WEGO

GHMPO

Zero Emission Vehicle Transition Plan

JUNE 2023

PREPARED BY

Planning Communities

MGL
Microgrid Labs

INTERNATIONAL
TRANSPORTATION LEARNING CENTER

GAINESVILLE-HALL
Metropolitan Planning Organization

2875 Browns Bridge Road
Gainesville, GA 30504
Tel: 770.531.6809
Fax: 770.531.3902
ghmpo.org

A Resolution by the Gainesville-Hall Metropolitan Planning Organization Policy Committee Adopting the Hall Area Transit Zero Emission Vehicle Transition Plan

WHEREAS, the Gainesville-Hall Metropolitan Planning Organization is the designated Metropolitan Planning Organization for transportation planning within the Gainesville Metropolitan Area Boundary which includes all of Hall County and a portion of Jackson County following the 2010 Census; and

WHEREAS, the Policy Committee (PC) is the recognized decision making body for transportation planning within the Gainesville-Hall Metropolitan Planning Organization (GHMPO); and

WHEREAS, GHMPO conducts transit planning in partnership with Hall Area Transit throughout all of Hall County; and

NOW, THERE, BE IT RESOLVED that the Gainesville-Hall Metropolitan Planning Organization adopts the Hall Area Transit Zero Emission Vehicle Transition Plan.

A motion was made by PC member Sam Couvillon and seconded by PC member Richard Higgins and approved this the 8th Day of August, 2023.

Edward R. Asbridge
Mayor Ed Asbridge, City of Flowery Branch
GHMPO Policy Committee

Subscribed and sworn to me this the 8th Day of August, 2023

ANAEL DOMINGUEZ
NOTARY PUBLIC
MY COMMISSION EXPIRES
JANUARY 22, 2024
HALL COUNTY, GEORGIA

Notary Public

My commission expires 1-22-24

Table of Contents

Introduction

Hall Area Transit (HAT) is the public transportation service provider for Hall County, Georgia. HAT is part of the City of Gainesville/Hall County Community Services department and delivers transportation services with the microtransit service WeGo using an agency fleet of 22 vehicles. In December 2020, HAT launched an on-demand vanpool service through known as WeGo serving the City of Gainesville; in July 2021, WeGo service replaced the fixed-route Gainesville Connector and Dial-a-Ride service and was expanded to the remaining parts of Hall County. This service was introduced as a more cost effective and efficient option than fixed-route service that also addresses first-last mile connectivity. Passengers can book using a free app or by phone, and can be picked up and dropped off within a few blocks of their origin and destination.

The Zero Emission Vehicle Transition Plan (ZEVTP) evaluates scenarios for adopting the agency's electric vehicles and charging infrastructure, and assesses available technologies, resources, facilities and partnerships to develop a strategy for transitioning HAT to a fully zero emission fleet.

FTA Requirements

Under the Bipartisan Infrastructure Law, transit agencies using the expanded Low or No Emission Program or the Grants for Buses and Bus Facilities Competitive Program to purchase zero emission buses (battery electric, hydrogen fuel cell, or rubber tire trolley buses powered by overhead catenaries) must submit a plan for implementing a transition to a Zero Emission Vehicle (ZEV) fleet. While these grants refer to buses, the FTA defines a low or no emission bus as "a passenger vehicle used to provide public transportation that sufficiently reduces energy consumption or harmful emissions, including direct carbon emissions, when compared to a standard vehicle", which would apply to electric WeGo vans. The Zero Emission Vehicle Transition Plan (ZEVTP) is being prepared in accordance with Federal Transit Administration (FTA) guidelines as set in the Dear Colleague Letter dated December 1, 2021.

Approach

The ZEVTP was developed based on FTA guidance for preparing Zero-Emission Transition Plans (2021) in alignment with statutory requirements for projects related to zero-emission vehicles applying for funding under the Grants for Buses and Bus Facilities Program (49 USC 5339(b)) and the Low or No Emission Program (49 USC 5339(c)). FTA defines six key elements for these plans as listed below.

1. Demonstrate a **long-term fleet management** with a strategy for how the applicant intends to use the current request for resources and future acquisitions.
2. Address the availability of **current and future resources to meet costs** for the transition and implementation.
3. Consider **policy and legislation** impacting relevant technologies.
4. Include an evaluation of **existing and future facilities** and their relationship to the technology transition.
5. Describe the **partnership** of the applicant **with the utility or alternative fuel provider**.
6. Examine the **impact of the transition on the current workforce** by identifying skill gaps, training needs, and retraining needs of the existing workers to operate and maintain zero-emission vehicles and related infrastructure and avoid displacement of the existing workforce..

Each element of the plan was evaluated for the specific local and agency operating context. Scenarios were developed to assess future electrification strategies and suitability for HAT's operating conditions.

FTA Element 1: Long-Term Fleet Management Plan

FTA requires a long-term fleet management plan that shows how funding requests will support a strategic fleet transition. This section of the plan provides an overview of the existing HAT fleet, a comparison of the available technologies, and a detailed analysis of HAT's current and future fleet and routing to identify potential scenarios for the transition to zero emission vehicles (ZEVs).

1

FTA ELEMENT 1

Demonstrate a long-term fleet management plan with a strategy for how the applicant intends to use the current request for resources and future acquisitions.

Fleet Overview

As of April 2023, the active HAT microtransit fleet is comprised of 22 vehicles with the following breakdown:

Microtransit Fleet

Number of vehicles in operation	Manufacturer / Model	Vehicle / Description
10	Dodge Ram Promaster 1500	17' vans
5	Dodge Ram Promaster 1500	19' vans
2	Ford Candidate II	19' shuttle buses
5	BraunAbility Voyager Rear Entry	17' vans

Table 1-1: Microtransit Fleet

20 VANS → 2 SHUTTLE BUSES → 22 VEHICLES

The microtransit vehicles operate only on weekdays, with the exception of major holidays, for a total of 252 days throughout the year. A maximum of 20 vehicles operate per day. The vehicles operate Monday-Friday between 5:00 AM and 9:00 PM.

The model years of the microtransit vehicles range from 2020 to 2023.

The fleet assessment used information about the current active fleet as provided by HAT to extract the key inputs for fleet modeling efforts.

KEY MICROTRANSIT OPERATING STATS

- 439,117 miles traveled/year
- Averaging 21,956 miles per vehicle/year
- Average fuel economy of 12.6 miles per gallon (MPG)
- Total fuel consumption of 34,808 gallons of fuel

ZEV Technologies

Table 1-2 compares current available technologies.

	Description	Benefits	Challenges
Diesel	Diesel is refined from crude oil that is less refined than gasoline and takes longer to evaporate.	• Lowest petroleum-based fuel cost and cost per mile • Burns at a lower rate than gasoline resulting in high fuel economy • Diesel engine's life expectancy may range from 250,000-300,000 miles	• High emissions • High maintenance costs compared to gasoline
Gasoline	Gasoline is another refined crude oil that has a relatively more complex refining process than diesel and ignites more evenly. HAT uses it for the 22 vehicles in operation	• Lower emissions than diesel • Lower maintenance costs compared to diesel	• Lower fuel economy than diesel • Higher TCO than diesel
Hybrid-Electric	Hybrid-electric uses low sulfur diesel in combination with energy stored in batteries.	• Lower emissions than diesel • Higher fuel economy than diesel	• Higher TCO than diesel • Unsuitable for long distances due to reduced regenerative breaking
Battery Electric	Battery Electric uses on-board batteries to drive electric motors.	• Zero tailpipe emissions and noise • Operating costs one-third of diesel	• Higher initial investment costs • Requires recharging for long distances and extended routes due to range constraints

Table 1-2: Fuel technology comparison

Zero emission technologies for transit vehicles generally fall into one of two types: battery-electric vehicles (BEVs) and hydrogen powered fuel cell electric vehicles (FCEVs).

BEVs are driven by electric motors and derive energy from on-board batteries. BEVs must be charged at a station; unlike BEV buses which require specialized infrastructure for charging, BEV vans and shuttles may be charged at commercial charging stations, allowing them to use standard AC charging and DC fast-charging stations. BEV vans and shuttles use plug-in chargers, which vary in output from 50 to 300 kW. Battery sizes range from 68kWh to over 120kWh. Adoption of BEV vans and shuttles lags behind that of BEV cars and buses, and many agencies choose to retrofit gasoline or diesel transit vans to electric, but there are commercially available vans on the market (METRO Staff, 2022). The Ford E-Transit is available as a full-sized cargo van or cutaway with an estimated range of 126 miles, and the electric version of the conventional version of the Ford Transit which is commonly used for microtransit. (Cruz & Dorian, n.d.; Ford, 2023).

BEV van and shuttle technology is expected to improve in the coming years. One promising initiative is a partnership between Zeus Electric Chassis Inc. and Pegasus Bus Company, who have stated that their goal is "to change the trajectory of electric shuttle and paratransit bus development, performance, and reliability." They plan to produce a Pegasus Bus on a Zeus Z-19 Power Platform specifically designed for transit and paratransit with a standard range of 150 miles (METRO Staff, 2022).

FCEVs generate electricity by combining hydrogen from an on-board storage tank and oxygen from the air emitting only heat and water vapor. Although the use of FCEV buses has grown in recent years, usage of FCEV cars, and especially vans, is far more limited. As of mid-2022, fewer than 15,000 FCEV cars were in use in the United States – all of these vehicles are in California, the only state with a hydrogen vehicle fueling network (Voelcker, 2022). FCEV vans are not currently in use for microtransit – Ford is planning to test FCEV E-Transit vans in the UK, but these vehicles are prototypes not available for mass production (Carey, 2023). Therefore, FCEV technology was not considered to be a suitable option for HAT.

Detailed Assessment and Modeling of Future Fleet Technologies

The HAT microtransit fleet is relatively new, with the oldest vehicles from 2019, and the fleet currently consists entirely of internal combustion engine (ICE) cutaway vans. FTA indicates that cutaway vehicles are eligible for replacement after approximately five years in service, which informs the anticipated timeline for the van fleet transition. Based on vehicle ages, current funding availability, and budgeted and anticipated fleet expansions, it is estimated that the entire fleet could transition to BEVs by 2029, as shown in Figure 1-1. This timeline and the rate of transition may be affected by future budget allocations and grant funding.

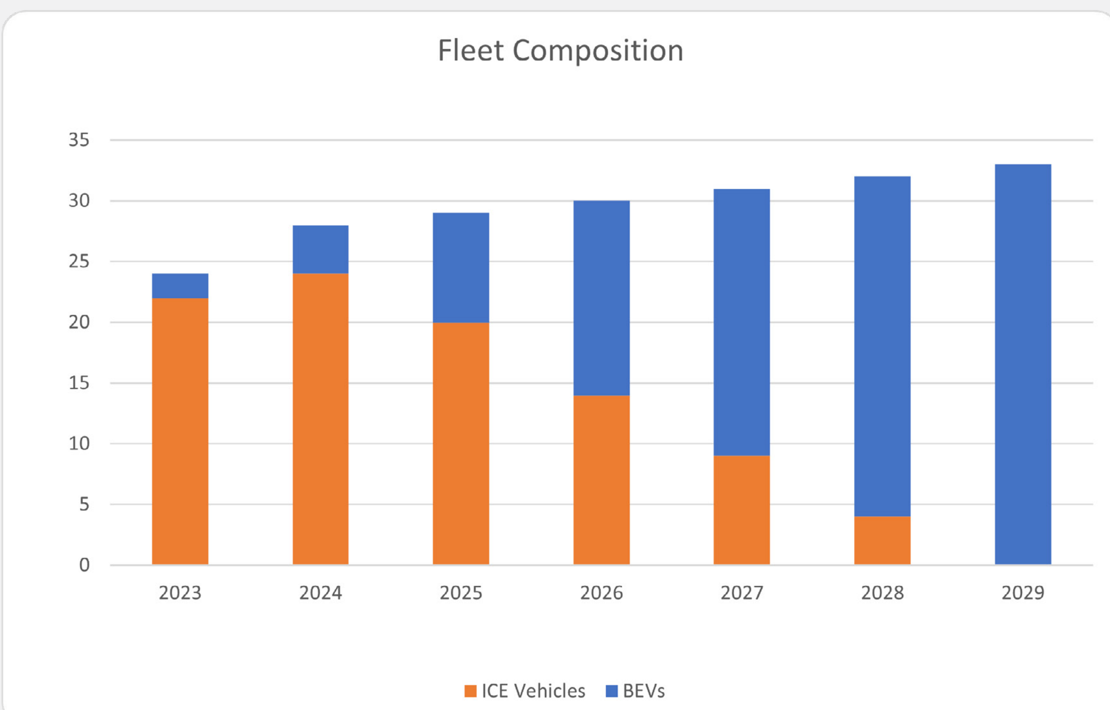


Figure 1-1: Projected Fleet Composition

Modeling Approach

The fleet transition plan was developed using the results of an in-depth technical analysis conducted with a software platform (EVOPT®) specifically designed for fleet transition planning and optimization of vehicle deployments.

The following were key inputs to the model from the current active HAT fleet

- Vehicle make and model, and fuel type.
- Vehicle mileage and annual fuel usage.
- Operating schedule for the microtransit fleet.
  - o Hours of operation, and driver schedules to extract number of trips per day, driving time, and daily mileage per vehicle integrated with driver schedule for the microtransit fleet.

