Electrifying US Freight Corridors – Concept and Pilot
For an Agile Interconnected Road Transport Microgrid Solution

ASSOCIATES ENERGY SOLUTIONS

Market problem

Freight infrastructure, including road transport, is the lifeblood of the United States economy and a subset of critical infrastructure. Road transport is among the fastest-growing sectors[1], accounting for at least 80% of the global increase in diesel consumption[2] and nearly one-third of global transportation sector CO_2 emissions[3]. In the United States the transportation sector is now the largest source of greenhouse gas emissions, with medium- and heavy-duty vehicles used for freight among the most significant contributors.[4] Early-stage electrification plans and proposed market solutions for essential and heavily trafficked domestic freight corridors in the United States have not been optimized around five important factors:

- Current regulations that specify truck driver hours-of-service requirements
- Total cost of infrastructure
- Industry reliability requirements
- Permitting and interconnection timelines
- Disaster resilience, including recovery time reduction

INF and its partner ecosystem believe plans for zero-emission charging infrastructure that will meet ambitious federal and state energy goals must account for these factors to produce viable market solutions that will enable widespread adoption by producing the greatest co-benefits for road transport stakeholders. Regional planning efforts need to be coordinated to ensure that a unified, right-sized network is created.

Proposed market solution- the best solution isn't always the fastest charging scenario

INF and its partner ecosystem are developing market solutions for medium and heavy duty truck charging which optimize for current regulations that specify truck driver hours-of-service requirements i.e. when and how long drivers are allowed to drive by placing specific limits on the amount of time they drive the truck and how many total hours they can work before they are no longer permitted to drive a commercial motor vehicle.[5]

Enabling truck depots to function as microgrids by optimizing the charging rate around the driver hours-of-service requirements carries significant co-benefits. Optimizing the total number of truck depots reduces the total cost of infrastructure of building out the US electric vehicle infrastructure by minimizing the number and complexity of interconnection requests: siting truck depots at locations with low local interconnection facility costs at the point of interconnection minimizes construction of interconnection stations and transmission line extensions. Further, integrating battery storage and solar

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[1] International Transport Forum. Is Low-Carbon Road Freight Possible? (2018).
[2] Greene, Suzanne. Freight Transportation Overview. Retrieved from: https://climate.mit.edu/explainers/freight-transportation. https://climate.mit.edu/explainers/freight-transportation (2020).
[3] Ritchie, Hannah. Cars, planes, trains: where do CO2 emissions from transport come from?. Published online at OurWorldInData.org. Retrieved from: https://ourworldindata.org/co2-emissions-from-transport. (2020).
[4] Squires, Anna. NREL Tapped To Help Electrify 4 Major Freight Corridors. Retrieved from: https://www.nrel.gov/news/program/2023/nrel-tapped-to-help-electrify-4-major-freight-corridors.html. (2023)
[5] FMCSA. Interstate Truck Driver's Guide to Hours of Service. https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/Drivers%20Guide%20to%20HOS%202015_508.pdf

enables peak shaving, energy arbitrage, and resilient service if the serving utility's grid goes offline. Finally, microgrid islanding capabilities can contribute to disaster resilience and meet industry reliability requirements.

Evergreen Charing System- a win for investors, utilities, freight industry, and the planet

The proposed Evergreen Charging System is one emerging example that addresses the factors named above by providing an agile interconnected freight microgrid solution that: maximizes reliability and profitability of freight charging requirements; optimizes the total federal and private cost of infrastructure to build out a unified, national-level solution; and minimizes the number and complexity of permits and utility interconnections.

In this conceptual example, a highly replicable, scalable, modular, grid-connected truck depot microgrid features multi-port charging stations which use the hours-of-service requirements to optimize charge-control strategies. Integrated carport solar PV, proximal ground-mount solar PV if available, and integrated battery energy storage are utilized to enable vehicle-to-grid (V2G) solutions to optimize charging costs and enable private sector coordination to minimize critical transportation network downtime due to disasters (i.e support FEMA Emergency Support Function #14 – Cross-Sector Business and Infrastructure).

Figure 1 - ECS Concept with Parasal Carport Design – Used with permission from Parasol Structures

Additionally, the Evergreen Charging Solution could enable a match of solar PV energy production for every kWh charged for a true zero emission solution that allows for investors to maximize return for investing in solar generation by providing significant offtake partners with predictable loads. Further, the V2G solution could reduce costs to energy utilities and provide a backup power supply to reduce impacts of intermittent electricity generation.

Product ecosystem strategy and next steps

INF is a leading installer and support contractor of electric vehicle supply equipment (EVSE) and cloud infrastructure. We seek to use our deep knowledge of freight industry's real-world problems and our immense supply chain network to identify technical partners, anchor investors, and private joint venture opportunities to support validation and piloting of technologies that will support the buildout of a reliable, interoperable interstate network of truck depots. We seek to meet the actual needs of freight stakeholders by enabling practical solutions which unlock the greatest investment co-benefits and result in the development of a reliable infrastructure prepared to meet the freight industry's uptime requirements.

Proof of concept and pilot

INF is seeking to partner with applications-focused, academic researchers, leading transportation logistics firms, and others to complete the analysis that will identify prospective pilot locations with potential highest ROI and utilization. INF is simultaneously performing a manufacturing logistics study for carport solar components and decarbonized steel currently underway with Parasol Structures and Nucor. INF's intention is to aggregate multiple datasets (DAT, CASS, FTR, 3PL) and leverage AI to accelerate transportation model development that will demonstrate proof of concept. In 2024 INF's team will perform the optimization analysis to select the pilot site, and engineer the pilot site. In 2024 to 2025 INF's team will build and study the pilot site and then develop a national roll-out plan.