Smart Freight Centre

Powering Forward: Scaling Electric Truck Projects

Building Collaborative Models for the I-10 Corridor

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About Smart Freight Centre

Smart Freight Centre is an international non-profit organization focused on reducing greenhouse gas emissions from freight transportation. Smart Freight Centre's vision is an efficient and zero emission global logistics sector. Smart Freight Centre's mission is to collaborate with the organization's global partners to quantify impacts, identify solutions, and propagate logistics decarbonization strategies. Smart Freight Centre's goal is to guide the global logistics industry in tracking and reducing the industry's greenhouse gas emissions by one billion tonnes by 2030 and to reach zero emissions by 2050 or earlier, consistent with a 1.5°C future.

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Contents

Tables

Figures

Executive Summary

This report outlines key lessons to-date from the development of the Interstate-10 (I-10) Zero-Emission Freight Corridor pilot project, an industry consortium coordinated by the Smart Freight Centre and involving shippers (Microsoft, PepsiCo), carriers/logistics service providers (Maersk, DB Schenker and AIT Worldwide Logistics) and an infrastructure provider (Terawatt). The project aims to accelerate the deployment of long-haul electric trucking along the I-10 corridor from Los Angeles to El Paso and start operations by 2027, three years ahead of planned operations without such a consortium.

Real-world implementation projects are critical for advancing road freight electrification. Whether testing temporary vehicle and infrastructure solutions or deploying at scale, a structured approach to project development is essential. The key strategic objectives of the I-10 Corridor project include:

- Mobilizing Resources for a Sector-Wide Transition: Aggregating demand, funding vehicles and infrastructure, and establishing a collaborative industry model.
- Generating Real-World Data & Learnings: Using pilot results to refine implementation design and inform the broader transition to electric trucking.
- Developing Recommendations for Scaling: Providing insights for logistics companies, technology providers, and policymakers to expand similar projects.
- Raising Awareness & Industry Competence: Enhancing the logistics sector's understanding of electric trucks and charging infrastructure.

The I-10 was identified as a priority zero-emission freight corridor under the U.S. National Zero-Emission Freight Corridor Strategy. Early findings from the I-10 Corridor project have identified several critical lessons for successfully scaling electric truck initiatives:

- **Anchor Projects on Shipper Demand**
  - Projects gain momentum faster when driven by shippers who commit early and aggregate freight volumes.
  - Higher committed freight volumes improve project economics, allowing capital costs to be spread more evenly and reducing the green premium on electric trucking.
  - Transparency on costs and potential financial benefits (e.g., total cost of ownership analysis) helps shippers make informed commitments.
- **Ensure a Strong Link to Government Policies**
  - Aligning projects with national and state-level policies enhances funding opportunities and regulatory support.
  - The U.S. National Zero-Emission Freight Corridor Strategy prioritizes investment in medium- and heavy-duty vehicle charging infrastructure, reinforcing the viability of the I-10 project.
  - Developers must stay informed about evolving incentive programs and regulatory changes that may impact project financing and adoption.
- **Leverage Infrastructure Providers (CPOs) for Operational Success**
  - Charging infrastructure providers (CPOs) play a central role in optimizing charging schedules, site security, and cost management.
  - Relying on CPO expertise in business development and communication can enhance project visibility and stakeholder engagement.
  - Keeping multiple CPOs engaged fosters a competitive business environment, ensuring long-term network resilience.
- **Deepen Operational Model Development**
  - Successful electric truck operations require customized models based on range, charging times, driver hours-of-service regulations, and overnight security.

- The lack of sleeper cab options in current U.S. electric truck models necessitates alternative operational strategies.
- Insights from ongoing pilot projects and early vehicle testing on the I-10 route will provide valuable data for refining future deployments.

