 19:00	18	Tuesday	19	20	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
93	1/4 20:00	18	Tuesday	20	21	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
94	1/4 21:00	18	Tuesday	21	22	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
95	1/4 22:00	18	Tuesday	22	23	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
96	1/4 23:00	18	Tuesday	23	24	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21

wendel

Project Name: Letchworth BEB Study

Building: Letchworth CSD

Date: 7/9/2024

Description: Percent of Hour on Charger

Days of Week to Exclude:
Saturday
Sunday

Hour Number	Timestamp	Outside dry-bulb temp (F)	Day of the Week	Hours (0-23)	Hours (1-24)	20 - Ghost Run	34 - Ghost Run	36	37	38	39 - Ghost Run	59 - Ghost Run	62 - Contracted route	73	75	76	78	80	81	82	86	87	88	89	90	91	Buses in Station
97	1/5 0:00	18	Wednesday	0	1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
98	1/5 1:00	19	Wednesday	1	2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
99	1/5 2:00	19	Wednesday	2	3	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
100	1/5 3:00	20	Wednesday	3	4	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
101	1/5 4:00	19	Wednesday	4	5	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
102	1/5 5:00	18	Wednesday	5	6	100%	100%	50%	100%	100%	100%	100%	100%	95%	100%	75%	100%	100%	100%	100%	100%	100%	100%	100%	100%	92%	21
103	1/5 6:00	17	Wednesday	6	7	25%	25%	0%	0%	25%	25%	25%	75%	0%	8%	0%	50%	58%	58%	42%	100%	0%	0%	37%	25%	0%	14
104	1/5 7:00	20	Wednesday	7	8	25%	25%	0%	0%	50%	25%	25%	0%	0%	0%	0%	0%	0%	0%	0%	25%	0%	0%	0%	0%	0%	6
105	1/5 8:00	23	Wednesday	8	9	100%	100%	0%	0%	100%	100%	100%	0%	5%	0%	33%	50%	40%	42%	40%	0%	32%	43%	27%	25%	20%	16
106	1/5 9:00	26	Wednesday	9	10	100%	100%	50%	83%	100%	100%	100%	0%	100%	0%	100%	100%	100%	100%	100%	93%	100%	100%	100%	100%	100%	19
107	1/5 10:00	26	Wednesday	10	11	100%	100%	100%	100%	100%	100%	100%	0%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	19
108	1/5 11:00	27	Wednesday	11	12	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	20
109	1/5 12:00	27	Wednesday	12	13	100%	100%	42%	83%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
110	1/5 13:00	26	Wednesday	13	14	100%	100%	0%	0%	92%	100%	100%	100%	92%	92%	33%	92%	100%	92%	92%	93%	92%	92%	92%	92%	92%	19
111	1/5 14:00	26	Wednesday	14	15	100%	100%	0%	0%	33%	100%	100%	100%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	7
112	1/5 15:00	25	Wednesday	15	16	25%	25%	0%	33%	100%	25%	25%	100%	0%	0%	20%	0%	50%	0%	0%	37%	0%	0%	0%	0%	0%	10
113	1/5 16:00	24	Wednesday	16	17	25%	25%	58%	100%	100%	25%	25%	100%	30%	40%	100%	52%	0%	87%	35%	100%	38%	35%	57%	17%	35%	20
114	1/5 17:00	23	Wednesday	17	18	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	20
115	1/5 18:00	22	Wednesday	18	19	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%	100%	100%	100%	100%	100%	100%	100%	100%	21
116	1/5 19:00	21	Wednesday	19	20	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
117	1/5 20:00	21	Wednesday	20	21	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
118	1/5 21:00	20	Wednesday	21	22	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
119	1/5 22:00	20	Wednesday	22	23	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
120	1/5 23:00	19	Wednesday	23	24	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
121	1/6 0:00	19	Thursday	0	1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
122	1/6 1:00	19	Thursday	1	2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
123	1/6 2:00	19	Thursday	2	3	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
124	1/6 3:00	19	Thursday	3	4	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
125	1/6 4:00	18	Thursday	4	5	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
126	1/6 5:00	16	Thursday	5	6	100%	100%	50%	100%	100%	100%	100%	100%	95%	100%	75%	100%	100%	100%	100%	100%	100%	100%	100%	100%	92%	21
127	1/6 6:00	15	Thursday	6	7	25%	25%	0%	0%	25%	25%	25%	75%	0%	8%	0%	50%	58%	58%	42%	100%	0%	0%	37%	25%	0%	14
128	1/6 7:00	15	Thursday	7	8	25%	25%	0%	0%	50%	25%	25%	0%	0%	0%	0%	0%	0%	0%	0%	25%	0%	0%	0%	0%	0%	6
129	1/6 8:00	15	Thursday	8	9	100%	100%	0%	0%	100%	100%	100%	0%	5%	0%	33%	50%	40%	42%	40%	0%	32%	43%	27%	25%	20%	16
130	1/6 9:00	15	Thursday	9	10	100%	100%	50%	83%	100%	100%	100%	0%	100%	0%	100%	100%	100%	100%	100%	93%	100%	100%	100%	100%	100%	19
131	1/6 10:00	18	Thursday	10	11	100%	100%	100%	100%	100%	100%	100%	0%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	19
132	1/6 11:00	20	Thursday	11	12	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	20
133	1/6 12:00	23	Thursday	12	13	100%	100%	42%	83%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
134	1/6 13:00	23	Thursday	13	14	100%	100%	0%	0%	92%	100%	100%	100%	92%	92%	33%	92%	100%	92%	92%	93%	92%	92%	92%	92%	92%	19
135	1/6 14:00	24	Thursday	14	15	100%	100%	0%	0%	33%	100%	100%	100%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	7
136	1/6 15:00	24	Thursday	15	16	25%	25%	0%	33%	100%	25%	25%	100%	0%	0%	20%	0%	50%	0%	0%	37%	0%	0%	0%	0%	0%	10
137	1/6 16:00	23	Thursday	16	17	25%	25%	58%	100%	100%	25%	25%	100%	30%	40%	100%	52%	0%	87%	35%	100%	38%	35%	57%	17%	35%	20
138	1/6 17:00	21	Thursday	17	18	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	20
139	1/6 18:00	20	Thursday	18	19	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%	100%	100%	100%	100%	100%	100%	100%	100%	21
140	1/6 19:00	21	Thursday	19	20	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
141	1/6 20:00	22	Thursday	20	21	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
142	1/6 21:00	23	Thursday	21	22	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
143	1/6 22:00	25	Thursday	22	23	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
144	1/6 23:00	28	Thursday	23	24	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
145	1/7 0:00	30	Friday	0	1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
146	1/7 1:00	31	Friday	1	2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
147	1/7 2:00	31	Friday	2	3	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
148	1/7 3:00	32	Friday	3	4	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
149	1/7 4:00	31	Friday	4	5	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
150	1/7 5:00	30	Friday	5	6	100%	100%	50%	100%	100%	100%	100%	100%	95%	100%	75%	100%	100%	100%	100%	100%	100%	100%	100%	100%	92%	21
151	1/7 6:00	29	Friday	6	7	25%	25%	0%	0%	25%	25%	25%	75%	0%	8%	0%	50%	58%	58%	42%	100%	0%	0%	37%	25%	0%	14
152	1/7 7:00	31	Friday	7	8	25%	25%	0%	0%	50%	25%	25%	0%	0%	0%	0%	0%	0%	0%	0%	25%	0%	0%	0%	0%	0%	6
153	1/7 8:00	33	Friday	8	9	100%	100%	0%	0%	100%	100%	100%	0%	5%	0%	33%	50%	40%	42%	40%	0%	32%	43%	27%	25%	20%	16
154	1/7 9:00	35	Friday	9	10	100%	100%	50%	83%	100%	100%	100%	0%	100%	0%	100%	100%	100%	100%	100%	93%	100%	100%	100%	100%	100%	19
155	1/7 10:00	34	Friday	10	11	100%	100%	100%	100%	100%	100%	100%	0%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	19
156	1/7 11:00	34	Friday	11	12	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	20
157	1/7 12:00	33	Friday	12	13	100%	100%	42%	83%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
158	1/7 13:00	32	Friday	13	14	100%	100%	0%	0%	92%	100%	100%	100%	92%	92%	33%	92%	100%	92%	92%	93%	92%	92%	92%	92%	92%	19
159	1/7 14:00	31	Friday	14	15	100%	100%	0%	0%	33%	100%	100%	100%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	7
160	1/7 15:00	30	Friday	15	16	25%	25%	0%	33%	100%	25%	25%	100%	0%	0%	20%	0%	50%	0%	0%	37%	0%	0%	0%	0%	0%	10
161	1/7 16:00	29	Friday	16	17	25%	25%	58%	100%	100%	25%	25%	100%	30%	40%	100%	52%	0%	87%	35%	100%	38%	35%	57%	17%	35%	20
162	1/7 17:00	29	Friday	17	18	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	20
163	1/7 18:00	28	Friday	18	19	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	50%	100%	100%	100%	100%	100%	100%	100%	100%	21
164	1/7 19:00	26	Friday	19	20	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
165	1/7 20:00	25	Friday	20	21	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
166	1/7 21:00	23	Friday	21	22	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
167	1/7 22:00	23	Friday	22	23	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21
168	1/7 23:00	23	Friday	23	24	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	21

wendel

Project Name: Letchworth BEB Study

Building: Letchworth CSD

Date: 7/9/2024

Description Energy Used Per Bus per hour (kWh)

Hour Number	Timestamp	Outside dry-bulb temp (F)	Day of the Week	Hours (0-23)	Hours (1-24)	20 - Ghost Run	34 - Ghost Run	36	37	38	39 - Ghost Run	59 - Ghost Run	62 - Contracted Route	73	75	76	78	80	81	82	86	87	88	89	90	91	Average Energy Usage Hours
1	1/1 0:00	28	Saturday	0.0	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	1/1 1:00	28	Saturday	1	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1/1 2:00	29	Saturday	2	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	1/1 3:00	29	Saturday	3	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	1/1 4:00	29	Saturday	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	1/1 5:00	29	Saturday	5	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	1/1 6:00	29	Saturday	6	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	1/1 7:00	29	Saturday	7	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	1/1 8:00	30	Saturday	8	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	1/1 9:00	30	Saturday	9	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	1/1 10:00	30	Saturday	10	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	1/1 11:00	30	Saturday	11	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	1/1 12:00	30	Saturday	12	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	1/1 13:00	30	Saturday	13	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	1/1 14:00	30	Saturday	14	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	1/1 15:00	30	Saturday	15	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	1/1 16:00	30	Saturday	16	17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	1/1 17:00	30	Saturday	17	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	1/1 18:00	30	Saturday	18	19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	1/1 19:00	30	Saturday	19	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	1/1 20:00	31	Saturday	20	21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	1/1 21:00	31	Saturday	21	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	1/1 22:00	30	Saturday	22	23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	1/1 23:00	30	Saturday	23	24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	1/2 0:00	29	Sunday	0	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	1/2 1:00	29	Sunday	1	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	1/2 2:00	29	Sunday	2	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	1/2 3:00	29	Sunday	3	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	1/2 4:00	29	Sunday	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	1/2 5:00	30	Sunday	5	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	1/2 6:00	30	Sunday	6	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
32	1/2 7:00	30	Sunday	7	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
33	1/2 8:00	30	Sunday	8	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
34	1/2 9:00	30	Sunday	9	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	1/2 10:00	30	Sunday	10	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
36	1/2 11:00	31	Sunday	11	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
37	1/2 12:00	31	Sunday	12	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
38	1/2 13:00	31	Sunday	13	14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
39	1/2 14:00	31	Sunday	14	15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40	1/2 15:00	31	Sunday	15	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
41	1/2 16:00	30	Sunday	16	17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42	1/2 17:00	30	Sunday	17	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
43	1/2 18:00	29	Sunday	18	19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
44	1/2 19:00	28	Sunday	19	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45	1/2 20:00	28	Sunday	20	21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
46	1/2 21:00	27	Sunday	21	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
47	1/2 22:00	27	Sunday	22	23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48	1/2 23:00	26	Sunday	23	24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
49	1/3 0:00	26	Monday	0	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	1/3 1:00	25	Monday	1	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51	1/3 2:00	25	Monday	2	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
52	1/3 3:00	24	Monday	3	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
53	1/3 4:00	23	Monday	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
54	1/3 5:00	23	Monday	5	6	0.00	0.00	33.17	0.00	0.00	0.00	0.00	0.00	4.03	0.00	21.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.11	16.44
55	1/3 6:00	22	Monday	6	7	35.08	35.08	66.35	72.86	45.06	35.08	48.42	22.90	80.57	47.35	85.81	32.46	31.42	17.06	48.97	0.00	47.24	79.00	31.42	51.79	85.27	49.96
56	1/3 7:00	22	Monday	7	8	35.08	35.08	66.35	72.86	30.04	35.08	48.42	91.61	80.57	51.65	85.81	64.93	75.40	40.94	83.95	57.46	47.24	79.00	49.61	69.06	85.27	61.21
57	1/3 8:00	22	Monday	8	9	0.00	0.00	66.35	72.86	0.00	0.00	0.00	91.61	76.54	51.65	57.20	32.46	45.24	23.88	50.37	76.62	32.28	44.77	36.38	51.79	68.21	54.89
58	1/3 9:00	22	Monday	9	10	0.00	0.00	33.17	12.14	0.00	0.00	0.00	91.61	0.00	51.65	0.00	0.00	0.00	0.00	0.00	5.11	0.00	0.00	0.00	0.00	0.00	38.74
59	1/3 10:00	22	Monday	10	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91.61	0.00	51.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.63
60	1/3 11:00	22	Monday	11	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.65
61	1/3 12:00	22	Monday	12	13	0.00	0.00	38.14	13.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.94
62	1/3 13:00	21	Monday	13	14	0.00	0.00	65.39	82.39	3.17	0.00	0.00	0.00	7.15	6.47	67.64	5.31	0.00	5.31	6.10	6.56	5.01	6.24	4.22	5.15	6.05	18.81
63	1/3 14:00	21	Monday	14	15	0.00	0.00	65.39	82.39	25.34	0.00	0.00	0.00	85.83	77.61	101.46	63.68	0.00	63.74	73.19	98.36	60.15	74.85	50.69	61.85	72.62	70.48
64	1/3 15:00	20	Monday	15	16	38.12	38.12	71.06	59.69	0.00	38.12	52.62	0.00	93.28	84.35	88.22	69.21	29.98	69.28	79.54	67.71	65.38	81.35	55.10	67.22	78.93	64.59
65	1/3 16:00	19	Monday	16	17	38.12	38.12	29.61	0.00	0.00	38.12	52.62	0.00	65.30	50.61	0.00	33.45	59.96	9.24	51.70	0.00	40.32	52.88	23.88	56.02	51.30	43.20
66	1/3 17:00	17	Monday	17	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.96
67	1/3 18:00	16	Monday	18	19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.98
68	1/3 19:00	16	Monday	19	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
69	1/3 20:00	15	Monday	20	21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70	1/3 21:00	15	Monday	21	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
71	1/3 22:00	13	Monday	22	23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
72	1/3 23:00	11	Monday	23	24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
73	1/4 0:00	9	Tuesday	0	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
74	1/4 1:00	9	Tuesday	1	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
75	1/4 2:00	10	Tuesday	2	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
76	1/4 3:00	10	Tuesday	3	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
77	1/4 4:00	9	Tuesday	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

wendel

Project Name: Letchworth BEB Study

Building: Letchworth CSD

Date: 7/9/2024

Description Energy Used Per Bus per hour (kWh)

Hour Number	Timestamp	Outside dry-bulb temp (F)	Day of the Week	Hours (0-23)	Hours (1-24)	20 - Ghost Run	34 - Ghost Run	36	37	38	39 - Ghost Run	59 - Ghost Run	62 - Contracted Route	73	75	76	78	80	81	82	86	87	88	89	90	91	Average Energy Usage Hours
78	1/4 5:00	7	Tuesday	5	6	0.00	0.00	38.94	0.00	0.00	0.00	0.00	0.00	4.73	0.00	25.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.34	19.30
79	1/4 6:00	6	Tuesday	6	7	41.17	41.17	77.87	85.51	52.89	41.17	56.83	26.88	94.56	55.57	100.71	38.10	36.87	20.02	57.48	0.00	55.44	92.72	36.88	60.79	100.08	58.64
80	1/4 7:00	8	Tuesday	7	8	41.17	41.17	77.87	85.51	35.26	41.17	56.83	107.52	94.56	60.63	100.71	76.21	88.49	48.05	98.53	67.44	55.44	92.72	58.22	81.05	100.08	71.84
81	1/4 8:00	11	Tuesday	8	9	0.00	0.00	72.11	79.18	0.00	0.00	0.00	99.56	83.19	56.14	62.17	35.28	49.17	25.95	54.75	83.27	35.08	48.65	39.54	56.29	74.14	59.65
82	1/4 9:00	13	Tuesday	9	10	0.00	0.00	36.05	13.20	0.00	0.00	0.00	99.56	0.00	56.14	0.00	0.00	0.00	0.00	0.00	5.55	0.00	0.00	0.00	0.00	0.00	42.10
83	1/4 10:00	15	Tuesday	10	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	99.56	0.00	56.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	77.85
84	1/4 11:00	17	Tuesday	11	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	56.14
85	1/4 12:00	19	Tuesday	12	13	0.00	0.00	41.45	14.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.19
86	1/4 13:00	19	Tuesday	13	14	0.00	0.00	71.06	89.54	3.44	0.00	0.00	0.00	7.77	7.03	73.51	5.77	0.00	5.77	6.63	7.13	5.45	6.78	4.59	5.60	6.58	20.44
87	1/4 14:00	18	Tuesday	14	15	0.00	0.00	71.06	89.54	27.54	0.00	0.00	0.00	93.28	84.35	110.27	69.21	0.00	69.28	79.54	106.91	65.38	81.35	55.10	67.22	78.93	76.60
88	1/4 15:00	18	Tuesday	15	16	38.12	38.12	71.06	59.69	0.00	38.12	52.62	0.00	93.28	84.35	88.22	69.21	29.98	69.28	79.54	67.71	65.38	81.35	55.10	67.22	78.93	64.59
89	1/4 16:00	18	Tuesday	16	17	38.12	38.12	29.61	0.00	0.00	38.12	52.62	0.00	65.30	50.61	0.00	33.45	59.96	9.24	51.70	0.00	40.32	52.88	23.88	56.02	51.30	43.20
90	1/4 17:00	18	Tuesday	17	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.96
91	1/4 18:00	18	Tuesday	18	19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.98
92	1/4 19:00	18	Tuesday	19	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
93	1/4 20:00	18	Tuesday	20	21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
94	1/4 21:00	18	Tuesday	21	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
95	1/4 22:00	18	Tuesday	22	23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
96	1/4 23:00	18	Tuesday	23	24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
97	1/5 0:00	18	Wednesday	0	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
98	1/5 1:00	19	Wednesday	1	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
99	1/5 2:00	19	Wednesday	2	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	1/5 3:00	20	Wednesday	3	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
101	1/5 4:00	19	Wednesday	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
102	1/5 5:00	18	Wednesday	5	6	0.00	0.00	36.05	0.00	0.00	0.00	0.00	0.00	4.38	0.00	23.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.72	17.87
103	1/5 6:00	17	Wednesday	6	7	38.12	38.12	72.11	79.18	48.98	38.12	52.62	24.89	87.56	51.46	93.26	35.28	34.14	18.54	53.23	0.00	51.34	85.86	34.15	56.29	92.67	54.30
104	1/5 7:00	20	Wednesday	7	8	35.08	35.08	66.35	72.86	30.04	35.08	48.42	91.61	80.57	51.65	85.81	64.93	75.40	40.94	83.95	57.46	47.24	79.00	49.61	69.06	85.27	61.21
105	1/5 8:00	23	Wednesday	8	9	0.00	0.00	66.35	72.86	0.00	0.00	0.00	91.61	76.54	51.65	57.20	32.46	45.24	23.88	50.37	76.62	32.28	44.77	36.38	51.79	68.21	54.89
106	1/5 9:00	26	Wednesday	9	10	0.00	0.00	33.17	12.14	0.00	0.00	0.00	91.61	0.00	51.65	0.00	0.00	0.00	0.00	0.00	5.11	0.00	0.00	0.00	0.00	0.00	38.74
107	1/5 10:00	26	Wednesday	10	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91.61	0.00	51.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.63
108	1/5 11:00	27	Wednesday	11	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.65
109	1/5 12:00	27	Wednesday	12	13	0.00	0.00	38.14	13.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.94
110	1/5 13:00	26	Wednesday	13	14	0.00	0.00	65.39	82.39	3.17	0.00	0.00	0.00	7.15	6.47	67.64	5.31	0.00	5.31	6.10	6.56	5.01	6.24	4.22	5.15	6.05	18.81
111	1/5 14:00	26	Wednesday	14	15	0.00	0.00	65.39	82.39	25.34	0.00	0.00	0.00	85.83	77.61	101.46	63.68	0.00	63.74	73.19	98.36	60.15	74.85	50.69	61.85	72.62	70.48
112	1/5 15:00	25	Wednesday	15	16	35.08	35.08	65.39	54.92	0.00	35.08	48.42	0.00	85.83	77.61	81.17	63.68	27.58	63.74	73.19	62.30	60.15	74.85	50.69	61.85	72.62	59.43
113	1/5 16:00	24	Wednesday	16	17	35.08	35.08	27.24	0.00	0.00	35.08	48.42	0.00	60.08	46.56	0.00	30.78	55.16	8.50	47.57	0.00	37.09	48.65	21.97	51.54	47.20	39.75
114	1/5 17:00	23	Wednesday	17	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.16
115	1/5 18:00	22	Wednesday	18	19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.58
116	1/5 19:00	21	Wednesday	19	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
117	1/5 20:00	21	Wednesday	20	21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
118	1/5 21:00	20	Wednesday	21	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
119	1/5 22:00	20	Wednesday	22	23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
120	1/5 23:00	19	Wednesday	23	24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
121	1/6 0:00	19	Thursday	0	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
122	1/6 1:00	19	Thursday	1	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
123	1/6 2:00	19	Thursday	2	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
124	1/6 3:00	19	Thursday	3	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
125	1/6 4:00	18	Thursday	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
126	1/6 5:00	16	Thursday	5	6	0.00	0.00	36.05	0.00	0.00	0.00	0.00	0.00	4.38	0.00	23.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.72	17.87
127	1/6 6:00	15	Thursday	6	7	38.12	38.12	72.11	79.18	48.98	38.12	52.62	24.89	87.56	51.46	93.26	35.28	34.14	18.54	53.23	0.00	51.34	85.86	34.15	56.29	92.67	54.30
128	1/6 7:00	15	Thursday	7	8	38.12	38.12	72.11	79.18	32.65	38.12	52.62	99.56	87.56	56.14	93.26	70.57	81.94	44.49	91.24	62.45	51.34	85.86	53.92	75.06	92.67	66.52
129	1/6 8:00	15	Thursday	8	9	0.00	0.00	72.11	79.18	0.00	0.00	0.00	99.56	83.19	56.14	62.17	35.28	49.17	25.95	54.75	83.27	35.08	48.65	39.54	56.29	74.14	59.65
130	1/6 9:00	15	Thursday	9	10	0.00	0.00	36.05	13.20	0.00	0.00	0.00	99.56	0.00	56.14	0.00	0.00	0.00	0.00	0.00	5.55	0.00	0.00	0.00	0.00	0.00	42.10
131	1/6 10:00	18	Thursday	10	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	99.56	0.00	56.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	77.85
132	1/6 11:00	20	Thursday	11	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.65
133	1/6 12:00	23	Thursday	12	13	0.00	0.00	38.14	13.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.94
134	1/6 13:00	23	Thursday	13	14	0.00	0.00	65.39	82.39	3.17	0.00	0.00	0.00	7.15	6.47	67.64	5.31	0.00	5.31	6.10	6.56	5.01	6.24	4.22	5.15	6.05	18.81
135	1/6 14:00	24	Thursday	14	15	0.00	0.00	65.39	82.39	25.34	0.00	0.00	0.00	85.83	77.61	101.46	63.68	0.00	63.74	73.19	98.36	60.15	74.85	50.69	61.85	72.62	70.48
136	1/6 15:00	24	Thursday	15	16	35.08	35.08	65.39	54.92	0.00	35.08	48.42	0.00	85.83	77.61	81.17	63.68	27.58	63.74	73.19	62.30	60.15	74.85	50.69	61.85	72.62	59.43
137	1/6 16:00	23	Thursday	16	17	35.08	35.08	27.24	0.00	0.00	35.08	48.42	0.00	60.08	46.56	0.00	30.78	55.16	8.50	47.57	0.00	37.09	48.65	21.97	51.54	47.20	39.75
138	1/6 17:00	21	Thursday	17	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.16
139	1/6 18:00	20	Thursday	18	19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.98
140	1/6 19:00	21	Thursday	19	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
141	1/6 20:00	22	Thursday	20	21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
142	1/6 21:00	23	Thursday	21	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
143	1/6 22:00	25	Thursday	22	23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
144	1/6 23:00	28	Thursday	23	24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
145	1/7 0:00	30	Friday	0	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
146	1/7 1:00	31	Friday	1	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
147	1/7 2:00	31	Friday	2	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
148	1/7 3:00	32	Friday	3	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
149	1/7 4:00	31	Friday	4	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
150	1/7 5:00	30	Friday	5	6	0.00	0.00	33.17	0.00	0.00	0.00	0.00	0.00	4.03	0.00	21.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.11	16.44
151	1/7 6:00	29	Friday	6	7	35.08	35.08	66.35	72.86	45.06	35.08	48.42	22.90	80.57	47.35	85.81	32.46	31.42	17.06	48.97	0.00	47.24	79.00	31.42	51.79	85.27	49.96
152	1/7 7:00	31	Friday	7	8	35.08	35.08	66.35	72.86	30.04	35.08	48.42	91.61	80.57	51.65	85.81	64.93	75.40	40.94	83.95	57.46	47.24	79.00	49.61	69.06	85.27	61.21
153	1/7 8:00	33	Friday	8	9	0.00	0.00	66.35	72.86	0.00	0.00	0.00	91.61	76.54	51.65	57.20	32.46	45.24	23.88	50.37	76.62	32.28	44.77	36.38	51.79	68.21	54.89
154	1/7 9:00	35	Friday	9	10	0.00	0.00	33.17	12.14	0.00	0.00	0.00	91.61	0.00	51.65	0.00	0.00	0.00	0.00	0.00	5.11	0.00	0.00	0.00	0.00	0.00	38.74

Project Name: Letchworth BEB Study

Building: Letchworth CSD

Date: 7/9/2024

Description Energy Used Per Bus per hour (kWh)

