DRPT
VIRGINIA DEPARTMENT OF RAIL AND PUBLIC TRANSPORTATION

March 31, 2025

EV and HEV Workforce Development

A Collaborative Initiative with the National Renewable Energy Laboratory

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Introduction

The purpose of this technical memo is to detail the methodology and findings related to the EV and HEV Workforce Development project, a collaborative initiative between the Virginia Department of Rail and Public Transportation (DRPT) and the National Renewable Energy Laboratory (NREL). This work is a continuation of the **Virginia Transit Equity and Modernization Study**, aka. **HJ 542**. This initiative aims to support transit agencies in their workforce development efforts by providing comprehensive guidance, assisting with employee recruitment, retention and reskilling, and addressing skill gaps such as identifying training needs and supporting the development of new programs. This initiative aims to support transit agencies in workforce development by providing comprehensive guidance, assisting with employee recruitment, retention and reskilling, and addressing skill gaps such as identifying training needs and supporting the development of new programs.

The EV and HEV Workforce Development project includes findings across three key areas:

1. **Inventory of Current Educational Capacity:** Develop a comprehensive list of relevant training programs related to electric vehicles (EVs), hydrogen electric vehicles (HEVs) or hydrogen fuel cell electric vehicles (HFCEVs), and related charging infrastructure.
2. **Employee and Training Demand Analysis:** Project the need for training across Virginia (VA) related to electric vehicles (EVs), hydrogen electric vehicles (HEVs) or hydrogen fuel cell electric vehicles (HFCEVs), and related charging infrastructure.
3. **Investment and Collaboration Opportunities:** Provide transit agencies with information on investment and collaboration opportunities to support workforce development efforts relating to low- and no-emission vehicle deployment.

The EV and HEV Workforce Development project is focused on several key Workforce Groups and Occupations (referred to throughout as 'workers') which were identified as critical for the deployment of low- and no-emission vehicles:

1. **Electrician and EV Charging Infrastructure**: Electrical Engineers, Electronical and Electronics Engineering Technologists and Technicians, Electricians, and Plant Maintenance Workers
2. **Hydrogen Fuel Cells**: Chemical Engineers and Chemists
3. **Manufacturing**: Industrial Engineering Technologists and Technicians, Mechanical and Mechatronics Engineers, and Welding Technologists and Technicians
4. **Automotive Maintenance and Service**: Automotive, Bus and Truck Technicians and Mechanics
5. **Transit and Facility Management**: Facilities Managers, Vehicle Operations, Vehicle Operations Support, Transportation Planners, and Training and Development Specialists

These workers reflect occupations at transit agencies as well as occupations and skillsets that will enable the broader transition and may contribute to competition in the talent marketplace.

Transit agencies can use this resource to support their workforce planning efforts as they transition to low- and no-emission vehicles. Engaging in efforts to develop a long-term workforce pipeline in public-private partnership with employers and training providers can mitigate potential workforce challenges.

Methodology

Inventory of Current Educational Capacity Methodology

The methodology the authors applied to achieve the output of the Inventory of Current Educational Capacity included several key steps: initial data collection through the National Center for Education Statistics (NCES) College Navigator tool; refinement of the list by filtering out non-applicable institutions; validation of programs through online searches and interviews; categorization based on relevance to the defined Workforce Groups; and finally, engagement with stakeholders such as educational institutions, EV and HEV industry players, and Virginia Clean Cities.

These Workforce Groups are defined as follows:

1. **EV Workforce Development Consortium and Special Programs**: Programs specifically designed to develop skills related to EVs and related infrastructure.
2. **Manufacturing**: Programs focusing on industrial maintenance, mechanical engineering, mechatronics, welding, and related programs[1].
3. **Automotive Maintenance and Service**: Programs in automotive technology, hybrid and EV technician training, diesel mechanics, and related programs.
4. **Electrician and EV Charging Infrastructure**: Programs in electrical engineering, electronics engineering, and related programs.
5. **Hydrogen Fuel Cells**: Programs in chemistry, chemical engineering, and related programs[2].
6. **Transit and Facility Management**: Programs in Commercial Driver's License and vehicle operations, transportation planning, training and development, and related programs[3].

These Workforce Groups reflect various aspects of work relating to EVs, HFCEVs, and related infrastructure. The Workforce Groups were adapted at the direction of DRPT

[1] This does not include original equipment manufacturing.
[2] Related programs could include hydrogen delivery, storage and management, pipefitting, pipe sensors, and hydrogen safety, codes, and standards. Note, the authors did not discover any programs in these domains in Virginia.
[3] Related programs could include health and safety. This analysis identified health and safety as a core competency in a majority of programs for Manufacturing, Automotive Maintenance and Service, and Electrician and EV Charging Infrastructure Workforce Groups. Occupational Health & Safety (OSHA) and other related safety standards trainings are also related programs.

and NREL from *Building an EV Workforce: A Review of Southeast Transportation Electrification Workforce*[4].

This approach delivers a point in time inventory of educational programs offered by colleges, universities, technical and vocational schools, and private companies relevant to the Workforce Groups.

This inventory is current as of February 2025 and includes higher education institutions in Virginia with related programs. Engagement with Virginia Clean Cities has supported the development of a more comprehensive inventory. Additional institutions may have launched related programs since the completion of the Inventory of Current Educational Capacity. A complement to this technical memo is a Microsoft Excel document which also includes the Virginia EV Workforce Development Inventory.

This inventory is augmented with qualitative findings from interviews with representatives of the following educational institutions:

- James Madison University
- Norfolk State University
- Northern Virginia Community College
- Southwest Virginia Community College
- Virginia Tech Transportation Institute

These interviews aimed to identify:

- Current developments and interest in EV/HFCEV capacity expansion,
- Challenges and opportunities faced by faculty, staff, facilities, and administration in developing or expanding relevant course offerings,
- Challenges and opportunities facing current/former/future students, and
- Challenges and opportunities that policies may present for collaboration within and between educational institutions.

Inventory and interview findings can be found in subsequent sections.

Employee and Training Demand Analysis Methodology

The methodology the authors applied to achieve the output of the Employee and Training Demand Analysis included several key steps:

1. **Forecast Workforce Supply:** Accessing the Integrated Postsecondary Education Data System (IPEDS), the core postsecondary education data collection program for National Center for Education Statistics (NCES), and Apprenticeships.gov to download historical completions relating to the Workforce Groups and Occupations and projecting those completions through 2035
2. **Forecast Employee Demand:** Accessing Projection Central and the Bureau of Labor Statistics to download employment data relating to the Workforce

[4] **https://nicholasinstitute.duke.edu/publications/building-ev-workforce-review-southeast-transportation-electrification-workforce**

Groups and Occupations and forecasting employment to 2035 based on scenarios
3. **Forecast Training Demand:** Identifying the forecasted training demand gap or surplus between workforce supply and employee demand for the Workforce Groups and Occupations for the years 2025 and 2035
4. **Synthesize Findings:** Detail all analysis within a report

This approach delivers a point in time assessment of training needs to support Commonwealth transit agencies in their workforce development efforts.

The quantitative analysis contain herein is augmented with qualitative findings from interviews with representatives from the following groups:

- Automotive Service Groups
- Charging Station Operators
- Commonwealth Agencies
- Higher Education Institutions
- Original Equipment Manufacturers
- Public Transit and Fleet Operators
- Trade Groups
- Utility Companies
- Workforce Development Stakeholders

These interviews aimed to identify:

- Current and future demand for EVs and HFCEVs,
- Current and future demand for workers to support the EV and HFCEV sector,
- Specific skills, training programs, and capacity needed to support the growing EV and HFCEV workforce, and
- Opportunities for collaboration between the EV and HFCEV sector and post-secondary training providers.

Investment and Collaboration Opportunities Methodology

The methodology the authors applied to achieve the output of the Investment and Collaboration Opportunities included several key steps:

1. **Research Investment and Collaboration Opportunities:** Conduct a scan of local, state, federal and national funding opportunities for transit agencies to consider for their workforce development efforts and assess these opportunities with relevant stakeholders that may have funding available
2. **Research Peer State Case Studies:** Conduct a scan of peer states to understand what policies enable collaboration and workforce development efforts related to electric vehicles (EVs), hydrogen fuel cell electric vehicles (HFCEVs), and related charging infrastructure
3. **Summarize Policy Considerations:** List policy considerations including lessons learned, leading practices, and barriers to address sourced from the peer case studies and qualitative interview findings
4. **Synthesize Findings:** Detail all findings within a report

Engagement with Virginia Clean Cities supports the comprehension of the information within. This approach delivers a point in time snapshot into the

investment and collaboration opportunities available to support Commonwealth transit agencies in their workforce development efforts.

Summary and Interview Findings

Inventory of Current Educational Capacity

Virginia has 115 institutions with programs relevant to the Workforce Groups. These institutions are inventoried and categorized based on their program offerings related to EVs, HFCEVs, and related infrastructure.

The institutions marked as 'Yes' have programs specifically related to EVs, HFCEVs, or related infrastructure, indicating a direct alignment with the workforce development needs in these areas. The institutions marked as 'Potential' have programs that, while not currently specific to EVs, HFCEVs or related infrastructure, have the potential to evolve and include relevant curriculum in the future. This categorization identifies both current capabilities and future opportunities for workforce development in the EV, HFCEV, and related infrastructure sectors.

Out of the 115 institutions, 29 (25%) were found to have at least one workforce group program specifically related to EVs, HFCEVs, or related infrastructure (Table 1). Out of a total of 295 workforce group programs, 46 (16%) EV-specific workforce group programs were found across all institutions. Across the six Workforce Groups, 249 (84%) programs were marked as 'Potential.'

Table 1. Workforce Groups Programs

Workforce Groups	Yes		Potential		Total (Yes or Potential)	
	Count	*Percent*	*Count*	*Percent*	*Count*	*Percent*
EV Workforce Development Consortium and Special Programs	13	11%	-	-	13	11%
Manufacturing	2	2%	54	47%	56	49%
Automotive Maintenance and Services	18	16%	24	21%	42	37%
Electrician and Charging Infrastructure	12	10%	55	48%	67	58%
Hydrogen Fuel Cells	1	1%	38	33%	39	34%
Transit and Facility Management	0	0%	78	68%	78	68%
Total Workforce Group Programs	46	16%	249	84%	295	50%
Total Institutions	29	25%	115	100%	115	100%

The geographic distribution of EV-specific programs in Virginia shows significant concentrations in Northern Virginia and Virginia Beach with strong potential for additional capacity in this area due to the clusters of nearby institutions. In contrast, Richmond and Western Virginia have fewer programs, indicating opportunities for

development to meet educational and industry demands, suggesting a strategic focus on expanding EV-specific education in these areas.

The 29 institutions with EV-specific programs include 15 specialized training programs (vocational or specialized training programs, industry-recognized credential programs, youth education programs, apprenticeships, etc.) and 14 traditional academic institutions (community colleges or four-year universities). Of the 104 institutions with 'Potential' programs, the majority are traditional academic institutions, with the rest being specialized training programs. Traditional academic institutions dominate the Manufacturing Workforce Group and are significant in the Automotive Maintenance and Service, Electrician and Charging Infrastructure, Hydrogen Fuel Cells, and Transit and Facility Management Workforce Groups. Overall, traditional academic institutions play a crucial role in EV-specific and 'Potential' programs. This may be attributed to funding available for traditional institutions in Virginia, especially community colleges which received a 40% increase in state and local appropriations between 2019 and 2023[5]. These institutions play an important role in the workforce development landscape and will continue to be key players in Virginia's future EV/HEV educational capacity.

Interview Findings

In-depth interviews were conducted with five educational institutions across Virginia. These discussions revealed several common themes and insights, which have been segmented into three key areas: 1) the current landscape of educational capacity, 2) opportunities and challenges of scaling educational programs, and 3) policy considerations to build educational capacity.

The takeaways described below provide an overview of key themes and highlight shared challenges and potential policies for advancing EV-related education and workforce development in the Commonwealth.

Current Landscape of Educational Capacity

The current landscape of educational capacity in Virginia reveals a substantial demand for skilled workers in the electrical and automotive fields, particularly those with expertise in electric vehicles. Institutions interviewed report a high demand for electrical workers and automotive technicians, driven by the evolving automotive industry and the increasing complexity of vehicle systems. However, in certain regions such as Northern Virginia, this demand is surpassed by the demand for healthcare and IT workers which have been a long-standing focus area of education institutions.

There is strong student interest in EV-related coursework especially among engineering students. However, maintaining student engagement in advanced courses remains a challenge, as many students become employable with lower-level skills and do not pursue further specialization. This is especially true for automotive

5 **https://www.richmondfed.org/region_communities/regional_data_analysis/regional_matters/2024/rm_05_24_24_following_the_money**

technicians and electricians that have ample employment opportunities prior to pursuing additional education related to EVs and related infrastructure.

Opportunities and Challenges of Scaling Educational Programs

A common theme of institutions with programs related to EVs and related infrastructure was partnerships with employers and nonprofits. Partnerships are a key opportunity area for developing and scaling educational programs. For example, Norfolk State University has a partnership with EVHybridNoire to bring the **E-Mobility Fellowship Program** to the campus. This program allows students the ability to obtain an E-Mobility certification upon completion of the program and students will have access to workshops, sessions, and speakers from top industry leaders and companies. It is through partnerships that educational institutions may have access to donated equipment for hands on learning. Partnerships also support the talent development pipelines for employers.

All institutions interviewed acknowledge the need for additional educational capacity related to EV, and related infrastructure. However, several challenges were noted which have curbed progress. Funding and resource constraints are a primary barrier, as institutions struggle to secure the necessary financial support for program expansion and infrastructure development. The high cost of equipment, such as EV chargers and safety gear, further complicates these efforts. Additionally, there is a significant shortage of qualified instructors, making it difficult for institutions to hire and retain educators with the necessary industry experience and certifications. This shortage limits the ability to fully utilize new lab spaces and expand program offerings. Furthermore, the rapid pace of technological advancements in the automotive industry presents a challenge for educational programs to remain current and relevant.

Policy Considerations to Build Educational Capacity

To build educational capacity and address the challenges faced by institutions, several policy efforts were proposed by the institutions interviewed. Streamlining processes for community colleges to acquire new facilities and equipment would enable quicker expansion of training programs. Policies that allow highly qualified technicians, even those without associate degrees, to teach EV-related courses could help mitigate the instructor shortage. Additionally, aligning educational programs with industry-recognized credentials is crucial for ensuring that graduates are well-prepared for the workforce and can qualify for financial aid programs like FastForward[6]. Encouraging partnerships with industry players can enhance program relevance and quality. Supporting registered apprenticeships allows individuals to earn and learn while contributing to the overall capacity of the workforce as they pursue credentials. Establishing state-level guidelines and standards for EV, HFCEV, and related infrastructure training can facilitate the rapid development of programs and ensure consistency across educational institutions. By considering these policy efforts, Virginia can enhance its educational capacity and better prepare its workforce for the demands of the EV, HFCEV, and related infrastructure industry.

[6] **https://fastforwardva.org/**

Employee and Training Demand Analysis

Understanding the current and future need of workers for the deployment of low- and no-emission vehicles is essential for all Virginia transit agencies. The shortage of Automotive Maintenance and Service workers, including bus mechanics, is expected to worsen due to declining new graduates and the need for continuous education on EV technology, creating significant recruitment and retention challenges for transit agencies. Additionally, while there will be sufficient short-term supply of Electricians and Electronics Engineering Technologists for charging infrastructure development, long-term needs will require skilled field engineers with operations and maintenance skills, necessitating strategic workforce development and retention efforts.

This analysis uncovered many key findings and trends, which are sourced in the detailed findings section below, that transit agencies will need to understand as they navigate workforce changes in the future including:

- **Today's shortage of Automotive Maintenance and Service workers including bus mechanics is expected to worsen due to declining rates of new graduates and the need for continuous education on EV technology and safety.** New graduates for these roles are rising much slower than other workers and there are few apprenticeships. This is straining transit agencies and competitor employers that are struggling to recruit and retain these workers. The training demand gap which is the gap between newly credentialed workers and annual openings from separations and retirees is projected to be over 1,700 in 2025 and growing to over 1,800 workers in 2035. Transit agencies must implement retention and career pathway strategies to maintain and upskill incumbent workers. Partnerships with local training providers and shared worker agreements with other local fleet operators can support an adequate future supply of workers.

- **Plant Maintenance workers are estimated to have high future employee demand which will increase competition for workers due to the high training gap.** Employment is projected to rise another 7% for these workers from 2022 to 2032. Meanwhile, the training demand gap in 2025 is estimated at over 4,000 workers and this gap will prevail in 2035 unless intervention increases the supply of newly credentialed workers. The rise of alternative fuel types including battery electric and hydrogen will increase the complexity and technical knowledge required for these roles at transit agencies. Additionally, other roles such as supply managers and fuel procurement managers will need to understand how their job functions translate to a low- and no-emission fleet.

- **Vehicle Operations and Vehicle Operations Support workers are estimated to have high annual openings from turnover and retirements which will result in recruitment difficulties due to the high training gap.** The supply of

newly credentialed workers for these roles is much lower than the projected employee demand from annual openings for both of these roles. Vehicle Operations workers have an increase in employment opportunities with the rise of work as delivery drivers for companies like Amazon, FedEx, and UPS. Dedicated workforce development efforts must be established surrounding recruiting and retaining these workers as well as establishing long-term workforce pipelines.

- **Facilities Managers and Training and Development Specialists are estimated to have an oversupply of workers and transit agencies should prioritize cultivating these workers' skills relating to EVs, HFCEVs, and related charging infrastructure.** Both of these occupations are expected to have positive growth from 2022 to 2023, at 4% and 7%, respectively. However, these two occupations require unique skills to support a transit agency with their deployment of low- and no-emission vehicles. Therefore, efforts to cultivate a workforce with that specific technical knowledge is vital for transit agencies to participate in.

- **Transit agencies can expect a sufficient number of Electrician and Electronics Engineering Technologists and Technicians for their charging infrastructure needs in the short-term and workers with operations and maintenance skills will be essential for the long-term.** Electrician and Electronics Engineering Technologists and Technicians is projected to grow 9% from 2022 to 2032 with sufficient supply of newly credentialed workers to meet this demand. Beyond this time period, the employee demand associated with charging infrastructure is operations and maintenance work which is typically completed by a field engineer with a combination of electro-mechanical, software, troubleshooting, and diagnostics skills. Transit agencies must be aware of the long-term workforce needs associated with charging infrastructure and plan accordingly.

Interview Findings

Nearly 20 stakeholders shared their perspectives relating to EVs, HFCEVs, related charging infrastructure and workforce development. Their perspectives shed light on current and future employee and training demand in the Commonwealth as well as considerations for addressing current and future workforce shortages.

Growing Demand for EVs, and HFCEVs among Transit Agencies:
Transit agencies are increasingly adopting EVs and HFCEVs, with Northern Virginia and Blacksburg leading in adoption through successful pilot programs and initiatives. Charlottesville and other regions are conducting studies to explore the deployment of low- and no-emission vehicles to meet local environmental goals or in partnership with utility providers. Interviewees stated that over the next five years, demand for low- and no-emission vehicles will remain consistent. Beyond 2030, interviewees projected that demand for EVs, HFCEVs, and relating charging infrastructure will ramp up as the technology advances and costs decrease.

However, the growth of EVs, HFCEVs, and related charging infrastructure among transit agencies have several key dependencies including:

- Infrastructure needs for EVs, HFCEVs, and related charging infrastructure. A robust electric grid and utility investment in infrastructure is required to support the increased need for EV charging and ensure a reliable and efficient energy supply, especially during peak demand periods. There are a number of competing priorities for the microgrid especially in Northern Virginia where data centers are being developed.
- An expanded network of charging stations to accommodate the rising number of EVs. This is a present-day obstacle for transit agencies as the range for EVs are less than vehicles with a diesel or hybrid engine. Developing fast-charging networks that are strategically placed along routes can significantly reduce downtime for transit vehicles, ensuring operational efficiency.
- Access to adequately trained workers to maintain EVs, HFCEVs, and related charging infrastructure. Workforce development has not been a primary focus area of transit agencies up until this point.
- Policy incentives, including federal and state grants, subsidies, and tax incentives. These incentives are crucial in reducing financial burdens on transit agencies and accelerating the transition to sustainable transportation solutions.
- The availability of affordable vehicles on the Commonwealth procurement contract or meet Buy America standards with advanced technology to accommodate transit agencies' needs.

Several transit agencies are exploring the opportunities that hydrogen technology can provide, and several have recently completed out of state site visits to transit agencies that are deploying HFCEVs. One transit agency is deploying several EVs alongside HFCEVs to analyze outcomes on operations and the workforce. Hydrogen technology can address the range constraints that EVs have as their energy generation and storage capacity is much higher. However, Virginia must explore the viability of local hydrogen production and distributions to support transit agencies with the deployment of HFCEVs. Additionally, Virginia lacks workers with technical capabilities to support local hydrogen technology outside of the maritime industry (e.g., pipefitters). Workforce pipelines will need to be developed to support the growth of hydrogen technology.

Current and Future Employee Demand:
Currently, transit agencies face considerable challenges in recruiting and retaining qualified mechanics and drivers. The specialized nature of the work, which requires expertise in new technologies such as electric drivetrains, makes it difficult to find candidates with the necessary skills and experience. This is especially true as diesel mechanics already have high employee demand and training for EV maintenance is an advanced-level automotive technology course. Additionally, the existing workforce is aging, leading to a potential shortage of experienced workers as current employees retire.

Compounding these issues is the competition from other industries for young graduates and skilled workers. Many young professionals are drawn to sectors

perceived as more dynamic or lucrative, making it harder for transit agencies to attract new talent. Transit agencies are competing with many employers from HVAC to Amazon warehouses for newly credentialed workers. This competition exacerbates the recruitment challenges and highlights the need for targeted strategies to attract and retain skilled workers for transit agencies.

The growth of EVs, and related charging infrastructure is driving new employee demand in the Commonwealth. Specifically for transit agencies, this employee demand encompasses various roles, particularly mechanics specialized in EV maintenance including electrical systems, battery management, and high voltage systems, and drivers trained to operate these advanced vehicles. However, it is important to note that the deployment of low- and no-emission vehicles does not necessitate new workers, and rather, an upskilling and reskilling of existing workers on the necessary skills. Transit agencies can focus their efforts on retaining their workforce, implementing a skill development plan, and recruiting new workers as needed. For example, in the future, a fleet and facility manager may need to understand multiple technologies such as EV and HFCEV to effectively manage the operations and routes of fleets with different fuel types.

There are several future employee demand disruptors that transit agencies need to be aware of including:

- The implementation of HFCEVs will result in new net workforce needs for transit agencies. Virginia Energy can be a resource into the workers needed for this fuel type as the agency is presently working on a Hydrogen Roadmap for the Commonwealth.
- As warranties for EV and related charging infrastructure near their end date, transit agencies will need to be prepared to address maintenance needs. These workers must be skilled in troubleshooting, diagnostics, electro-mechanics, and software.

Preparing for future employee demand is essential for the successful adoption and integration of low- and no-emission vehicles by transit agencies.

Current and Future Training Demand:
The deployment of EVs, HFCEVs, and related charging infrastructure by transit agencies necessitates a workforce with specialized skills and training. Automotive technology requires both initial training and continuing education. Mechanics must first have a strong foundation in vehicles and must be proficient in maintaining and repairing electric drivetrains and diagnostics for battery management systems. Mechanics also need to be well-versed in safety protocols specific to handling high-voltage systems and hydrogen storage, ensuring the safe and efficient operation of these vehicles. Soft skills like troubleshooting are essential competencies along with technical skills including the use of diagnostic tools, and software fixes.

Presently, training related to charging infrastructure has primarily focused on upskilling electricians with the necessary skills for charging infrastructure installation. What is increasingly in-demand in Virginia is a network of field technicians that can diagnose issues with charging infrastructure that may be an

electro-mechanical or software issue. Training on charging infrastructure maintenance offered through training institutions are under-developed in the Commonwealth due to the high number of charging manufacturers and varying technology. Furthermore, reliability-centered maintenance principles are increasingly in-demand and a separate discipline from current electrician training.

To prepare for future training needs, transit agencies need to consider the following:

- Leveraging local training institutions and the expertise of OEM training materials to train workers.
- Accessing the latest tools and safety equipment, including diagnostic tools, and high-voltage safety gear, to provide effective training.
- Cultivating a culture of continuous learning and development given the rapid advancements in EV, HFCEV, and relating charging infrastructure technology. Training programs need to be regularly updated to incorporate new technologies and leading practices so that the workforce remains current with new developments.

Potential Solutions to Address Employee and Training Demand:
Several potential solutions were provided by interviewees for transit agencies to consider to address current and future employee and training demand including:

- **Collaborating with private industry, and post-secondary training providers to address employee and training challenges.** By leveraging resources and expertise from both sectors, these partnerships can create comprehensive training programs and facilities. For example, employers such as manufacturers and dealerships are already developing specialized training programs tailored to their specific vehicles and providing hands-on and practical training to mechanics and drivers. Partnerships with dealerships can allow for shadow opportunities for mechanics upskilling to work with EVs. A partnership between employers with a training institution in the form of a training center can address both training demand needs and the development of a workforce pipeline for employers. Such partnerships may include initiatives like funding for training programs, developing standardized curricula, and securing necessary tools and safety equipment. This collaborative approach can advance workforce preparedness for the deployment of low- and no-emission vehicles.

- **Establishing workforce development plans to maintain and grow critical workers.** Offering incentives such as advanced step wages for mechanics specializing in EVs can attract and retain talent. Establishing career pathways and rewarding workers for acquiring specialized skills from continuous learning can also boost employee retention. Cultivating a culture of continuously learning can support the receptivity of the workforce-to-workforce development opportunities.
- **Sharing critical workers across local partners.** Partnerships with other operators of low- and no-emission fleets such as local governments and colleges or universities to share mechanics can address employee demand needs and increase access to skilled workers.

- **Hosting an apprenticeship program to create a pipeline of skilled workers.** Apprenticeship opportunities at transit agencies can help train mechanics effectively. State-funded apprenticeship programs offer a blend of classroom instruction and on-the-job training, giving workers the practical experience they need. This can be done in partnership with post-secondary institutions such as a trade and vocational school.

- **Supporting the establishment of standardized training curriculum.** Transit agencies can engage in partnerships with training providers to develop training centers and co-create curriculum, addressing some of the constraints to establish new training programs. As equipment gets more standardized such as charging infrastructure, Virginia can create standardized training programs. To set up a new training program, community colleges in Virginia can receive funding from the Virginia Community College System after a clear demand signal has been established that demonstrates sufficient student enrollment to sustain and profit from the class. Additionally, community colleges need to forecast training demand over the next several years. On the other hand, private for-profit institutions like ECPI or Centura College can assemble training programs more quickly than public community colleges. The Transit Workforce Center also provides resources for transit agencies seeking support with training development.