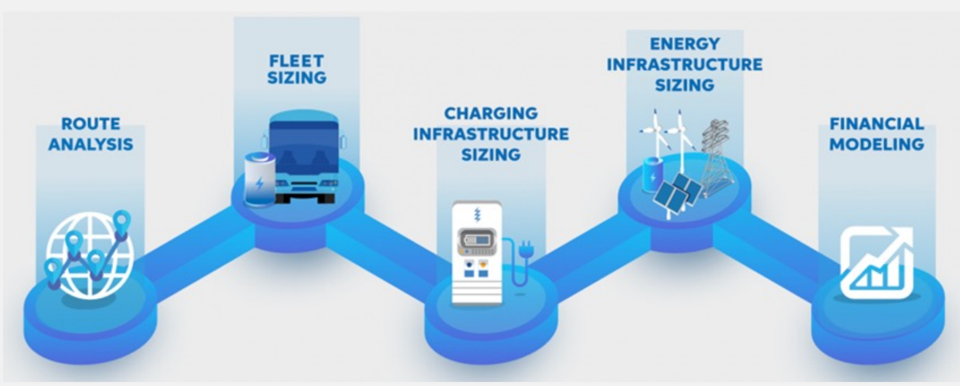
The operating schedule of the fleet was manually reconstructed from the received information, and then uploaded into the modeling software for analysis. The electrification analysis included:

1. Route energy analysis integrating of weather, terrain gradient, gross vehicle weight rating (GVWR), and passenger capacity.
2. Vehicle battery and charging equipment sizing.
3. Energy load profiles.

Overall goals of the assessment are to determine the suitability of vehicles for electrification, and the most cost-effective options to electrify the HAT fleet through equipment right-sizing while maintaining operational uptime, and to inform a long-term management plan.

Modeling Platform

EVOPT® incorporates algorithms for route energy analysis, vehicle battery and charging infrastructure sizing, charging scenario simulation, financial modeling, and emission reduction calculations. The figure below illustrates the main modules. EVOPT® uses a rigorous energy modeling algorithm to accurately extract the real-world energy needs of an electric vehicle, which is important in cold and hot weather when the battery range can decrease up to 40% below the nominal values. These algorithms incorporate the effects of vehicle mileage, average payload, terrain gradient, and temperature and have been independently verified against real-world fleets in operation to confirm accuracy. The resulting route energy estimates includes two major elements: traction energy (required to move the vehicle); heating, ventilation, and air conditioning (HVAC). The calculated energy values are then used to perform the vehicle battery charging equipment right-sizing assessment, extract the daily energy needs at the charging location, and inform the financial and emission reduction analyses.



Route Energy Analysis

The route energy analysis provides the energy required to complete daily operations (where a daily operation is the sum of all the trips completed by a vehicle from the time it leaves and returns to depot) based on real-world electric vehicle efficiency values calculated using vehicle mileage, GVWR, and climate. For the HAT fleet, the analysis was conducted for the winter temperature of 36°F (reflecting the historic 24-hr average of the daily temperature data collected for Hall County by the National Oceanic and Atmospheric Administration, NOAA) to size the vehicle batteries for conditions that can present operational constraints. (Note: the energy analysis does not include the energy that might be needed for battery preconditioning under certain cold temperature conditions).

The GVWR chosen for the electric microtransit fleet was taken from a commercially available ZEV equivalent to a HAT Dodge Ram Promaster 3500 cutaway shuttle (14,500 lbs for the ZEV replacement).

The resulting energy efficiency for the ZEVs was 0.8 kWh/mile. Figure 1-2 shows the total energy requirements obtained for the 20 analyzed vehicles. The modeled energy is equally distributed across the vehicles and the mileage served based on HAT's county-wide service area, rather than fixed route service

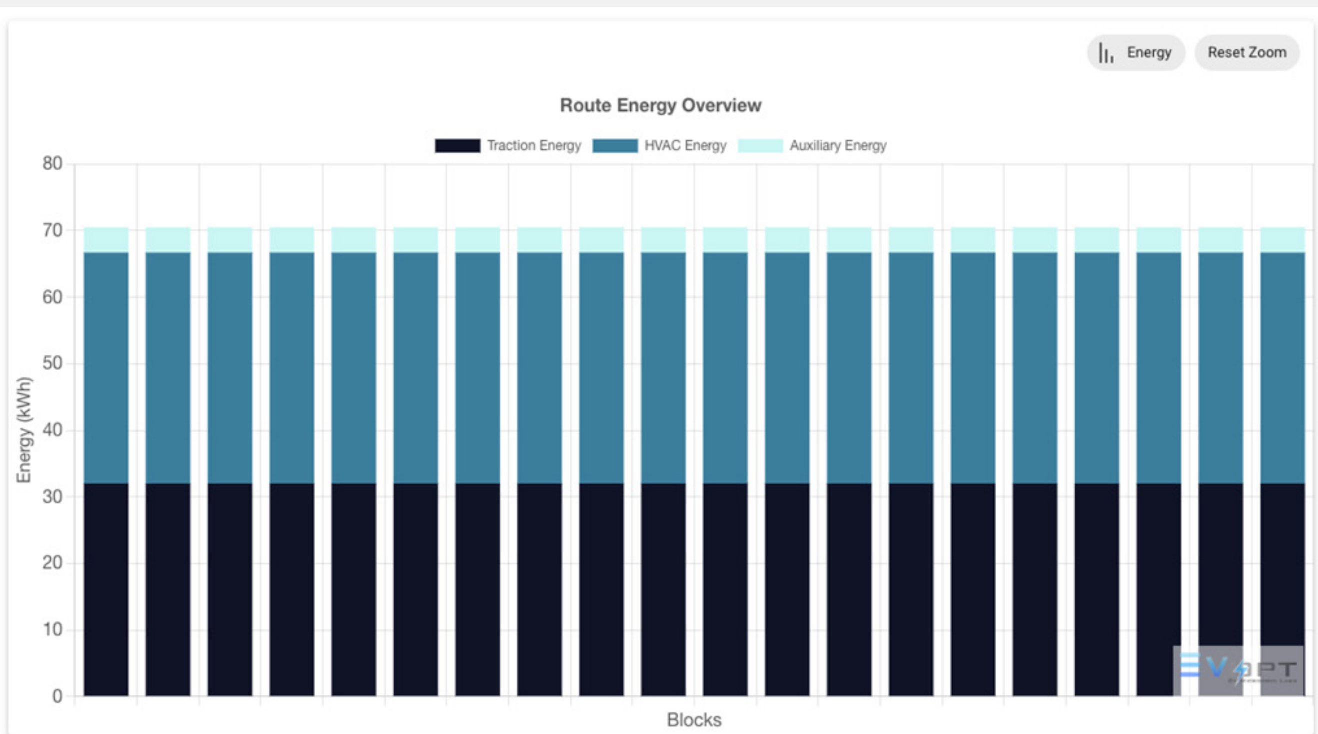


Figure 1-2: Results of the energy analysis for the HAT vehicles. The total energy is the sum of traction, HVAC, and auxiliary loads.

Equipment and Fleet Sizing

The results of the route energy analysis were used to size the vehicle batteries and charging equipment.

Figure 1-3 shows the battery sizes needed to operate each vehicle in year 12, the modeled vehicle lifespan, after accounting for battery degradation (3% degradation per year of operation) and 80% usable battery capacity. The modeling suggests that 100% of the vehicles can be operated on one charge by a 120-kWh battery, throughout the 12-year modeled lifespan of the vehicle.

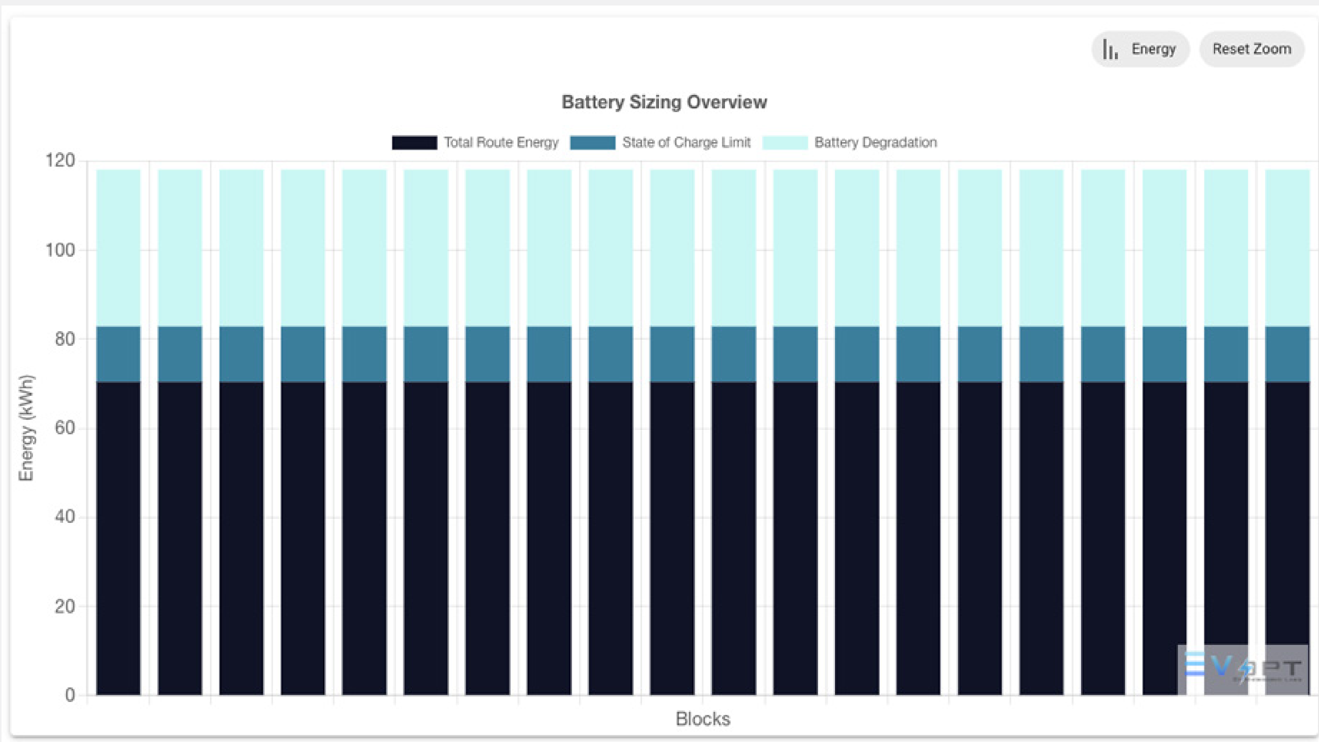


Figure 1-3. Chart of battery sizes needed for each vehicle for year 12 of operation. All vehicles are feasible to be electrified with existing BEV technology and a single charge.

Charging Scenarios/Sizing

The charging scenario analysis was performed by evaluating different charger sizes to find the minimum power rating required to maintain operational viability of the vehicles. This charging scenario assumes:

- Charging will occur only at the maintenance facility.
- Operating fleet size is based on the 20 vehicles in daily use.
- The fleet consists of 20 cutaways (battery size of 120-kWh).
- The vehicles operate 252 days a year and operate from 5am to 9pm daily.
- Every vehicle has the same efficiency, or fuel economy (0.8 kWh/mi).
- Vehicles are available to charge for 90% of the time they are at the facility.
- Every vehicle has its own charging port.

For the modeled microtransit fleet, four charger options (11.5 kW, 19.2 kW, 30 kW, and 60 kW charging ports) were selected for evaluation. For each scenario, the analysis calculates the number of chargers and vehicles needed to operate the fleet at each specific charger rating. Figure 1-4 shows the charger ratings and the resulting vehicle replacement ratio. The replacement ratio is the comparison of the number of BEV vs ICE vehicles it would take to fulfil the operational requirements. In this case, 20 BEVs could fulfil the same operational requirements as 20 gasoline vehicles, for a 1:1 replacement ratio. In this case, an 11.5 kW port for each vehicle would minimize the replacement ratio while not oversizing the charger.

Select Charging Scenario

	Scenario	Charger Count	Rating	Vehicle	Battery Capacity	BEV Needed	ICE Needed	Replacement Ratio
☑	Scenario 1	20	11.5 *kW*	23'Cutaway	120 *kWh*	20	20	1
☐	Scenario 2	20	19.2 *kW*	23'Cutaway	120 *kWh*	20	20	1
☐	Scenario 3	20	30 *kW*	23'Cutaway	120 *kWh*	20	20	1
☐	Scenario 4	20	60 *kW*	23'Cutaway	120 *kWh*	20	20	1

Figure 1-4: Charging scenarios created for the HAT analysis of the microtransit fleet.

Figure 1-5 shows the full fleet sizing result. The 20 vehicles in daily operation can be served with a 120-kWh battery and an 11.5 kW charging port for each vehicle.

Electric Vehicles (BEV) | Conventional Vehicles (ICE)

Rating	Charger Count	Vehicle Type	Vehicle Size	Battery Capacity	Total Blocks	Feasible Blocks	ICE Needed	Equivalent BEV	Replacement Ratio
11.5 *kW*	20	Cutaway	23 *ft*	120 *kWh*	20	20	20	20	1

Figure 1-5: Results of charging scenario for the 20 BEVs covering daily operations.

Key Findings

- Route energy efficiencies calculated for wintertime conditions are 0.8 kWh/mile for the modeled ZEVs.
- The daily energy requirement for each vehicle is 71 kWh.
- 100% of the fleet vehicles are 'feasible' and daily routes can be completed on a single charge (typically overnight) with a 120 kWh battery throughout a 12 -year modeled lifespan of the BEV.
- For the fleet operating under average conditions modeled in this study, an 11.5 kW charger is appropriate to maintain vehicle operability.

Recommendations

- Under the modeled conditions, the HAT microtransit fleet can be electrified with 120 kWh battery vehicles that are charged once daily.
- HAT can use the battery sizing results to inform vehicle procurement and a long-term fleet management plan.