- **Develop Clear Contractual Agreements and Tendering Processes**
  - Electric truck service contracts differ from traditional diesel trucking agreements, often requiring longer commitments and demand guarantees.
  - Establishing clear pricing and contracting structures is critical for ensuring shipper commitments and infrastructure investments.
  - A validated total cost of ownership (TCO) approach can help standardize pricing discussions and attract more shippers to the project.
- **Remain Flexible to Stakeholder-Specific Operational Requirements**
  - Adapting to unique shipper and carrier needs—such as specific truck models, security requirements, or charging preferences—enhances project feasibility.
  - Early project structures that required large upfront capital investments from shippers were adjusted to a more flexible operating expense (OPEX) model, improving participation rates.

The I-10 Zero-Emission Freight Corridor represents a pioneering model for scaling electric trucking in North America. By fostering multi-stakeholder collaboration, aligning with policy initiatives, and applying lessons from early implementation, this initiative is setting the stage for sustainable, long-haul electric freight transport. The insights gained from this project will inform the future development of national zero-emission freight corridors, helping to accelerate the transition to clean logistics and significantly reduce emissions across the freight sector.

1 About Smart Freight Centre's Fleet Electrification Coalition

Smart Freight Centre's **Fleet Electrification Coalition (FEC)** is a road freight program aimed at accelerating the large-scale deployment of electric trucks by leveraging aggregated demand. The program seeks to support shippers and fleet owners in transitioning to zero-emission vehicles, with a goal of achieving 30% zero-emission road freight by 2030 and 100% by 2040 globally.

Transitioning to electric trucks presents several challenges, including limited vehicle supply, inadequate charging infrastructure, and financial barriers. However, rapid advancements in clean technology, improving model availability, and projected cost parity before 2030 provide strong opportunities for adoption. Additionally, regulations in key regions like Europe and California mandate that 30-45% of new truck sales must be electric by 2030, positioning shippers as key drivers of market demand.

Collaboration is essential to overcoming these challenges and demonstrating the feasibility of electric trucks today. Therefore, FEC's theory of change centers shippers as the most motivated and influential industry stakeholder to decarbonize supply chains. Channeling shipper demand towards collaborative projects and partnerships is the over-arching catalyzer for mass adoption of electric trucks.

Shippers are the most motivated and influential industry stakeholders to decarbonize supply chains. Aggregating demand enables asset utilization for carriers, which in turn benefits charging infrastructure providers. This demonstrated demand can then provide scaled and consistent finance to support industry leadership and stronger policies. Below in **Figure 1,** it can be seen how this translates into FEC's strategies of action.

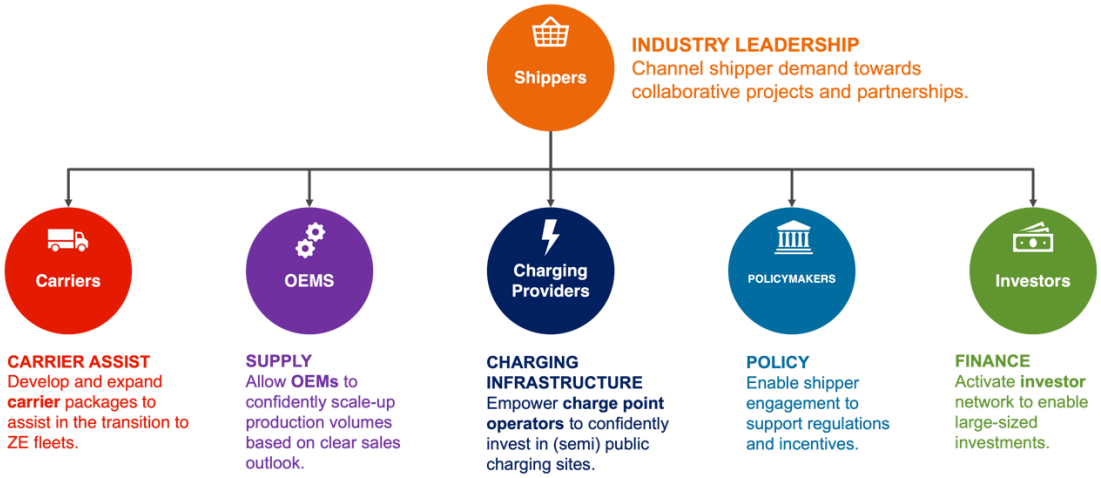


Figure 1. FEC's strategies for action to decarbonize the road freight sector

By implementing these strategies, FEC aims to drive the widespread adoption of electric trucks and help achieve global sustainability targets for road freight.