- **Cultivating early career awareness to create a sustainable long-term workforce pipeline.** Pre-apprenticeships and early career awareness programs can support generating student interest in EV, HFCEV, and related charging infrastructure careers at transit agencies. For example, northern Virginia successfully implemented a mobile lab for middle and high school students to learn about life and health sciences. This mobile lab also serves as a state-of-the-art training facility. It was developed in a public-private partnership between George Washington University and Governor's Academy. The benefit is that it brought training on costly advanced technology to students throughout the region.

- **Participating in local workforce development initiatives.** The Virginia Tech Transportation Institute's Dock to Door Coalition, which was formed 2.5 years ago by a National Science Foundation grant, includes 85 organizations that are working to improve supply chain efficiency, effectiveness, and sustainability. The coalition focuses on four programmatic areas: federated data sharing platform, automated and connected vehicles, carbon-neutral and sustainable freight, and workforce development and community engagement. The workforce development and community engagement area is focusing on electric vehicles and starting with a small pilot area to inventory existing programs and foster collaboration among partners. More information can be found at this link: **https://www.docktodoor.vtti.vt.edu/programs/workforce-development/**.

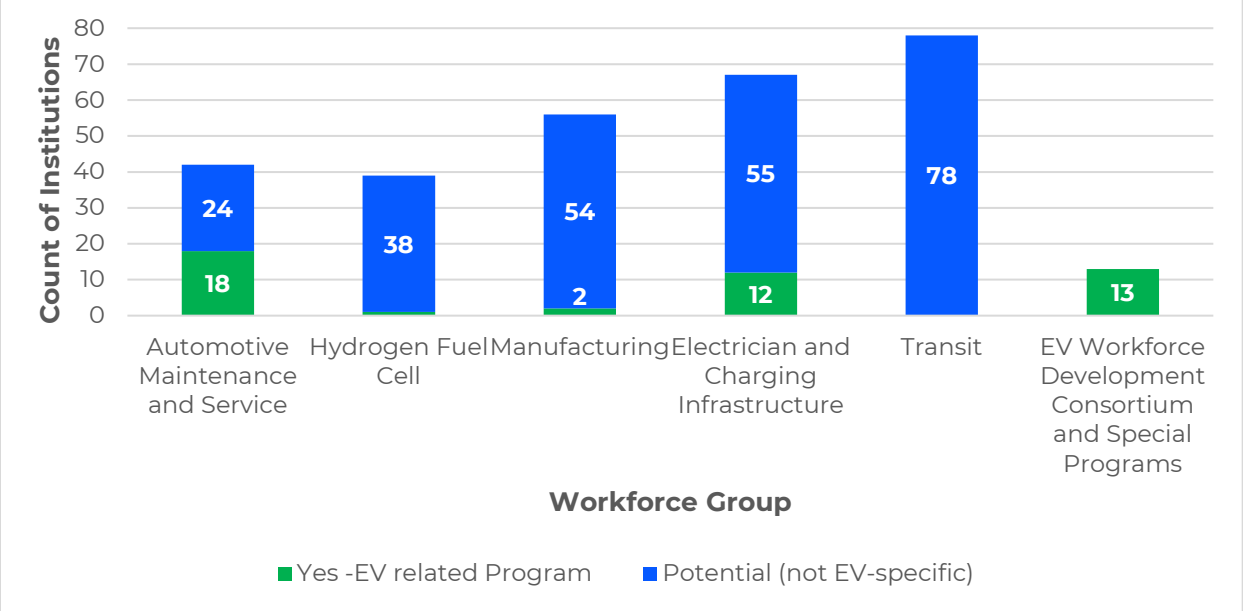
Detailed Findings

Inventory of Current Educational Capacity

Workforce Groups

This section provides a comprehensive overview of Virginia's Inventory of institutions and programs with educational capacity relating to the six Workforce Groups. Institutions are categorized based on 'Yes-EV Related Program' or 'Potential (Not EV-Specific)' for each of the Workforce Groups. Figure 1 visually represents the distribution of institutions in the Inventory across the Workforce Groups, illustrating the current landscape and potential growth areas for EV/HEV educational capacity.

Figure 1. Distribution of Institutions Across the Workforce Groups



Additional details on these programs can be found in the Appendix Inventory Table **here**.

EV Workforce Development Consortium and Special Programs
Thirteen institutions were classified as EV Workforce Development Consortium or Special Programs.

Examples of out-of-state institutions include:

- Electric Vehicle Infrastructure Training Program (EVITP), which provides training and certification for electricians and contractors to install and maintain EV charging infrastructure
- SkillFusion, which is an online program to certify electric vehicle supply equipment (EVSE) workers

In-state institution examples include:

- National Institute for Automotive Service Excellence (ASE), which offers certification programs for automotive technicians, including those specializing in hybrid and electric vehicles
- Edtunity, which is public vocational education facility offering free courses for veterans on Electric Vehicle Technician Operations & Maintenance

Manufacturing
Two institutions were found with EV-specific manufacturing programs and 54 (47%) were identified as 'Potential.'

Examples of institutions with EV-specific manufacturing programs include:

- SAE Incorporated, which offers courses on Hybrid and EV Engineering
- Virginia Polytechnic Institute and State University, which is working with GM to design advanced EV vehicles and build workforce pipelines

Automotive Maintenance and Services
Eighteen institutions (16%) were found with EV-specific automotive maintenance and services programs and 24 (21%) were marked as 'Potential.'

Examples of EV-specific programs include:

- Advanced Technology Institute, which has programs in Automotive Technology (including Hybrid Engines), Diesel Mechanic Training, and education partnerships with Audi, GM, and Ford
- Northern Virginia Community College (NOVA), which has programs in Automotive Technology, including an Electric, Hybrid, and Autonomous Vehicles Career Studies Certificate and a Hybrid EV Technology course
- Reynolds Community College, with programs in Hybrid Electric Vehicle Technology
- Southwest Virginia Community College, which is launching an EV safety course in Fall 2025

Electrician and Charging Infrastructure
Twelve institutions (10%) were found with EV-specific electrician and charging infrastructure programs and 55 institutions (48%) were marked as 'Potential.'

EV-specific workforce group program examples include:

- DeVry University-Virginia, which has an Engineering Technology Program with a specialization in Renewable Energy and Sustainable Power
- Electric Cooperative Training Center in Palmyra, VA which provides safety, training and education services supporting rural electric cooperative members and staff through safety, training and education opportunities including electric vehicle charging

Hydrogen Fuel Cells
Only one institution was found with an EV-specific hydrogen fuel cells training program (SAE Incorporated), however, 38 (33%) were marked as 'Potential.'

Examples of institutions marked with 'Potential' for hydrogen fuel cells training include:

- Hampton University, which has programs in Chemistry and Chemical Engineering
- University of Virginia-Main Campus, which has programs in Chemistry and Chemical Engineering
- Virginia Polytechnic Institute and State University, which has programs in Chemistry and Chemical Engineering

Transit Facility Management

No institutions were found with EV-specific transit training programs; however, 78 institutions (68%) were marked as 'Potential.'

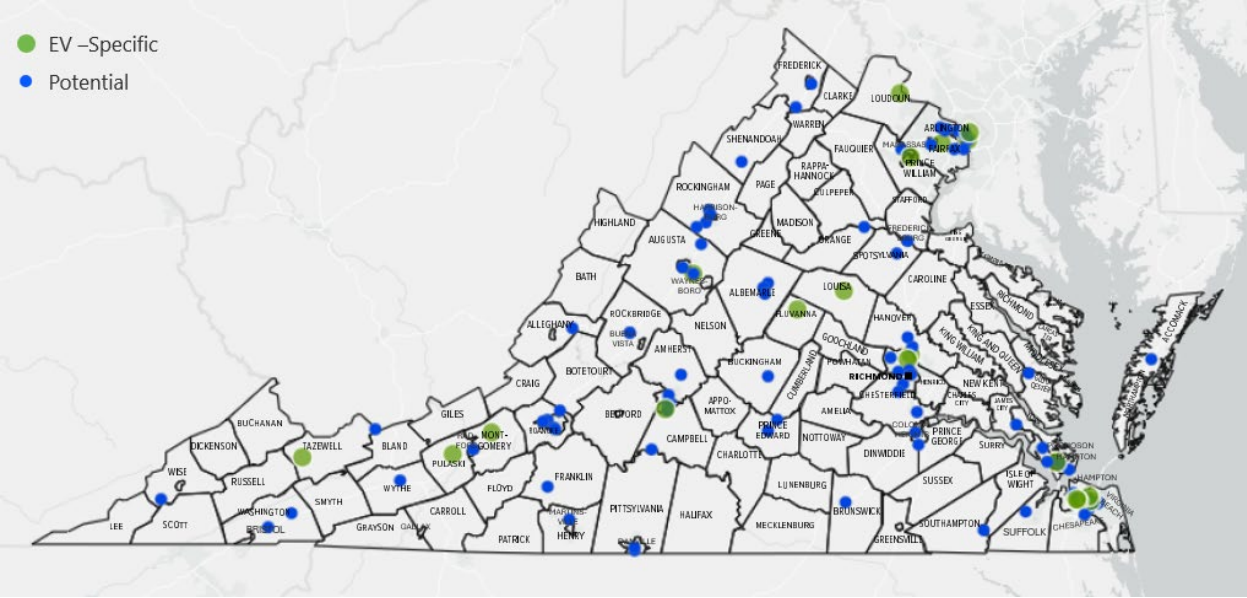
Examples of institutions marked with 'Potential' for Transit and Facility Management training include:

- Virginia Commonwealth University, which has programs in Business, Education, Human Resources Management, Public Policy, Public Administration, and Urban Planning
- Regent University, which has programs in Business Administration, Education, Management, Organizational Leadership, Public Administration and Public Policy, Human Resources Management, and Non-Profit, Public, and Organizational Management

Geographic Distribution of Programs

The geographic distribution of institutions with EV-specific programs and 'Potential' programs across Virginia reveals significant regional concentrations and areas for potential development. Northern Virginia and the coastal regions of Virginia Beach emerge as primary hubs for existing EV-specific programs. These regions also show a strong potential for further expansion, supported by a cluster of institutions in nearby counties. The concentration of programs in these regions underscores their importance in the current and future landscape of EV-specific education. Conversely, Western Virginia presents a sparser distribution of EV-specific programs, indicating a clear opportunity for development and expansion of EV-specific educational initiatives in this underserved region to meet educational and industry demands.

Figure 2. Geographic Distribution of Programs



Geographic Distribution of Programs Details

Several institutions with EV-related programs are concentrated in the Northern Virginia region, which correlates to the high EV adoption in this region[7]. The counties of Fairfax, Prince William, and Loudoun have institutions like Northern Virginia Community College, National Energy Education Development Program, and National Institute for Automotive Service Excellence (ASE) that offer EV-specific programs.

Similarly, there is a noticeable cluster of institutions around the Richmond area in Central Virginia. Henrico County has Reynolds Community College, which has an EV-specific Automotive Maintenance and Service program, and there are several institutions with 'Potential' programs in the Richmond area.
The coastal region of Hampton Roads has several institutions with 'Potential' programs, and Virginia Peninsula Community College, which has an EV-specific Automotive Maintenance and Service program. Norfolk County and Virginia Beach are home to Tidewater Community College, Virginia Wesleyan University, Norfolk State University, and Advanced Technology Institute which all have EV-specific programs.

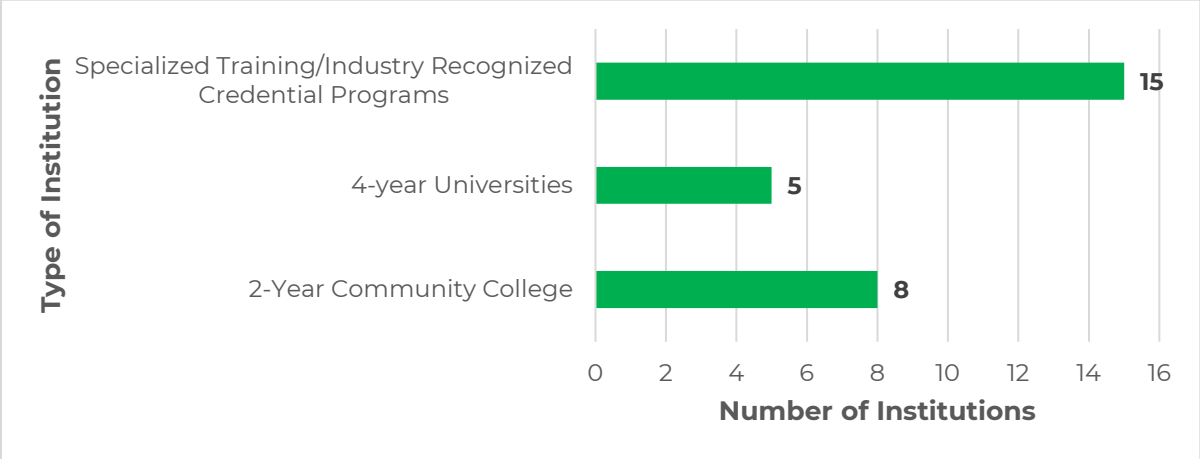
Western Virginia has a sparser distribution, with a few institutions scattered across this area. Southwest Virginia Community College and New River Community College are located in Tazwell County and Pulaski County, respectively, and offer EV-specific Automotive Maintenance and Service programs. Roanoke County has a cluster of institutions, including Virginia Western Community College and Roanoke College, that have 'Potential' programs.

[7] **https://vtrc.virginia.gov/reports/all-reports/25-r12/**

Institution Types

Most of the institutions are categorized based on type by NCES with a few additional types included to enhance the analysis and further segment the institutions[8]. The distribution of workforce group programs across traditional academic and specialized institutions were analyzed based on the institution types. Traditional academic institutions can be defined as four-year public and private universities or two-year community colleges. Specialized institutions can be defined as those including vocational or specialized training programs, industry-recognized credential programs, youth education programs, apprenticeships, and public vocational programs that provide targeted education and skills development tailored to specific industries or professions.

Figure 1: Types of Institutions with EV-Specific Programs



Institution Type Details

Of the 29 institutions that have EV-specific programs, 15 (52%) are vocational or specialized training institutions, including 12 specialized training/industry recognized credential programs, one youth education program, and two public vocational centers. The remaining 13 (45%) are traditional academic institutions. Of these 13 traditional academic institutions, five are four-year universities and eight are two-year community colleges.

Of the 104 institutions with 'Potential' programs, 78 (75%) are traditional academic institutions, including 26 (25%) two-year community colleges and 52 (50%) four-year universities. Twenty-six of the 104 institutions (22%) are vocational or specialized training institutions, including four private trade and technical schools, one community college, seven career and technical education programs, three industry recognized credential programs, two public vocational-educational facilities, two employer-sponsored programs, and seven registered apprenticeships.

[8] Institution types determined by the project team includes Registered Apprenticeship, Employer-Sponsored Program, Industry recognized credential, Youth Education Program, Career and Technical Education, and Public vocational-educational facility.

Regarding the Workforce Groups:

- Traditional academic institutions comprise a significant portion of institutions with programs that align to the Manufacturing Workforce Group with 41 (73%) programs, while specialized institutions contribute 15 (27%) programs.

- The Automotive Maintenance and Service Workforce Group's 18 EV-specific programs consist of 10 traditional academic institutions and eight specialized training programs. Additionally, of the 24 Automotive Maintenance and Service workforce group programs marked as 'potential', traditional academic institutions account for 12 (50%) and specialized institutions for 12 (50%).

- The 12 EV-specific Electrician and Charging Infrastructure Workforce Group programs consist of three (25%) traditional academic institutions and nine (75%) specialized training programs. There are 55 institutions with Electric and Charging Infrastructure Workforce Group programs marked as 'potential,' with traditional academic institutions contributing 39 (71%) and specialized institutions 16 (29%).

- For the Hydrogen Fuel Cells Workforce Group, traditional academic institutions are the majority provider of these programs with 38 'Potential' programs. The sole EV-Specific Hydrogen Fuel Cells program is a specialized training program.

- Similarly, the Transit Workforce Group consists of 78 'Potential' programs, 75 (96%) of which are traditional academic institutions.

All the EV Workforce Development Consortium and Special Programs are specialized programs.

Overall, the analysis of training programs across various institutions reveals that traditional academic institutions play a leading role in offering both EV-specific and 'Potential' programs. Traditional academic institutions, including four-year universities and two-year community colleges, play a crucial role, particularly in Manufacturing, Automotive Maintenance and Service, and the Transit Workforce Groups. Despite the significant contribution of specialized training institutions, traditional academic institutions remain the primary providers, especially in areas like Hydrogen Fuel Cells training and Electrician and Charging Infrastructure programs.

Employee and Training Demand Analysis

This section contains detailed findings on the following analyses which can be used to understand trends in the Workforce Groups and Occupations that are relevant to a transit agency's deployment of EVs, HFCEVs, and related charging infrastructure:

1. **Workforce Supply:** Tabulates the historical completion of workers trained for EV, HFCEV, and related charging infrastructure occupations for forecasting
2. **Employee Demand:** Estimates the number of anticipated job opportunities for select occupations based on historical job growth and scenarios

3. **Training Demand:** Estimates the gap or surplus between the forecasted workforce supply and employee demand which reflects unmet or misaligned training demand and future needs
4. **Regional Analysis:** Identifies counties across Virginia with high and low preparedness for training demand based upon 2023 completions

These trends can support the case for addressing the current and future gaps in training demand and the imperative for workforce planning and long-term workforce pipeline development.

Workforce Supply

The workforce supply analysis focused on two academic pathways: post-secondary completions and state registered apprenticeship completions relating to the Workforce Groups and Occupations. Focusing on these two academic pathways captured the most common ways individuals are prepared for a career. More information on these programs can be found within the **Appendix**. Another pathway to a career can be Career Technical Education which helps high school students acquire challenging academic and technical skills and be prepared for high-skill, high-wage, and in-demand occupations. As the workforce supply analysis focused on post-secondary academic pathways, CTE completions were not included. More information about Virginia CTE completions can be found in the **Appendix**.

Historical workforce supply figures were forecasted to the years 2025 and 2035 and can be found in the **Training Demand** section.

Post-Secondary Completions

This section includes a comprehensive review of the post-secondary completions (also known as education after high school) from all higher education institutions in Virginia offering programs related to each targeted Workforce Group as seen in the **Appendix**. Historical completions data from Virginia institutions were sourced from the **Integrated Postsecondary Education Data System** (IPEDS) for the years 2013 to 2023 (Table 2). The data are segmented by Occupation within each Workforce Group, highlighting trends and changes over the years. This data can be used to understand the historical pipeline of newly credentialed workers trained for roles relating to EVs, HFCEVs, and related charging infrastructure.

Table 2. Virginia Completions by Workforce Group and Occupation (2013 to 2023)

Workforce Group & Occupation	2013	2014	2015	2016	2017	2018	2019	2020	2021[9]	2022	2023
Automotive Maintenance and Service											
Automotive, Bus and Truck Technicians and Mechanics	687	859	748	724	735	684	763	691	467	718	768

[9] In 2021 completion rates for certain Occupations may have been impacted more than others by the COVID-19 pandemic.

Workforce Group & Occupation	2013	2014	2015	2016	2017	2018	2019	2020	2021[9]	2022	2023
Automotive Maintenance and Service Total	**687**	**859**	**748**	**724**	**735**	**684**	**763**	**691**	**467**	**718**	**768**
Hydrogen Fuel Cell											
Chemical Engineer	221	219	218	207	209	208	237	246	238	202	223
Chemists	699	685	721	693	748	662	670	644	691	657	637
Hydrogen Fuel Cell Total	**920**	**904**	**939**	**900**	**957**	**870**	**907**	**890**	**929**	**859**	**860**
Electrician and Charging Infrastructure											
Electrical and Electronics Engineering Technologists and Technicians	1,026	1,019	979	1,051	1,073	1,161	1,301	1,307	1,348	1,486	1,535
Electrical Engineers	484	520	537	518	576	639	623	554	604	502	485
Electricians	205	215	227	223	221	248	309	293	284	426	394
Plant Maintenance	86	117	89	104	106	123	126	100	117	98	104
Electrician and Charging Infrastructure Total	**1,801**	**1,871**	**1,832**	**1,896**	**1,976**	**2,171**	**2,359**	**2,254**	**2,353**	**2,512**	**2,518**
Manufacturing											
Industrial Engineering Technologists and Technicians	381	341	339	310	408	328	379	363	390	383	435
Mechanical Engineers	1,013	1,039	1,136	1,166	1,284	1,300	1,282	1,292	1,209	1,136	1,173
Welding Technologists and Technicians	496	565	687	789	738	704	780	668	812	910	995
Manufacturing Total	**1,890**	**1,945**	**2,162**	**2,265**	**2,430**	**2,332**	**2,441**	**2,323**	**2,411**	**2,429**	**2,603**
Transit and Facility Management											
Facilities Managers	10,019	11,273	11,508	12,260	12,196	12,101	12,046	11,716	11,947	12,105	12,365
Training and Development Specialists	2,964	3,456	3,612	3,621	3,629	3,476	3,525	3,816	4,115	4,452	4,671

Workforce Group & Occupation	2013	2014	2015	2016	2017	2018	2019	2020	2021[9]	2022	2023
Transportation Planners	831	1,059	973	1,008	1,015	1,070	1,022	1,051	1,137	1,186	1,201
Vehicle Operations	440	422	415	373	325	283	148	109	153	184	240
Vehicle Operations Support[10]	569	502	539	493	366	325	265	237	247	231	209
Transit and Facility Management Total	**14,823**	**16,712**	**17,047**	**17,755**	**17,531**	**17,255**	**17,006**	**16,929**	**17,599**	**18,158**	**18,686**
Workforce Groups Grand Total	**20,121**	**22,291**	**22,728**	**23,540**	**23,629**	**23,312**	**23,476**	**23,087**	**23,759**	**24,676**	**25,435**
All Virginia Completions	**126,154**	**128,149**	**130,289**	**135,895**	**134,599**	**135,142**	**138,226**	**138,489**	**143,733**	**145,182**	**142,971**

Source: IPEDS Data Center

Automotive Maintenance and Service

- The total number of Automotive, Bus, and Truck Technicians and Mechanics completions fluctuated over the years, starting at 687 in 2013, peaking at 859 in 2014, and then experiencing a decline during the years of the COVID-19 pandemic (2020-2021) and subsequent rise to 768 in 2023.

Hydrogen Fuel Cell

- The number of Chemical Engineers remained stable, with minor fluctuations, starting at 221 in 2013 and ending at 223 in 2023.
- There was a slight decline in the number of Chemists from 699 in 2013 to 637 in 2023, with some variations in between.
- The total completions aligned to the Hydrogen Fuel Cell Occupations varied between 957 in 2017 and 859 in 2022, ending at 860 in 2023.

Electrician and Charging Infrastructure

- Electrical and Electronics Engineering Technologists and Technicians saw a steady 51% increase from 1,026 in 2013 to 1,535 in 2023.
- The number of Electrical Engineers varied, starting at 484 in 2013, peaking at 639 in 2018, and then decreasing to 485 in 2023.
- There was a notable increase in Electricians from 205 in 2013 to 394 in 2023.
- The number of Plant Maintenance completions showed minor fluctuations, starting at 86 in 2013 and ending at 104 in 2023.
- The total number of completions aligned to the Electrician and Charging Infrastructure Occupations increased steadily from 1,801 in 2013 to 2,518 in 2023.

[10] Completions for Vehicle Operations Support workers does include CDLs attained through two- and four-year institutions that report to NCES and does not reflect all pathways to a CDL.

Manufacturing

- The number of Industrial Engineering Technologists and Technicians varied, starting at 381 in 2013, dipping in the middle years, and rising to 435 in 2023.
- There was a general upward trend in Mechanical Engineers from 1,013 in 2013 to 1,173 in 2023.
- The number of Welding Technologists and Technicians increased significantly from 496 in 2013 to 995 in 2023.
- The total number of completions aligned to the Manufacturing Occupations overall showed steady 38% growth from 1,890 in 2013 to 2,603 in 2023.

Transit and Facility Management

- Facilities Managers consistently had the highest numbers, starting at 10,019 in 2013 and increasing to 12,365 in 2023[11].
- There was a steady 35% increase in Training and Development Specialists from 2,964 in 2013 to 4,671 in 2023.
- The number of Transportation Planners showed an upward trend from 831 in 2013 to 1,201 in 2023.
- There was a significant decline in Vehicle Operations completions from 440 in 2013 to 240 in 2023.
- The number of Vehicle Operations Support completions decreased from 569 in 2013 to 209 in 2023.
- The total completions aligned to the Transit and Facility Management occupations were consistently high, ranging from 14,823 in 2013 to 18,686 in 2023.

Completions for the Workforce Groups grew by 26% from 2013 to 2023 (increasing from 20,121 to 25,435 graduates) while the overall completion rates in Virginia increased by only 13% during the same period. Given those growth rates, the Workforce Groups became a larger portion of the overall completions in the Commonwealth during that time period, growing from 16% in 2013 to 18% in 2023. While both totals show a general upward trend, All Virginia Completions exhibit some fluctuations, whereas Workforce Group completions demonstrate a more consistent year-on-year increase.

