Electric Vehicle and Charging Infrastructure Roadmap for Southeast West Virginia

Prepared for:

West Virginia Regions I and 4 Planning and Development Council

July 2024

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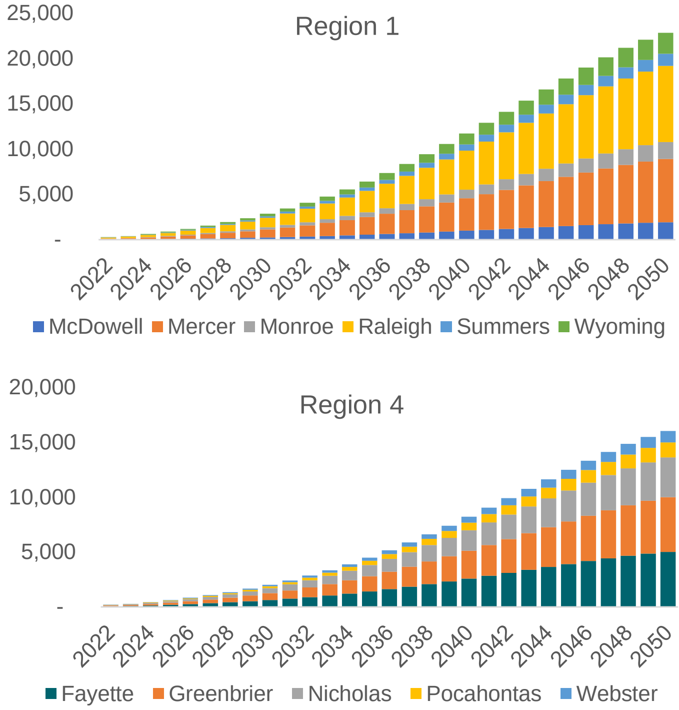
1. Executive Summary

Siemens PTI was tasked with developing a comprehensive feasibility and siting study for EV charging stations throughout West Virginia's Regions 1 and 4 Planning and Development Councils. The objective was to evaluate the feasibility of siting new EV charging stations in strategic locations throughout each region which would catalyze economic development, support existing businesses, improve quality of life for residents and visitors, and support key tourism destinations.

Figure 1: Registered Light-Duty EVs by Council and County



This study, detailed in the following chapters, indicates EV adoption is expected to continue both for Council residents and tourists travelling to the many state and federal parks in the area. Early local commercial fleet EV adopters are expected to include schools, transit agencies, and local delivery operators like USPS, FedEx, and UPS, among others. EV charging infrastructure must support residents who own EVs and ensure that visiting EV drivers are not deterred from choosing West Virginia based on charging availability.

The study estimates that over $1 billion in tourist related spending across the Councils will increasingly depend upon charging access. Research indicates that Pocahontas, Greenbrier, Raleigh, and Fayette counties account for over 60% of tourism spending. As neighboring states like Ohio, Pennsylvania, Virginia, and North Carolina accelerate EV adoption, the availability of EV charging infrastructure will become increasingly crucial.

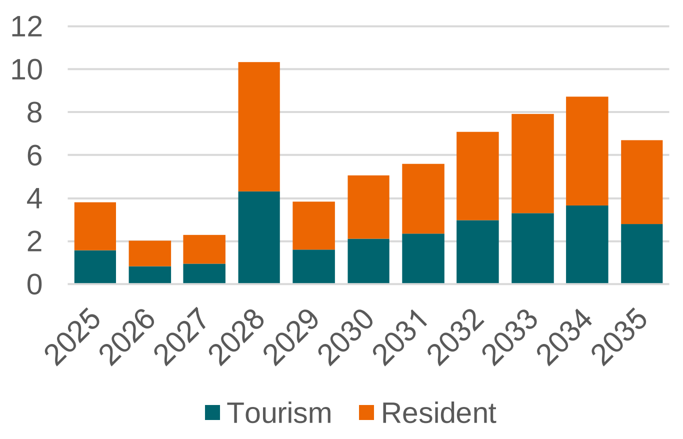
Considering current spending, and forecasted EV adoption, as much as $100 million per year in tourism spending could be lost by 2035.

EV charging will be increasingly available along the interstates and other major arteries supported by the federal NEVI program, but NEVI will not fund charging along secondary roads or at major points of interest. However, other strong federal, state and utility incentives support EV adoption and infrastructure development. Further, some local charging will be provided by fuel stations and retailers like Walmart and Sams Club.

Based on forecasted resident and tourist EV adoption, Siemens PTI estimates 113 chargers located at 29 stations through 2035 would be required. About 42% of this charging infrastructure would support tourist needs at local parks. The direct capital and operating costs to build, own, and operate these chargers total $33.34 million with the majority being development costs. On the employment side, around 64 jobs would be created, of which most would support station operations. It is important to note that not all costs and jobs will be induced in Councils.

Figure 2: Direct Development Costs ($Thousands)

Figure 3: Direct Development & Operations Employment



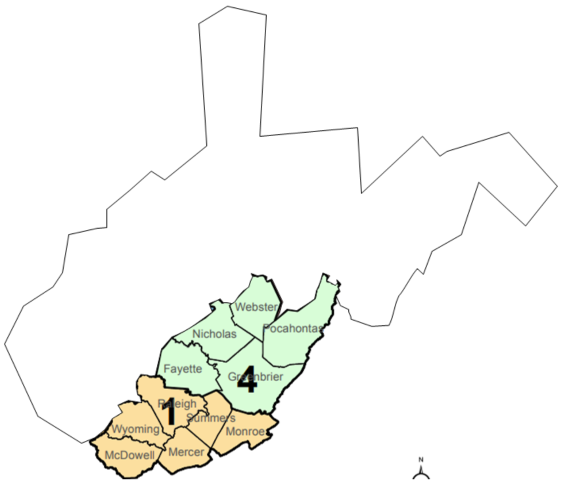
The importance of EV charging infrastructure is clearly noted and more detailed insight into the current and future EV ecosystem is described in this document.

2. Background and Overview

Siemens PTI understands that the Region 1 and 4 Planning and Development Councils of West Virginia combined their efforts to craft an Electric Vehicle (EV) charging study across their jurisdictions.

The Councils seek a comprehensive feasibility and siting study for EV charging stations throughout Regions 1 and 4 which comprise the eleven counties identified in Figure 4 below. The objective of the study is to evaluate the feasibility of siting new EV charging stations in strategic locations throughout each region which would catalyze economic development, support existing businesses, improve quality of life for residents and visitors, and support key tourism destinations.

Figure 4: West Virginia Regional Planning Councils 1 & 4 County Constituents



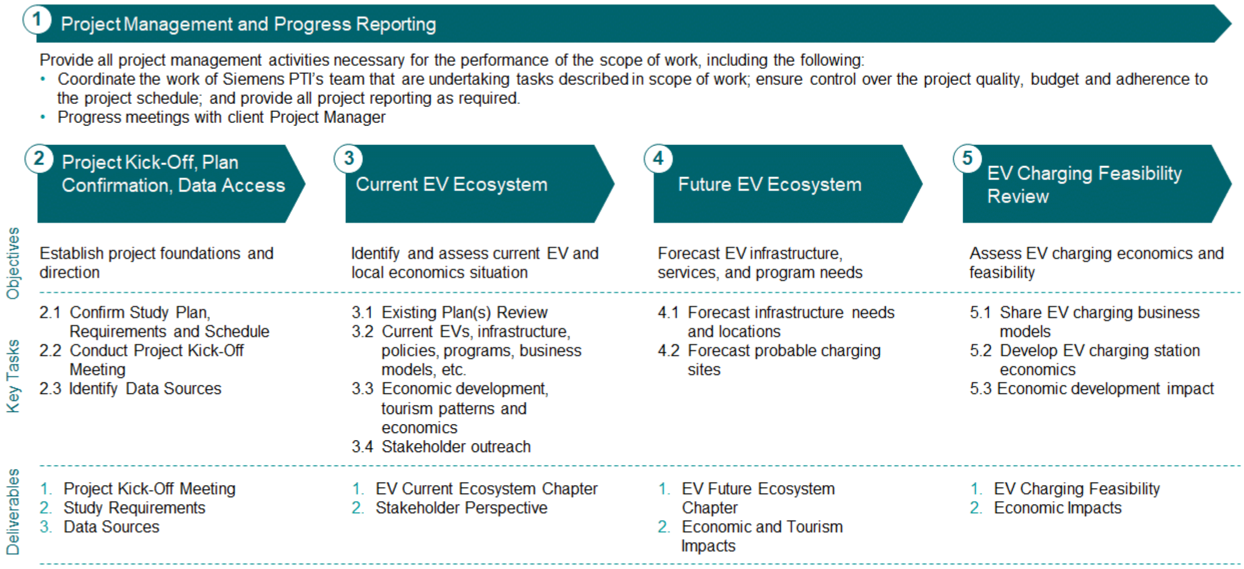
The study objective is twofold:

1. Assess opportunity for EVs and associated charging to support economic development within the Councils, and
2. Provide foundational information and support to local entities most likely to consider EVs for fleet operations.