FTA Element 2: Current and Potential Funding Summary

HAT is planning to transition to a fully zero emission fleet. This analysis outlines the planned future funding that can support this transition and identifies additional funding sources that may be available to fill any funding gaps.

2

FTA ELEMENT 2

Address the availability of current and future resources to meet costs for the transition and implementation.

Current and Planned Funding for Zero Emission Vehicles

HAT receives funding from federal, state, and local sources.

GHMPO's 2021-2024 Transportation Improvement Plan identifies transit funds from 2021 through 2024. Table 2-1 below summarizes funds that may support the ZEV transition. Funds for future replacement and expansion vehicles can be directed towards ZEVs. A portion of funds for planned building and facility improvements and renovation could be directed towards vehicle charging or other support infrastructure for ZEVs.

Description	Funding Source	2021	2022	2023	2024	Total
Replacement Vehicles	Section 5307 (Urban Capital)	$1,300,000	$0	$0	$600,000	**$1,900,000**
Expansion Vehicles	Section 5307 (Urban Capital)	$0	$0	$625,000	$200,000	**$825,000**
Parking Lot & Building Improvements	Section 5307 (Urban Capital)	$0	$0	$0	$50,000	**$50,000**
Replacement Vehicles	Section 5311 (Rural Capital)	$0	$0	$0	$50,000	**$50,000**
Buy <30 Foot Bus For Expansion	Transit Funds for the Atlanta Urbanized Area in Hall County	$0	$0	$0	$800,000	**$800,000**
Rehab/renovate Administrative Facility	Transit Funds for the Atlanta Urbanized Area in Hall County	$0	$0	$0	$190,000	**$190,000**

Table 2-1 – FY 2021 - 2024 Hall Area Transit Capital Expenses

GHMPO has also requested to flex $391,424 in FHWA Carbon Reduction Funds (Y606) to purchase ZEVs under FTA oversight.

Potential Grants and Other Funding Sources

While funds allocated to HAT may be used to support the ZEV transition, additional funding sources are also available. The following programs may provide funding that supports planning for, transitioning to, implementing, operating, and maintaining zero emission vehicles.

Potential Grants and Funding Sources		
Agency	**Program**	**Program Description & Eligible Activities**
Federal Funding Sources		
United States Department of Transportation (USDOT)	Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Grant Program	**Program Type:** Competitive grants **Project Types supported:** Investments in surface transportation projects that will have a significant local or regional impact; Capital projects and planning projects. **ZE Transition Applicability:** Could be used for future ZEV purchases, related infrastructure, or planning assistance
	Transportation Infrastructure Finance and Innovation Act (TIFIA) loans, loan guarantees, and standby lines of credit	**Program Type:** Competitive grants **Project Types supported:** Projects of regional and national significance. **ZE Transition Applicability:** Unlikely to be needed for current HAT plans, but may be applicable for future significant projects or expansions.
	Bus and Bus Facilities Grant Program	**Program Type:** Competitive grants **Project Types supported:** Purchase, replacement, or rehabilitation of buses, related equipment, or bus-related facilities. WeGo vehicles should qualify as buses under the policy definition, which states that "a low or no emission bus is defined as a passenger vehicle used to provide public transportation that sufficiently reduces energy consumption or harmful emissions, including direct carbon emissions, when compared to a standard vehicle." The Buses and Bus Facilities Competitive Program has funded projects that do not include buses, including an Idaho Department of Transportation project to buy commuter vans and a Bloomington-Normal Public Transit System to fund microtransit vehicles. Direct recipients for the Buses and Bus Facilities Competitive Program must operate a fixed route service, although subrecipients do not have this requirement. HAT may seek opportunities to apply as a subrecipient. **ZE Transition Applicability:** Could be used to purchase ZE vehicles as replacements or for fleet expansion, purchase charging or other ZE fueling equipment and infrastructure, future facility expansions, and other elements needed for full fleet transition.
	Low or No Emission Vehicle Program - 5339(c)	**Program Type:** Competitive grants **Project Types supported:** Purchase or lease of zero-emission and low-emission transit buses as well as acquisition, construction, or lease of required supporting facilities. **ZE Transition Applicability:** Could be used for future ZE bus purchases and related infrastructure.

Federal Transit Administration (FTA)	Accelerating Innovative Mobility Program	**Program Type:** Competitive grants **Project Types supported:** Activities leading to the development and testing of innovative mobilities. **ZE Transition Applicability:** HAT's on-demand WeGo service and integration with an app represents an innovative approach, making the service a potential candidate for this program.
	Zero Emission Research Opportunity (ZERO) Program (as part of consortium led by a nonprofit organization)	**Program Type:** Competitive grants **Project Types supported:** Efforts to research, demonstrate, test, and evaluate zero emission and related technology for public transportation applications. **ZE Transition Applicability:** Program is applicable to non-project organizations; however, HAT could participate as part of a consortium led by a non-profit.
	Mobility on Demand (MOD) Sandbox Demonstration Program - 5312	**Program Type:** Competitive grants **Project Types supported:** Planning, equipment, developing software, and piloting projects that demonstrate innovative Mobility on Demand. **ZE Transition Applicability:** HAT's on-demand WeGo service, which utilizes a technology platform including an app for users, is a potential candidate for this grant program.
State of Georgia Funding Sources		
Georgia Environmental Finance Authority	Georgia Solar Program	**Program Type:** Rebate program **Project Types supported:** Materials, design, and installation of ground or rooftop mounted solar. **ZE Transition Applicability:** TThis program could be used to build supportive charging infrastructure. Georgia Solar Program rebate funds are available to cities, counties, and K-12 public schools; HAT would need to partner with City of Gainesville or Hall County to take advantage of this program.
	Solar Resiliency Technical Assistance Program	**Program Type:** Technical Assistance **Project Types supported:** Creation of solar and storage resilient "critical facilities", including government facilities and transportation systems. **ZE Transition Applicability:** This program could provide technical assistance to aid HAT in creating more resilient facilities. Additionally, the program has provided funding for feasibility studies and installations.

Table 2-2 – Potential Grants and Funding Resources for HAT

Total Cost of Ownership

A financial analysis was conducted to model the existing fleet and compare against a fully electrified fleet. The primary inputs for the financial analysis used a combination of fleet specific and industry average capital and operational costs. The capital costs for the existing fleet reflect the price that HAT paid with their local funds. Annual mileage and fuel usage, along with the associated fueling costs, were obtained directly from HAT and used in the total costs for the existing fleet. For the simulated BEV fleet, electricity usage and costs were calculated for the unmanaged charging scenario, using the Georgia Power tariff *Power and Light Medium "PLM-14"*, summarized in Table 2-4. The electricity costs were calculated for each month and accounted for the average monthly temperature to scale the charging needs (for instance, the fleet will use less energy in April compared to January because of the mild springtime temperatures, requiring less HVAC load, allowing the battery to maintain charge longer and require less charging). The modeled BEV fleet assumes that 25% of the vehicle and charger costs will be covered by grants.

	Costs and incentives	Microtransit	Gasoline
CAPITAL	Vehicle Cost	$72,621	$200,000
	Vehicle Incentives	n/a	25% of cost
	Charging Equipment Costs Including Installation	n/a	$ 6,900 for a 11.5 kW charger port ($600/kW)
	Charging Infrastructure Incentives	n/a	25% of cost
OPERATIONAL	Fuel (Fleet Cost/yr)	$103,979	Electricity rate ($/kWh) = $0.11571 Demand charges ($/kW) = $8.47 Monthly charge: $141
	Maintenance ($/mile)	$1.50	$0.53

Table 2-4. Data inputs for the financial modeling module. The inputs are categorized by Capital and Operational costs. The numbers are on a per-vehicle and per-charger port basis unless otherwise stated.

Figures 2-1 through 2-3 show the results of the financial analysis for the HAT fleet. Capital costs, operating costs, and total costs (sum of capital and operating costs) are shown for the existing gasoline vehicles (ICE fleet) and the BEV fleet under the unmanaged charging scenario. To conservatively estimate Total Cost of Ownership (TCO), replacement of ICE vehicles and BEVs is assumed after 6 years of operation. Thus, capital costs are incurred twice, first in the beginning of Year 1 and then following the end of the 6th year. This is reflected in the TCO in Figure 2-3. While the capital costs associated with the existing ICE fleet are lower than the BEV fleet, the total lifetime costs are lower for a BEV fleet due to the much lower operating costs. The TCO analysis only compares the cost of vehicles required for daily operation, i.e., no spares. The lifetime cumulative costs at the 12-year mark are $12.3 million for the ICE fleet and $9.5 million for the BEV fleet.

Initial fleet capital costs + **Fleet operating costs per year** × **12 years** = **Total costs**

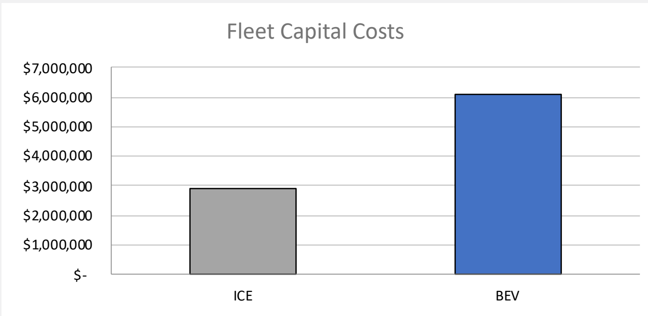


Figure 2-1: Initial fleet capital costs.

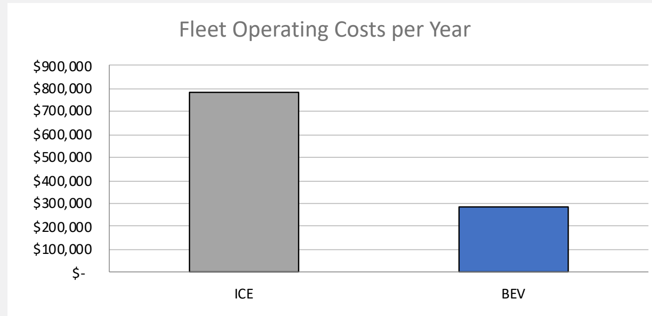
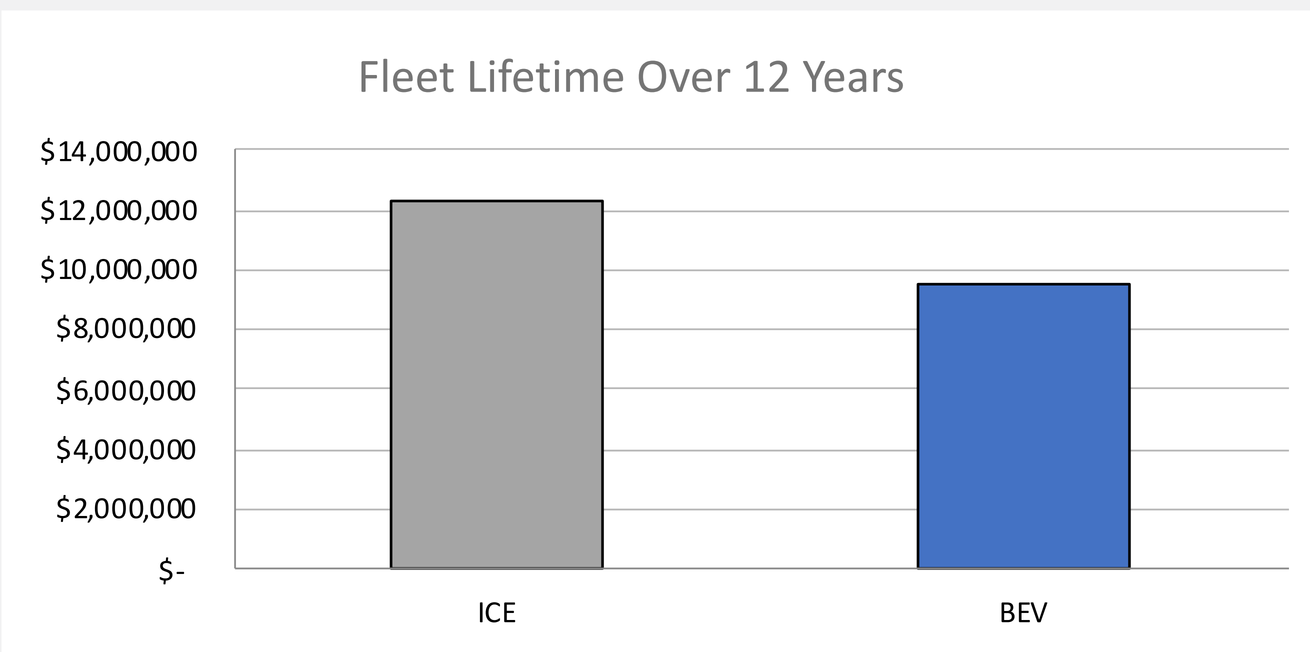


Figure 2-2: Fleet operating costs per year

Figure 2-3: Fleet costs over 12 years. The total includes the initial capital costs, plus cumulative operating costs over 12 years.



Model-Based Emissions Analysis

The emissions analysis was performed to account for both greenhouse gases (GHG) and nitrogen oxides (NOx) emitted by the gasoline vehicle tailpipes, and emissions coming from electricity generation needed for vehicle charging. The analysis used emission factors (EFs) obtained as follows, and listed in Table 2-5:

- Gasoline tailpipe EFs
    - GHG EFs were obtained from the EPA Emission Factor Inventory. GHGs were reported as carbon dioxide equivalent (CO2e) which includes CO2, CH4, and N2O.
    - NOx EFs were obtained from the Argonne National Laboratory AFLEET tool which has state and vehicle age specific EF values (EF values are for Georgia, and 2021, which is the average fleet age).
- Electricity grid emissions
    - GHG EFs (as CO2e) and NOx EFs were obtained from the EPA Power Profiler eGRID Summary Tables, which lists specific EFs for each state.