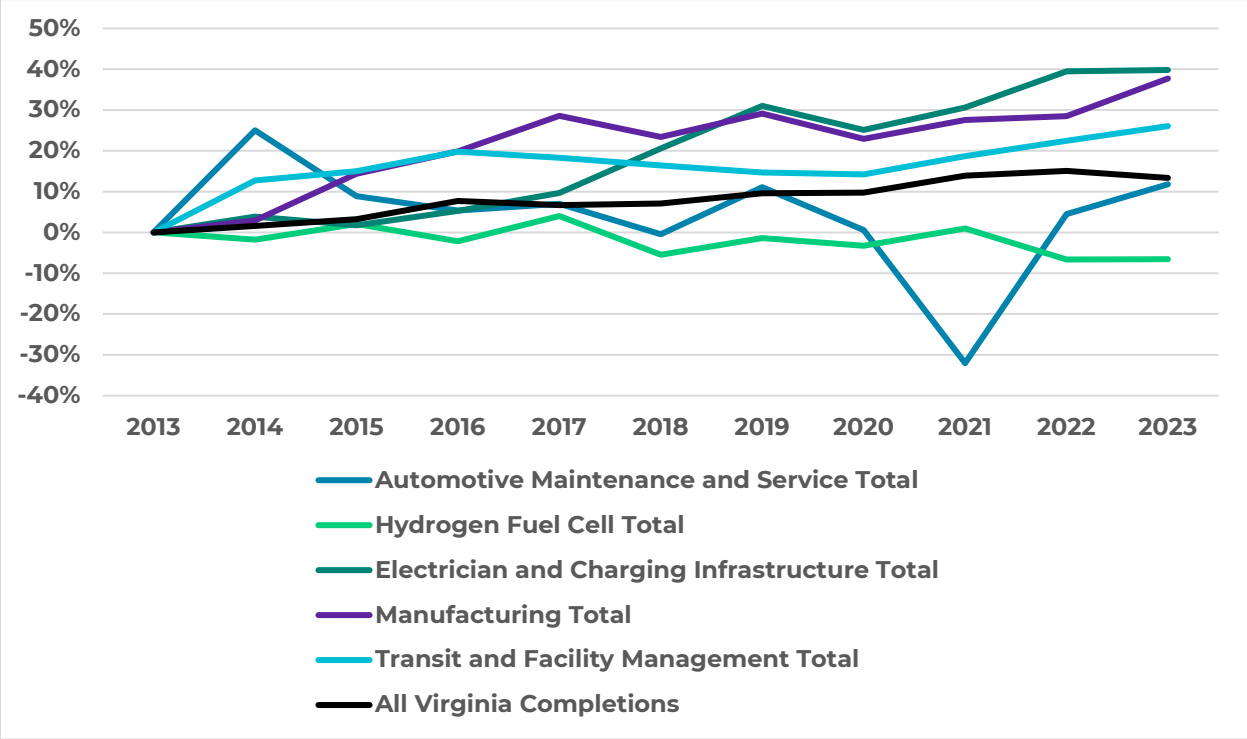
Figure 4 visually represents the cumulative completions growth of each Workforce Group over the 10-year period from 2013 to 2023 represented in Table 1, highlighting several key trends:

- Automotive Maintenance and Service completions are more variable, with notable fluctuations over the years, peaking at 32% from 2013 to 2021 and then settling at 12% growth from 2013 to 2023.
- Hydrogen Fuel Cell completions have the least growth, increasing to 7%.
- Completions for the Electrician and Charging Infrastructure workers exhibit the most significant growth, reaching 40%.
- Completions for the Manufacturing workers demonstrates substantial growth, with completions increasing to 38%.

[11] The substantial number of completions can be contributed to completions relating to Business Administration.

- Completions for the Transit and Facility Management workers have steady growth, reaching 26%.
- All Virginia completions increase gradually to 13%, and notably, the completions for all but two Workforce Groups(Automotive and Maintenance and Hydrogen Fuel Cell) outpace the overall growth of all completions in Virginia.

Figure 4: Cumulative Completions Growth Rate by Workforce Group by Year (2013 to Year)



Apprenticeships

In addition to post-secondary completions, the analysis includes historical data on completer apprentices from 2015 to 2024 sourced from **Apprenticeships.gov** (Table 3). Overall, there is a positive growth trend across the Workforce Groups and Occupations with a notable expansion of Electrician and Charging Infrastructure, and Manufacturing apprenticeships in 2020. Apprenticeships have been growing at a steady pace all across the United States as they are a recognized way for students to build valuable skills, address barriers of rising education costs, and also enter a clear pathway into work opportunities at the end of their training[12].

[12] **https://www.forbes.com/sites/adigaskell/2023/04/13/research-reveals-that-apprenticeships-offer-a-bright-future-to-participants/**

Table 3: Virginia Completer Apprentices by Workforce Group and Occupation (2015 to 2024)[13]

Workforce Group & Occupation	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Automotive Maintenance and Service										
Automotive, Bus and Truck Technicians and Mechanics	-	4	-	-	1	1	4	2	-	3
Automotive Maintenance and Service Total	**-**	**4**	**-**	**-**	**1**	**1**	**4**	**2**	**-**	**3**
Electrician and Charging Infrastructure										
Electrical and Electronics Engineering Technologists and Technicians	2	7	-	-	-	26	34	47	50	51
Electricians	6	10	2	4	12	255	382	420	432	364
Plant Maintenance	2	5	-	-	-	69	111	94	190	82
Electrician and Charging Infrastructure Total	**10**	**22**	**2**	**4**	**12**	**350**	**527**	**561**	**672**	**497**
Manufacturing										
Industrial Engineering Technologists and Technicians	16	25	1	2	1	139	97	69	77	78
Mechanical Engineers	-	-	-	-	-	6	5	10	5	6
Welding Technologists and Technicians	2	17	1	-	-	64	82	71	59	50
Manufacturing Total	**18**	**42**	**2**	**2**	**1**	**209**	**184**	**150**	**141**	**134**
Transit and Facility Management										
Training and Development Specialists	-	-	-	-	-	8	11	12	11	8
Vehicle Operations	-	-	-	-	-	2	1	16	13	1
Transit and Facility Management Total	**-**	**-**	**-**	**-**	**-**	**10**	**12**	**28**	**24**	**9**
Workforce Groups Grand Total	**28**	**68**	**4**	**6**	**14**	**570**	**727**	**741**	**837**	**643**
All Virginia Completer Apprentices	**126**	**759**	**33**	**711**	**148**	**1,223**	**1,719**	**1,990**	**2,129**	**2,329**

Source: U.S. Department of Labor ApprenticeshipUSA

Automotive Maintenance and Service

- The total number of Automotive, Bus, and Truck Technicians and Mechanics completer apprentices was consistently low, with four in 2016, dipping to one in 2020 and 2021, and then up to three in 2024.

[13] There were no apprentice completers for the Hydrogen Fuel Cell Workforce Group including Chemical Engineers and Chemists, Electrical Engineers, Facilities Managers, Transportation Planners, or Vehicle Operations Support during the period of time analyzed.

Electrician and Charging Infrastructure

- Electrical and Electronics Engineering Technologists and Technicians completer apprentices saw a significant increase, starting with two completers in 2015 and rising to 51 in 2024.
- The number of Electricians completer apprentices varied, with a notable increase from six in 2015 to 364 in 2024, peaking at 432 in 2023.
- The number of Plant Maintenance completer apprentices showed growth, starting with only two completers in 2015 and reaching 190 in 2023, with a decline to 82 in 2024.
- The total number of completer apprentices for the Electrician and Charging Infrastructure Occupations increased significantly from 10 in 2015 to 672 in 2023, with a slight decline to 497 in 2024.

Manufacturing

- There was a notable increase in Industrial Engineering Technologists and Technicians completer apprentices from 16 in 2015 to 139 in 2020, with a slight decline to 78 in 2024.
- The number of Mechanical Engineers completer apprentices remained low, with six in 2020, peaking at 10 in 2022, and ending at six in 2024.
- The number of Welding Technologists and Technicians completer apprentices increased significantly from two in 2015 to 82 in 2021, with some fluctuations, ending at 50 in 2024.
- The total completer apprentices for the Manufacturing Occupations varied from 18 in 2015 to 209 in 2020, ending at 134 in 2024.

Transit and Facility Management

- The number of Training and Development Specialists completer apprentices showed minor fluctuations, with eight completers in 2020, peaking at 12 in 2022, and decreasing to eight in 2024.
- The number of Vehicle Operations apprenticeships were low, with two in 2020, peaking at 16 in 2022, and then decreasing to one in 2024.
- Total completer apprentice for the Transit and Facility Management Occupations ranged from 10 in 2020, up to 28 in 2022, and back down to nine in 2024.

The total number of completer apprentices across all Workforce Groups showed a significant increase from 28 in 2015 to 643 in 2024, indicating overall growth in completer apprentices. There was a substantial rise in all apprenticeship completions over the years, which aligns with the overall upward trend observed in the Workforce Group Totals, indicating a growing interest and participation in apprenticeship programs. Certain sectors, such as Electrician and Charging Infrastructure and Manufacturing, have shown notable growth, contributing significantly to the overall increase in completer apprentices. The proportion of Workforce Group completer apprentices to all Virginia peaks in 2020 where the Workforce Group Completer Apprentices constitute about 47% of all Completer Apprentices. However, in the following years, this proportion shows a slight decline to roughly 28% by 2024.

Employee Demand

The employee demand section analyzes historical job growth trends and projects out employee demand to the year 2035 according to three different scenarios. A list of the specific standards occupation codes (SOCs) that make up each of the Workforce Groups and Occupations can be found in the **Appendix**.

Historical Employment

Historical employment data sourced from the **Bureau of Labor Statistics' Occupation Employment and Wage Statistics** serves as the foundational data for projecting the future workforce needs relating to EVs, HFCEVs, and related charging infrastructure.

Table 4 represents historical data on total employment in Virginia by Occupation and Workforce Group from 2018 to 2022. The data highlights the number of employed individuals across the Workforce Groups and Occupations, showing trends and changes over the years.

Key trends observed in Virginia employment from 2018 to 2022 include:

- A stable employment landscape in the Automotive Maintenance and Service, with minor fluctuations in the number of Automotive, Bus and Truck Technicians and Mechanics.
- Hydrogen Fuel Cell workers experienced a notable decline in employment, particularly among Chemical Engineers which declined nearly 60%.
- Electrician and Charging Infrastructure worker employment saw a modest increase, driven by a significant rise in the number of Electricians (over 25% increase).
- Manufacturing worker employment remained fairly stable, with a 11% decline in Industrial Engineering Technologists and Technicians, a slight decline in Mechanical and Mechatronics Engineers and a 12% growth in Welding Technologists and Technicians.
- Transit and Facility Management worker employment displayed overall stability with slight growth, particularly in Vehicle Operations Support and a decline of over 50% in Facility Managers.

Table 4. Virginia Historical Employment by Workforce Group and Occupation (2018 to 2022)

Workforce Group & Occupation	2018	2019	2020	2021	2022
Automotive Maintenance and Service					
Automotive, Bus and Truck Technicians and Mechanics	26,480	27,120	25,840	25,870	26,350
Automotive Maintenance and Service Total	**26,480**	**27,120**	**25,840**	**25,870**	**26,350**
Hydrogen Fuel Cell					
Chemical Engineers	980	860	690	380	400
Chemists	4,540	4,690	4,790	4,130	4,470
Hydrogen Fuel Cell Total	**5,520**	**5,550**	**5,480**	**4,510**	**4,870**
Electrician and Charging Infrastructure					

Workforce Group & Occupation	2018	2019	2020	2021	2022
Electrical and Electronics Engineering Technologists and Technicians	11,390	10,970	10,320	9,557	9,280
Electrical Engineers	11,820	10,540	9,900	8,480	8,320
Electrician	21,580	23,750	23,260	27,540	27,170
Plant Maintenance	42,080	43,500	41,300	43,140	45,070
Electrician and Charging Infrastructure Total	**86,870**	**88,760**	**84,780**	**88,717**	**89,840**
Manufacturing					
Industrial Engineering Technologists and Technicians	16,750	16,670	15,555	15,170	14,930
Mechanical and Mechatronics Engineers	11,780	11,740	11,500	12,650	11,670
Welding Technologists and Technicians	8,330	8,940	8,850	9,440	9,300
Manufacturing Total	**36,860**	**37,350**	**35,905**	**37,260**	**35,900**
Transit and Facility Management					
Facilities Managers	9,503	8,220	7,170	3,950	4,480
Training and Development Specialists	13,610	14,650	15,370	14,390	14,940
Transportation Planners	4,050	3,240	3,980	4,000	3,960
Vehicle Operations	66,205	68,389	66,340	69,480	67,500
Vehicle Operations Support	15,448	16,170	16,550	19,050	20,350
Transit and Facility Management Total	**108,816**	**110,669**	**109,410**	**110,870**	**111,230**
Workforce Groups Grand Total	**264,545**	**269,449**	**261,415**	**267,227**	**268,190**
All Virginia Occupations	**3,832,840**	**3,878,770**	**3,701,220**	**3,753,230**	**3,873,060**

Source: Bureau of Labor Statistics Occupation Employment and Wage Statistics

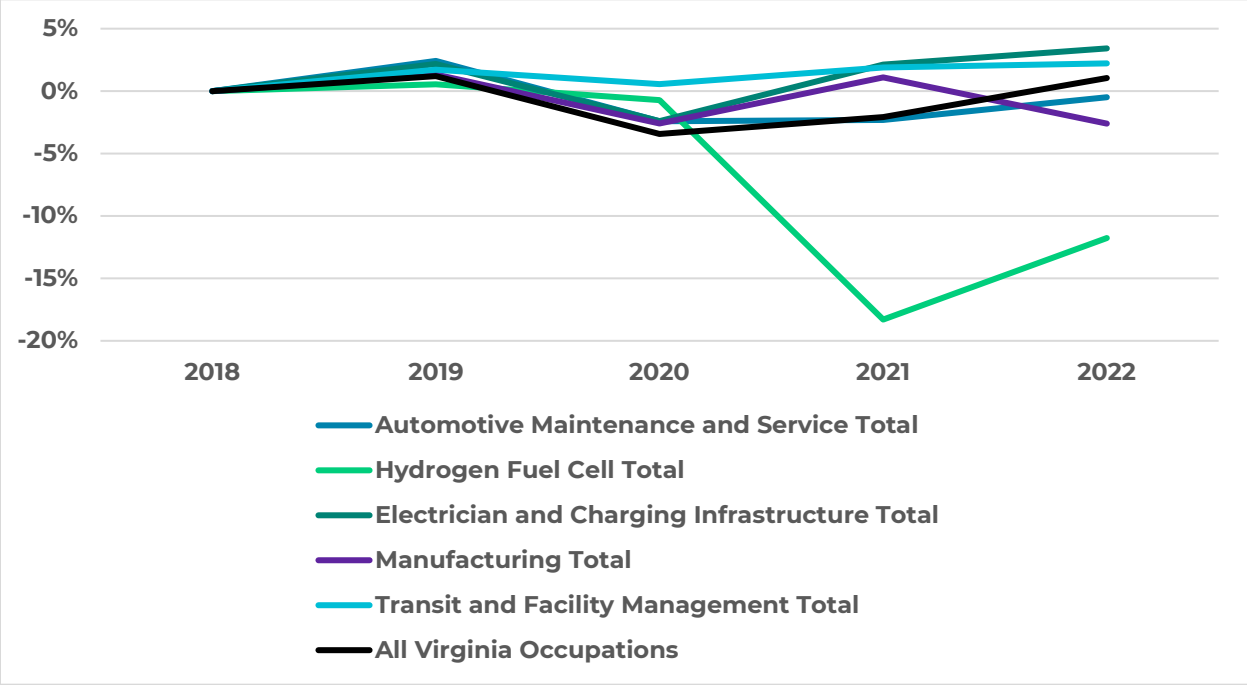
The total employment across all Workforce Groups showed a slight 1% increase from 264,545 in 2018 to 268,190 in 2022, indicating overall stability and slight growth in employment across these Occupations in Virginia. All Virginia Occupations grew 1% between the years 2018 and 2022, indicating that employment trends within the Workforce Groups are reflective of the broader employment trends in Virginia. The rate of change in employment numbers for both the Workforce Group Grand Totals and All Virginia Occupations follows a similar pattern, showing an increasing trend from 2018 to 2022, with a dip in 2020 due to the pandemic, and recovery thereafter. The Workforce Groups comprise approximately 7% of All Virginia Occupations employment.

Figure 5 shows the cumulative employment growth rate for each Workforce Group over the 5-year period of 2018 to 2022 that is illustrated in Table 3, highlighting several key trends:

- Automotive Maintenance and Service Workforce Group Employment shows no growth.
- Hydrogen Fuel Cell worker employment experienced the most significant decline, particularly in 2021, where it dropped to -18% from 2018 to 2021 before recovering slightly to -12% from 2018 to 2022.

- Electrician and Charging Infrastructure worker employment modestly grew to 3%, after a slight dip in 2020.
- Manufacturing worker employment fluctuates and declines to -3%.
- Transit and Facility Management worker employment maintains a steady rate of around 2% growth.
- All Virginia occupations fluctuate in employment, declining to -3% from 2018 to 2020 during the pandemic, and gradually increasing to 1% in 2022. Notably, only the employment of Electrician and Charging Infrastructure and Transit and Facility Management workers outpace the overall growth rate of all Virginia occupations.

Figure 5: Cumulative Employment Growth Rate by Workforce Group by Year (2013 to Year)



Projected Employment

Projections Central provides a 10-year forecast of employment for all occupations in a state. These Long-Term Occupation Projections (2022-2032) data was gathered and mapped to the corresponding Occupations and Workforce Groups. According to the BLS, these figures account for the effects of EVs, HFCEVs, and related charging infrastructure in its employment forecasts according to the past experience of overall pace of technological change. Additionally, existing laws and policies with significant impacts on economic trends are assumed to hold throughout the projection period.

Table 5 provides an overview of the projected job trends in Virginia for the years 2022 to 2032, categorized by Workforce Group and Occupation. The data includes the number of jobs in 2022 and 2032, the change in job numbers, the percent change, and the average annual openings.

The projected employment data for Virginia from 2022 to 2032 indicates overall growth across the Workforce Group and Occupations. Some notable trends include a 7% increase in Chemical Engineers and an 8% rise in Chemists within the Hydrogen Fuel Cell Workforce Groups. The Electrician and Charging Infrastructure Workforce Group is expected to grow significantly, with Electrical and Electronics Engineering Technologists and Technicians increasing by 9%, and Electricians by 5%. The Manufacturing sector also shows growth in Mechanical and Mechatronics Engineers by 9% and Welding Technologists and Technicians by 7%. Employment in the Transit and Facility Management Workforce Group is projected to increase by 3% with the highest increase in Training and Development Specialists at 7%.

Table 5. Virginia Jobs and Average Annual Openings by Workforce Group and Occupation (2022 to 2032)

Workforce Group & Occupation	Base Year (2022)	Projected (2032)	Change	Percent Change	Avg Annual Openings
Automotive Maintenance and Service					
Automotive, Bus and Truck Technicians and Mechanics	30,300	30,000	-300	-1%	2,500
Automotive Maintenance and Service Total	**30,300**	**30,000**	**-300**	**-1%**	**2,500**
Hydrogen Fuel Cell					
Chemical Engineers	410	440	30	7%	30
Chemists	4,660	5,010	350	8%	390
Hydrogen Fuel Cell Total	**5,070**	**5,450**	**380**	**7%**	**420**
Electrician and Charging Infrastructure					
Electrical and Electronics Engineering Technologists and Technicians	9,480	10,330	850	9%	1,080
Electrical Engineers	8,600	9,100	500	6%	520
Electrician	29,160	30,560	1,400	5%	2,810
Plant Maintenance	46,350	49,630	3,280	7%	4,460
Electrician and Charging Infrastructure Total	**93,590**	**99,620**	**6,030**	**6%**	**8,870**
Manufacturing					
Industrial Engineering Technologists and Technicians	15,350	15,280	-70	0%	1,600
Mechanical and Mechatronics Engineers	12,750	13,850	1,100	9%	850
Welding Technologists and Technicians	9,830	10,530	700	7%	1,050
Manufacturing Total	**37,930**	**39,660**	**1,730**	**5%**	**3,500**
Transit and Facility Management					
Facilities Managers	4,730	4,930	200	4%	370
Training and Development Specialists	15,130	16,180	1,050	7%	1,400
Transportation Planners	4230	4460	230	5%	370
Vehicle Operations	72,620	74,260	1,640	2%	8,780
Vehicle Operations Support	25,090	26,030	940	4%	2,530
Transit and Facility Management Total	**121,800**	**125,860**	**4,060**	**3%**	**13,450**
Workforce Groups Grand Total	**284,460**	**296,130**	**11,670**	**4%**	**28,370**
All Virginia Occupations	**4,248,520**	**4,438,600**	**190,080**	**5%**	**480,280**

Source: Projection Central (Rounded to the nearest whole number)

Overall, total employment across all Workforce Groups is projected to increase by 4%, from 284,460 in 2022 to 296,130 in 2032, with approximately 28,370 average annual openings. The total number of jobs in Virginia is projected to grow from 4,248,520 in 2022 to 4,438,600 in 2032, an increase of 190,080 jobs, representing a 5% growth. Based on this data provided by Projection Central, the Workforce Group worker employment is projected to grow 1% slower than all Virigina occupations from 2022-2032.

Projection Scenarios

The Employee and Training Demand Analysis explored three employee demand scenarios co-created with Virginia Clean Cities and validated by DRPT. This information can be used by transit agencies to understand how employee demand may fluctuate based on varying levels of investment in EVs, HFCEVs, related charging infrastructure and workforce. These scenarios were developed using historical employment data, long-term projections, and market research (Table 6).

The employee demand scenarios project employment based on:

1. **Recent Levels of Investment:** Based on employment estimates from Projection Central, this employee demand projection to 2035 assumes the continuation of significant laws and policies like the National Electric Vehicle Infrastructure (NEVI) Formula Program and the Inflation Reduction Act.

2. **Moderate Federal and State Investment:** Uses regression analysis of historical BLS employment data from 2018-2022, to create upper and lower bounds of predicted 2035 employee demand, reflecting moderate investment and resulting in moderate growth projections.

3. **Moderate Federal and Current State Investment:** Based on the impact of recent state policies on employment, such as the Virginia Clean Economy Act. This scenario uses an analysis conducted by E2 on data from the 2022 U.S. Energy and Employment Report (USEER)[14] suggesting that Virginia's clean energy jobs grew more than 3.5 times faster year-over-year than overall employment in the Commonwealth. Applying this multiplier (3.5) to historical BLS employment data from 2018-2022 estimates a higher 2035 employee demand for clean energy jobs, assuming continued current state investment in EVs, HFCEVs, related charging infrastructure and workforce.

See the **Appendix** for the projection scenarios with lower and upper bound limits for employee demand and a description of clean energy jobs.

Table 6. Virginia Employee Demand Projected Employment Scenarios (2035)

Workforce Group & Occupation	Current Federal and State Investment	Moderate Federal and State Investment	Moderate Federal and Current State Investment	Directional Line[15]
Automotive Maintenance and Service				

[14] **E2-FS-Clean-Jobs-VA-2022-23-04-C_03.pdf**
[15] Directional line not to scale.

Workforce Group & Occupation	Current Federal and State Investment	Moderate Federal and State Investment	Moderate Federal and Current State Investment	Directional Line[15]
Automotive, Bus and Truck Technicians and Mechanics	30,120	26,195	25,933	
Automotive Maintenance and Service Total	**30,120**	**26,195**	**25,933**	
Hydrogen Fuel Cell				
Chemical Engineers	428	194	617	
Chemists	4,874	2,145	6,891	
Hydrogen Fuel Cell Total	**5,302**	**2,339**	**7,508**	
Electrician and Charging Infrastructure				
Electrical and Electronics Engineering Technologists and Technicians	10,002	3,077	14,306	
Electrical Engineers	8,904	1,006	12,826	
Electrician	30,010	42,290	41,885	
Plant Maintenance	48,353	49,223	69,479	
Electrician and Charging Infrastructure Total	**97,269**	**95,596**	**138,496**	
Manufacturing				
Industrial Engineering Technologists and Technicians	15,308	14,700	10,437	
Mechanical and Mechatronics Engineers	13,424	12,332	17,990	
Welding Technologists and Technicians	10,258	14,324	14,337	
Manufacturing Total	**38,990**	**41,356**	**42,764**	
Transit and Facility Management				
Facilities Managers	4,851	-9,563	6,906	
Training and Development Specialists	15,771	19,798	23,031	
Transportation Planners	4,370	6,194	6,105	
Vehicle Operations	73,610	78,567	104,056	
Vehicle Operations Support	25,659	31,970	31,371	
Transit and Facility Management Total	**124,261**	**126,966**	**171,469**	
Workforce Groups Grand Total	**295,942**	**292,454**	**386,169**	

Source: Analysis of data from Projection Central, Bureau of Labor Statistics, an analysis conducted by E2 on data from the 2022 U.S. Energy and Employment Report (Rounded to the nearest whole number)
Note: The linear regression model creates a best-fit line, which minimizes the difference between predicted values and actual values. The actual values are determined based on

actual job counts for each year, with predicted values following the best-fit-line for future years. The line will yield a negative rate of change, meaning future values are less than a previous year's value, if there was a negative rate of change in historical values. For Facilities Managers, employment declined from 2018-2023, creating a negative rate of change. Therefore, the linear regression model will also have a negative rate of change.
The Automotive Maintenance and Service Workforce Group shows stability across all scenarios. This indicates that while EV and HFCEV adoption may affect some traditional automotive, bus and truck technician and mechanic roles, overall demand remains steady. This is consistent with the qualitative feedback that employee demand for these workers will remain unchanged with the implementation of low- and no-emission vehicles. Rather, the experience and skills of these workers will evolve resulting in the need for reskilling and upskilling.

Under the Current Federal and State Investment scenario, Electrician and Charging Infrastructure employment is projected to reach 97,269 by 2035. However, with Moderate Federal and current State Investment, this number could grow significantly to 138,496, reflecting the impact of strong state policies and investments.

The Manufacturing Workforce Group sees modest growth under all scenarios. This may reflect Virginia's strong presence in non-manufacturing industries outside of the maritime industry.

The Transit and Facility Management Workforce Group experiences the most significant growth under the Moderate Federal and Current State Investment scenario, with total employment projected to reach 171,469 by 2035. This highlights the potential for substantial job creation in transit-related roles with current state support for clean energy initiatives.

The grand total employment across all workforce groups is projected to range from 292,454 to 386,169, depending on the level of investment and policy support. Overall, these scenarios provide a comprehensive analysis of potential projected employee demand for 2035 relating to EVs, HFCEVs, and related charging infrastructure.

Employee Demand Disruptors
Recent economic development announcements in Virginia highlight significant company expansions and new projects that will impact employment of the Workforce Groups Occupations, particularly in the fields of manufacturing, energy infrastructure, and automotive. These projects collectively represent thousands of new jobs and significant investments in local economies. Transit agencies should be particularly aware of these developments, as they will increase competition for skilled workers, which is crucial as it can affect the availability of qualified personnel for transit operations. Awareness of regional economic development projects may result in additional workforce related funding and programs for transit agencies to benefit from.

Delta Star Transformers Expansion

Delta Star is expanding its Lynchburg, Virginia facility to enhance the production of heavy-duty charging infrastructure. This project will increase employee demand for electric vehicle charging manufacturing workers.

- **Number and Type of Jobs**: 149 jobs (heavy-duty charging infrastructure manufacturing)
- **Timeline**: Announced in May 2023; expected to be completed by late 2024

DuPont Battery Plant Expansion

DuPont's battery manufacturing plant in Chesterfield County, Virginia, has expanded to bolster the production of advanced battery materials. This expansion supports the growing need for energy storage solutions and has increased employee demand for manufacturing workers.