2 Background and Motivation

2.1 Road Freight and Zero-Emission Truck Regulatory Updates in the U.S.

Transportation is the largest source of U.S. greenhouse gas (GHG) emissions (28%), with freight playing a major role. Despite making up only 10% of vehicles, medium- and heavy-duty trucks contribute 30% of transportation-related GHG emissions, 45% of nitrogen oxide emissions, and over 50% of fine particulate matter emissions. The U.S. truck market includes 12 million class 2b-8 trucks, with heavy-duty trucks making up 5.1 million.
To address freight emissions, the EPA's Phase 3 GHG standards (2027-2032) aim to cut 1 billion tons of GHGs by 2055, making tractor emissions 40% stricter than Phase 2 and accelerating zero-emission truck (ZET) adoption. At the state level, as of May 2024, 11 states have adopted regulations like the Advanced Clean Truck and Fleet rules, covering 27% of medium- and heavy-duty vehicles and 37% of ZET deployments. These policies are projected to add 460,000 new ZETs by 2030.

2.2 State of Zero-Emission Trucks in the U.S.

In the U.S. there are more than 30,000 ZET on the road today, with more than 120 ZET models available from 40 different OEMs. When it comes to zero-emission heavy-duty trucks, they represent 36% of total ZET deployments. With California (10%), Texas (9%), Indiana (8%), Illinois (5%) and Pennsylvania (4%) leading the market in deployments.
Battery-electric trucks are expected to lower life-cycle carbon emissions by 44% to 79% compared to their diesel equivalents. They are also expected to achieve a lower total cost of ownership than diesel trucks for many vehicle types by 2040. In addition, the health and environmental benefits of transitioning fully to ZET by 2040 would be estimated to be $485 billion.
While there has been a dramatic increase in ZET deployments, it has primarily been within the cargo van vehicle segment. Of the 16,600 ZET deployments between 2017 – June 2023 roughly 14,400 have been cargo vans, or 87%. Heavy-duty trucks represented a little more than 5% of total deployments.

2.3 Building a Zero-Emission Corridor Along the I-10

This project will establish a truck electrification corridor along the I-10 between Los Angeles and El Paso, aiming for full deployment by 2027. A strong collaborative ecosystem is essential to scaling long-distance electric trucking, boosting confidence in the technology, and driving investment, vehicle deployment, and policy support. The project will also identify systemic changes and solutions to barriers, enabling broader adoption across North America.

ZETs will significantly cut GHG emissions and air pollution while driving economic and technological progress. Battery-electric truck technology has rapidly advanced, with growing model availability and cost parity with diesel expected before 2030. While most deployments focus on short-haul trucking, long-haul electrification offers the greatest potential cost savings. However, no operational corridors currently exist, and key challenges remain, including limited infrastructure, financial constraints, commercial and technological barriers, and the lack of large-scale deployment models.

A key motivation for the I-10 corridor selection was its alignment with the U.S. vision for decarbonizing freight. This includes its commitment under the Global Memorandum of Understanding for Zero-Emission Medium- and Heavy-Duty Vehicles and the National Zero-Emission Freight Corridor Strategy. The strategy phases infrastructure expansion from 2024 to 2040, with the I-10 prioritized as a priority corridor for electrification due to its high freight volume and potential community benefits. This initiative is a critical step toward scaling zero-emission trucking nationwide.