For the modeled microtransit fleet, four charger options (11.5 kW, 19.2 kW, 30 kW, and 60 kW charging ports) were selected for evaluation. For each scenario, the analysis calculates the number of chargers and vehicles needed to operate the fleet at each specific charger rating. Figure 1-4 shows the charger ratings and the resulting vehicle replacement ratio. The replacement ratio is the comparison of the number of BEV vs ICE vehicles it would take to fulfil the operational requirements. In this case, 20 BEVs could fulfil the same operational requirements as 20 gasoline vehicles, for a 1:1 replacement ratio. In this case, an 11.5 kW port for each vehicle would minimize the replacement ratio while not oversizing the charger.

Emissions Factors (EFs)	CO_2e	NOx
Gasoline (lbs/gallon)	19.41	0.5
Electric Grid (lbs/MWh)	762.4	0.3

Table 2-5. Fuel specific CO2e and NOX emission factors (EFs) for gasoline and electricity used in the analysis.

Figure 2-4 shows the results of the emission analysis for the HAT fleet. CO2e and NOx emissions are shown for the existing gasoline vehicles (ICE fleet) and for the future fleet (BEV fleet).

The electrification of the HAT fleet would eliminate more than 103 tons of NOx emissions from the fleet. Electricity production for fleet charging would still emit CO2e, but still result in net GHG savings of 2,912 tons of CO2e for the fleet.

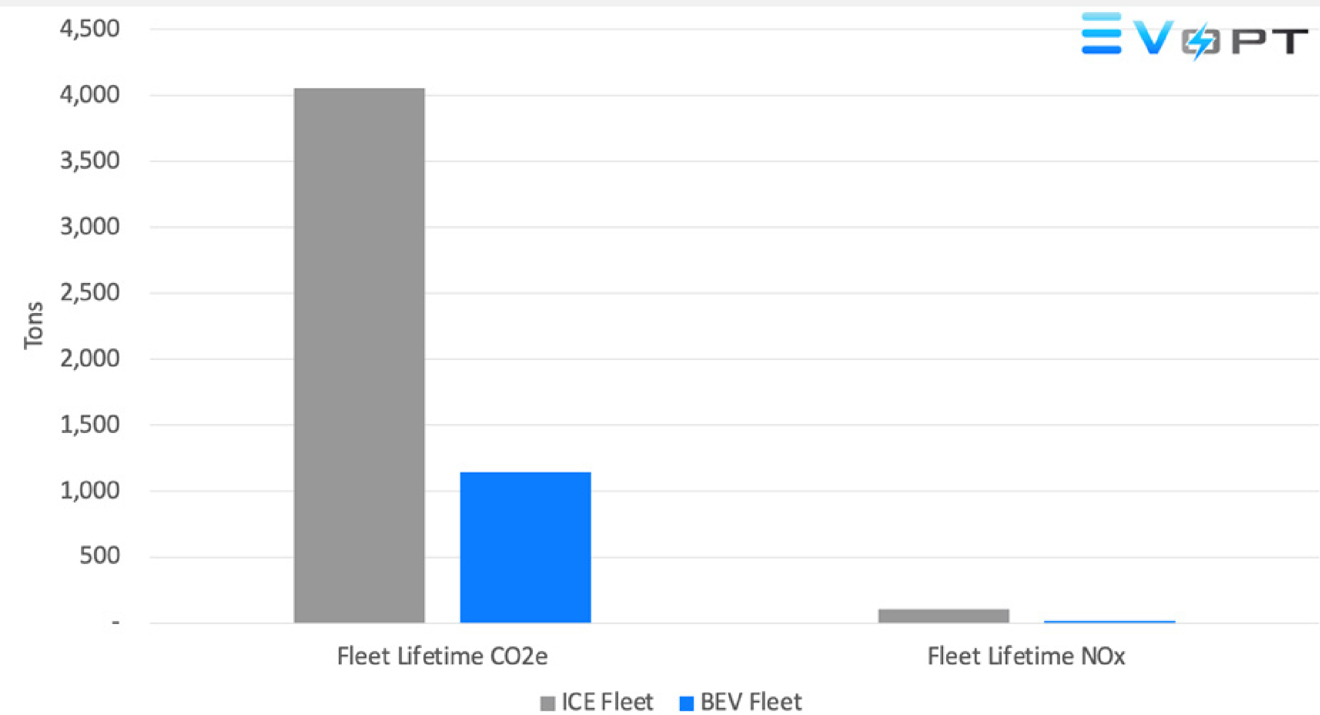


Figure 2-4: Emission analysis for the HAT microtransit fleet.

Key Findings

- The Buses and Bus Facilities Competitive Program requires that direct recipients of funds operate a fixed route transit system. HAT is not eligible to be a direct recipient of funds, but they may be eligible as a subrecipient through another state agency.
- Although WeGo vehicles are not vans, the system still qualifies as a public transit zero emission bus under federal definitions. Thus, even though HAT no longer operates any full-sized buses or cutaways, the system is still eligible for zero and low emission bus grants.
- Electrification of HAT fleet vehicles would save an average of $219,000 per vehicle over 12 years.
- Electrification of the HAT fleet would result in net GHG savings of 2,912 tons of CO2e and 103.97 tons of NOx for the fleet over 12 years.

Recommendations

- HAT should evaluate whether they may be eligible as a subrecipient for federal grants where they are not eligible as a direct recipient.
- If HAT transitions the fleet to BEVs on the most expedited timeline that is feasible and supported by available funding , the agency will significantly reduce operational costs as well as emissions.

FTA Element 3: Policy and Legislation Impact Analysis

HAT's transition to a zero-emission fleet is guided by federal, state, and local policies and legislation. Many policies support the fleet transition, while some may create challenges. The analysis below outlines key relevant policies, legislation, plans, and guidance and summarizes how they may impact or provide opportunities for HAT.

3

FTA ELEMENT 3

Consider policy and legislation impacting relevant technologies.

Federal Policies and Legislation Impact Analysis

Reducing carbon emissions is a global priority, demonstrated by the agreement of 196 countries at the 2015 United Nations Conference of the Parties in Paris to limit global warming to less than two degrees Celsius compared to pre-Industrial Revolution levels. Federal orders, legislation, and policies support this goal.

Federal Executive Order 14057

100% ZEV acquisitions by 2035

Federal Legislation, Regulations, And Guidance		
Legislation, Regulation, or Guidance	**Key Provisions**	**Impacts/Opportunities for HAT**
Executive Order 14008: Tackling the Climate Crisis at Home and Abroad (2021)	• Creates a new position and climate task force and sets intention to participate in forums and develop plans to meet Paris Agreement • Sets policy for government-wide approach to climate, including procurement to support climate action including zero emission vehicles for government fleets. • Promotes assessment, disclosure, and mitigation of climate risks. • Develops climate finance plan and focuses on aligning investments with climate action. • Established Justice 40 Initiative and other environmental justice efforts	• Establishes policy supporting zero emission fleets. • May lead to available federal resources

Federal Legislation, Regulations, And Guidance		
Legislation, Regulation, or Guidance	**Key Provisions**	**Impacts/Opportunities for HAT**
Justice 40 Initiative	• Sets an intention to provide 40 percent of the benefits of federal investments to disadvantaged communities. • Focuses on investments related to climate change and clean energy	• Implementation of ZEVs may need to demonstrate the level of benefit to disadvantaged communities
Federal Sustainability Plan	• Plan to implement EO 14008 • ZEV strategies include optimizing agency fleet management, aligning financial planning, expanding charging infrastructure, improving workforce understanding for cultural change, seek seeking opportunities for State, Tribal, and local government fleets to benefit, and establishing a Zero Emission Vehicle Fleets Federal Leaders Working Group.	• Establishes policy supporting zero emission fleets. • May lead to available federal resources
Executive Order 14057: Catalyzing Clean Energy Industries and Jobs through Federal Sustainability (2021)	• Seeks to reduce emissions across federal operations. • Includes a goal of 100 percent zero emission vehicle acquisitions by 2035, with 100 percent of light-duty vehicle acquisitions to be zero emission vehicles by 2027.	• Provides detailed goals for zero emission vehicle acquisitions at the federal level. • May lead to available federal resources
Bipartisan Infrastructure Law (BIL) and Related Implementation (Pub. L. 117-58) (2021O	• Includes requirements for zero emission transitions for some Federal transit grant programs. • Federal Transit Administration (FTA) requires transit agencies applying for competitive funding to include a Zero Emission Transition Plan with the application for funding for • Grants for Buses and Bus Facilities Competitive Program (49 USC §5339(b)) • Low or No Emission Program (49 USC §5339(c))	• Requires completion of a Zero Emission Transition Plan to apply for certain federal grants
FTA Guidance for Zero Emission Transition Plans (Dear Colleague letter dated December 1, 2021)	• Provides guidance on preparing Zero Emission Transition Plans • Refers applicants to the Guidebook for Deploying Zero Emission Transit Buses published by the Transit Cooperative Research Program (TCRP) in 2021 for additional information.	• Establishes FTA Expectations for key grant programs. • TCRP Guidebook is a valuable resource for transit agencies at any phase of zero emission deployment, from initial needs assessment through monitoring performance and evaluating data
USDOT Innovation Principles	• USDOT Innovation principles support policy priorities related to creating high quality jobs, achieving racial equity, increasing opportunity, and tackling the climate crisis, driving innovation. • Seeks to increase adaptability and resilience to future-proof infrastructure. • Focused on empowering workers. • Allows for experimentation, learning opportunities, and collaboration. • Promotes flexibility and adaptability to technology changes	• Sets policy direction for transportation innovation. • May provide resources for testing and piloting new technologies. • May provide support for training and developing staff

Table 3-1 – Federal legislation, regulations and guidance supporting reducing carbon emissions

State of Georgia Policy and Legislation Impact Analysis

The State of Georgia's efforts to promote electric vehicles are based primarily on economic goals and partnerships. No specific state-level GHG, climate, or fleet transition plans were identified, and no state-level targets for emission reduction or ZEV adoption have been set. Georgia's Alternative Fuel Vehicle (AFV) Annual Fee presents a minor barrier in the form of an annual licensing fee per zero emission vehicle.

State Policies, Legislation and Plans		
State Policy, Legislation, Guidance	**Key Provisions and Actions**	**Impacts / Opportunities for Gainesville**
Alternative Fuel Vehicle (AFV) Annual Fee	• All-electric vehicles are subject to an annual licensing fee of $316.40 for commercial vehicles and $210.87 for non-commercial vehicles.	• This fee will increase the cost per vehicle per year and require HAT to ensure the requirements are met

Table 3-2 – Georgia State Policies

Local Plans and Policy Impact Analysis

There are several comprehensive and mobility plans for the Gainesville-Hall County region that are in alignment with HAT's plans for a full transition to a zero-emission transit fleet.

The GHMPO 2020 Regional Transportation Plan was adopted in May 2020. One of the Goals and Planning Factors is protecting the environment, promoting energy conservation, and promoting consistency between transportation improvement and other planning efforts. The plan also identifies Environment in its Goals and Objectives, specifically the development of a transportation system that conserves energy, improves air quality, and protects natural resources.

The GHMPO FY2024 Unified Planning Work Program (UPWP) was updated in March 2023. The UPWP supports Planning Emphasis Areas outlined by the FHWA and FTA that are supportive of HAT's zero-emission transition, including Tackling the Climate Crisis, Equity and Justice, and Planning and Environmental Linkages. Key UPWP activities and products highlight HAT transit expansion and improvement, including improvements for WeGo microtransit, in FY2024, and this current ZEVTP.

The Gainesville 2040 Comprehensive Plan was updated in June 2022. The plan highlights the success of HAT's WeGo service in providing an innovative solution that is responsive to the needs of riders. The plan also includes Environmental Sustainability as one of the ten Community Objectives.

Key Findings

- The ZEVTP fulfills a wide variety of policy goals and requirements, including federal climate goals and local goals to continue to enhance mobility while protecting the environment and promoting energy conservation.
- Although WeGo vehicles are now vans, they appear to still qualify as a "low or no emission bus" under federal program definitions and would thus be eligible for grant funding.
- Georgia's Alternative Fuel Vehicle (AFV) Annual Fee presents a minor barrier in the form of an annual licensing fee per zero emission vehicle.

Recommendations

- Ongoing mobility and transit planning efforts should consider the impact of recommendations on the ZEVTP. When any substantial changes to transit service are planned, the ZEVTP timeline and recommendations may require slight adjustments to align with future transit services.

FTA Element 4: Evaluation of Current and Future Facilities

4

FTA ELEMENT 4

Include an evaluation of existing and future facilities and their relationship to the technology transition.

Transitioning to a ZE fleet may require modifications to or construction of transit facilities to support ZEVs, such as charging and fueling stations or maintenance facilities and equipment. This section outlines existing, proposed, and potentially needed facilities. The facilities assessment includes analysis of the existing electrical capacity at the facility where the electric vehicles would be charged.

Transit fleet operators need to make sure that implementing and deploying new technologies doesn't create major disruption to service. For a fleet running on electricity, power disruptions are a concern, as any grid-level disruption can effectively disable their fleet. Thus, HAT must ensure that they can continue to operate their fleet and provide critical mobility services even in the event of a grid outage.