- **Number and Type of Jobs**: 60 jobs (battery manufacturing)
- **Timeline**: Announced under Governor Bob McDonnell; project completed and operational since 2012

Hitachi Energy Expansion

Hitachi Energy is expanding its operations in Bland County, Virginia, focusing on energy infrastructure manufacturing. This expansion will support the production of critical components for the energy sector, aiding the energy transition and increasing employee demand for manufacturing workers.

- **Number and Type of Jobs**: 165 jobs (energy infrastructure manufacturing)
- **Timeline**: Announced in October 2022; expected to be completed by mid-2024

Microporous Expansion

Microporous is enhancing its Piney Flats, Tennessee facility, which is near the Virginia border. This expansion will increase the production of battery separators, essential for energy storage solutions, and is expected to have a notable impact on the Virginia workforce.

- **Number and Type of Jobs**: 170 jobs (advanced manufacturing)
- **Timeline**: Announced in November 2024; project completion expected by mid-2026

R&B Sports and Classics Expansion

R&B Sports and Classics in Lynchburg, Virginia, is expanding its operations to better serve the automotive restoration and manufacturing market. This project will enable the company to handle a higher volume of classic and sports car restorations and increase employee demand for automotive workers.

- **Number and Type of Jobs**: 100 jobs (automotive restoration and manufacturing)
- **Timeline**: Announced in August 2024; expected to be operational by early 2026

Topsoe Manufacturing Facility

Topsoe is establishing a new facility in Henrico County, Virginia, dedicated to clean energy technology manufacturing including hydrogen production. This project will

advance the production of clean energy technologies and cultivate a hydrogen technology workforce.

- **Number and Type of Jobs**: 100 jobs (clean energy technology manufacturing)
- **Timeline**: Announced in May 2024; expected to be operational by late 2025

Volvo Manufacturing Expansion at New River Valley Plant

Volvo's New River Valley Plant in Dublin, Virginia, is set to expand, focusing on electric truck manufacturing. This initiative will significantly boost Volvo's production capacity and meet the rising demand for electric vehicles. This effort will also increase employee demand for both manufacturing and automotive workers.

- **Number and Type of Jobs**: 777 jobs (electric truck manufacturing)
- **Timeline**: Announced for 2024; expansion expected to be completed by the end of 2025

More Virginia announcements of new businesses or expansions can be found here: **announcements.vedp.org/Announcements/**.

Training Demand

The training demand section identifies the gap between current and future workforce supply and employee demand for the years 2025 and 2035. To calculate the alignment or misalignment between workforce supply and average annual employee demand, the average annual openings were subtracted from the supply figures for 2025 and 2035. Average annual openings includes both net new jobs and replacement jobs from retirements and separations. Table 7 illustrates the training demand gap or surplus by Workforce Group and Occupation. The workforce supply figures were calculated based upon historical post-secondary completions and completer apprentices. Occupations with a training gap are highlighted in red indicating a shortage of newly credentialed workers to fill the average annual openings. Occupations with an oversupply of credentials in relation to average annual openings are highlighted in yellow. Finally, occupations without a training gap, where workforce supply and employee demand are aligned are highlighted in green.

Table 7. Training Demand Gap or Surplus by Workforce Group and Occupation (2025 and 2035)

More demand than supply of credentials (>-1,000)
More supply of credentials than demand (>1,000)
Demand and supply appear in relative balance (≤1,000 and ≥-1,000)

Workforce Group & Occupation	Average Annual Openings	Supply 2025	2025 Alignment	Supply 2035	2035 Alignment
Automotive Maintenance and Service					
Automotive, Bus and Truck Technicians and Mechanics	2,500	772	-1,728	688	-1,812

Workforce Group & Occupation	Average Annual Openings	Supply 2025	2025 Alignment	Supply 2035	2035 Alignment
Automotive Maintenance and Service Total	**2,500**	**772**	**-1,728**	**688**	**-1,812**
Hydrogen Fuel Cell					
Chemical Engineers	30	217	187	191	161
Chemists	390	622	232	521	131
Hydrogen Fuel Cell Total	**420**	**839**	**419**	**712**	**292**
Electrician and Charging Infrastructure					
Electrical and Electronics Engineering Technologists and Technicians	1,080	1,786	706	3,427	2,347
Electrical Engineers	520	454	-66	300	-220
Electrician	2,810	934	-1,876	4,452	1,642
Plant Maintenance	4,460	186	-4,274	184	-4,276
Electrician and Charging Infrastructure Total	**8,870**	**3,360**	**-5,510**	**8,363**	**-507**
Manufacturing					
Industrial Engineering Technologists and Technicians	1,600	558	-1,042	861	-739
Mechanical and Mechatronics Engineers	850	1,170	320	1,171	321
Welding Technologists and Technicians	1,050	1,290	240	3,487	2,437
Manufacturing Total	**3,500**	**3,018**	**-482**	**5,519**	**2,019**
Transit and Facility Management					
Facilities Managers	370	12,721	12,351	14,618	14,248
Training and Development Specialists	1,400	5,215	3,815	8,874	7,474
Transportation Planners	370	1,267	897	1,597	1,227
Vehicle Operations	8,780	318	-8,462	1,020	-7,760
Vehicle Operations Support	2,160	186	-1,974	97	-2,063
Transit and Facility Management Total	**13,080**	**19,707**	**6,627**	**26,206**	**13,126**

Source: Analysis of Bureau of Labor Statistics data (Rounded to the nearest whole number)

In the Automotive Maintenance and Service Workforce Group, there is a significant gap between workforce supply and employee demand for Automotive, Bus, and Truck Technicians and Mechanics, with a training demand gap of 1,728 in 2025 that increases to 1,812 in 2035. This indicates an estimated current and future shortage of individuals trained for these roles.

The Hydrogen Fuel Cell Workforce Group is aligned in terms of workforce supply and employee demand. A training gap is not estimated in 2025 nor 2035.

The Electrician and Charging Infrastructure Workforce Group shows a mix of surplus and gaps. Electrical and Electronics Engineering Technologists and Technicians and Electrical Engineers are estimated to not have a training gap in 2025. However, the

projected workforce supply of Electrical and Electronics Engineering Technologists and Technicians outpaces average annual openings resulting in an oversupply of these workers by 2035. Electricians are projected to have a training gap of 1,876 in 2025 and then supply outpaces demand by 1,642 in 2035. Plant maintenance workers have a prevailing training gap in 2025 and 2035 of over 4,000.

In the Manufacturing Workforce Group, there is a significant gap in some roles and a surplus in others. Industrial Engineering Technologists and Technicians have a shortfall of supply in 2025, with 1,042 more openings than newly credentialed workers. However, this training gap is resolved by 2035 due to the growing rate of completions. Mechanical and Mechatronics Engineers will not have an estimated training gap in 2025 nor 2035. Welding Technologists and Technicians do not have a training gap in 2025 and are projected to have a training surplus in 2035 of 2,437.

The Transit and Facility Management Workforce Group shows a significant surplus in some roles and a notable gap in others. Facilities Managers have a surplus in both 2025 and 2035 which can be attributed to the high number of business administration completions in Virginia. Despite this surplus, it will be important to expose prospective facilities managers to the unique operations at transit agencies. Training and Development Specialists also show a workforce supply surplus of 3,815 in 2025 and 7,474 in 2035. In the same way, dedicated intervention is required to ensure that there is an adequate pipeline of these workers familiar with EVs, HFCEVs, and related charging infrastructure. Finally, Vehicle Operations and Vehicle Operations Support have significant training gaps in 2025 and 2035.

The data highlights the need for strategic planning in workforce training to address gaps and surpluses across the Workforce Groups and Occupations, ensuring a balanced and adequately supplied workforce for the future.

Regional Analysis

This section visualizes completions for each of the five Workforce Groups Occupations across different regions in Virginia for the year 2023. The figures below highlight the geographic distribution of these completions, emphasizing areas with high concentrations of newly credentialed workers and identifying regions with lower completion rates.

The 2023 completions relating to the Workforce Groups exhibit significant regional variations across different sectors. Urban and suburban areas such as Fairfax County, Norfolk, and Richmond show higher concentrations of completions, particularly in sectors like Electrician and Charging Infrastructure and Hydrogen Fuel Cell. Conversely, rural regions, especially in Southwest Virginia, display lower completion rates, indicating potential gaps in local training programs or demand.

This analysis can support an understanding of the training landscape in Virginia, identifying areas of strength, and pinpointing regions that may require additional training programs or resources to meet training demands. Targeted workforce development initiatives can support a balanced distribution of skilled professionals

across the Commonwealth, addressing both current industry needs and future growth opportunities.

Figure 6: 2023 Automotive Maintenance and Service Workforce Group Number of Completions

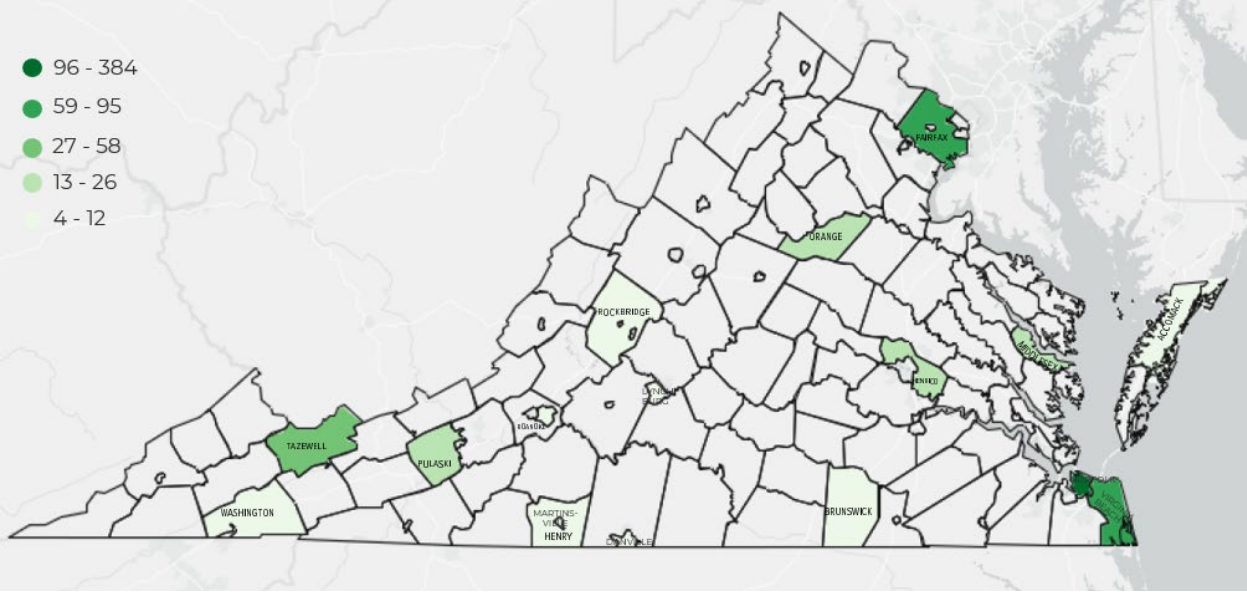


Figure 6 shows the concentration of 2023 completions for Automotive Maintenance and Service workers across Virginia. The highest concentration of completions is seen in the southeastern and northern regions of Virginia, particularly Norfolk City (384), Virginia Beach City (82), and Fairfax County (95). However, there is a notable lack of completions in Central and Southwest Virginia. Tazewell County (58) has the highest concentration of completions in Southwest Virginia followed by Pulaski (16) and Washington (10).

Figure 7: 2023 Hydrogen Fuel Cell Workforce Group Number of Completions

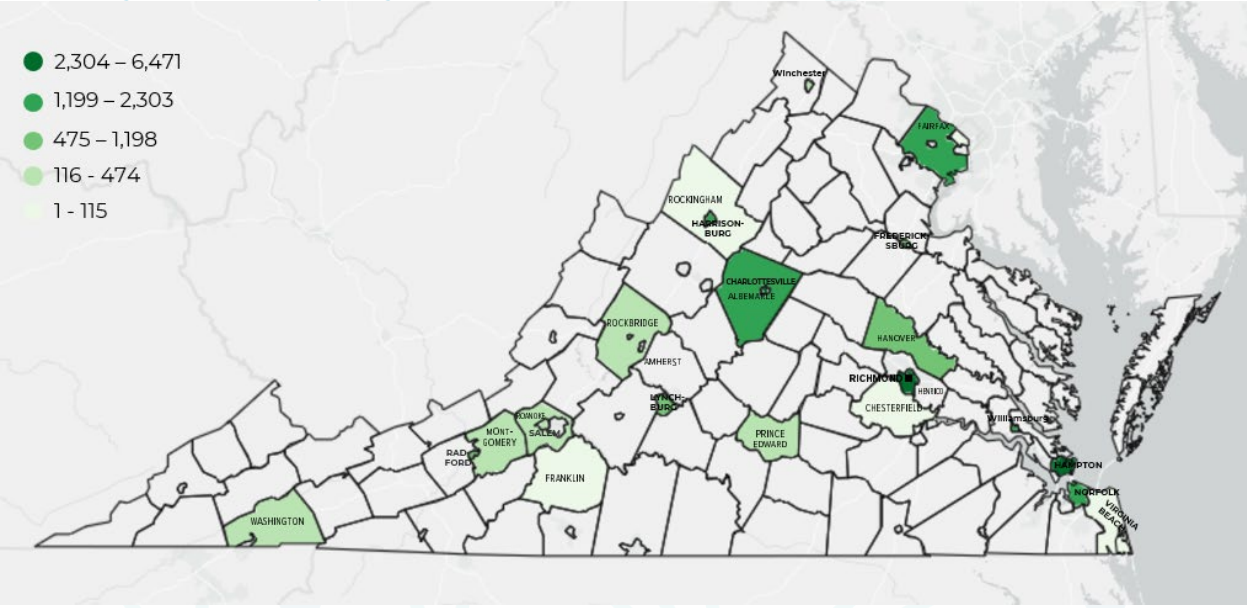


Figure 7 illustrates the levels of 2023 completions for Hydrogen Fuel Cell workers across Virginia. Hydrogen Fuel Cell completions are primarily concentrated in Central and Eastern Virginia, with the highest concentrations in the Richmond (173) and Hampton (190) areas. Other areas with notable completions include Charlottesville (207) and Albemarle County (27), as well as Fairfax (33), Hanover (13), and Norfolk (28).

There is a notable lack of Hydrogen Fuel Cell completions in Southwestern Virginia, with counties such as Washington (5), Montgomery (7), and Roanoke (8) graduating fewer than 10 each.

Figure 8: 2023 Electrician and Charging Infrastructure Workforce Group Number of Completions

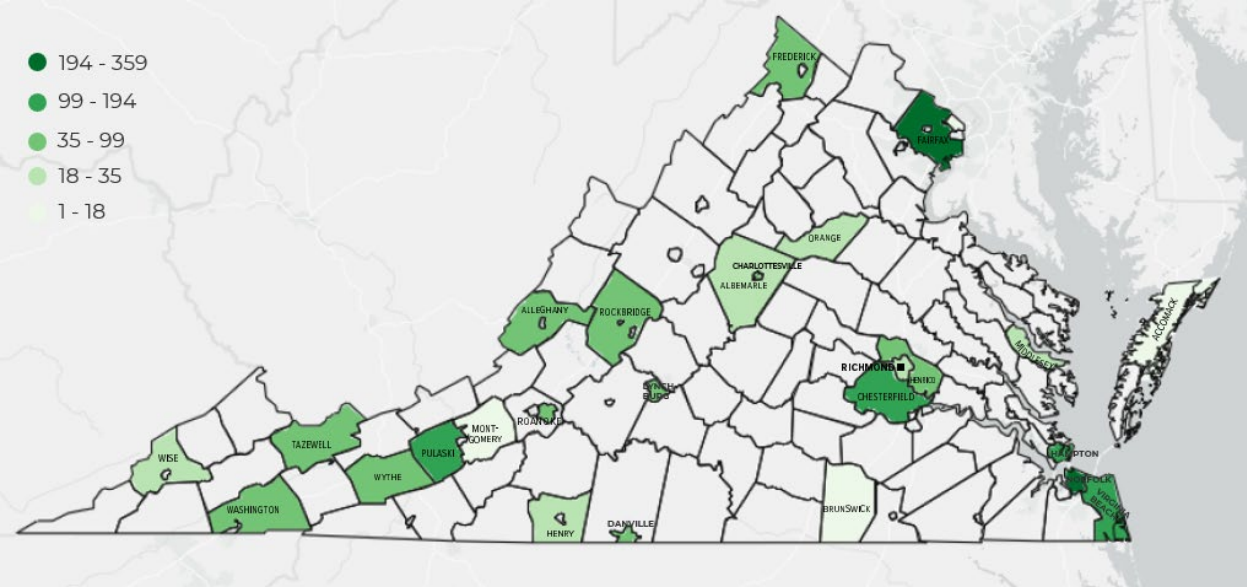


Figure 8 displays the levels of 2023 concentration for Electrician and Charging Infrastructure workers. These completions are widely distributed across Virginia, with higher concentrations in both urban and suburban areas.

The highest number of completions are in Fairfax County (328) and in Norfolk County (359) followed by Hampton (194) and Virginia Beach (194), and the greater Richmond area, Chesterfield (142), Henrico (55), and Richmond City (28). These areas have more technical programs to meet the employee demand for skilled workers due to presence of maritime industry.

Areas such as Frederick (62) in northern Virginia, Rockbridge (73), and Alleghany (74), and Lynchburg (60) have moderate completions. These regions support regional workforce needs, including those tied to industrial, commercial, or residential electrical work.

Southwest Virginia also has several counties with completions, although they remain on the lower end in terms of numbers, with exception to Pulaski County (182), which

has one of the highest concentrations of Electrician and Charging Infrastructure completions in Southwest Virginia.

Figure 9: 2023 Manufacturing Workforce Group Number of Completions

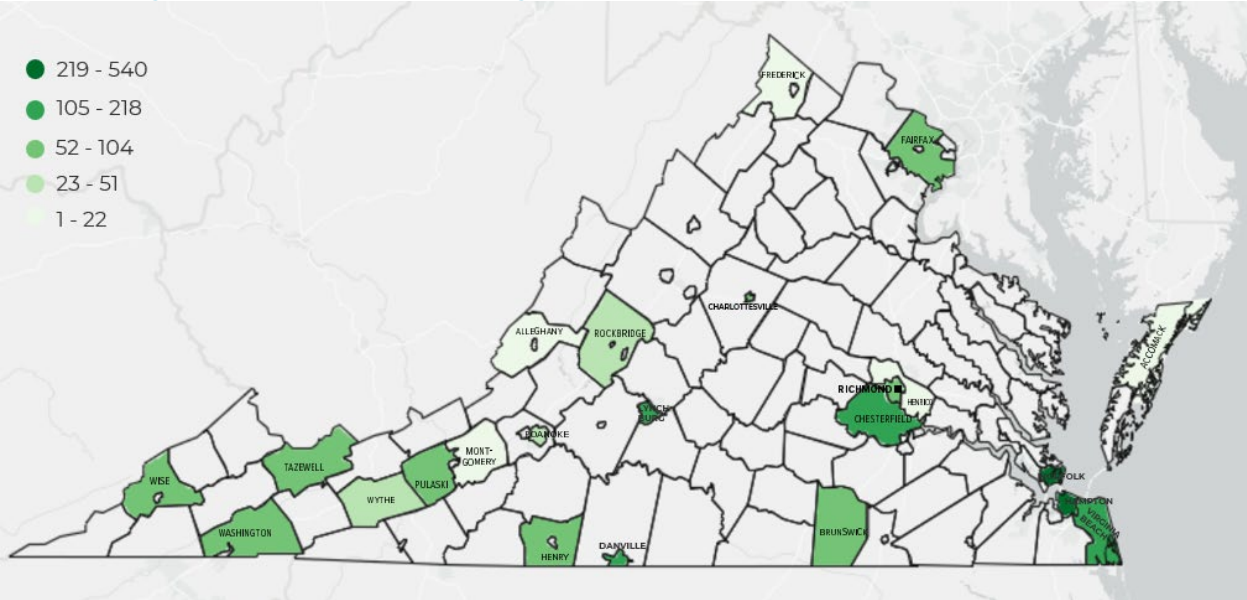


Figure 9 shows the concentration of 2023 completions for the Manufacturing workers in Virginia. The highest Manufacturing completions are in the Hampton (447) and Norfolk (540) areas. Areas with moderate activity include Lynchburg (218), Virginia Beach (156), and Chesterfield (134). Manufacturing completions are also widely distributed across rural counties in Southwest Virginia, including Wise (67), Washington (71), Tazewell (69), and Pulaski (104), with lower concentrations in areas like Montgomery (19) and Wythe (8).

Figure 10: 2023 Transit and Facility Management Workforce Group Number of Completions

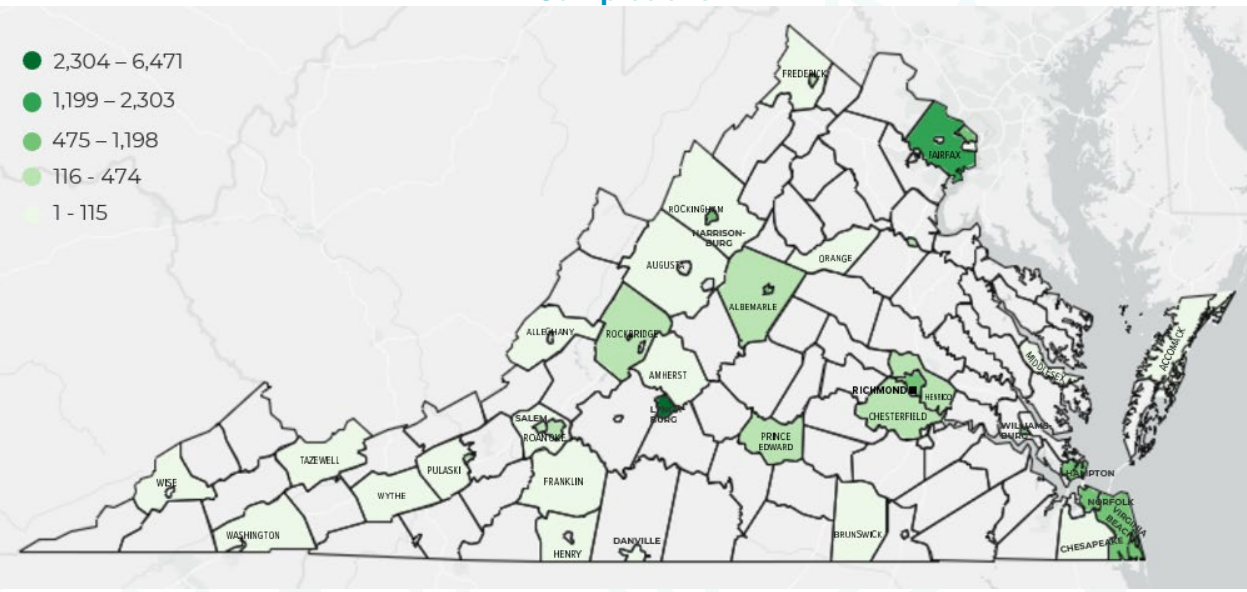


Figure 10 shows the concentration of 2023 Transit and Facility Management Workforce Group Occupation completions across Virginia. The highest concentration of these completions is in Lynchburg (6,471), followed by Fairfax County (2,303) in Northern Virginia. Richmond (772), Hampton, (814), and Virginia Beach (966) have moderate levels of completions, while Central Virginia Counties such as Prince Edward (474), Albemarle (238), Chesterfield (230), and Henrico (224) have slightly fewer. These areas are home to major universities, government facilities, and transit infrastructure, contributing to training demand for these workers.

Southwestern Virginia counties of Tazewell (85), Washington (61), Pulaski (57), Wise (26), and parts of Central Virginia have few completions suggesting a lack of local training programs or lower demand for Transit and Facility Management professionals in less urbanized regions.

Investment and Collaboration Opportunities

The findings in this section include several key segments of information for transit agencies to learn more about programs that can assist with addressing skill gaps and training needs:

- **Investment and Collaboration Opportunities**
- **Peer State Case Studies**
- **Policy Considerations**

Efforts to build sustainable workforce pipelines for skilled trades is gaining traction at all levels of government and this is especially true for the deployment of low- and no-emission vehicles. Local, state, federal, and national programs have increasingly focused on equipping workers with the skills and training necessary to support electric vehicle and related charging infrastructure and prepare for the emerging hydrogen economy. By aligning funding, policy incentives, and educational initiatives, these efforts aim to support a skilled and adaptable workforce ready to meet the demands of transit agencies.

State and Local Opportunities

This section provides a listing of various local and state-funded programs and initiatives as of March 2025 for transit agencies to reference for their workforce development efforts. Each program addresses specific needs within the Commonwealth, ranging from enhancing electric vehicle infrastructure to developing a skilled workforce in clean energy sectors.

Investment Opportunities

Table 8 contains details about each program, including the funding amount allocated, the category of the initiative, and the funding timeline. This section also includes information on how transit agencies can apply for funding, along with relevant websites and contact information for further assistance.

Table 8. Local and State Investment Opportunities (As of March 2025)

Program Name	Funding Amount	Category	Funding Timeline
Community Development Block Grant Community Improvement Grants	$15.5 million total allocation	Economic Development, Community Development, and Public Infrastructure	Ongoing
GO Virginia Growth and Opportunity Fund	Grants vary depending on region allocation; requires a 2-to-1 match which can be cash, in-kind or a combination	Workforce and Economic Development	Ongoing
GO Virginia Planning Grant	$100,000	Planning and Needs Assessment	Ongoing
Making Efficient and Responsible Investments in Transit (MERIT) – Public Transportation Workforce Development Program	Varies	Workforce Development for Public Transportation Careers	Ongoing (December 1 through February 1 Application Timeline)
New Economy Workforce Credential Grant	$5 million in year 1; $7.5 million in year 2	Non-credit training	Ongoing
Virginia Career Works Grant Program and Tax Credits	Varies	Workforce Training, Retraining, and Upskilling	Ongoing

Community Development Block Grant Community Improvement Grants
The Community Development Block Grant (CDBG) Community Improvement Grant is a federally funded program with funding in 2024-25 of over $15 million for economic development, community development, and public infrastructure projects. This ongoing program supports localities with addressing the greatest needs of the community which may include training.

