Equipping the U.S. Workforce for Electric Vehicle Integration: A Thematic Analysis of EV Technician Training Under the Bipartisan Infrastructure Law (2022-2026)

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Abstract— **The United States is shifting significantly toward Electric Vehicles (EVs), driven by environmental priorities and federal initiatives such as the Bipartisan Infrastructure Law (BIL). This research examines the development of a skilled EV technician workforce, focusing on implementing the National Electric Vehicle Infrastructure (NEVI) program from 2022 to 2026. Through qualitative thematic analysis of nationwide state representatives' perspectives, the study identifies key strategies, challenges, and regional variations in workforce development. The findings underscore the essential role of skilled technicians in facilitating the rapid growth of EV adoption and supporting charging infrastructure. While some states have established robust training programs, others face obstacles linked to regional and resource limitations. The research highlights the importance of enhanced stakeholder collaboration and communication to bridge these gaps. The study contributes to academic discussions and practical solutions for workforce development during the U.S. EV transition by presenting a detailed framework for improving EV technician training. Future research should explore the long-term impacts of federal programs and incorporate advanced technologies into training programs.**

Keywords— *Electric Vehicles (EVs), Workforce Development Technician Training, Bipartisan Infrastructure Law (BIL), National Electric Vehicle Infrastructure (NEVI) Program, State-Level Implementation, Challenges and Strategies*

I. INTRODUCTION

The transition to electric vehicles (EVs) in the United States is gaining momentum due to growing environmental concerns and government initiatives to reduce carbon emissions. The transportation sector remains the most significant contributor to greenhouse gas (GHG) emissions, accounting for approximately 29% of total emissions in the U.S. [1]. The U.S. government has introduced policies and funding programs to accelerate EV adoption, including the Bipartisan Infrastructure Law (BIL), which allocates $7.5 billion to support EV charging infrastructure development and workforce training [2]. The National Electric Vehicle Infrastructure (NEVI) program, a key initiative under the BIL, aims to deploy a nationwide EV charging network and prepare a skilled workforce of EV technicians capable of supporting the transition [3]. However, disparities in workforce preparedness across different states highlight the need for a more structured approach to EV technician training [4].

As states implement NEVI funding, varying readiness levels to train EV technicians emerge, revealing gaps in strategic planning, budget allocation, and stakeholder engagement. Some states have actively integrated EV-related training into community college curricula and partnered with industry stakeholders to create certification programs. In contrast, others lack concrete plans or financial resources to support such initiatives [5]. State Preparedness for EV Technicians (SPEVT) has been introduced as a framework to assess each state's workforce readiness, factoring in key indicators such as the number of training programs, funding allocation, and regional disparities [6]. Understanding these differences is crucial to ensuring a smooth transition and reducing the skills gap in the EV workforce.

This study employs a thematic analysis approach to evaluate state representatives' perspectives in workforce planning under the NEVI program. By analyzing interview data from officials across 24 states, the research identifies key trends, challenges, and best practices in EV technician training [7]. The findings indicate that while many states recognize the importance of workforce development, their approaches vary significantly based on regional priorities, stakeholder engagement, and available financial resources [8]. Furthermore, stakeholder collaboration is critical in shaping EV workforce strategies, as successful training programs require coordination between government agencies, educational institutions, and private sector entities.

This paper contributes to the ongoing discussion on EV workforce development by outlining effective policies and training strategies that align with federal and state-level objectives. By identifying thematic patterns from stakeholder interviews, the study offers insights into bridging workforce gaps and enhancing technician training programs to meet the

rising demand for EV maintenance skills [9]. Additionally, the findings underscore the necessity of aligning state-level implementation strategies with federal investments to ensure an equitable and efficient workforce transition.

II. LITERATURE REVIEW

The transition to EVs in the United States has prompted a significant demand for skilled EV technicians. NEVI program, established under BIL, aims to support this transition by developing a nationwide charging network and upskilling the workforce to maintain EV infrastructure [10]. Research indicates that preparing technicians for this transition requires targeted training programs and collaboration between government agencies, educational institutions, and industry stakeholders [11]. However, existing literature highlights gaps in understanding these training programs' effectiveness and regional variations [12].

Government policies play a pivotal role in shaping workforce development within the EV sector. Several studies have analyzed the impact of policy frameworks on training programs, noting that incentives and funding allocations significantly influence workforce preparedness [13]. The NEVI program's implementation from 2022 to 2026 has provided a strategic roadmap for states to integrate technician training into their EV infrastructure plans. However, research suggests that disparities in funding and policy adaptation across states result in uneven workforce readiness [14].