This section also outlines the social and environmental context of HAT operations to provide an initial screening of any future facilities recommendations. As HAT develops future facilities and services, demographic and social factors should be considered to inform equitable distributions of the benefits and burdens associated with transit services and facilities. When possible, facilities should not be placed in areas at risk due to environmental hazards such as flooding, and potential environmental and climate hazards, especially those intersecting with areas of social vulnerability, should be incorporated into planning a resilient transit system.

Existing & Planned Facilities

Transit Centers and Maintenance Facilities

HAT operates a transit facility and utilizes a City fleet maintenance facility, both located in Gainesville. The agency is planning for expansion and changes in vehicle types. The parking lot at the transit facility at 687 Main Street SW Gainesville, GA 30501 is at maximum capacity and the agency is searching for additional property that would allow parking of 10-15 additional vehicles.

EV Charging Infrastructure

There is currently no EV charging infrastructure in place as part of the HAT system. As part of the transition, the agency will have to install new chargers and related EV infrastructure.

Distributed Energy Resources and Resiliency Analysis

A transit depot with charging infrastructure and distributed energy resources (DER) assets to support a fleet of electric vehicles has the potential to function as an advanced electric grid that can charge the fleet at the lowest possible cost and lowest impact on the grid, while generating and storing energy.

A key point of consideration for an all-electric fleet can be the ability to disconnect from grid and fully support the local loads during an outage (i.e., island mode). This can be achieved by implementing a microgrid at the depot. Microgrids also provide the opportunity to integrate local renewable energy generation to reduce lifecycle carbon emissions and increase resilience.

A DER and resiliency analysis was performed to help HAT plan risks associated with power disruptions for a long-term electric fleet management scenario. The analysis consisted of estimating a solar photovoltaic (PV) output from the current HAT depot and designing an integrated solar PV and battery energy storage system (BESS) that can function as a local microgrid when coupled with a controller software that can direct power generated and stored onsite to the vehicle charging stations. In such a conceptual design, the microgrid can instantaneously island itself in the event of a power outage, allowing HAT to operate their fleet and thus providing the needed resiliency, in addition to reducing electricity costs through local energy generation and charging management measures.

A microgrid is a local, self-sufficient energy system that uses distributed energy resources to produce power. A microgrid serves a local area or specific purpose, such as charging a transit fleet.

An assessment of solar PV generation potential of the HAT main facility was prepared. The analysis was conducted with the software PVWatts, which allows the user to design a solar array system and to estimate the solar output potential of a location on an annual basis by considering seasonality (see Figure 4-1). The analysis indicates that the HAT rooftop and carport have approximately 262 kW DC solar peak generation potential, corresponding to 367,121 kWh of annual production. To put these numbers in perspective, the fully electrified HAT fleet of 20 BEVs would require 249,517 kWh of charging capacity annually at the depot.

Thus, solar PV could completely offset the charging load from the vehicles.

Figure 4-1: Solar PV generation potential estimated for the HAT facility, including rooftop and carport solar.

This microgrid system was modeled with a BESS rated at 250 kW and 500 kWh coupled with the onsite solar array of 262 kW. The DER analysis results were used to explore resiliency options for the fully electrified fleet. Assuming that the BESS is fully charged at the onset of the power outage, the analysis calculated the number of hours that the entire fleet can operate in resilient mode.

Table 4-1 shows the length of operations that could be sustained in the case of a grid outage occurring at 1 AM on a weekday and the solar array and BESS supporting all charging loads (representing a worst-case scenario). During the winter months when solar production is the lowest and HVAC requirements are high, full operations can be sustained for about 22 hours. During the milder spring and fall months when HVAC requirements are low, operations can be sustained from 73-156 hours. In the summer months when HVAC requirements to cool the buses are high operations can be sustained for 23-49 hours.

Month	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Fully Electric Fleet	22	22	24	97	156	49	23	25	73	156	43	24

Table 4-1: Estimated daily hours of operation in resilient mode during a hypothetical power outage. In this simulation, the power to the vehicle chargers is supplied by solar onsite generation combined with a BESS system in a microgrid design.

Figure 4-2 shows a more detailed simulation for the BEV fleet in the month of August. It is worth noting that power outages are most likely to occur during the coldest and hottest months of the year due to winter snowstorms or blackouts that are caused by grid stressors such as high air conditioning usage in summertime or hurricane-related damage. In these instances, the HAT fleet operator would need to decide which services can be discontinued and which ones are most essential to be covered in a power outage situation.

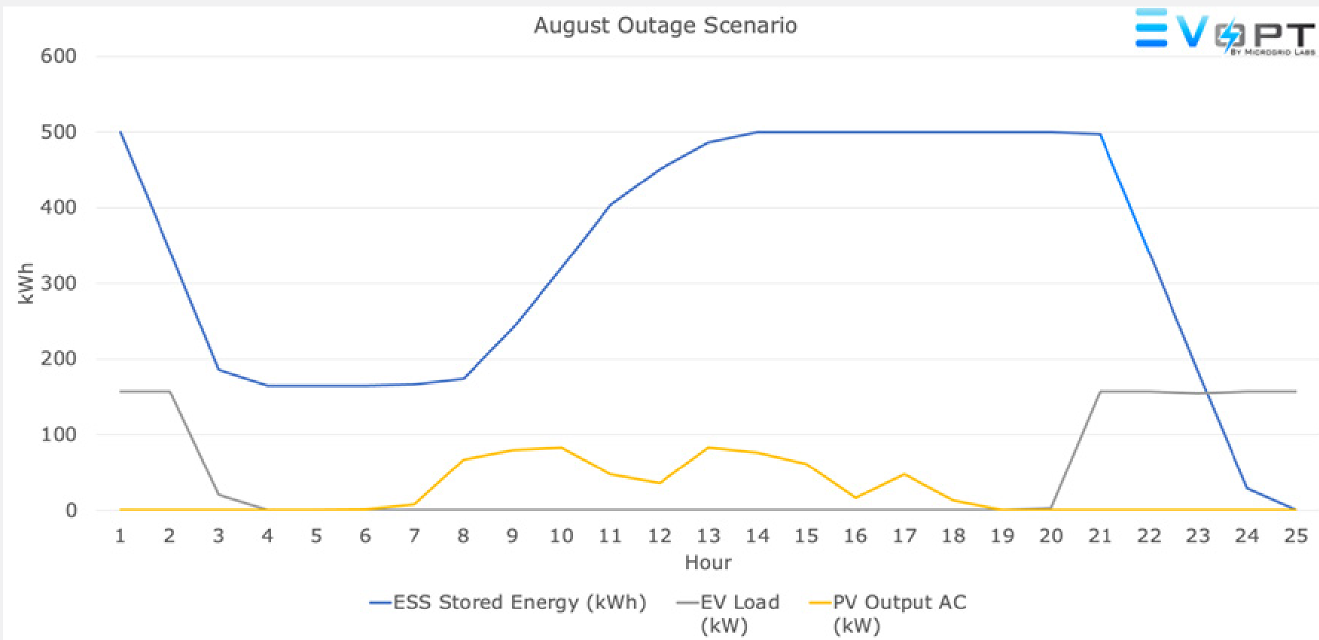


Figure 4-2: Simulation of a grid outage in the month of August with solar output (kW), BESS stored energy (kWh), and needed EV load (kW) for the fleet 20 BEVs charging fully at depot.

In the long-term, HAT will have to prepare emergency response plans that incorporate resilient operation scenarios. While power outages are often impossible to predict, accurate weather forecasting can allow operators to predict in advance when an outage event is likely to occur and take the appropriate measures to prepare the system by ensuring BESS are completely charged and altering the operating strategy as necessary.

Context/Screening for Future Facilities Planning

Social and Environmental Context

HAT provides microtransit services in the Gainesville-Hall County area. As ZEVs are introduced into the microtransit fleet, the social and environmental context of this service area should be considered to ensure that that transit services are as equitable and resilient as possible.

Social Context and Demographics

The deployment of zero emission vehicles has the potential of reducing emissions of GHGs and other criteria pollutants that are harmful to vulnerable populations including those served by transit. HAT provides reliable and safe public transportation services to Gainesville/Hall County community members, which include vulnerable populations that depend on the existence of these public services.

Social context and demographics were examined using two tools: the Social Vulnerability Index (SVI) and the Climate and Economic Justice Screening Tool developed to support the federal Justice 40 initiative.

Social Vulnerability Index

The Social Vulnerability Index (SVI) was created by the Centers for Disease Control (CDC) and Agency for Toxic Substances and Disease Registry (ATSDR) to provide a snapshot of the relative social vulnerability, or risk of negative effects caused by external stresses on human health, of communities. The SVI provides an aggregate view of sixteen variables as reported by the U.S. Census to provide a snapshot of the overall vulnerability level.

The following map shows the SVI for HAT's service area. The areas with the highest vulnerability are in the central and south-eastern regions of Gainesville-Hall Metropolitan Planning Organization (GHMPO).

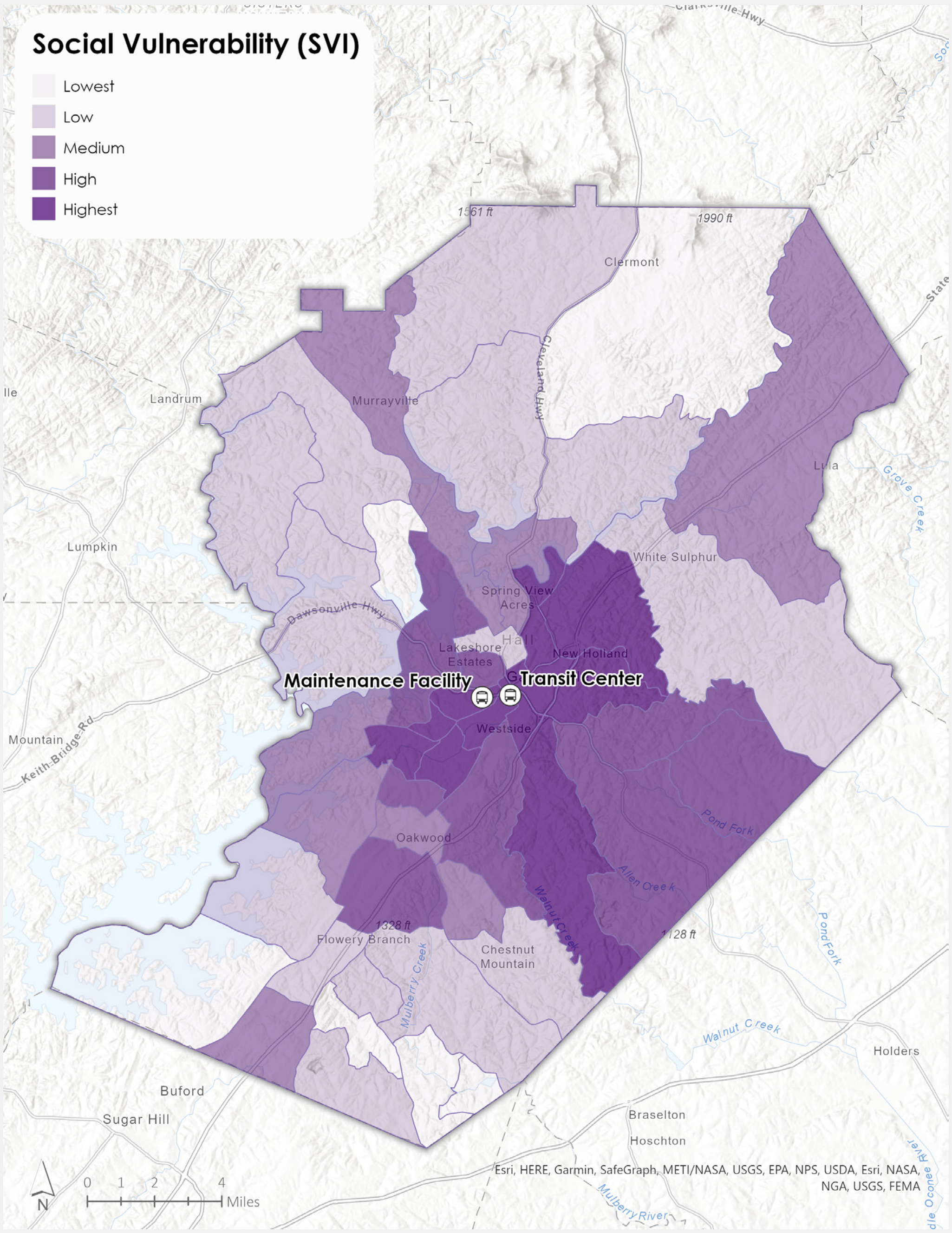


Figure 4-3: Social Vulnerability Index Map

Climate and Economic Justice Screening Tool

The Federal Justice 40 initiative sets a goal of delivering 40 percent of the overall benefits of many Federal investments to disadvantaged communities that are marginalized, underserved, and overburdened by pollution. The Climate Justice and Economic Screening Tool is a mapping tool that identifies Census Tracts that are considered disadvantaged because they demonstrate a combination of socioeconomic and burden thresholds identified in the tool. There are similarities between the results of this tool and the SVI, but they are not identical. The tool includes 31 different socioeconomic factors and environmental burdens. Eleven census tracts in Hall County are identified as disadvantaged. The map identifies these Census Tracts. All disadvantaged census tracts in Hall County meet the threshold for low income. More detailed maps showing the parameters determining the disadvantaged status of the census tracts identified through the Justice40 screening throughout Hall County / HAT's service area are shown in Appendix A along with detailed on the thresholds met for each designated tract.

The locations of disadvantaged populations and their characteristics can inform equitable distribution of transit services and benefits. Many vulnerable communities are exposed to higher levels of hazards like air pollution. Risk factors like asthma can increase the severity of impacts related to these exposures. Replacing conventional vehicles with ZEVs improves air quality and reduces exposure to harmful emissions on and near roads. The benefits of ZEVs should be distributed as equitably as possible.