Competitive grants are awarded following the competitive review of all applicable applications. The timeline for submission of competitive grant applications to the VA Department of Housing and Community Development (DHCD) is the spring of every year, with a second round conducted in the fall if funding remains. Applications review will occur in late spring/early summer, and announcements of competitive grant offers are anticipated in late summer/early fall.

Transit agencies can apply for funding through the DHCD website or by contacting the DHCD directly. Detailed information and application forms can be found on the DHCD website **here**.

GO Virginia Growth and Opportunity Fund

The GO Virginia Coalition was launched in 2015 by Virginia's senior business leaders with bipartisan support to create high-paying jobs through incentivized public-private partnership. The FY 23-FY 24 biennium budget allocated $30 million for the

fund in FY 24. The Virginia Growth and Opportunity Fund awards grants varying depending on regional allocation. The program requires a 2-to-1 match, which can be cash, in-kind, or a combination. This ongoing program focuses on workforce and economic development, supporting projects that drive regional economic growth and enhance workforce capabilities. A Go Virginia Planning Grant is suggested prior to a larger award under this fund.

Transit agencies can learn more about this program from the Virginia Department of Housing and Community Development (DHCD) website or by contacting the DHCD directly. Detailed information on this program can be found **here**.

GO Virginia Planning Grant

Regions can apply for a Go Virginia Planning Grant for planning projects and pilots. Regions are limited to $250,000 per fiscal year for planning grants and each individual planning grant may not exceed $100,000. This ongoing grant supports regional planning efforts to identify and address economic development needs. It aims to foster collaboration and strategic planning to drive economic growth and development across the state. A Planning Grant is an essential first step towards substantial funding from Go Virginia for a larger project.

Transit agencies can access this program by applying through the GO Virginia website or contacting their regional GO Virginia office directly. Detailed information can be found **here.**

Making Efficient and Responsible Investments in Transit (MERIT) – Public Transportation Workforce Development Program

The Public Transportation Workforce Development Program is sponsored by DRPT and aims to raise awareness and professional development of public transportation careers in various roles, including management, maintenance, and operations. This program also encourages apprenticeships across different industry sectors, focusing on roles like mechanics, operators, and supervisors. The grant supports qualified individuals with hands-on experience, covering wages, benefits, training (e.g., Commercial Driver's License), and travel. Both post-collegiate apprenticeships and pre-graduate training are eligible. Applicants must conduct open recruitment to select qualified individuals, as the program is not for staff augmentation. This grant can also be used to support agency staff reskilling and upskilling efforts through recognized training programs.

Transit agencies can access this program by contacting DRPT directly or accessing DRPT's WebGrants portal **here**. Additional details on all of DRPTs grant programs can be found in their "Blue Book" **here**.

New Economy Workforce Credential Grant

The New Economy Workforce Credential Grant is a state-funded initiative created by the General Assembly in 2016, providing $5 million in the first year and $7.5 million in the second year for eligible institutions for the purpose of non-credit training that leads to a workforce credential in a high demand field. This program is administered by the State Council of Higher Education for Virginia. The funds from this grant can

subsidize workforce training for both a student and institution for students that satisfactorily completed the workforce credential after completing the training (up to $4,000 for one training completion and credential). This ongoing program aims to enhance workforce development and meet the needs of the evolving economy. The FY 2025 and FY 2026 appropriation is estimated to be $22.5 million and $23.8 million, respectively, pending enactment of state budget legislation in 2025 and 2026.

Transit agencies can share this program with their local community colleges, higher education centers, Richard Bland College and New College Institute that do not have programs aligned to EV, HFCEV, and related charging infrastructure workforce training. More information can be found **here**.

Virginia Career Works

Virginia Career Works offers a number of financial incentives and tax credits for worker training, retraining, and upskilling. A transit agency can work with their local workforce board to understand what assistance they may be eligible for. Example programs include:

- Incumbent Worker Training Grant Program
- On the Job Training Grant Program
- **V3 Employment Grant**
- **Worker Retraining Tax Credit**
- **Work Opportunity Tax Credit**

Virginia Works

The Secretary of Labor's Office has announced two competitive funding opportunities, "Investing in Workforce Development Innovation for the Future of the Commonwealth" and "Facilitating Career Pivots into High-Demand Occupations," funded via the Governor's set-aside Workforce Innovation Opportunity Act (WIOA) Title I funds and administered by Virginia Works, the Commonwealth's workforce development agency. A total of $1.8 million is available across both funding opportunities.

Local Workforce Development Boards, Educational Institutions, and Non-Profit Entities, including Professional Associations, are eligible to apply for these opportunities. Educational institutions, non-profit entities, and transit agencies must demonstrate and discuss partnership with one or more local workforce boards for a successful application. If you need help identifying or contacting a local workforce development board, **please find an interactive map here**.

Employer partnerships are encouraged but not required. Each partner must contribute a letter of commitment with this application describing the intended collaboration. In addition, a funding match of 50% of grant award request is required. WIOA Title I funds may not be used to satisfy the match requirement.

For both opportunities, the application deadline is **5 pm ET, April 25, 2025.** The award date is **June 6, 2025, with a 12-month period of performance from June 27, 2025 to June 30, 2026.** Q&A sessions will be hosted for interested parties on

Tuesday, April 8, from 2-3 pm and Friday, April 22, from 2-3 pm. To sign up, please email **subawardinquiries@virginiaworks.gov**.

1. **Investing in Workforce Development Innovation for the Future of the Commonwealth:** Funds programs or initiatives designed to (1) increase Registered Apprenticeship enrollment, (2) increase job placements in high-demand occupations, (3) enhance the efficiency of American Job Center service delivery via operational improvements, or (4) cultivate digital skills for job seekers in the Commonwealth.
    - **Funds Awarded:** $900,000 total, with up to $150,000 per applicant.
    - **Expected Outcomes & Metrics:** Please contact DRPT for the Request for Proposals document. Of note, activities and progress toward the proposal's stated goals and expenditure of funds will be evaluated on a monthly basis, with a six-month performance and progress review.

2. **Facilitating Career Pivots into High-Demand Occupations:** Funds programs or initiatives providing job placement activities such as, but not limited to upskilling, reskilling, innovative career transitions, coaching activities, and interactive learning & hiring events that support individuals in transferring existing skills across industries to other high-demand occupations. Target populations may include, but are not limited to, dislocated Federal talent.
    - **Funds Awarded:** $900,000 total, with up to $150,000 per applicant.
    - **Expected Outcomes & Metrics:** Please contact DRPT for the Request for Proposals document. Of note, activities and progress toward the proposal's stated goals and expenditure of funds will be evaluated on a monthly basis, with a six-month performance and progress review.

Collaboration Opportunities
These collaboration opportunities aim to grow clean energy infrastructure throughout Virginia will benefit transit agencies seeking to deploy low- and no-emission transportation solutions.

Green Hydrogen Fuel Lab
In 2023, the Green Hydrogen Fuel Lab, an initiative by Hampton Roads Alliance in GO Virginia Region 5, received a grant of more than $1.4 million for a green hydrogen clean energy transition demonstration site. Another $5 million in investment came from public and private entities. This Lab will support between three and five hydrogen transition projects that will drive industry investment, establish a hydrogen competency center to education and attract private investment and create workforce and talent programs. This effort is in collaboration with the Virginia Tech Corporate Research Center and other stakeholders. Transit agencies can learn more about this collaboration opportunity **here**.

Mid-Atlantic Electrification Partnership
The Mid-Atlantic Electrification Partnership (MAEP) is a $14.6 million multi-state effort across Virginia, Washington DC, Maryland, and West Virginia to create an electrified regional ecosystem. The MAEP has installed hundreds of EV chargers, performed numerous educational and workforce seminars with local communities,

procured 111 electric vehicles for Virginia's fleets and ride sharing organizations, and supported the roll out of hundreds of electric school buses. This program will conclude on September 30, 2025, and final products, metrics, reporting, and data collected from this effort can be shared to organizations seeking assistance creating EV workforce programs by contacting Virginia Energy.

Southwest Virginia Hydrogen Hub

The Southwest Virginia Hydrogen Hub allocated up to $1 million through four planning grants of $250,000 each. This program is focused on planning for potential hydrogen production facilities in Southwest Virginia. Applications for these grants were due January 31, 2025. Transit agencies in Southwest Virginia can reach out to Virginia Energy for more information on awardees in their area. More information on this collaboration opportunity can be found **here**.

Virginia Clean Energy Innovation Bank

The Virginia Clean Energy Innovation Bank is a state-funded program with a budget of $9.25 million seeded by the 2024 State Budget. This ongoing initiative supports clean power generation and energy infrastructure projects by partnering with a range of other state agencies and program to identify investment opportunities. It aims to accelerate the development and deployment of innovative clean energy infrastructure, contributing to the state's clean energy goals. Transit agencies can learn more about this collaboration opportunity **here**.

Federal and National Opportunities

The following section provides a detailed overview of various federal-funded programs and initiatives as of March 2025 that could impact workforce development efforts related to EV, HFCEV, and related charging infrastructure across the United States. These programs may be available to transit agencies and workforce consortiums in Virginia.

Investment Opportunities

Table 9 lists details about each program, including the funding amount allocated, the initiative categories, and the funding timelines. This section also includes information on how transit agencies and other eligible entities can apply for funding, along with relevant websites and contact information for further assistance.

Table 9. Federal Investment Opportunities (As of March 2025)

Program Name	Funding Amount	Category	Funding Timeline
Charging and Fuel Infrastructure (CFI) Program	$2.5 billion	Electric and Hydrogen Infrastructure and Workforce Development	Paused
Low or No Emission Grant Program (Low-No)	$5.6 billion through 2026	Electric & Hydrogen Buses and Workforce Development	Ongoing
National Electric Vehicle Infrastructure (NEVI) Formula Program	$100 million for Virginia	EV Charging Infrastructure and Workforce Development	Paused

Program Name	Funding Amount	Category	Funding Timeline
National Science Foundation - Advanced Technological Education (ATE) Program	$74 million for technical education	STEM Workforce Development	Proposals due October 2, 2025
Regional Clean Hydrogen Hubs	$7 billion	Hydrogen Research, Innovation, and Workforce Development	Closed
Vehicle Technologies Office Program	$88 million	Advanced Vehicle Research and Development Including Electric Vehicle Workforce Development	Submission Deadline for Full Application: June 18, 2025

Charging and Fuel Infrastructure (CFI) Program

The CFI Program was created by the Infrastructure Investment and Jobs Act (IIJA) for the purpose of infrastructure for drivers of electric, hydrogen, propane, and natural gas vehicles. This program provides two funding categories of grants: (1) Community Charging and Alternative Fueling Grants (Community Program); and (2) Charging and Alternative Fuel Corridor Grants (Corridor Program). The IIJA provides $2.5 billion over five years for this program. To date, this program has awarded three rounds of funding totaling $1.779 billion to 147 applicants. There have been two VA awardees including $1.4 million to Henrico County Community Charging Network to build 38 EV charging ports at seven, publicly accessible community facilities. Funds will also be used to help identify and plan for future phases on EV infrastructure development[16].

Any future CFI Notice of Funding Opportunity (NOFO) will be announced on **Grants.gov** and this **website**. No estimated date for NOFO release is available at this time.

National Electric Vehicle Infrastructure (NEVI) Formula Program

The National Electric Vehicle Infrastructure (NEVI) Formula Program is a federal initiative that began in 2021. It provides $100 million for Virginia to develop EV charging infrastructure. The program is currently paused, but it is designed to support infrastructure development over five years. As of March 2024, 51 of 53 planned projects are on hold due to the pause of the program.

For detailed information on awards, program updates, federal EV infrastructure grant opportunities, and educational resources please visit **VDOT's Electric Vehicle Infrastructure Deployment website**.

Low or No Emission Grant Program (Low-No)

The Low or No Emission Grant Program (Low-No) is a federal initiative that has been open since FY 2016. The Bipartisan Infrastructure Law provided $5.6 billion through 2026 for the Low-No Program. For FY 2024, approximately $1.1 billion was available for grants under this program. In FY 2025, approximately $1.5 billion funded grants

[16] **https://www.fhwa.dot.gov/environment/cfi/grant_recipients/**

under this program. This program includes a provision that 0.5% of a request may be for workforce development training and an additional 0.5% may be for training at the National Transit Institute (NTI). Applicants proposing any project related to zero-emission vehicles are required to spend at least 5% of their award on workforce development and training as outlined in their Zero-Emission Transition Plan, unless the applicant certifies that their financial need is less. There have been several awards in Virginia in recent years of this program including the County of Fairfax, City of Alexandria, Loudoun County, Transportation District Commission of Hampton Roads, and Virginia DRPT.

Transit agencies can apply for funding through the Federal Transit Administration (FTA) website or by contacting the FTA directly. Detailed information and application forms can be found on the FTA website **here**.

National Science Foundation Advanced Technological Education (ATE) Program

The National Science Foundation Advanced Technological Education (ATE) Program will have approximately $74 million in FY 2025 for new and continuing awards with new awards totaling $69 million. This program aims to support partnership between grades 7-12, two-year higher education institutions, industry, and economic development agencies to advance training and workforce development for science and engineering technicians. The ATE program supports curriculum development; professional development of college faculty and secondary school teachers; career pathway development for both students and incumbent workers; and other activities including applied research projects that advance the knowledge base related to technician education. There have been 14 awards in Virginia for this program which can be found **here**.

Transit agencies can access this program and participate in a partnership that applies for funding through the National Science Foundation (NSF) website or by contacting the NSF directly at **ate-prog@nsf.gov**. Detailed information and application forms can be found **here**.

Regional Clean Hydrogen Hubs

The Regional Clean Hydrogen Hubs (H2Hubs) program is a federal initiative that began in 2022. It provides $7 billion for hydrogen research and innovation, aiming to establish regional hydrogen hubs across the United States. This funding is available over several years to support the development of clean hydrogen production, processing, delivery, storage, and end-use.

Detailed information on this program can be found on the DOE website **here**.

Vehicle Technologies Office Program

The Vehicle Technologies Office Program is a federal initiative that began in 2003. In FY 2025, it has up to $88 million available for advanced vehicle research and development, including electric vehicle workforce development. The workforce development topic area targets the development of outreach, awareness, and partnership building efforts including engagement with the local Clean Cities and Communities coalition.

Transit agencies can access this program by applying through the Department of Energy (DOE) website or by contacting the DOE directly. **Download the full funding opportunity** on the Office of Energy Efficiency and Renewable Energy Exchange website.

Collaboration Opportunities
The collaboration opportunities aim to support transit agencies with workforce development efforts associated with the deployment of low- and no-emission transportation solutions.

Transit Workforce Center
Operated by the **International Transportation Learning Center (ITLC)**, the Transit Workforce Center (TWC) is the Federal Transit Administration's national technical assistance center for transit workforce development. TWC supports the workforce development needs of urban, suburban, tribal, and rural public transportation entities across the country.

Transit agencies can contact TWC by email, phone, or through their website to receive **technical assistance** from TWC on a variety of workforce development issues including:

- apprenticeship and mentorship
- recruitment and hiring
- incumbent workforce retention
- training and career advancement
- workforce partnerships
- workforce data and research

Under the Transit Workforce Center, ITLC staff have developed a library of workforce development resources and programs useful to transit agencies strengthening and preparing their technical workforce for the integration of low- and no-emission vehicles into their fleets:

- **Battery Electric Bus (BEB) familiarization course**
- **BEB webinar series**
- **Zero Emission Bus (ZEB) maintenance recommended practice**
- Zero-emission fleet transition plan resources and best practices (see **FTA Resources: Transit Workforce Center**)
- **Apprenticeship frameworks**
- **Apprenticeship funding information**
- **American Transit Training and Apprenticeship Innovators Network**
- **Mentorship metrics**
- **Mentor training**
- Foundational skills curriculum
- **National Transit Frontline Worker Recruitment Toolkit** and career awareness resources
- **Train the Trainer Levels 1 and 2**

Peer State Case Studies

This memo identified five peer states with similar Dillon's Rule[17] policy environment that offer practices for consideration by the Commonwealth and transit agencies as they develop the workforce needed to support the transition to low- and no-emission fleets. Key takeaways highlight lessons learned and leading practices to consider prior to replication. The following peer state case studies are detailed within this section:

- Alabama
- Arkansas
- Nevada
- New Hampshire
- Vermont

Alabama

Alabama has taken significant strides toward developing a robust workforce aimed at supporting its growing EV, hydrogen fuel cell, and related charging infrastructure workforce.

Key Takeaways:

- Alabama's state government has made commitments towards workforce development by clearly articulating priorities and recommendations:
  - Use state innovation funds to launch targeted grants (e.g., Innovate Alabama awarded $150,000 to Trenholm State Community College for development of EV technician training).
- The legislature can provide essential funding for innovative workforce development projects especially when matched by private investment:
  - In 2024, legislators allocated $30 million to establish the EV Technology Center within the Alabama Robotics Technology Park, to offer cutting-edge training in EV assembly, battery technology, and advanced manufacturing techniques in partnership with academic institutions and industry leaders.

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17 "Dillon's Rule" states that local governments (referred to as "the corporation"): [possess] and can exercise the following powers and no others: First, those granted in express words; Second, those necessarily or fairly implied or in incident to the powers expressly granted; Third, those essential to the declared objects and purposes of the corporation, not simply convenient, but indispensable. Any fair, reasonable doubt concerning the existence of the power is resolved by the courts against the corporation, and the power is denied. In situations where the state legislature is unclear, the court's role is to interpret and determine legislative intent. To that end, courts adopt some guiding principles known as "rules of statutory construction." Dillon's Rule is one such principle, used by some state courts in interpreting the authority granted to city governments, when such authority is called into question. It is important to note that the state legislature may legislatively override Dillon's Rule, unless prohibited by the state constitution.
https://www.watersystemscouncil.org/download/wellcare_information_sheets/other_information_sheets/Dillons-Rule.pdf

- Workforce development strategies rely on collaboration between training institutions and industry leaders:
    - Alabama Industrial Development Training (AIDT) oversees the EV Technology Center's training programs, working in tandem with the University of Alabama's Alabama Mobility and Power Center and the Alabama Community College System.

Details

To oversee and continually adapt workforce initiatives in the state, the Lieutenant Governor's Commission on 21st Century Workforce focuses on improving workforce development and training to recruit and retain quality jobs. The Commission annually releases workforce development recommendations which serves as a guide for policy makers[18].

Trenholm State Community College leveraged funding from Innovate Alabama Network to launch targeted programs designed specifically to train individuals for employment within the EV industry, reflecting the state's dedication to sustainable energy transitions and economic growth.[19] The $150,000 grant covers the cost of three EVs for students' hands-on-learning and provides funding for course fees, instructors, textbooks, and the Automotive Service Excellence exam and certification fees for students and community members. Innovate Alabama is the state's first public-private partnership that was established by Governor Ivey that focuses on entrepreneurialism, technology, and innovation.

In 2023, the University of Alabama, and its partners, the University of Georgia and Mississippi State University, were awarded a $1 million NSF Regional Innovative Engines planning grant[20]. This project aims to create a supply chain ecosystem for stakeholders within the EV supply chain to participate in activities related to transportation electrification. A critical activity of this grant is to build capacity to education a capable EV workforce by identifying workforce development activities across the ecosystem[21]. Anticipated outcomes related to workforce development include developing workforce requirements for each community of practice and developing a structure for the National (workforce) Training Center. This planning grant is an essential first step towards potentially becoming an NSF Engine which may include additional investment.

Central to Alabama's workforce development strategy is the establishment of dedicated training facilities, such as the Electric Vehicle Technology Center at Alabama Robotics Technology Park, which represents a substantial $30 million investment into specialized workforce training. This Center is uniquely positioned to enhance the skills of automotive technicians, preparing them specifically for the

[18] **https://ltgov.alabama.gov/lt-governors-commission-on-21st-century-workforce-recommends-historic-transformative-changes/**
[19] **https://innovatealabama.org/stories/2024/06/trenholm-state-uses-innovate-alabama-grant-to-supercharge-alabamas-ev-workforce/**
[20] **https://news.ua.edu/2023/05/ua-led-electric-vehicle-project-wins-initial-national-award/**
[21] **magnet.ua.edu**

technological shifts associated with electric vehicle manufacturing and maintenance[22]. Alabama Industrial Development Training and the Alabama Department of Commerce are working closely together with auto industry leaders to guide the Center's training efforts.

Alabama's strategic participation in regional initiatives, such as the Southeast Hydrogen Hub, demonstrates its recognition of hydrogen as an integral part of its long-term energy and workforce development strategy[23]. The goal of the Southeast Hydrogen Hub is to develop a multi-state energy ecosystem that enables the deployment of green hydrogen as an efficient energy solution for customers and communities. Although this project was not awarded the $1.25 million in federal funds to be matched by private funds, it exhibits the opportunity of partnerships to create quality jobs and build a skilled workforce[24].

Similarly, two Alabama institutions (The University of Huntsville Alabama and Alabama A&M University) are a part of the Hydrogen Education for a Decarbonized Global Economy (H2EDGE), which is supported by the Department of Energy's Hydrogen and Fuel Cell Technology Office and the Low-Carbon Resources Initiative. This effort focuses on developing and training workers for the hydrogen industry through a combination of professional development activities and targeted instruction at the university level[25].

Arkansas

Arkansas has invested in workforce development initiatives designed to strengthen its position in the rapidly evolving EV and hydrogen power sectors. Recognizing the critical need for skilled labor to support these growing industries, the state has strategically directed resources to training and infrastructure projects, enhancing Arkansas' competitive advantage in energy innovation.

Key Takeaways:

- Arkansas' state government has prioritized higher education including the development of grant programs to increase training for in-demand industries including energy and advanced manufacturing:
    - The University of Arkansas Pulaski Technical College is launching an energy grid management program to bridge technology and energy skills gaps, funded by an $88 million HIRED grant.
- Energy projects, such as the Clarksville hydrogen power plant, demonstrate economic impacts and a step towards clean energy solutions for transportation:

[22] **https://www.madeinalabama.com/2024/10/alabama-leaders-kick-off-ev-technology-center-project-to-boost-training/**
[23] **https://www.amazingalabama.com/2022/11/02/major-southeast-utilities-establish-hydrogen-hub/**
[24] **https://www.wunc.org/2023-10-13/u-s-picks-7-clean-hydrogen-hubs-but-passes-over-southeast-bid**
[25] **https://hydrogen.epri.com/en/h2edge.html**

  - Syntex Industries is building Arkansas's first hydrogen power plant, which will generate over 500 megawatts of emission-free energy and create 100 jobs.
- Arkansas has developed a dedicated office with a clear leadership structure to provide coordination and oversight on complex infrastructure issues including workforce development:
  - The Office of the Infrastructure Coordinator is coordinating infrastructure workforce preparation with educational institutions and industry stakeholders.

Details

Like many other states, Arkansas is presently facing a skills gap in technology and energy sectors to support the growth of artificial intelligence and EV infrastructure. To address this gap, the University of Arkansas Pulaski Technical College which is based in North Little Rock is launching an energy grid management training program. This training program will include online coursework, industry certification and continuing education opportunities to meet the needs of the workers and businesses. The program was developed in partnership with major utility providers so that the curriculum reflects work realities[26]. This training program was made possible by the Higher Industry Readiness through Educational Development (HIRED) grant program which started as a result of the Workforce Initiative Act of 2015[27]. Present funding priorities for this $88 million grant program includes Advanced Manufacturing, Energy Infrastructure and Utilities, and Skilled Trades[28]. At the same time, the Arkansas Higher Education Coordination Board is working towards a goal of increasing the number of residents with a post-secondary credential or degree to 55% by 2030.

Additionally, Arkansas has made strides in hydrogen power workforce development through participation in regional partnerships. The HALO Hydrogen Hub, a collaborative initiative involving Arkansas, Louisiana, and Oklahoma, focuses on creating a robust hydrogen economy that includes infrastructure, transportation, and storage of hydrogen, alongside dedicated workforce training to sustain this industry[29]. Although this effort did not receive federal funding, the public-private partnership approach positions Arkansas for future investment opportunities.

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[26] **https://finance.yahoo.com/news/ua-pulaski-tech-launches-online-161200418.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuYmluZy5jb20v&guce_referrer_sig=AQAAANxJnl9Ks41vUa1p7xNk3lV5F1CJ97mu8BQsr9neXeHNDy99UCQGWj3o88fkFh2E0p1nBm9zj3tTSk733CtJkN3jG8Q6nk24ppaK3yDWFLFjeJj2Zs-tl7BwwoSDOfIx5HnaiySVJsOeMqtVT-GUkcpPSHA7XYCU0FS35JB2695R**

[27] **https://arkansasadvocate.com/briefs/arkansas-state-officials-announce-26-million-in-workforce-development-grants/#:~:text=The%20grants%20are%20part%20of%20the%20HIRED%20program%2C,education%20and%20workforce%20training%20programs%2C%20according%20to%20ADHE**.

[28] **https://adhe.edu/File/HIRED%20AR%20Workforce%20Webinar%20Slides.pdf**

[29] **https://www.opportunitylouisiana.gov/key-industry/energy/carbon-reduction/halo-hub**

Further strengthening Arkansas' commitment, a hydrogen power plant project in Clarksville, spearheaded by Syntex Industries, represents the state's first major step toward hydrogen power production. This plant is projected to generate over 500 megawatts of emission-free energy, creating over 100 employment opportunities and providing a solution for clean energy fuel for transportation in Clarksville[30].

To support these specialized initiatives, Arkansas established the Office of the Infrastructure Coordinator, tasked with maximizing the impact of federal infrastructure funding by coordinating infrastructure workforce preparation. The Office collaborates closely with educational institutions and industry stakeholders, aligning workforce training with market needs related to infrastructure[31]. Adding to this, the 2023-2024 Arkansas Energy and Environment Innovation Plan which was supported by the United States Environmental Protection Agency outlines comprehensive strategies for infrastructure training and workforce development[32].

Nevada

Nevada (NV) is expanding workforce development efforts related to EVs and HFCEVs to prepare a skilled workforce to meet industry demands. Strategic investments in the EV and hydrogen sectors are aligned with targeted workforce training initiatives to cultivate a skilled labor force for future industry growth.

Key Takeaways:

- Nevada is fostering collaborative public-private partnerships to rapidly develop and deploy workforce education programs that are directly tied to charging infrastructure workforce development:
    - NV Energy is collaborating with the Northern Nevada Electric Joint Apprentice and Training Committee and the Electrical Joint Apprentice and Training Center of Southern Nevada to enhance their existing Electric Vehicle Infrastructure Training Program.
- Nevada's Governor's Office of Economic Development (GOED) is working with other state agencies to invest in workforce training programs to support the clean energy sector:
    - Through the Workforce Innovations for the New Nevada program, GOED has allocated over $17 million to develop training opportunities for emerging industries including advanced manufacturing and technology.
- Nevada's hydrogen power initiatives are creating significant employment opportunities and advancing clean energy capacity:
    - The state hosts one of the country's largest hydrogen production facilities, the Air Liquide hydrogen plant, capable of producing 30 tons per day of clean hydrogen, positioning Nevada at the forefront of hydrogen production.