Siemens PTI designed the work scope to deliver an EV charging plan founded on facts and designed to identify attractive locations, and support business decisions. The base study approach is presented in Figure 5 below. To further their understanding and the usefulness of the study, the Councils elected to add specific research and analysis on the following topics:

- Regional Stakeholder and Site Information Gathering
- Electrified School Bus Requirements
- Electrified Transit Bus Requirements
- Electrified Fleet Requirements
- Electric Micromobility
- EV Charging at State and Federal Parks
- Electrification Policies, County and City
- Electrification Impacts on Utility Feeders

Figure 5: Charging Study Plan



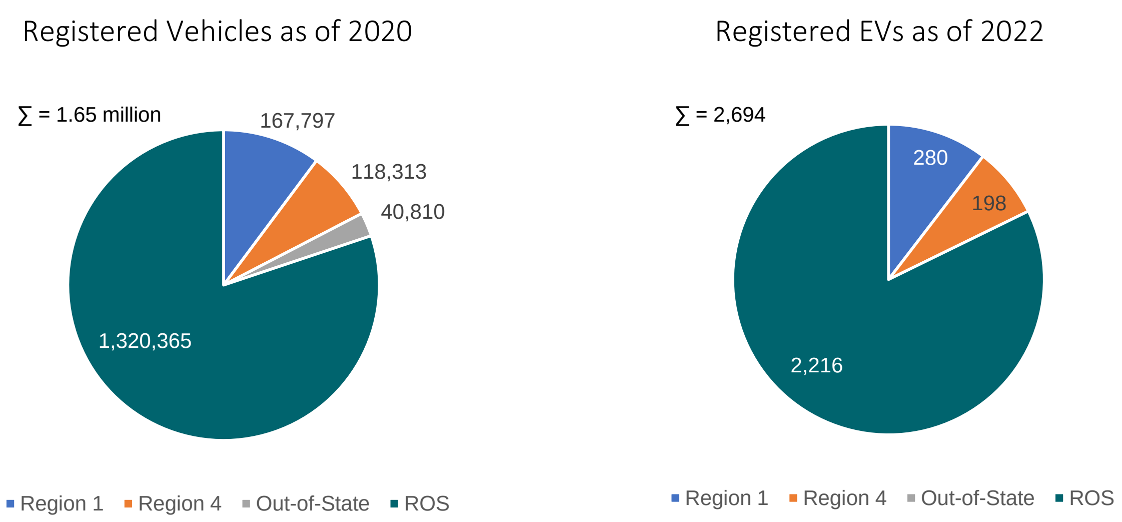
3. Current EV Ecosystem

To establish a basis for forecasting how EVs and associated charging infrastructure will develop in the Councils, Siemens PTI conducted research to determine the current number of EVs and the local charging infrastructure.

3.1 Current Vehicle and EV Population

About 17% of West Virginia registered vehicles resided in Regions 1 & 4 as of 2020. Further, about 0.16% of West Virginia registered vehicles in 2022 were EVs. According to the American Community Survey, across West Virginia population declined 0.46% p.a. from 2015 to 2021 and the number of households declined 0.64% from 2017 to 2022. Declining population and number of households suggest the number of registered vehicles will decline in many West Virginia counties.

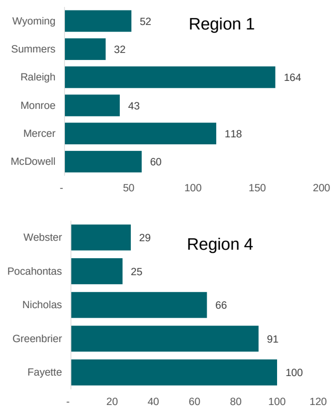
Figure 6: Current West Virginia Registered Vehicles

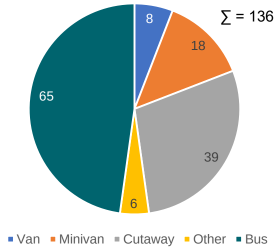


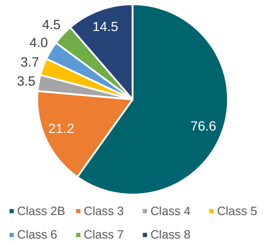
Source: West Virginia Division of Motor Vehicles Annual Report 2020

Key transportation segments for early EV adoption include school buses, transit buses and smaller commercial vehicles. Across West Virginia, there are 3,832 operating school buses. In Region 1 there are 469 and in Region 4 there are 311. Across Regions 1 and 4, there are three public transit agencies including: Kanawha Valley Regional Transportation Authority, Mountain Transit Authority, and New River Transit Authority, Additionally, Bluefield Area Transit is a municipally owned transit department also serving part of the area. Between them, there are 136 operating vehicles of which most are cutaways or buses. Most commercial trucks are either small (class 2b and 3) typically used in local service or tractor trailers (class 8) used for longer larger loads hauled greater distances. For reference, Class 2b tend to be large pickup (i.e., F250/ 350) often used by local contractors.

Figure 7: Composition of Council Commercial Vehicle by Type







Source: World Resource Institute

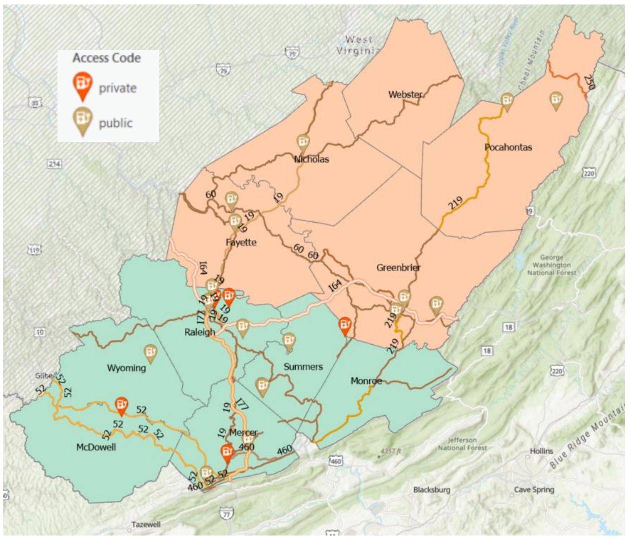
3.2 Current EV Charger Locations

Our research found that there was a total of thirty charging locations, each with several chargers and plugs available in the Councils as indicated in Figure 8 below. Note that not all chargers are available for public access and that a mix of charger levels are available.

Figure 8: Existing EV Charging Locations

- 30 Existing EV Charger Locations between Regions 1 & 4
  - Region 1 counties include: 17 Locations
    - 5 Private & 12 Publicly Accessible
  - Region 4 counties include: 13 Locations

Region	Access	EV Network	L1 EVSE Count	L2 EVSE Count	DCFC EVSE Count
1	Private	Non-Tesla	4	2	
	Public	Non-Tesla	1	12	
		Tesla		11	16
4	Public	Non-Tesla		23	1
		Tesla		6	8
Grand Total			5	54	25



Source: AFDC

3.3 Regional Stakeholder and Site Information Gathering

Local stakeholders can provide critical input guiding and supporting EV adoptions and charging planning. Stakeholders are in a unique position within each community to identify attractive locations, business partners, and unique local concerns. To inform the community about the project, gather input to support plan development, and build connections which will be vital in future EV charging development, one stakeholder meeting was conducted for each Region. The meetings were conducted with members of Regions 1 and 4 January 29-30, 2024. During those meeting, Siemens PTI and planning leadership for each region presented a brief project slide deck to inform and elicit feedback and conversation. Mayors, County representatives, and leaders of one of some transit bus fleets attended and showed particular interest. Recent developments, including the Tennessee Tech charger offering and EV loan program were discussed and garnered great interest.

3.4 EV Policies

Substantial EV and charging incentives currently available with more on the way from federal and state governments, and utilities primarily.

Figure 9: EV Incentive Summary

Over $18 billion in Federal incentives alone

Program	Incentives
National Electric Vehicle Infrastructure (NEVI) Formula Program	$5 billion for states to build a national EV charging network
Community and Fueling Infrastructure (CFI) Grant Program	$2.5 billion for EV charging among other incentives
Low- or Non-Emission Vehicle Program for Transit	$5.6 billion in support of low- and No-Emission transit bus deployments
Clean School Bus Program	$5 billion in support of electric school bus deployments

+

West Virginia EV Incentives

Laws and Incentives

Information in this list is updated throughout the year and comprehensively reviewed annually after West Virginia's legislative session ends.
Last Comprehensive Review: March 2024

State Incentives
- West Virginia's National Electric Vehicle Infrastructure (NEVI) Planning

Utility/Private Incentives
- Residential Electric Vehicle (EV) Charging Station Rebate - Appalachian Power
- Electric Vehicle (EV) Time-Of-Use (TOU) Rate – Appalachian Power Company
- Electric Vehicle (EV) Infrastructure Support

Laws and Regulations
- Alternative Fuel Vehicle Fee
- Alternative Fuel Production Subsidy Prohibition
- Alternative Fuels Tax
- Public Utility Definition
- Alternative Fuel Use Requirement
- Mid-Atlantic Region Electric Vehicle (EV) Support

Source: AFDC

3.4.1 West Virginia NEVI Plan

The National Electric Vehicle Infrastructure (NEVI) program allocates federal funds to each state to be administered in accordance with their filed plans to reinforce current charging corridors and establish new ones. The West Virginia Department of Transportation is expected to receive $45.7 million in NEVI funds over 5 Years to support building of an estimated 912 new public charging ports. West Virginia divided thee plan into two phases as defined below in Figure 10.

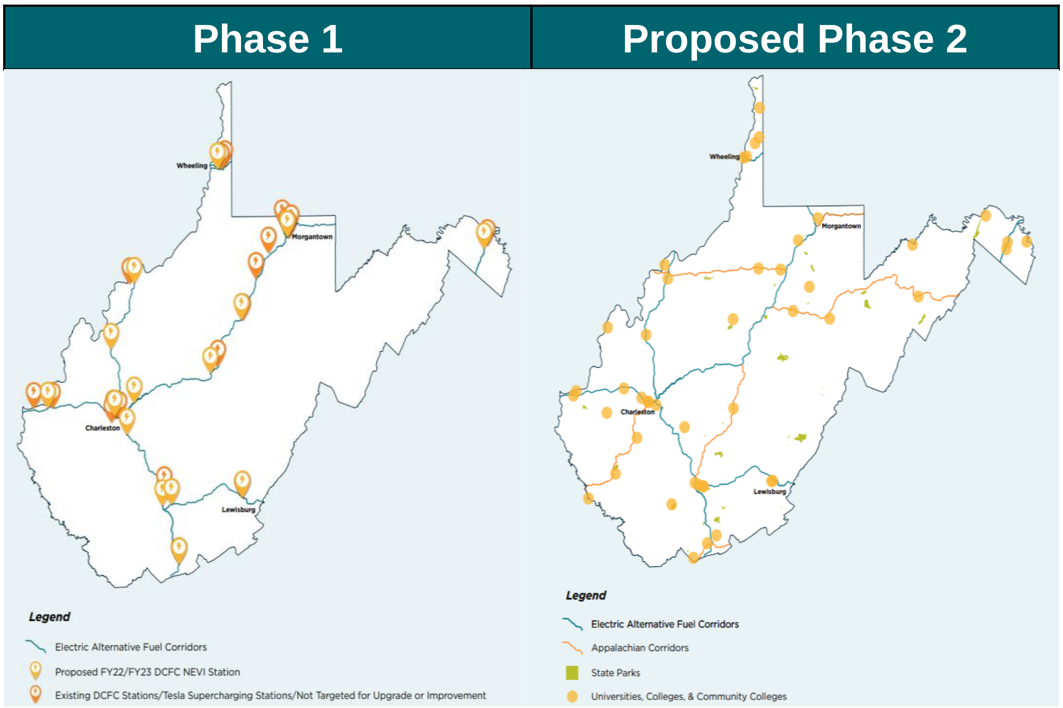
Figure 10: West Virginia NEVI Plan Funding Summary

Phase	Duration	Cost (% of Total NEVI Funds)	Goal	Progress
Phase 1 (Electric AFC Charging)	2 Years	30-37%	• Build-out of NEVI stations along designated AFCs • Chargers will be located within 1 mile of AFCs • 50 miles or less of spacing between chargers	• 15 charging stations have been proposed (60 ports)
Phase 2 (Community-Based Charging)	3 Years	63-70%	• Designed to build out additional charging corridors • Completive and community-based grant process • Chargers may be located on any public road or publicly accessible location	• Site selection process will begin once Phase 1 is complete

*AFC: Alternative Fuel Corridor

Phase 1 includes development of 15 charging stations (60 plugs) at defined locations. Each station is expected to cost about $1,200,000 in NEVI funds and be operational in 2025.