Future service and facilities planning should incorporate demographic and social characteristics to ensure equitable distribution of impacts. While the impacts of implementing ZEVs are generally positive, facilities may have negative impacts such as increased noise or traffic. Potential facility locations should be assessed to ensure that negative impacts are not increasing in already heavily burdened communities, while benefits are distributed equitably and in support of Justice 40 goals.

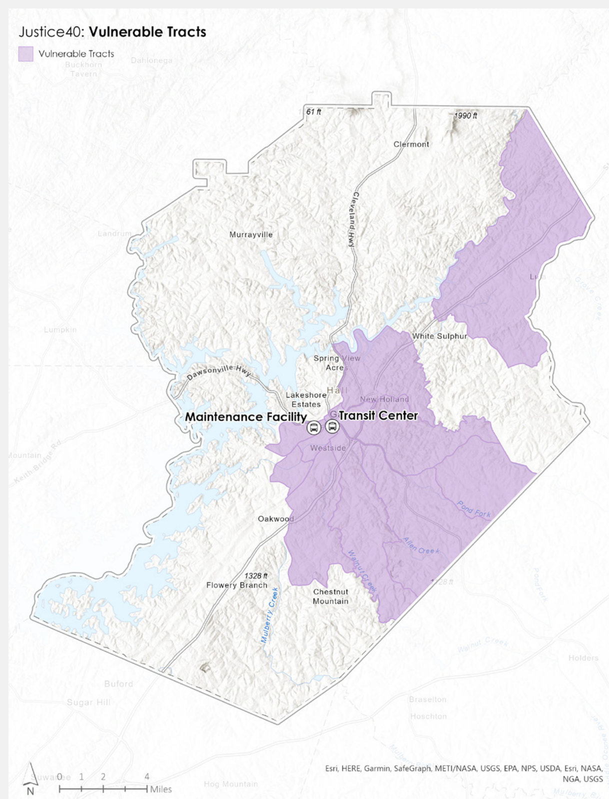


Figure 4-4: Justice40 Vulnerable Tracts

Environmental Context

Gainesville's topography consists of creeks and streams in and around the city. There are various environmentally sensitive areas located throughout the city, including streams, the Chattahoochee River and Lake Lanier. All surface waters are protected by ordinances stipulating setbacks ranging from 25-150 feet. Hall County and the City of Gainesville employ development standards that prevent land disturbance and encourage maintenance of local topography. Gainesville has a humid subtropical climate with hot summers and cold winters. The summers are hot and muggy, while the winters are short and very cold. The temperature typically varies from 34°F to 88°F and is rarely below 22°F or above 94°F. Areas susceptible to severe heat must be analyzed to determine locations that may need service routes and shelters for stops.

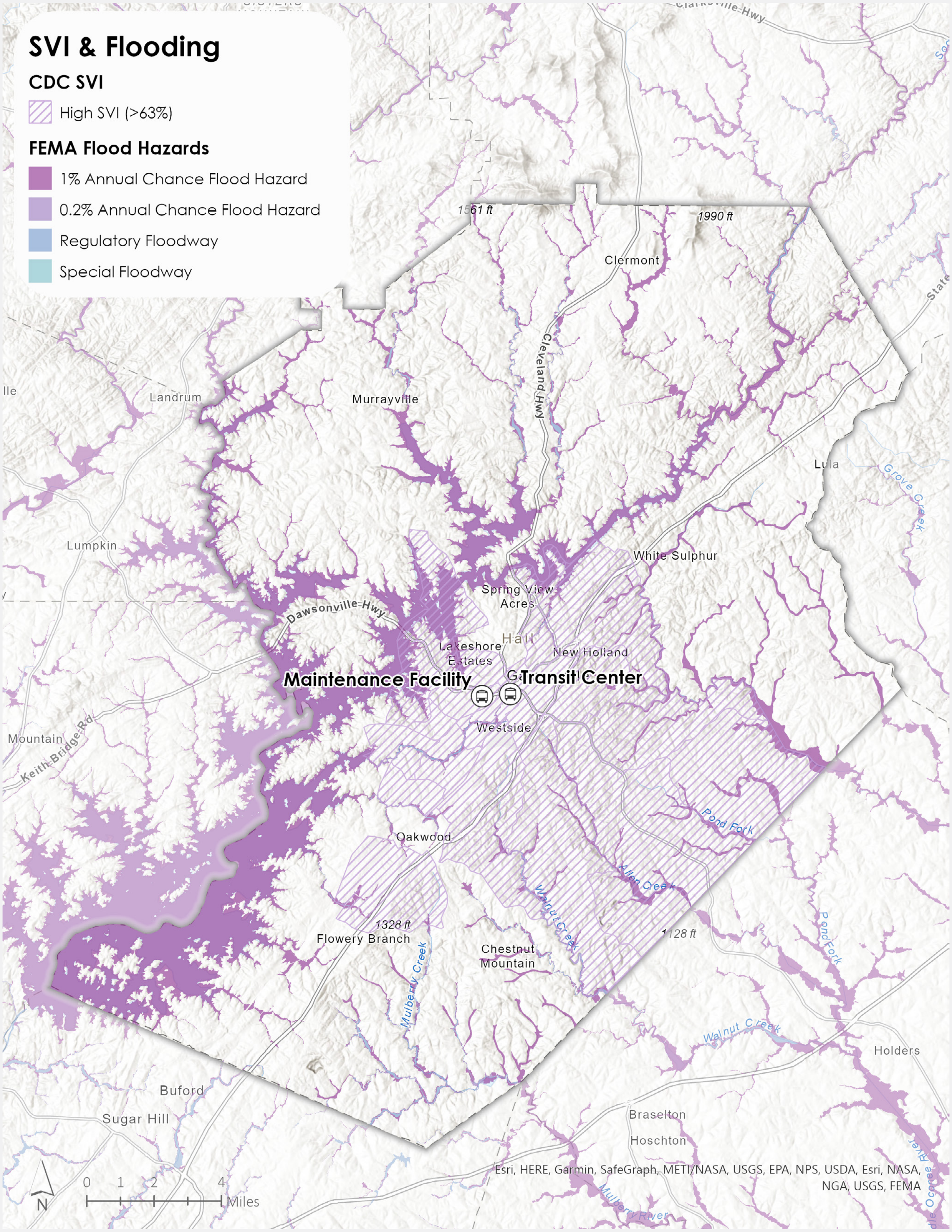


Figure 4-5: Social Vulnerability Index & Flooding Map

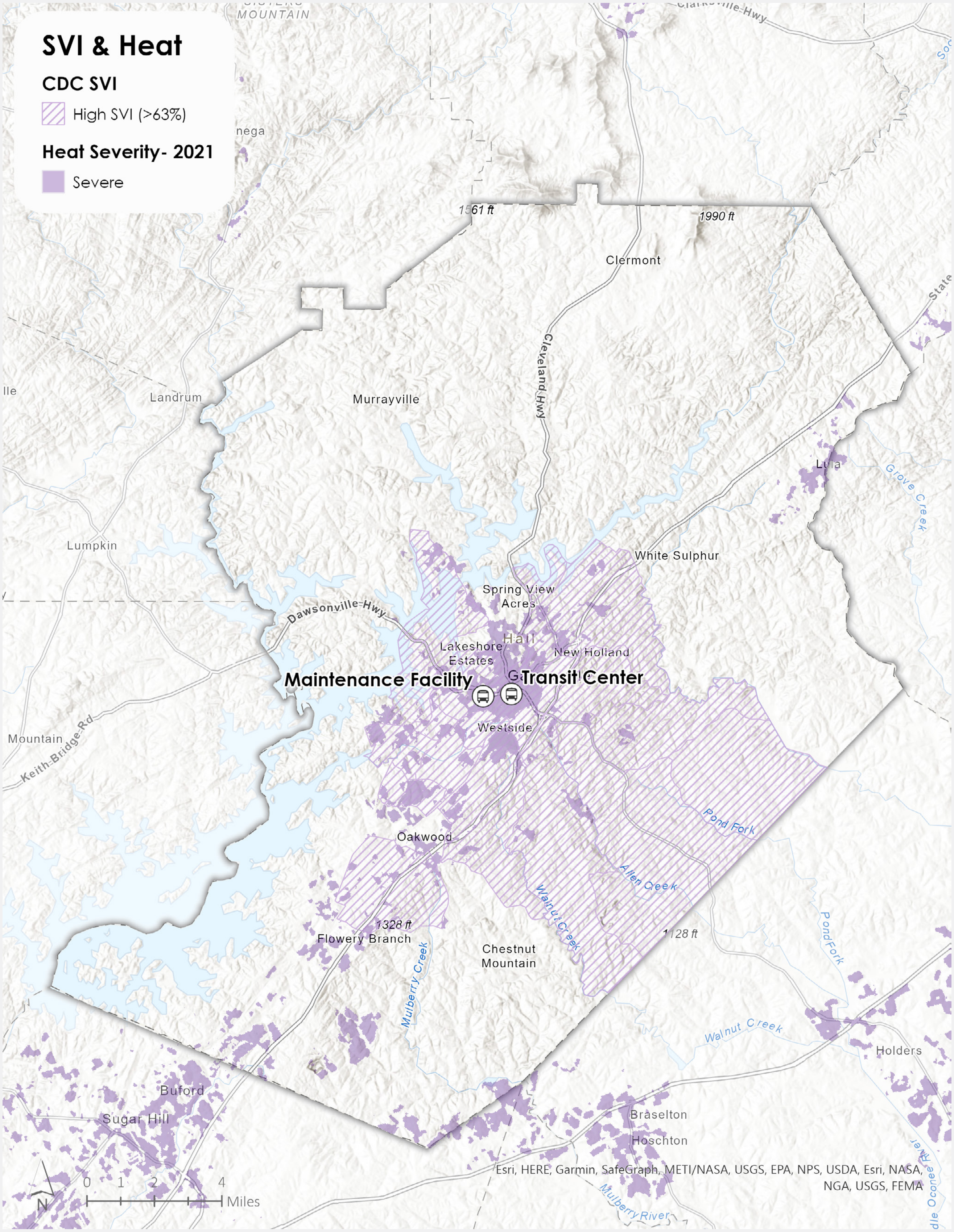


Figure 4-6: Social Vulnerability Index & Heat Map

The maintenance facility and transit center are located in areas with relatively high social vulnerability and severe heat risk. Potential flooding is unlikely to affect current HAT facilities but could disrupt service and should be considered when siting future facilities. As the risk and severity of storms, wildfires, floods, and other climate-related events increases, planning for effective emergency management and response is essential. The potential for power outages or other fuel disruptions should be considered when planning for a resilient ZE fleet.

Key Findings

- Analysis indicates that the HAT rooftop and carport have approximately 262 kW DC solar peak generation potential, corresponding to 367,121 kWh of annual production, completely offsetting the charging load from the vehicles.
- Areas with the highest social vulnerability are in the central and south-eastern regions of Gainesville-Hall Metropolitan Planning Organization (GHMPO).
- HAT's maintenance facility and transit center are susceptible to severe heat risk while potential flooding is likely to affect routes and services.

Recommendations

- HAT should consider the implementation of a microgrid backed by onsite solar generation and a BESS to enhance resiliency and ensure that fleet operations can be sustained in the event of a grid outage.
- As ZEVs are introduced into the microtransit fleet, the social and environmental context of this service area should be considered to ensure that that transit services are as equitable and resilient as possible.

FTA Element 5: Utility Stakeholder and Energy Considerations

HAT's transition to a ZE fleet will require coordination with other entities. Utility stakeholders are particularly important, as ZEVs can create additional demand on utilities. Partnerships also offer opportunities to support implementation of innovative approaches and new technologies. This section outlines the existing and potential stakeholder partnerships that can support the ZEVTP.

5

FTA ELEMENT 5

Describe the partnership of the applicant with the utility or alternative fuel provider.

In order to support conversations with utilities and other potential partners, a predictive load profile with peak power demands was calculated based on the modeling analysis in Element 1. HAT can use this information to engage with Georgia Power and anticipate and plan for energy requirements and necessary infrastructure upgrades.

Utility Stakeholders

It is important for transit agencies transitioning to a ZEV fleet to work closely with utility providers. Transit agencies need assurance of a reliable supply for its power and other needs, while utility companies need to understand the agency's needs and any potential impact of the transition on overall demand.

Hall County's energy utility is Georgia Power. Georgia Power's Electric Transportation Make Ready Program can reduce the cost of charging infrastructure; chargers in projects included in this program are designed, installed, owned, and maintained by Georgia Power.

Other Stakeholders and Partnerships

While partnerships with utility stakeholders are critically important for fleet transition. HAT may also wish to pursue partnerships with other entities that can provide additional expertise or support opportunities for funding. For example, partnerships with universities or manufacturers can provide opportunities to participate in testing new technologies or systems. Community organizations or non-profits may be able to provide support or help with equitable implementation of ZEVs and there are funding programs that require partnerships, for example FTA's Zero Emission Research Opportunity (ZERO) program provides funds to consortiums led by non-profit organizations.

The Partnership Matrix identifies utility stakeholders as well as other entities that HAT may consider partnering with in the future.

