

# Piloting the Transition to Freight Electrification

Lessons Learned in Electrifying On-Road  
Medium- and Heavy-Duty Vehicles



Electrification  
Coalition

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## Executive Summary

Over the last few years, the Electrification Coalition (EC) supported freight electrification pilot projects of several large national and international companies ('pilot partners'). We worked with these companies to better understand their challenges in implementing pilot electrification projects and identify best practices. Based on our findings, below is a summary of our key recommendations for fleets that are considering or actively planning to electrify in the future:

- Engage all relevant business units of the company in electrification planning and develop a project charter or memorandum of understanding.
- Select a project champion, ideally someone in a senior role with the company, to lead the pilot project.
- Engage external relevant stakeholders as early as possible. These stakeholders include electric utilities, electric vehicle (EV) charging solution providers, electric truck manufacturers, and in some instances, property owners and contracted third-party logistics companies.
- Collect internal fleet data, if not already available, and develop a methodology to utilize the up-to-date modeling for the total cost of ownership (TCO) and return on investment (ROI) to determine the economics and viability of the pilot projects.
- Map facility locations and then pair each facility with the numerous funding and financing opportunities offered by the federal, state, and local governments and utilities for freight electrification.
- Leverage the experience and expertise of third-party organizations working to scale freight electrification, such as the EC.







## Introduction

The transportation sector has historically depended on oil to move our people and goods and, therefore, is subject to the volatile global oil market. Electrification offers the most scalable solution to wean ourselves from this resource. However, transportation electrification, particularly for medium- and heavy-duty (MHD) freight vehicles, poses new opportunities and challenges for companies seeking to adopt electric freight vehicles. Many of these companies' key challenges include vehicle availability and procurement, charging infrastructure, capital costs, incentive and funding availability, engagement with the local electric utility, and project timelines.

Even with just a few vehicles, piloting electric freight vehicle adoption can help companies and fleet managers better understand these challenges. These pilot projects offer an opportunity for companies to collect and interpret new types of data related to their transportation logistics, engage with their utilities in new ways, learn about electrification operations and charging, and experience these vehicles firsthand.

To help companies overcome the real-world challenges of freight electrification and accelerate deployment, the EC launched the *Freight and Goods Delivery Electrification Project*. The project was a collaboration between the EC and its corporate fleet partners, specifically shippers, focused on deploying electric freight vehicles, specifically battery electric MHD on-road vehicles. The EC provided technical and strategic support to its corporate partners to develop and implement commercial freight and goods delivery pilot projects.

The *Freight and Goods Delivery Electrification Project* started as listening sessions in key freight hubs across the United States, including the Atlanta and Denver metropolitan areas. The initial plan for the Project was to develop freight electrification plans specifically to support the fleets operating in these areas. However, in hearing from the relevant stakeholders, the EC learned that the Project should instead be fleet-focused as each fleet's priorities and needs varied. This report provides lessons learned

***Even with just a few vehicles, piloting electric freight vehicle adoption can help companies and fleet managers better understand these challenges.***

specific to our corporate partners' pilot projects. It expands upon our 2020 report, [\*Electrifying Freight: Pathways to Accelerating the Transition\*](#), which identified critical barriers to freight electrification and solutions the public and private sectors can take to overcome them. In this report, we provide recommendations to companies on avoiding pitfalls and replicating best practices to deploy electric freight vehicles effectively. support to its corporate partners to develop and implement commercial freight and goods delivery pilot projects.