Figure 11: West Virginia NEVI Proposed Charging Locations



Source: West Virginia NEVI Plan

Figure 12: West Virginia NEVI Phase 1 Charging Locations

ID	City Name	Route	Interstate Exit	Number of Ports	NEVI Funding Sources
1	Huntington	I-64	15	4	FY22/FY23
2	South Charleston	I-64	56	4	FY22/FY23
3	Ripley	I-77	138	4	FY22/FY23
4	Parkersburg	I-77	176	4	FY22/FY23
5	**Tamarack**	**I-64**	**42**	**4**	**FY22/FY23**
6	**Princeton**	**I-77**	**9**	**4**	**FY22/FY23**
7	**Lewisburg**	**I-64**	**169**	**4**	**FY22/FY23**
8	Sutton	I-79	62	4	FY22/FY23
9	Weston	I-79	99	4	FY22/FY23
10	Morgantown	I-68	1	4	FY22/FY23
11	Wheeling	I-70	4	4	FY22/FY23
12	Martinsburg	I-81	13	4	FY22/FY23
13	Kanawha City	I-64	89	4	FY22/FY23
14	Elkview	I-79	9	4	FY24
15	**Beaver**	**I-64**	**125**	**4**	**FY24**

Note: Counties with the Councils are highlighted

Source: West Virginia NEVI Plan

3.4.2 Other EV Policies

The Charging and Fueling Infrastructure (CFI) Grant Program provides funding to strategically deploy publicly accessible electric vehicle charging infrastructure and other alternative fueling infrastructure. It has two tracks; the Community program, which focuses on installing charging infrastructure on public roads, schools, parks, and in publicly accessible parking facilities, and the Corridor program, which looks to deploy electric vehicle charging and hydrogen/propane/natural gas fueling infrastructure along designated alternative fuel corridors. The Community program will prioritize rural areas as well as low- and moderate-income neighborhoods with low ratios of private parking or high ratios of multiunit dwellings. As for funding, the Bipartisan Infrastructure Law provides $2.5 billion over 5 years for the CFI program, where federal cost-sharing is up to 80%, while applicants must provide the remaining.

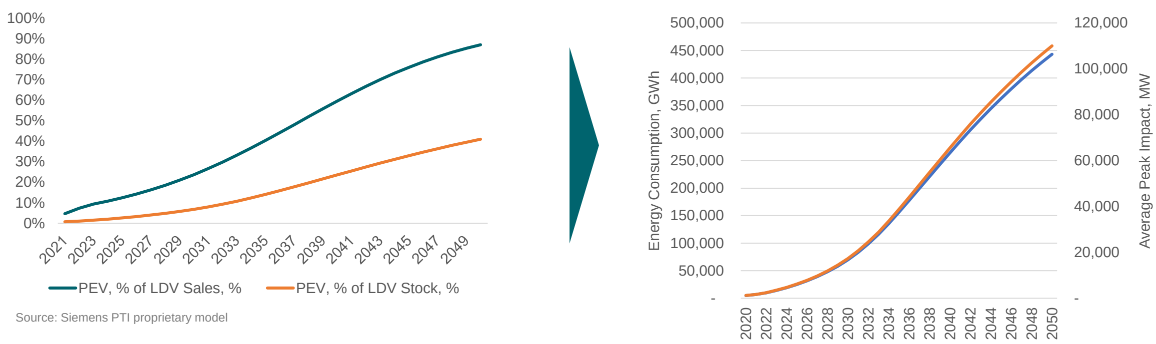
4. Future EV Ecosystem

4.1 Vehicle Adoption

4.1.1 Light-Duty Vehicle Forecasting

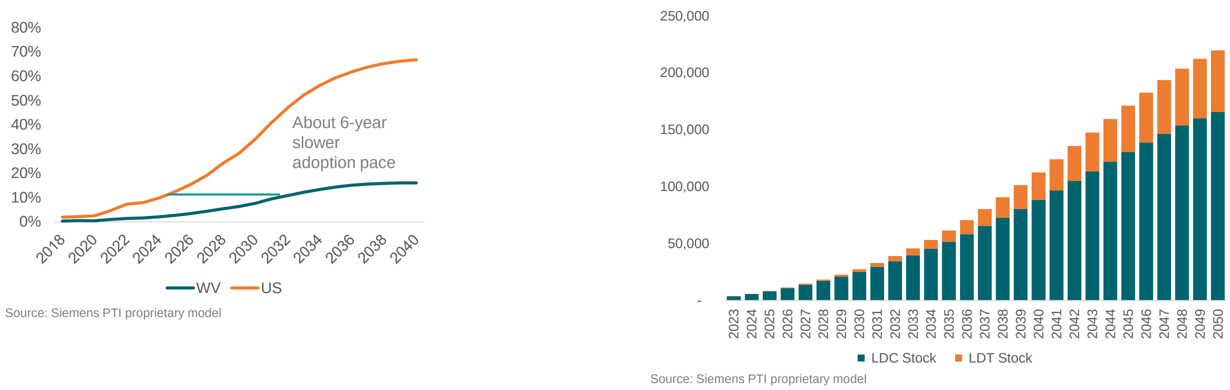
To establish a basis for determining the potential need for charging infrastructure, Siemens PTI first forecasted the adoption of EVs in the Councils. Siemens PTI leveraged its proprietary EV adoption forecasting model to provide both national and West Virginia specific adoptions forecasts providing perspective on that of the Councils. Across the US, by 2050 approximately 87% of new LDVs are expected to be EVs, but only 41% of registered vehicles will be EVs, and its registered (operating) vehicles that drive electric demands. It is important to note that while the pace of US EV purchases increases, it takes time to turnover the approximately 260 million LDV stock.

Figure 13: US Light-Duty Vehicle EV Growth



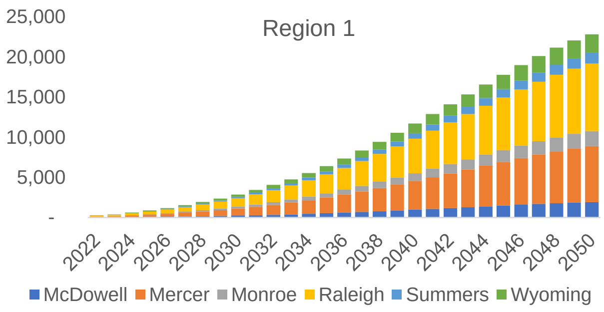
Of course, results vary by state and locality and our forecast suggests EV adoption will be slower in West Virginia than across the country.

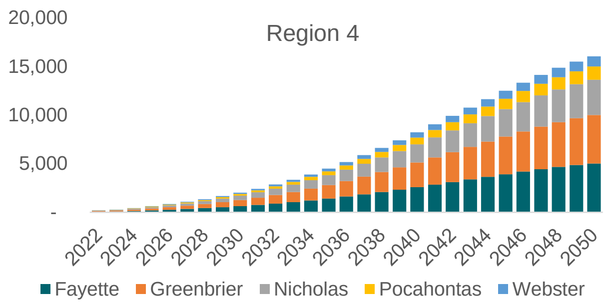
Figure 14: West Virginia Light-Duty Vehicle EV Growth



Siemens PTI segmented the state EV forecasts to the county level based on registered vehicles and recent county population and household growth trends to forecast EV adoption in the Councils. Downward trends in these metrics slow the pace of vehicle purchases and registrations regardless of whether vehicles are EV or traditional.

Figure 15: Council and County Light-Duty Vehicle EV Growth



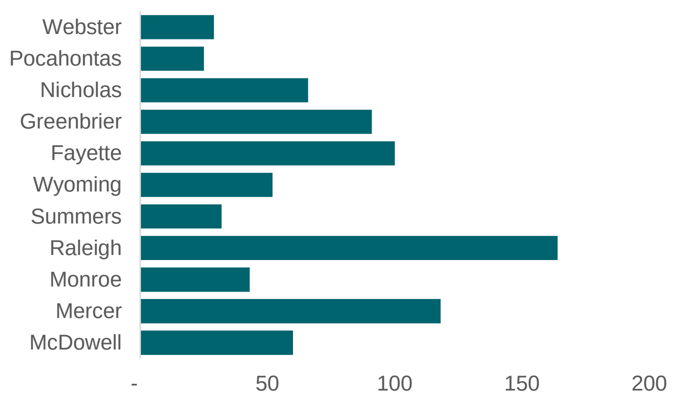


4.1.2 Electrified School Bus Requirements

EV school buses are expected to begin arriving in the Councils by 2025. Federal funds available via the Clean School Bus Program, which provides $5 billion in support of electric school bus deployments across the US, provides a strong national incentive. In West Virginia, there are 3,832 operating school buses. In Region 1 there are 469 and in Region 4 there are 311.

West Virginia purchased 41 all-electric GreenPower school buses; the first 4 Type A Nano BEAST school buses were delivered to Cabell, Clay, Monongalia, and Kanawha counties. Kanawha County is set to receive another in 2024. These EV school buses are manufactured in the company's South Charleston facility.