Hour Number	Timestamp	Outside dry-bulb temp (F)	Day of the Week	Hours (0-23)	Hours (1-24)	20 - Ghost Run	34 - Ghost Run	36	37	38	39 - Ghost Run	59 - Ghost Run	62 - Contracted Route	73	75	76	78	80	81	82	86	87	88	89	90	91	Average Energy Usage Hours
155	1/7 10:00	34	Friday	10	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91.61	0.00	51.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.63
156	1/7 11:00	34	Friday	11	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.65
157	1/7 12:00	33	Friday	12	13	0.00	0.00	34.83	12.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.68
158	1/7 13:00	32	Friday	13	14	0.00	0.00	59.71	75.23	2.89	0.00	0.00	0.00	6.53	5.91	61.77	4.85	0.00	4.85	5.57	5.99	4.58	5.70	3.86	4.71	5.53	17.18
159	1/7 14:00	31	Friday	14	15	0.00	0.00	59.71	75.23	23.14	0.00	0.00	0.00	78.37	70.87	92.65	58.15	0.00	58.21	66.83	89.82	54.93	68.34	46.29	56.48	66.31	64.35
160	1/7 15:00	30	Friday	15	16	32.03	32.03	59.71	50.15	0.00	32.03	44.21	0.00	78.37	70.87	74.12	58.15	25.19	58.21	66.83	56.89	54.93	68.34	46.29	56.48	66.31	54.27
161	1/7 16:00	29	Friday	16	17	35.08	35.08	27.24	0.00	0.00	35.08	48.42	0.00	60.08	46.56	0.00	30.78	55.16	8.50	47.57	0.00	37.09	48.65	21.97	51.54	47.20	39.75
162	1/7 17:00	29	Friday	17	18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.16
163	1/7 18:00	28	Friday	18	19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.58
164	1/7 19:00	26	Friday	19	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
165	1/7 20:00	25	Friday	20	21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
166	1/7 21:00	23	Friday	21	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
167	1/7 22:00	23	Friday	22	23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
168	1/7 23:00	23	Friday	23	24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Project Name: Letchworth BEB Study
Building: Letchworth CSD
Date: 7/9/2024
Description Charge Being Delivered to the Battery (kWh) with Demand Reduction

Max:	8.42	8.42	101.29	72.91	7.48	8.42	10.78	24.37	55.71	119.95	58.71	25.35	23.03	14.41	38.77	27.38	23.01	42.77	15.23	38.36	43.65	677.67			
Min:	0.85	0.85	8.14	4.44	0.05	0.85	2.40	4.66	4.33	8.55	2.55	5.39	6.00	2.50	4.08	2.70	4.18	4.33	2.20	2.65	5.70	4.66			

Hour Number	Timestamp	Outside dry-bulb temp (F)	Day of the Week	Hours (0-23)	Hours (1-24)	20 - Ghost Run	34 - Ghost Run	36	37	38	39 - Ghost Run	59 - Ghost Run	62 - Contracted Route	73	75	76	78	80	81	82	86	87	88	89	90	91	Impact on Battery Total	# of Buses Charging	Average Charge to Battery	Max Charge to Battery
1	1/1 0:00	28	Saturday	0	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1/1 1:00	28	Saturday	1	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	1/1 2:00	29	Saturday	2	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	1/1 3:00	29	Saturday	3	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	1/1 4:00	29	Saturday	4	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	1/1 5:00	29	Saturday	5	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	1/1 6:00	29	Saturday	6	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	1/1 7:00	29	Saturday	7	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	1/1 8:00	30	Saturday	8	9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	1/1 9:00	30	Saturday	9	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	1/1 10:00	30	Saturday	10	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	1/1 11:00	30	Saturday	11	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	1/1 12:00	30	Saturday	12	13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	1/1 13:00	30	Saturday	13	14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	1/1 14:00	30	Saturday	14	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	1/1 15:00	30	Saturday	15	16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	1/1 16:00	30	Saturday	16	17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	1/1 17:00	30	Saturday	17	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	1/1 18:00	30	Saturday	18	19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	1/1 19:00	30	Saturday	19	20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	1/1 20:00	31	Saturday	20	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	1/1 21:00	31	Saturday	21	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	1/1 22:00	30	Saturday	22	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24	1/1 23:00	30	Saturday	23	24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25	1/2 0:00	29	Sunday	0	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26	1/2 1:00	29	Sunday	1	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	1/2 2:00	29	Sunday	2	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	1/2 3:00	29	Sunday	3	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	1/2 4:00	29	Sunday	4	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	1/2 5:00	30	Sunday	5	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	1/2 6:00	30	Sunday	6	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
32	1/2 7:00	30	Sunday	7	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
33	1/2 8:00	30	Sunday	8	9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34	1/2 9:00	30	Sunday	9	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	1/2 10:00	30	Sunday	10	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	1/2 11:00	31	Sunday	11	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	1/2 12:00	31	Sunday	12	13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	1/2 13:00	31	Sunday	13	14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	1/2 14:00	31	Sunday	14	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	1/2 15:00	31	Sunday	15	16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	1/2 16:00	30	Sunday	16	17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	1/2 17:00	30	Sunday	17	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	1/2 18:00	29	Sunday	18	19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	1/2 19:00	28	Sunday	19	20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	1/2 20:00	28	Sunday	20	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	1/2 21:00	27	Sunday	21	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47	1/2 22:00	27	Sunday	22	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	1/2 23:00	26	Sunday	23	24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	1/3 0:00	**26**	**Monday**	**0**	**1**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	1/3 1:00	25	Monday	1	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
51	1/3 2:00	25	Monday	2	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	1/3 3:00	24	Monday	3	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	1/3 4:00	23	Monday	4	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54	1/3 5:00	23	Monday	5	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	1/3 6:00	22	Monday	6	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	1/3 7:00	22	Monday	7	8	1.0	1.0	0.0	0.0	0.0	1.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	4.0	2.1	5.4
57	1/3 8:00	22	Monday	8	9	4.2	4.2	0.0	0.0	0.0	4.2	7.4	0.0	5.4	0.0	36.0	9.6	7.2	2.8	21.6	0.0	17.1	23.4	2.5	13.5	10.8	170.0	15.0	11.3	36.0
58	1/3 9:00	22	Monday	9	10	4.2	4.2	54.0	48.7	0.0	4.2	7.4	0.0	47.2	0.0	49.1	21.1	19.8	7.5	32.3	20.6	18.5	35.6	10.7	32.3	35.1	452.6	18.0	25.1	54.0
59	1/3 10:00	22	Monday	10	11	4.2	4.2	83.4	61.8	0.0	4.2	7.4	0.0	47.2	0.0	49.1	21.1	19.8	7.5	32.3	22.4	18.5	35.6	10.7	32.3	35.1	497.0	18.0	27.6	83.4
60	1/3 11:00	22	Monday	11	12	4.2	4.2	83.4	61.8	0.0	4.2	7.4	0.0	47.2	0.0	49.1	21.1	19.8	7.5	32.3	22.4	18.5	35.6	10.7	32.3	35.1	497.0	18.0	27.6	83.4
61	1/3 12:00	22	Monday	12	13	4.2	4.2	45.0	51.5	0.0	4.2	7.4	20.8	47.2	92.2	49.1	21.1	19.8	7.5	32.3	22.4	18.5	35.6	10.7	32.3	35.1	561.3	20.0	28.1	92.2
62	1/3 13:00	21	Monday	13	14	4.2	4.2	0.0	0.0	0.0	4.2	7.4	20.8	43.3	84.6	36.0	19.4	19.8	6.9	29.6	20.9	17.0	32.6	9.8	29.6	32.2	422.4	18.0	23.5	84.6
63	1/3 14:00	21	Monday	14	15	4.2	4.2	0.0	0.0	2.1	4.2	7.4	20.8	0.0	0.0	0.0	0.0	19.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	62.7	7.0	9.0	20.8
64	1/3 15:00	20	Monday	15	16	1.1	1.1	0.0	5.4	6.7	1.1	5.4	20.8	0.0	0.0	3.2	0.0	9.9	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	59.1	10.0	5.9	20.8
65	1/3 16:00	19	Monday	16	17	5.4	5.4	11.6	17.1	6.7	5.4	5.4	20.8	5.5	9.9	17.2	6.7	0.0	11.3	5.2	13.0	5.2	5.5	7.7	9.0	18.9	192.8	20.0	9.6	20.8
66	1/3 17:00	17	Monday	17	18	8.3	8.3	20.6	17.1	6.7	8.3	10.1	20.8	19.3	25.8	17.2	13.4	0.0	13.1	15.5	13.0	14.2	16.5	14.1	13.7	19.5	295.4	20.0	14.8	25.8
67	1/3 18:00	16	Monday	18	19	8.3	8.3	20.6	17.1	6.7	8.3	10.1	20.8	19.3	25.8	17.2	13.4	7.8	13.1	15.5	13.0	14.2	16.5	14.1	13.7	19.5	303.2	21.0	14.4	25.8
68	1/3 19:00	16	Monday	19	20	8.3	8.3	20.6	17.1	6.7	8.3	10.1	20.8	19.3	25.8	17.2	13.4	16.3	13.1	15.5	13.0	14.2	16.5	14.1	13.7	19.5	311.7	21.0	14.8	25.8
69	1/3 20:00	15	Monday	20	21	8.3	8.3	20.6	17.1	6.7	8.3	10.1	20.8	19.3	25.8	17.2	13.4	16.3	13.1	15.5	13.0	14.2	16.5	14.1	13.7	19.5	311.7	21.0	14.8	25.8
70	1/3 21:00	15	Monday	21	22	8.3	8.3	20.6	17.1	6.7	8.3	10.1	20.8	19.3	25.8	17.2	13.4	16.3	13.1	15.5	13.0	14.2	16.5	14.1	13.7	19.5	311.7	21.0	14.8	25.8
71	1/3 22:00	13	Monday	22	23	8.3	8.3	20.6	17.1	6.7	8.3	10.1	20.8	19.3	25.8	17.2	13.4	16.3	13.1	15.5	13.0	14.2	16.5	14.1	13.7	19.5	311.7	21.0	14.8	25.8
72	1/3 23:00	11	Monday	23	24	8.3	8.3	20.6	17.1	6.7	8.3	10.1	20.8	19.3	25.8	17.2	13.4	16.3	13.1	15.5	13.0	14.2	16.5	14.1	13.7	19.5	311.7	21.0	14.8	25.8
73	1/4 0:00	9	Tuesday	0	1	8.3	8.3	20.6	17.1	6.7	8.3	10.1	20.8	19.3	25.8	17.2	13.4	16.3	13.1	15.5	13.0	14.2	16.5	14.1	13.7	19.5	311.7	21.0	14.8	25.8
74	1/4 1:00	9	Tuesday	1	2	8.3	8.3	20.6	17.1	6.7	8.3	10.1	20.8	19.3	25.8	17.2	13.4	16.3	13.1	15.5	13.0	14.2	16.5	14.1	13.7	19.5	311.7	21.0	14.8	25.8
75	1/4 2:00	10	Tuesday	2	3	8.3	8.3	20.6	17.1	6.7	8.3	10.1	20.8	19.3	25.8	17.2	13.4	16.3	13.1	15.5	13.0	14.2	16.5	14.1	13.7	19.5	311.7	21.0	14.8	25.8
76	1/4 3:00	10	Tuesday	3	4	8.3	8.3	20.6	17.1	6.7	8.3	10.1	20.8	19.3	25.8	17.2	13.4	16.3	13.1	15.5	13.0	14.2	16.5	14.1	13.7	19.5	311.7	21.0	14.8	25.8
77	1/4 4:00	9	Tuesday	4	5	8.3	8.3	20.6	17.1	6.7	8.3	10.1	20.8	19.3	25.8	17.2	13.4	16.3	13.1	15.5	13.0	14.2	16.5	14.1	13.7	19.5	311.7	21.0	14.8	25.8
78	1/4 5:00	7	Tuesday	5	6	8.3	8.3	10.3	17.1	6.7	8.3	10.1	20.8	18.3	25.8	12.9	13.4	16.3	13.1	15.5	13.0	14.2	16.5	14.1	13.7	17.9	294.5	21.0	14.0	25.8
79	1/4 6:00	6	Tuesday	6	7	5.4	5.4	0.0	0.0	5.4	5.4	5.4	15.6	0.0	11.6	0.0	6.7	9.5	7.7	6.5	13.0	0.0	0.0	5.2	13.5	0.0	116.2	14.0	8.3	15.6
80	1/4 7:00	8	Tuesday	7	8	1.2	1.2	0.0	0.0	0.0	1.2	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	12.3	5.0	2.5	5.4
81	1/4 8:00	11	Tuesday	8	9	5.4	5.4	0.0	0.0	0.0	5.4	9.4	0.0	5.4	0.0	36.0	11.3	8.4	3.6	21.6	0.0	17.1	23.4	3.3	13.5	10.8	180.0	15.0	12.0	36.0
82	1/4 9:00	13	Tuesday	9	10	5.4	5.4	54.0	55.8	0.0	5.4	9.4	0.0	54.4	0.0	58.0	24.8	23.0	9.8	37.9	23.8	22.4	42.0	14.1	35.4	42.6	523.5	18.0	29.1	58.0

Project Name: Letchworth BEB Study
Building: Letchworth CSD
Date: 7/9/2024
Description Charge Being Delivered to the Battery (kWh) with Demand Reduction

Max:						8.42	8.42	101.29	72.91	7.48	8.42	10.78	24.37	55.71	119.95	58.71	25.35	23.03	14.41	38.77	27.38	23.01	42.77	15.23	38.36	43.65	677.67			
Min:						0.85	0.85	8.14	4.44	0.05	0.85	2.40	4.66	4.33	8.55	2.55	5.39	6.00	2.50	4.08	2.70	4.18	4.33	2.20	2.65	5.70	4.66			
Hour Number	Timestamp	Outside dry-bulb temp (F)	Day of the Week	Hours (0-23)	Hours (1-24)	20 - Ghost Run	34 - Ghost Run	36	37	38	39 - Ghost Run	59 - Ghost Run	62 - Contracted Route	73	75	76	78	80	81	82	86	87	88	89	90	91	Impact on Battery Total	# of Buses Charging	Average Charge to Battery	Max Charge to Battery
83	1/4 10:00	15	Tuesday	10	11	5.4	5.4	98.9	70.9	0.0	5.4	9.4	0.0	54.4	0.0	58.0	24.8	23.0	9.8	37.9	25.9	22.4	42.0	14.1	35.4	42.6	585.7	18.0	32.5	98.9
84	1/4 11:00	17	Tuesday	11	12	5.4	5.4	98.9	70.9	0.0	5.4	9.4	0.0	54.4	0.0	58.0	24.8	23.0	9.8	37.9	25.9	22.4	42.0	14.1	35.4	42.6	585.7	18.0	32.5	98.9
85	1/4 12:00	19	Tuesday	12	13	5.4	5.4	45.0	59.1	0.0	5.4	9.4	23.1	54.4	105.6	58.0	24.8	23.0	9.8	37.9	25.9	22.4	42.0	14.1	35.4	42.6	648.7	20.0	32.4	105.6
86	1/4 13:00	19	Tuesday	13	14	5.4	5.4	0.0	0.0	0.0	5.4	9.4	23.1	49.9	96.8	36.0	22.8	23.0	9.0	34.7	24.2	20.6	38.5	12.9	32.4	39.0	488.5	18.0	27.1	96.8
87	1/4 14:00	18	Tuesday	14	15	5.4	5.4	0.0	0.0	2.4	5.4	9.4	23.1	0.0	0.0	0.0	0.0	23.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	74.1	7.0	10.6	23.1
88	1/4 15:00	18	Tuesday	15	16	5.4	5.4	0.0	5.8	7.4	5.4	5.4	23.1	0.0	0.0	3.5	0.0	11.5	0.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0	77.7	10.0	7.8	23.1
89	1/4 16:00	18	Tuesday	16	17	5.4	5.4	12.5	18.2	7.4	5.4	5.4	23.1	5.7	10.1	18.4	6.9	0.0	11.6	5.3	13.6	5.3	5.7	7.9	9.0	18.9	201.4	20.0	10.1	23.1
90	1/4 17:00	18	Tuesday	17	18	8.0	8.0	22.2	18.2	7.4	8.0	10.1	23.1	19.9	26.4	18.4	13.9	0.0	13.6	16.0	13.6	14.6	17.0	14.4	14.2	20.1	307.0	20.0	15.3	26.4
91	1/4 18:00	18	Tuesday	18	19	8.0	8.0	22.2	18.2	7.4	8.0	10.1	23.1	19.9	26.4	18.4	13.9	7.8	13.6	16.0	13.6	14.6	17.0	14.4	14.2	20.1	314.8	21.0	15.0	26.4
92	1/4 19:00	18	Tuesday	19	20	8.0	8.0	22.2	18.2	7.4	8.0	10.1	23.1	19.9	26.4	18.4	13.9	16.3	13.6	16.0	13.6	14.6	17.0	14.4	14.2	20.1	323.2	21.0	15.4	26.4
93	1/4 20:00	18	Tuesday	20	21	8.0	8.0	22.2	18.2	7.4	8.0	10.1	23.1	19.9	26.4	18.4	13.9	16.3	13.6	16.0	13.6	14.6	17.0	14.4	14.2	20.1	323.2	21.0	15.4	26.4
94	1/4 21:00	18	Tuesday	21	22	8.0	8.0	22.2	18.2	7.4	8.0	10.1	23.1	19.9	26.4	18.4	13.9	16.3	13.6	16.0	13.6	14.6	17.0	14.4	14.2	20.1	323.2	21.0	15.4	26.4
95	1/4 22:00	18	Tuesday	22	23	8.0	8.0	22.2	18.2	7.4	8.0	10.1	23.1	19.9	26.4	18.4	13.9	16.3	13.6	16.0	13.6	14.6	17.0	14.4	14.2	20.1	323.2	21.0	15.4	26.4
96	1/4 23:00	18	Tuesday	23	24	8.0	8.0	22.2	18.2	7.4	8.0	10.1	23.1	19.9	26.4	18.4	13.9	16.3	13.6	16.0	13.6	14.6	17.0	14.4	14.2	20.1	323.2	21.0	15.4	26.4
97	1/5 0:00	18	Wednesday	0	1	8.0	8.0	22.2	18.2	7.4	8.0	10.1	23.1	19.9	26.4	18.4	13.9	16.3	13.6	16.0	13.6	14.6	17.0	14.4	14.2	20.1	323.2	21.0	15.4	26.4
98	1/5 1:00	19	Wednesday	1	2	8.0	8.0	22.2	18.2	7.4	8.0	10.1	23.1	19.9	26.4	18.4	13.9	16.3	13.6	16.0	13.6	14.6	17.0	14.4	14.2	20.1	323.2	21.0	15.4	26.4
99	1/5 2:00	19	Wednesday	2	3	8.0	8.0	22.2	18.2	7.4	8.0	10.1	23.1	19.9	26.4	18.4	13.9	16.3	13.6	16.0	13.6	14.6	17.0	14.4	14.2	20.1	323.2	21.0	15.4	26.4
100	1/5 3:00	20	Wednesday	3	4	8.0	8.0	22.2	18.2	7.4	8.0	10.1	23.1	19.9	26.4	18.4	13.9	16.3	13.6	16.0	13.6	14.6	17.0	14.4	14.2	20.1	323.2	21.0	15.4	26.4
101	1/5 4:00	19	Wednesday	4	5	8.0	8.0	22.2	18.2	7.4	8.0	10.1	23.1	19.9	26.4	18.4	13.9	16.3	13.6	16.0	13.6	14.6	17.0	14.4	14.2	20.1	323.2	21.0	15.4	26.4
102	1/5 5:00	18	Wednesday	5	6	8.0	8.0	11.1	18.2	7.4	8.0	10.1	23.1	18.9	26.4	13.8	13.9	16.3	13.6	16.0	13.6	14.6	17.0	14.4	14.2	18.4	304.8	21.0	14.5	26.4
103	1/5 6:00	17	Wednesday	6	7	5.4	5.4	0.0	0.0	5.4	5.4	5.4	17.3	0.0	11.6	0.0	6.9	9.5	7.9	6.7	13.6	0.0	0.0	5.3	13.5	0.0	119.3	14.0	8.5	17.3
104	1/5 7:00	20	Wednesday	7	8	0.9	0.9	0.0	0.0	0.0	0.9	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.5	0.0	0.0	0.0	0.0	0.0	21.7	5.0	4.3	13.5
105	1/5 8:00	23	Wednesday	8	9	4.2	4.2	0.0	0.0	0.0	4.2	7.6	0.0	5.4	0.0	36.0	9.8	7.4	2.9	21.6	0.0	17.1	23.4	2.6	13.5	10.8	170.7	15.0	11.4	36.0
106	1/5 9:00	26	Wednesday	9	10	4.2	4.2	54.0	50.0	0.0	4.2	7.6	0.0	48.7	0.0	51.3	21.7	20.2	7.8	33.2	18.6	19.4	37.0	11.3	31.2	36.7	461.1	18.0	25.6	54.0
107	1/5 10:00	26	Wednesday	10	11	4.2	4.2	87.0	63.6	0.0	4.2	7.6	0.0	48.7	0.0	51.3	21.7	20.2	7.8	33.2	20.3	19.4	37.0	11.3	31.2	36.7	509.3	18.0	28.3	87.0
108	1/5 11:00	27	Wednesday	11	12	4.2	4.2	87.0	63.6	0.0	4.2	7.6	0.0	48.7	0.0	51.3	21.7	20.2	7.8	33.2	20.3	19.4	37.0	11.3	31.2	36.7	509.3	18.0	28.3	87.0
109	1/5 12:00	27	Wednesday	12	13	4.2	4.2	45.0	53.0	0.0	4.2	7.6	20.9	48.7	89.5	51.3	21.7	20.2	7.8	33.2	20.3	19.4	37.0	11.3	31.2	36.7	567.0	20.0	28.4	89.5
110	1/5 13:00	26	Wednesday	13	14	4.2	4.2	0.0	0.0	0.0	4.2	7.6	20.9	44.7	82.0	36.0	19.9	20.2	7.1	30.4	19.0	17.8	33.9	10.3	28.6	33.7	424.4	18.0	23.6	82.0
111	1/5 14:00	26	Wednesday	14	15	4.2	4.2	0.0	0.0	2.1	4.2	7.6	20.9	0.0	0.0	0.0	0.0	20.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	63.3	7.0	9.0	20.9
112	1/5 15:00	25	Wednesday	15	16	1.0	1.0	0.0	5.3	6.7	1.0	5.4	20.9	0.0	0.0	3.2	0.0	10.1	0.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0	59.1	10.0	5.9	20.9
113	1/5 16:00	24	Wednesday	16	17	5.4	5.4	11.3	16.8	6.7	5.4	5.4	20.9	5.2	9.6	16.7	6.4	0.0	10.9	4.9	12.7	5.0	5.2	7.5	9.0	6.6	176.9	20.0	8.8	20.9
114	1/5 17:00	23	Wednesday	17	18	7.8	7.8	20.1	16.8	6.7	7.8	9.5	20.9	18.4	25.0	16.7	12.8	0.0	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	285.9	20.0	14.3	25.0
115	1/5 18:00	22	Wednesday	18	19	7.8	7.8	20.1	16.8	6.7	7.8	9.5	20.9	18.4	25.0	16.7	12.8	7.2	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	293.1	21.0	14.0	25.0
116	1/5 19:00	21	Wednesday	19	20	7.8	7.8	20.1	16.8	6.7	7.8	9.5	20.9	18.4	25.0	16.7	12.8	15.1	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	301.0	21.0	14.3	25.0
117	1/5 20:00	21	Wednesday	20	21	7.8	7.8	20.1	16.8	6.7	7.8	9.5	20.9	18.4	25.0	16.7	12.8	15.1	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	301.0	21.0	14.3	25.0
118	1/5 21:00	20	Wednesday	21	22	7.8	7.8	20.1	16.8	6.7	7.8	9.5	20.9	18.4	25.0	16.7	12.8	15.1	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	301.0	21.0	14.3	25.0
119	1/5 22:00	20	Wednesday	22	23	7.8	7.8	20.1	16.8	6.7	7.8	9.5	20.9	18.4	25.0	16.7	12.8	15.1	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	301.0	21.0	14.3	25.0
120	1/5 23:00	19	Wednesday	23	24	7.8	7.8	20.1	16.8	6.7	7.8	9.5	20.9	18.4	25.0	16.7	12.8	15.1	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	301.0	21.0	14.3	25.0
121	1/6 0:00	19	Thursday	0	1	7.8	7.8	20.1	16.8	6.7	7.8	9.5	20.9	18.4	25.0	16.7	12.8	15.1	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	301.0	21.0	14.3	25.0
122	1/6 1:00	19	Thursday	1	2	7.8	7.8	20.1	16.8	6.7	7.8	9.5	20.9	18.4	25.0	16.7	12.8	15.1	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	301.0	21.0	14.3	25.0
123	1/6 2:00	19	Thursday	2	3	7.8	7.8	20.1	16.8	6.7	7.8	9.5	20.9	18.4	25.0	16.7	12.8	15.1	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	301.0	21.0	14.3	25.0
124	1/6 3:00	19	Thursday	3	4	7.8	7.8	20.1	16.8	6.7	7.8	9.5	20.9	18.4	25.0	16.7	12.8	15.1	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	301.0	21.0	14.3	25.0
125	1/6 4:00	18	Thursday	4	5	7.8	7.8	20.1	16.8	6.7	7.8	9.5	20.9	18.4	25.0	16.7	12.8	15.1	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	301.0	21.0	14.3	25.0
126	1/6 5:00	16	Thursday	5	6	7.8	7.8	10.1	16.8	6.7	7.8	9.5	20.9	17.4	25.0	12.5	12.8	15.1	12.7	14.8	12.7	13.5	15.7	13.6	13.0	18.1	284.2	21.0	13.5	25.0
127	1/6 6:00	15	Thursday	6	7	5.4	5.4	0.0	0.0	5.4	5.4	5.4	15.7	0.0	11.6	0.0	6.4	8.8	7.4	6.2	12.7	0.0	0.0	5.0	3.2	0.0	104.0	14.0	7.4	15.7
128	1/6 7:00	15	Thursday	7	8	1.0	1.0	0.0	0.0	0.0	1.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	0.0	0.0	11.7	5.0	2.3	5.4
129	1/6 8:00	15	Thursday	8	9	4.6	4.6	0.0	0.0	0.0	4.6	8.2	0.0	5.4	0.0	36.0	10.6	7.9	3.3	21.6	0.0	17.1	23.4	2.9	13.5	10.8	174.4	15.0	11.6	36.0
130	1/6 9:00	15	Thursday	9	10	4.6	4.6	54.0	53.0	0.0	4.6	8.2	0.0	51.5	0.0	54.1	23.2	21.7	8.8	35.5	22.8	20.8	39.2	12.7	35.3	39.4	494.1	18.0	27.5	54.1
131	1/6 10:00	18	Thursday	10	11	4.6	4.6	92.9	67.4	0.0	4.6	8.2	0.0	51.5	0.0	54.1	23.2	21.7	8.8	35.5	24.9	20.8	39.2	12.7	35.3	39.4	549.4	18.0	30.5	92.9
132	1/6 11:00	20	Thursday	11	12	4.6	4.6	92.9	67.4	0.0	4.6	8.2	0.0	51.5	0.0	54.1	23.2	21.7	8.8	35.5	24.9	20.8	39.2	12.7	35.3	39.4	549.4	18.0	30.5	92.9
133	1/6 12:00	23	Thursday	12	13	4.6	4.6	45.0	56.1	0.0	4.6	8.2	22.6	51.5	98.8	54.1	23.2	21.7	8.8	35.5	24.9	20.8	39.2	12.7	35.3	39.4	611.6	20.0	30.6	98.8
134	1/6 13:00	23	Thursday	13	14	4.6	4.6	0.0	0.0	0.0	4.6	8.2	22.6	47.2	90.6	36.0	21.3	21.7	8.1	32.6	23.2	19.0	35.9	11.6	32.4	36.1	460.2	18.0	25.6	90.6
135	1/6 14:00	24	Thursday	14	15	4.6	4.6	0.0	0.0	2.2	4.6	8.2	22.6	0.0	0.0	0.0	0.0	21.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	68.3	7.0	9.8	22.6
136	1/6 15:00	24	Thursday	15	16	1.1	1.1	0.0	5.3	6.8	1.1	5.4	22.6	0.0	0.0	3.2	0.0	10.8	0.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0	62.0	10.0	6.2	22.6
137	1/6 16:00	23	Thursday	16	17	5.4	5.4	11.5	16.8	6.8	5.4	5.4	22.6	5.2	9.6	16.8	6.4	0.0	10.9	4.9	12.7	5.0	5.2	7.5	9.0	6.6	178.9	20.0	8.9	22.6
138	1/6 17:00	21	Thursday	17	18	7.8	7.8	20.3	16.8	6.8	7.8	9.5	22.6	18.4	25.0	16.8	12.8	0.0	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	288.0	20.0	14.4	25.0
139	1/6 18:00	20	Thursday	18	19	7.8	7.8	20.3	16.8	6.8	7.8	9.5	22.6	18.4	25.0	16.8	12.8	7.3	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	295.3	21.0	14.1	25.0
140	1/6 19:00	21	Thursday	19	20	7.8	7.8	20.3	16.8	6.8	7.8	9.5	22.6	18.4	25.0	16.8	12.8	15.3	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	303.3	21.0	14.4	25.0
141	1/6 20:00	22	Thursday	20	21	7.8	7.8	20.3	16.8	6.8	7.8	9.5	22.6	18.4	25.0	16.8	12.8	15.3	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	303.3	21.0	14.4	25.0
142	1/6 21:00	23	Thursday	21	22	7.8	7.8	20.3	16.8	6.8	7.8	9.5	22.6	18.4	25.0	16.8	12.8	15.3	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	303.3	21.0	14.4	25.0
143	1/6 22:00	25	Thursday	22	23	7.8	7.8	20.3	16.8	6.8	7.8	9.5	22.6	18.4	25.0	16.8	12.8	15.3	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	303.3	21.0	14.4	25.0
144	1/6 23:00	28	Thursday	23	24	7.8	7.8	20.3	16.8	6.8	7.8	9.5	22.6	18.4	25.0	16.8	12.8	15.3	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	303.3	21.0	14.4	25.0
145	1/7 0:00	30	Friday	0	1	7.8	7.8	20.3	16.8	6.8	7.8	9.5	22.6	18.4	25.0	16.8	12.8	15.3	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	303.3	21.0	14.4	25.0
146	1/7 1:00	31	Friday	1	2	7.8	7.8	20.3	16.8	6.8	7.8	9.5	22.6	18.4	25.0	16.8	12.8	15.3	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	303.3	21.0	14.4	25.0
147	1/7 2:00	31	Friday	2	3	7.8	7.8	20.3	16.8	6.8	7.8	9.5	22.6	18.4	25.0	16.8	12.8	15.3	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	303.3	21.0	14.4	25.0
148	1/7 3:00	32	Friday	3	4	7.8	7.8	20.3	16.8	6.8	7.8	9.5	22.6	18.4	25.0	16.8	12.8	15.3	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	303.3	21.0	14.4	25.0
149	1/7 4:00	31	Friday	4	5	7.8	7.8	20.3	16.8	6.8	7.8	9.5	22.6	18.4	25.0	16.8	12.8	15.3	12.7	14.8	12.7	13.5	15.7	13.6	13.0	19.7	303.3	21.0	14.4	25.0
150	1/7 5:00	30	Friday	5	6	7.8	7.8	10.1	16.8	6.8	7.8	9.5	22.6	17.4	25.0	12.6	12.8	15.3	12.7	14.8	12.7	13.5	15.7	13.6	13.0	18.1	286.4	21.0	13.6	25.0
151	1/7 6:00	29	Friday	6	7	5.4	5.4	0.0	0.0	5.4	5.4	5.4	16.9	0.0	11.6	0.0	6.4	8.9	7.4	6.2	12.7	0.0	0.0	5.0	3.2	0.0	105.4	14.0	7.5	16.9
152	1/7 7:00	31	Friday	7	8	0.9	0.9	0.0	0.0	0.0	0.9	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0	0.0	0.0	11.1	5.0	2.2	5.4
153	1/7 8:00	33	Friday	8	9	3.8	3.8	0.0	0.0	0.0	3.8	7.0	0.0	5.4	0.0	36.0	9.6	7.2	2.8	21.6	0.0	17.1	23.4	2.5	13.5	10.8	168.2	15.0	11.2	36.0
154	1/7 9:00	35	Friday	9	10	3.8	3.8	54.0	48.7	0.0	3.8	7.0	0.0	47.2	0.0	49.1	21.1	19.8	7.5	32.3	20.6	18.5	35.6	10.7	32.3	35.1	450.8	18.0	25.0	54.0
155	1/7 10:00	34	Friday	10	11	3.8	3.8	83.4	61.8	0.0	3.8	7.0	0.0	47.2	0.0	49.1	21.1	19.8	7.5	32.3	22.4	18.5	35.6	10.7	32.3	35.1	495.2	18.0	27.5	83.4
156	1/7 11:00	34	Friday	11	12	3.8	3.8	83.4	61.8	0.0	3.8	7.0	0.0	47.2	0.0	49.1	21.1	19.8	7.5	32.3	22.4	18.5	35.6	10.7	32.3	35.1	495.2	18.0	27.5	83.4
157	1/7 12:00	33	Friday	12	13	3.8	3.8	45.0	51.5	0.0	3.8	7.0	6.0	47.2	87.3	49.1	21.1	19.8	7.5	32.3	22.4	18.5	35.6	10.7	32.3	35.1	539.7	20.0	27.0	87.3
158	1/7 13:00	32	Friday	13	14	3.8	3.8	0.0	0.0	0.0	3.8	7.0	6.0	43.3	80.0	36.0	19.4	19.8	6.9	29.6	20.9	17.0	32.6	9.8	29.6	32.2	401.3	18.0	22.3	80.0
159	1/7 14:00	31	Friday	14	15	3.8	3.8	0.0	0.0	2.0	3.8	7.0	6.0	0.0	0.0	0.0	0.0	19.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.0	7.0	6.6	19.8
160	1/7 15:00	30	Friday	15	16	0.9	0.9	0.0	4.9	2.4	0.9	5.4	6.0	0.0	0.0	2.9	0.0	9.9	0.0	0.0	4.1	0.0	0.0	0.0	0.0	0.0	38.4	10.0	3.8	9.9
161	1/7 16:00	29	Friday	16	17	5.4	5.4	10.4	12.0	2.4	5.4	5.4	6.0	4.9	9.2	12.0	6.0	0.0	10.2	4.6	6.0	4.7	4.9	7.1	9.0	6.2	137.2	20.0	6.9	12.0
162	1/7 17:00	29	Friday	17	18	2.4	2.4	12.0	12.0	2.4	2.4	2.4	6.0	12.0	15.5	12.0	6.0	0.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	135.5	20.0	6.8	15.5
163	1/7 18:00	28	Friday	18	19	2.4	2.4	12.0	12.0	2.4	2.4	2.4	6.0	12.0	15.5	12.0	6.0	7.1	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	142.6	21.0	6.8	15.5

