

Shared Charging for e-Trucks

First Steps Towards a Third Way of Charging

August 2024

Shared Charging for e-Trucks

First Steps Towards a Third Way of Charging

Date: August 2024

© Smart Freight Centre, 2024

Suggested citation: Smart Freight Centre. Shared Charging for e-Trucks. 2024

This publication may be reproduced in whole or in part in any form for educational or non-profit purposes without special permission from the copyright holder, provided acknowledgment of the source is made. Smart Freight Centre would appreciate receiving a copy of any publication that uses 'Shared Charging for e-Trucks.' as a source. No use of this publication may be made for resale or for any other commercial purpose whatsoever, without prior permission in writing from Smart Freight Centre.

Disclaimer

The views expressed in this publication are those of Smart Freight Centre and staff, and do not necessarily reflect the views of the Board of Trustees of Smart Freight Centre. Smart Freight Centre does not guarantee the accuracy of the data included in this publication and does not accept responsibility for consequence of their use.

Acknowledgements

This report was written by Samuel Barendregt (Smart Freight Centre).

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.

Contact

Smart Freight Centre

Keizersgracht 560, 1017 EM, Amsterdam, Netherlands

P.O. Box 11772, 1001 GT, Amsterdam, Netherlands

Tel office: +31 6 4695 4405

www.smartfreightcentre.org

info@smartfreightcentre.org

Do we need another way to charge?

Due to the outsized proportion of greenhouse gas (GHG) emissions generated by internal combustion engines, long distance battery electric trucks (BETs) offer the potential to significantly decrease the logistics sector's emissions. However, BET technology is in the early market stage, and key elements including the provision of charging infrastructure are shrouded in uncertainty. Currently, the predominant assumption maintains that BETs will charge at either private or public facilities. However, this concept note will seek to outline challenges to this strategy and forefront shared charging as a third way forward.

Private charging is built exclusively for a company's (contracted) fleet and enables charging either at the depot or destination. This "behind the fence" infrastructure is off-limits to other electric fleets. Private charging is common as it requires relatively simple coordination and provides an important level of control to the owner. However, as demand for electricity grid capacity continues to outpace grid upgrades, it is increasingly unlikely that private charging alone will meet the charging capacity required by BETs. Additional concerns such as low utilization and high up-front investments contribute to uncertainty around private charging as the main path forward.

Public charging is regarded as the solution for enabling long-haul electric truck routes, and for those who do not have access to private infrastructure. Public charging offers benefits to fleet owners, such as unlocking long-haul routes and no up-front infrastructure investments. However, as the BET transition is heavily dependent on favorable total cost of ownership calculations, reliance on public charging infrastructure entails a cost per kilowatt hour which has yet to fall within a range widely deemed as acceptable.¹ Due in large part to these calculations, public charging cannot be relied upon as a fleet's sole charging strategy.

Shared charging, where multiple companies come together to share capital and operational expenditures, has been well received in its introduction. Identified as a "middle-ground" between public and private charging, shared charging seeks to address drawbacks of the two more common strategies. Ideally located in logistics hotspots, such as a business park or other high-traffic locations, shared charging may be the key to enabling faster fleet electrification. Shared charging allows companies to provide volume guarantees to the site operators to secure high utilization rates, resulting in lower pricing than public charging locations.

The recently announced National Zero-Emission Freight Corridor Strategy from the United States Departments of Energy and Transportation prioritizes infrastructure deployment to accelerate zero-emission medium and heavy-duty vehicles. The National Strategy is to first electrify hubs, then connect these hubs and finally expand a complete network of zero-emission (ZE) corridors across the country. Shared charging offers a cost optimal path towards the electrification of these hubs. Regardless of geographical location, this hub-to-corridor-to-network approach will serve as the blueprint for the battery electric truck uptake.

There is a need to investigate more fully this third way to charge, as the apparent benefits directly address many of the hurdles in the path towards BET adoption. The following information contained here reflects the most recent conversations within the Fleet Electrification Coalition's shared charging working group and reflects input designed to create the conditions for a successful rollout of shared charging locations.

¹ In determining the range of acceptable energy pricing for (shared) charging, fleet owners will need to find a balanced charging strategy to reach an acceptable 'average cost of energy' within wider TCO calculations.

Zeroing in on Shared Charging

The Fleet Electrification Coalition, in late 2023, put together a proposal for its members to join a working group aimed at conceptual solution development. As a result, a diverse range of stakeholders from fifteen organizations engaged to produce definitions and requirements to enable the success of such a solution. The following is a reflection of these conversations.