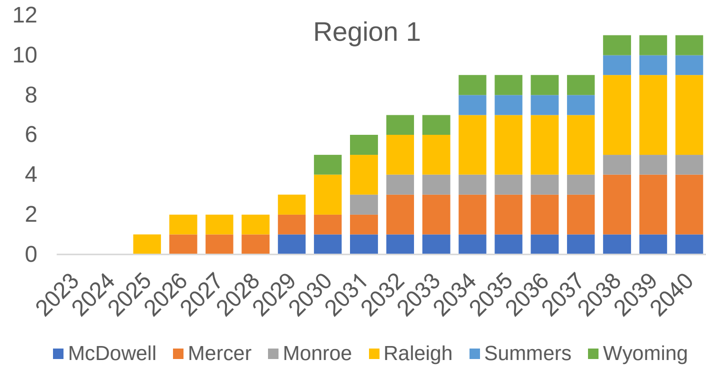
Figure 16: School Bus Fleet by Region and County, No. of school buses.

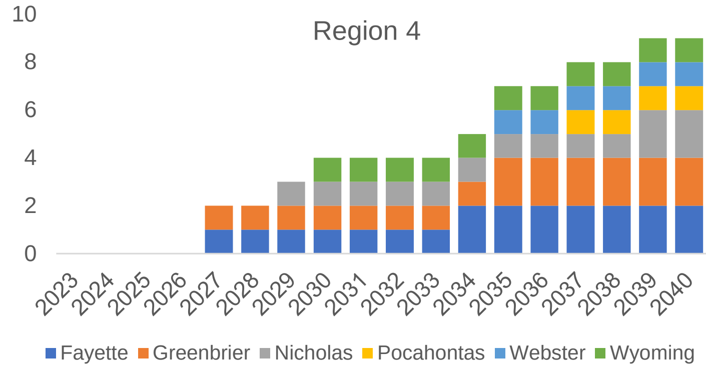


Source: World Resource Institute

Siemens PTI maintains a state and national electric school bus adoption forecast as part of its proprietary EV forecasting capability, which formed the basis for the EV school bus forecast.

Figure 17: Council EV School Bus Forecast

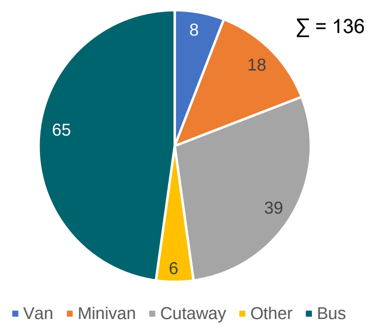




4.1.3 Electrified Transit Bus Requirements

Similarly, EV transit buses continue to be strongly supported by the Federal Transit Authority (FTA) and are expected to be adopted in the Councils. As of 2021, more than 1,300 zero-emission transit buses were delivered or awarded to U.S. transit agencies. There are three public transit agencies serving the Regions including: Kanawha Valley Regional Transportation Authority, Mountain Transit Authority, and New River Transit Authority. Further, the Bluefield Area Transit is a municipally owned transit department also serving part of the area. Between them, there are 136 operating vehicles of which most are cutaways or buses.

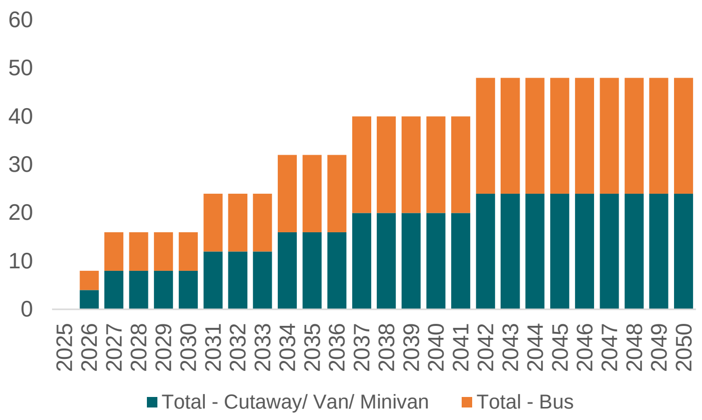
Figure 18: Transit Vehicles Serving the Councils by Type



Source: American Public Transit Association, BTA website

Siemens PTI maintains a state and national electric transit bus adoption forecast as part of its proprietary EV forecasting capability, which formed the basis for the EV transit bus forecast.

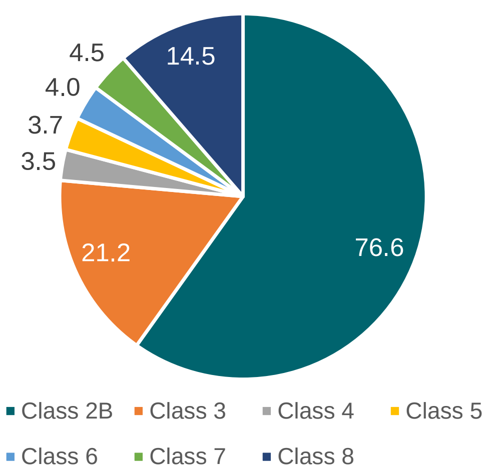
Figure 19: Council EV Transit Bus Forecast



4.1.4 Electrified Fleet Requirements

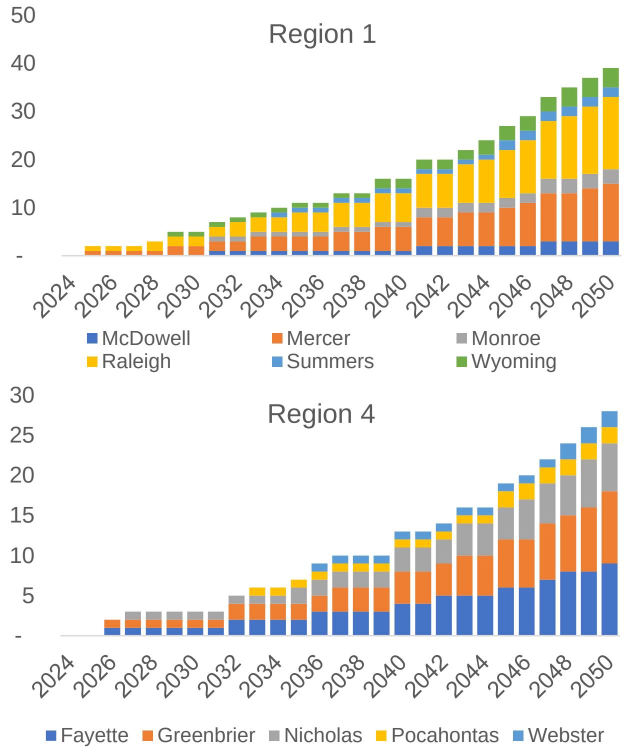
In West Virginia, most commercial trucks are either relatively small (class 2b and 3), which are typically used in local service, or tractor trailers (class 8) used for longer larger loads. For reference, Class 2b trucks tend to be large pickup (i.e., F250/ 350) often used by local contractors. A breakdown of West Virginia's commercial vehicles by class is presented in Figure 20 below.

Figure 20: West Virginia Commercial Vehicles by Class



Siemens PTI maintains a state and national electric commercial truck adoption forecasts as part of its proprietary EV forecasting capability, which formed the basis for the EV commercial truck forecast. These forecasts vary by state since each has different EV adoption targets and incentives for commercial vehicles. Obviously increased commercial trucks offerings, increased incentives, and increased local experience with commercial EV accelerates adoption. Within the commercial fleets, back-to-base operating vehicles are easiest to transition to EVs, at least in the early years. These vehicles have predictable charging needs facilitating charge planning, and somewhat shorter routes which aligns well with the current capacity of commercial EV batteries.

Figure 21: Council EV Commercial Truck Forecast by County

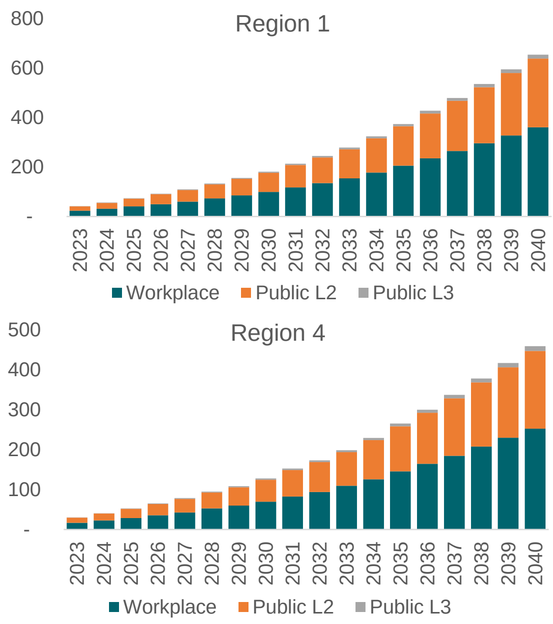


4.2 Potential EV Charging Locations

4.2.1 Public Charging Sites

As discussed above, Siemens PTI forecasted the charging equipment required to support the expected EV population based on the local forecast of EV demands. The number of charge plugs required per registered EV was sourced from a National Renewable Energy Laboratory (NREL) study which estimated workplace, public L2 and public L3 plugs needed by state. Note that one charger may contain anywhere from one to four plugs, depending upon the model. Not all L2 or L3 chargers are the same; equipment ratings and ultimately the speed of charging varies between vendors. For example, a single two port 50-amp L2 charger will charge at 50 amps per plug, and another will charge at 50 amps for each plug. This is particularly important for fleet vehicles that need to charge within a specified timeframe.