The rapid advancement of EV technology necessitates continuous updates in technician training curricula. Studies have emphasized the need for training programs to incorporate emerging technologies such as battery management systems, power electronics, and cybersecurity measures [15]. Integrating digital learning tools, augmented reality simulations, and hands-on experience with high-voltage systems has been identified as a crucial component of practical EV technician training [16]. However, research remains limited in assessing how well training institutions have adapted to these technological advancements.

A key challenge in EV workforce development is regional variation in infrastructure deployment. The literature suggests that states with higher levels of NEVI funding and pre-existing automotive industry presence have progressed more in training EV technicians [17]. Conversely, states with limited resources and lower adoption rates of EV technology face more significant obstacles in establishing comprehensive training programs. This discrepancy highlights the need for federal and state-level coordination to ensure workforce preparedness across all regions [18].

Stakeholder collaboration is essential for successful EV workforce development. Prior studies have underscored the role of partnerships between educational institutions, automotive manufacturers, and utility companies in shaping training programs [19]. Industry-driven certifications and apprenticeships have emerged as effective mechanisms to bridge the theoretical knowledge and practical application gap. However, challenges remain in aligning training outcomes with industry needs due to evolving technological requirements and workforce expectations [20].

Economic considerations also influence the expansion of EV technician training programs. The Bureau of Labor Statistics projects a significant increase in EV maintenance and infrastructure development jobs over the next decade [21].

However, research indicates that wage disparities, job security concerns, and skilled trainers' availability impact the attractiveness of EV technician careers [22]. Addressing these economic factors is critical for ensuring a sustainable and well-trained workforce.

The long-term sustainability of EV technician training programs depends on continuous funding and policy support. Studies have called for comprehensive workforce planning that integrates technical training with broader sustainability and transportation policies [23]. Additionally, ongoing assessments of training effectiveness and workforce demand projections are needed to refine educational strategies and align them with industry developments [24].

In conclusion, the literature underscores the importance of structured and adaptive training programs for EV technicians. While the NEVI program provides a foundation for workforce development, further research is required to address regional disparities, technological advancements, and industry collaboration challenges. By integrating policy support, educational innovation, and industry engagement, the U.S. can effectively equip its workforce to transition to electric mobility [25].

III. METHODOLOGY

A. Research Design

This study employs a qualitative research methodology utilizing thematic analysis to examine the preparedness of U.S. states in training electric vehicle (EV) technicians under the Bipartisan Infrastructure Law (2022–2026) [4]. The thematic approach was selected to systematically identify and analyze shared patterns of meaning within the collected dataset [26].

B. Data Collection

Data was collected using semi-structured interviews with representatives from state agencies, training institutions, and industry stakeholders. This method allowed for a balance between structured inquiries and open-ended discussions, providing rich qualitative insights [27]. The development of the interview questions was informed by existing literature and validated through an iterative review process, followed by approval from the Institutional Review Board (IRB) [28].

C. Participants and Sampling

Participants were selected using purposive sampling to ensure that individuals with direct experience in EV technician training and policy implementation were included [29]. This targeted approach ensured that the data collected was relevant and aligned with the research objectives [30].

D. Data Analysis

Thematic analysis was conducted using NVivo software to facilitate systematic coding, categorization, and theme development [31]. The coding process followed an inductive approach, allowing themes to emerge organically from the data without being constrained by predefined categories [32]. The key stages of analysis included:

- Transcription and Data Cleaning – Audio recordings were transcribed verbatim, with careful attention to contextual nuances [33].

- Initial Coding – Data were coded based on recurring topics, utilizing NVivo software to enhance accuracy and organization [34].
- Categorization and Theme Development – Coded data were grouped into conceptual categories, leading to the identification of overarching themes related to state preparedness for EV technician training [35].

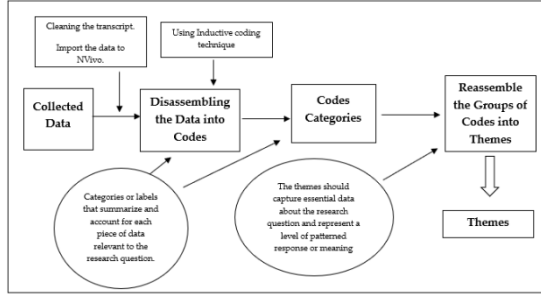The qualitative data analysis process is illustrated in Figure 1 below:

Fig. 1. Data Analysis Process in Qualitative Research here.