Details

[30] **https://www.5newsonline.com/article/news/local/clarksville-syntex-build-hydrogen-power-plant/527-67aae833-017a-4fa3-a17e-84a3df7047b3**
[31] **https://www.dfa.arkansas.gov/infrastructure/**
[32] **https://www.epa.gov/system/files/documents/2024-03/5d-02f35201-pcap-arkansas-eei-plan.pdf**

To prepare Nevada's electrical workforce for expansions in EV infrastructure, NV Energy has collaborated with the Northern Nevada Electric Joint Apprentice and Training Committee and the Electrical Joint Apprentice and Training Center of Southern Nevada to bolster their existing Electric Vehicle Infrastructure Training Program. These partnerships aim to enhance recruitment efforts and eliminate barriers to entry for individuals from historically underserved communities, thereby increasing access to clean energy jobs[33]. This program was made possible by Nevada's Transportation Electrification Plan (TEP) which was adopted by the Nevada Legislature in 2021 and approved in part in 2023 by the Public Utilities Commission of Nevada. Through the TEP, NV Energy will invest nearly $70 million to expand EV charging infrastructure across Nevada[34].

Furthermore, the Greenlane EV Charging Corridor—a joint venture between NV Energy, BlackRock, and other private partners—is another example of Nevada's commitment to enhancing EV infrastructure[35]. This 280-mile commercial charging corridor connecting Las Vegas to Los Angeles. The installation and long-term maintenance of this charging infrastructure may also warrant future investment in workforce development and training.

Nevada's Governor's Office of Economic Development (GOED) is collaborating with other state entities including the Nevada system of Higher Education, the Governor's Office of Workforce Innovation, the Department of Employment, Training and Rehabilitation, and the Nevada Department of Education to cultivate a skilled workforce for local businesses. Through the Workforce Innovations for the New Nevada program, GOED has allocated over $17 million to develop training opportunities at institutions for emerging sectors such as advanced manufacturing and technology[36]. These efforts focus on targeted skill areas, such as battery manufacturing, which are essential for companies operating in the state like Tesla.

Nevada has also seen private investment in the hydrogen sector in recent years. In 2022, the country's largest hydrogen production facility, the Air Liquide hydrogen plant, opened in North Las Vegas. This facility produces 30 tons of liquid hydrogen per day and is powered by fully renewable electricity. This project can provide enough clean hydrogen energy for 40,000 fuel cell vehicles[37]. Moreover, the clean hydrogen produced can be utilized by transit agencies to power hydrogen fuel cell buses, contributing to the state's efforts to develop sustainable and environmentally friendly public transportation systems.

In line with this, Nevada's public transportation sector has begun integrating hydrogen fuel cell electric buses into its fleets. To date, the Southern Nevada Regional Transportation Commission (RTC) has been awarded over $16 million in

[33] **https://www.nvenergy.com/cleanenergy/tep-economic-impact-and-workforce**
[34] **https://www.nvenergy.com/cleanenergy/transportation-electrification-plan**
[35] **https://electrek.co/2024/03/27/greenlane-announces-la-to-lv-charging-corridor-for-commercial-trucks/**
[36] **https://goed.nv.gov/programs/winn/**
[37] **https://usa.airliquide.com/air-liquide-inaugurates-us-its-largest-liquid-hydrogen-production-facility-world**

federal funding for hydrogen fuel cell buses and the necessary fueling infrastructure. In 2021, the Washoe County RTC received a $6.8 million federal grant to purchase two hydrogen fuel cell buses and build a fueling station. In 2023, the Commission received an additional $8.8 million in federal funds to acquire six more buses and expand its fueling station[38]. These efforts mark a step towards sustainable mobility, requiring extensive workforce training programs in hydrogen safety, vehicle maintenance, and advanced fueling technologies, further stimulating local workforce development efforts to meet this demand.

Nevada's State Energy Program-Energy Workforce Development initiative reflects a targeted investment of over $2 million designed to develop comprehensive, equitable, and community-focused clean energy training programs. This initiative is overseen by the Governor's Office of Energy (GOE) in response to rising workforce demand for energy efficiency jobs. GOE is addressing several challenges through this initiative, including staffing shortages in the skilled labor industry, the development and expansion of educational pathways, and essential recruitment and retention efforts[39].

New Hampshire

New Hampshire's approach to workforce development integrates targeted funding with collaborative partnerships to position the state to meet future energy demands.

Key Takeaways:

- Federal grants are being utilized to fund education and training efforts to support New Hampshire's growing network of EV infrastructure:
  - The $15 million "Next Level NH" initiative is supported by the Federal Highway Administration's Charging and Fueling Infrastructure (CFI) Discretionary Grant Program and supports EV Basic-Training Bootcamp.
- New Hampshire has landed hydrogen power investments to advance renewable energy and create job opportunities due to a streamlined policy and regulatory environment:
  - Q Hydrogen in Groveton is a hydrogen plant that is using a new method to produce hydrogen while creating new hydrogen-focused jobs in hydrogen technology and plant operations.
- Public-private partnerships are being leveraged to develop a skilled workforce to meet the demands of the clean energy sector.
  - Clean Energy NH facilitates training programs and education efforts in collaboration with municipalities and businesses.

Details

On May 30, 2018, New Hampshire passed Senate Bill 517 (SB 517), creating the Electric Vehicle Charging Stations Infrastructure Commission to recommend policies and programs for zero emission vehicles. The Commission met from August 24, 2018, through October 30, 2020, producing two annual reports with their activities,

[38] **https://thenevadaindependent.com/article/overshadowed-by-electrification-push-hydrogen-gains-steam-in-nevada-public-transportation**
[39] **https://energy.nv.gov/Programs/Workforce_Development/**

findings, and legislative recommendations. Although the Commission expired on November 1, 2020, its reports continue to guide ongoing electric vehicle initiatives in the state[40].

In January 2025, the Federal Highway Administration's Charging and Fueling Infrastructure (CFI) Discretionary Grant Program awarded New Hampshire $15 million for the "Next Level NH" program, focusing on deploying publicly accessible EV charging infrastructure across urban, suburban, and rural areas[41]. The "Next Level NH" initiative aims to support two key efforts which are underway: a Technical Assistance Provider Network and an EV Basic-Training Bootcamp.

NH Saves, a collaboration of New Hampshire's electric and natural gas utilities, has recently prioritized assessing the state's energy workforce supply and demand. The 2024-2026 New Hampshire Statewide Energy Efficiency Plan which was submitted to the New Hampshire Public Utilities Commission includes several specific actions that NH utilities are taking to address workforce development needs. These initiatives include expanding high school education to highlight energy career opportunities, hosting technical trainings to fill skill gaps and support workers' career growth, and coordinating with state agencies to seek external funding for workforce needs[42].

In the hydrogen sector, New Hampshire has made progress through new investments, such as the Q Hydrogen in Groveton. Q Hydrogen plans to commercialize a unique method of producing hydrogen gas, which is not used elsewhere. Q Hydrogen leadership specifically cited the streamlined regulatory process in New Hampshire and the collaboration between regulators and politicians as key reasons for locating the power plant in the state. This hydrogen plant signifies substantial investment in renewable energy technology and workforce development, creating job opportunities focused on hydrogen technology and plant operations[43].

Supporting these strategic initiatives, Clean Energy NH, a membership-based non-profit, is leading New Hampshire's clean energy transition. This organization is a collaboration between individuals, businesses, and municipalities and serves as an advisor on state energy policy. Clean Energy NH facilitates technical assistance and education to address the specific workforce needs of New Hampshire's clean energy sector, ensuring alignment with industry demands[44].

[40] **https://www.des.nh.gov/climate-and-sustainability/transportation/alternative-fuel-and-electric-vehicles**
[41] **https://www.dot.nh.gov/news-and-media/new-hampshire-granted-15m-electric-vehicle-charging-infrastructure**
[42] **https://www.puc.nh.gov/Regulatory/Docketbk/2023/23-068/INITIAL%20FILING%20-%20PETITION/23-068_2023-06-30_NH_UTILITIES_EE-TRIENNAIL-PLAN.PDF**
[43] **https://www.nhbr.com/q-hydrogen-creating-a-worlds-first-in-new-hampshires-north-country/**
[44] **https://www.cleanenergynh.org/**

Vermont

Vermont is taking steps toward creating a robust workforce capable of supporting its growing electric vehicle infrastructure and preparing for future hydrogen energy developments.

Key Takeaways:

- In the last decade, Vermont has made investments in EV charging infrastructure, becoming a national leader in EV charging stations per capita:
  - Since 2014, Vermont has invested over $3.5 million to install public EV charging stations across all 14 counties, including 41 fast charging stations and 89 Level 2 charging stations.
- Vermont has several goals that aim to electrify transit fleets, reduce greenhouse gas emissions, and achieve energy independence which will require future investments in workforce development:
  - By 2050, Vermont aims to transition its fleet of approximately 400 transit vehicles to no-emission vehicles and meet 90% of energy needs from renewable sources, as mandated by the 2020 Global Warming Solutions Act.
- Vermont is enhancing its training capacity to meet workforce demands related to EVs and HFCEVs.
  - Vermont Technical College offers an Advanced Technology Vehicle course which introduces the design, operation and servicing of electric, hybrid, alternative fuel, and fuel cell vehicles.

Details

Since 2014, the State of Vermont has made strides in developing its EV charging infrastructure. With an investment of over $3.5 million, Vermont has installed public EV charging stations across all 14 counties, including 41 fast charging stations and 89 Level 2 charging stations. These efforts have positioned Vermont as a leader in EV charging stations per capita, with 114 public charging stations per 100,000 people[45]. One success story was able to address a key barrier to installing EV chargers – the availability of workers. Hazen Converse of Essential Energy Solutions and Memphremagog Rentals were awarded $28,360 to install one dual port level 2 charging stations in 2024. Hazen Converse is planning next steps to advancing the project, which involves providing training for the future workforce in skilled trades. He is looking into opportunities to offer career training and education in Renewable Energy and Electrical Systems at the high school career and technical center where he teaches[46].

The Vermont Agency of Transportation (VTrans) has made a policy decision to transition the state's entire fleet of approximately 400 transit vehicles across seven

[45] **https://accd.vermont.gov/community-development/funding-incentives/electric-vehicle-supply-equipment-evse-grant-program**

[46] **https://outside.vermont.gov/agency/ACCD/ACCD_Web_Docs/CD/CPR/Success-Stories/CPR-EVSE-Newport-Memphre-Rentals-Case-Study.pdf?_gl=1*1g9cozm*_ga*Mjc4NjIzNTc0LjE3NDI5NDg3MjM.*_ga_V9WQH77KLW*MTc0Mjk0ODcyMi4xLjEuMTc0Mjk0ODgwMi4wLjAuMA..**

transit agencies to no-emission vehicles by 2050[47]. This is in line with the 2020 Global Warming Solutions Act which created a legally binding emission reduction requirement. This act requires Vermont to reduce greenhouse gas emission to 75% below 1990 levels by 2050[48]. Furthermore, Vermont's goal is to meet 90% of energy needs from renewable sources by 2050. Although there have not been monumental investments in workforce and training to prepare for this transition, VTrans' Electrification of Vermont's Public Transit Fleet plan does include a scan of workforce and training needs. The Plan cites working with manufacturers to provide as much training as possible for operators, maintenance crews, and first responders. Drive Electric Vermont, a public-private partnership, plays a crucial role in promoting EV adoption and infrastructure development across the state[49]. The program offers financial incentives for EV purchases, conducts educational campaigns, provides technical assistance for installing charging stations, and advocates for supportive policies. Founded in 2012 by the Vermont Energy Investment Corporation (VEIC), Drive Electric Vermont collaborates with over 100 local organizations, including utilities, state agencies, regional planning commissions, businesses, nonprofits, and foundations to advance transportation electrification. One key pillar of Drive Electric Vermont's work is education and outreach. Drive Electric Vermont offers online resources and supports events to promote awareness and understanding of EV technologies.

Additionally, the Vermont Department of Housing and Community Development provides grants of up to $100,000 to support the installation of Level 1 and Level 2 electric vehicle chargers at workplaces[50]. Eligible applicants for these grants include government agencies, businesses, and non-profit organizations. This program can be used to expand the prevalence of charging infrastructure and accessibility for training institutions and transit agencies.

In 2023, Vermont, along with the States of New York, New Jersey, Maine, Rhode Island, Connecticut, and the Commonwealth of Massachusetts announced the submission of the group's proposal for a Northeast Regional Clean Hydrogen Hub to the U.S. Department of Energy to compete for a $1.25 billion share of the $8 billion in federal hydrogen hub funding available as part of the Infrastructure Investment and Jobs Act[51]. Although this effort did not receive federal funding, the public-private partnership approach positions Vermont for future investment opportunities.

Vermont is enhancing its training capacity to meet the demands of the evolving EV and HFCEV job market. For example, Vermont Technical College which is a part of

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47 **https://legislature.vermont.gov/Documents/2022/WorkGroups/Senate%20Transportation/Zero%20Fare%20Public%20Transit/Witness%20Documents/W~Ross%20MacDonald~VTRANS%20Zero-Emission%20Transit%20Plan-%20Executive%20Summary~1-6-2022.pdf**

48 **https://publicservice.vermont.gov/publicservice/about-us/publications-and-resources/energy-resources/total-energy-study**

49 **https://www.driveelectricvt.com/about-us**

50 **https://afdc.energy.gov/laws/13259**

51 **https://www.governor.ny.gov/news/seven-states-northeast-regional-clean-hydrogen-hub-announce-submission-362-billion-proposal-us**

Vermont State University offers an Advanced Technology Vehicle course which introduces the design operation and servicing of electric, hybrid, alternative fuel, and fuel cell vehicles.

Policy Considerations

Based on the case studies from peer states, Virginia can consider the following lessons learned and leading practices to have direct, measurable impacts on EV, HFCEV, and related charging infrastructure workforce development:

- **Increasing Incentives for Energy Investments:** Virginia can encourage greater private-sector participation by expanding grant programs and other incentives to expand the market, infrastructure, and required workforce.
    - Policy makers can consider additional opportunities for energy investment.
    - Transit agencies can engage in public-private partnership to be eligible for energy investment opportunities which may include workforce development allowances.
- **Strengthening Industry-Education Collaboration:** Establishing advisory councils comprised of industry, academic, and government representatives can help maintain cutting-edge curricula and anticipate future workforce demands.
    - Policy makers can consider setting up these partnerships to advise on workforce development such as Alabama's Lieutenant Governor's Commission on 21st Century and New Hampshire's Electric Vehicle Charging Stations Infrastructure Commission.
    - Transit agencies can develop a relationship with local educational institutions including community colleges and technical school to discuss new curriculum offerings that meets workforce demand.
- **Prioritize Skill Development Initiatives:** Virginia can further support skill development for in-demand jobs and encouraging earn-and-learn opportunities for workers to gain new skills such as Registered Apprenticeships.
    - Policy makers can continue to invest in earn and learn opportunities such as Registered Apprenticeships especially for workers that are essential for the deployment of low- and no-emission vehicles.
    - Transit agencies can leverage several resources such as DRPT's Workforce Development Program to build and expand Registered Apprenticeship opportunities.
- **Fostering Regional Partnerships:** Coordinating with neighboring states on workforce initiatives can enhance resource sharing, align training standards, and open new funding opportunities.
    - Policy makers can encourage regional partnerships by convening nearby states to discuss the development of a broader supply chain according to the model set forth by Alabama's NSF Regional Innovation Planning Grant.
    - Transit agencies near Virginia's borders can conduct site visits with out-of-state transit agencies to discuss lessons learned and leading practices related to workforce development.

- **Expanding Workforce Development State-wide:** Expanding training access to all Virginia communities including rural areas will expand access to workers skilled for EV, HFCEV, and related charging infrastructure industries.
    - Policy makers can prioritize investments in areas with low educational capacity for EVs, HFCEVs, and related charging infrastructure.
    - Transit agencies which may be having issues with filling roles associated with the deployment of low- and no-emission vehicles can discuss these needs with the local workforce development system to see what assistance may be available.

In general, Dillon's Rule states including Virginia may have less of an ability to enact programs without enabling legislation from the general assembly and governor approvals. However, this may be less of a factor for transit agencies in Virginia than the ability to access federal formula funding or grants for clean transportation solutions and workforce development efforts. What will be important for transit agencies to deploy low- and no-emission vehicles as well as engage in complementary workforce efforts is the ability to access debt financing to reduce the high costs associated with equipment and facility capital expense.

Conclusion

This technical memo of Virginia's educational capacity, workforce supply and demand, and investment opportunities related to EVs, HFCEVs, and associated infrastructure reveals insights for transit agencies and policymakers. The inventory of educational institutions across Virginia provides a comprehensive list of training programs and interview feedback on the further development of additional educational capacity, though challenges such as funding constraints, high equipment costs, and a shortage of qualified instructors must be addressed. The analysis of employee and training demand highlights trends and identifies gaps in workforce supply, emphasizing the need for upskilling current workers and aligning training with employee demand. Additionally, the list of investment and collaboration opportunities at local, state, federal, and national levels offers resources for transit agencies' workforce development efforts, with peer state case studies providing valuable examples for policy makers. This technical memo emphasizes the importance of fostering regional partnerships and strengthening industry-education collaboration to build a future-ready workforce. By addressing challenges and leveraging regional strengths, Virginia can effectively prepare its workforce for the evolving workforce demands related to EV, HFCEV, and associated charging infrastructure, supporting the deployment of low- and no-emission vehicles.

Appendix

Inventory Table

Legend:

Yes	The workforce group program is related to EVs, HFCEVs, and related charging infrastructure.
Potential	The workforce group program is not related to EVs, HFCEVs, or related charging infrastructure but has the potential to include related curriculum in the future.
No or N/A	The workforce group program is not present.

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Advanced Technology Institute	5700 Southern Blvd Ste 100, Virginia Beach, Virginia 23462	2-year, Private for-profit	Programs in Automotive Technology (including Hybrid Engines), Commercial Driving, Diesel Mechanic Training, Electrical Systems Training, Industrial Maintenance, and Welding curriculum. Has education partnerships with Audi, GM, and Ford.	No	Potential	Yes	Potential	N/A	Potential
American National University	1813 East Main Street, Salem, Virginia 24153	4-year, primarily associate's, Private for-profit	Business	No	N/A	N/A	N/A	N/A	Potential
Averett University	420 W Main St, Danville, Virginia 24541	4-year, Private not-for-profit	Programs in Business, Chemistry, Education, and Human Resource Management.	No	N/A	N/A	N/A	Potential	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Axle Mobility	N/A	< 2-year, Private for-profit	Free electric limited vehicle training for technicians and fleets to learn more about electric vehicle systems, safety, and to prepare for introductory ASE certifications.	Yes	N/A	Yes	N/A	N/A	N/A
Bluefield University	3000 College Avenue, Bluefield, Virginia 24605	4-year, Private not-for-profit	Programs in Business, Chemistry, and Education.	No	N/A	N/A	N/A	Potential	Potential
Blue Ridge Community College	One College Lane, Weyers Cave, Virginia 24486-0080	2-year, Public	Programs in Business, Management, Advanced Manufacturing Technology, Automotive Analysis and Repair, Engineering and Engineering Technology, Welding and CDL.	No	Potential	Potential	Potential	N/A	Potential
Bridgewater College	402 E College St, Bridgewater, Virginia 22812-1599	4-year, Private not-for-profit	Programs in Business, Chemistry, and Human Resources Management.	No	N/A	N/A	N/A	Potential	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Brightpoint Community College	13101 Route 1, Chester, Virginia 23831-5316	2-year, Public	Programs in Business, Electrical Engineering Technology, Electricity, Energy Technology, Industrial Electricity, Industrial Maintenance, Mechanical Engineering, Science, and Welding. Brightpoint also has an Apprenticeship Academy for Electricity, Industrial Electricity, Industrial Maintenance, and Welding. Brightpoint also offers short-term credentials via a partnership with Community College Workforce Alliance (CCWA) for in-demand jobs including a CDL.	No	Potential	Potential	Potential	N/A	Potential
Bryant & Stratton College-Hampton	5030 Kilgore Ave, Hampton, Virginia 23666-2198	4-year, Private not-for-profit	Programs in Business and Human Resources Management.	No	N/A	N/A	N/A	N/A	Potential
Bryant & Stratton College-Richmond	8141 Hull St Rd, North Chesterfield, Virginia 23235	4-year, Private not-for-profit	Programs in Business and Human Resources Management.	No	N/A	N/A	N/A	N/A	Potential
Bryant & Stratton College-Virginia Beach	301 Centre Pointe Dr, Virginia Beach, Virginia 23462	4-year, primarily associate's, Private not-for-profit	Programs in Business and Human Resources Management.	No	N/A	N/A	N/A	N/A	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Central Virginia Community College	3506 Wards Rd, Lynchburg, Virginia 24502-2498	2-year, Public	Programs in Business, Human Resource Management, Education, Electrical Technology, Engineering, Industrial Maintenance, Mechatronics, and Welding. Offers an NCCER Electrical program, CDL training, and an Electric Vehicle Fundamentals Course. CVCC Workforce Solutions has a Corporate Training Department that offers customized training solutions including apprenticeship and certification programs to help area businesses thrive.	No	Potential	Yes	Potential	N/A	Potential
Centura College-Chesapeake	932 Ventures Way, Chesapeake, Virginia 23320	4-year, primarily associate's, Private for-profit	Business	No	N/A	N/A	N/A	N/A	Potential
Centura College-Newport News	616 Denbigh Blvd., Newport News, Virginia 23608	< 2-year, Private for-profit	Offers a Combination Welding diploma.	No	Potential	N/A	N/A	N/A	N/A
CET-Alexandria	6295 Edsall Rd, Plaza 500, Ste. 220, Alexandria, Virginia 22312	< 2-year, Private not-for-profit	Building/Property Maintenance	No	N/A	N/A	N/A	N/A	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
ChargePoint University	N/A	Industry Recognized Credential	Programs with AC and DC equipment certifications and microcredential specific to ChargePoint products.	Yes	N/A	N/A	Yes	N/A	N/A
Charger Help	N/A	Industry Recognized Credential	Courses in EVSE maintenance and repair in preparation for Part One of the SAE EVSE Certification Exam. Courses are taught by master trainers certified in other fields such as Tesla, Tritium, and Siemens, and the program itself works with SAE.	Yes	N/A	N/A	Yes	N/A	N/A
Christopher Newport University	One Avenue of the Arts, Newport News, VA 23606	4-year, Public	Programs in Business, Teaching, Chemistry, and Electrical Engineering.	No	N/A	N/A	Potential	Potential	Potential
Charlottesville Area Technical Education Center	1000 East Rio Road Charlottesville, VA 22901	Registered Apprentice-ship	Offers an Electrical Registered Apprenticeship.	No	N/A	N/A	Potential	N/A	N/A
Columbia College	8620 Westwood Center Drive, Vienna, Virginia 22182	2-year, Private for-profit	Business	No	N/A	N/A	N/A	N/A	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Danville Community College	1008 S Main St, Danville, Virginia 24541-4004	2-year, Public	Programs in Business, Welding, Technical Studies Industrial Technician - Electrical and Mechanical Engineering, Automotive Analysis and Repair, Electrical and Electronic Concepts, Industrial Electronic and Electrical Principles, and Electrical/Electronic Engineering Technology. DCC also offers Advanced Manufacturing & Skilled Trades Workforce Training including NCCER Industrial Maintenance Electrical and Instrumentation, NCCER Electrical, Electrical Tradesman License Renewal, and Welding.	No	Potential	Potential	Potential	N/A	Potential
DeVry University-Virginia	1400 Crystal Dr, Ste 120, Arlington, VA 22202 703-414-4000	4-year, primarily associate's, Private for-profit	Programs in Business, Engineering Technology, and Human Resources Management. DeVry also offers workforce expansion solutions to support upskilling, reskilling or talent acquisition needs.	No	N/A	N/A	Yes	N/A	Potential
Eastern Mennonite University	1200 Park Rd Harrisonburg, VA 22802-2462	4-year, Private not-for-profit	Programs in Business, Chemistry, Education, Human Resources Management, and Mechanical Engineering.	No	Potential	N/A	N/A	Potential	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Eastern Shore Community College	29316 Lankford Hwy, Melfa, Virginia 23410	2-year, Public	Programs in Automotive, Business, NCCER Electrical, Electricity-Electrician, Electronics Technology, Industrial Technology, and Welding. The Automotive Trainee, Career Studies Certificate is offered in partnership with Accomack County Public School. Graduates of the Automotive Trainee course can transfer to Tidewater Community College and complete an associate degree. The CDL training is offered in partnership with Virginia DMV as part of the FastForward short-term industry recognized license or credential program.	No	Potential	Potential	Potential	N/A	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
ECPI University	5555 Greenwich Rd, Virginia Beach, Virginia 23462	4-year, primarily associate's, Private for-profit	Programs in Business, Human Resources Management, Mechatronics, Electronics Engineering, Mechanical Engineering, Electronics Engineering Technology, and Mechanical Engineering Technology. Many of these programs of study are also offered online. Has several locations, all have technology programs - Virginia Beach, Newport News, Northern Virginia, Richmond, and Roanoke.	No	Potential	N/A	Potential	N/A	Potential
Edtunity	852 Tidewater Dr. Suite D Norfolk, VA 23504	Public Vocational-Educational Facility	Free microtrack course for Veterans on Electric Vehicle Technician Operations & Maintenance (ETAi Certification) Electric Vehicle Technician: Credential: Level 1 (EVTC).	Yes	N/A	Yes	Yes	N/A	N/A
Electric Cooperative Training Center in Palmyra, Va.	1293 Salem Church Road, Palmyra, VA 22963	< 2-year, Private not for-profit	Safety, Training, and Education Services supporting rural electric cooperative members and staff through safety, training, and educational opportunities, including electric vehicle charging.	No	N/A	N/A	Yes	N/A	N/A