Figure 22: Council Charge Plug Requirements



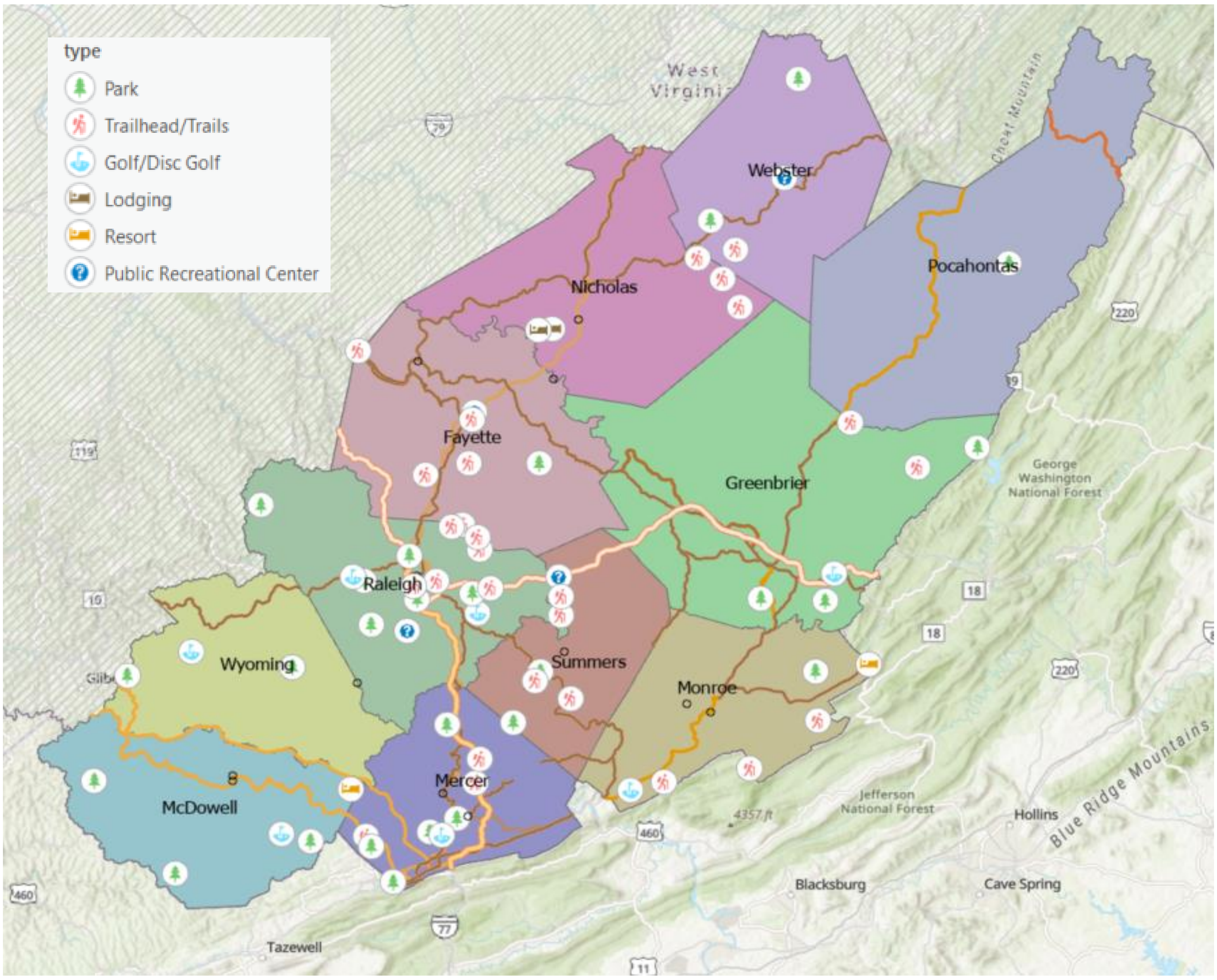
Deciding where public charging is likely to be developed is complex considering site competitiveness, attractiveness, and readiness. A set of common key factors for site selection are detailed below in Figure 23.

Figure 23: Public Charging Location Factors

Key Factors	Examples
Charging Alternatives	A given base of registered vehicles requires a certain number of workplace, public L2 and L3 plugs to support and existing charging infrastructure and that under development provide part of that need
Points of Interest (POIs)	Since L2 charge rates are relatively slow, EVs must be connected for 1 to 2 hours at least to add appreciable charge to any EV. Owners will need a reason to park for a few hours (e.g., shopping, tourist attractions, museums, hotels, marinas, etc.).
Available Parking	Existing parking lots or decks are natural targets for EV charging.
Traffic	EV owners will want to charge in relatively convenient locations. Hwy X will prove attractive for L3 charging, and key routed in the city are obvious potential choices for L2 charging.
Residential Mix	Share of occupied residences, owner-occupied homes, single-family detached residences, multifamily residences
Workplace Locations	Private vehicles are stationary for the longest periods of time at home or work providing ideal L2 charging opportunities and potentially diminishing public access demand
Relative Strength of Electric Service	Sites with known substation or feeder limits will likely be more costly and time-consuming to upgrade making them less attractive.
Appropriate Zoning	Re-zoning property can be time consuming and costly. Developers seeking quick returns with low costs and risks will avoid difficult site, so appropriate commercial zoning is highly preferred.
Disadvantaged Communities	While the recent IIJA and IRA laws provided economic support for EV charging, additional funding support is available for charging stations in disadvantaged communities, which eases the economic burdens of station development and ownership.
Amenable Site Owners	While EV charging make seems sensible in a given area, if nearby site owners are uninterested for whatever reason, alternate locations may prove easier to develop.
Stakeholder Insight	Local residents may be in a position to add insight about specific installation locations and potential owners.

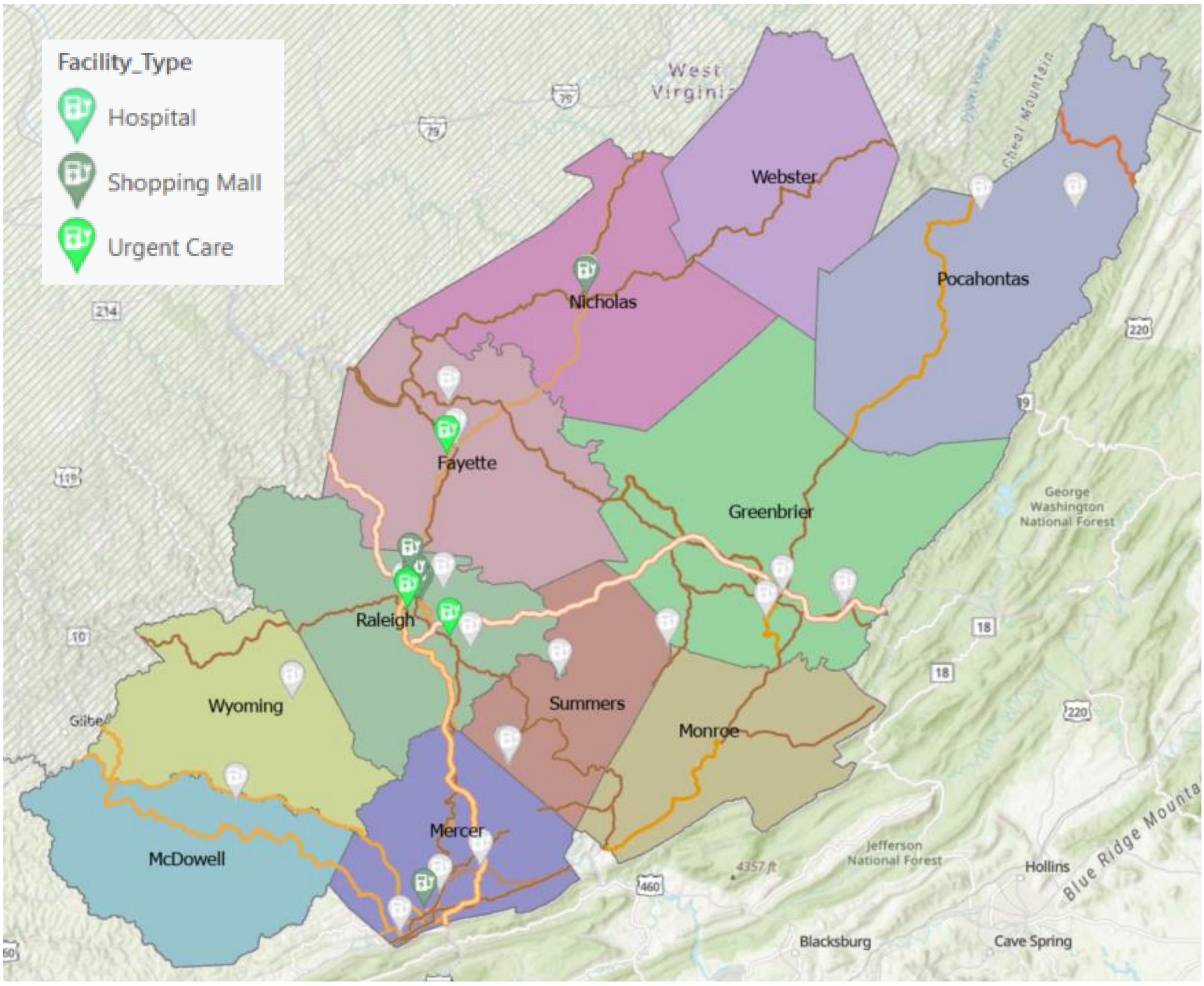
In considering charging locations, Siemens PTI found that southern West Virginia is in a unique position where there is a lot of untapped potential for EV infrastructure expansion, and that both locals and tourists can benefit from strategically placed chargers. Potential locations include, but are not limited to: Universities, Army Facilities, Municipal Infrastructure, Conference Centers, Libraries, Recreational Centers, Lodges/Hotels, Parks, Trailheads, Golf Courses. Large national retailers with local facilities and traffic flow are in a uniquely competitive position, and Walmart, for example, announced plans to develop charging at all its locations. While they may develop charging alone, they may also take on partners. Also, large national fleets will develop charging for their own fleets (e.g., USPS) and developers offering public charging may be able to leverage the required infrastructure improvements to support their projects.

Figure 24: Potential Public Charging Locations



Siemens PTI applies its expertise to identify an initial list of more attractive charging locations across the Councils. These included shopping malls, hospitals, and urgent care clinics. We also identified locations where charger upgrades would be beneficial noting that there are five L1 chargers that can be upgraded to L2, and that additional L2 and DCFC chargers can be installed in some existing locations as indicated in Figure 25 below.

Figure 25: Potential Charging Upgrade Locations



Region	Access	L2 EVSE Loc	DCFC EVSE Loc
1	Public	9	
4	Public	2	3
Grand Total		11	3

4.2.2 EV Charging at State and Federal Parks

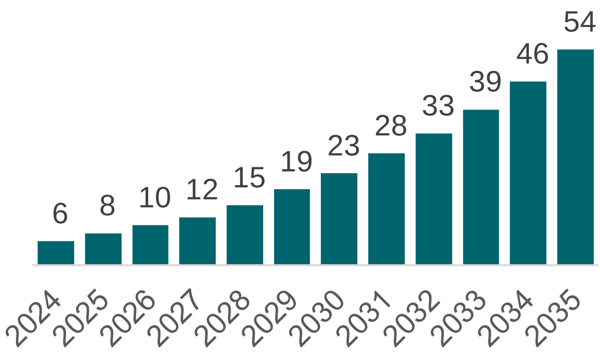
One of the most important trends noted is that most tourism comes from within West Virginia itself. Almost 60% of the visitors to State parks are West Virginia residents, and even though attendance is well distributed among the parks, visitation has declined in recent years. West Virginia resident attendance to different activities such as lodging and camping has been growing, but outside tourists seem to be finding other recreational spots, as their attendance has been slowly declining. A couple of State Parks were identified as needing a charging infrastructure plan based on tourism trends, others experienced relatively low demand, needing only 3 to 4 plugs by 2035. These parks are Bluestone, Hawks Nest, Pipestem, Twin Falls, and Watoga. A summary of West Virginia state park trends is presented in Figure 26 below.