E. Data Validation

To ensure the reliability of the findings, the study incorporated multiple validation strategies, including:

- Triangulation: The integration of interviews, policy documents, and secondary data sources to enhance credibility [36].
- Reflexivity: Continuous researcher reflection to mitigate biases in data interpretation [37].
- Peer Review: Independent coding verification by a second researcher to ensure consistency and accuracy [38].

F. Limitations

The primary limitation of this study is its reliance on qualitative data, which, while rich in depth, may not be fully generalizable across all U.S. states. Additionally, the study focuses on the timeframe from 2022 to 2026, meaning that evolving policy and technological advancements may impact the long-term applicability of the findings [39].

IV. FINDINGS

A. Engagement Patterns and Regional Participation

A total of 28 state representatives from 24 states participated in this study, providing insights into the strategies and policies supporting EV technician training. The participating states spanned different U.S. regions, reflecting diverse approaches to training programs and stakeholder engagement.

B. State Strategies for EV Technician Training

The findings indicate that states are at varying stages of EV technician training program development. Three key themes emerged:

1) Addressing Workforce Demand
- State representatives emphasized the critical shortage of trained EV technicians due to the increasing number of electric vehicles.

- 20 of 24 states reported initiating partnerships with technical colleges and industry stakeholders to develop EV-specific curricula.

2) Budget Allocations and Funding Priorities
- Only 11 states had a dedicated budget for EV technician training, while others prioritized EV charging infrastructure over workforce development.
- NEVI funding constraints were frequently cited, with some states struggling to allocate sufficient resources for technician education.
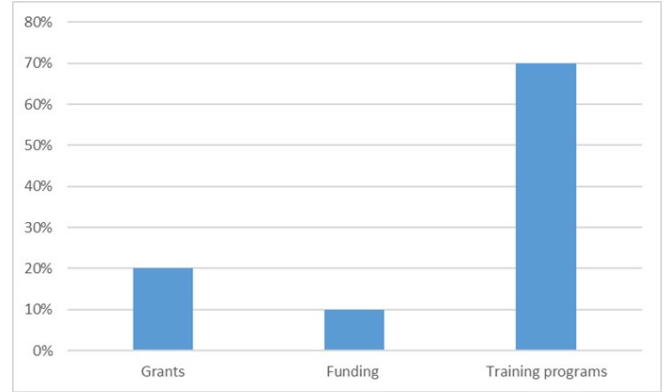

Fig. 2. State Budget Allocation Methods.

3) Communication and Stakeholder Collaboration

- Stakeholders, including educational institutions, labor unions, dealerships, and government agencies, played pivotal roles in EV training initiatives.
- Most states engaged stakeholders using a mix of public meetings, online platforms, and surveys, though challenges remained in ensuring effective coordination.
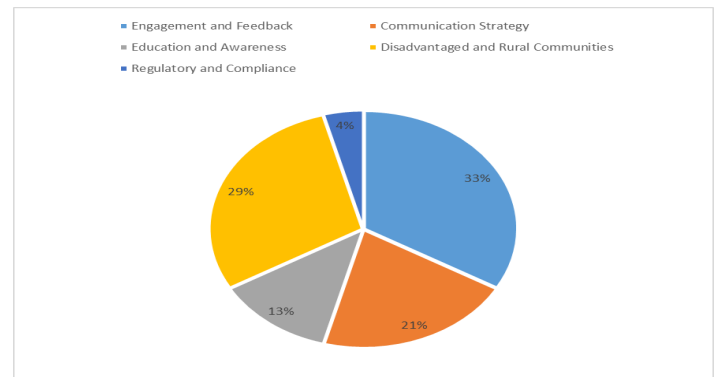

Fig. 3. Distribution of Communication Challenges Among Participants.

C. Implications for Policy and Training Programs

These findings provide a roadmap for improving state-level training initiatives under the Bipartisan Infrastructure Law (2022-2026). Addressing funding gaps, strengthening state-industry partnerships, and enhancing stakeholder communication will be crucial to ensuring a prepared EV workforce.

V. DISCUSSION

A. Interpreting the Findings

The transition to electric vehicles in the United States, driven by the Bipartisan Infrastructure Law (2022–2026), necessitates a robust workforce of trained EV technicians. This study analyzed key themes emerging from state-level efforts to prepare for this shift, highlighting disparities in training readiness, funding allocation, and stakeholder collaboration.