## The Case for Freight Electrification

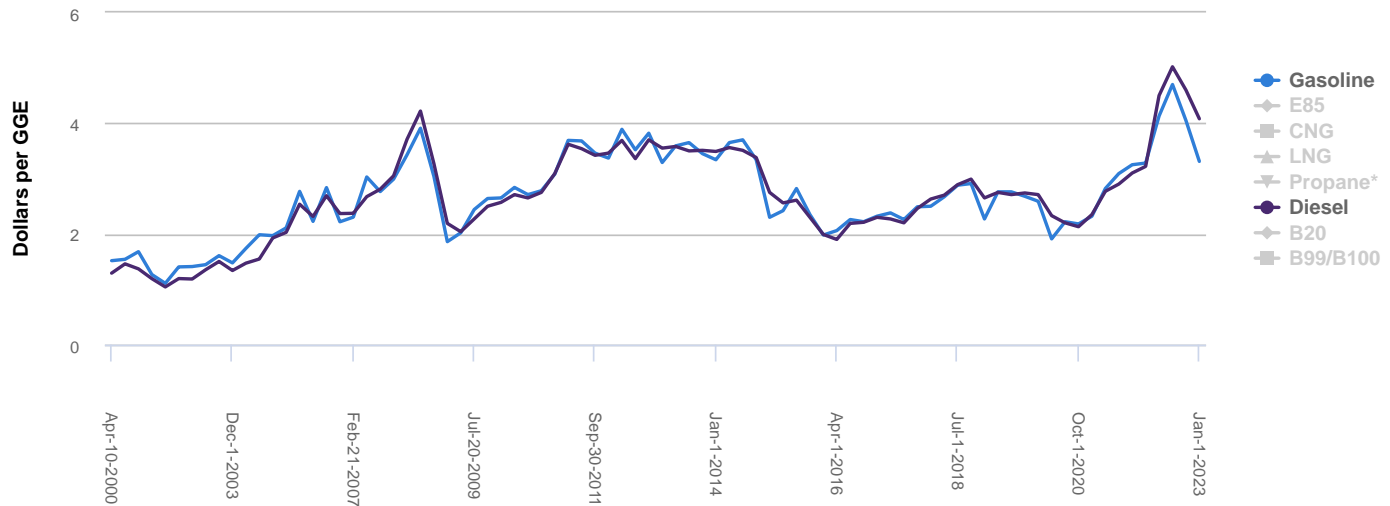
Despite making up less than 10 percent of registered vehicles in the U.S. in 2020, MHD vehicles were responsible for 28 percent of the U.S. transportation sector's fuel consumption and 26 percent of the sector's greenhouse gas emissions.<sup>1</sup> This issue will compound further as freight activity is expected to triple globally by 2050.<sup>2</sup>

Transitioning to electric freight vehicles offers corporate shippers and carriers one of the best opportunities to mitigate their emissions while reducing the demand for oil in the U.S. transportation sector. The following sections outline the national

<sup>1</sup> [Table VM-1 - Highway Statistics 2020 - Policy | Federal Highway Administration \(dot.gov\)](#) and [Fast Facts: U.S. Transportation Sector Greenhouse Gas Emissions, 1990-2020 \(EPA-420-F-22-018, May 2022\)](#)  
<sup>2</sup> <https://hewlett.org/wp-content/uploads/2020/04/Hewlett-Zero-Emission-Road-Freight-Strategy-2020-2025.pdf>



### Average Retail Fuel Prices in the United States



Source: <https://afdc.energy.gov/data/10326>

and economic security, environmental, health, equity, and cost-saving benefits of shifting the transportation sector from oil to electric-based.

## Economic

One of the main barriers to freight electrification today is the upfront capital costs of electric trucks and supporting infrastructure. However, electric freight vehicles' total operation costs (TOC), including fuel, maintenance, and related costs, are lower than diesel trucks.<sup>3</sup> This is primarily because the price of electricity has been historically lower and less volatile than diesel and gas prices, as illustrated in the figure below, which can provide more certainty for shippers and carriers as they set their fuel budgets.

Additionally, the California Air and Resource Board (CARB) estimates that the maintenance cost of an electric MHD vehicle is 4.7 cents per mile less than that of diesel trucks, which can save fleet operators hundreds of thousands of dollars over the lifespan of their fleet vehicles.<sup>4</sup> In addition to having a lower TOC, electric trucks are beginning to achieve TCO parity with diesel trucks. The U.S. Department of Energy estimates battery electric MHD will be cost-

competitive with their diesel counterparts by 2030 and 2035, respectively.<sup>5</sup>