Figure 26: Council State Park Visitation Summary

Overall Characteristics 2018-2023					
State Parks	**WV Tourism**	**Avg. Growth**	**Camping Sites**	**WV Tourism**	**Avg. Growth**
Avg. Non-Resident attendance	85,926	-3%	Avg. Non-Resident Overnight stays	4,973	4%
Avg. Resident attendance	121,570	-3%	Avg. Resident Overnight stays	6,541	4%
Avg. Total Attendance	207,495	-3%	Avg. Total Overnight stays	11,514	3.21%
Lodging Sites	**WV Tourism**		**Charger Requirements**	**NREL Study Derivation**	
Avg. Non-Resident Overnight stays	3,033	-6%	State Public L2	0.028571429	
Avg. Resident Overnight stays	1,392	9%			
Avg. Total Overnight stays	4,425	-2.34%	**County Overnight Visitors**	**WV Tourism**	
			Persons/ Trip	2	
Cabin Sites	**WV Tourism**				
Avg. Non-Resident Overnight stays	4,976	-9%	**Visit Location Origin**	**WV Tourism**	
Avg. Resident Overnight stays	2,913	12%	Non-Resident	41%	
Avg. Total Overnight stays	7,889	-5.31%	Resident	59%	

Forecasted usage suggests about 54 chargers will be required in the 16 studied parks by 2035. As of today, about 6 chargers are needed to support EV traffic in the parks. Chargers denoted are L2 charging stations with 2 plugs each. These estimates assume approximately 20% of EV trips will require charging, but if consumer behavior changes, more chargers might be required.

Figure 27: Council State Park L2 Charger Forecast



With this said, installation of new sites can be exponential, as nearby sites can "share" infrastructure in early years. It is important to note that while charger use will be equal between West Virginia resident and non-resident use, near-term state incentives might change how this looks in the upcoming years, as other states adapt EVs faster. Furthermore, as EV adoption in the general population grows, consumer behavior might change and out-from-home charging habits might become more popular, pushing the need for infrastructure.

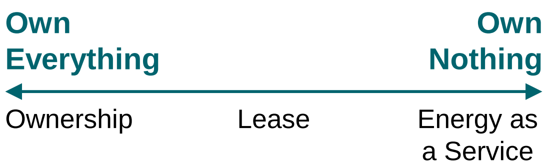
Appalachian Power and Mon Power provide electric service across Councils 1 and 4. Siemens PTI's energy and distribution planning engineers met with distribution planning counterparts in each utility to discuss potential grid limitations in general and at the potential charging locations identified. Both utilities indicated they maintain adequate capacity in each area to support the level of proposed charging development and that no capacity upgrades were anticipated. Further, they indicated that single phase power is available everywhere and is sufficient for level 2 charging, and that three-phase power is only available in more populated locations and is required for level 3 charging. Thus, were we considering potential level 3 sites in more rural locations (e.g., parks), system upgrades would likely be required, but since we only identified level 2 charging for parks, no grid upgrades are anticipated.

5. EV Charging Feasibility and Economic Impacts

5.1 EV Charging Business Models

Public and private charge point operators (CPOs) have several business model options from which to select ranging from the traditional own everything option to owning nothing. The traditional option requires the CPO provide capital and build, own, and operate the charging network and perhaps the EV fleet as well, depending upon the application. In this model, the CPO must develop an operating and maintenance plan and procedures, train staff, and provide spare parts etc. to ensure reliable operations.

Figure 28: Range of EV Charging Business Model Options



On the other end of the spectrum, a fleet owner, for example, seeking to transition to EVs, could allow a third party to finance and provide all required equipment and services for a fee. In this energy as a service model, the third party would finance and procure the EVs, build own and operate the charging network, and ensure reliable operations of the EVs and charging equipment. At the end of a term, the EVs and charging equipment could revert to the fleet owner or be removed by the provider.

Between the two ends of this business model spectrum are a range of intermediate alternatives. A sample of these might include:

- Fleet owner procures EVs and charging network, contracting for operations and maintenance services,
- Fleet owner procures EVs, and third party provides charging network ensuring uptime via contractual metrics and penalties, or
- Fleet owner leases EVs and/or charging network.

Regardless of the selection, its important the right charging business model is selected to align and deliver business goals given business constraints. Business model selection may hinge on the tradeoffs between profits, risk, and competition for scarce capital.

5.2 EV Charging Station Economics

Owning and operating a fleet of EV charging stations can offer numerous financial and non-financial benefits and costs, some not so obvious, as outlined in Figure 29 below.

Figure 29: EV Charging Station Benefits and Costs

	Benefits	Costs

Non-Financial	• Gather tangible charging behavior data
	  • Utilization
	    • Time of day, Day of month, Weekend v. weekday
	  • Energy & load requirements
	  • Grid impacts
	• Evaluate charging rates
	  • Energy - $/kWh
	  • Time - $/hour
	• Positive image impacts
	• Proof of concept
		• Equipment reliability/ availability
		• Remote reset capabilities
		• Spare parts requirements and use
		• Service requirements

Financial	• Revenues • Margins • IRR/ NPV	• Capital costs • O&M costs • Working capital requirements

Favorable EV charging stations economics are driven by several core factors outlined in Figure 30 below. While capital costs and availability often garner the most attention, they are the easiest to predict. Further, there are significant incentives to lessen the capital burden. Charger utilization, essentialy the number of charging sessions in each timeframe, combined with the charge rate provides the project revenue required to offset capital and operating costs. Depending upon the location, additional revenues may be derived via advertising or convenience item sales like drinks and snacks. In some locations, public EV charging is established at new locations with convenience items offered via machines rather than traditional convenience store storefronts.

Figure 30: EV Charge Station Economic Drivers

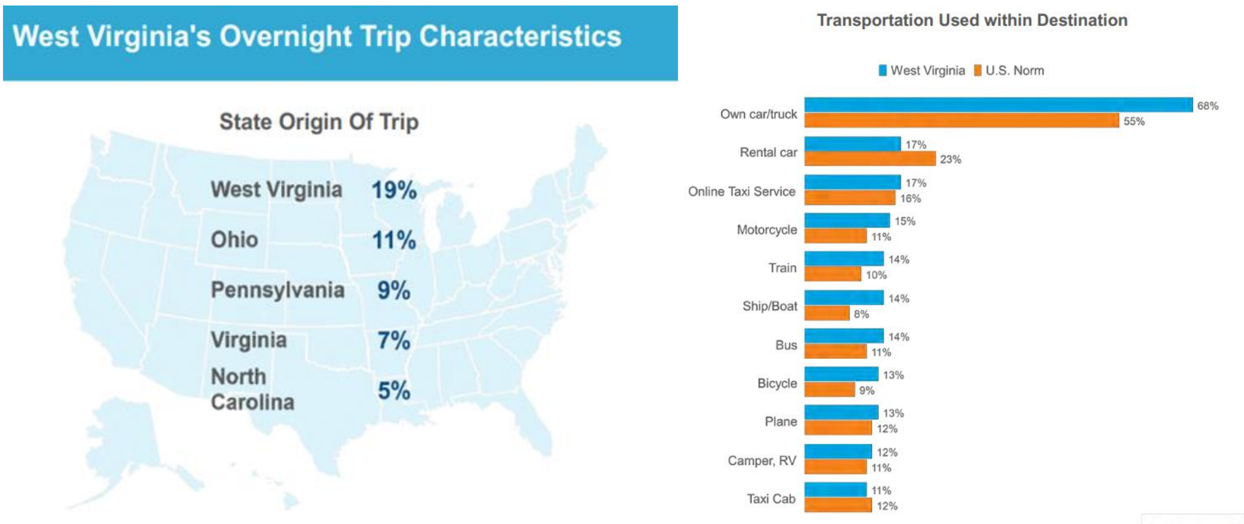
Category	Information
Utilization	• Current known measures • Peak potential at each site • Recently reported/ studied national utilization trends • Forecast EV growth indicating pace of change
Availability	• Current charge program and site experience • Recently reported/ studied national observance • Availability guarantees
Charge Rate	• Current rates • Local competitive charge rates and structures establishing local expectation • Location convenience and access premium, perhaps by site
Capital Costs	• Requirement for and to pay for utility necessary upgrades • “Make-ready” infrastructure cost – largely defined by distance • Site service upgrades

Site selection readiness review differs for fleet owners with distinct sites and charge station siting for public access.

5.3 Economic Development Impact

West Virginia is a tourism crossroad with overnight visitors arriving from within the state and most surrounding states largely by personally owned vehicles.

Figure 31: West Virginia Tourism Drivers



Source: West Virginia Tourism Office, https://www.travelstats.com/impacts/westvirginia

The New River/Greenbriar region, which mostly aligns with the Councils geographically, recorded overnight visitors of almost 2.8 million in 2021 generating total direct spending of $785.4 million and $58.8 million in tax receipts. Total tourism spending per county was estimated based on the information given by the West Virginia Tourism Office, which considers multiple factors such as food, transportation, accommodations, retail sales, etc. Said total direct spending turns out to be $411.1 million in Council 1 and $592.0 million in Council 4.