Project Name: Letchworth BEB Study

Building: Letchworth CSD

Date: 7/9/2024

Description Charge Being Delivered to the Battery (kWh) with Demand Reduction

					Max:	8.42	8.42	101.29	72.91	7.48	8.42	10.78	24.37	55.71	119.95	58.71	25.35	23.03	14.41	38.77	27.38	23.01	42.77	15.23	38.36	43.65	677.67			
					Min:	0.85	0.85	8.14	4.44	0.05	0.85	2.40	4.66	4.33	8.55	2.55	5.39	6.00	2.50	4.08	2.70	4.18	4.33	2.20	2.65	5.70	4.66			
Hour Number	Timestamp	Outside dry-bulb temp (F)	Day of the Week	Hours (0-23)	Hours (1-24)	20 - Ghost Run	34 - Ghost Run	36	37	38	39 - Ghost Run	59 - Ghost Run	62 - Contracted Route	73	75	76	78	80	81	82	86	87	88	89	90	91	Impact on Battery Total	# of Buses Charging	Average Charge to Battery	Max Charge to Battery
164	1/7 19:00	26	Friday	19	20	2.4	2.4	12.0	12.0	2.4	2.4	2.4	6.0	12.0	15.5	12.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	141.5	21.0	6.7	15.5
165	1/7 20:00	25	Friday	20	21	2.4	2.4	12.0	12.0	2.4	2.4	2.4	6.0	12.0	15.5	12.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	141.5	21.0	6.7	15.5
166	1/7 21:00	23	Friday	21	22	2.4	2.4	12.0	12.0	2.4	2.4	2.4	6.0	12.0	15.5	12.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	141.5	21.0	6.7	15.5
167	1/7 22:00	23	Friday	22	23	2.4	2.4	12.0	12.0	2.4	2.4	2.4	6.0	12.0	15.5	12.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	141.5	21.0	6.7	15.5
168	1/7 23:00	23	Friday	23	24	2.4	2.4	12.0	12.0	2.4	2.4	2.4	6.0	12.0	15.5	12.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	141.5	21.0	6.7	15.5

Project Name: Letchworth BEB Study

Building: Letchworth CSD

Date: 7/9/2024

Description Remaining Charge (kWh) in the Battery with Demand Reduction

Hour Number	Timestamp	Outside dry-bulb temp (F)	Day of the Week	Hours (0-23)	Hours (1-24)	20 - Ghost Run	34 - Ghost Run	36	37	38	39 - Ghost Run	59 - Ghost Run	62 - Contracted Route	73	75	76	78	80	81	82	86	87	88	89	90	91	Total (All Buses)	Average Battery Charge
1	1/1 0:00	28	Saturday	0	1	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
2	1/1 1:00	28	Saturday	1	2	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
3	1/1 2:00	29	Saturday	2	3	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
4	1/1 3:00	29	Saturday	3	4	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
5	1/1 4:00	29	Saturday	4	5	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
6	1/1 5:00	29	Saturday	5	6	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
7	1/1 6:00	29	Saturday	6	7	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
8	1/1 7:00	29	Saturday	7	8	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
9	1/1 8:00	30	Saturday	8	9	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
10	1/1 9:00	30	Saturday	9	10	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
11	1/1 10:00	30	Saturday	10	11	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
12	1/1 11:00	30	Saturday	11	12	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
13	1/1 12:00	30	Saturday	12	13	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
14	1/1 13:00	30	Saturday	13	14	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
15	1/1 14:00	30	Saturday	14	15	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
16	1/1 15:00	30	Saturday	15	16	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
17	1/1 16:00	30	Saturday	16	17	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
18	1/1 17:00	30	Saturday	17	18	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
19	1/1 18:00	30	Saturday	18	19	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
20	1/1 19:00	30	Saturday	19	20	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
21	1/1 20:00	31	Saturday	20	21	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
22	1/1 21:00	31	Saturday	21	22	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
23	1/1 22:00	30	Saturday	22	23	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
24	1/1 23:00	30	Saturday	23	24	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
25	1/2 0:00	29	Sunday	0	1	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
26	1/2 1:00	29	Sunday	1	2	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
27	1/2 2:00	29	Sunday	2	3	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
28	1/2 3:00	29	Sunday	3	4	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
29	1/2 4:00	29	Sunday	4	5	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
30	1/2 5:00	30	Sunday	5	6	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
31	1/2 6:00	30	Sunday	6	7	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
32	1/2 7:00	30	Sunday	7	8	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
33	1/2 8:00	30	Sunday	8	9	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
34	1/2 9:00	30	Sunday	9	10	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
35	1/2 10:00	30	Sunday	10	11	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
36	1/2 11:00	31	Sunday	11	12	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
37	1/2 12:00	31	Sunday	12	13	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
38	1/2 13:00	31	Sunday	13	14	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
39	1/2 14:00	31	Sunday	14	15	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
40	1/2 15:00	31	Sunday	15	16	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
41	1/2 16:00	30	Sunday	16	17	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
42	1/2 17:00	30	Sunday	17	18	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
43	1/2 18:00	29	Sunday	18	19	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
44	1/2 19:00	28	Sunday	19	20	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
45	1/2 20:00	28	Sunday	20	21	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
46	1/2 21:00	27	Sunday	21	22	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
47	1/2 22:00	27	Sunday	22	23	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
48	1/2 23:00	26	Sunday	23	24	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
49	1/3 0:00	26	Monday	0	1	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
50	1/3 1:00	25	Monday	1	2	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
51	1/3 2:00	25	Monday	2	3	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
52	1/3 3:00	24	Monday	3	4	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
53	1/3 4:00	23	Monday	4	5	136.1	136.1	356.4	315.9	136.1	136.1	170.1	518.4	348.3	445.5	332.1	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	356.4	5768.82	274.7
54	1/3 5:00	23	Monday	5	6	136.1	136.1	323.2	315.9	136.1	136.1	170.1	518.4	344.3	445.5	310.6	255.2	255.2	255.2	291.6	255.2	255.2	299.7	255.2	259.2	349.3	5703.06	271.6
55	1/3 6:00	22	Monday	6	7	101.0	101.0	256.9	243.0	91.0	101.0	121.7	495.5	263.7	398.2	224.8	222.7	223.7	238.1	242.6	255.2	207.9	220.7	223.7	207.4	264.0	4703.90	224.0
56	1/3 7:00	22	Monday	7	8	66.9	66.9	190.5	170.2	61.0	66.9	78.7	403.9	183.1	346.5	139.0	157.8	148.3	197.2	158.7	197.7	160.7	141.7	174.1	138.3	178.8	3426.79	163.2
57	1/3 8:00	22	Monday	8	9	71.1	71.1	124.2	97.3	61.0	71.1	86.1	312.3	112.0	294.8	117.8	134.9	110.3	176.1	129.9	121.1	145.5	120.3	140.2	100.1	121.3	2718.59	129.5
58	1/3 9:00	22	Monday	9	10	75.3	75.3	145.0	133.9	61.0	75.3	93.5	220.7	159.2	243.2	166.9	156.0	130.1	183.6	162.2	136.5	164.0	155.9	151.0	132.3	156.4	2977.48	141.8
59	1/3 10:00	22	Monday	10	11	79.5	79.5	228.4	195.7	61.0	79.5	101.0	129.1	206.5	191.5	216.1	177.2	149.9	191.0	194.5	158.9	182.6	191.5	161.7	164.6	191.5	3331.20	158.6
60	1/3 11:00	22	Monday	11	12	83.8	83.8	311.8	257.5	61.0	83.8	108.4	129.1	253.7	139.9	265.2	198.3	169.6	198.5	226.8	181.3	201.1	227.1	172.4	196.8	226.6	3776.54	179.8
61	1/3 12:00	22	Monday	12	13	88.0	88.0	318.7	295.3	61.0	88.0	115.8	149.8	301.0	232.1	314.3	219.5	189.4	206.0	259.1	203.7	219.6	262.7	183.1	229.1	261.7	4285.95	204.1
62	1/3 13:00	21	Monday	13	14	92.2	92.2	253.3	213.0	57.8	92.2	123.3	170.6	337.1	310.2	282.6	233.6	209.1	207.6	282.6	218.1	231.6	289.1	188.7	253.5	287.8	4426.23	210.8
63	1/3 14:00	21	Monday	14	15	96.4	96.4	187.9	130.6	34.6	96.4	130.7	191.4	251.3	232.6	181.2	169.9	228.9	143.8	209.4	119.7	171.5	214.3	138.0	191.7	215.2	3431.83	163.4
64	1/3 15:00	20	Monday	15	16	59.3	59.3	116.8	76.3	41.2	59.3	83.5	212.1	158.0	148.3	96.2	100.7	208.8	74.6	129.8	56.6	106.1	132.9	83.0	124.5	136.3	2263.67	107.8
65	1/3 16:00	19	Monday	16	17	26.6	26.6	98.9	93.4	47.9	26.6	36.3	232.9	98.2	107.5	113.4	73.9	148.8	76.6	83.3	69.6	71.0	85.6	66.8	77.4	103.9	1765.21	84.1
66	1/3 17:00	17	Monday	17	18	34.9	34.9	119.5	110.5	54.6	34.9	46.4	253.7	117.5	133.4	130.5	87.3	88.9	89.7	98.8	82.6	85.1	102.0	80.9	91.2	123.4	2000.69	95.3
67	1/3 18:00	16	Monday	18	19	43.1	43.1	140.1	127.7	61.2	43.1	56.5	274.4	136.8	159.2	147.7	100.8	66.7	102.9	114.4	95.6	99.3	118.5	95.0	104.9	143.0	2273.95	108.3
68	1/3 19:00	16	Monday	19	20	51.4	51.4	160.7	144.8	67.9	51.4	66.6	295.2	156.1	185.0	164.8	114.2	83.0	116.0	129.9	108.7	113.5	135.0	109.1	118.6	162.5	2585.65	123.1
69	1/3 20:00	15	Monday	20	21	59.7	59.7	181.3	161.9	74.5	59.7	76.7	316.0	175.5	210.9	182.0	127.6	99.2	129.2	145.4	121.7	127.6	151.5	123.2	132.3	182.1	2897.35	138.0
70	1/3 21:00	15	Monday	21	22	67.9	67.9	201.9	179.0	81.2	67.9	86.8	336.7	194.8	236.7	199.1	141.0	115.5	142.3	160.9	134.7	141.8	167.9	137.3	146.0	201.6	3209.06	152.8
71	1/3 22:00	13	Monday	22	23	76.2	76.2	222.5	196.1	87.8	76.2	96.9	357.5	214.1	262.5	216.3	154.5	131.8	155.5	176.5	147.7	156.0	184.4	151.4	159.7	221.2	3520.76	167.7
72	1/3 23:00	11	Monday	23	24	84.4	84.4	243.1	213.2	94.5	84.4	107.0	378.2	233.4	288.4	233.4	167.9	148.0	168.6	192.0	160.7	170.1	200.9	165.4	173.5	240.7	3832.46	182.5
73	1/4 0:00	9	Tuesday	0	1	92.7	92.7	263.7	230.3	101.1	92.7	117.1	399.0	252.7	314.2	250.6	181.3	164.3	181.8	207.5	173.8	184.3	217.3	179.5	187.2	260.3	4144.17	197.3
74	1/4 1:00	9	Tuesday	1	2	101.0	101.0	284.3	247.4	107.8	101.0	127.2	419.8	272.0	340.0	267.8	194.7	180.6	194.9	223.0	186.8	198.5	233.8	193.6	200.9	279.8	4455.87	212.2
75	1/4 2:00	10	Tuesday	2	3	109.2	109.2	304.9	264.6	114.5	109.2	137.3	440.5	291.3	365.9	284.9	208.2	196.9	208.0	238.6	199.8	212.6	250.3	207.7	214.6	299.4	4767.57	227.0
76	1/4 3:00	10	Tuesday	3	4	117.5	117.5	325.5	281.7	121.1	117.5	147.4	461.3	310.6	391.7	302.1	221.6	213.1	221.2	254.1	212.8	226.8	266.8	221.8	228.3	318.9	5079.28	241.9