Federal and state funding, financing, and incentive opportunities can lower the upfront costs of electric freight vehicles. The recently enacted Inflation Reduction Act (IRA) and Bipartisan Infrastructure Law (BIL) provide a historic level of funding and incentives for deploying clean energy technologies, including electric freight vehicles. For example, the IRA creates a Commercial Clean Vehicle Tax Credit worth up to \$40,000 for each vehicle. Several states have also enacted voucher programs that can further reduce these costs. California's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) provides entities with a point-of-sale voucher for zero-emission and near-zero-emission vehicles.<sup>6</sup> Additionally, technology development, particularly as it relates to battery technology, has helped lower the costs of EVs. The cost of a lithium-ion battery pack, a critical factor in the price of these vehicles, has declined nearly 90 percent between 2010 and 2020.<sup>7</sup>

## National and Economic Security

The U.S. transportation sector's reliance on oil can pose both economic and national security risks as oil is a global commodity whose supply—and,

<sup>3</sup> <https://www.c2es.org/wp-content/uploads/2020/02/Insights-On-Electric-Trucks-For-Retailers-And-Trucking-Companies.pdf>

<sup>4</sup> <https://www.act-news.com/news/calculating-tco-for-medium-and-heavy-duty-evs/>

<sup>5</sup> <https://www.nrel.gov/docs/fy22osti/82081.pdf>

<sup>6</sup> <https://californiahvip.org/>

<sup>7</sup> <https://about.bnef.com/blog/battery-pack-prices-cited-below-100-kwh-for-the-first-time-in-2020-while-market-average-sits-at-137-kwh/>

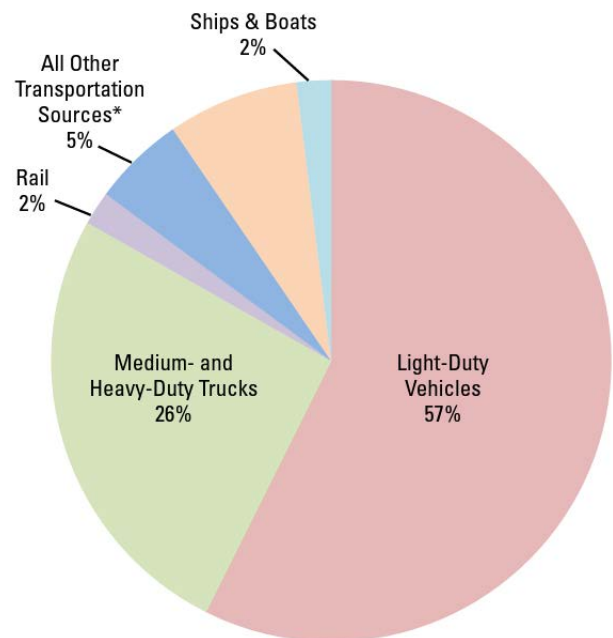
therefore, price—can be easily manipulated by just a few countries, many of which do not share the same values as the U.S. Major world events can also impact the supply and price of oil. The Russian invasion of Ukraine in 2022 resulted in a surge in fuel prices worldwide. While diesel prices have cooled in recent months, 2022 saw a surge in diesel prices, reaching a record high of \$5.82 per gallon in June 2022.<sup>8</sup>

Transitioning to electric freight vehicles can alleviate these challenges. The electricity that would power the electric freight vehicles is generated almost entirely domestically from a diverse set of energy resources, insulated from many of the global factors that impact the price of oil. Additionally, a growing percentage of the electricity that powers the U.S. comes from clean and renewable energy sources. In the last 20 years, the share of the clean energy generation capacity has increased by more than 10 percent.<sup>9</sup>

## Environmental, Health, and Equity

MHD vehicles are responsible for an outsized role in emissions from the transportation sector. In addition to contributing to 26 percent of emissions from the transportation sector, MHD vehicles generated 69 percent of total ozone- and particle-forming nitrogen oxide (NOx) emissions and 55 percent of total particle pollution.<sup>10</sup>

These emissions contribute to climate change and negatively impact human health, particularly those in historically disadvantaged communities, including communities of color and low-income communities. The American Lung Association (ALA) found in their 2022 *State of the Air* report that a person of color is 61 percent more likely than a white person to live in a county with a failing grade for at least one air pollutant and 3.6 times more likely than a white person to live in a county with failing grades for all three air pollutants measured (ozone, year-round particle pollution, and short-term particle pollution).<sup>11</sup> According to the Environmental Protection Agency,