Partner Organization	Partner Type(s)				Type	Description
	Utility	Energy	Climate	Community		
Climate Reality Project: Atlanta Chapter		X	X	X	Non-profit	Climate Reality Project is a non-profit that works on training and educating people about climate solutions and energy transition around the world. The organization is working on major steps towards zero emissions. HAT may partner with the organization to enable knowledge sharing and best practices on reducing community and municipal emissions and to help staff and commuters learn about transit climate solutions.
Electric Mobility and Innovation Alliance Barton Lowrey, Director BLowrey@georgia.org Georgia Department of Economic Development Technology Square, 75 5th Street N.W. Suite 1200 Atlanta, GA 30308	X	X			Public	Led by the Georgia Department of Economic Development, the Alliance supports the growth of electric vehicles and innovation throughout the state of Georgia. Their latest report (2021 -2022) identifies electrification of fleets as an opportunity. HAT may benefit from additional partnerships and opportunities to aid in the ZEV transition through the Alliance
Georgia Power				X	Public	The transition to ZEVs will increase the demand for electricity and the consumption of it by the agency's facilities. A partnership with Georgia Power will enable the agency to work with the utility provider to manage demand during peak times, negotiate pricing, help set up and manage required infrastructure to support charging, or develop distributed energy resources such as solar projects.
Lanier Technical College, Gainesville				X	Public	HAT and the City can benefit from partnerships with educational institutions that would enable knowledge sharing and training of staff. Lanier Technical College's provides an Automotive & Transportation Technologies program that may be relevant to fleet maintenance and transition. During the agency's fleet transition to zero emission, graduates could be recruited and/or allowed to intern at the City's shops and the City may explore options to share knowledge and technical expertise with the college.

Partner Organization	Partner Type(s)				Type	Description
	Utility	Energy	Climate	Community		
Southern Alliance for Clean Energy, Georgia Chapter		X	X	X	Private, Non-profit	The Southern Alliance for Clean Energy (SACE) promotes responsible and equitable energy choices to ensure clean, safe, and healthy communities throughout the Southeast. SACE works with utilities, decision makers, and in local communities to promote clean energy. HAT may seek out technical assistance and opportunities to connect with additional partners from SACE.

Table 5-1 – Potential Partnership Stakeholders for HAT

Energy Considerations

Charging Demand

The load profile analysis provides the daily energy load profile resulting from the fleet charging needs at a specific charging rate, and the size of the transformer needed to support fleet charging.

Two load profiles are possible: 1) unmanaged, e.g., load generated by vehicles charging at full rated power until the battery is fully charged; and 2) managed, e.g., optimized charging scenario during which vehicles charge at a lower power rating and for longer time as allowed by the vehicle schedule to maintain uptime; this optimization can be achieved through a dedicated charging software. The 11.5 kW AC chargers do not have the capability to be managed, and since the HAT fleet only requires an 11.5 kW charger, managed charging was not considered as a viable strategy.

Figure 5-1 is an example of the load profile calculation output and shows the load profile for the simulated microtransit fleet of 20 BEVs covering the daily operations and charging at 11.5 kW in depot. The fleet has a peak power demand of 230 kW.

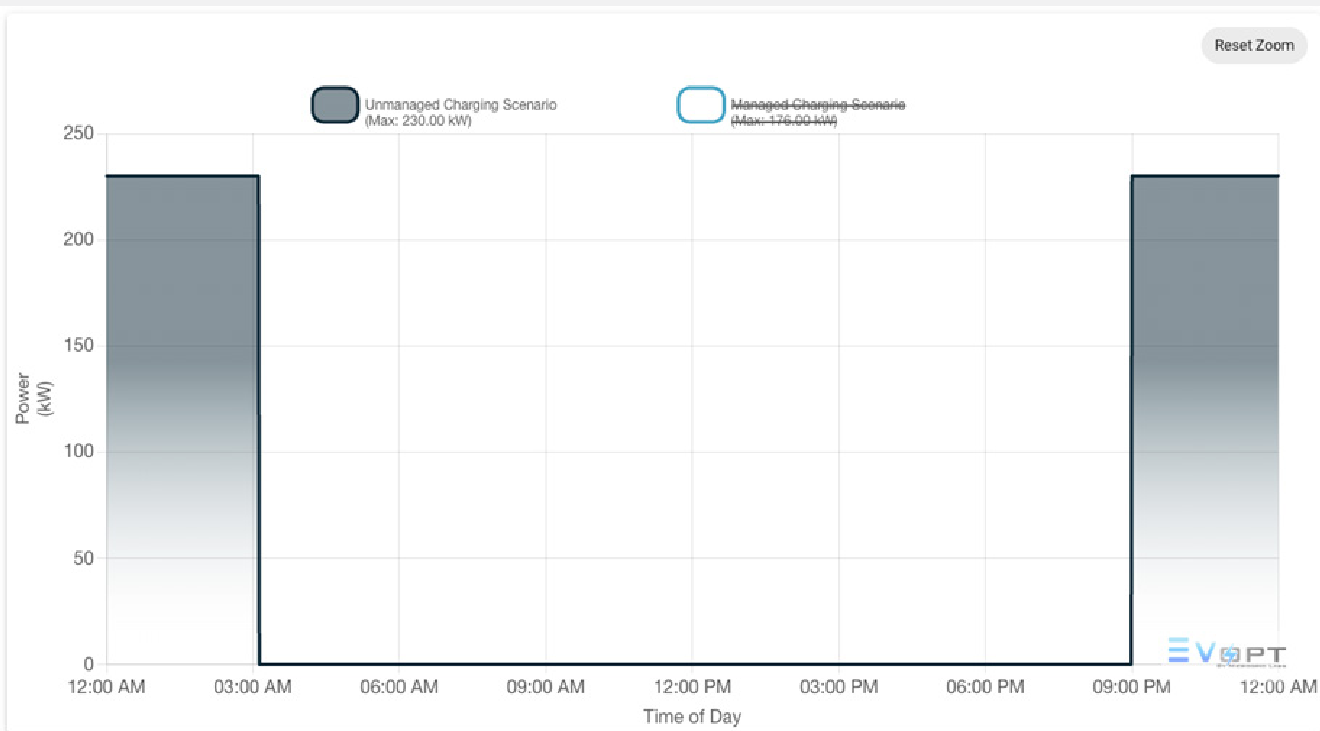


Figure 5-1. Results of energy analysis for the depot, showing unmanaged charging profiles for the fleet of 20 BEVs charging at 11.5 kW.

Table 5-2 shows the projected peak power demands and associated transformer size required at the maintenance facility for the entire electric fleet.

Electrification Scenario	Fleet Makeup	Peak Power Unmanaged	Minimum Transformer Size Unmanaged
100% Electrification	20 BEVs	230 kW	320 kVA

Table 5-2. Results of energy analysis for the depot with the fully electrified fleet.

Key Findings

- Partnership opportunities are available to support the transition to zero emissions in support of climate, energy and other goals.
- The deployment of the 20 microtransit vehicles charging in-depot at 11.5 kW will generate a daily peak power demand of 230 kW and will require a minimum transformer of 320 kVA.

Recommendations

- HAT could explore partnership with Lanier Technical College through their Automotive & Transportation Technologies program.
- Collaborating with community climate and energy partners could support HAT's transition efforts through education, engagement, or funding partnerships.
- HAT can use the results of the energy load profile to discuss the pathway to full fleet electrification with the local utility to assess what infrastructure is needed and plan the timing and costs of upgrades accordingly without causing service disruption.

FTA Element 6: Human Resources Analysis

Considering the fleet for Hall Area Transit will mainly consist of transit vehicles built on light-duty EV platforms, the transition to an EV, be it battery-electric or fuel-cell-electric, will follow a similar track to that of an automotive fleet. The City's fleet technicians should already have skills in maintaining a similar fleet driven by internal-combustion engine (ICE) power and are therefore skilled in areas such as Suspension and Steering; Brakes; Climate Controls; and Low Voltage Electrical, and the upskill for the maintenance staff is, therefore, less dramatic. However, considering that the staff have had no official training on HV Safety, Electric Propulsion, Energy Storage Systems, there is still a significant gap that needs to be closed when making the transition to a zero-emission fleet.

6

FTA ELEMENT 6

Examine the impact of the transition on the applicant's current workforce by identifying skill gaps, training needs, and retraining needs of the existing workers of the applicant to operate and maintain zero-emission vehicles and related infrastructure and avoid displacement of the existing workforce.

Suggested Approach

Under the Bipartisan Infrastructure Law, transit agencies using the expanded Low or No Emission Program or the Grants for Buses and Bus Facilities Competitive Program to purchase Zero-Emission Bus ((ZEB) battery electric, hydrogen fuel cell, or rubber tire trolley buses powered by overhead catenaries) must submit a plan for implementing a transition to a Zero Emission Bus (ZEB) fleet. To assist agencies with an examination of the impact of transition to a zero-emission fleet on the current workforce, the Federal Transit Administration (FTA) has issued information on a Zero Emission Fleet Transition Plan Element 6: Workforce Evaluation Tool consisting of eight (8) questions:

1. *Identify the skills, training and credentials required to maintain and operate the proposed fleet and associated infrastructure.*
2. *Describe how the skills of existing workers will be assessed. Identify the estimated number and percentage of workers who may be impacted by this transition as a result of new skills requirements.*
3. *Assess and identify any current or anticipated gaps between necessary workforce skills identified above and the existing baseline skills/credential requirements of the current workforce.*
4. *Describe the training plan, including strategies and partners that will be deployed and resourced to help the agency transition existing workers to meet new skills requirements. Identify any additional staff that will need to be recruited and hired.*
5. *Identify the process by which training programs and partners will be identified and selected.*
6. *Indicate the role training resources will play in supporting the recruitment, training and development of new workers, and what steps are being taken to ensure non-displacement of the existing workforce.*
7. *To demonstrate steps to avoid displacement, explain how current workers were engaged in the development of these transition strategies and how they will be consulted in finalizing any plans and training to meet the needs of this transition.*
8. *Identify how training needs will be paid for.*

Skills, Training, and Credentials Needed

The City's technicians are likely already skilled in Basic Electrical and Electrical Theory topics, and have proficiency in use of Digital Multimeters (DMMs) so refresher training should be pursued to guarantee that the skills are recently solidified to establish the base on which the rest of the required training can build. Courses on HV Safety and PPE are imperative and must be prioritized for any staff that will encounter HV equipment. After establishing the foundational and safety skills, ZEB Familiarization needs to follow to create a very high-level overview of the equipment. Finally, OEM-specific training should close out the process of upskilling with the expectation that refresher training take place annually to update the learners of any changes in vehicle functionality, and requalify on HV safety.

Operators require less training on ZEB equipment, but they should not be overlooked. In any instance of new equipment, Operators should receive at least a half-day class of instruction on safe and efficient use of the vehicle. An Operator that is trained to drive a ZEB efficiently can mean the difference between 80 miles of operation on a single charge, and 100 miles (depending on the battery sizing).

Administrative staff should also not be overlooked as they will need to be aware of safety response measures, and some may need to understand the capabilities and limitations of the equipment in operation. These personnel should receive ZEB Familiarization training at a minimum. Typically, four (4) hours of introduction will suffice.

Assessment of Existing Worker Skills

The most effective way to identify the skills of exiting workers is through a well-written skills gap analysis. This analysis involves a questionnaire that is answered by the relevant personnel, and the responses are analyzed to understand where the workforce is deficient in certain skills. The skills gap analysis can also be used to conceptualize how well the training program is working for HAT staff. It is extremely important that the any staff or contractors administering the skills gap analysis emphasize that the data collected will not result in any punitive measures against the respondents, rather that it will help the administrative staff more effectively target the necessary training. Further, written protocols forbidding punitive actions against staff should be implemented to prevent the possibility of collecting flawed data.

Skills Gap

As mentioned in the introduction to this section, the maintenance staff will have an advantage in the transition to zero-emission technologies. The main focus needs to be on training for the new technologies that differ from current designs, HV safety, and PPE. Operators will need training on how to efficiently drive any zero-emission vehicles with emphasis on the fact that their ability to drive efficiently will seriously impact the operational range of the vehicle. Administrative staff will need to receive introductory-level training on zero-emission vehicles to best prepare for ways in which the operational characteristics will impact their work, and the response procedures necessary in case of emergency.

Training Plan

Below are resources immediately available to HAT to follow through on the recommended actions.

- Electrified Transportation Pro+ Training and Certification program
  - Resource for identifying skills needed to maintain and repair ZEBs.
- Bus Maintenance Apprenticeship Framework
  - Apprenticeship frameworks approved by DOL.
- ASE transit bus certifications for Electrical/Electronic Systems (H6)
  - Method for quantifying electrical skills.
- Skills Gap Survey
  - Survey used for identifying electrical/electronic skills gaps.
- APTA standard/recommended practice
  - Job tasks that can be used to focus updated job descriptions
- Report on recommended procurement language
  - Draft recommended procurement language for ZEBs
- Fluke Multimeter Online Training
  - Online digital multimeter training
- E/E troubleshooting training
  - Available through Simutec
- Electrical System Training-aids
  - Available through Veejer
- Labor-Management Partnership
  - Best practices for joint labor-management partnerships
- Zero Emission Bus Committee
- Workforce Development Committee
- Community Transportation Association of America (CTAA)
- Zero Emission Bus Resource Alliance (ZEBRA)
- The West Coast Center of Excellence in Zero Emission Technology and Renewable Energy

Selection of Training Programs and Partners

Community colleges, technical colleges, trade schools and state workforce development boards are immediately available resources that can be utilized to support upskilling HAT's workforce. In most cases, community colleges, technical colleges, and trade schools already have an automotive program available, and guidance from the transit agency is needed to focus in on gaps. Additional support is available through the International Transportation Learning Center's (ITLC) Transit Workforce Center (TWC) on ZEB Training Standards in transit that can be supplied to identified training partners. Contact the Center at twc@transportcenter.com or via the web page.