3 Partnerships

The I-10 Consortium is a shipper-carrier coalition that has been formed to accelerate heavy-duty truck deployment. This partnership will bring to light the operational and contractual realities of deploying a project of this scale. In addition, the projects aims to highlight ways to mitigate potential barriers that will enable pilot replication and the faster adoption of long-distance electric trucks elsewhere in North America and beyond.
For example, specific situational learnings from this project can be used to help replicate and scale projects in other geographies such as:

- Using the implementation to better understand and create layouts for different contractual relationships. For instance, contracting can be quite similar to diesel trucks, but now that electric trucks are being introduced there will be new stakeholders involved, such as infrastructure providers. The consortium would explore how to manage these types of contractual relationships.
- Gaining a better understanding of different operational models at charging stations such as: overnight security and how that impacts security and parking. Since current electric tractors in the U.S. do not have sleeper cab options, other alternatives will need to be laid out amongst partners to enable satisfaction with the site design.
- Laying the foundation for attracting other shippers, carriers and infrastructure providers so that freight volumes can be scaled up.

The Consortium will also work to prove that cross-collaboration is both possible and is an effective way to lead change in the heavy-duty electric truck space. A key part of developing this collaborative model will rely on the development of long-term commitments between carriers, shippers and infrastructure providers. In order to develop these sorts of long-term commitments, it is important to understand the different stakeholder groups and address, to the extent possible, their nuanced perspectives and objectives when it comes to the project. Such as:

- **Cargo owners/shippers:** focus on minimal disruption to supply chains, understanding operational challenges, and assessing environmental impacts.
- **Infrastructure providers:** aim to demonstrate the viability of business models for electrified freight movement and showcase economic feasibility.
- **Carriers:** seek to enhance sustainable offerings, strengthen relationships with cargo owners and position themselves as leaders in sustainable transportation.

3.1 Stakeholder Responsibilities

In the creation of this Consortium, having clearly defined roles and responsibilities is critical. Each partner has specific expertise and roles it must play to ensure the overall success of the project. The roles and responsibilities of these different members can be seen below in **Table 1**. The current list of stakeholders have been members since the launch of the Consortium in Fall 2023. New members will likely join the Consortium and the list will be updated accordingly.

Table 1. Stakeholder roles and responsibilities in the I-10 Consortium

Partner	Responsibilities
All project partners	▪ Collaborate to fulfill a shared vision of success. ▪ Communicate project findings including lessons learned and insights for pilot project replication, and corridor scaling.
Infrastructure provider (Terawatt)	▪ Build, test and operate charging infrastructure. ▪ Sign contracts with carriers based on agreed freight volumes and pricing. ▪ Share network map and proposed truck volumes.

*Shippers** (Microsoft, PepsiCo)	▪ Share corridor information and operational characteristics with the infrastructure provider, carrier(s) and project coordinator. ▪ Share volume information with each carrier individually. ▪ Test desired volume of heavy-duty electric trucks. ▪ Use trucks between any origin and destination of their choosing. ▪ Sign contract(s) with one or more carriers.
Carriers (Maersk, AIT Worldwide Logistics, DB Schenker)	▪ Sign contract with infrastructure provider, based on agreed freight volumes and infrastructure pricing to be negotiated between the individual carriers and infrastructure provider. ▪ Sign contract with each shipper, based on agreed freight volumes and pricing (infrastructure and transportation_ to be negotiated between the individual carriers and shippers. ▪ Develop and finalize operational model and plan allocation of electric trucks to the corridor. ▪ Test charging infrastructure, in collaboration with infrastructure provider.
Project Lead and Coordinator (Smart Freight Centre)	▪ Lead and coordinate project activities. ▪ Collect data on EV benchmark performance and charging system duty cycles, and coordinate emission calculation methods with partner NGOs. ▪ Develop roadmap to scale up I-10 corridor post-2027, including emissions benefits, and evaluation of public and private funding opportunities. ▪ Evaluate operational data, coordinating with partners on data analysis. ▪ Engage with additional shippers and carriers to scale up demand and supply post-2027, including shippers with westbound cargo. ▪ Lead and facilitate communication of project findings.