Share of U.S. Transportation Sector GHG Emissions by Source, 2020.  
Source: <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockkey=P10153PC.pdf>

72 million Americans are estimated to live in communities near trucking routes. They are more likely to be people of color, have lower incomes, and are more likely to experience higher rates of adverse human health impacts.<sup>12</sup>

Electrifying MHD vehicles in the freight industry will have tremendous environmental benefits and downstream health and equity benefits. ALA determined that by transitioning to zero-emission trucking between 2020 and 2050, counties with major trucking routes could save \$735 billion in public health costs and avoid 66,800 premature deaths, 1.75 million asthma attacks, and 8.5 million lost workdays.

## Lessons Learned

Pilot projects are an essential first step for companies pursuing and implementing new practices that will affect business operations. They help identify hurdles and best practices and provide an opportunity to adjust to issues that arise without a large-scale impact on operations. Below are lessons learned and notable observations from the projects that EC's partners implemented and recommendations to overcome potential barriers.

<sup>8</sup> <https://gasprices.aaa.com/>

<sup>9</sup> <https://www.eia.gov/energyexplained/electricity/electricity-in-the-us.php>

<sup>10</sup> <https://www.lung.org/getmedia/13248145-06f0-4e35-b79b-6dfacfd29a71/zeroing-in-on-healthy-air-report-2022> and <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockkey=P10153PC.pdf>

<sup>11</sup> <https://www.lung.org/research/sota/key-findings>

<sup>12</sup> <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockkey=P10144Y3.pdf>



## Internal Corporate Alignment and Cross-Collaboration

Organizations that demonstrated greater internal alignment about the goals and needs for a fleet transition found that by working cross-department, they could communicate project changes more effectively, make decisions more quickly, and be more resilient to project disruptions. Additionally, effectively working across departments—such as between sustainability officers and fleet managers—had proven to identify and resolve challenges that had yet to be identified more effectively during their original project design. The necessity for collaboration has even been recognized by the federal government, demonstrated by the creation of the Joint Office of Energy and Transportation through the BIL. This office seeks to facilitate collaboration between experts and coordinate resources at the Department of Energy and the Department of Transportation to ensure the effective and efficient deployment of EVs and supporting infrastructure.<sup>13</sup>

### Recommendation: Build a cross-departmental team and common agenda

The EC recommends that companies and organizations bring together all relevant business units to create a freight electrification pilot project team at the start of the project. To ensure effective partnership among the different business units, the team should include individuals from the following departments: fleet management, sustainability, policy, supply chain, and operations. The team should hold an initial meeting to develop a document, such as a memorandum of understanding or project charter, to ensure internal alignment and effective decision-making strategies throughout the pilot project and set collective goals. The agreement should consider the following:

- What is the primary objective of this project?
- How does the project contribute to the company's sustainability goals?
- What does success look like, and how will it be measured?
- What minimum ROI is required for a pilot project at a specific facility?





- What TCO model will be used? And in the event of any delays with the project, what are the plans to utilize updated TCO models?
- How will the weight of the battery electric truck impact payload and, therefore, the number of shipments the company has to make?

A cross-department, collaborative approach allows a diverse perspective to open possibilities for creative, innovative solutions and better results. This approach also allows for effective communication and information sharing, enabling departments to move quickly in decision-making and aligning departmental goals. When various departments, such as sustainability, procurement, and government relations, are involved in the project's early planning stages, they contribute a unique perspective on the projected and actual impact of the project based on their area of expertise. It also provides opportunities to identify leads in the various departments and to have them precisely measure the project's impact based on their departmental goals.

Collaboratively working across departments requires establishing a common goal. Companies that utilize the corporate plan as a north star allow business departments to derive their individual department goals. Those department goals should be communicated across other departments as the project or program may intersect, and the need to understand how competing goals could occur within an organization. Creating a shared language that allows everyone to clearly understand

the goals and mission is essential. The glue that binds together cross-departmental collaboration is communication. Open, honest, consistent, and detailed communication allows various departments to understand the work each plays in the overall corporate goals. This allows everyone to understand the impact of their work not just within their department but as it relates to other departments and the company's north star work.

