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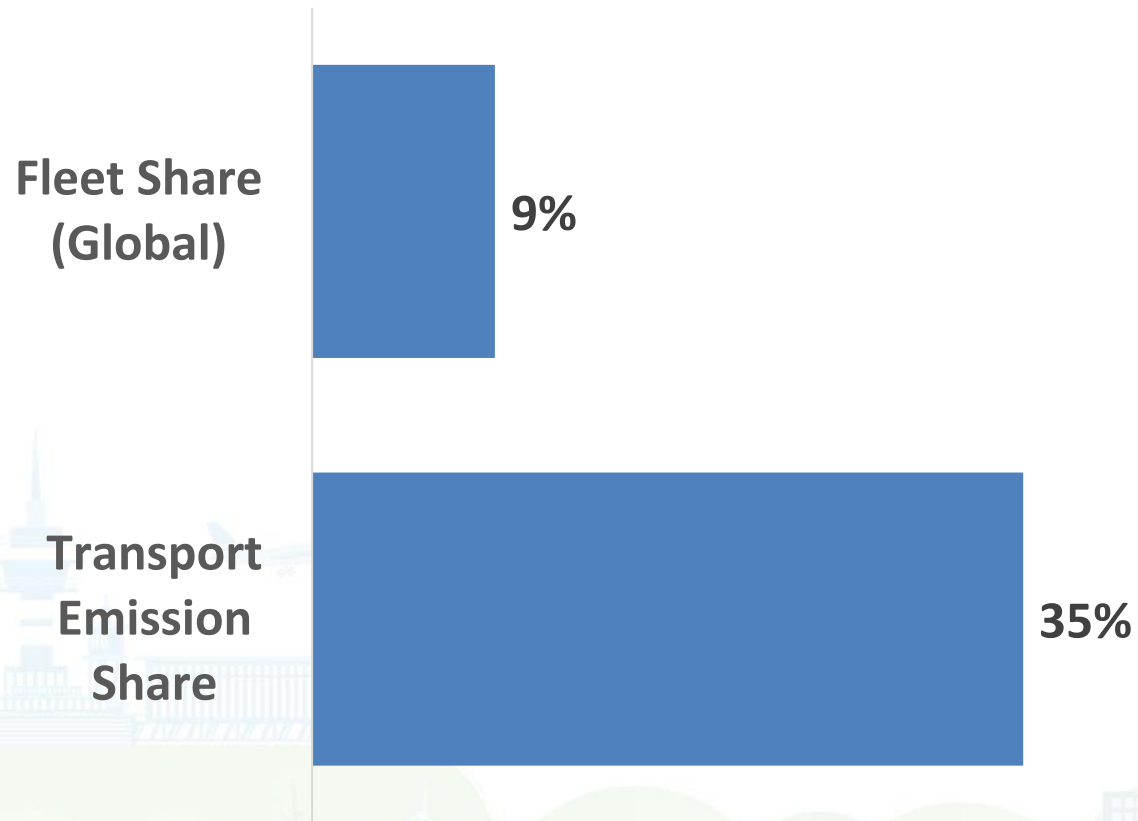
Replicable Battery Swapping Models for Electric Heavy-Duty Trucks to Support Freight Logistics

Michael Anyala

Senior Transport Specialist (Road Asset Management)
Transport Sector Office



Introduction and Context



Freight Decarbonization Challenges

Freight transport is vital for regional trade but hard to decarbonize due to high energy use and diesel reliance.

Battery Swapping Solution

Battery swapping offers a scalable, operationally viable alternative for electric heavy-duty trucks to reduce emissions.

Policy and Replication Insights

Drawing on China's experience and ADB analysis to inform CAREC policy on adapting battery swapping models.

Technology Pathways for eHDVs

Technology Option	Main Strength	Key Limitation
Depot / Slow Charging	Low infrastructure cost; simple deployment	Limited range and long downtime
Fast / Megawatt Charging	Reduced charging time	High grid impact and capital cost
Battery Swapping	3–5 minute refueling; high utilization	Requires standardized network

Global Trends in Electrifying Heavy Trucks



Europe's Charging-Based Approach

Europe emphasizes charging solutions with high-power depot and highway chargers, supported by emission standards and public funding.



United States Charging Model

The US follows a charging-led model driven by federal and state incentives, with innovation in early-adopter states like California.

PRC's Dual-Track System

PRC uses both charging and large-scale battery swapping, matching solutions to freight intensity and operational needs.

PRC Experience with Battery Swapping

1. Large-scale Deployment

By 2025, over 300,000 electric heavy-duty trucks operated in the PRC with widespread battery swapping adoption.

启源芯动力

Models

3. Business Model Innovation

Vehicle–battery separation and battery-as-a-service models reduce costs and encourage fleet operator adoption.

2. Policy and Standardization

Consistent policy support and standardization have promoted electrification and battery swapping pilots across regions.

4. Corridor-Based Deployment

Concentrating battery swapping stations along freight corridors enhances demand concentration and utilization efficiency.

Assessing Replicability Beyond the PRC

1. Study Scope and Focus

- Assessment initially targets Southeast Asian countries like Viet Nam, Indonesia, and Thailand for eHDT battery swapping model adaptability.

2. Core Assessment Criteria

- Study examines market readiness, freight demand, infrastructure capacity, regulatory frameworks, and financial viability.

3. Relevance to CAREC Countries

- Findings inform applicability for CAREC's corridor freight, industrial logistics, and electrification policies.



Source: Qiyuan green power

Recommendations and Key Takeaways



1. Targeted Pilot Projects

- Start pilot projects on priority freight corridors with concentrated demand and clear operational benefits.

2. Enabling Policy Frameworks

- Develop regulatory frameworks including incentives for eHDTs, battery swapping standards, and streamlined permits.

3. Integrated Transport and Energy Planning

- Ensure reliable electricity supply by integrating transport and energy planning using grid-friendly battery swapping.

4. Private Sector Mobilization

- Encourage private sector participation via business models like battery-as-a-service and public–private partnerships.

Thank You

manyala@adb.org