Project Name: Letchworth BEB Study

Building: Letchworth CSD

Date: 7/9/2024

Description Remaining Charge (kWh) in the Battery with Demand Reduction

Hour Number	Timestamp	Outside dry-bulb temp (F)	Day of the Week	Hours (0-23)	Hours (1-24)	20 - Ghost Run	34 - Ghost Run	36	37	38	39 - Ghost Run	59 - Ghost Run	62 - Contracted Route	73	75	76	78	80	81	82	86	87	88	89	90	91	Total (All Buses)	Average Battery Charge
77	1/4 4:00	9	Tuesday	4	5	125.8	125.8	346.1	298.8	127.8	125.8	157.5	482.1	330.0	417.5	319.2	235.0	229.4	234.3	269.6	225.9	241.0	283.2	235.9	242.1	338.5	5390.98	256.7
78	1/4 5:00	7	Tuesday	5	6	134.0	134.0	317.5	315.9	134.4	134.0	167.6	502.8	343.6	443.3	306.9	248.4	245.7	247.5	285.1	238.9	255.2	299.7	250.0	255.8	348.1	5608.32	267.1
79	1/4 6:00	6	Tuesday	6	7	98.2	98.2	239.6	230.4	86.9	98.2	116.1	491.5	249.0	399.4	206.2	217.0	218.3	235.1	234.1	251.9	199.7	207.0	218.3	208.5	248.0	4551.80	216.8
80	1/4 7:00	8	Tuesday	7	8	58.3	58.3	161.7	144.9	51.7	58.3	64.7	384.0	154.4	338.8	105.5	140.8	129.8	187.1	135.6	187.7	144.3	114.3	160.0	127.4	147.9	3055.48	145.5
81	1/4 8:00	11	Tuesday	8	9	63.7	63.7	89.6	65.7	51.7	63.7	74.1	284.4	76.7	282.6	79.3	116.8	89.1	164.8	102.4	104.4	126.3	89.0	123.8	84.6	84.6	2280.97	108.6
82	1/4 9:00	13	Tuesday	9	10	69.1	69.1	107.6	108.3	51.7	69.1	83.4	184.9	131.1	226.5	137.3	141.6	112.1	174.6	140.3	122.7	148.7	131.0	137.8	120.0	127.1	2594.01	123.5
83	1/4 10:00	15	Tuesday	10	11	74.5	74.5	206.5	179.1	51.7	74.5	92.8	85.3	185.5	170.3	195.3	166.5	135.1	184.3	178.2	148.6	171.2	172.9	151.9	155.4	169.7	3023.97	144.0
84	1/4 11:00	17	Tuesday	11	12	79.9	79.9	305.4	250.0	51.7	79.9	102.1	85.3	239.9	114.2	253.3	191.3	158.2	194.1	216.1	174.5	193.6	214.9	166.0	190.8	212.3	3553.49	169.2
85	1/4 12:00	19	Tuesday	12	13	85.3	85.3	308.9	294.2	51.7	85.3	111.5	108.4	294.4	219.9	311.3	216.1	181.2	203.9	253.9	200.4	216.1	256.9	180.1	226.2	254.9	4145.81	197.4
86	1/4 13:00	19	Tuesday	13	14	90.7	90.7	237.8	204.6	48.2	90.7	120.9	131.5	336.5	309.7	273.8	233.1	204.2	207.1	282.0	217.5	231.2	288.6	188.4	253.1	287.3	4327.64	206.1
87	1/4 14:00	18	Tuesday	14	15	96.1	96.1	166.8	115.1	23.0	96.1	130.2	154.6	243.2	225.3	163.5	163.9	227.3	137.8	202.5	110.6	165.8	207.3	133.3	185.9	208.4	3252.75	154.9
88	1/4 15:00	18	Tuesday	15	16	63.4	63.4	95.7	61.2	30.5	63.4	83.0	177.7	149.9	141.0	78.8	94.7	208.8	68.6	123.0	47.7	100.4	125.9	78.2	118.6	129.5	2103.14	100.1
89	1/4 16:00	18	Tuesday	16	17	30.7	30.7	78.7	79.4	37.9	30.7	35.8	200.8	90.3	100.4	97.2	68.1	148.8	71.0	76.6	61.3	65.4	78.7	62.2	71.6	97.0	1613.26	76.8
90	1/4 17:00	18	Tuesday	17	18	38.6	38.6	100.9	97.6	45.3	38.6	45.9	223.9	110.2	126.8	115.6	82.0	88.9	84.5	92.6	74.9	80.0	95.7	76.7	85.8	117.1	1860.26	88.6
91	1/4 18:00	18	Tuesday	18	19	46.6	46.6	123.1	115.8	52.7	46.6	56.0	247.0	130.1	153.2	134.1	95.8	66.7	98.1	108.6	88.5	94.6	112.7	91.1	99.9	137.2	2145.03	102.1
92	1/4 19:00	18	Tuesday	19	20	54.5	54.5	145.3	133.9	60.1	54.5	66.2	270.1	150.1	179.6	152.5	109.7	83.0	111.6	124.7	102.1	109.2	129.7	105.5	114.1	157.3	2468.25	117.5
93	1/4 20:00	18	Tuesday	20	21	62.5	62.5	167.5	152.1	67.5	62.5	76.3	293.2	170.0	205.9	170.9	123.6	99.2	125.2	140.7	115.7	123.8	146.7	120.0	128.2	177.4	2791.48	132.9
94	1/4 21:00	18	Tuesday	21	22	70.4	70.4	189.8	170.3	74.9	70.4	86.5	316.3	189.9	232.3	189.3	137.4	115.5	138.8	156.7	129.3	138.4	163.7	134.4	142.4	197.4	3114.70	148.3
95	1/4 22:00	18	Tuesday	22	23	78.4	78.4	212.0	188.5	82.3	78.4	96.6	339.4	209.8	258.7	207.7	151.3	131.8	152.3	172.7	142.9	153.0	180.7	148.8	156.6	217.5	3437.92	163.7
96	1/4 23:00	18	Tuesday	23	24	86.4	86.4	234.2	206.7	89.8	86.4	106.7	362.5	229.8	285.1	226.2	165.1	148.0	165.9	188.8	156.5	167.6	197.7	163.3	170.7	237.6	3761.15	179.1
97	1/5 0:00	18	Wednesday	0	1	94.3	94.3	256.4	224.9	97.2	94.3	116.9	385.6	249.7	311.4	244.6	179.0	164.3	179.4	204.8	170.1	182.2	214.7	177.7	184.9	257.7	4084.37	194.5
98	1/5 1:00	19	Wednesday	1	2	102.3	102.3	278.6	243.1	104.6	102.3	127.0	408.7	269.6	337.8	263.0	192.8	180.6	193.0	220.8	183.7	196.8	231.7	192.1	199.0	277.8	4407.59	209.9
99	1/5 2:00	19	Wednesday	2	3	110.2	110.2	300.9	261.3	112.0	110.2	137.2	431.8	289.5	364.2	281.4	206.7	196.9	206.6	236.8	197.3	211.4	248.7	206.6	213.2	297.8	4730.82	225.3
100	1/5 3:00	20	Wednesday	3	4	118.2	118.2	323.1	279.5	119.4	118.2	147.3	454.9	309.5	390.6	299.9	220.5	213.1	220.1	252.9	210.9	226.0	265.7	221.0	227.3	317.9	5054.04	240.7
101	1/5 4:00	19	Wednesday	4	5	126.1	126.1	345.3	297.7	126.8	126.1	157.4	478.0	329.4	416.9	318.3	234.4	229.4	233.7	268.9	224.5	240.6	282.7	235.4	241.5	338.0	5377.26	256.1
102	1/5 5:00	18	Wednesday	5	6	134.1	134.1	320.3	315.9	134.2	134.1	167.6	501.1	343.9	443.3	308.8	248.2	245.7	247.2	284.9	238.1	255.2	299.7	249.9	255.7	348.7	5610.63	267.2
103	1/5 6:00	17	Wednesday	6	7	101.4	101.4	248.2	236.7	90.6	101.4	120.3	493.5	256.4	403.5	215.5	219.9	221.0	236.6	238.4	251.7	203.8	213.8	221.0	212.9	256.0	4644.03	221.1
104	1/5 7:00	20	Wednesday	7	8	67.2	67.2	181.9	163.9	60.6	67.2	77.3	401.9	175.8	351.8	129.7	154.9	145.6	195.7	154.4	207.8	156.6	134.8	171.4	143.8	170.7	3380.39	161.0
105	1/5 8:00	23	Wednesday	8	9	71.4	71.4	115.5	91.0	60.6	71.4	84.9	310.3	104.7	300.2	108.5	132.3	107.8	174.7	125.7	131.2	141.4	113.5	137.6	105.5	113.3	2672.83	127.3
106	1/5 9:00	26	Wednesday	9	10	75.6	75.6	136.4	128.9	60.6	75.6	92.6	218.7	153.4	248.5	159.8	154.0	127.9	182.5	158.8	144.7	160.8	150.5	148.9	136.7	150.0	2940.22	140.0
107	1/5 10:00	26	Wednesday	10	11	79.7	79.7	223.4	192.5	60.6	79.7	100.2	127.1	202.1	196.8	211.0	175.7	148.1	190.2	192.0	165.0	180.1	187.5	160.1	167.8	186.8	3306.22	157.4
108	1/5 11:00	27	Wednesday	11	12	83.9	83.9	310.3	256.1	60.6	83.9	107.8	127.1	250.9	145.2	262.3	197.3	168.2	198.0	225.1	185.3	199.5	224.5	171.4	199.0	223.5	3763.83	179.2
109	1/5 12:00	27	Wednesday	12	13	88.1	88.1	317.2	295.3	60.6	88.1	115.4	148.0	299.6	234.7	313.6	219.0	188.4	205.8	258.3	205.7	218.9	261.5	182.7	230.1	260.2	4278.99	203.8
110	1/5 13:00	26	Wednesday	13	14	92.2	92.2	251.8	213.0	57.4	92.2	123.0	168.8	337.1	310.2	281.9	233.6	208.5	207.6	282.6	218.1	231.6	289.1	188.7	253.5	287.8	4421.24	210.5
111	1/5 14:00	26	Wednesday	14	15	96.4	96.4	186.4	130.6	34.2	96.4	130.7	189.7	251.3	232.6	180.5	169.9	228.7	143.8	209.4	119.7	171.5	214.3	138.0	191.7	215.2	3427.38	163.2
112	1/5 15:00	25	Wednesday	15	16	62.4	62.4	121.0	81.0	40.9	62.4	87.6	210.6	165.5	155.0	102.4	106.2	211.2	80.1	136.2	61.9	111.3	139.4	87.4	129.8	142.6	2357.28	112.3
113	1/5 16:00	24	Wednesday	16	17	32.7	32.7	105.1	97.8	47.6	32.7	44.6	231.4	110.6	118.0	119.1	81.8	156.0	82.5	93.6	74.5	79.2	96.0	72.9	87.3	102.0	1898.19	90.4
114	1/5 17:00	23	Wednesday	17	18	40.5	40.5	125.2	114.5	54.3	40.5	54.1	252.3	129.0	143.1	135.8	94.7	100.9	95.2	108.3	87.2	92.7	111.7	86.5	100.3	121.7	2128.92	101.4
115	1/5 18:00	22	Wednesday	18	19	48.3	48.3	145.3	131.3	60.9	48.3	63.6	273.2	147.3	168.1	152.6	107.5	80.5	107.9	123.1	99.9	106.2	127.4	100.1	113.2	141.4	2394.45	114.0
116	1/5 19:00	21	Wednesday	19	20	56.1	56.1	165.4	148.1	67.6	56.1	73.0	294.0	165.7	193.1	169.3	120.3	95.6	120.6	137.8	112.6	119.8	143.0	113.8	126.2	161.1	2695.42	128.4
117	1/5 20:00	21	Wednesday	20	21	63.9	63.9	185.5	164.9	74.3	63.9	82.5	314.9	184.0	218.1	186.0	133.2	110.7	133.3	152.6	125.2	133.3	158.7	127.4	139.2	180.7	2996.39	142.7
118	1/5 21:00	20	Wednesday	21	22	71.7	71.7	205.6	181.7	81.0	71.7	92.0	335.8	202.4	243.2	202.7	146.0	125.7	146.1	167.4	137.9	146.9	174.4	141.1	152.2	200.4	3297.36	157.0
119	1/5 22:00	20	Wednesday	22	23	79.5	79.5	225.7	198.4	87.7	79.5	101.4	356.7	220.7	268.2	219.4	158.9	140.8	158.8	182.1	150.6	160.4	190.0	154.7	165.1	220.1	3598.33	171.3
120	1/5 23:00	19	Wednesday	23	24	87.3	87.3	245.8	215.2	94.3	87.3	110.9	377.5	239.1	293.2	236.1	171.7	155.9	171.5	196.9	163.3	173.9	205.7	168.3	178.1	239.8	3899.30	185.7
121	1/6 0:00	19	Thursday	0	1	95.1	95.1	265.9	232.0	101.0	95.1	120.4	398.4	257.4	318.3	252.8	184.5	171.0	184.2	211.6	175.9	187.5	221.4	182.0	191.1	259.5	4200.27	200.0
122	1/6 1:00	19	Thursday	1	2	102.9	102.9	286.0	248.8	107.7	102.9	129.9	419.3	275.8	343.3	269.5	197.4	186.0	196.9	226.4	188.6	201.0	237.0	195.6	204.1	279.2	4501.24	214.3
123	1/6 2:00	19	Thursday	2	3	110.7	110.7	306.1	265.6	114.4	110.7	139.3	440.1	294.2	368.3	286.2	210.2	201.1	209.6	241.2	201.3	214.5	252.7	209.2	217.0	298.9	4802.21	228.7
124	1/6 3:00	19	Thursday	3	4	118.5	118.5	326.2	282.3	121.1	118.5	148.8	461.0	312.5	393.4	302.9	223.1	216.2	222.3	255.9	214.0	228.1	268.4	222.9	230.0	318.6	5103.17	243.0
125	1/6 4:00	18	Thursday	4	5	126.3	126.3	346.3	299.1	127.7	126.3	158.3	481.9	330.9	418.4	319.6	235.9	231.3	235.0	270.7	226.6	241.6	284.0	236.5	243.0	338.3	5404.14	257.3
126	1/6 5:00	16	Thursday	5	6	134.1	134.1	320.3	315.9	134.4	134.1	167.7	502.7	343.9	443.4	308.8	248.7	246.4	247.7	285.4	239.3	255.2	299.7	250.1	256.0	348.7	5616.86	267.5
127	1/6 6:00	15	Thursday	6	7	101.4	101.4	248.2	236.7	90.8	101.4	120.5	493.5	256.4	403.6	215.5	219.9	221.0	236.6	238.4	252.0	203.8	213.8	221.0	202.9	256.0	4634.88	220.7
128	1/6 7:00	15	Thursday	7	8	64.3	64.3	176.1	157.5	58.2	64.3	73.3	393.9	168.8	347.4	122.3	149.3	139.1	192.1	147.1	192.7	152.5	128.0	167.1	127.9	163.3	3249.54	154.7
129	1/6 8:00	15	Thursday	8	9	68.9	68.9	104.0	78.3	58.2	68.9	81.5	294.4	91.0	291.3	96.1	124.6	97.8	169.5	114.0	109.4	134.5	102.7	130.5	85.1	100.0	2469.48	117.6
130	1/6 9:00	15	Thursday	9	10	73.5	73.5	122.0	118.2	58.2	73.5	89.6	194.8	142.5	235.2	150.2	147.8	119.5	178.3	149.5	126.7	155.3	141.9	143.2	120.4	139.4	2753.08	131.1
131	1/6 10:00	18	Thursday	10	11	78.0	78.0	214.9	185.6	58.2	78.0	97.8	95.3	194.0	179.0	204.3	171.1	141.2	187.1	185.0	151.6	176.0	181.1	155.9	155.7	178.9	3146.82	149.8
132	1/6 11:00	20	Thursday	11	12	82.6	82.6	307.8	252.9	58.2	82.6	106.0	95.3	245.5	127.4	258.5	194.3	162.9	196.0	220.6	176.5	196.8	220.3	168.6	191.0	218.3	3644.61	173.6
133	1/6 12:00	23	Thursday	12	13	87.2	87.2	314.7	295.3	58.2	87.2	114.2	117.8	297.0	226.1	312.6	217.6	184.6	204.8	256.1	201.4	217.6	259.5	181.3	226.3	257.7	4204.35	200.2
134	1/6 13:00	23	Thursday	13	14	91.7	91.7	249.3	213.0	55.0	91.7	122.3	140.4	337.1	310.2	281.0	233.6	206.3	207.6	282.6	218.1	231.6	289.1	188.7	253.5	287.8	4382.45	208.7
135	1/6 14:00	24	Thursday	14	15	96.3	96.3	183.9	130.6	31.9	96.3	130.5	163.0	251.3	232.6	179.5	169.9	227.9	143.8	209.4	119.7	171.5	214.3	138.0	191.7	215.2	3393.63	161.6
136	1/6 15:00	24	Thursday	15	16	62.4	62.4	118.6	81.0	38.7	62.4	87.5	185.5	165.5	155.0	101.5	106.2	211.2	80.1	136.2	61.9	111.3	139.4	87.4	129.8	142.6	2326.46	110.8
137	1/6 16:00	23	Thursday	16	17	32.7	32.7	102.8	97.8	45.5	32.7	44.5	208.1	110.6	118.0	118.3	81.8	156.0	82.5	93.6	74.5	79.2	96.0	72.9	87.3	102.0	1869.40	89.0
138	1/6 17:00	21	Thursday	17	18	40.5	40.5	123.1	114.5	52.4	40.5	54.0	230.7	129.0	143.1	135.0	94.7	100.9	95.2	108.3	87.2	92.7	111.7	86.5	100.3	121.7	2102.25	100.1
139	1/6 18:00	20	Thursday	18	19	48.3	48.3	143.3	131.3	59.2	48.3	63.4	253.2	147.3	168.1	151.8	107.5	78.2	107.9	123.1	99.9	106.2	127.4	100.1	113.2	141.4	2367.61	112.7
140	1/6 19:00	21	Thursday	19	20	56.1	56.1	163.6	148.1	66.0	56.1	72.9	275.8	165.7	193.1	168.6	120.3	93.5	120.6	137.8	112.6	119.8	143.0	113.8	126.2	161.1	2670.90	127.2
141	1/6 20:00	22	Thursday	20	21	63.9	63.9	183.9	164.9	72.9	63.9	82.4	298.4	184.0	218.1	185.4	133.2	108.8	133.3	152.6	125.2	133.3	158.7	127.4	139.2	180.7	2974.19	141.6
142	1/6 21:00	23	Thursday	21	22	71.7	71.7	204.2	181.7	79.7	71.7	91.9	320.9	202.4	243.2	202.1	146.0	124.0	146.1	167.4	137.9	146.9	174.4	141.1	152.2	200.4	3277.47	156.1
143	1/6 22:00	25	Thursday	22	23	79.5	79.5	224.5	198.4	86.5	79.5	101.4	343.5	220.7	268.2	218.9	158.9	139.3	158.8	182.1	150.6	160.4	190.0	154.7	165.1	220.1	3580.76	170.5
144	1/6 23:00	28	Thursday	23	24	87.3	87.3	244.8	215.2	93.4	87.3	110.8	366.1	239.1	293.2	235.7	171.7	154.6	171.5	196.9	163.3	173.9	205.7	168.3	178.1	239.8	3884.05	185.0
145	1/7 0:00	30	Friday	0	1	95.1	95.1	265.1	232.0	100.2	95.1	120.3	388.6	257.4	318.3	252.4	184.5	169.9	184.2	211.6	175.9	187.5	221.4	182.0	191.1	259.5	4187.34	199.4
146	1/7 1:00	31	Friday	1	2	102.9	102.9	285.4	248.8	107.0	102.9	129.8	411.2	275.8	343.3	269.2	197.4	185.1	196.9	226.4	188.6	201.0	237.0	195.6	204.1	279.2		
147	1/7 2:00	31	Friday	2	3	110.7	110.7	305.7	265.6	113.9	110.7	139.3	433.8	294.2	368.3	286.0	210.2	200.4	209.6	241.2	201.3	214.5	252.7	209.2	217.0	298.9		
148	1/7 3:00	32	Friday	3	4	118.5	118.5	326.0	282.3	120.7	118.5	148.8	456.3	312.5	393.4	302.8	223.1	215.7	222.3	255.9	214.0	228.1	268.4	222.9	230.0	318.6		
149	1/7 4:00	31	Friday	4	5	126.3	126.3	346.3	299.1	127.5	126.3	158.2	478.9	330.9	418.4	319.5	235.9	231.0	235.0	270.7	226.6	241.6	284.0	236.5	243.0	338.3		
150	1/7 5:00	30	Friday	5	6	134.1	134.1	323.2	315.9	134.4	134.1	167.7	501.5	344.3	443.4	310.6	248.7	246.2	247.7	285.4	239.3	255.2	299.7	250.1	256.0	349.3		
151	1/7 6:00	29	Friday	6	7	104.5	104.5	256.9	243.0	94.7	104.5	124.7	495.5	263.7	407.7	224.8	222.7	223.7	238.1	242.6	252.0	207.9	220.7	223.7	207.4	264.0		
152	1/7 7:00	31	Friday	7	8	70.2	70.2	190.5	170.2	64.7	70.2	81.7	403.9	183.1	356.0	139.0	157.8	148.3	197.2	158.7	197.7	160.7	141.7	174.1	138.3	178.8		

Project Name: Letchworth BEB Study

Building: Letchworth CSD

Date: 7/9/2024

Description Remaining Charge (kWh) in the Battery with Demand Reduction

Hour Number	Timestamp	Outside dry-bulb temp (F)	Day of the Week	Hours (0-23)	Hours (1-24)	20 - Ghost Run	34 - Ghost Run	36	37	38	39 - Ghost Run	59 - Ghost Run	62 - Contracted Route	73	75	76	78	80	81	82	86	87	88	89	90	91	Total (All Buses)	Average Battery Charge
153	1/7 8:00	33	Friday	8	9	74.0	74.0	124.2	97.3	64.7	74.0	88.7	312.3	112.0	304.4	117.8	134.9	110.3	176.1	129.9	121.1	145.5	120.3	140.2	100.1	121.3		
154	1/7 9:00	35	Friday	9	10	77.7	77.7	145.0	133.9	64.7	77.7	95.7	220.7	159.2	252.7	166.9	156.0	130.1	183.6	162.2	136.5	164.0	155.9	151.0	132.3	156.4		
155	1/7 10:00	34	Friday	10	11	81.5	81.5	228.4	195.7	64.7	81.5	102.7	129.1	206.5	201.1	216.1	177.2	149.9	191.0	194.5	158.9	182.6	191.5	161.7	164.6	191.5		
156	1/7 11:00	34	Friday	11	12	85.3	85.3	311.8	257.5	64.7	85.3	109.8	129.1	253.7	149.4	265.2	198.3	169.6	198.5	226.8	181.3	201.1	227.1	172.4	196.8	226.6		
157	1/7 12:00	33	Friday	12	13	89.0	89.0	322.0	296.5	64.7	89.0	116.8	135.1	301.0	236.7	314.3	219.5	189.4	206.0	259.1	203.7	219.6	262.7	183.1	229.1	261.7		
158	1/7 13:00	32	Friday	13	14	92.8	92.8	262.3	221.3	61.8	92.8	123.8	141.1	337.7	310.8	288.5	234.0	209.1	208.0	283.1	218.6	232.0	289.7	189.1	254.0	288.4		
159	1/7 14:00	31	Friday	14	15	96.5	96.5	202.6	146.1	40.6	96.5	130.8	147.1	259.4	239.9	195.9	175.9	228.9	149.8	216.3	128.8	177.1	221.3	142.8	197.5	222.0		
160	1/7 15:00	30	Friday	15	16	65.4	65.4	142.9	100.8	43.0	65.4	92.0	153.1	181.0	169.1	124.6	117.7	213.6	91.6	149.4	76.1	122.2	153.0	96.5	141.0	155.7		
161	1/7 16:00	29	Friday	16	17	35.8	35.8	126.0	112.8	45.4	35.8	49.0	159.1	125.8	131.7	136.6	92.9	158.4	93.4	106.5	82.1	89.8	109.2	81.7	98.5	114.8		
162	1/7 17:00	29	Friday	17	18	38.2	38.2	138.0	124.8	47.8	38.2	51.4	165.1	137.8	147.2	148.6	98.9	103.3	99.4	112.5	88.1	95.8	115.2	87.7	104.5	120.8		
163	1/7 18:00	28	Friday	18	19	40.6	40.6	150.0	136.8	50.2	40.6	53.8	171.1	149.8	162.6	160.6	104.9	82.8	105.4	118.5	94.1	101.8	121.2	93.7	110.5	126.8		
164	1/7 19:00	26	Friday	19	20	43.0	43.0	162.0	148.8	52.6	43.0	56.2	177.1	161.8	178.1	172.6	110.9	88.8	111.4	124.5	100.1	107.8	127.2	99.7	116.5	132.8		
165	1/7 20:00	25	Friday	20	21	45.4	45.4	174.0	160.8	55.0	45.4	58.6	183.1	173.8	193.6	184.6	116.9	94.8	117.4	130.5	106.1	113.8	133.2	105.7	122.5	138.8		
166	1/7 21:00	23	Friday	21	22	47.8	47.8	186.0	172.8	57.4	47.8	61.0	189.1	185.8	209.1	196.6	122.9	100.8	123.4	136.5	112.1	119.8	139.2	111.7	128.5	144.8		
167	1/7 22:00	23	Friday	22	23	50.2	50.2	198.0	184.8	59.8	50.2	63.4	195.1	197.8	224.6	208.6	128.9	106.8	129.4	142.5	118.1	125.8	145.2	117.7	134.5	150.8		
168	1/7 23:00	23	Friday	23	24	52.6	52.6	210.0	196.8	62.2	52.6	65.8	201.1	209.8	240.1	220.6	134.9	112.8	135.4	148.5	124.1	131.8	151.2	123.7	140.5	156.8		

wendel

Project Name: Letchworth BEB Study
Building: Letchworth CSD
Date: 7/9/2024
Description Charge Delivered From the Utility Grid (kW) with Demand Reduction

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wendel

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Letchworth CSD Anticipated Battery Electric Bus Procurement by Year

	Existing	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Total
BEB Bus Procurement Schedule	0	0	0	0	0	0	3	2	4	5	1	3	1	6	25
168 kWh BEB	0	0	0	0	0	0	0	0	0	1	1	1	0	1	4
Cumulative 168 kWh BEBs	0	0	0	0	0	0	0	0	0	1	2	3	3	4	
210 kWh BEB	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Cumulative 210 kWh BEBs	0	0	0	0	0	0	0	0	0	1	1	1	1	1	
315 kWh BEB	0	0	0	0	0	0	3	2	2	2	0	0	1	0	10
Cumulative 315 kWh BEBs	0	0	0	0	0	0	3	5	7	9	9	9	10	10	
Placeholder	0	0	0	0	0	0	0	0	2	1	0	2	0	5	10
Cumulative Placeholder BEBs	0	0	0	0	0	0	0	0	2	3	3	5	5	10	
Total Battery Electric Bus Fleet Size	0	0	0	0	0	0	3	5	9	14	15	18	19	25	25

Current Fleet Size	25
New Proposed Buses	0
Proposed Fleet Size	25

*Placeholder BEB represent buses with no current possible BEB replacements based on today's technology. The development of larger battery capacities may be possible in the future.

Letchworth CSD Anticipated EV Charger Procurement by Year

	Existing	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Total
BEB Charger Procurement Schedule	0	0	0	0	0	0	3	2	4	5	1	3	0	6	24
24 kW EV Charger	0	0	0	0	0	0	0	0	0	3	1	1	0	1	6
Cumulative 24 kW Chargers	0	0	0	0	0	0	0	0	0	3	4	5	5	6	
60 kW EV Charger	0	0	0	0	0	0	2	2	4	2	0	0	0	2	12
Cumulative 60 kW Chargers	0	0	0	0	0	0	2	4	8	10	10	10	10	12	
120 kW EV Charger	0	0	0	0	0	0	1	0	0	0	0	1	0	3	5
Cumulative 120 kW Chargers	0	0	0	0	0	0	1	1	1	1	1	2	2	5	
155 kW EV Charger	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Cumulative 154.896029900314 kW Chargers	0	0	0	0	0	0	0	0	0	0	0	1	1	1	
Total BEB Chargers	0	0	0	0	0	0	3	5	9	14	15	18	18	24	24

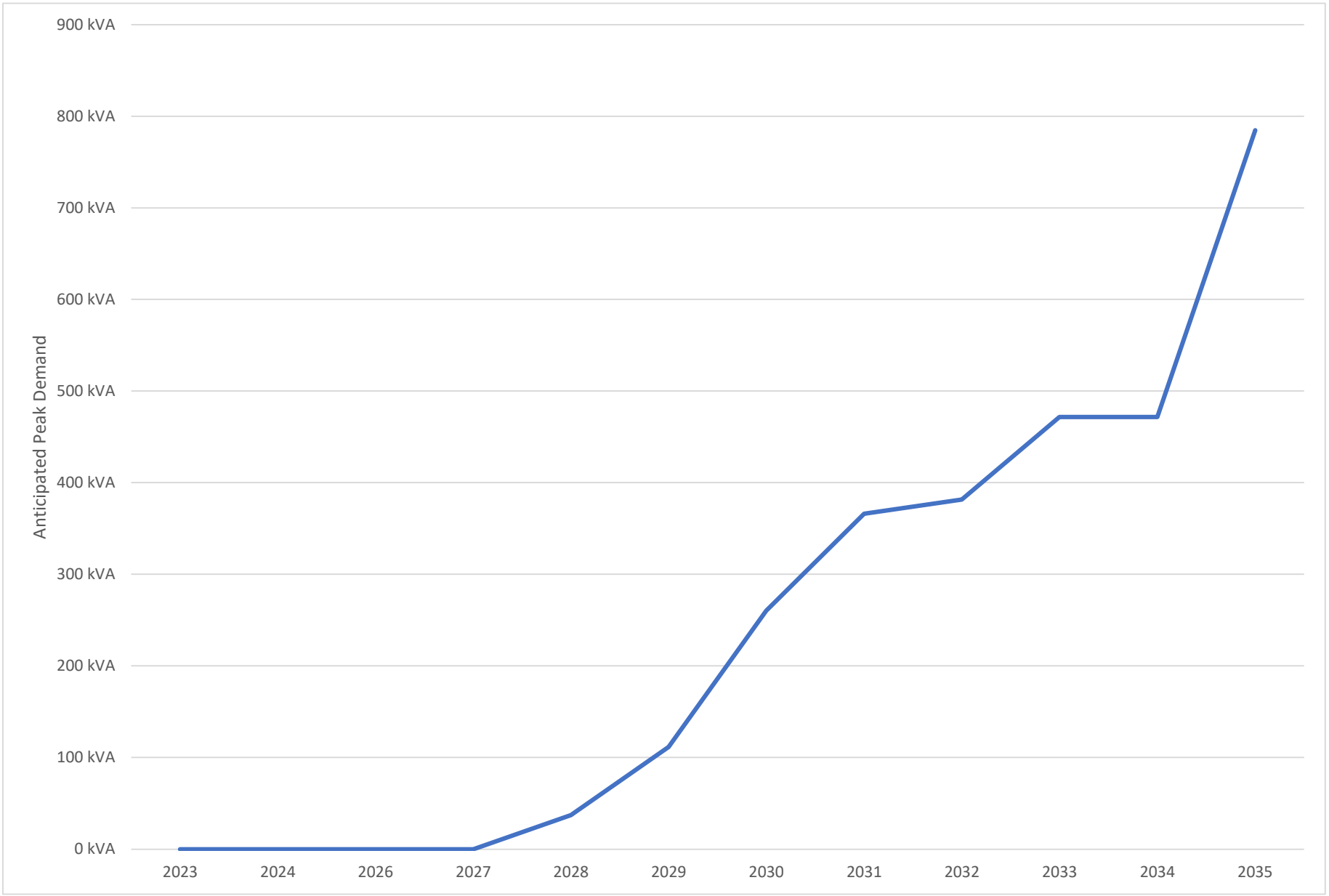
Current BEB Chargers	0
Proposed BEB Chargers	24

Note that 10 of the proposed 120 kW chargers are associated with placeholder BEBs. Actual charger size required may vary based on BEB size procured.