Developing a practical approach to decision-making is critical when engaging in cross-department collaboration for freight electrification projects. This allows organizations to be more agile in responding quickly to market changes such as supply chain issues and departmental disputes, and misalignment of project costs. This ambiguity can cause an organization to lose time and misuse resources, human and financial.

## Staffing

The EC engaged with individuals across multiple departments, such as fleet maintenance, sustainability, and government relations. The level of knowledge and goals on freight electrification within each of these companies differed in each department. Historically, transportation policy has been a small component of the policy portfolio for shippers. However, due to the complexity and nascency of freight electrification, our pilot partners' government relations teams have had to restructure their approach to transportation policy by becoming more proactive in this space. One pilot partner, for example, hired their first staffer focused solely on transportation policy. Fleet managers must also retrain their drivers and maintenance teams to support the effective deployment of electric freight vehicles. Due to the diversity in subject matter and necessary stakeholder involvement in freight electrification, the role of an internal champion is vital to deploy pilot projects.

Challenges that can occur include:

- The internal champion may not have the authority to help move a project along.
- Their role and responsibilities may not be well defined.
- They may not be strong communicators or negotiators.







- They may not support all elements of the project.
  - They may be stretched too thin that they cannot provide the necessary attention to the project.
  - They may transition from the position or leave the company before completing the project.
- Specifically, the EC observed negative impacts on electrification projects when internal champions changed roles or left the company. These shifts in responsibilities led to delays in advancing specific pilot projects and coordination with third-party organizations, like the EC.

To successfully implement freight electrification projects, the role of an internal champion is highly effective, mainly because freight electrification is a relatively new concept for many shippers and carriers and requires a novel approach. An internal champion is a person who advocates and supports a cause, and in this specific scenario, a freight electrification pilot project. Their role is to shepherd the project through the organization by eliminating obstacles such as office politics, resource issues, time and labor costs, competing priorities, and goals. Internal champions should be selected at the start of the project and have the ability and resources necessary to fulfill the role. Internal champions can help get all stakeholders on board, achieve project milestones, and bring a project over the finish line to completion.

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### **Recommendation: Identify an internal champion/leader**

The EC recommends that companies develop internal champions within the freight electrification pilot project team, ideally, someone in a senior role within the company who can effectively communicate the value proposition of freight electrification to the C-suite executives of the company. This is particularly important given the number of different business units involved in implementing a freight electrification pilot project. These champions will be critical to ensure the timely execution of the pilot project and to help navigate cross-cutting challenges that may arise.

As the freight industry moves toward electrification because of the improved TCO for these vehicles and federal and state regulations, the EC recommends that companies prepare their staff for this transition as early as possible, as has our pilot partners. While each company will utilize its capital as they see fit, this could include hiring staff or providing additional resources to educate and train the existing team. Investing in a well-versed staff in electrification will allow a company to better prepare for freight electrification and take advantage of recently enacted policies designed to reduce the upfront costs of freight electrification, such as those in the IRA and BIL. In addition to developing champions, the EC recommends companies maintain up-to-date work plans in case of staffing changes within the company, as it will ensure the continuity of the pilot project. A company may also consider establishing multiple champions to keep project deadlines on target in case of staffing changes. As has been mentioned, many of these projects can take years to implement, which increases the likelihood of staffing changes during the planning and execution phase of a pilot project.

### **Supply Chain and Infrastructure**

As companies begin electric freight pilot projects, supply chain challenges may occur and delay the delivery of electric trucks and the associated infrastructure. Current supply chain constraints and delays in critical EV materials, such as semiconductors, have seriously impacted the EV market. Some companies that have earmarked



electric freight projects have had or are experiencing delays in delivering their electric freight trucks and other supplies. For example, one of the EC's Freight and Goods Delivery Electrification Project partners experienced a significant delay in their truck delivery. Uncertainty and delays such as these can push back project deliverables, corporate decarbonization goals, and project timelines and incur additional costs for these companies. Utility companies are experiencing a marked increase in demand for energy, mainly as companies implementing these pilot projects may require greater electrical capacity at their facilities. Utilities increasingly need to address the electrical grid infrastructure demands while developing the workforce necessary to manage them. Therefore, companies deploying electric freight projects may experience delays when requesting support from utility companies.