Figure 32: Council Tourism Drivers and Spending

New River/Greenbrier Valley Region								
Year	Total Direct Travel Spending (Thousands)	Visitor Spending by Type of Accommodation (Thousands)	Visitor Spending by Commodity Purchased (Thousands)	Industry Earnings Generated by Travel Spending (Thousands)	Industry Employment Generated by Travel Spending	Tax Receipts Generated by Travel Spending (Thousands)	Average Overnight Spending (PP)	Overnight Visitor Volume
2014	$ 672,042	$ 664,398	$ 664,398	$ 196,317	6,951	$ 52,150	$ 207	2,474,727
2015	$ 603,842	$ 595,518	$ 595,518	$ 197,028	6,659	$ 50,857	$ 193	2,415,805
2016	$ 586,273	$ 577,395	$ 577,395	$ 197,071	6,717	$ 49,441	$ 188	2,424,771
2017	$ 620,271	$ 610,948	$ 610,948	$ 203,494	6,860	$ 51,404	$ 197	2,466,884
2018	$ 671,416	$ 661,071	$ 661,071	$ 218,913	7,156	$ 55,184	$ 203	2,557,421
2019	$ 704,120	$ 693,334	$ 693,334	$ 236,587	7,677	$ 57,513	NA	2,648,095
2020	$ 591,163	$ 583,182	$ 583,182	$ 198,880	6,330	$ 46,044	NA	2,355,516
2021	$ 785,443	$ 778,524	$ 778,524	$ 235,715	7,118	$ 58,837	NA	2,795,580

County Tourism Spending (Thousands)											
Year	Webster	Pocahontas	Nicholas	Fayette	Greenbrier	Raleigh	Summers	Monroe	Mercer	Wyoming	Mcdowell
2014	$ 9,748	$ 88,562	$ 61,883	$ 75,494	$ 225,522	$ 171,071	$ 18,773	$ 10,369	$ 111,536	$ 33,733	$ 25,544
2015	$ 8,054	$ 80,154	$ 52,575	$ 65,495	$ 215,313	$ 150,862	$ 16,950	$ 9,764	$ 97,352	$ 27,364	$ 20,742
2016	$ 7,603	$ 87,388	$ 49,724	$ 64,975	$ 199,399	$ 156,651	$ 16,631	$ 9,575	$ 93,814	$ 25,706	$ 19,477
2017	$ 8,007	$ 92,860	$ 53,552	$ 69,012	$ 211,737	$ 157,903	$ 17,400	$ 9,771	$ 105,510	$ 27,135	$ 20,265
2018	$ 7,953	$ 115,681	$ 55,674	$ 71,638	$ 238,314	$ 168,677	$ 19,783	$ 10,017	$ 113,494	$ 27,939	$ 20,937
2019	$ 8,600	$ 119,168	$ 62,578	$ 78,901	$ 240,142	$ 183,028	$ 19,971	$ 10,232	$ 115,392	$ 28,248	$ 28,206
2020	$ 7,527	$ 123,303	$ 49,852	$ 71,041	$ 214,350	$ 136,529	$ 19,796	$ 10,181	$ 88,609	$ 25,320	$ 25,337
2021	$ 9,922	$ 144,513	$ 63,473	$ 98,995	$ 275,133	$ 173,940	$ 28,427	$ 10,710	$ 130,665	$ 33,822	$ 33,752

Source: West Virginia Tourism Office, https://www.travelstats.com/impacts/westvirginia

To discern the seasonal nature of tourism travel, Siemens PTI accessed monthly federal park visitor data from the New River Gorge National Park and Bluestone National Scenic River and noted strong summer month tourism interest.

Figure 33: Council Federal Park Facility Monthly Visitation

Recreation Visits by Month
New River Gorge NP & PRES

Current year data are preliminary and subject to change. Data will be finalized by the end of the first quarter of next calendar year.

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
2023	38,149	42,210	74,879	126,494	197,509	233,909	286,821	235,837	190,817	141,544	100,314	38,740	1,707,223
2022	31,656	39,219	69,767	117,824	174,882	203,538	273,494	215,254	180,086	168,930	79,143	39,730	1,593,523
2021	33,856	36,361	103,151	126,454	151,995	220,558	288,827	212,484	178,614	173,459	110,368	46,593	1,682,720
2020	30,180	31,358	56,577	52,875	109,036	155,085	170,593	145,611	108,306	111,263	50,939	32,551	1,054,374

Recreation Visits by Month
Bluestone NSR

Current year data are preliminary and subject to change. Data will be finalized by the end of the first quarter of next calendar year.

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
2023	182	281	377	469	1,393	4,150	5,956	3,702	3,084	1,511	188	300	21,593
2022	0	0	0	0	809	3,080	3,519	3,368	2,270	1,067	0	0	14,113
2021	0	0	0	0	843	3,619	8,892	6,282	3,530	3,544	0	0	26,710
2020	0	0	0	0	0	0	8,890	7,036	4,857	4,424	0	0	25,207
2019	75	84	218	375	3,800	6,659	9,530	6,939	5,299	4,684	0	0	37,663
2018	60	87	100	200	350	6,500	8,500	6,500	4,694	4,000	200	125	31,316

6. Electric Micro-mobility

The West Virginia Planning and Development Council has requested Siemens PTI to advise upon micro–mobility charging hub options. This guidebook will provide information such as vendor options, charging station design specifications, and a cost assessment.

6.1 Electric micro-mobility overview

Micro-mobility refers to lightweight, often single person modes for transportation designed for short distances, typically in urban area. These vehicles are typically smaller, more agile, and can complement existing public and private transportation methods. Common vehicles include scooters, bicycles, skateboards, and mopeds. Though electric micro-mobility vehicles are often used to address commuting challenges in urban environments, they have become popular for recreational purposes too, opening new opportunities for outdoor recreational activities.

Each micro-mobility method and platform has its own unique pros and cons:

1. Electric Scooters: The largest micromobility platform, e-scooters are popular in urban areas as a last-mile transportation solution and work well with ride-sharing platforms, offering riders convenient ways to navigate small areas quickly. One drawback of distributed e-scooter sharing is the lack of designated parking areas, which often leads to them being placed in ways that obstruct sidewalks or onto private property.

2. Electric Bicycles: E-bikes leverage the convenience and control of traditional bikes with electric assistance, allowing riders to travel longer distances or more difficult terrain with less effort. They work well with existing bike infrastructure including paths, lanes, and bike racks.

3. Electric Skateboards: E-skateboards have appeared recently as fun, agile ways to travel short distances, offering maneuverability and flexibility among tech-savvy commuters seeking alternative transportation choices.

4. Electric Mopeds: E-mopeds have grown in popularity as they are suitable for individuals looking for reliable ways to commute on roadways within a city across short distances between towns. They tend to offer more range while maintaining the flexibility of traditional mopeds or motorcycles.

For local adoption on which technology may be most applicable to Regions 1 and 4, it is important to consider commuter practices and recreational trends. Given the proliferation of outdoor activities and the projected increase over time from out-of-region visitors, it is likely e-bike usage will increase in the region. Low difficulty trails and bike paths in the area compliment the use case for E-bikes, which open outdoor activities to new users.

6.2 E-micromobility infrastructure and site development

E-micromobility infrastructure refers to the charging stations, parking facilities, and other amenities to support electrified transportation. Though E-mobility infrastructure can be harmonized with EV charging infrastructure, it is not the same and there are distinct differences.

1. Site selection: E-micromobility site selection focuses less on traffic patterns and more on localized consumer behaviors and road access. Areas such as university campuses and commercial districts are ideal because they attract higher utilization across areas that are designed for walking.

2. Parking/Docking and Electric Infrastructure: E-micromobility is less intensive in terms of electrical impacts and is instead concerned with offering sufficient parking, particularly for systems that concentrate on fixed charging and parking stations. Consequently, micromobility designers emphasize sufficient parking at docking stations over electrical impact concerns.

3. Shared vs Private Growth: E-micromobility, much like EVs, is a new frontier with many different frameworks that work based on consumer preferences and what the local and visitor population needs. In the case of West Virginia, it is unlikely there are sufficient population to support large scale shared micromobility platforms. Instead, the growth in national and state park tourism would suggest that there may be growth of private e-micromobility which will look for flexible charging infrastructure and specific tourism locations.

6.3 Safety

Micromobility introduces new safety concerns, not only relating to the operation of the devices but also as it pertains to charging infrastructure standards. Lithium-ion batteries are the primary battery type used for micromobility. Physical damage, electrical damage, extreme temperatures, product defects, and overcharging have led to chemical fires which release heat, smoke, and toxic gasses. The diverse range of developers for these devices increases the odds of equipment malfunctions as there are no uniform performance or safety standards in effect. Moreover, for applications that are in remote areas, such as the state parks and trails in economic development Regions 1 and 4, fires from equipment failures could lead to wildfires.

The National Fire Protection Association has released several standards which can help address the safety requirements pertinent to the development of remote and at home micromobility charging:

- NFPA 70 (National Electrical Code): This standard provides requirements for the installation of electrical wiring and equipment, including those related to charging infrastructure for electric vehicles and micro-mobility devices.

- NFPA 1 (Fire Code): NFPA 1 addresses fire safety requirements for buildings and facilities, including provisions related to electrical systems, hazardous materials, and emergency preparedness, which may be relevant to micro-mobility charging locations.

- NFPA 70B (Recommended Practice for Electrical Equipment Maintenance): This document provides guidelines for the maintenance of electrical equipment, which may include recommendations for maintaining charging infrastructure and preventing electrical hazards.

- NFPA 111 (Standard on Stored Electrical Energy Emergency and Standby Power Systems): NFPA 111 addresses the design, installation, operation, and maintenance of emergency and standby power systems, which may be relevant for ensuring the reliability of backup power systems in micro-mobility charging facilities.

6.4 Micromobility providers and systems

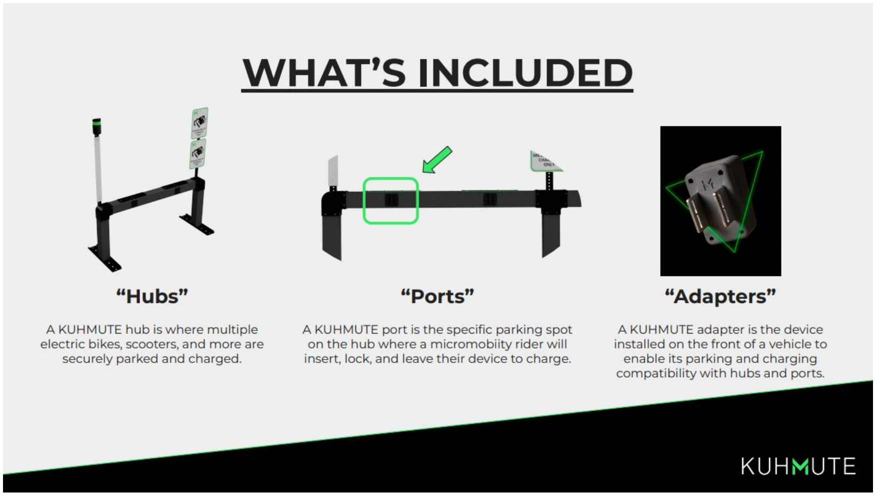
Siemens PTI has compiled a list of vendors who sell micro–mobility charging hubs that meet West Virginia Planning and Development Council's requirements. These vendors provide both charging and securing mechanisms for individuals to safely charge their e-bikes or e-scooters without worrying about theft. Each vendor has a slightly unique design for their docking station, but all designs are compatible for outdoor installation. Siemens PTI notes these vendors are not ideally suited for outdoor recreational activities such as using an e-bike for trail rides. However, they can provide formative information and help cities and perhaps some resort operators with on-site transportation. The provided vendors do not constitute as an endorsement of any single system, rather it is illustrative of the options available to planners.