Letchworth CSD Anticipated Load Growth by Year

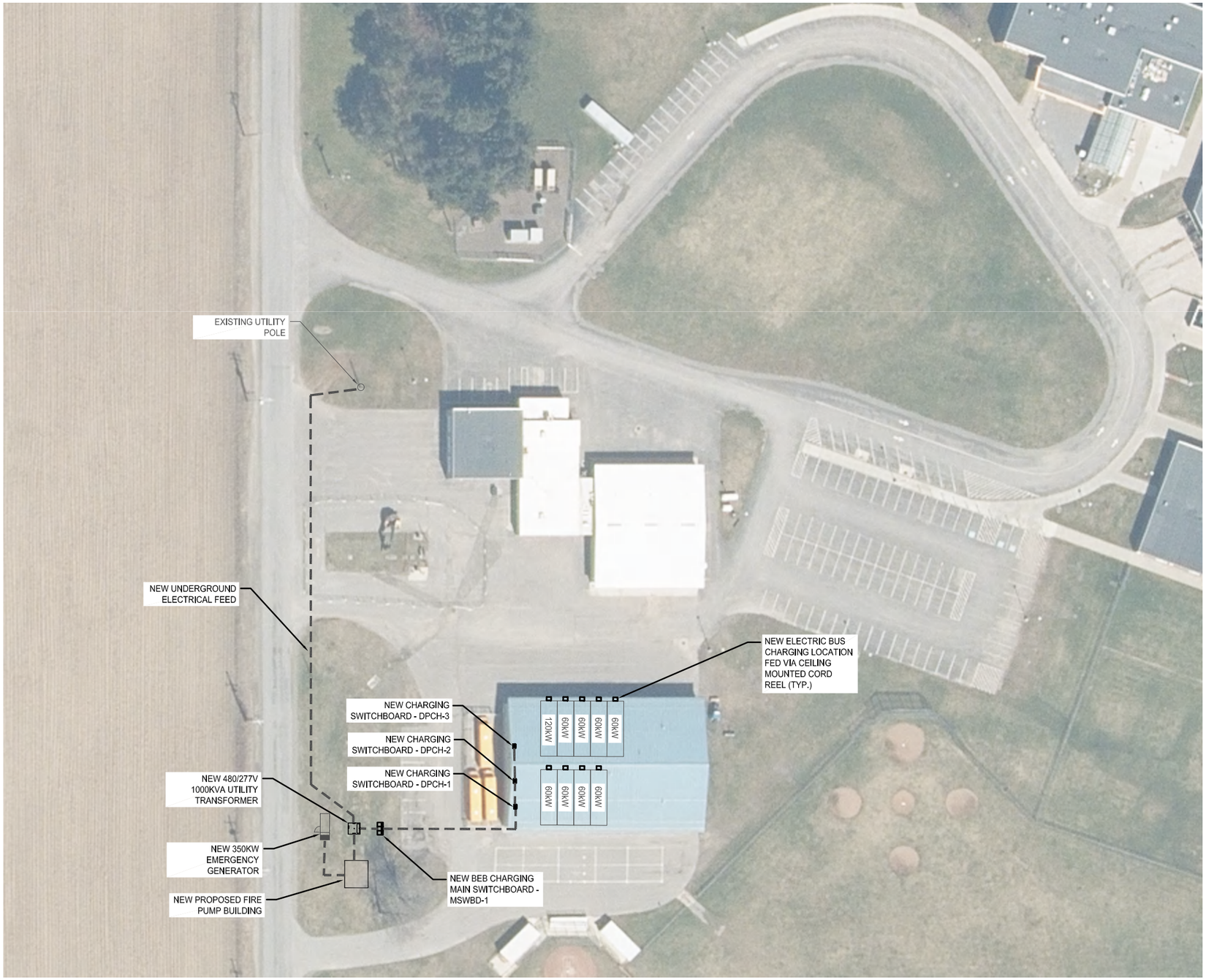
	Proposed	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
BEB Bus Additions														
Projected BEB's added per year	25	0	0	0	0	0	3	2	4	5	1	3	1	6
Cumulative 168 kWh BEBs	4	0	0	0	0	0	0	0	0	1	2	3	3	4
Cumulative 210 kWh BEBs	1	0	0	0	0	0	0	0	0	1	1	1	1	1
Cumulative 315 kWh BEBs	10	0	0	0	0	0	3	5	7	9	9	9	10	10
Cumulative Placeholder BEBs	10	0	0	0	0	0	0	0	2	3	3	5	5	10
Cumulative 0 kWh BEBs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumualtive BEB's	25	0	0	0	0	0	3	5	9	14	15	18	19	25
24 kW EV Charger	6	0	0	0	0	0	0	0	0	3	1	1	0	1
Procured Route Bus Chargers		0	0	0	0	0	0	0	0	2	1	1	0	1
Procured Spare Bus Chargers		0	0	0	0	0	0	0	0	1	0	0	0	0
Cumulative Total Chargers		0	0	0	0	0	0	0	0	3	4	5	5	6
Cumulative Route Bus Chargers		0	0	0	0	0	0	0	0	2	3	4	4	5
Fully Connected Charger Load		0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	80 kVA	106 kVA	133 kVA	133 kVA	160 kVA
Anticipated Overnight Charger Load		0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	22 kVA	30 kVA	37 kVA	37 kVA	45 kVA
Anticipated Mid-day Charger Load	27 kVA	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**31 kVA**	**47 kVA**	**63 kVA**	**63 kVA**	**78 kVA**
60 kW EV Charger	12	0	0	0	0	0	2	2	4	2	0	0	0	2
Procured Route Bus Chargers		0	0	0	0	0	1	2	4	2	0	0	0	2
Procured Spare Bus Chargers		0	0	0	0	0	1	0	0	0	0	0	0	0
Cumulative Total Chargers		0	0	0	0	0	2	4	8	10	10	10	10	12
Cumulative Route Bus Chargers		0	0	0	0	0	1	3	7	9	9	9	9	11
Fully Connected Charger Load		0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	126 kVA	252 kVA	504 kVA	630 kVA	630 kVA	630 kVA	630 kVA	756 kVA
Anticipated Overnight Charger Load		0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	35 kVA	71 kVA	142 kVA	177 kVA	177 kVA	177 kVA	177 kVA	213 kVA
Anticipated Mid-day Charger Load	63 kVA	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**37 kVA**	**112 kVA**	**260 kVA**	**335 kVA**	**335 kVA**	**335 kVA**	**335 kVA**	**409 kVA**
120 kW EV Charger	5	0	0	0	0	0	1	0	0	0	0	1	0	3
Procured Route Bus Chargers		0	0	0	0	0	0	0	0	0	0	1	0	3
Procured Spare Bus Chargers		0	0	0	0	0	1	0	0	0	0	0	0	0
Cumulative Total Chargers		0	0	0	0	0	1	1	1	1	1	2	2	5
Cumulative Route Bus Chargers		0	0	0	0	0	0	0	0	0	0	1	1	4
Fully Connected Charger Load		0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	126 kVA	126 kVA	126 kVA	126 kVA	126 kVA	252 kVA	252 kVA	630 kVA
Anticipated Overnight Charger Load		0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	35 kVA	35 kVA	35 kVA	35 kVA	35 kVA	71 kVA	71 kVA	177 kVA
Anticipated Mid-day Charger Load	126 kVA	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**74 kVA**	**74 kVA**	**297 kVA**
155 kW EV Charger	1	0	0	0	0	0	0	0	0	0	0	1	0	0
Procured Route Bus Chargers		0	0	0	0	0	0	0	0	0	0	1	0	0
Procured Spare Bus Chargers		0	0	0	0	0	0	0	0	0	0	0	0	0
Cumulative Total Chargers		0	0	0	0	0	0	0	0	0	0	1	1	1
Cumulative Route Bus Chargers		0	0	0	0	0	0	0	0	0	0	1	1	1
Fully Connected Charger Load		0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA
Anticipated Overnight Charger Load		0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	0 kVA
Anticipated Mid-day Charger Load	0 kVA	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**
Total Fully Connected Load		0 kVA	0 kVA	0 kVA	0 kVA	0 kVA	252 kVA	378 kVA	630 kVA	836 kVA	862 kVA	1,015 kVA	1,015 kVA	1,546 kVA
Total Anticipated Overnight Peak Charger Load		**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**71 kVA**	**106 kVA**	**177 kVA**	**235 kVA**	**243 kVA**	**286 kVA**	**286 kVA**	**435 kVA**
Total Anticipated Mid-day Peak Charger Load	24 Chgrs	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**0 kVA**	**37 kVA**	**112 kVA**	**260 kVA**	**366 kVA**	**382 kVA**	**472 kVA**	**472 kVA**	**785 kVA**

1. Anticipated Charger Loads assume a Load Factor of 54% based on results of charging model with demand reduction implemented.
2. Anticipated Charger Loads dos not include the charging of spare buses which are assumed to charge outside of peak hours.
3. Anticipated Charger Loads include a Safety Factor of 10%


900 kVA
800 kVA
700 kVA
600 kVA
500 kVA
400 kVA
300 kVA
200 kVA
100 kVA
0 kVA
Anticipated Peak Demand
2023
2024
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035

Appendix C - Concept Development & Phasing Plan Drawings

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CHARGER QUANTITY

24kW PLUG-IN	0
60kW PLUG-IN	8
120kW PLUG-IN	1
155kW PLUG-IN	-
-	-
TOTAL AFTER PHASE 1	9

CHARGER FEEDERS

50A UNDERGROUND FEEDER, FOR EACH 24kW CHARGER

100A UNDERGROUND FEEDER, FOR EACH 60kW CHARGER

200A UNDERGROUND FEEDER, FOR EACH 120kW CHARGER

300A UNDERGROUND FEEDER, FOR EACH 155kW CHARGER

1 SITE PLAN LAYOUT - PHASE 1 (2028-2030)

SCALE: 1"=80'-0"

CONCEPTUAL - NOT FOR CONSTRUCTION

wendel

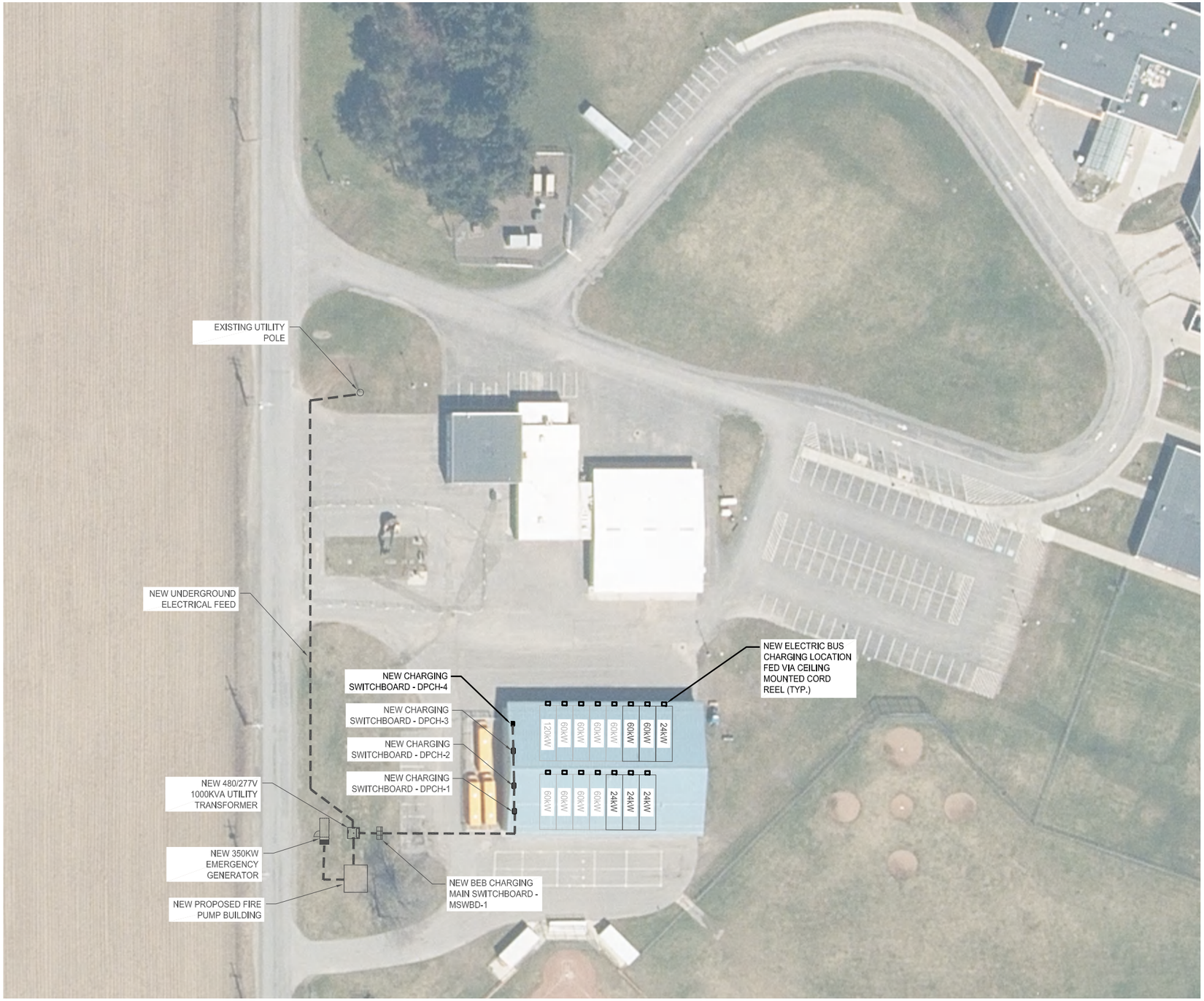
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LETCHWORTH CENTRAL SCHOOL DISTRICT

Charging Equipment Layout - Phase 1

Proj. No.	630801
Date	06/10/2024
Drawing Number	E1

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CHARGER QUANTITY

PHASE 1	24kW PLUG-IN	0
	60kW PLUG-IN	8
	120kW PLUG-IN	1
	155kW PLUG-IN	-
	-	-
PHASE 2	24kW PLUG-IN	4
	60kW PLUG-IN	2
	120kW PLUG-IN	0
	155kW PLUG-IN	-
	-	-
	TOTAL AFTER PHASE 2	15

CHARGER FEEDERS

- 50A UNDERGROUND FEEDER, FOR EACH 24kW CHARGER
- 100A UNDERGROUND FEEDER, FOR EACH 60kW CHARGER
- 200A UNDERGROUND FEEDER, FOR EACH 120kW CHARGER
- 300A UNDERGROUND FEEDER, FOR EACH 155kW CHARGER

1 SITE PLAN LAYOUT - PHASE 2 (2031-2032)

SCALE: 1"=80'-0"

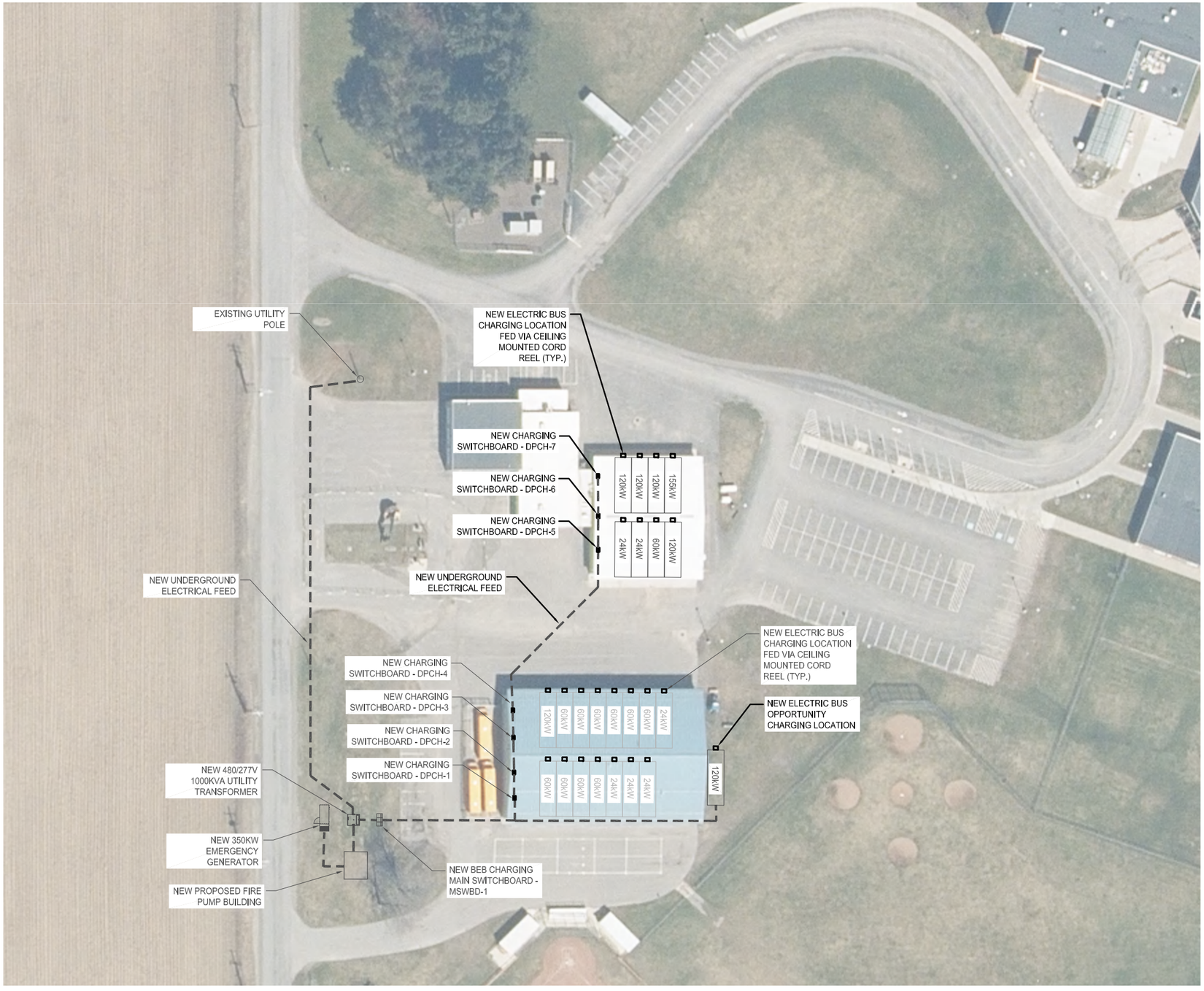
CONCEPTUAL - NOT FOR CONSTRUCTION

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LETCHWORTH CENTRAL SCHOOL DISTRICT
Charging Equipment Layout - Phase 1

Proj. No.	630801
Date	06/10/2024
Drawing Number	E2

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CHARGER QUANTITY

PHASE 1	24kW PLUG-IN	0
	60kW PLUG-IN	8
	120kW PLUG-IN	1
	155kW PLUG-IN	-
	-	-
PHASE 2	24kW PLUG-IN	4
	60kW PLUG-IN	2
	120kW PLUG-IN	0
	155kW PLUG-IN	-
	-	-
PHASE 3	24kW PLUG-IN	2
	60kW PLUG-IN	2
	120kW PLUG-IN	4
	155kW PLUG-IN	1
	-	-
	TOTAL AFTER PHASE 3	24

CHARGER FEEDERS

- 50A UNDERGROUND FEEDER, FOR EACH 24kW CHARGER
- 100A UNDERGROUND FEEDER, FOR EACH 60kW CHARGER
- 200A UNDERGROUND FEEDER, FOR EACH 120kW CHARGER
- 300A UNDERGROUND FEEDER, FOR EACH 155kW CHARGER

1 SITE PLAN LAYOUT - PHASE 3 (2033-2035)

SCALE: 1"=80'-0"

CONCEPTUAL - NOT FOR CONSTRUCTION

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LETCHWORTH CENTRAL SCHOOL DISTRICT
Charging Equipment Layout - Phase 1

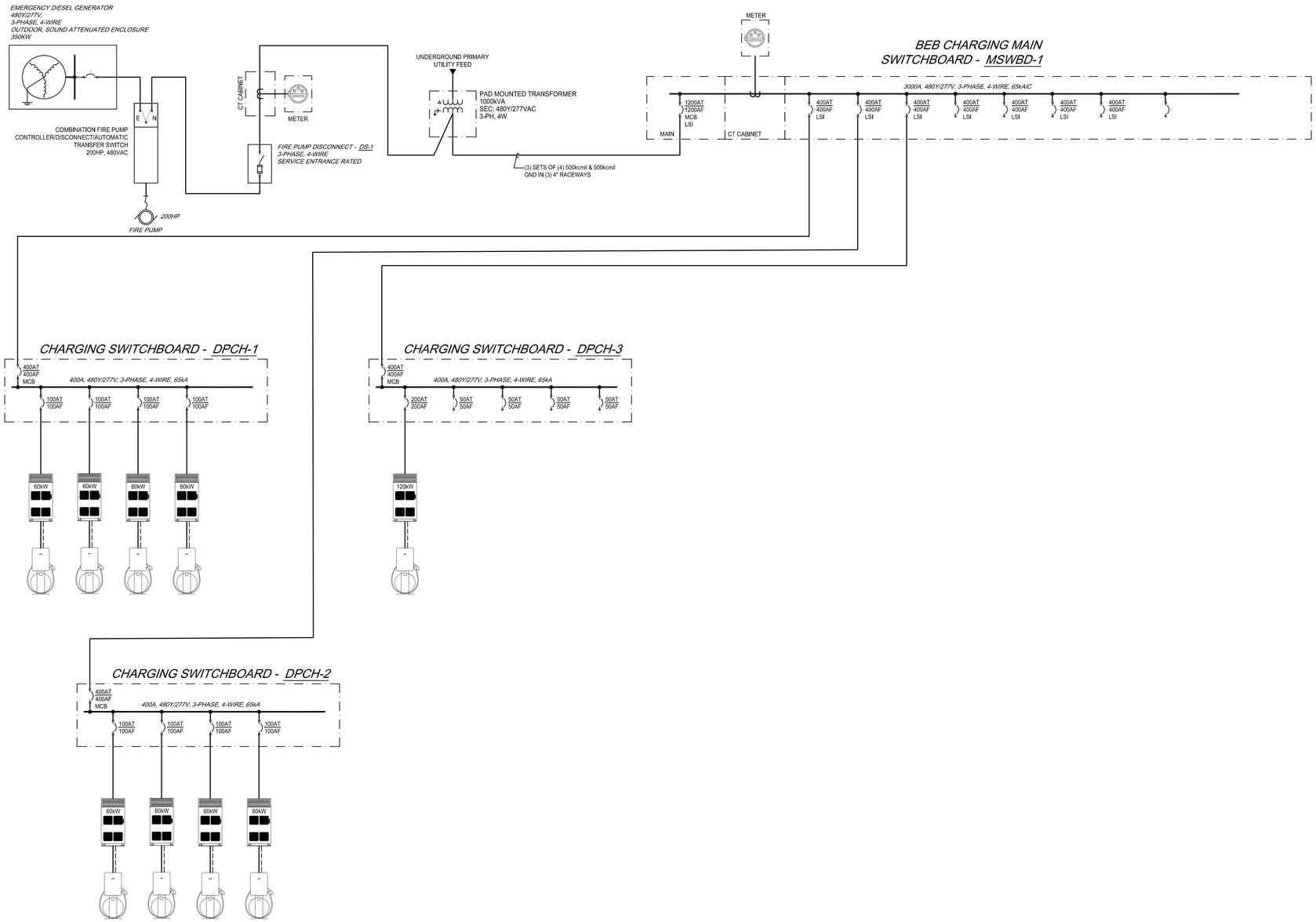
Proj. No.	630801
Date	06/10/2024
Drawing Number	E3

CHARGER QUANTITY

24kW PLUG-IN	0
60kW PLUG-IN	8
120kW PLUG-IN	1
155kW PLUG-IN	-
-	-
TOTAL AFTER PHASE 1	9

CHARGER FEEDERS

50A UNDERGROUND FEEDER, FOR EACH 24kW CHARGER
100A UNDERGROUND FEEDER, FOR EACH 60kW CHARGER
200A UNDERGROUND FEEDER, FOR EACH 120kW CHARGER
300A UNDERGROUND FEEDER, FOR EACH 155kW CHARGER



1 BUS CHARGING SINGLE LINE DIAGRAM - PHASE 1 (2028-2030)
SCALE: NONE

CONCEPTUAL - NOT FOR CONSTRUCTION

LETCHWORTH CENTRAL SCHOOL DISTRICT

wendel
Centerpointe Corporate Park
375 Essjay Road, Suite 200
Williamsville, NY 14221
www.wendelcompanies.com
p:716.688.0766 f:716.625.6825
WENDEL ENGINEERING P.C.