### **Recommendation: Engage external stakeholders early and often**

The EC recommends that companies considering freight electrification pilot projects engage with the relevant stakeholders as early as possible, particularly their local utility company. Early interactions with these stakeholders offer the opportunity to prepare for any supply chain constraints and develop strong relationships, which

will be particularly important as the fleets look to scale their freight electrification projects.

Key stakeholders to connect with are the facility's property owner that will host a pilot project (if the facility is leased), existing or potential third-party logistics companies and contracted carriers, electric utilities, EV charging solution providers, and electric truck manufacturers.

### **Cost Modeling**

Companies considering TCO and the ROI models relevant to internal combustion engines (ICE) will not be able to correctly determine the true costs and returns from electric freight vehicles. Companies must realize that the TCO and ROI for EVs do not fit the traditional models or analysis. Companies must weigh the cost, impact, and overall corporate decarbonization goals, including the environmental, social, and governance reporting metrics and investments based on this. To respond to national and corporate decarbonization goals, companies must develop or use new models that reflect the long-term costs on ROI by switching to EVs.

The accuracy of these models is critically important. For example, one of the pilot partners required the cost of the EV they purchased to be less than a specific dollar figure to move forward with the



purchase. Similarly, another pilot partner required a particular ROI to move forward with a freight electrification project.

### **Recommendation: Conduct a TCO analysis**

Companies must utilize the most up-to-date TCO modeling to determine a company's true cost of electrification. For example, the EC and Atlas Public Policy recently launched the latest version of the Dashboard for Rapid Vehicle Electrification (DRVE) Tool.<sup>14</sup> The DRVE Tool provides companies with TCO analysis and assesses the best fit for companies transitioning their fleet to electric trucks.

## **Funding and Incentive Opportunities**

To maximize the support for their fleet electrification, it was important for these companies to have access to additional funding and incentives to support their project. These funding and incentive opportunities can close the TCO or ROI gaps mentioned in the previous section for a company to make a significant capital expense and move forward with a freight electrification pilot project.

Localities, states, the federal government, and utilities all offer funding and incentive opportunities to reduce the costs associated with freight electrification. These opportunities greatly influence whether a company moves forward with a pilot project at a particular facility, as experienced by one of our pilot partners, particularly regarding state-level grant programs.

In working with the EC, one of the Freight and Goods Delivery Electrification Project partners developed a mapping tool, matching all the facilities the company was looking to implement a pilot project with the funding opportunities offered for freight electrification. This tool allows companies to make informed decisions as they look to deploy electric freight vehicles.

### **Recommendation: Pursue federal, state, local, or other funding and incentive opportunities**

To take advantage of the funding and incentive opportunities, the EC recommends companies take a similar approach from the observation—mapping out the facilities and the eligible funding and incentive opportunities at each facility will support a company in making the business case to implement a freight electrification pilot project. This information will

<sup>14</sup> <https://electrificationcoalition.org/resource/drve/>





also be useful as states are moving forward with policies such as the Advanced Clean Truck rule and the Advanced Clean Fleet rule, which may provide another incentive to move forward with a project in a particular state.

## Collaboration with Third-Party Organizations

Electrifying freight at scale requires collaboration with third-party organizations. The work of scaling freight electrification is growing and changing at a rapid pace. Keeping up with technology, policy, data, news, and information requires collaboration and sharing information with others.

Multiple types of organizations work to accelerate the deployment of electric freight vehicles. These organizations tend to structure their strategic missions into one of the following: (1) advocacy, (2) implementation, (3) messaging, (4) or a combination of these approaches. For example, the EC provides policy and implementation support on freight electrification for its pilot partners.