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Electric Vehicle Infrastructure Training Program (EVITP)	811 N. Main Street, Suite 202, Royal Oak, MI 48067	< 2-year, Private not for-profit	Provides training and certification for electricians and contractors to install and maintain EV charging infrastructure. This program has trained 34 contractors in Virginia, including multistate vendors.	Yes	N/A	N/A	Yes	N/A	N/A
Emory & Henry University	P.O. Box 947 Emory, Va. 24327	4-year, Private not-for-profit	Programs in Business, Chemistry, Pre-Engineering, and Engineering Science.	No	Potential	N/A	Potential	Potential	Potential
Fairfax ACE Program	7510 Lisle Avenue, Falls Church, VA 22043	Registered Apprentices hip	Offers a Registered Apprenticeship in Electrical.	No	N/A	N/A	Potential	N/A	N/A
Ferrum College	215 Ferrum Mountain Road, Ferrum, Virginia 24088-9000	4-year, Private not-for-profit	Programs in Business, Chemistry, and Education.	No	N/A	N/A	N/A	Potential	Potential
Flipp Inc.	16890 Oak St, Dillwyn, VA 23936	Public Vocational-Educational Facility	Grant-based programs related to workforce development of the previously incarcerated, with interest in EVSE and EV training programs.	No	Potential	Potential	Potential	N/A	N/A
Ford Automotive Student Service Educational Training (ASSET)	Ford Motor Company, World Head-quarters, 1 American Road, Dearborn, MI 48126	Employer-Sponsored Program	A two-year program that combines classroom learning with hands-on experience at a Ford or Lincoln dealership. It is available at select community colleges and technical schools including Tidewater Community College.	No	N/A	Potential	N/A	N/A	N/A

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
General Motors Automotive Service Educational Program (ASEP)	General Motors, 100 Renaissance Center, Detroit, MI 48243	Employer-Sponsored Program	Provides students with the skills needed to work as service technicians at GM dealerships. The program includes classroom instruction and hands-on training. One location in Virginia: Northern Virginia Community College	No	N/A	Potential	N/A	N/A	N/A
George Brown College	N/A	4-year, Public	The Electric Vehicle (EV) Technician training program equips automotive service technicians and electricians with the skills to diagnose, service, and repair high-voltage EVs and charging stations.	No	N/A	Yes	Yes	N/A	N/A
George Mason University	4400 University Dr, Fairfax, Virginia 22030-4444	4-year, Public	Programs in Business, Chemistry, Education, Electrical Engineering, Mechanical Engineering, and Public Policy.	No	Potential	N/A	Potential	Potential	Potential
Germanna Community College	2130 Germanna Hwy, Locust Grove, Virginia 22508-2102	2-year, Public	Programs in Automotive Diagnostician, Automotive Technician, Business, Chemistry, CDL, Electrical Engineering, Electrician, Industrial Maintenance, Mechanical Engineering, Technology in Mechatronics, and Welder.	No	Potential	Potential	Potential	Potential	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Goodwill	6301 Midlothian Turnpike, Richmond, VA 23225	< 2-year, Private not for-profit	The Goodwill Career and Technical Academy has programs for Electrical Helpers and offers CDL certification. Launched EV programs in partnership with Accenture in Georgia in 2024 and may expand to Virginia.	No	N/A	N/A	Potential	N/A	Potential
Hampden-Sydney College	Hampden-Sydney, VA 23943	4-year, Private not-for-profit	Chemistry	No	N/A	N/A	N/A	Potential	N/A
Hampton University	200 William R. Harvey Way, Hampton, Virginia 23668-0099	4-year, Private not-for-profit	Programs in Chemistry, Business, Chemical Engineering, Education, Electrical Engineering, Human Resources Management, and Public Administration.	No	N/A	N/A	Potential	Potential	Potential
Hollins University	7916 Williamson Rd NW, Roanoke, Virginia 24020	4-year, Private not-for-profit	Programs in Business, Chemistry, and Education.	No	N/A	N/A	N/A	Potential	Potential
IBEW 26 Training	7016 Infantry Ridge Rd, Manassas, VA 20109	Registered Apprentice-ship	5-year training program, including a minimum 8,000 hours of on-the-job training in the electrical construction industry with the supervision of a journeyman electrician.	No	N/A	N/A	Potential	N/A	N/A

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
ITC Learning	N/A	Career and Technical Education	Offers courses and certifications ranging from mechanical engineering to EVSE technicians. The Electric Vehicle Skills Training combines the basics of EVs and EVSEs with specifics of EVSE.	No	Potential	Yes	Yes	N/A	N/A
James Madison University	800 South Main Street, Harrisonburg, Virginia 22807	4-year, Public	Programs in Business, Chemistry, Education, Electro-Mechanical Systems Engineering, and Public Administration. Energy workforce programs and certificates possible through Center for Advancement of Sustainable Energy and Virginia Clean Cities.	No	Potential	N/A	Potential	Potential	Potential
Laurel Ridge Community College	173 Skirmisher Lane, Middletown, Virginia 22645	2-year, Public	Programs in Business Administration, Electronics, Electrical Apprenticeship/ Journeyman/ Licensure, Mechanical Engineering, Mechatronics, CDL, and Welding.	No	Potential	N/A	Potential	N/A	Potential
Liberty University	1971 University Blvd, Lynchburg, Virginia 24515	4-year, Private not-for-profit	Programs in Business, Education, Electrical Engineering, Chemistry, Mechanical Engineering, Industrial Engineering Technology, Industrial & Systems Engineering, Public Administration, and Public Policy.	No	Potential	N/A	Potential	Potential	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Longwood University	201 High St, Farmville, Virginia 23909	4-year, Public	Programs in Business Administration and Management, Education, and Chemistry.	No	N/A	N/A	N/A	Potential	Potential
Louisa County Public Schools	815 Davis Highway Mineral, VA 23117	Career and Technical Education	Pilot EV Charging Curriculum includes Level Setting & Alignment, Electric Vehicle Ecosystem, EV General Overview, EV History, How EVs Work, Introduction to EV Charging Stations, Unpacking the EV Driver Experience, The Charging Process, The Network Providers Role, EV Charging Station Basics, Safe & Healthy Workplace, Charging Speeds, EVSE Customer Interface Faults, Troubleshooting Common Issues, Station Swap Out, Service Call, and Communication Excellence.	Yes	N/A	N/A	Yes	N/A	N/A
Massanutten Technical Center	325 Pleasant Valley Rd, Harrisonburg, VA 22801-9728	Registered Apprentice-ship	Offers Registered Apprenticeships in Electrical, Industrial Maintenance, Welding and Manufacturing.	No	Potential	N/A	Potential	N/A	N/A
Mary Baldwin University	318 Prospect Street, Staunton, Virginia 24401	4-year, Private not-for-profit	Programs in Business Administration and Management, Chemistry, Education, and Human Resources Management.	No	N/A	N/A	N/A	Potential	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Marymount University	2807 N Glebe Rd, Arlington, Virginia 22207-4299	4-year, Private not-for-profit	Programs in Business, Chemistry, Education, and Mechanical Engineering.	No	Potential	N/A	N/A	Potential	Potential
Mountain Empire Community College	3441 Mountain Empire Road, Big Stone Gap, Virginia 24219	2-year, Public	Programs in Business, Electricity, Electrical Fabricator, Mechatronics Technology, Energy Technology with Electrical Emphasis, Industrial Maintenance and Welding. Workforce solution programs include CDL. MECC's Center for Workforce and Innovation of Appalachia designs timely, customized training programs to address the ever-changing opportunities and challenges faced by employers.	No	Potential	N/A	Potential	N/A	Potential
Mountain Gateway Community College	1000 College Drive, Clifton Forge, Virginia 24422-1000	2-year, Public	Programs in Business, Basic Electronics and Electrical Troubleshooting, CDL, Electrical and Instrumentation Technology, Electrical Wiring, Welding, Industrial Maintenance Mechanic, Practical Electrical Technician.	No	Potential	N/A	Potential	N/A	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
National Institute for Automotive Service Excellence (ASE)	1503 Edwards Ferry Road NE, Suite 401, Leesburg, VA 20176	Industry recognized credential	Offers certification programs for automotive technicians, including those specializing in hybrid and electric vehicles.	Yes	N/A	Yes	N/A	N/A	N/A
National Energy Education Development Program	8408 Kao Circle, Manassas, VA 20110	Youth Education Program	Provides educators with curriculum resources in the science of energy, electricity, transportation and career and workforce development. All education resources are free.	Yes	N/A	Yes	N/A	N/A	N/A
New Horizon Regional Education Centers	520 Butler Farm Road Hampton, VA 23666	Registered Apprentice-ship	The Center for Apprenticeship & Adult Training offers programs in Automotive Technology, Electrical, and Welding.	No	Potential	Potential	Potential	N/A	N/A
New River Community College	5251 College Drive, Dublin, Virginia 24084-3660	2-year, Public	Has programs in Business, Engineering, Electrical Engineering Technology, Electronics Technology, Automotive Analysis and Repair, Welding Technology, Advanced Manufacturing, Applied Mechatronics, Electricity, Industrial Maintenance, Mechatronics Fundamentals, Practical Electrical Energy Technician, Practical Electrical Technician, and CDL.	No	Potential	Yes	Potential	N/A	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Norfolk State University	700 Park Avenue, Norfolk, Virginia 23504-8000	4-year, Public	Programs in Business, Chemistry, and Electrical and Electronics Engineering. A new workforce development training program at NSU's Virginia Beach Higher Education Center will soon be launched focused on EV charging infrastructure installation.	No	N/A	N/A	Yes	Potential	Potential
Norfolk Technical Center	1330 North Military Highway Norfolk, Virginia 23502	Career and Technical Education	Programs in Automotive Technology, Welding Technology, and Engineering Technology.	No	Potential	Potential	N/A	N/A	N/A
Northern Virginia Community College (NOVA)	4001 Wakefield Chapel Rd, Annandale, Virginia 22003-3796	2-year, Public	Programs in Automotive Technology including an Electric, Hybrid, and Autonomous Vehicles Career Studies Certificate, Hybrid EV Technology, Business, Public Administration, Engineering, and Engineering Technology. Workforce and Professional programs include CDL.	No	Potential	Yes	Potential	N/A	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Old Dominion University	5115 Hampton Blvd, Norfolk, Virginia 23529	4-year, Public	Programs in Advanced Engineering and Energy Systems, Business, Chemistry, Education, Electrical and Computer Engineering, Electrical Engineering, Electrical Engineering Technology, Energy Engineering, Manufacturing Engineering Technology, Mechanical Engineering, Mechanical Engineering Technology, and Public Administration and Policy.	No	Potential	N/A	Potential	Potential	Potential
Patrick & Henry Community College	645 Patriot Avenue, Martinsville, Virginia 24112	2-year, Public	Programs in General Engineering Technologies, Industrial Electronics Technology, Advanced Manufacturing Technician, Applied Mechatronics, Automotive Maintenance and Light Repair, Welding, CDL, and Business.	No	Potential	Potential	Potential	N/A	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Paul D Camp Community College	100 N College Dr, Franklin, Virginia 23851	2-year, Public	Programs in Business, Industrial Technology - Electronic-Electrical/Electronic Controls, Mechatronics, Electricity, Industrial Maintenance, Practical Electrician, Practical Electrical Technician, Energy Technology, Electrical Technology, Building Maintenance, Welding, and CDL.	No	Potential	N/A	Potential	N/A	Potential
Piedmont Virginia Community College	501 College Drive, Charlottesville, Virginia 22902-7589	2-year, Public	Programs in Business Administration, CDL, Compact Diesel Engine Repair, Electrical, Electronics Technician, Engineering, Industrial Electronics Technology: Electronics Engineering and Mechanical Engineering Specializations, Maintenance Technician, Manufacturing Technician, and Welding.	No	Potential	Potential	Potential	N/A	Potential
Pruden College and Career Academy	4169 Pruden Boulevard Suffolk, VA 23434	Career and Technical Education	Offers Career and Technical Education (CTE) courses in Auto Body Technology, Automotive Technology, Electricity, and Welding. Adult education courses include Industrial Welding.	No	Potential	Potential	Potential	N/A	N/A

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Radford University	801 East Main St., Radford, Virginia 24142	4-year, Public	Programs in Business Administration, Chemistry, and Education.	No	N/A	N/A	N/A	Potential	Potential
Randolph College	2500 Rivermont Ave, Lynchburg, Virginia 24503-1555	4-year, Private not-for-profit	Programs in Business, Chemistry, and Robotics and Mechatronics Engineering.	No	Potential	N/A	N/A	Potential	Potential
Randolph-Macon College	204 Henry St, Ashland, Virginia 23005-5505	4-year, Private not-for-profit	Programs in Business, Chemistry, and Engineering.	No	Potential	N/A	Potential	Potential	Potential
Rappahannock Community College	12745 College Drive, Glenns, Virginia 23149-2616	2-year, Public	Programs in Welding, Business, CDL, Diesel Mechanics Technology, Electrical and Instrumentation Technician, General Engineering Technology, Practical Electrical Technician, and Pre-Engineering Specialization.	No	Potential	Potential	Potential	N/A	Potential
Regent University	1000 Regent University Dr, Virginia Beach, Virginia 23464	4-year, Private not-for-profit	Programs in Business Administration, Education, Management, Organizational Leadership, Public Administration and Public Policy, Human Resources Management, and Non-Profit/Public/Organizational Management.	No	N/A	N/A	N/A	N/A	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Reynolds Community College	1651 East Parham Road, Richmond, Virginia 23228-2327	2-year, Public	Programs in Automotive Maintenance and Light Repair, Automotive Technology, including Hybrid Electric Vehicle Technology, Automotive Original Equipment Manufacturing (OEM), Business, Welding, Chemical Engineering, and Electrical/ Computer Engineering.	No	Potential	Yes	Potential	Potential	Potential
Richard Bland College	11301 Johnson Road, South Prince George, Virginia 23805-7100	2-year, Public	Business	No	N/A	N/A	N/A	N/A	Potential
Richmond Adult Technical Center	2015 Seddon Way, Suite 110 Richmond, Virginia	Registered Apprentice-ship	Registered Apprenticeships in Electricity, Automotive, and Automotive Body Repair and training program in Welding.	No	Potential	Potential	Potential	N/A	N/A
Richmond Electricians' Joint Apprentice-ship Training Committee	11255 Air Park Road, Ashland, VA 23005	Industry Recognized Credential	Offers Inside Wireman Apprenticeship and the Construction Wireman program for new Electricians, and primer course for the Electric Vehicle Infrastructure Training Program (EVITP) Certification Exam.	No	N/A	N/A	Potential	N/A	N/A
Roanoke College	221 College Lane, Salem, Virginia 24153-3794	4-year, Private not-for-profit	Programs in Business Administration and Management, Chemistry, and Education.	No	N/A	N/A	N/A	Potential	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Roanoke Technical Education Center	2200 Grandin Rd SW, Roanoke, VA 24015	Career and Technical Education	Programs in Automotive Technology, and Welding.	No	Potential	Potential	N/A	N/A	N/A
SAE Incorporated	901 15th Street NW, Suite 520 Washington, DC 20005	< 2-year, Private not for-profit	Offers hundreds of classroom, online, and on-demand online courses to support the professional growth of engineers and technical and business professionals. Courses address key technical drivers, technologies, regulations, and business/ management topics across the aerospace, automotive, and commercial vehicle industries. SAE Partnerships include Virginia classroom activities in Fairfax County focused on manufacturing, EV, HFCEV, and related infrastructure.	Yes	Yes	Yes	Yes	Yes	N/A
Shenandoah University	1460 University Dr, Winchester, Virginia 22601-5195	4-year, Private not-for-profit	Programs in Business Administration and Management, Education, Organizational Leadership, Operations, and Chemistry.	No	N/A	N/A	N/A	Potential	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
SkillFusion	308 1/2 S Main St Suite A, Rochester, MI 48307	Industry Recognized Credential	A program to certify electric vehicle supply equipment (EVSE) workers. This program includes both video-based and in-person training options although it is not Virginia-based.	Yes	N/A	N/A	Yes	N/A	N/A
SkillsUSA Virginia	1480 Crystal Drive, Suite 900, Arlington, VA 22202	Career and Technical Education	A partnership of students, teachers, and industry working together to ensure America has a skilled workforce. They offer competitions and training in automotive service technology, welding, and electrical trades.	No	Potential	Potential	Potential	N/A	N/A
South University-Richmond	2151 Old Brick Rd, Glen Allen, Virginia 23060	4-year, Private for-profit	Business	No	N/A	N/A	N/A	N/A	Potential
South University-Virginia Beach	301 Bendix Rd, Ste 100, Virginia Beach, Virginia 23452	4-year, Private for-profit	Programs in Business Administration and Management, Organizational Leadership, and Public Administration.	No	N/A	N/A	N/A	N/A	Potential
Southside Virginia Community College	109 Campus Drive, Alberta, Virginia 23821	2-year, Public	Programs in Automotive Diagnosis and Tune-Up, Electricity, Business, Welding, Diesel Technician, and Industrial Maintenance.	No	Potential	Potential	Potential	N/A	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Southwest Virginia Community College	369 College Road US Rt. 19, 6 Miles S. Claypool Hill, Cedar Bluff, Virginia 24609	2-year, Public	Programs in Advanced Manufacturing, Business, Electrical-Electronics, Welding, Automotive Diagnostics and Repair, Electrical Installation, Industrial Maintenance, Mechatronics, CDL, Diesel Repair, and Business. Southwest Virginia Community College is launching a 16-credit hour EV safety course in Fall 2025.	No	Potential	Yes	Potential	N/A	Potential
Spotsylvania Career & Tech Center	6713 Smith Station Road Spotsylvania, VA 22553	Registered Apprentice-ship	Registered Apprenticeships in Electricity.	No	N/A	N/A	Potential	N/A	N/A
Strayer University-Virginia	2121 15th Street N, Arlington, Virginia 22201	4-year, Private for-profit	Programs in Business Administration and Management, Education, Human Resources Management, Organizational Leadership, Operations Management and Supervision, and Purchasing, Procurement/Acquisitions and Contracts Management.	No	N/A	N/A	N/A	N/A	Potential
Sweet Briar College	134 Chapel Drive, Sweet Briar, Virginia 24595-9998	4-year, Private not-for-profit	Chemistry	No	N/A	N/A	N/A	Potential	N/A

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Tidewater Community College	121 College Place, Norfolk, Virginia 23510	2-year, Public	Programs in Automotive Maintenance & Light Repair Technician, Automotive Technician, Automotive Technology, Business, Diesel Engine Technician, Electrical, Electronics Engineering Technology, Engineering, Engineering Technology, Industrial & Business Management, Mechanical, Mechatronics, CDL and Welding. Tidewater Community College's Automotive program includes hybrid electric vehicle technology.	No	Potential	Yes	Potential	N/A	Potential
Tidewater Tech-Trades	4535 E. Princess Anne Rd., Norfolk, Virginia 23502	< 2-year, Private for-profit	Programs include Automotive Technician Training and Combination Welding.	No	Potential	Potential	N/A	N/A	N/A
Toyota Technician Training & Education Network (T-TEN)	Toyota Motor North America, 6565 Head-quarters Drive, Plano, TX 75024	Industry recognized credential	A partnership program with community colleges and technical schools to train students to become Toyota and Lexus certified technicians. Partnerships in VA include Reynolds Community College and Tidewater Community College.	Yes	N/A	Yes	Potential	N/A	N/A

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Triplett Technical Center	6375 S. Main St. Mt. Jackson, VA 22842	Career and Technical Education	Programs in Automotive Technology, Auto Body Technology, and Electricity. Several programs offered at Triplett Tech award college credit for a corresponding course at Laurel Ridge Community College including Electricity II.	No	N/A	Potential	Potential	N/A	N/A
University of Lynchburg	1501 Lakeside Dr, Lynchburg, Virginia 24501-3113	4-year, Private not-for-profit	Programs in Business Administration and Management, Education, Human Resources Management, Organizational Leadership, and Chemistry.	No	N/A	N/A	N/A	Potential	Potential
University of Management and Technology	1901 Fort Myer Drive, Suite 700, Arlington, Virginia 22209-1609	4-year, Private for-profit	Programs in Business Administration and Management, Human Resources Management, Public Administration, and Engineering/Industrial Management.	No	Potential	N/A	N/A	N/A	Potential
University of Mary Washington	1301 College Ave, Fredericksburg, Virginia 22401-5300	4-year, Public	Programs in Business Administration and Management, Operations Management and Supervision, and Chemistry.	No	N/A	N/A	N/A	Potential	Potential
University of Richmond	410 Westhampton Way, University of Richmond, Virginia 23173	4-year, Private not-for-profit	Programs in Business Administration and Management, and Chemistry.	No	N/A	N/A	N/A	Potential	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
University of the Potomac-VA Campus	7799 Leesburg Pike, Falls Church, Virginia 22043-2536	4-year, Private for-profit	Programs in Business Administration and Management, Operations Management and Supervision, Project Management, and Office Management and Supervision.	No	N/A	N/A	N/A	N/A	Potential
University of Virginia-Main Campus	1827 University Avenue, Charlottesville, Virginia 22903-2628	4-year, Public	Programs in Chemical Engineering, Chemistry, Education, Electrical Engineering, Human Resources Management, Mechanical Engineering, Public Policy, Public Administration, and Urban and Environmental Planning.	No	Potential	N/A	Potential	Potential	Potential
Valley Career & Technical Center	49 Hornet Rd. Fishersville, VA 22939	Career and Technical Education	Career and Technical Education courses in Auto Body Technology, Automotive Technology, Diesel Equipment Technology, Electricity, Industrial Maintenance, and Welding. Adult education courses in Automotive, Electrical, Industrial Maintenance, and Welding.	No	Potential	Potential	Potential	N/A	N/A
Virginia Common-wealth University	910 W Franklin St, Richmond, Virginia 23284-2512	4-year, Public	Programs in Business, Chemistry, Education, Electrical Engineering, Human Resources Management, Mechanical Engineering, and Public Policy, Public Administration, and Urban Planning.	No	Potential	N/A	Potential	Potential	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Virginia Department of Fire Programs	1005 Technology Park Drive, Glen Allen, VA 23059-4500	< 2-year, Public	Electric Vehicle and Lithium-Ion Battery Fire Safety Awareness Training and Certificate Program is available for fire professionals.	Yes	N/A	N/A	N/A	N/A	N/A
Virginia Highlands Community College	100 VHCC Drive, Abingdon, Virginia 24212-0828	2-year, Public	Programs in Business, Diesel Technology, Electrical Technology, Energy, Engineering, Industrial Electricity, Mechatronics, Welding, and CDL.	No	Potential	Potential	Potential	N/A	Potential
Virginia Peninsula Community College	99 Thomas Nelson Drive, Hampton, Virginia 23666	2-year, Public	Programs in Business, Engineering, Automotive Technology, Electrical Engineering Technology, Welding, Mechanical Engineering Technology, Mechatronics Technology, Electrician and CDL. Several of these programs are also offered online. Also offers an online Electric Vehicle Fundamentals (EVF) course.	No	Potential	Yes	Potential	N/A	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Virginia Polytechnic Institute and State University	210 Burruss Hall, 800 Drillfield Dr., Blacksburg, Virginia 24061-0131	4-year, Public	Programs in Business, Chemical Engineering, Chemistry, Education, Electrical Engineering, Engineering Science and Mechanics, Mechanical Engineering, Public Administration, Public Policy, Urban and Regional Planning, and Urban and Environmental Policy and Planning. Virginia Tech is part of the EcoCAR EV Challenge and is working with GM to design advanced vehicles and build workforce pipelines.	Yes	Yes	N/A	Potential	Potential	Potential
Virginia Military Institute	VMI Parade, Lexington, Virginia 24450-0304	4-year, Public	Programs in Business, Chemistry, Electrical and Computer Engineering, and Mechanical Engineering.	No	Potential	N/A	Potential	Potential	Potential
Virginia State University	1 Hayden Drive, Petersburg, Virginia 23806	4-year, Public	Programs in Business, Chemistry, Education, Electrical and Electronic Engineering Technology, Manufacturing Engineering, Mechanical Engineering, Mechanical Engineering Technology, and Public Administration.	No	Potential	N/A	Potential	Potential	Potential
Virginia Technical Institute (VTI)	201 Ogden Road, Altavista, VA 24517	Industry recognized credential	Programs in Electrical, Industrial Maintenance, and Welding.	No	Potential	N/A	Potential	N/A	N/A

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Virginia Union University	1500 N Lombardy St, Richmond, Virginia 23220	4-year, Private not-for-profit	Programs in Business Administration and Management and Chemistry.	No	N/A	N/A	N/A	Potential	Potential
Virginia University of Lynchburg	2058 Garfield Ave, Lynchburg, Virginia 24501	4-year, Private not-for-profit	Programs in Business Administration, Management and Operations.	No	N/A	N/A	N/A	N/A	Potential
Virginia Wesleyan University	5817 Wesleyan Drive, Virginia Beach, Virginia 23455	4-year, Private not-for-profit	Programs in Business, Chemistry, and Education. Offers online courses and career training programs including the online Electric Vehicle Fundamentals (EVF), CDL, Electrical Technician, Maintenance Technician, Engineering Technician, Welder Technician, Mechatronics, and Passenger Endorsement for CDL.	No	Potential	Yes	Potential	Potential	Potential
Virginia Western Community College	3094 Colonial Ave, Roanoke, Virginia 24015	2-year, Public	Programs in Business, Automotive Analysis & Repair, Autonomous Vehicle Technology, CLD, Mechatronics, Electrical Engineering, Electrical Wiring, and Welding.	No	Potential	Potential	Potential	N/A	Potential
Washington and Lee University	204 West Washington Street, Lexington, Virginia 24450-2116	4-year, Private not-for-profit	Programs in Business Administration, Chemistry, and Integrated Engineering.	No	N/A	N/A	N/A	Potential	Potential

Institution	Address	Type	Description (Program)	EV Workforce Development Consortium and Special Programs	Manufacturing	Automotive Maintenance and Service	Electrician and Charging Infrastructure	Hydrogen Fuel Cell	Transit and Facility Management
Washington University of Science and Technology	2900 Eisenhower Avenue, Alexandria, VA 22314	4-year, primarily associate's, Private for-profit	Business	No	N/A	N/A	N/A	N/A	Potential
William & Mary	200 Richmond Road, Williamsburg, Virginia 23187-8795	4-year, Public	Programs in Business, Chemistry, Education, and Public Policy.	No	N/A	N/A	N/A	Potential	Potential
Wilson Workforce and Rehabilitation Center (WWRC)	243 Woodrow Wilson Avenue Fishersville VA 22939	Public vocational-educational facility	Provides workforce training programs in Business, Manufacturing Technology, and Auto Mechanics. WWRC provides training and rehabilitation services to people with disabilities to assist them to enter or re-enter the workforce and live more independently.	No	Potential	Yes	N/A	N/A	Potential
Wytheville Community College	1000 E Main Street, Wytheville, Virginia 24382-3308	2-year, Public	Programs in Automotive Systems Technology, Industrial Maintenance, CDL, Business, Electrical, and Welding.	No	Potential	Potential	Potential	N/A	Potential

Inventory of Current Educational Capacity Interview Guide

The interview questions below were developed in collaboration with NREL and VA DRPT to facilitate the interviews with educational institutions.