6.4.1 Kuhmute

Kuhmute is an American company based in Flint, MI. They partnered with Joyride to provide their clients with both a charging and locking docking station and a digital platform (Joyride app) to track charging, track devices, and manage charging cost.

Kuhmute's docking station can be indoor or outdoor provided it has a 120v plug and comes in three standard sizes – 2 ports, 4 ports, and 6 ports charging docks. If more ports are necessary, Kuhmute recommends purchasing more of their standard sizes and configuring the installation that best suits the charging hub location. Kuhmute has created an adapter that is compatible with most e-bike and e-scooter manufacturers.

Figure 34: Kuhmute Standard Hub



6.4.2 City Dock

City Dock is a one size fits all vendor. A Romanian company, they have two types of charging stations available for e–scooters and e–bikes: one with parking and charging and another one with parking, charging, and securing. Overall, they provide their clients with both a charging and locking dock station and a digital platform (CITYDOCK app) to track charging, track devices, find docking space, and manage charging cost.

City Dock's station is outdoor only and needs a 220/230v plug. It comes in one standard size; each charger hub comes with 6 locking and charging ports that are compatible with charging both e-bikes and e-scooters.

Figure 35: City Dock Standard Station

6.4.3 Swiftmile

Swiftmile is an American company based out of California. A pioneer of the micro mobility front, they have been providing their clients with customized charging and locking docking stations as well as an economic solution to finance public charging stations (ad revenue). This approach allows both Swiftmile and their clients to finance public charging stations at a much more affordable rate and thereby lowering the cost. They have three types of charging stations available for e–scooters and e–bikes: one with parking, one with parking, charging, and securing, and one with parking, charging, securing, a digital screen.

Swiftmile's docking station comes in 4 standard sizes – 2 ports, 4 ports, 6 ports, and 8 ports charging docks and can use 120 or 220v plugs. The docking station (charging docks and ports) is weatherized. This means that devices can be charged in any weather conditions.

Swiftmile's approach to public charging station ownership unconventional. They offer two options – Swiftmile can either own and operate the docking station or the client can own the and operate docking station.

Figure 36: Swiftmile Standard Station

6.5 Vendor Contact

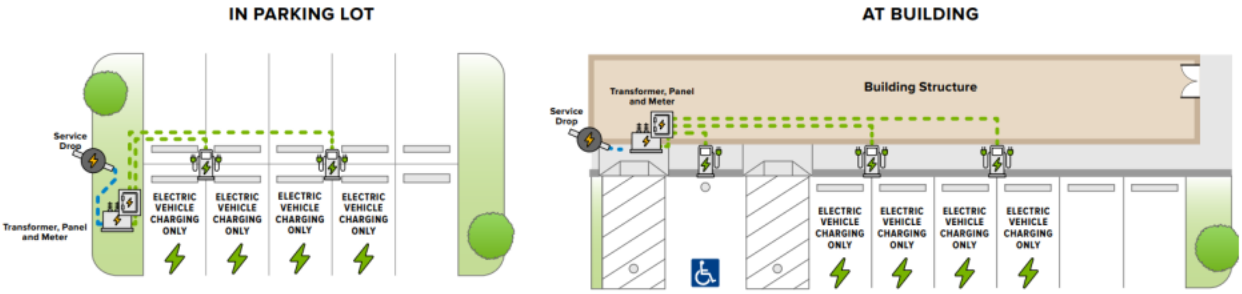
Figure 37: Vendor Contact Information

Vendor Name	Docking Station Options	Contact
KUHMUTE	Charging Port	Sanji Alwis Chief Commercial Officer (CCO) sanji@kuhmute.com (617) 480-5292
	2 Charging Port Hub	
	4 Charging Port Hub	
	6 Charging Port Hub	
City Dock	Charging Port	Musat Marian Chief Executive Officer (CEO) marian@citydock.ro +40727360354
	6 Charging Port Hub	
Swiftmile	Charging Port	Colin Roche Chief Executive Officer (CEO) colin@swiftmile.com (650) 346 – 0541
	Parking + Charging	
	Parking + Charging with Digital Screen	

7. Economic Impacts

Economic and jobs impacts for the installation and maintenance of L2 charging stations are based in part upon station design. A typical parking lot and building located small L2 charging stations sketch is provided below.

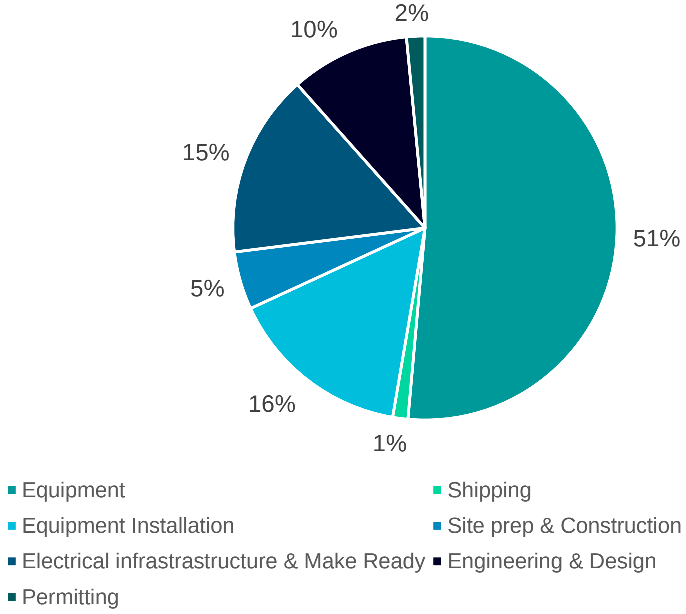
Figure 38: Indicative EV Charging



- **Existing service assumed unable to handle increased load. Transformer upgrade to 90% of charger maximum power.**
- **No future proofing assumed in default case. User input required.**
- **3 chargers (2 ports/cords per charger).**
- **Trenching/boring from transformer to cabinet to chargers. Default assumes 75 ft at $80/ft.**
- **ADA compliance, retractable cords, signage, bollards/curbs and striping/sidewalks.**

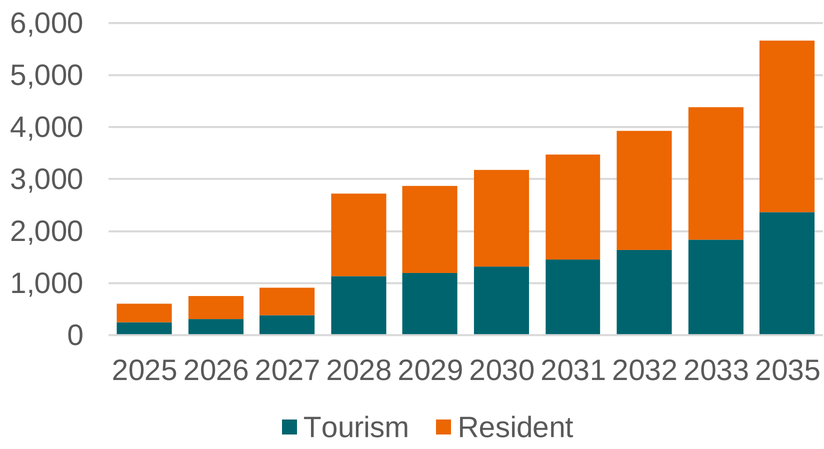
Capital cost for typical L2 stations is comprised of several components with over half the capital costs stemming from technical equipment and its installation, as per noted on the following figure.

Figure 39: EV Station Cost Breakdown, typical L2.



Siemens PTI's analysis suggests that EV charging can bring significant direct and induced benefits. Direct benefits include development and operational expenditures, all of which grow exponentially and are notably impacted by the implementation of the single L3 station in 2028. It is also important to recognize benefits accrued from charging stations which primarily serve tourists and the residents, so Siemens PTI estimated the benefits of each and provide the direct benefits in the following figures.

Figure 40: Direct Development & Operations Costs ($ Thousands)



There is also a direct impact on employment caused by the new stations. The impact of the L3 station installed in 2028 is evident in Figure 41 below.

Figure 41: Direct Development & Operations Employment (Number of Jobs)

For clarity, the following figures represent the development and operational costs separately since development costs occur once and operational costs are ongoing efforts. The exponential trend is clearly seen, as well as the even distribution between residential and touristic impacts. However, West Virginia resident impacts continue to be the majority, a trend expected to continue.

Figure 42: Direct Development Costs ($Thousands)

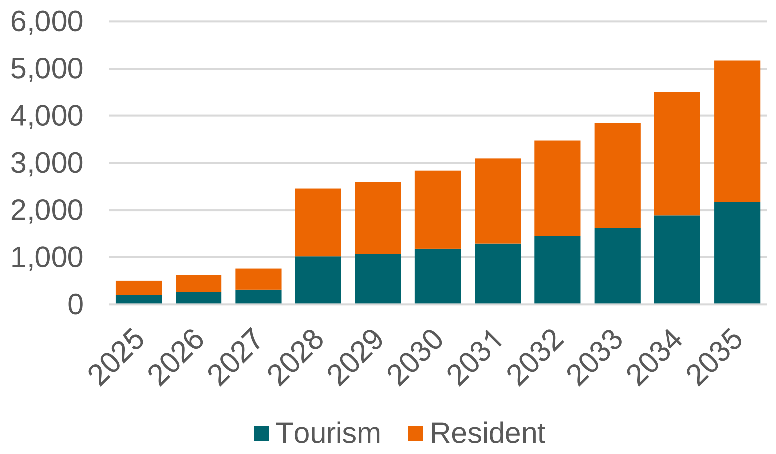


Figure 43: Direct Operating Cost ($Thousand)