*Information provided by shippers/cargo owners will be governed by the non-disclosure agreements between each shipper and each project partner (e.g. project coordinator, carriers, and infrastructure provider) and will not be shared by any project partner with any other shippers.

3.2 Shared Vision of Success

With the identification of different roles and responsibilities, understanding a shared vision of success creates a common purpose for the Consortium. To do this for the I-10 project, individual I-10 Consortium members were interviewed to better identify where this alignment occurred. Therefore, the shared vision of success amongst the Consortium members has been identified below:

- Demonstrate the operational feasibility of electric vehicle technology for over-the-road trucking in North America, particularly along the I-10 corridor
- Gather learnings to expand the pilot, and develop collaboration and business models to scale and replicate the initiative in other corridors
- Lead a systemic change in the EV trucking and transportation ecosystem, including multi-stakeholder collaboration models that rely on long-term commitments, as well as new operational, finance and procurement models
- Prove that cross-collaboration is both possible and an effective way to lead change in the heavy-duty electric vehicle space
- Foster collaboration that enables the equitable sharing of risks and costs needed to achieve tangible results and overcome obstacles together as a value chain

4 Project Priorities, Milestones and Outputs

4.1 Project Priorities

In order to keep a focused scope over the next two years before deployment in 2027, Consortium members highlighted a few key areas where they felt the project should focus going forward. Many points were raised, primarily focusing on getting more clarity on costs and increasing shipper engagement. These prioritizations are explained in further detail below.

- **Focus on new shipper engagement:** Most participants noted the importance of focusing on new shipper outreach. Considering the impact this will have on improving the investment case and green premium, it was determined to be the highest priority. This includes gaining a better understanding of TCO estimates for the I-10 project using industry validated input data.
- **Understanding project success requirements:** Gaining a better understanding from project participants on the "non-negotiables" for project success. This includes gathering information from participants on what their requirements would be for pricing structures, contracting structures and electric truck requirements.
- **Moving towards firm commitments:** All project participants have signed a letter of interest demonstrating their intention to participate in the project. As the CPO determines its commercial proposal, the next stage will be to firm up volume commitments from shippers through contracts to enable both the CPO and carriers/LSPs to create firm commitments on pricing. In addition, this improves investment certainty when approaching investors. With the development of an industry-validated TCO model, directional pricing can help to provide more financial transparency between now and 2027 implementation.

4.2 Project Milestones and Outputs

This timeline, as can be seen in **Figure 2,** outlines key milestones for the I-10 Consortium. The project launched in Fall 2023, with pilot project design and site selection scheduled for June 2024, followed by a press release at New York Climate Week in September 2024. Efforts will continue through 2027, focusing on recruiting shippers, developing an economic and operational model using real-world data, and mobilizing infrastructure. Additional steps include building financial models and instruments (2026-2027) and tendering trucks (2026-2027) to support fleet electrification and deployment.