Partnerships with third-party organizations can assist companies as they engage with other key stakeholders in freight electrification. The EC supported a pilot project partner in their engagement with electric utilities related to electric rate design. In addition to facilitating engagement

with electric utilities, the EC supported another pilot partner in evaluating technology options and their associated costs and connected them with the relevant technology providers, including OEMs and EV supply equipment (EVSE) providers. While companies may have the expertise and resources to coordinate directly with freight electrification stakeholders, it can be helpful to have a third-party organization that is already established in the field serve as a liaison.

Through conversations with the pilot partners, the EC established the Electric Freight Consortium in 2022 to facilitate peer-to-peer learning for shippers, carriers, OEMs, and other EV supply chain stakeholders. The Consortium has grown to include members outside of the Freight and Goods Delivery Electrification Project, bringing a greater diversity of knowledge and experience in deploying electric freight vehicles. The Consortium will aggregate these diverse perspectives and voices to promote best practices and advocate for policies from a holistic lens.

### Recommendation: Secure technical and implementation support partners

The EC and other notable third-party organizations have generated resources and literature for companies that want to electrify their freight vehicles. The EC recommends that companies looking to deploy freight electrification pilot projects first identify which type of support they may need to achieve their corporate goals in freight electrification. Based on this need, the company should identify and engage with an organization like the EC. Third-party organizations are uniquely positioned to aggregate the voices of the companies looking to transition to electric freight vehicles and move the industry towards electrification.

## Conclusion

There are many reasons to be optimistic about freight electrification. The industry has made considerable progress in recent years, especially in 2022. In August of 2022, IKEA announced a partnership with Electrify America and Electrify Commercial to install delivery fleet EV charging



stations in more than 25 of their retail locations and public-facing ultra-fast public charging stations.<sup>15</sup> In November, Amazon announced that there are more than 1,000 all-electric Rivian vans deployed in more than 100 cities across the U.S. after first being rolled out in July.<sup>16</sup> In 2022, Volvo completed its Volvo LIGHTS project, a public-private partnership demonstrating the real-world viability of freight electrification.<sup>17</sup> And in December 2022, Tesla delivered its first all-electric semi-trailer truck to PepsiCo following a demonstration of a 500-mile trip on a single charge while carrying a full load.<sup>18</sup>

To complement industry action, states and the federal government are accelerating the adoption of electric freight vehicles. The IRA dedicated \$379 billion in incentives and programs to develop and deploy clean energy technologies, including EVs. Notably, the law established a first-of-a-kind

Commercial Clean Vehicle Tax Credit, reducing the upfront capital costs of electric freight vehicles. The law also extends EV charging infrastructure incentives and provides critical funding that states and companies can use to deploy electric freight vehicles. The BIL included dedicated and formula funding for transportation electrification that is just beginning to be dispersed. The EC will conduct a deeper analysis of the two laws to identify specific incentive and funding opportunities and how they will scale freight electrification.

However, several opportunities for the greater adoption of electric freight vehicles must be more thoroughly examined, particularly when moving from pilot projects to full-scale deployment. For example, it is necessary to explore how shippers can utilize their relationships with third-party logistics and carrier companies to accelerate freight electrification. It is critical to engage utility companies at the start of a project. Lastly, it is vital to examine how smaller shipping companies, such as independent owner-operators, can be included early in the transition and are not left out, particularly in accessing the incentives and funding from the EV provisions within the IRA and BIL.

<sup>15</sup> <https://www.ikea.com/us/en/newsroom/corporate-news/ikea-u-s-electrify-america-announce-collaboration-ultra-fast-public-and-fleet-charging-stations-pubbe485af0>

<sup>16</sup> <https://www.aboutamazon.com/news/transportation/rivian-amazon-van-expands-to-100-us-cities-by-end-of-2022>

<sup>17</sup> <https://www.lightsproject.com/>

<sup>18</sup> <https://electrek.co/2022/12/01/tesla-semi-delivery-event-news-hub-livestream-updates/>





*The Electrification Coalition is a nonpartisan, nonprofit organization that develops and implements a broad set of strategies to facilitate the widespread adoption of electric vehicles to overcome the economic, public health, and national security challenges that stem from America's dependence on oil.*