Protection and Expansion of the Workforce

HAT has an opportunity to proactively attract ZEB-focused talent by incentivizing current and potential employees with training and comparable salaries. Maintaining zero-emission vehicles requires significant technical skill, and compensation adjustment for this increased level of technical expertise should be anticipated. Further, utilizing apprenticeship framework that includes training on zero-emission vehicles guarantees a continued pipeline of workers are skilled, and incentivizes potential candidates to pursue a path in transit.

Worker Engagement

Under the resources in the Training Plan section is a link to best practices for establishing and maintaining joint labor-management partnerships. For the smoothest transition to maintaining and operating a zero-emission fleet, establishing HAT's own zero-emission fleet committee is highly recommended. The committee should be comprised of equal numbers of management and frontline workforce, be empowered to address a variety of issues that may arise, and meet regularly. These committees have proven to be the most direct line of feedback from the workforce on concerns that may affect the agency's ability to operate the fleet, as well as an extremely effective way to communicate new initiatives from the management, gaining additional buy-in.

Training Resources

Currently, all grants received by transit agencies in the United States have an additional 5% of the funding requested added to the total amount that is allocated towards workforce development. This funding is sufficient for the training needed to upskill HAT's workforce. In the event that this funding is exhausted, exploring a registered apprenticeship program is a viable option to secure additional funding. Workforce development boards are an additional resource to identify funding available to the agency for further training needs. Finally, as of writing, there are currently 224 open grants in Georgia that are available for workforce development. Many of these grants require minimal input on proposals to receive funding.

Recommended Training Courses

Below are the recommended number of training hours to successfully transition HAT's workforce personnel to operating and maintaining zero-emission vehicles. Note that while the costs for training may vary based on location, an estimate of $65/learner/hour of training can be applied to calculate total cost.

Course	Description	Target Audience	Length (Hours)
Operator Orientation	Class should cover driver familiarity, operation of all vehicle systems including the wheelchair ramp, and CDL pre-trip requirements for the safe operation of Battery Electric powered vehicles. This orientation should also cover familiarity of vehicle for safe operation and specific procedures that can be used to train First Responders.	Maintenance Personnel, Operations Personnel (Operators, Supervisors, Managers, etc.), First Responders	4 - 6 Hours
Maintenance General Orientation	Class should cover fluid types, fluid quantities, fluid level checks inspection and maintenance of fluid types, (manual and electronic), fill ports and basic servicing of bus to include PM schedules and all related safety precautions, procedures for charging buses for quick or slow charge and cover all hazards, safety procedures, and PPE.	Maintenance Personnel and Operations Personnel, if applicable	8 Hours
Electrical and Vehicle Communications	Class should cover the non-propulsion electrical system and vehicle controller communications systems (multiplexing, etc.). Class should cover the inspection, location, troubleshooting, diagnostics, maintenance and repair of voltage monitors, battery equalizer, battery maintenance, print reading, CAN system, ladder logic, wiring color coding, harnesses, connectors, plugs, and schematics.	Maintenance Personnel	24 Hours
Energy Storage & Management Systems	Class should cover the inspection, location, troubleshooting/diagnostics, maintenance (preventive and corrective) and repair of the high voltage energy storage system, battery management system, and any related components, controllers, etc. The class should provide safety procedures for handling and working with a high voltage system, and power down procedures; general construction and principles of operation and troubleshooting; battery thermal management system, pumps/piping diagnostics, lock-out/tag-out, and assembly and disassembly procedures.	Maintenance Personnel	12 Hours

Course	Description	Target Audience	Length (Hours)
Propulsion System Familiarization/HV Safety	Class should cover fluid types, fluid quantities, fluid level checks inspection and maintenance of fluid types, (manual and electronic), fill ports and basic servicing of bus to include PM schedules and all related safety precautions. procedures for charging buses for quick or slow charge and cover all hazards, safety procedures, and PPE related to both types of charging.	Maintenance Personnel	16 Hours
Charging System Equipment	Class should cover the inspection, location, troubleshooting/diagnostics, maintenance (preventive and corrective) and repair of all aspects of the charging equipment.	Maintenance Personnel or Facilities Maintenance Personnel (Contractors, if applicable).	8 Hours
Wheelchair Ramp System	Class should cover the inspection, location, troubleshooting/diagnostics, maintenance (preventive and corrective) and repair of the wheelchair ramp system including automatic and manual operation as applicable	Maintenance Personnel	4 Hours
Operator Totals			**4-14 Hours**
Maintenance Totals			**76 – 78 Hours**

Figure 6-1: Recommended Training Courses

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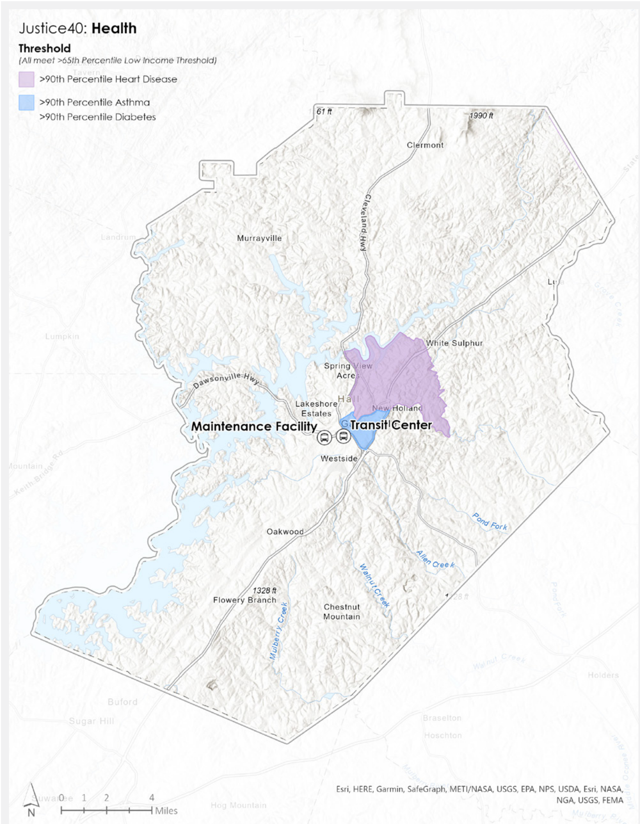
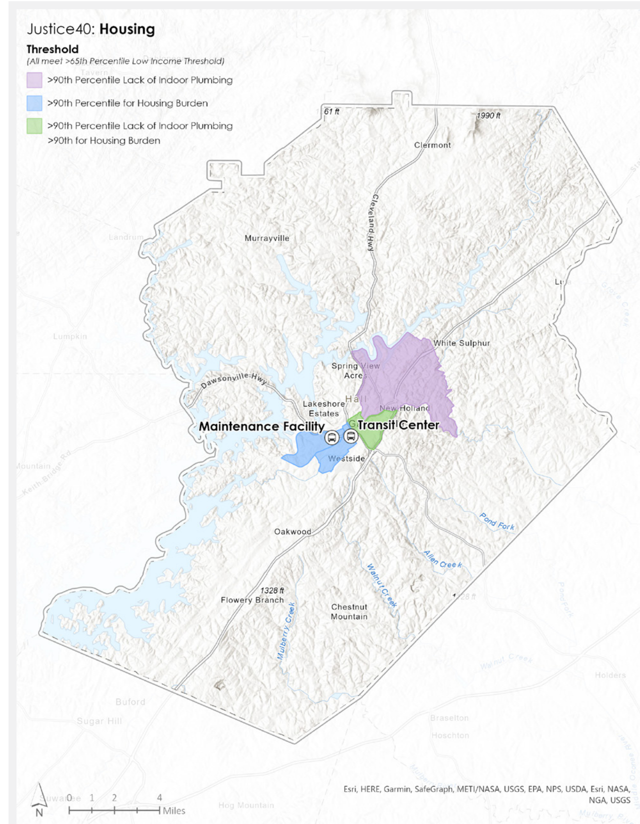
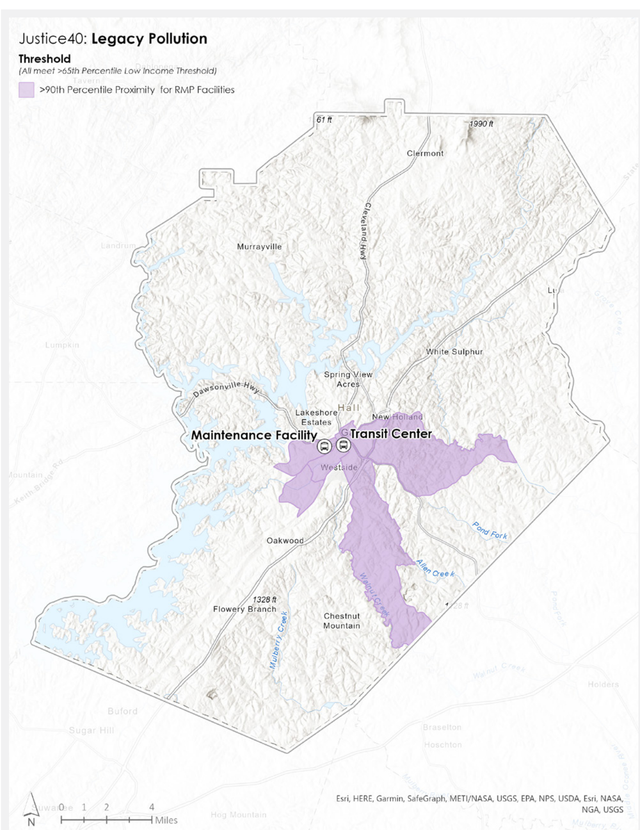
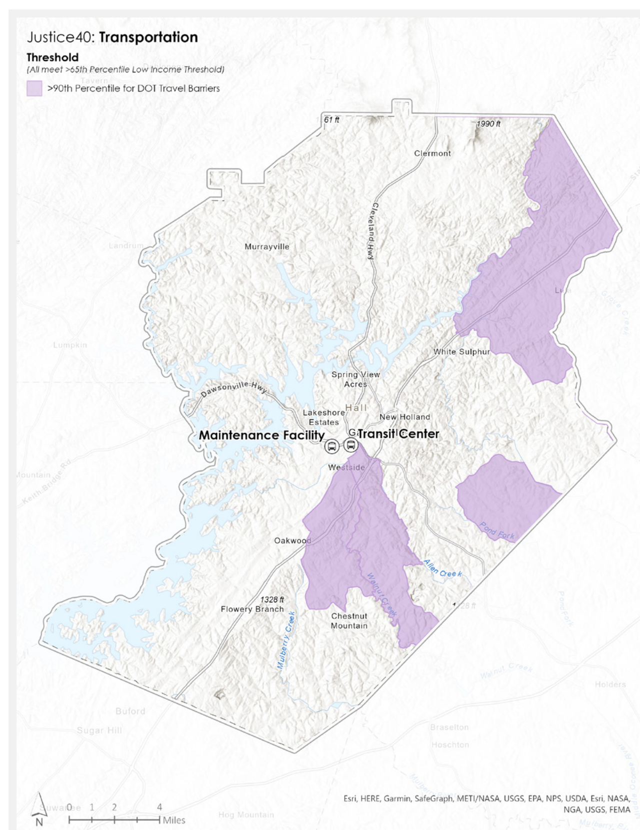
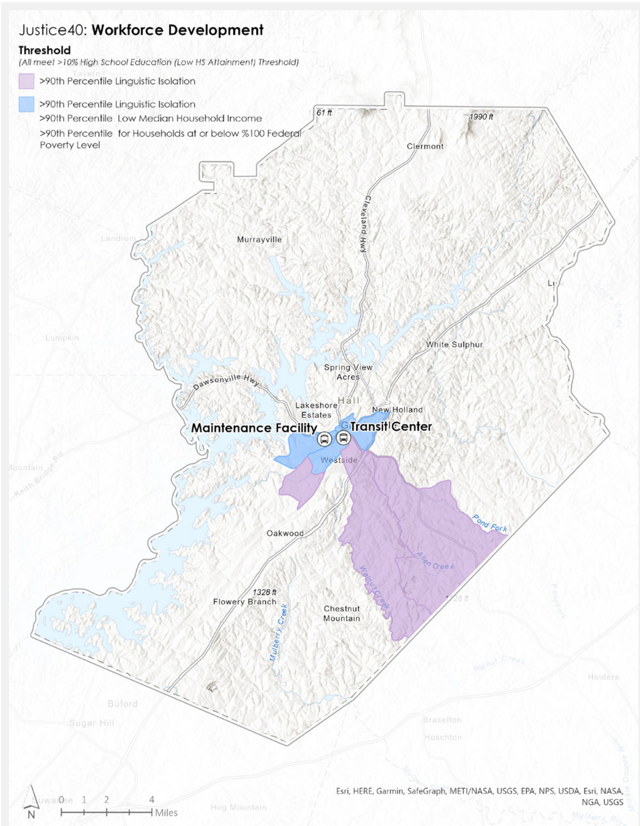
Appendix A: Justice40 Screening











Justice40: Workforce Development
Threshold
(All meet >10% High School Education (Low HS Attainment) Threshold)
>90th Percentile Linguistic Isolation
>90th Percentile Linguistic Isolation
>90th Percentile Low Median Household Income
>90th Percentile for Households at or below %100 Federal Poverty Level
61 ft
1990 ft
Clermont
Cleveland Hwy
Murrayville
White Sulphur
Spring View Acres
Dawsonville Hwy
Hall
Lakeshore Estates
New Holland
Maintenance Facility
Transit Center
Westside
Pond Fork
Oakwood
1328 ft
Flowery Branch
Chestnut Mountain
Mulberry Creek
Buford
Sugar Hill
Braselton
Hoschton
0 1 2 4 Miles
N
Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, EPA, NPS, USDA, Esri, NASA, NGA, USGS

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