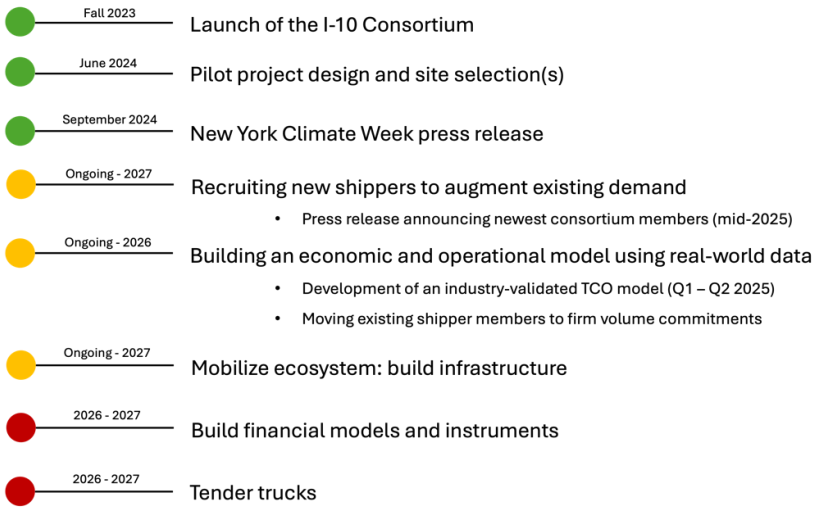


Figure 2. Key milestones and outputs for the I-10 Consortium

5 Lessons Learned To-Date

Given the project's long-term nature, lessons were gathered from I-10 Consortium members to guide subsequent project phases and facilitate external communication.

One-on-one interviews were carried out with each member of the project. Qualitative data from the interviews were then aggregated and sorted. Findings from the interviews demonstrated that while project partners identified many areas of improvement and potential project risks, there were also clear benefits and opportunities.

Below are some of the lessons learned thus far:

- **Anchor projects on shipper demand:** Projects move much faster if they are driven by a group of front-runner shippers who can aggregate demand and provide anchor volume to bring other parties into the Consortium. The current business model of the I-10 project requires a high aggregated shipper demand to improve overall economics. Higher committed freight volumes along the corridor enable capital costs to be spread more evenly amongst shippers. Thus, reducing the green premium that would be applied. In the absence of strong shipper demand, other projects have been slower to take off and remained in planning stages.

  Securing shipper commitments is also dependent on a list of financial and non-financial information or benefits. On the financial side, for example, providing transparency on costs can help shippers determine volume commitments, which in turn provides demand certainty for CPOs raising capital for infrastructure deployment and to carriers when securing contractual pricing. In the absence of firm pricing (e.g. the I-10 project does not get deployed fully until 2027), project leads can explore other avenues such as directional pricing estimates provided through TCO analysis that is validated with Consortium members.

  Non-financial benefits can also be important, particularly in the earlier stages of Consortium building, when looking to build momentum to attract shippers. This can include:

  - Significant emissions reduction benefits that can meet ambitious sustainability targets
  - Medium-term supply benefits of electric trucks versus other decarbonization strategies (e.g. biofuels)
  - Situational and operational learnings that can be used in other sustainability and electric truck projects across the country
  - Conducting real-world operational projects to better equip the company to technological change
  - Demonstrative innovation and industry-leadership
  - Group collaboration with best-in-class leaders to catapult heavy-duty electric truck adoption together rather than individually

  In addition, these non-financial benefits were indicated as important in building internal organizational buy-in from management with existing shipper members of the Consortium.

- **Ensure a strong link to government policies:** Despite being industry-led, these projects need a link to government roadmaps for electrified truck corridors to ensure policies and incentives are aligned. In March 2024 the Joint Office of Energy and Transportation released their National Zero-Emission Freight Corridor Strategy. The strategy prioritizes investments, planning and deployment for medium- and heavy-duty vehicle fuel infrastructure to advance zero-emission freight along the U.S.'s national corridors. One of the key corridors includes the I-10. This project therefore aligns with federal government strategy and its broader sustainability goals. In addition, sites along the I-10 are also the beneficiaries of government grants for charging infrastructure, and this project strengthens the case for future government grants.

Project developers should also keep in mind how evolving program requirements could affect project eligibility. As electric truck adoption and political environments change at both the federal and state level, so will regulatory policies. Particularly for policies such as incentives, which can substantially impact the capital cost contribution of the truck or infrastructure to the purchaser. An example, a recent update to California's Hybrid and Zero-Emission Truck and Bus Voucher Program removed incentives being applicable to companies with large fleets (50 or more trucks in the fleet). Other potential changes could be other states looking to put in place Advanced Clean Truck regulations like California's where draft regulations are either approved for implementation or rejected.