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NO.	REVISIONS	DATE

DWG. TITLE

PHASE 1
BUS CHARGING SYSTEM
SINGLE LINE DIAGRAM

0 1" 2"
GENERIC SCALE BAR
SCALE BAR SHOWN IS TWO INCHES ON THE ORIGINAL DRAWING. IF NOT TWO INCHES ON THIS SHEET, ADJUST ACCORDINGLY

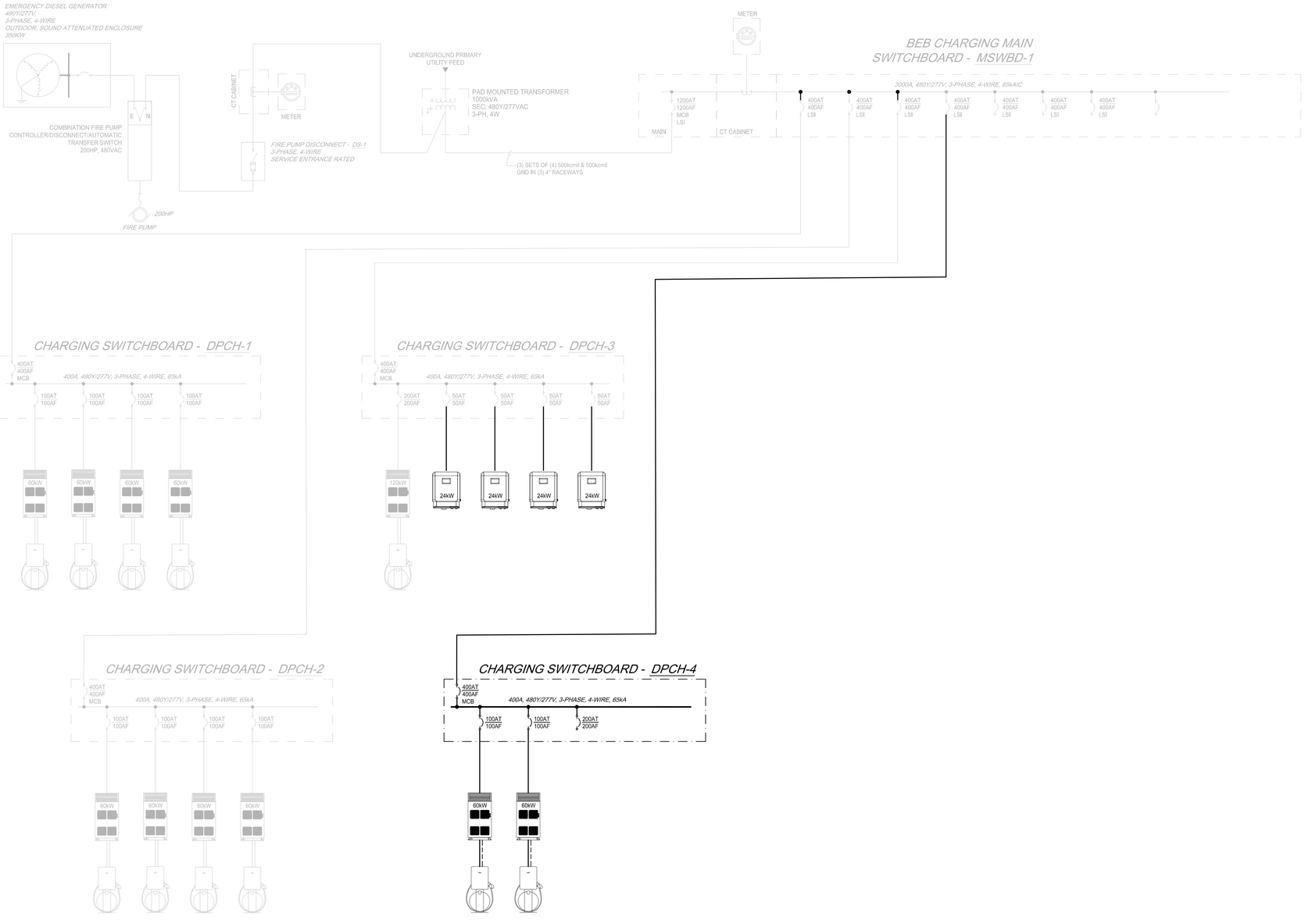
DATE	07-26-2024
SCALE	AS NOTED
DWN.	MSH
CHK.	JFW
PROJ. No.	632101
DWG. No.	E4

CHARGER QUANTITY

PHASE 1	24kW PLUG-IN	0
	60kW PLUG-IN	8
	120kW PLUG-IN	1
	155kW PLUG-IN	-
	-	-
PHASE 2	24kW PLUG-IN	4
	60kW PLUG-IN	2
	120kW PLUG-IN	0
	155kW PLUG-IN	-
	-	-
	TOTAL AFTER PHASE 2	15

CHARGER FEEDERS

- 50A UNDERGROUND FEEDER, FOR EACH 24kW CHARGER
- 100A UNDERGROUND FEEDER, FOR EACH 60kW CHARGER
- 200A UNDERGROUND FEEDER, FOR EACH 120kW CHARGER
- 300A UNDERGROUND FEEDER, FOR EACH 155kW CHARGER



1 BUS CHARGING SINGLE LINE DIAGRAM - PHASE 2 (2031-2032)
SCALE: NONE

CONCEPTUAL - NOT FOR CONSTRUCTION

LETCHWORTH CENTRAL SCHOOL DISTRICT

wendel
Centerpointe Corporate Park
375 Essjay Road, Suite 200
Williamsville, NY 14221
www.wendelcompanies.com
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NO.	REVISIONS	DATE

DWG. TITLE

PHASE 2
BUS CHARGING SYSTEM
SINGLE LINE DIAGRAM

0 1" 2"
GENERIC SCALE BAR
SCALE BAR SHOWN IS TWO INCHES ON THE ORIGINAL DRAWING. IF NOT TWO INCHES ON THIS SHEET, ADJUST ACCORDINGLY.

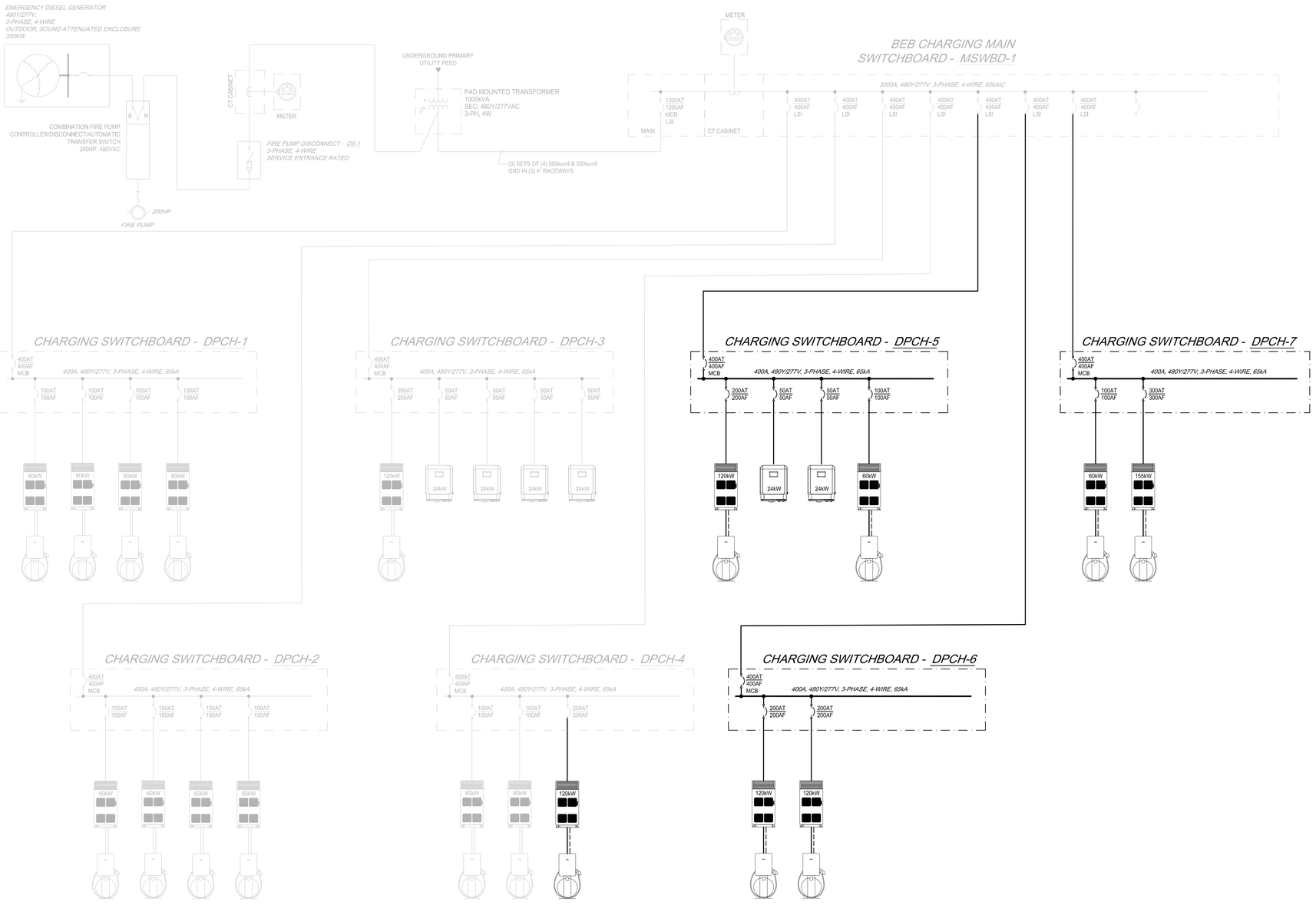
DATE	07-26-2024
SCALE	AS NOTED
DWN.	CHK.
PROJ. No.	632101
DWG. No.	E5

CHARGER QUANTITY

PHASE 1	24kW PLUG-IN	0
	60kW PLUG-IN	8
	120kW PLUG-IN	1
	155kW PLUG-IN	-
	-	-
PHASE 2	24kW PLUG-IN	4
	60kW PLUG-IN	2
	120kW PLUG-IN	0
	155kW PLUG-IN	-
	-	-
PHASE 3	24kW PLUG-IN	2
	60kW PLUG-IN	2
	120kW PLUG-IN	4
	155kW PLUG-IN	1
	-	-
	TOTAL AFTER PHASE 3	24

CHARGER FEEDERS

50A UNDERGROUND FEEDER, FOR EACH 24kW CHARGER
100A UNDERGROUND FEEDER, FOR EACH 60kW CHARGER
200A UNDERGROUND FEEDER, FOR EACH 120kW CHARGER
300A UNDERGROUND FEEDER, FOR EACH 155kW CHARGER



1 BUS CHARGING SINGLE LINE DIAGRAM - PHASE 3 (2033-2035)
SCALE: NONE

CONCEPTUAL - NOT FOR CONSTRUCTION

LETCHWORTH CENTRAL SCHOOL DISTRICT

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NO.	REVISIONS	DATE

DWG. TITLE

PHASE 3
BUS CHARGING SYSTEM
SINGLE LINE DIAGRAM

0 1" 2"
GENERIC SCALE BAR
SCALE BAR SHOWN IS TWO INCHES ON THE ORIGINAL DRAWING.
IF NOT TWO INCHES ON THIS SHEET, ADJUST ACCORDINGLY.

DATE	07-26-2024
SCALE	AS NOTED
DWN.	CHK.
PROJ. No.	632101
DWG. No.	E6

Appendix D - Original Scope of Work

EXHIBIT A-1: SCOPE OF WORK, SCHEDULE & BUDGET Agreement No. 120138
(For FlexTech Consultants: Task Work Order ID: 221635)
Flexible Technical Assistance

Genesee Valley BOCES

PROJECT DESCRIPTION

Goal of the Study

Genesee Valley BOCES is interested in utilizing NYSERDA's Flexible Technical (FlexTech) Assistance Program to evaluate the impact of a transition to zero emission school buses for the districts they support.

- Alexander Central School District
- Attica Central School District
- Avon Central School District
- Caledonia – Mumford Central School District
- Elba Central School District
- Genesee Valley BOCES
- Geneseo Central School District
- LeRoy Central School District
- Letchworth Central School District
- Livonia Central School District
- Oakfield – Alabama Central School District
- Pavilion Central School District
- Pembroke Central School District
- Perry Central School District
- Warsaw Central School District
- Wyoming Central School District
- York Central School District

Genesee Valley BOCES has been observing the nationwide transition to battery electric vehicles, and more recently has been reviewing New York State's requirements for the transition of school bus fleets to zero emission vehicles by 2035. The districts are interested in developing a transition plan that provides a path towards a zero-emission bus fleet by 2035.

Consultant Information

The districts seek to utilize the services of Wendel Energy Services, LLC, hereafter referred to as "the applicant," a long tenured NYSERDA Program Consultant. Wendel's contact information is as follows:

Wendel Energy Services, LLC
375 Essjay Road, Suite 200

Centerpointe Corporate Park
Williamsville, New York 14221

Wendel's NYSERDA Program Manager; Keith L. Krug, CEM kkrug@wendelcompanies.com

District and Facility Description & Utility Information

Genesee Valley BOCES serves 22 school districts in the Genesee, Livingston, Steuben and Wyoming counties and encompasses 1,800 square miles. It provides public educational services to 24,000 students. The following participating Districts are designated as an average-need school districts by the New York State Education Department.

District	Bus Fleet	Annual Utility Costs	SBC
Alexander Central School District	15	Electricity: $140,356 Gas: $73,194	yes
Attica Central School District	25	Electricity: $238,799 Gas: $96,651	yes
Avon Central School District	14	Total Energy Costs: 128,531	yes
Caledonia – Mumford Central School District	22	Electricity: $215,766 Gas: $56,192	yes
Elba Central School District	11	Electricity: $105,000 Gas: $85,000	yes
Genesee Valley BOCES	2	Electricity: $216,621 Gas: $305,350	yes
Geneseo Central School District	19	Electricity: $232,418 Gas: $101,033	yes
LeRoy Central School District	22	Electricity: $226,612 Gas: $189,069	no
Letchworth Central School District	38	Electricity: $150,384 Gas: $78,577	yes
Livonia Central School District	36	Electricity: $327,971 Gas: $129,218	yes
Oakfield – Alabama Central School District	19	Electricity: $142,009 Gas: $40,213	yes
Pavilion Central School District	18	Electricity: $146,600 Gas: $71,544	yes
Pembroke Central School District	28	Electricity: $169,795 Gas: $109,503	yes
Perry Central School District	16	Electricity: $163,785 Gas: $113,041	yes
Warsaw Central School District	9	Electricity: $9,000 Gas: $116,000	yes
Wyoming Central School District	8	Electricity: $335,00 Gas: $15,180	yes
York Central School District	22	Electricity: $129,120 Gas: $12,673	yes

Based on discussions between the District and Wendel personnel, the following will be evaluated to determine the transition to a zero-emission vehicle plan.

PROJECT TASKS

The steps necessary to develop a zero-emission transition plan for the school bus fleet are listed below:

Task 1–Project Kickoff and Status Meetings

- Kickoff with the District, NYSERDA, and Wendel
- Wendel assumes to meet on site one time for the kickoff and the site survey
- All other meetings will be virtual
- Deliverables for this task will be meeting minutes

Task 2 – Existing Conditions Review

Existing Infrastructure & Data Collection

Wendel will analyze the following elements of existing assets and properties belonging to the districts that could potentially impact future electric bus charging, maintenance, operating and educational activities. The purpose of this review is to establish a baseline understanding of the current conditions from which upgrade/modification recommendations can be developed.

- **Bus fleet information** – Fleet size (current and projected), bus replacement plan/schedule, bus types/size.
- **Bus schedules and route data** – Detailed bus routes, departure and return times, operational hours, mileage, fuel consumption, operational contingency/resiliency plans.
    - Data should be provided in excel spreadsheet format with clear start and finish times, associated distances, and vehicle identifiers for each route.
- **Bus parking/storage arrangements** – Indoor/Outdoor, location
- **Fueling –** current operational requirements for fueling
- **Utility Data** – Name of local utility and contact, existing service size (kVA), voltage and capacity, Make-Ready Program information
- **Existing School Electrical Distribution information** – existing capacity, condition, expansion capability. Any as-built electrical site drawings (one-line distribution drawings) The existing internal electrical distribution system would be reviewed to determine the existing systems ability to handle additional load and to determine where new distribution equipment may be located, including new transformers, switchgear, and panelboards.
- **Existing Site Plan** – CAD file of overall site plan to determine space availability and space programming.

The schedule and fee are dependent on the data format, quality, and accuracy of documentation received from the client.

The deliverable for this task is a memo.

Task 3 – Existing Route Energy Analysis

Wendel will analyze the available bus route data for each route to determine the time and distance required for a bus to complete the route. Fuel consumption data from the existing diesel fleet will also be incorporated into the analysis. This analysis along with assumptions from previous studies will be used to develop high level anticipated energy requirements per route. Wendel to determine the basis of design for buses and chargers, minimum battery size requirements, number of chargers, charging requirements, and charging durations necessary.

Wendel will develop a conceptual charging strategy for the fleet utilizing assumptions derived from previous studies of battery electric buses. The charging strategy will be developed based on the smallest available battery size that meets the districts route needs. The charging strategy will identify the following items:

1. Anticipated peak demand during both on-peak and off-peak utility periods
2. Proposed charging profile for all buses on an hour-by-hour basis.
3. Overall Energy impact of implementing Battery Electric Buses:
    - Gallons of diesel saved
    - Additional kWh utilized
    - Overall Metric Tons of CO2 saved

Anticipated deliverables for Task 3 would be:

An Existing Conditions Assessment Reporting documenting all findings from the infrastructure and documentation review and the Existing Route Energy analysis.

Task 4 - Transition Planning

Future System Concept, Phasing Approach & Costing

Once loads are identified, meetings with the local utility will be scheduled to discuss options to support the necessary loads, overall costs of the utility upgrade and responsibility of the costs.

Based upon the developed energy requirements and charging strategy, Wendel will work with the local utility to determine the charging load profile, power demand and options for obtaining the power from the utility. Wendel will work with the utility and their Make-Ready Program to develop site requirements. Items included in this analysis include:

1. Utility's ability to supply the required power for bus charging
2. Preferred utility power interface:
    a. Upgrade existing service to supply all needs
    b. Provide a new service for just the bus charging requirements
    c. Reliability of bus charging service feed
    d. Potential off-site back-up options for the bus charging, including a second feed from a different substation - Redundancy options and reliability data would be reviewed to determine the reliability of the new feeds that may be necessary for fleet electrification.

The future system concept will address the following major capital and operational topics:

1. Infrastructure and asset recommendations:
    - battery electric vehicle types and quantities

    - vehicle charger quantities, power levels and placement/layout
    - vehicle maintenance bay equipment (lifts) quantities and placement/layout
    - electrical distribution infrastructure upgrades
2. Operational recommendations:
    - Conceptual school transportation routings and stop timings
    - vehicle dispatching and parking/layover locations
    - charging session timings accounting for regular maintenance activities

Working with the school district, Wendel will develop a conceptual plan for one site per participating district for the electrification of the fleet over time. This will be a phased approach based on available funding cycles, fleet replacement schedules, utility system build out schedules, and internal distribution system build out schedules. Phasing to allow for growth in infrastructure without replacing previous phase investments would be one of the goals of the phasing plan.

The concept plan will include the following items:

1. Preferred utility interface equipment (transformers, incoming switchgear, etc.)
2. On-site distribution equipment including distribution switchgear/panelboards, transformers, and wiring to the chargers
3. Charger types, sizes, locations, and number of dispensers

Working with the school district, Wendel will develop a high-level opinion of probable costs to implement the zero-emissions transition plan. Wendel will utilize estimates from previous studies as the basis of the transition plan cost estimate and scaled for the participating districts. The estimate will include the phased implementation costs of the following major items:

1. School District portion of any estimated charges for the utility to upgrade the system to provide the power required to the site for bus charging
2. Electrical equipment and installation costs for the utility interface
3. Bus charging system distribution equipment and installation costs including switchgear, panelboards, wiring
4. Charger and dispenser and installation costs
5. Other costs associated with a transition, an addition, renovations, etc.
6. Wendel would be looking for the School District to provide estimated costs for the school buses for inclusion into the overall phased implementation costs

Anticipated deliverables for Task 4 would be:

A Transition plan report containing the future system concept and phasing approach including costing projections;

1. A conceptual site plan showing preferred equipment locations
2. A conceptual one-line power diagram showing the incoming utility power and bus charging distribution
3. A phasing plan showing how the implementation plan would progress over time to meet the 2035 transition plan goal.
4. An opinion of probable cost estimate for each phase of the implementation phasing plan.

Task 5 – Final Report

Wendel will prepare a draft report to summarize the overall recommendations and results of the study for concurrent review by NYSERDA and the participating District for one combined set of comments. The applicant shall update the report based on those comments and provide a final report to the satisfaction of NYSERDA and the district. Wendel will present the findings of the study.

- Task 1 Project Kickoff and Status Meetings: The applicant shall compile meeting minutes
- Task 2 Existing Conditions Review: The applicant shall provide the compilation of the data.
- Task 3 Existing Route Energy Analysis: The applicant shall provide an existing conditions assessment documenting all findings from the infrastructure and documentation review and the Existing Route Energy analysis.
- Task 4 Transition Planning: The applicant shall provide a memo to provide findings on the following:
    - Utility's ability to provide power for the project
    - Infrastructure asset recommendations and Operational recommendations,
    - Transition plan report including
        - A conceptual site plan showing preferred equipment locations
        - A conceptual one-line power diagram showing the incoming utility power and bus charging distribution
        - A phasing plan showing how the implementation plan would progress over time to meet the 2035 transition plan goal.
        - An opinion of probable cost estimate for each phase of the implementation phasing plan.
        - estimates
- Task 5: The applicant shall prepare a draft memo report to summarize the overall recommendations and results of the study. The report will meet the deliverable requirements listed in the Program Summary.

ASSUMPTIONS

In preparing this proposal, Wendel has made the following assumptions regarding the Task Work Order:

- Access to electrical rooms
- Access to and accompaniment by facility staff to tenant spaces will be provided
- Access to building management software systems will be provided
- As built and survey, if available will be provided
- Access to site
- The owner will provide two years' worth of electric costs.
- A draft report will be reviewed by both the owner and NYSERDA simultaneously, with each party providing one set of review comments. Wendel will update the draft report based on the written comments. Comments from NYSERDA's project manager/technical reviewer will be coordinated, so that one combined set of comments will be addressed by Wendel.

SCHEDULE

Wendel will provide a schedule including start and end dates upon receiving a notice to proceed. Please note that the schedule below is per participating district and will be scheduled during the kickoff.

Milestone	Weeks from Notice to Proceed
Task 1: Project Kickoff and Status Meetings	2 weeks
Task 2: Existing Conditions Review	14 weeks
Task 3: Transition Planning	18 weeks
Task 4: Final Report	24 weeks

PROJECT BUDGET

The total cost to complete the tasks associated with the scope of with is $539,381.50. The Districts will contribute 25% or $134,845.38 and NYSERDA will contribute 75% or $404,536.13, as a specified in the NYSERDA purchase order. NYSERDA funding and eligibility is based on NYSERDA PON 4192. This is the total fee and includes direct expenses such as mileage, postage, printing, instrument rental, etc. except as noted.

District	Total Cost	Total Per District with 5% Discount	75% NYSERDA Cost Share	25% District Cost Share
Alexander Central School District	$38,500.00	$36,575.00	$27,431.25	$9,143.75
Attica Central School District	$35,595.00	$33,815.25	$25,361.44	$8,453.81
Avon Central School District	$34,525.00	$32,798.75	$24,599.06	$8,199.69
Caledonia – Mumford Central School District	$34,835.00	$33,093.25	$24,819.94	$8,273.31
Elba Central School District	$33,515.00	$31,839.25	$23,879.44	$7,959.81
Genesee Valley BOCES	$16,155.00	$15,347.25	$11,510.44	$3,836.81
Geneseo Central School District	$35,380.00	$33,611.00	$25,208.25	$8,402.75
LeRoy Central School District	$35,535.00	$33,758.25	$25,318.69	$8,439.56
Letchworth Central School District	$35,965.00	$34,166.75	$25,625.06	$8,541.69
Livonia Central School District	$35,540.00	$33,763.00	$25,322.25	$8,440.75

Oakfield – Alabama Central School District	$35,545.00	$33,767.75	$25,325.81	$8,441.94
Pavilion Central School District	$34,025.00	$32,323.75	$24,242.81	$8,080.94
Pembroke Central School District	$35,215.00	$33,454.25	$25,090.69	$8,363.56
Perry Central School District	$33,600.00	$31,920.00	$23,940.00	$7,980.00
Warsaw Central School District	$30,460.00	$28,937.00	$21,702.75	$7,234.25
Wyoming Central School District	$28,250.00	$26,837.50	$20,128.13	$6,709.38
York Central School District	$35,130.00	$33,373.50	$25,030.13	$8,343.38
TOTAL	**$567,770.00**	**$539,381.50**	**$404,536.13**	**$134,845.38**

Appendix E - Cutsheets

CAMBER

22-24 kW

CAMBER
CHARGING SYSTEMS

RELIABLE DC FAST CHARGING FOR FLEETS

The Camber 22-24 kW Wallbox Charger is ideal for fleets with smaller battery EVs who want an All-in-One Solution.

Single-Phase or Three-Phase input power options allow for flexible installation, which can reduce infrastructure costs.

The compact 22-24 kW Wallbox can be mounted on a wall or on an optional pedestal with cable management for flexible installation.

Remote monitoring and intelligent diagnostics allow for quick issue resolution and efficient field service. Broad voltage range (up to 920 VDC) ensures compatibility with both today's and next generation electric vehicles.

- OCPP 1.6 Compliant and 4G Enabled
- 200A CCS1 Cable



WALL MOUNTED CHARGER

getcamber.com

22-24 kW

CAMBER CHARGING SYSTEMS

WALL MOUNTED CHARGER

DC OUTPUT	SINGLE PHASE	THREE PHASE
Maximum Power [kW]	19.5 kW at 208 V 22.5 kW at 240 V	24 kW Peak; 22.5 kW Continuous
Voltage Range [V]	150 – 920 VDC	
Output Current	60 [A]	
Available Connectors	CCS-1	
Maximum Number of EVs Charging Simultaneously	1	
AC INPUT FOR DC OUTPUT	**SINGLE PHASE**	**THREE PHASE**
Voltage [V]	208-240 VAC +/- 10% (60 Hz)	480Y/277 VAC +/- 10% (60 Hz)
AC Input Power Connection	L1, L2, GND	L1, L2, L3, N, GND
AC Input Current and Max Power	100 A; 20.8-24 kVA	32 A; 26.6 kVA 35 A; 26 kVA at 432 VAC (-10% dip)
Recommended Upstream Circuit Breaker	125A	50A
Power Factor	> 0.96	
Current THD	IEE519 compliant 5%	
Frequency [Hz]	60	
Efficiency	94%	
GENERAL	**SINGLE PHASE**	**THREE PHASE**
Interface	7" Full Color Touchscreen Display	
	RFID Card Reader	
	Emergency Stop Pushbutton	
Protections	IP54, NEMA 3S	
Cable Length [ft]	23 ft	
Operating Temperature	From -31° F to 131° F (with linear derating above 113° F)	
Relative Humidity	From 5% to 95%	
Maximum Altitude (above sea level)	≤ 8,200 ft	
Communications	Ethernet + OCPP 1.6 + 4G Connectivity	
Dimensions (W x D x H) [ft]	30.3" x 23" x 11.8" without Pedestal	
Weight	132 lbs excluding Backplate (22 lbs) and Cables	
Certifications	UL 2202, CSA No. 107.1-16, NEC Article 625, DIN 70121, ISO 15118	
Optional Pedestal	Pedestal with Solar Powered LED Lighting, Removable Front Panel for Conduit, Mounting and Service Access, Cable Management, Corrosion-Resistant Lightweight Aluminum Construction, Optional Integrated AC Disconnect Means, Mounting Hardware. Allows for ADA Compliant Installation.	

CAMBER

CAMBER
CHARGING
SYSTEMS

INDUSTRIAL SERIES

RELIABLE DC FAST CHARGING FOR FLEETS

The Camber Industrial Series charging system is designed explicitly for fleet applications.

Available in 60 kW, 90 kW, 120 kW, 150 kW and 180 kW configurations. Charge up to 3 vehicles from the same charger with automated, multi-dispenser configurations, including up to 3 single-cable dispensers.

Dispensers can be sited separately (up to 500 feet away) from the charging cabinet, enabling greater flexibility in design and configuration for fleets.

Remote monitoring, intelligent diagnostics and a modular design allows for quick issue resolution and efficient field service.

Broad voltage range (up to 1000 VDC) ensures compatibility with both today's and next generation electric vehicles.