1. Can you describe any recent or future initiatives your institution has/will undertake related to EV/HFCEV capacity expansion, and the specific programs or courses that have been introduced to address the growing demand?
2. Have you had any success attracting students with specific outreach or innovative programs?
3. What are the primary challenges your institution faces in developing or expanding EV/HFCEV-related course offerings?
4. How is your institution addressing the need for specialized facilities and equipment to support EV/HHCEV education?
5. What are the main challenges current students face when pursuing education in EV/HFCEV technologies?
6. What career/placement opportunities are available to graduates with training in EV/HFCEV technologies?
7. What policy changes at the state level would facilitate better collaboration with other educational institutions on EV/HFCEV educational initiatives?
8. How is your institution leveraging technology and online learning to expand access to EV/HFCEV education?
9. What feedback have you received from graduates and industry partners regarding preparedness for the EV/HFCEV field?

Workforce Supply

Workforce Group Classification of Instructional Programs

Workforce Group	Occupation	CIP (2020)	CIP (2010)
Electrician and Charging Infrastructure	*Electrical Engineers*	14.10 - Electrical, Electronics, and Communications Engineering	14.10 - Electrical, Electronics and Communications Engineering

Workforce Group	Occupation	CIP (2020)	CIP (2010)
	Electrical and Electronics Engineering Technologists and Technicians	15.03 - Electrical/Electronic Engineering Technologies/ Technicians 15.04 - Electromechanical Technologies/ Technicians 15.12 - Computer Engineering Technologies/ Technicians 15.99 - Engineering/ Engineering-Related Technologies/ Technicians, Other 47.01 - Electrical/ Electronic Maintenance and Repair Technologies/ Technicians	15.03 - Electrical Engineering Technologies/ Technicians 15.04 - Electromechanical Instrumentation and Maintenance Technologies/ Technicians 15.12 - Computer Engineering Technologies/ Technicians 15.99 - Engineering Technologies/ Technicians, Other 47.01 - Electrical/ Electronics Maintenance and Repair Technology
	Electricians	46.03 - Electrical and Power Transmission Installers	46.03 - Electrical and Power Transmission Installers
	Plant Maintenance	15.17 - Energy Systems Technologies/ Technicians 46.04 - Building/ Construction Finishing, Management, and Inspection	46.04 - Building/ Construction Finishing, Management, and Inspection
Hydrogen Fuel Cell	*Chemical Engineer*	14.07 - Chemical Engineering 14.32 - Polymer/ Plastics Engineering 41.03 - Physical Science Technologies/ Technicians	14.07 - Chemical Engineering 14.32 - Polymer/ Plastics Engineering 41.03 - Physical Science Technologies/ Technicians
	Chemists	40.05 - Chemistry	40.05 - Chemistry
Manufacturing	*Industrial Engineering Technologists and Technicians*	15.06 - Industrial Production Technologies/ Technicians	N/A
	Mechanical and Mechatronics Engineers	14.11 - Engineering Mechanics 14.19 - Mechanical Engineering 15.08 - Mechanical Engineering Related Technologies/ Technicians	14.11 - Engineering Mechanics 14.19 - Mechanical Engineering 15.08 - Mechanical Engineering Related Technologies/ Technicians
	Welding Technologists and Technicians	48.05 - Precision Metal Working	48.05 - Precision Metal Working
Automotive Maintenance and Service	*Automotive, Bus and Truck Technicians and Mechanics*	47.06 - Vehicle Maintenance and Repair Technologies/ Technicians	47.06 - Vehicle Maintenance and Repair Technologies

Workforce Group	Occupation	CIP (2020)	CIP (2010)
Transit and Facility Management[52]	*Facilities Managers*	15.15 - Engineering-Related Fields 46.04 - Building/ Construction Finishing, Management, and Inspection 52.02 - Business Administration, Management and Operations	15.15 - Engineering-Related Fields 46.04 - Building/ Construction Finishing, Management, and Inspection 52.02 - Business Administration, Management and Operations
	Vehicle Operations	49.02 - Ground Transportation	49.02 - Ground Transportation
	Vehicle Operations Support	52.04 - Business Operations Support and Assistant Services	52.04 - Business Operations Support and Assistant Services
	Transportation Planners	04.03 - City/Urban, Community, and Regional Planning 44.04 - Public Administration 44.05 - Public Policy Analysis	04.03 - City/Urban, Community, and Regional Planning 44.04 - Public Administration 44.05 - Public Policy Analysis
	Training and Development Specialists	13.04 - Education Administration and Supervision 13.05 - Educational/ Instructional Media Design 13.12 - Teacher Education and Professional Development, Specific Levels and Methods 52.10 - Human Resources Management and Services	13.04 - Education Administration and Supervision 13.05 - Educational/ Instructional Media Design 13.12 - Teacher Education and Professional Development, Specific Levels and Methods 52.10 - Human Resources Management and Services

Workforce Group Apprenticeships

Workforce Group	Occupation	Apprenticeship Occupations
Electrician and Charging Infrastructure	*Electrical Engineers*	N/A
	Electrical and Electronics Engineering Technologists and Technicians	Control Equip Elec-Tech Drafter, Electrical Electric Power Generator Technician Electrical Technician Electromechanical Technician Electronic Mechanic Electronics Technician Instrumentation & Controls Technician

[52] Additional occupations may be relevant for transit agencies including Accountants and Auditors, Managers, Cost Estimators, Secretaries and Administrative Assistants, Receptionists and Information Clerks, Advertising and Promotions Managers, Public Relations Specialists and Compliance Officers.

Workforce Group	Occupation	Apprenticeship Occupations
	Electricians	Electrician (Including Interior Electrician) Electrician, Maintenance Electrician, Substation Line Installer-Repairer Line Maintainer (Including High Voltage Electrician)
	Plant Maintenance	Building Maintenance Building Maintenance Repairer Electric Meter Tester Industrial Maintenance Repairer Machine Repairer, Maintenance Maint Mechanic Maintenance Mechanic Maintenance Machinist Maintenance Production Technician Maintenance Repair, Industrial Millwright Operating Engineer Power-Plant Operator Set-Up Technician Substation Operator
Hydrogen Fuel Cell	*Chemical Engineer*	N/A
	Chemists	N/A
Manufacturing	*Industrial Engineering Technologists and Technicians*	Engineering Technicians Field Service Engineer Industrial Engineering Technician Industrial Manufacturing Technicians Inspectors and Testers Inspector, Metal Fabricate Machinist (Including Precision Machinist) Machinist, Experimental Maker Professional (Including Machine Operator 1)
	Mechanical and Mechatronics Engineers	Engineering Technicians Mechanical Engineering Technician Mechatronics Technician
	Welding Technologists and Technicians	Metal Fabricator Production Welder Sheet Metal Worker Welder, Arc Welder, Combination Welding Technician
Automotive Maintenance and Service	*Automotive, Bus and Truck Technicians and Mechanics*	Automobile Mechanic (Including Light-Wheel Vehicle Mechanic) Automotive Mechanic Automotive Technician Specialist Maint Mechanic (Const; Petrol) (Including Heavy-Wheel Vehicle Mechanic) Transit Bus Technician
Transit and Facility Management	*Facilities Managers*	N/A
	Vehicle Operations	Heavy and Tractor Trailer Truck Driver Truck Driver, Heavy
	Vehicle Operations Support	Dispatcher, Service
	Transportation Planners	N/A

Workforce Group	Occupation	Apprenticeship Occupations
	Training and Development Specialists	Education & Training Human Resource Assistant Human Resources Associate Teacher Aide I Trade/Industry Instructor Workforce Development Specialist

Career Technical Education

Additional sources of training capacity can be completers of Career Technical Education (CTE). From the Virginia Department of Education:

- Career and technical education (CTE) programs in Virginia public schools serve more than 690,000 students in CTE courses in grades 6-12. These programs are designed to prepare young people for productive futures while meeting the commonwealth's need for well-trained and industry-certified technical workers.

Virginia acknowledges the importance of career and technical education to students and the commonwealth through diploma seals awarded by the Board of Education, by recognizing industry credentialing in its diploma requirements, and through the use of Career Pathways as an integral part of the newly required Academic and Career Plan.

Several Career Pathways were identified as having relevance to the Workforce Groups which also includes the number of CTE Completers[53]. A CTE Completer is a CTE concentrator who has earned all of the required units in a state-recognized CTE Program identified by the Career Pathways. The Career Pathway represents a common set of skills and knowledge, both academic and technical, necessary to pursue a full range of career opportunities - ranging from entry level to management, including technical and professional careers. Note, although Career Clusters exist relating to Automotive Maintenance and Services, there were no completions relating to this Workforce Group in the data analyzed.

Virginia CTE Completions (2018-2023)

Workforce Group	Career Pathway	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
Electrician and Charging Infrastructure	*Energy Efficiency*	0	0	0	8	7
	Energy Transmission and Distribution	0	0	0	1	9
	Engineering and Technology	3,531	3,506	3,221	3,547	3,503
	Power Generation	0	0	0	7	0
Hydrogen Fuel Cell	*Environmental Service Systems*	53	58	62	94	110
	Fuels Production	0	0	0	1	0
	Natural Resources Systems	174	161	131	129	116
Manufacturing	*Maintenance, Installation and Repair*	292	264	245	140	244
	Maintenance/Operations	170	190	188	139	194

[53] **https://data.virginia.gov/dataset/cte-completers-by-career-pathway-state-level-virginia**

Workforce Group	Career Pathway	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
	Manufacturing Production Process Development	408	452	495	507	506
	Power, Structural and Technical Systems	314	319	333	424	409
Transit and Facility Management	*Administration and Administrative Support*	15	11	12	162	145
	Administrative Support	387	247	353	262	199
	Facility and Mobile Equipment Maintenance	1,116	1,051	1,105	1,047	1,160
	Fuels Production	0	0	0	1	0
	General Management	1,398	1,176	1,056	1,378	1,154
	Governance	93	141	77	202	119
	Human Resources Management	26	27	15	13	14
	Operations Management	32	116	150	194	176
	Planning	38	40	31	26	7
	Public Management and Administration	21	17	23	17	41
	Regulation	3	1	0	15	3
	Teaching/Training	896	1,028	863	733	730
	Transportation Operations	259	304	272	347	423
	Transportation Systems/Infrastructure Planning, Management and Regulation	17	13	20	10	36
Workforce Groups Grand Total		**9,243**	**9,122**	**8,652**	**9,404**	**9,305**
All Virginia CTE Completions		**41,249**	**43,232**	**41,241**	**43,951**	**46,028**

Source: Virginia Open Data Portal

Transit agencies can also access this information by Division or school district to identify schools for a potential workforce development partnership[54].

Employee Demand

Workforce Group SOCs

Workforce Group	Occupation	SOC (2018)	SOC (2010)
Electrician and Charging Infrastructure	*Electrical Engineers*	17-2071 - Electrical Engineers 17-2072 - Electronics Engineers, Except Computer	17-2071 - Electrical Engineers 17-2072 - Electronics Engineers, Except Computer

[54] **https://data.virginia.gov/dataset/cte-completers-by-career-pathway-by-division-virginia**

Workforce Group	Occupation	SOC (2018)	SOC (2010)
	Electrical and Electronics Engineering Technologists and Technicians	17-3023 - Electrical and Electronics Engineering Technologists and Technicians 17-3024 - Electro-Mechanical and Mechatronics Technologists and Technicians 51-2028 - Electrical, Electronic, and Electromechanical Assemblers, Except Coil Winders, Tapers, and Finishers	17-3023 - Electrical and Electronics Engineering Technicians 17-3024 - Electro-Mechanical and Mechatronics Technicians 51-2022 - Electrical and Electronic Equipment Assemblers 51-2023 - Electromechanical Equipment Assemblers
	Electricians	47-2111 - Electricians 47-3013 - Helpers--Electricians 49-2092 - Electric Motor, Power Tool, and Related Repairers 49-2093 - Electrical and Electronics Installers and Repairers, Transportation Equipment 49-2095 - Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	47-2111 - Electricians 47-3013 - Helpers--Electricians 49-2092 - Electric Motor, Power Tool, and Related Repairers 49-2093 - Electrical and Electronics Installers and Repairers, Transportation Equipment 49-2095 - Electrical and Electronics Repairers, Powerhouse, Substation, and Relay
	Plant Maintenance	51-8013 - Power Plant Operators 49-9071 - Maintenance and Repair Workers, General 49-9041 - Industrial Machinery Mechanics	51-8013 - Power Plant Operators 49-9071 - Maintenance and Repair Workers, General 49-9041 - Industrial Machinery Mechanics
Hydrogen Fuel Cell	*Chemical Engineer*	17-2041 - Chemical Engineers	17-2041 - Chemical Engineers
	Chemists	19-2031 - Chemists 19-2041 - Environmental Scientists and Specialists, Including Health	19-2031 - Chemists 19-2041 - Environmental Scientists and Specialists, Including Health
Manufacturing	*Industrial Engineering Technologists and Technicians*	17-3026 - Industrial Engineering Technologists and Technicians 51-4031 - Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic 17-3029 - Engineering Technologists and Technicians, Except Drafters, All Other 51-9061 - Inspectors, Testers, Sorters, Samplers, and Weighers	17-3026 - Industrial Engineering Technologists and Technicians 51-4031 - Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic 17-3029 - Engineering Technologists and Technicians, Except Drafters, All Other 51-9061 - Inspectors, Testers, Sorters, Samplers, and Weighers
	Mechanical and Mechatronics Engineers	17-2141 - Mechanical Engineers 17-2199 - Engineers, All Other	17-2141 - Mechanical Engineers 17-2199 - Engineers, All Other

Workforce Group	Occupation	SOC (2018)	SOC (2010)
	Welding Technologists and Technicians	51-4121 - Welders, Cutters, Solderers, and Brazers	51-4121 - Welders, Cutters, Solderers, and Brazers
Automotive Maintenance and Service	*Automotive, Bus and Truck Technicians and Mechanics*	49-2096 - Electronic Equipment Installers and Repairers, Motor Vehicles 49-3023 - Automotive Service Technicians and Mechanics 49-3031 - Bus and Truck Mechanics and Diesel Engine Specialists	49-2096 - Electronic Equipment Installers and Repairers, Motor Vehicles 49-3023 - Automotive Service Technicians and Mechanics 49-3031 - Bus and Truck Mechanics and Diesel Engine Specialists
Transit and Facility Management[55]	*Facilities Managers*	11-3013 - Facilities Managers 11-3051 - Industrial Production Managers	11-3011 - Administrative Services Managers 11-3051 - Industrial Production Managers
	Vehicle Operations	53-3032 - Heavy and Tractor-Trailer Truck Drivers 53-3051 - Bus Drivers, School 53-3052 - Bus Drivers, Transit and Interagency 53-3053 - Shuttle Drivers and Chauffeurs	53-3032 - Heavy and Tractor-Trailer Truck Drivers 53-3021 - Bus Drivers, Transit and Interagency 53-3022 - Bus Drivers, School or Special Client
	Vehicle Operations Support	43-5032 - Dispatchers, Except Police, Fire, and Ambulance 53-1047 - First Line Supervisors of Transportation & Material Moving Workers, Exc Aircraft Cargo Handling Supervisor 53-6061 - Passenger Attendants	43-5032 - Dispatchers, Except Police, Fire, and Ambulance 53-1031 - First-Line Supervisors of Transportation and Material-Moving Machine and Vehicle Operators 53-6061 - Transportation Attendants, Except Flight Attendants
	Transportation Planners	19-3099.01 - Transportation Planners	19-3099.01 - Transportation Planners
	Training and Development Specialists	13-1151 - Training and Development Specialists 11-3131 - Training and Development Managers	13-1151 - Training and Development Specialists 11-3131 - Training and Development Managers

Employee Demand Scenario: Recent Levels of Investment

Workforce Group & Occupation	2035	Lower Bound	Upper Bound
Automotive Maintenance and Service			
Automotive, Bus and Truck Technicians and Mechanics	30,120	27,108	33,132
Automotive Maintenance and Service Total	**30,120**	**27,108**	**33,132**
Hydrogen Fuel Cell			
Chemical Engineers	428	385	471
Chemists	4,874	4,387	5,361

[55] Additional occupations may be relevant for transit agencies including Accountants and Auditors, Managers, Cost Estimators, Secretaries and Administrative Assistants, Receptionists and Information Clerks, Advertising and Promotions Managers, Public Relations Specialists and Compliance Officers.

Workforce Group & Occupation	2035	Lower Bound	Upper Bound
Hydrogen Fuel Cell Total	**5,302**	**4,772**	**5,832**
Electrician and Charging Infrastructure			
Electrical and Electronics Engineering Technologists and Technicians	10,002	9,001	11,002
Electrical Engineers	8,904	8,014	9,795
Electrician	30,010	27,009	33,011
Plant Maintenance	48,353	43,518	53,188
Electrician and Charging Infrastructure Total	**97,269**	**87,542**	**106,996**
Manufacturing			
Industrial Engineering Technologists and Technicians	15,308	13,777	16,839
Mechanical and Mechatronics Engineers	13,424	12,082	14,767
Welding Technologists and Technicians	10,258	9,232	11,283
Manufacturing Total	**38,990**	**35,091**	**42,889**
Transit and Facility Management			
Facilities Managers	4,851	4,366	5,336
Training and Development Specialists	15,771	14,194	17,348
Transportation Planners	4,370	3,933	4,807
Vehicle Operations	73,610	66,249	80,971
Vehicle Operations Support	25,659	23,093	28,225
Transit and Facility Management Total	**124,261**	**111,835**	**136,687**
Grand Total	**295,942**	**266,348**	**325,536**

Source: Analysis of Projection Central Data

Employee Demand Scenario: Moderate Federal and State Investment

Workforce Group & Occupation	2035	Lower Bound	Upper Bound
Automotive Maintenance and Service			
Automotive, Bus and Truck Technicians and Mechanics	26,195	24,832	27,559
Automotive Maintenance and Service Total	**26,195**	**24,832**	**27,559**
Hydrogen Fuel Cell			
Chemical Engineers	194	-560	948
Chemists	2,145	1,412	2,878
Hydrogen Fuel Cell Total	**2,339**	**852**	**3,826**
Electrician and Charging Infrastructure			
Electrical and Electronics Engineering Technologists and Technicians	3,077	2,544	3,610
Electrical Engineers	1,006	-897	2,909
Electrician	42,290	39,200	45,380
Plant Maintenance	49,223	46,394	52,052
Electrician and Charging Infrastructure Total	**95,596**	**87,241**	**103,951**
Manufacturing			
Industrial Engineering Technologists and Technicians	14,700	12,203	17,198
Mechanical and Mechatronics Engineers	12,332	11,267	13,397
Welding Technologists and Technicians	14,324	13,539	15,109
Manufacturing Total	**41,356**	**37,009**	**45,704**
Transit and Facility Management			
Facilities Managers	-9,563	-12,231	-6,894
Training and Development Specialists	19,798	18,382	21,214
Transportation Planners	6,194	5,240	7,148
Vehicle Operations	78,567	74,945	82,190

Workforce Group & Occupation	2035	Lower Bound	Upper Bound
Vehicle Operations Support	31,970	29,797	34,143
Transit and Facility Management Total	**126,966**	**116,133**	**137,801**
Grand Total	**292,454**	**266,068**	**318,840**

Source: Analysis of Bureau of Labor Statistics Data

Employee Demand Scenario: Moderate Federal and Current State Investment

Workforce Group & Occupation	2035	Lower Bound	Upper Bound
Automotive Maintenance and Service			
Automotive, Bus and Truck Technicians and Mechanics	25,933	23,339	28,526
Automotive Maintenance and Service Total	**25,933**	**23,339**	**28,526**
Hydrogen Fuel Cell			
Chemical Engineers	617	555	678
Chemists	6,891	6,202	7,580
Hydrogen Fuel Cell Total	**7,508**	**6,757**	**7,583**
Electrician and Charging Infrastructure			
Electrical and Electronics Engineering Technologists and Technicians	14,306	12,875	15,736
Electrical Engineers	12,826	11,543	14,109
Electrician	41,885	37,696	46,073
Plant Maintenance	69,479	62,531	76,427
Electrician and Charging Infrastructure Total	**138,496**	**124,646**	**139,881**
Manufacturing			
Industrial Engineering Technologists and Technicians	10,437	9,393	11,481
Mechanical and Mechatronics Engineers	17,990	16,191	19,789
Welding Technologists and Technicians	14,337	12,903	15,770
Manufacturing Total	**42,764**	**38,488**	**43,192**
Transit and Facility Management			
Facilities Managers	6,906	6,216	7,597
Training and Development Specialists	23,031	20,728	25,334
Transportation Planners	6,105	5,494	6,715
Vehicle Operations	104,056	93,651	114,462
Vehicle Operations Support	31,371	28,234	34,508
Transit and Facility Management Total	**171,469**	**154,322**	**173,184**
Grand Total	**386,169**	**347,552**	**424,786**

Source: Analysis of Bureau of Labor Statistics Data and analysis conducted by E2 on data from the 2022 U.S. Energy and Employment Report (USEER)[56]

Clean Energy Jobs

The following table classifies the Occupations as clean energy jobs according to Virginia Clean Cities based upon time prevalence of the occupation to clean economy. This segmentation was validated by DRPT.

[56] **E2-FS-Clean-Jobs-VA-2022-23-04-C_03.pdf**

Occupations	Clean Energy Job (Yes/No)	Notes
Automotive, Bus and Truck Technicians and Mechanics	No	Skills are changing for this role due to clean energy innovation and upskilling and reskilling workers in this occupation will be required to work across traditional combustion engines and low- and no-emission vehicles. Existing work on traditional combustion engines will continue, therefore, employee demand for this occupation is not expected to rise.
Chemical Engineer	Yes	Research work for this occupation may be growing in the areas of rare earth metals and hydrogen fuel cells/sodium ion battery innovation. Therefore, employee demand for this occupation is expected to rise.
Chemists	Yes	Research work for this occupation may be growing in the areas of rare earth metals and hydrogen fuel cells/sodium ion battery innovation. Therefore, employee demand for this occupation is expected to rise.
Electrical and Electronics Engineering Technologists and Technicians	Yes	Employee demand for this occupation may increase due to the growth of charging infrastructure installation and maintenance.
Electrical Engineers	Yes	This occupation may be increasingly responsible for innovation with batteries and charging infrastructure building/ replacement/ and movement. Therefore, employee demand for this occupation is expected to rise.
Electricians	Yes	This occupation may be increasingly responsible for innovation with batteries and charging infrastructure building/ replacement/ and movement. Therefore, employee demand for this occupation is expected to rise.
Facilities Managers	Yes	This occupation will oversee new facilities associated with clean energy both at transit agencies and utilities. Therefore, employee demand for this occupation is expected to rise.
Industrial Engineering Technologists and Technicians	No	Net new growth is not expected for this occupation. However, the work of this occupation will evolve with the transition to clean energy.
Mechanical and Mechatronics Engineering	Yes	This occupation supports the manufacturing of infrastructure associated with clean energy (e.g., solar, wind, hydrogen). Therefore, employee demand for this occupation is expected to rise.
Plant Maintenance	Yes	This occupation may grow due to the additional plant facilities required for clean energy. Therefore, employee demand for this occupation is expected to rise.
Training and Development Specialists	Yes	As clean energy grows, employee demand for this occupation is expected to rise to instruct workers on skills associated with clean energy technology.
Vehicle Operations	Yes	As low- and no-emission vehicles are deployed and transit operations expand, employee demand for this occupation is expected to rise.
Vehicle Operations Support	Yes	Initially, employee demand for this occupation may rise alongside the changes in operations from the deployment of low and no emission vehicles.

Occupations	Clean Energy Job (Yes/No)	Notes
Transportation Planners	Yes	The employee demand for this occupation is expected to rise due to the addition of new routes, interconnected routes, and longer schedules from the deployment of low- and no-emission vehicles.
Welding Technologists and Technicians	Yes	This occupation supports welding activities associated with clean energy infrastructure (e.g., hydrogen pipelines). Therefore, employee demand for this occupation is expected to rise.

Additional Investment and Collaboration Opportunities

The table below includes additional state-level investment opportunities (as of March 2025) for transit agencies to reference for other low- and no-emission uses other than training and workforce development.

Program Name	Description	Funding Amount	Category	Funding Timeline
Making Efficient and Responsible Investment in Transit (MERIT) – Capital Assistance	DRPT prioritizes and allocates resources for capital projects through a scoring system in three categories: *State of Good Repair:* Projects focused on replacing or rehabilitating existing assets, excluding major projects over $3 million (State Match: up to 68%). *Minor Enhancement:* Projects under $3 million that add capacity or purchase new assets, including small vehicle expansions (State Match: up to 68%). *Major Expansion:* Projects over $3 million that expand or improve transit services or facilities, including large vehicle expansions or entire facility replacements (State Match: up to 50%). Eligible applicants can combine federal and state funds to reduce the local match requirement, but a minimum 4% local match is required for all projects.	Varies	Capital Projects	Ongoing (December 1 through February 1 Application Timeline)
Making Efficient and Responsible Investment in Transit (MERIT) - Technical Assistance	This grant program support studies, plans, research, data collection, and evaluation projects to help improve public transportation services. This includes providing technical analysis and guidance on operations, service delivery, customer service, expansions of service, and program delivery.	Varies	Public Transportation Technical Assistance	Ongoing (December 1 through February 1 Application Timeline)

Program Name	Description	Funding Amount	Category	Funding Timeline
Transit Ridership Incentive Program (TRIP)	This grant program provides funding to transit agencies and governing bodies for the purpose of creating more accessible, safe, and regionally significant transit networks. TRIP funds four project categories: zero and reduced fare, regional connectivity, public safety, and passenger amenities and facilities.	Varies	Public Transit Network Improvement	Ongoing (December 1 through February 1 Application Timeline)
SMART SCALE	A process that helps Virginia meet its most critical transportation needs using limited tax dollars. It evaluates potential transportation projects based on key factors like how they improve safety, reduce congestion, increase accessibility, contribute to economic development, promote efficient land use, and affect the environment. The anticipated benefits are calculated, and the projects are scored and ranked. This information is used by the Commonwealth Transportation Board to help guide and inform their project selection decisions.	Varies	Transportation Projects	Ongoing – Bi-annual Application Schedule (2-Years)