- **Ensure the CPO plays a central role:** CPOs add a deeper understanding of operations to determine how charging times affect trucking operations, cost, driver impacts and utility upgrade timelines. It is also helpful to rely on the business development resources that infrastructure providers have, including for communications. For example, during Climate Week New York in September 2024, the I-10 Consortium was announced publicly through a press release. It received a very positive reception, with more than 12 million views, largely due to the resources available through the I-10 project's CPO partner Terawatt. While this created external momentum to approach new shippers to join the coalition, it also created momentum and buy-in internally up to senior management within organizations already participating in the Consortium.

  As a note, it is good to keep different infrastructure providers involved in different projects, to foster a healthy business environment with multiple providers.

- **Deepen operational models:** Electric truck operations will need to rely on different operational models depending on the electric range, charging times and their interaction with Hours of Service regulations, overnight charging and where drivers sleep when the e-trucks do not have sleeper cab options available because of weight restrictions and additional security requirements while trucks are charging.

  Some organizations involved within the Consortium are working on multiple transformative sustainability initiatives within their organizations, including the I-10 project. Working within the Consortium provides valuable situational learnings that can then be applied into their own internal organizational structures. Current discussions on operational models have also proven to be valuable. For example, learnings from discussions around security requirements at charging stations provide insights into other zero-emission corridor projects an organization may be working on at present or in the future.
  In addition, while the deployment of the capital infrastructure along the I-10 will not be completed by the CPO until 2027, there will still be two years between now and the start date. Project participants highlighted the importance of continuing the involvement of all members so that the focus can continue to be action oriented. Finding purpose driven work within this two-year time frame will be important. A few shippers within the Consortium have already been deploying e-trucks along other corridors in the U.S. Some carriers have shipper customers who have conducted or are interested in conducting e-truck pilots along the I-10. There is an opportunity to create case studies and gain operational insights from these projects that could be leveraged in the I-10 project. Other opportunities could also include the early testing of e-trucks along the I-10 route to understand operating conditions for vehicles but using existing charging infrastructure.

- **Include contractual agreements and tendering:** Eventually the project needs to include actual contracts and tenders to operationalize e-truck service provision. These contracts will likely be different than for diesel trucks, relying on longer contracts with more demand guarantees, and possibly the inclusion of green premiums until e-trucks achieve TCO parity.

  It will thus be important for project leads to identify what are considered "project success metrics" for different members. This includes pricing and contracting structures. Identifying what does the CPO need to move forward with contractual obligations and what safeguards are needed so that shippers can commit to this project. Not doing this risks