- OCPP Compliant and 4G Enabled
- Small Footprint
- Multi-Dispenser Option
- Supports CCS1 & Pantograph Options



Camber charging systems are compliant with Federal DOT Buy America requirements

getcamber.com

CAMBER

CAMBER CHARGING SYSTEMS

ELECTRICAL OUTPUT					
Continuous DC Output Power	60 kW	90 kW	120 kW	150 kW	180 kW
DC Output Voltage	150–1000 VDC				
Continuous DC Output Current	200A, 500A Pantograph (Optional)			300A, 500A Pantograph (Optional)	
ELECTRICAL INPUT					
AC Input Power	63 kVA	95 kVA	126 kVA	158 kVA	189 kVA
AC Input Current	76A	114A	152A	190A	227A
AC Input Voltage	480 V +/- 10%				
AC Input Topology	5-wire WYE (3ph + N + GND)				
AC Input Frequency	60 Hz				
Current THD% at Full Power	<3%				
Power Factor	>0.99				
Efficiency	95%				
MECHANICAL					
Cooling	Integrated Air Cooling				
Weight	825 lbs	880 lbs	935 lbs	990 lbs	1056 lbs
Dimensions (D x W x H)	31.2 in x 39.6 in x 79.2 in | 80 cm x 100 cm x 200 cm				
Required Side Door Clearance	None				
Required Front and Rear Clearance	1000 mm				
ENVIRONMENTAL					
Environmental Rating	NEMA 3R				
Maximum Altitude	3000 m | 9800 ft (Power Derates Above 2000 m | 6500 ft)				
Operating Temperature	-22° F to 122° F | -30° C to 50° C				
Operating Humidity	4–95%				
MISC					
Approved Charger-to-Vehicle Interfaces	CCS1 Industrial Dispenser J3105-1 Infrastructure-Down Pantograph				
Approved Number of Dispensers per Power Cabinet	Up to 4 Single Cable Dispensers				
Sequential Charging Capabilities	1 @ 60 kW	1 @ 90 kW	1 @ 120 kW	1 @ 150 kW	1 @ 180 kW
Simultaneous Charging Capabilities	-	-	2 @ 60 kW	-	3 @ 60 kW
Power Cabinet to Dispenser or Pantograph Control Box Communications	Modbus TCP via Fiber Optic				
Max Distance between Power Cabinet and Dispenser	500 ft | 152.4 m (Fiber Optic)				
Management Communications	OCPP 1.6 control via 4G Cellular (Standard) Supports WiFi, Ethernet (Optional)				
Certifications	UL 2202, NEC 625, FCC Part 15 Class A				

CE SERIES
ELECTRIC



IC BUS® ECE SERIES SCHOOL BUS

THE NEXT-GENERATION IC BUS® CE SERIES SCHOOL BUS

PUTTING SAFETY FIRST

- Standard electronic stability control
- Bendix® Intellipark® electronic parking brake standard
- No Student Left Behind® child monitor system
- Single-panel glass on entrance door for improved driver visibility
- IC Bus® Full View Camera Technology™ by Rosco® (optional)
- Entrance Door Alerts integrated into Dash Cluster; providing door ajar alerts if vehicle in motion & door is not properly closed

DRIVERFIRST™ ENVIRONMENT

- Standard 'wing' style instrument panel, angled toward driver
- State of the Art digital instrument cluster, including visibility to state-of-charge, estimated range and more!
- Standard Driver HVAC system with adjustable controls for driver comfort
- Standard stalk shifter for transmission control; optional push button shifter
- Steering wheel switches/controls are integrated, backlit, and color-coded
- USB-A and USB-C charging ports standard
- Driver cup holder
- LED interior dome & stepwell lights, available dimmer option

DURABILITY & SERVICEABILITY

- Meets or exceeds FMVSS/CMVSS
- 16-gauge steel, 90G/90G galvanized coating on steel body for enhanced corrosion resistance
- 14 gauge steel threaded body bows with continuous runners connecting all roof bows for superior strength
- Spot-welded body construction & framer assembled front end
- Optional Naviflex coating available on the bumpers — for optimal corrosion resistance
- Improved accessibility to routine maintenance items
- 'Hood assist' dual spring struts – wide opening for serviceability

CONNECTIVITY FOR ON-TIME PERFORMANCE

- All vehicles include factory-installed telematics with 5-year connectivity subscription
- OnCommand® Connection
  - 24/7 diagnostics and predictive maintenance tools
  - Real-time tracking and monitoring
- IC Bus® 360
  - Seamless communications with dealers and up-to-date repair status
  - Complete VIN-based information with specs, complete parts catalog, remote health data, and more
  - Online service request initiation and estimate approvals
  - Complete service history, up-to-date campaign information, and engine calibration status

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- **GVWR**
  - Up to 35,000 lbs.
- **Capacity**
  - Up to 78 passengers
- **Wheelbase Options**
  - 217", 254", 276" or 289"
- **Single Rear Axle (4x2)**
  - Dana Spicer: 21,000 or 23,000 lbs.
- **Front Axle**
  - Meritor: 10,000 or 12,000 lbs.
- **Frame**
  - Heat-treated alloy steel (120,000 PSI)
- **Front Suspension**
  - Parabolic taper leaf: 10,000 or 12,000 lbs.
- **Rear Suspension**
  - International® Ride Optimized Suspension (IROS) Air: 21,000 or 23,000 lbs.
- **12V Electrical System**
  - Enersys Odyssey 12V 2300 CCA
- **Brakes**
  - Air disc brakes with ESC and ABS
  - Optional hydraulic brakes
- **Direct Drive Motor**
  - 650-volt, 6-phase permanent magnet motor
- **Tires**
  - 254", 276" & 289" wheelbase: 11R22.5 front and rear
  - 217" wheelbase: 255/70R22.5 front and rear
- **Rear Axle Ratio**
  - 5.57 or 6.83
- **Regenerative Braking**
  - Driver selectable, three levels
- **Peak Power**
  - 255 kW or 342 hp
- **Powertrain Batteries and Range Options**
  - 210 kWh (135 miles)
  - 315 kWh (200+ miles)
- **Charge Port**
  - Front standard or optional rear location
- **Charging**
  - Standard AC and DCFC charging ready
- **Fuel-Fired Heater**
  - Optional, left side
- **Kajeet SmartBus™ wifi available**
- **V2G Capability available**

www.ICBus.com

Note: The information and conclusions contained herein are believed to be correct at time of publication, but do not necessarily apply to similar vehicles with different specifications or with production dates after the production of this publication. Vehicles with different specifications or later dates of production may yield different results. Vehicle specifications are subject to change without notice. BAD 21001 01/2024

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LIONA

Technical Specifications*





WEIGHT & DIMENSIONS

Vehicle Length	313 in.
Vehicle Width	96 in.
Vehicle Height	111 in.
Wheelbase	143 in.
Gross Vehicle Weight Rating (GVWR)	22,350 lb
Capacity	Up to 24 passengers

ELECTRIC POWERTRAIN

Top Speed	60 mph
Maximum Power	160 kW • 215 HP
Maximum Torque	1,200 Nm
Ranges	75 - 150 miles
Battery Capacities	84 - 168 kWh
Motor & Inverter	SUMO LD • Dana TM4
Transmission	Direct drive No transmission
Charging Type	Level III (DC) – CCS Combo & Level II (AC) - J1772
Level II - Charging Time	
19.2 kW	3.4 - 8.75 hours
Level III - Charging Time	
24 kW 50 kW	3.5 - 7 hours 2 - 3.5 hours

CHASSIS

Front Axle	9,180 lb
Rear Axle	13,170 lb
Suspension	
Standard Optional	Spring suspension LiquidSpring suspension
Braking	Hydraulic disc brakes

*** SPECIFICATIONS ARE SUBJECT TO CHANGE.**

All-Electric
Mini School Bus

LION ELECTRIC

thelionelectric.com

Clean savings. Cleaner air. For our kids and community.

Lion is building today's ultimate electric school bus. Our vehicles are designed for kids with special needs in mind and **purpose-built** to optimize your transportation experience and ensure the safety of everyone on board..

The LIONA, all-electric mini school bus, is a turnkey solution of efficiency, performance, and sustainability.

The LionExperience:

- Grant writing and ability to leverage fundings
- Charging infrastructure design and project management
- Complete onboarding trainings
- Purpose-designed EV telematic system

Make your next move a bright one.

Savings Electric VS. Diesel

80%

ENERGY COST REDUCTION

60%

MAINTENANCE COST REDUCTION

1. ZERO-EMISSION SOLUTION
2. PROVEN SAFETY RECORDS
3. LOWEST TOTAL COST OF OWNERSHIP
4. REDUCTION OF MAINTENANCE DOWN TIME
5. BEST-IN-CLASS DRIVING EXPERIENCE
6. NO NOISE POLLUTION
7. FULLY CONFIGURABLE INTERIOR





Appendix F - Information Received from Client

	Type A, Type B, Type C, or Type D					*Please provide one of the three options below*			*For District Use*
Bus Number / Name	**Bus Type**	**Model Number**	**Year Bus Procured**	**Estimated Bus Replacement Year**	**Total Yearly Mileage**	**Weekly Fuel Consumption (Gallons)**	**Monthly Fuel Consumption (Gallons)**	**Yearly Fuel Consumption (Gallons)**	**Notes**
20	*Type A*	*Chevrolet 3500 30 passenger*	*2016*	*2024*	*3354*		*24.2*		*LCS Spare*
59	*Type C*	*BlueBird Vision 65 passenger*	*2017*	*2024*	*11716*				*LCS Spare*
62	*Type C*	*BlueBird Vision 65 passenger*	*2017*	*2024*	*4554*				*LCS Spare*
85	Type C	BlueBird Vision 65 passenger	*2019*	2025	858				*LCS Spare*
86	Type C	BlueBird Vision 65 passenger	*2019*	2025	12950				*LCS Regular/Amish*
34	*Type A*	*Chevrolet 3500 24 passenger w/c*	*2015*	*2025*	*12084*		*98.7*		*LCS Spare*
75	Type C	BlueBird Vision 65 passenger	*2021*	2027	24140		278.5		*LCS Regular/BOCES*
73	*Type C*	*BlueBird Vision 65 passenger*	*2021*	*2027*	*11846*		*229.6*		*LCS Regular*
74	*Type C*	*BlueBird Vision 65 passenger*	*2021*	*2027*	*9922*		*95*		*LCS Spare*
76	Type C	BlueBird Vision 65 passenger	*2022*	2028	20392		237.4		*LCS Alt Ed*
77	Type C	BlueBird Vision 65 passenger	*2022*	2028	7306				*LCS Spare*
78	Type C	BlueBird Vision 65 passenger	*2022*	2028	12374				*LCS Regular*
79	Type C	BlueBird Vision 65 passenger	*2022*	2028	13518				*LCS Spare*
36	*Type A*	*Chevrolet 3500 30 passenger*	*2019*	*2028*	*39591*		*171.8*		*LCS SPED*
80	Type C	BlueBird Vision 65 passenger	*2024*	2029	10916				*LCS Regular/YMCA/Late Take Home*
82	Type C	BlueBird Vision 65 passenger	*2024*	2029	12604				*LCS Regular*
87	Type C	BlueBird Vision 65 passenger	*2024*	2029	11550				*LCS Regular*
88	Type C	BlueBird Vision 65 passenger	*2024*	2029	17174				*LCS Regular*
81	Type C	BlueBird Vision 65 passenger	*2024*	2030	10222				*LCS Regular*
89	Type C	BlueBird Vision 65 passenger	*2024*	2030	8012				*LCS Regular*
90	Type C	BlueBird Vision 65 passenger	*2024*	2030	9528				*LCS Regular*
91	Type C	BlueBird Vision 65 passenger	*2024*	2030	14454				*LCS Regular*
37	*Type A*	*Chevrolet 3500 30 passenger*	*2021*	*2030*	*32640*		*196.5*		*LCS SPED*
39	*Type A*	*Chevrolet 3500 30 passenger*	*2023*	*2031*	*24*		*2.1*		*LCS Spare*
38	*Type A*	*Chevrolet 3500 18 passenger w/c*	*2023*	*2033*	*10608*		*86.7*		*LCS SPED*
18	*Suburban*	*Chevrolet Suburban*	*2022*	*2030*	*6020*		*25.5*		*LCS Religous/Sports*
14	*Suburban*	*Chevrolet Suburban*	*2020*	*2028*	*5814*		*24.7*		*LCS Spare/Sports*
17	*Suburban*	*Chevrolet Suburban*	*2020*	*2028*	*3426*		*14.5*		*LCS Spare/Sports*
11	*Suburban*	*Chevrolet Suburban*	*2018*	*2026*	*26232*		*111*		*LCS SPED*
12	*Suburban*	*Chevrolet Suburban*	*2019*	*2027*	*31566*		*186.5*		*LCS SPED*

District Route Number / Route Name	Bus Number / Name	Route Start Time	Route End Time	Total Route Distance (Miles)	Deadhead Distance (Miles)	Distance to Next Route (miles)	Number of Students	Last route of shift?	Days of Week Route is in Use	Notes
Castile 2- P-4 PM	81	*2:10PM*	2:57PM	26 Miles	390 Feet	0	34	*no*	M,T,W,TH,F	*Letchworth Location*
Castile 2- 5-12 PM	81	*3:20PM*	4:08PM	22 Miles	2.4 Miles	0	62	*yes*	M,T,W,TH,F	*Letchworth Location*
Castile 2- P-4 AM	81	*6:50AM*	7:43AM	13 Miles	1.3 Miles	0	28	*no*	M,T,W,TH,F	*Letchworth Location*
Castile 2- 5-12 PM	81	*7:55AM*	8:35AM	14 Miles	1.3 Miles	0	47	*yes*	M,T,W,TH,F	*Letchworth Location*
Pike P-4 PM	82	*2:10PM*	3:14PM	32 Miles	3.2 Miles	0	38	*no*	M,T,W,TH,F	*Letchworth Location*
Pike 5-12 PM	82	*3:20PM*	4:39PM	36 Miles	3.5 Miles	0	45	*yes*	M,T,W,TH,F	*Letchworth Location*
Pike P-4 AM	82	*6:40AM*	7:46AM	31 Miles	1.5 Miles	0	26	*no*	M,T,W,TH,F	*Letchworth Location*
Pike 5-12 AM	82	*7:40AM*	8:36AM	32 Miles	1.0 Miles	0	38	*yes*	M,T,W,TH,F	*Letchworth Location*
Amish PM	86	*2:11PM*	3:38PM	53 Miles	6.5 Miles	0	43	*yes*	M,T,W,TH,F	*Letchworth Location*
Amish Am	86	*7:30AM*	9:04AM	44 Miles	6.5 Miles	0	43	*yes*	M,T,W,TH,F	*Letchworth Location*
Castile 3 P-4 PM	87	*2:10PM*	2:56PM	28 Miles	4.0 Miles	0	43	*no*	M,T,W,TH,F	*Letchworth Location*
Castile 3 5-12 PM	87	*3:20PM*	4:37PM	27 Miles	3.8 Miles	0	51	*yes*	M,T,W,TH,F	*Letchworth Location*
Castile 3 P-4 AM	87	*6:15AM*	7:35AM	23 Miles	6.3 Miles	0	31	*no*	M,T,W,TH,F	*Letchworth Location*
Castile 3 5-12 AM	87	*7:17AM*	8:41AM	20 Miles	5.7 Miles	0	32	*yes*	M,T,W,TH,F	*Letchworth Location*
Bliss 2 P-4 PM	88	*2:10PM*	3:24PM	33 Miles	9.7 Miles	0	32	*no*	M,T,W,TH,F	*Letchworth Location*
Bliss 2 5-12 PM	88	*3:20PM*	4:39PM	38 Miles	9.2 Miles	0	61	*yes*	M,T,W,TH,F	*Letchworth Location*
Bliss 2-P-4 AM	88	*6:15AM*	7:30AM	36 Miles	6.2 Miles	0	27	*no*	M,T,W,TH,F	*Letchworth Location*
Bliss 2 5-12 AM	88	*7:30AM*	8:34AM	34 Miles	6.2 Miles	0	39	*yes*	M,T,W,TH,F	*Letchworth Location*
Gainesville/SS Run P-4 PM	89	*2:10PM*	3:00PM	18 Miles	2.4 Miles	0	63	*no*	M,T,W,TH,F	*Letchworth Location*
Gainesville/SS Run 5-12 PM	89	*3:20PM*	4:26PM	25 Miles	4.9 Miles	0	75	*yes*	M,T,W,TH,F	*Letchworth Location*
Gainesville/SS Run P-4AM	89	*6:37AM*	7:32AM	15 Miles	.02 Miles	0	34	*no*	M,T,W,TH,F	*Letchworth Location*
Gainesville/SS Run P5-12AM	89	*7:50AM*	8:44AM	24 Miles	1.7 Miles	0	59	*yes*	M,T,W,TH,F	*Letchworth Location*
Castile 3 P-4 PM	90	*2:10PM*	3:20PM	27 Miles	3.6 Miles	0	32	*No*	M,T,W,TH,F	*Letchworth Location*
Castile 3 5-12 PM	90	*3:20PM*	4:50PM	34 Miles	5 Miles	0	48	*yes*	M,T,W,TH,F	*Letchworth Location*
Castile 3- P-4 AM	90	*6:30AM*	7:37AM	33 Miles	4.6 Miles	0	39	*no*	M,T,W,TH,F	*Letchworth Location*
Castile 3 5-12 AM	90	*7:50AM*	8:45AM	26 Miles	3.2 Miles	0	59	*yes*	M,T,W,TH,F	*Letchworth Location*
Hermitage/Bliss P-4 PM	91	*2:10PM*	3:10PM	34 Miles	5.7 Miles	0	24	*no*	M,T,W,TH,F	*Letchworth Location*
Hermitage/Bliss 5-12 PM	91	*3:20PM*	4:39PM	34 Miles	5.7 Miles	0	33	*yes*	M,T,W,TH,F	*Letchworth Location*
Hermitage/Bliss P-4AM	91	*6:10AM*	7:30AM	46 Miles	5.6 Miles	0	24	*no*	M,T,W,TH,F	*Letchworth Location*
Hermitage/Bliss 5-12 AM	91	*7:30AM*	8:48AM	38 Miles	3.9 Miles	0	24	*yes*	M,T,W,TH,F	*Letchworth Location*
NYSSB-PM	11	12:50PM	3:20PM	71 Miles	35.5 Miles	0	1	yes	M,T,W,TH,F	*Letchworth Location*
NYSSB-AM	11	6:15AM	8:50AM	71 Miles	35.5Miles	0	1	yes	M,T,W,TH,F	*Letchworth Location*
Creekside PM	12	1:20PM	4PM	116 Miles	63.5 Miles	0	1	yes	M,T,W,TH,F	*Letchworth Location*
Creekside AM	12	7:10AM	10:30AM	116 Miles	63.5 Miles	0	1	yes	M,T,W,TH,F	*Letchworth Location*
Central Baptist PM	18	2:23PM	3:59PM	54 Miles	30.5 Miles	0	2	yes	M,T,W,TH,F	*Letchworth Location*
Central Baptist AM	18	7:45AM	8:45AM	54 Miles	30.5 Miles	0	2	yes	M,T,W,TH,F	*Letchworth Location*
O'Conner/Holy Childhood PM	36	12:40PM	4:25PM	123 Miles	60 Miles	0	4	yes	M,T,W,TH,F	*Letchworth Location*
O'Conner/Holy Childhood am	36	5:45AM	9:30AM	123 Miles	45 Miles	0	4	yes	M,T,W,TH,F	*Letchworth Location*

District Route Number / Route Name	Bus Number / Name	Route Start Time	Route End Time	Total Route Distance (Miles)	Deadhead Distance (Miles)	Distance to Next Route (miles)	Number of Students	Last route of shift?	Days of Week Route is in Use	Notes
Belmont/ Wellsville PM	37	1:05pm	3:40pm	109 Miles	48.7 Miles	0	3	yes	M,T,W,TH,F	*Letchworth Location*
Belmont/Wellsville AM	37	6:15am	9:10AM	109 Miles	59.3 Miles	0	3	yes	M,T,W,TH,F	*Letchworth Location*
LCS SPED RUN-PM	38	2:10PM	2:40PM	11 Miles	1.3 Miles	0	2	yes	M,T,W,Th,F	*Letchworth Location*
LCS SPED RUN-AM And Homeless	38	6:30AM	7:30AM	33 Miles	9.6 Miles	0	4	yes	M,T,W,TH,F	*Letchworth Location*
Bliss PM run P-4	73	2:10PM	3:20PM	42 Miles	9.9 Miles	0	14	no	M,T,W,TH,F	*Letchworth Location*
Bliss PM run 5-12	73	3:20PM	4:42PM	41 Miles	9.9 Miles	0	46	yes	M,T,W,TH,F	*Letchworth Location*
Bliss AM run- P-4	73	6:12AM	7:30AM	40 Miles	4.3 Miles	0	18	no	M,T,W,TH,F	*Letchworth Location*
Bliss AM run 5-12	73	7:35AM	8:57AM	42 Miles	2.7 Miles	0	52	yes	M,T,W,TH,F	*Letchworth Location*
Silver Springs PM run- P-4	75	2:10PM	3:09PM	29 Miles	4.2 Miles	0	35	no	M,T,W,TH,F	*Letchworth Location*
Silver Springs PM run 5-12	75	3:20PM	4:36PM	42 Miles	2.6 Miles	0	28	yes	M,T,W,TH,F	*Letchworth Location*
Silver Springs AM run P-4	75	6:20AM	7:35AM	29 Miles	4.2 Miles	0	35	no	M,T,W,TH,F	*Letchworth Location*
Silver Springs AM run 5-12	75	7:30AM	8:39AM	34 Miles	2.6 Miles	0	41	no	M,T,W,TH,F	*Letchworth Location*
Gilead/Alt Ed PM	76	1:35PM	3:48PM	82 Miles	26.7 Miles	0	23	yes	M,T,W,TH,F	*Letchworth Location*
Gilead/Alt. Ed AM	76	6:00AM	8:40AM	82 Miles	26.7 Miles	0	20	yes	M,T,W,TH,F	*Letchworth Location*
Castile/Pike/Lamont P-4 PM	78	2:10PM	3:17PM	29 Miles	1.6 Miles	0	22	no	M,T,W,TH,F	*Letchworth Location*
Castile/Pike/Lamont 5-12 PM	78	3:20PM	4:29PM	26 Miles	.9 Miles	0	43	yes	M,T,W,TH,F	*Letchworth Location*
Castile/Pike/Lamont-P-4 AM	78	6:45AM	7:35AM	24 Miles	4.9 Miles	0	19	no	M,T,W,TH,F	*Letchworth Location*
Castile/Pike/Lamont 5-12PM	78	7:32AM	8:30AM	21 Miles	3.5 Miles	0	33	yes	M,T,W,TH,F	*Letchworth Location*
YMCA SWIM- Tuesdays	80	3:45PM	4:45PM	17 Miles	16 Miles	0	50	no	Tuesday	*Letchworth Location*
LTH-Late Take Home	80	5:05PM	6:30PM	) Miles(Varies by ridership and da	(Varies by ridership and day)	0	30	yes	M,T,W,TH	*Letchworth Location*
Castile P-4 AM	80	6:50AM	7:46AM	27 Miles	4.6 Miles	0	36	no	M,T,W,TH,F	*Letchworth Location*
Castile 5-12 AM	80	7:50AM	8:36AM	26 Miles	4.1 Miles	0	41	yes	M,T,W,TH,F	*Letchworth Location*
CONTRACTED RUN AM		7:00:00 AM	11:00:00 AM	125			2		M,T,W,TH,F	*Letchworth Location*

INVOICE

Account #:	15330
Invoice #:	[redacted]
Invoice Total:	**$2,535.05**
Due Date:	**04/01/23**
Terms:	Net 30 Days
Delivered Date:	03/02/23

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12757936		D0002281708

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
048	ULSD (15 PPM SULFUR) SUPREME	850.00 GAL	$2.9824	$2,535.05

Subtotal	$2,535.05
Taxes	$0.00
Total	**$2,535.05**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $63.38 will apply for an invoice total of $2,598.43

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
MAR 1 0 2023
BY:
230836

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12546681
Invoice Total:	**$2,838.37**
Due Date:	**04/08/23**
Terms:	Net 30 Days
Delivered Date:	03/09/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12762235		D0002287548

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
048	ULSD (15 PPM SULFUR) SUPREME	896.40 GAL	$3.1664	$2,838.37

Subtotal	$2,838.37
Taxes	$0.00
Total	**$2,838.37**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $70.96 will apply for an invoice total of $2,909.33

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
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RECEIVED
MAR 17 2023
BY:
230865

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12552555
Invoice Total:	**$2,038.89**
Due Date:	**04/15/23**
Terms:	Net 30 Days
Delivered Date:	03/16/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12764458		D0002292840

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
048	ULSD (15 PPM SULFUR) SUPREME	678.70 GAL	$3.0041	$2,038.89

Subtotal	$2,038.89
Taxes	$0.00
Total	**$2,038.89**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $50.97 will apply for an invoice total of $2,089.86

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
MAR 27 2023
BY: Ashley R Carmichael
230865

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

NOCO 90

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	[redacted]
Invoice Total:	**$2,208.12**
Due Date:	**04/22/23**
Terms:	Net 30 Days
Delivered Date:	03/23/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12770100		D0002299015

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
048	ULSD (15 PPM SULFUR) SUPREME	749.10 GAL	$2.9477	$2,208.12

Subtotal	$2,208.12
Taxes	$0.00
Total	**$2,208.12**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $55.20 will apply for an invoice total of $2,263.32

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

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BY: [signature]

230865

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NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

INVOICE

Account #:	15330
Invoice #:	[redacted]
Invoice Total:	**$2,352.86**
Due Date:	**04/29/23**
Terms:	Net 30 Days
Delivered Date:	03/30/23

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12775444		D0002304354

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
048	ULSD (15 PPM SULFUR) SUPREME	785.70 GAL	$2.9946	$2,352.86

Subtotal	$2,352.86
Taxes	$0.00
Total	**$2,352.86**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $58.82 will apply for an invoice total of $2,411.68

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
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RECEIVED
APR 10 2023
BY: 230865

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

INVOICE

Account #:	15330
Invoice #:	SP12567293
Invoice Total:	**$673.81**
Due Date:	**05/06/23**
Terms:	Net 30 Days
Delivered Date:	04/06/23

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12780721		D0002309607

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
048	ULSD (15 PPM SULFUR) SUPREME	228.90 GAL	$2.9437	$673.81

Subtotal	$673.81
Taxes	$0.00
Total	**$673.81**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $16.85 will apply for an invoice total of $690.66

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
APR 17 2023
BY Ashleyn Carmichael
230865

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

Detach at perforation above and return with your check. Do not fold, clip, staple, or send cash. Thank you for your payment.

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150

Account #:	15330
Invoice #:	SP12567293
Invoice Total:	**$673.81**
Due Date:	**05/06/23**
Amount Enclosed	$

A 1.5% Service Charge will be assessed on unpaid invoice beyond account terms.

