Electrifying Freight: Case Studies and Strategies for Scaling Zero-Emission Trucking Ecosystems

Executive Summary

***Virginia Williams**, Research Associate, Virginia Tech Transportation Institute, gwilliams@vtti.vt.edu*

Electrifying medium- and heavy-duty freight vehicles (MHDVs) is critical to meeting climate goals but significant challenges remain; these include high costs, complex infrastructure, and limited public charging. This project highlights real-world models and strategies supporting the transition to zero-emission freight, with a focus on charging infrastructure and enabling partnerships. Case studies include:

1. Volvo LIGHTS Project: A flagship public-private partnership in Southern California led by Volvo Trucks, which integrates electric trucks, charging infrastructure, and workforce training. This project illustrates how OEM-led collaboration can create a robust freight electrification ecosystem.
2. Electric Island: A high-powered charging depot developed by Daimler Truck North America and Portland General Electric, which was designed to test and validate interoperable MHDV charging. It demonstrates how future-ready infrastructure can support broader freight electrification goals.
3. As-a-Service Models: Innovative business models that simplify electrification by bundling trucks, charging, and operations. Trucking-as-a-Service, Fleet-as-a-Service, and Charging-as-a-Service models all offer opportunities to bundle the infrastructure costs that can make it less complex for fleets. These models lower barriers by addressing cost, sequencing, and operational complexity, which will be especially critical for smaller fleets.

Successful freight electrification depends on cross-sector partnerships, scalable and future-ready infrastructure, flexible business models to support a variety of fleet types, and interoperability of the technology. Demonstration projects, such as Volvo LIGHTS and Electric Island, along with emerging as-a-service models, are essential to accelerate market readiness and build operator confidence.

Future Research: This report consolidates findings to support the Virginia Tech Transportation Institute's and the Dock to Door Coalition's future regional efforts. Key opportunities include:

1. East Coast freight charging demonstrations: Build publicly accessible, high-capacity freight charging infrastructure.

2. Fleet Readiness Surveys: Assess owner-operator and fleet manager interest in electrification.
3. Use case & persona playbook: Develop narratives and tools to guide decision-making for various fleet types.
4. Regional success database: Document real-world success stories to inspire adoption.
5. Policy analysis: Identify regulatory barriers and recommend strategies to streamline EV adoption.

By capturing best practices and viable business models, this work equips regional stakeholders to advance the clean freight ecosystem and expand access to the environmental and economic benefits of zero-emission transportation.