One of the primary insights from this research is the imbalance between infrastructure investment and workforce development. While significant funds from the National Electric Vehicle Infrastructure program are allocated to expanding charging networks, fewer resources are dedicated to training technicians to maintain and service these vehicles. The State Preparedness for EV Technicians (SPEVT) metric, developed in this study, underscores these disparities by assessing how well states balance these two priorities.

B. Strategic Planning and Investment: The Infrastructure-Training Imbalance

Figure 2 compares state investments in EV infrastructure and workforce training. Many states prioritize the development of charging stations over technician education despite widespread acknowledgment of the need for skilled EV mechanics.

The disparity in funding priorities highlights the risk of a workforce bottleneck—charging infrastructure expansion may outpace technician availability, resulting in maintenance delays and operational inefficiencies.

C. Stakeholder Collaboration and Communication Barriers

Stakeholder collaboration is essential for the success of EV technician training programs. This study identified five main stakeholder groups:

1. Educational Institutions – Community colleges and technical schools developing training curricula
2. Government Agencies – State transportation and labor departments facilitating funding and regulations
3. Industry Partners – Automakers and dealerships investing in technician training
4. Labor Unions and Mechanics – Advocating for re-skilling and certification pathways
5. Utility Companies – Ensuring charging infrastructure reliability

Despite these collaborations, communication gaps persist. Figure 3 illustrates the most frequently cited challenges in state-level EV workforce development initiatives, including misaligned priorities, bureaucratic delays, and unclear communication channels.

D. Regional Disparities in Training Readiness

States' preparedness to train EV technicians varies significantly based on economic, geographic, and political factors. Table 1 presents the State Preparedness for EV Technicians Scores, calculated using a multi-criteria assessment framework. States with high SPEVT scores tend to have established workforce development programs and strong industry partnerships, whereas states with low scores

often prioritize infrastructure expansion over technician training.

TABLE 1. STATE PREPAREDNESS FOR EV TECHNICIANS (SPEVT) SCORES

State	EV Workforce Development Score (%)	Infrastructure Investment Score (%)	SPEVT Score (%)
California	85%	90%	87.5%
Michigan	80%	85%	82.5%
Texas	60%	75%	67.5%
Tennessee	50%	80%	65.0%
Alabama	40%	70%	55.0%

States with higher scores are leading efforts to integrate workforce development into their EV transition strategies, demonstrating the importance of a balanced approach between infrastructure expansion and technician training.

E. Policy and Training Recommendations

To bridge the workforce gap and ensure the success of the EV transition, several policy recommendations emerge from this study:

- Increase Dedicated Funding for Technician Training
1. Mandate that a percentage of NEVI funding supports technician education.
2. Develop state-level grants to incentivize EV training programs at community colleges.
- Enhance Stakeholder Coordination
1. Create centralized communication platforms to align government agencies, industry partners, and educational institutions.
2. Establish interstate collaborations to share best practices in EV workforce development.
- Develop Standardized Certification Programs
1. Introduce a National EV Technician Certification to streamline training efforts across states.
2. Encourage partnerships between automakers and technical schools to provide hands-on training.

This study underscores the urgent need for a strategic, well-coordinated approach to EV workforce development in the U.S. The findings indicate that states prioritizing infrastructure expansion and technician training are better positioned for a smooth EV transition. Addressing communication gaps, reallocating funding priorities, and implementing standardized certification programs are essential to building a workforce sustaining the nation's shift to electric mobility.

VI. CONCLUSION

This study examined the preparedness of U.S. states in training electric vehicle technicians under the Bipartisan Infrastructure Law (2022–2026), revealing a critical gap between infrastructure investment and workforce development. While states prioritize deploying EV charging infrastructure, training skilled technicians to support this

infrastructure is lagging. This imbalance poses a significant challenge to the successful transition to electric mobility, as a shortage of qualified technicians could hinder the maintenance and repair of EV charging stations and vehicles.

The research also highlighted the importance of stakeholder collaboration in developing effective EV technician training programs. States that have successfully engaged educational institutions, industry partners, and labor unions in designing and implementing training initiatives are better positioned to meet the growing demand for EV technicians. However, many states continue to face challenges in coordinating these efforts, leading to disparities in training quality and accessibility.

To address these challenges, the study recommends a multi-pronged approach that includes increased funding for EV technician training programs, enhanced stakeholder collaboration, and the development of standardized training curricula. By prioritizing workforce development alongside infrastructure investment, states can ensure a smooth and sustainable transition to electric mobility. Establishing clear career pathways, industry-recognized certifications, and continuous professional development opportunities will be essential to attract and retain a skilled EV technician workforce.

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