**SINGLE-PIECE 1 SGL 137824AF07-A-1
24 1 SP 0.600

LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE NY 14066-9788

Remit to address:

NOCO ENERGY CORP. - FUELS
DEPARTMENT # 116218
P.O. BOX 5211
BINGHAMTON, NY 13902-5211

NOCO 90 YEARS

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP1257[illegible]
Invoice Total:	**$945.16**
Due Date:	**05/13/23**
Terms:	Net 30 Days
Delivered Date:	04/13/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12784347		D0002314572

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	313.80 GAL	$3.012	$945.16

Subtotal	$945.16
Taxes	$0.00
Total	**$945.16**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $23.63 will apply for an invoice total of $968.79

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

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APR 21 2023
BY: [signature]
230865

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	[redacted]
Invoice Total:	**$2,058.90**
Due Date:	**05/20/23**
Terms:	Net 30 Days
Delivered Date:	04/20/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12790499		D0002318825

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	689.10 GAL	$2.9878	$2,058.90

Subtotal	$2,058.90
Taxes	$0.00
Total	**$2,058.90**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $51.47 will apply for an invoice total of $2,110.37

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
MAY 1 - 2023
BY:
230865

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

NOCO 90 YEARS

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12581890
Invoice Total:	**$2,262.61**
Due Date:	**05/27/23**
Terms:	Net 30 Days
Delivered Date:	04/27/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12794606		D0002323393

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	812.60 GAL	$2.7844	$2,262.61

Subtotal	$2,262.61
Taxes	$0.00
Total	**$2,262.61**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $56.57 will apply for an invoice total of $2,319.18

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
MAY 5 - 2023
BY:
230865

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12586027
Invoice Total:	**$1,805.86**
Due Date:	**06/03/23**
Terms:	Net 30 Days
Delivered Date:	05/04/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12798002		D0002327704

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	684.40 GAL	$2.6386	$1,805.86

Subtotal	$1,805.86
Taxes	$0.00
Total	**$1,805.86**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $45.15 will apply for an invoice total of $1,851.01

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
MAY 11 2023
BY: [signature]
230865

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

INVOICE

Account #:	15330
Invoice #:	[illegible]
Invoice Total:	**$677.33**
Due Date:	**06/10/23**
Terms:	Net 30 Days
Delivered Date:	05/11/23

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12808000		D0002332695

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	267.70 GAL	$2.5302	$677.33

Subtotal	$677.33
Taxes	$0.00
Total	**$677.33**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $16.93 will apply for an invoice total of $694.26

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
MAY 19 2023
BY:

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

INVOICE

Account #:	15330
Invoice #:	[redacted]
Invoice Total:	**$1,175.28**
Due Date:	**06/10/23**
Terms:	Net 30 Days
Delivered Date:	05/11/23

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12804266		D0002331995

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	464.50 GAL	$2.5302	$1,175.28

Subtotal	$1,175.28
Taxes	$0.00
Total	**$1,175.28**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $29.38 will apply for an invoice total of $1,204.66

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
MAY 18 2023
BY:

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

NOCO 90 years

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	[redacted]
Invoice Total:	**$676.46**
Due Date:	**06/17/23**
Terms:	Net 30 Days
Delivered Date:	05/18/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12808202		D0002336582

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	257.10 GAL	$2.6311	$676.46

Subtotal	$676.46
Taxes	$0.00
Total	**$676.46**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $16.91 will apply for an invoice total of $693.37

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
MAY 25 2023
BY:

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

INVOICE

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

Account #:	15330
Invoice #:	SP12595837
Invoice Total:	**$1,440.00**
Due Date:	**06/18/23**
Terms:	Net 30 Days
Delivered Date:	05/19/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12814548		D0002337812

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	547.30 GAL	$2.6311	$1,440.00

Subtotal	$1,440.00
Taxes	$0.00
Total	**$1,440.00**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $36.00 will apply for an invoice total of $1,476.00

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
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RECEIVED
MAY 26 2023
BY:

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NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12599286
Invoice Total:	**$1,848.31**
Due Date:	**06/24/23**
Terms:	Net 30 Days
Delivered Date:	05/25/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12814315		D0002341095

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	692.80 GAL	$2.6679	$1,848.31

Subtotal	$1,848.31
Taxes	$0.00
Total	**$1,848.31**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $46.21 will apply for an invoice total of $1,894.52

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
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RECEIVED
JUN - 5 2023
BY: 230865

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

Product 047 Delivered: 692.8
Total Delivered Gallons: 692.8

NOCO 90 YEARS

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12607205
Invoice Total:	**$1,693.34**
Due Date:	**07/08/23**
Terms:	Net 30 Days
Delivered Date:	06/08/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12822610		D0002349531

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	659.30 GAL	$2.5684	$1,693.34

Subtotal	$1,693.34
Taxes	$0.00
Total	**$1,693.34**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $42.33 will apply for an invoice total of $1,735.67

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
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RECEIVED
JUN 20 2023
BY: Ashleigh Carmichael

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

INVOICE

Account #:	15330
Invoice #:	SP12610768
Invoice Total:	**$1,041.56**
Due Date:	**07/15/23**
Terms:	Net 30 Days
Delivered Date:	06/15/23

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12825957		D0002353256

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	394.50 GAL	$2.6402	$1,041.56

Subtotal	$1,041.56
Taxes	$0.00
Total	**$1,041.56**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $26.04 will apply for an invoice total of $1,067.60

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
JUN 26 2023
BY Ashley Carmichael
230865

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12612135
Invoice Total:	**$981.36**
Due Date:	**07/16/23**
Terms:	Net 30 Days
Delivered Date:	06/16/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12831138		D0002354536

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	371.70 GAL	$2.6402	$981.36

Subtotal	$981.36
Taxes	$0.00
Total	**$981.36**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $24.53 will apply for an invoice total of $1,005.89

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
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RECEIVED
JUN 26 2023
BY:
230865

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NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

"THIS IS TO CERTIFY THAT THE ABOVE NAMED MATERIALS ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELED AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE DEPARTMENT OF TRANSPORTATION"

Customer agrees to pay all expenses with any collection proceedings, including sellers attorneys fees.

NOCO 90 YEARS

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12614178
Invoice Total:	**$1,323.20**
Due Date:	**07/22/23**
Terms:	Net 30 Days
Delivered Date:	06/22/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12830976		D0002357730

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	483.50 GAL	$2.7367	$1,323.20

Subtotal	$1,323.20
Taxes	$0.00
Total	**$1,323.20**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $33.08 will apply for an invoice total of $1,356.28

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
JUL 3 2023
BY:

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

NOCO 90 YEARS

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12621535
Invoice Total:	**$361.07**
Due Date:	**08/05/23**
Terms:	Net 30 Days
Delivered Date:	07/06/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12838350		D0002364964

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	131.50 GAL	$2.7458	$361.07

Subtotal	$361.07
Taxes	$0.00
Total	**$361.07**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $9.03 will apply for an invoice total of $370.10

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
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JUL 17 2023
BY: [signature]
240062

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

NOCO 90 YEARS

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12629228
Invoice Total:	**$704.46**
Due Date:	**08/19/23**
Terms:	Net 30 Days
Delivered Date:	07/20/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12847400		D0002373254

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	249.20 GAL	$2.8269	$704.46

Subtotal	$704.46
Taxes	$0.00
Total	**$704.46**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $17.61 will apply for an invoice total of $722.07

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
JUL 31 2023
BY
240062

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NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

NOCO 90 YEARS

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12640241
Invoice Total:	**$1,333.91**
Due Date:	**09/09/23**
Terms:	Net 30 Days
Delivered Date:	08/10/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12859736		D0002384955

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	399.60 GAL	$3.3381	$1,333.91

Subtotal	$1,333.91
Taxes	$0.00
Total	**$1,333.91**

Invoice total is for cash, check, or ACH payment. If paying by credit card a 2.5% processing fee of $33.35 will apply for an invoice total of $1,367.26

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
AUG 17 2023
BY:
240062

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12644761
Invoice Total:	**$580.08**
Due Date:	**09/16/23**
Terms:	Net 30 Days
Delivered Date:	08/17/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12864071		D0002389134

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	170.60 GAL	$3.4002	$580.08

Subtotal	$580.08
Taxes	$0.00
Total	**$580.08**

Invoice total is for cash, check, ACH, or debit card payment. If paying by credit card a 2.5% processing fee of $14.50 will apply for an invoice total of $594.58

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
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RECEIVED
AUG 28 2023
BY: 240062

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

INVOICE

Account #:	15330
Invoice #:	SP12651633
Invoice Total:	**$745.37**
Due Date:	**09/29/23**
Terms:	Net 30 Days
Delivered Date:	08/30/23

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12871017		D0002397627

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	221.30 GAL	$3.3681	$745.37

Subtotal	$745.37
Taxes	$0.00
Total	**$745.37**

Invoice total is for cash, check, ACH, or debit card payment. If paying by credit card a 2.5% processing fee of $18.63 will apply for an invoice total of $764.00

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
SEP 11 2023
BY: _____
240062

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.

NOCO 90

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12655634
Invoice Total:	**$618.30**
Due Date:	**10/07/23**
Terms:	Net 30 Days
Delivered Date:	09/07/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12875017		D0002401750

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	184.20 GAL	$3.3567	$618.30

Subtotal	$618.30
Taxes	$0.00
Total	**$618.30**

Invoice total is for cash, check, ACH, or debit card payment. If paying by credit card a 2.5% processing fee of $15.46 will apply for an invoice total of $633.76

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
SEP 18 2023
BY: [signature]

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12659727
Invoice Total:	**$1,528.10**
Due Date:	**10/14/23**
Terms:	Net 30 Days
Delivered Date:	09/14/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12879012		D0002405928

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	441.80 GAL	$3.4588	$1,528.10

Subtotal	$1,528.10
Taxes	$0.00
Total	**$1,528.10**

Invoice total is for cash, check, ACH, or debit card payment. If paying by credit card a 2.5% processing fee of $38.20 will apply for an invoice total of $1,566.30

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
SEP 25 2023
BY: Philip Carmichael
240062

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

INVOICE

Account #:	15330
Invoice #:	SP12660418
Invoice Total:	**$1,936.93**
Due Date:	**10/15/23**
Terms:	Net 30 Days
Delivered Date:	09/15/23

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12884739		D0002406738

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	560.00 GAL	$3.4588	$1,936.93

Subtotal	$1,936.93
Taxes	$0.00
Total	**$1,936.93**

Invoice total is for cash, check, ACH, or debit card payment. If paying by credit card a 2.5% processing fee of $48.42 will apply for an invoice total of $1,985.35

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
If you are enrolled in automatic payments, this is for your records only.

RECEIVED
SEP 25 2023
BY
240062

NOCO Energy Corp. certifies that the amount of tax shown has been or will be paid by NOCO Energy Corp. or its supplier, or, if no motor fuel tax, petroleum business tax, or sales tax is shown, NOCO Energy Corp. certifies that no such taxes are being charged on the motor fuel based on an exemption.
NYS Cplm ...27383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

INVOICE

Account #:	15330
Invoice #:	SP12663891
Invoice Total:	**$2,179.17**
Due Date:	**10/21/23**
Terms:	Net 30 Days
Delivered Date:	09/21/23

NOCO
90
2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12884604		D0002410390

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	588.50 GAL	$3.7029	$2,179.17

Subtotal	$2,179.17
Taxes	$0.00
Total	**$2,179.17**

Invoice total is for cash, check, ACH, or debit card payment. If paying by credit card a 2.5% processing fee of $54.48 will apply for an invoice total of $2,233.65

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
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NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

NOCO 90

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12668183
Invoice Total:	**$3,313.24**
Due Date:	**10/28/23**
Terms:	Net 30 Days
Delivered Date:	09/28/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12889044		D0002415121

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	922.60 GAL	$3.5912	$3,313.24

Subtotal	$3,313.24
Taxes	$0.00
Total	**$3,313.24**

Invoice total is for cash, check, ACH, or debit card payment. If paying by credit card a 2.5% processing fee of $82.83 will apply for an invoice total of $3,396.07

Pay your bill online at WWW.NOCO.COM or mail payments to:
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NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

NOCO 90

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12673031
Invoice Total:	**$2,137.77**
Due Date:	**11/04/23**
Terms:	Net 30 Days
Delivered Date:	10/05/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12894894		D0002419806

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	600.60 GAL	$3.5594	$2,137.77

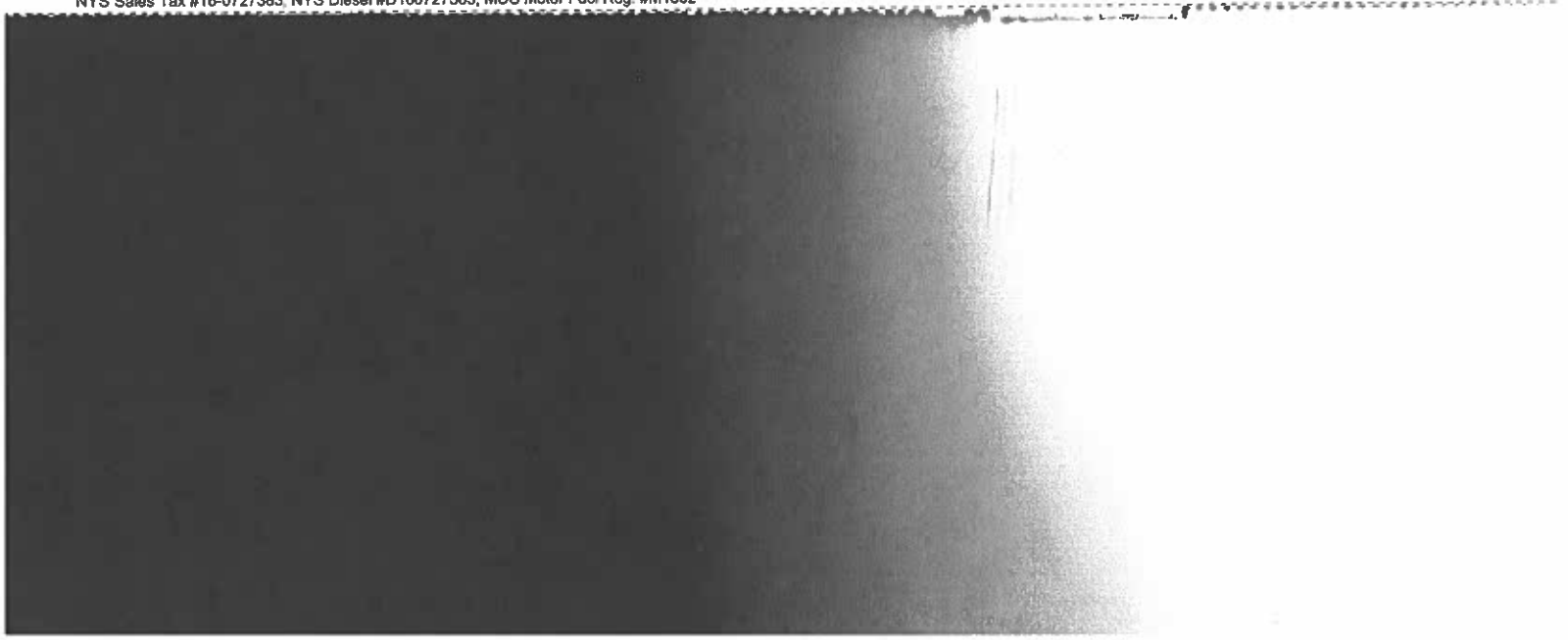
Subtotal	$2,137.77
Taxes	$0.00
Total	**$2,137.77**

Invoice total is for cash, check, ACH, or debit card payment. If paying by credit card a 2.5% processing fee of $53.44 will apply for an invoice total of $2,191.21

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
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NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862



INVOICE

Account #:	15330
Invoice #:	SP12676969
Invoice Total:	**$2,614.37**
Due Date:	**11/11/23**
Terms:	Net 30 Days
Delivered Date:	10/12/23

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12899327		D0002424564

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
047	ULSD (15 PPM SULFUR)	824.10 GAL	$3.1724	$2,614.37

Subtotal	$2,614.37
Taxes	$0.00
Total	**$2,614.37**

Invoice total is for cash, check, ACH, or debit card payment. If paying by credit card a 2.5% processing fee of $65.36 will apply for an invoice total of $2,679.73

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NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

INVOICE

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

Account #:	15330
Invoice #:	SP12677919
Invoice Total:	**$19,274.96**
Due Date:	**10/23/23**
Terms:	Net 10 Days
Delivered Date:	10/13/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12901712		383059548

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
048	ULSD (15 PPM SULFUR) SUPREME	5,997.00 GAL	$3.2141	$19,274.96

Subtotal	$19,274.96
Taxes	$0.00
Total	**$19,274.96**

Invoice total is for cash, check, ACH, or debit card payment. If paying by credit card a 2.5% processing fee of $481.87 will apply for an invoice total of $19,756.83

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
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NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

NOCO 90 Years

2440 SHERIDAN DRIVE | TONAWANDA, NY 14150
PHONE: (716) 833-6626

SHIP TO:
LETCHWORTH CSD
5550 SCHOOL RD
GAINESVILLE, NY 14066

INVOICE

Account #:	15330
Invoice #:	SP12712620
Invoice Total:	**$28,529.75**
Due Date:	**12/14/23**
Terms:	Net 10 Days
Delivered Date:	12/04/23

SALES ORDER #	PURCHASE ORDER #	DELIVERY REFERENCE #
SO12943147		383061800/1808

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	TOTAL PRICE
048	ULSD (15 PPM SULFUR) SUPREME	9,068.00 GAL	$3.1462	$28,529.75

Subtotal	$28,529.75
Taxes	$0.00
Total	**$28,529.75**

Invoice total is for cash, check, ACH, or debit card payment. If paying by credit card a 2.5% processing fee of $713.24 will apply for an invoice total of $29,242.99

Pay your bill online at WWW.NOCO.COM or mail payments to:
NOCO ENERGY CORP - FUELS, DEPARTMENT # 116218, P.O. BOX 5211, BINGHAMTON, NY 13902-5211
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NYS Sales Tax #16-0727383, NYS Diesel #D160727383, MUS Motor Fuel Reg. #M1862

Letchworth School Bus Garage

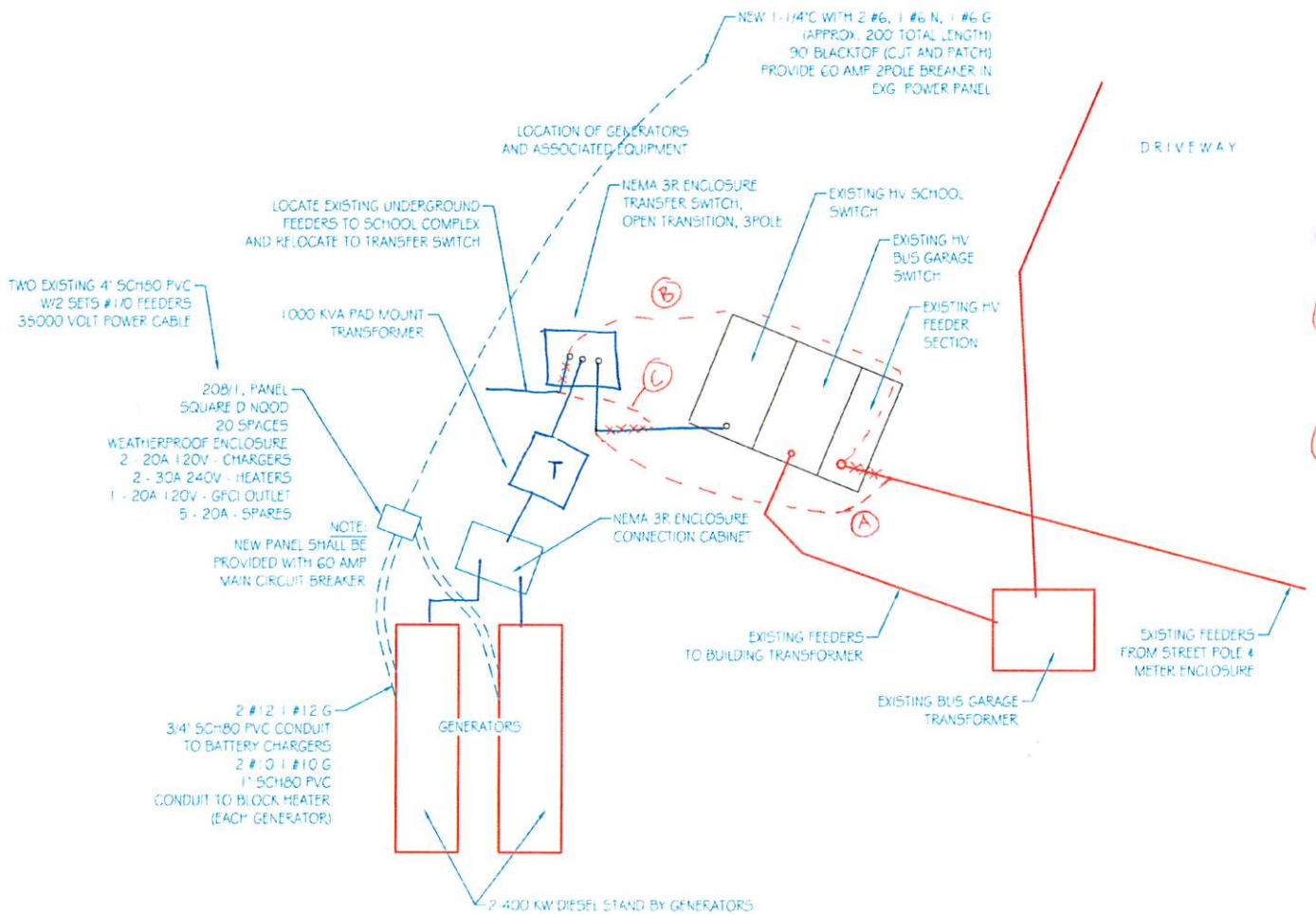
Water Supply-1 inch water line operating at 55-70 PSI

Building just has heat, smoke and/co2 protection by Johnson Controls
Electric - 3 phase 400 AMP service

Perry Bus Garage

200 amp single phase service
Panel full of breakers

Water supply–1 inch line at 100 PSI from Village
Building is sprinklered 6 inch line 880 GPM at 100 PSI supply



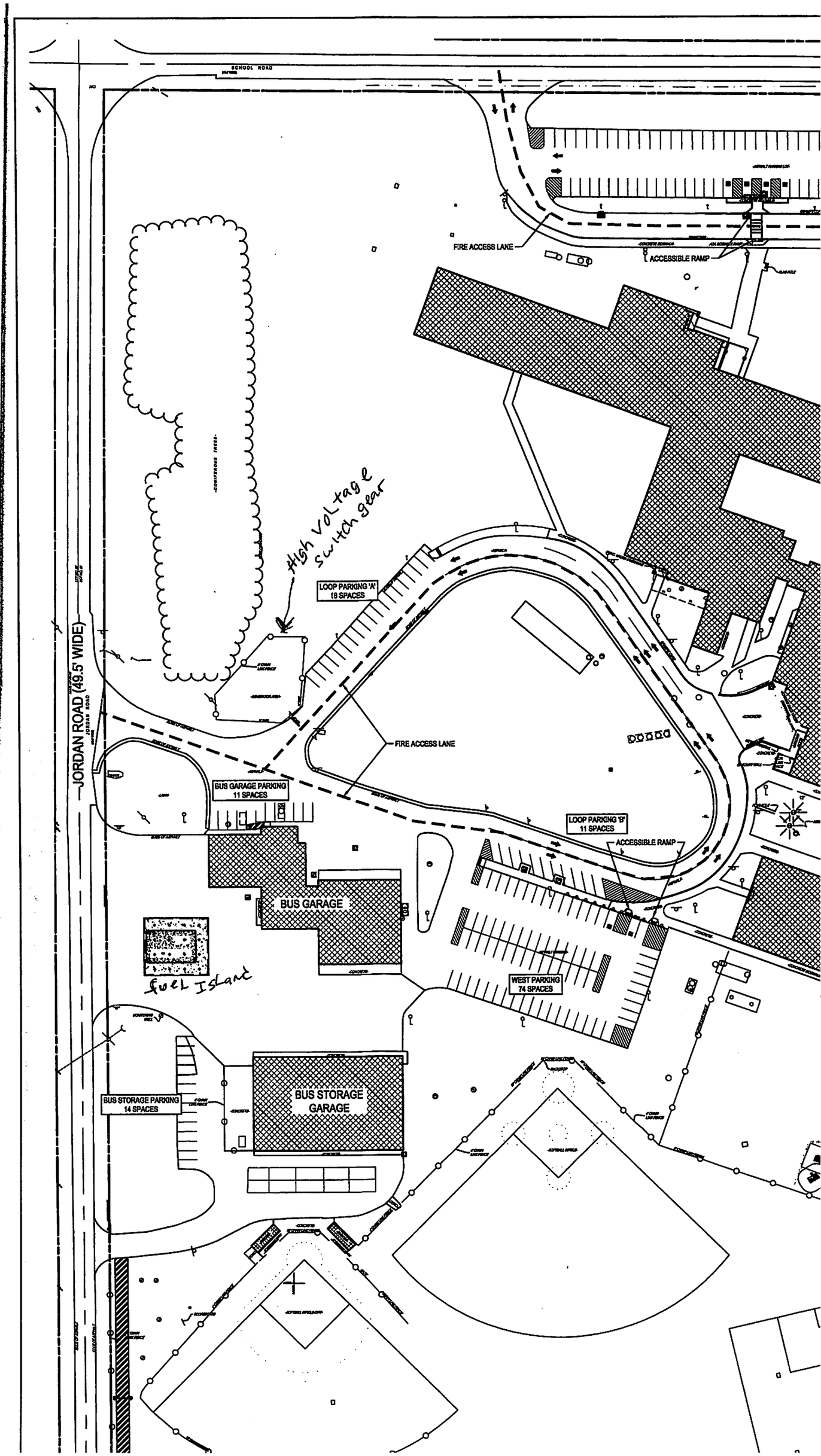
1 SITE PLAN
NTS

(A) FEEDERS RELOCATED TO TRANSFER SWITCH

(B) ATS POWER RELOCATED BACK TO HV CONNECTION CABINET

(C) OUTPUT OF HV SWITCH TO SCHOOL.

NO GOAB (GROUP OPERATED AIR SWITCH)


SCHOOL ROAD
JORDAN ROAD (49.5' WIDE)
FIRE ACCESS LANE
ACCESSIBLE RAMP
high voltage switch gear
LOOP PARKING 'A'
18 SPACES
FIRE ACCESS LANE
BUS GARAGE PARKING
11 SPACES
LOOP PARKING 'B'
11 SPACES
ACCESSIBLE RAMP
BUS GARAGE
fuel Island
WEST PARKING
74 SPACES
BUS STORAGE PARKING
14 SPACES
BUS STORAGE
GARAGE