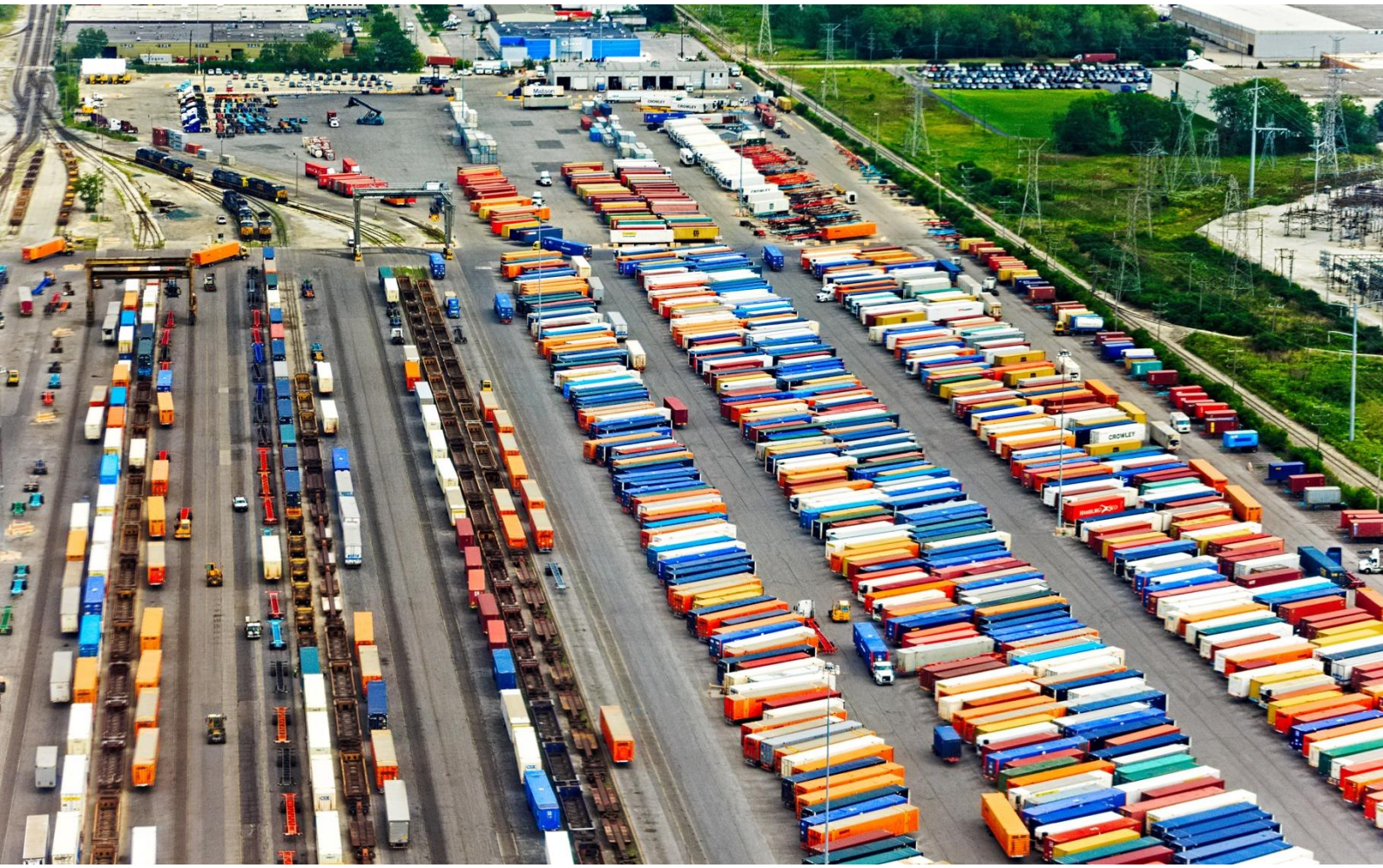
unmet milestones such as delays in contract signings, shippers backing out or changing freight volume commitments, insufficient total shipper volumes and infrastructure development delays at the charging sites. One possible solution to this is developing a TCO approach validated by carriers to be able to approach shippers with directional and/or relative pricing estimates compared to diesel to join the Consortium.

- **Adjust to organizational operational requirements**: Throughout the project there have been a series of operational requirements that have been unique to individual participants. For example, the use of Tesla trucks or certain charging requirements, or security requirements for specific shippers. Being nimble and adapting to changing operational requirements has allowed for additional flexibility that is important to Consortium members.

  In addition, initially the I-10 project had a high capital requirement for potential shippers. This requirement was meant to pay for the capital investment for infrastructure deployment being handled by the charging infrastructure provider Terawatt. Also, the first stages of the project were not across the whole Los Angeles to El Paso stretch of the highway. Rather it was meant to be a pilot with a smaller set of charging stations deployed. When it came to approaching potential new shippers to join the consortium, this proved to be a difficult sell. Eventually, the project participants pivoted the project to a full-scale deployment due to similar costs being calculated for implementation. As well, the initial capital requirement was removed, opting for an OPEX model where shippers would recover the cost of the capital through a green premium.

Smart Freight Centre

Join our journey towards efficient and zero-emission global freight and logistics



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