To unlock the following benefits of shared charging, the coordinating organization must first conduct a basic usage mapping exercise where they can analyze usage patterns of participating companies. Usage mapping includes research into anticipated charging requirements, times needed, volumes expected and more. With a successfully organized plan, the following components add greater value.

The three main criteria, those which differentiate shared charging from other solutions, include utilization, flexibility, and abatement of grid constraints.

Utilization – the key aspect of facilitating a positive return on investment for charging infrastructure is that it is fully used. On the other hand, the chargers must be available when needed, which adds complexity to the equation.

Flexibility - in shared charging, flexibility provides participants with the ability to right-size charging infrastructure in keeping up with fleet growth, enables efficient use of land and energy, and uses collected data to further improve utilization and management.

Grid Constraints - refers to the delays associated with grid upgrade requests and availability of electricity. Grid constraints are, of course, prevalent with all types of charging but shared charging collaboration is expected to reduce this impact by decreasing the number of competing upgrade requests from neighboring companies.

In the table below, these three criteria are placed in discussion with charging strategies to illustrate how shared charging relates to public and private charging and fulfills stakeholder requirements.

	Private	Shared	Public
Utilization	Sub-optimal utilization, only used by private fleet. Availability is guaranteed.	Known customer operating patterns translates to high utilization. Availability similarly managed.	High utilization is possible but requires complex analysis of customer patterns. Difficult to guarantee availability.
Flexibility	In full reliance on private charging, upgrade to infrastructure must be foreseen in planning to account for fleet expansion.	Allows fleets to be agile, and scale BET operations when needed. Minimizes delays caused by private infrastructure upgrades and minimizes spatial footprint of charging at depot.	Offers flexibility to fleet owners who wish to unlock long-distance routes.
Grid Constraints	Subject to grid constraints and may lead to direct competition with neighbors for limited upgrade possibilities.	One large grid upgrade request will be easier to accommodate than multiple smaller requests. Energy usage can be optimized based on cooperative structures to further ease impact.	Subject to grid constraints. If located on/near highways, can be further constrained if supply cables need to cross highways to connect with charging station.

Table 1. Summary of Charging Strategies and Working Group Criteria

In comparison to public and private charging, shared charging is a concept which provides a cost optimal, less resource intensive, relatively quicker deployment strategy for the satisfaction of charging infrastructure needs. Shared charging offers additional benefit in areas of high grid congestion.

The Role of Innovation

In the working group, a focus on innovation was evident. As BET adoption will require new ways of doing business, shared charging must anticipate and accommodate these new requirements. The results of our discussions on innovation are shared in the following section.

Digitalization must be embedded in the entire shared charging process to enable smart charging capabilities. The first application is in assignment and reservation of charging bays. Secondly, digital management tools should extend to fleet owners/operators to schedule charging remotely and in advance as well as pay for the electricity their vehicles use and to monitor charge levels. Digitalization can also monitor energy grid aspects to charge when there is a greener energy mix available or to reduce costs by charging at off-peak hours.

Site configuration and service will be designed to support the maximum range of charging requests, which can be optimized due to a high level of information on the charging group dynamics. Shared charging locations should be equipped with both overnight and fast charging systems as well as the capacity to introduce megawatt charging systems when they become more widely available in 2025, by installing underground infrastructure proactively. The adoption of BETs will require new strategies to work around charging requirements while maintaining logistics operations. Shared charging operators should therefore consider how to minimize disruption to their customers' schedules. By offering "valet" services to move vehicles from charging bays to secure parking lots or arranging drivers to transport vehicles back to their depot, operational sticking points related to BET adoption can be

addressed. Finally, the spatial configuration of a charging site should accommodate a maximum range of vehicle types (from vans to trucks) and configurations (with or without a trailer attached). These considerations will make charging more seamless and sooth concerns expressed in the working group, namely those around utilization rates and flexibility.

Initiators of a shared charging location will assume this role based on logistics cluster characteristics. The initiator serves as the coordinating organization and may perform services as a legal entity on behalf of the participating network of companies. Given the fractured nature of the logistics sector, several “initiators” were considered to account for these dynamics. In the working group, the three most prominent initiator profiles were:

1. Charge Point Operator (CPO) led - where a traditional charge point operator provides the infrastructure, facilities, and administration, but restricts access to only participating companies;
2. Cooperatively organized - where a group of neighboring companies pool resources and knowledge to develop a location amongst themselves; and
3. A leading company takes the initiative to build a charging site or liberalizes access to their already installed charging infrastructure. Awareness of these options expands the possibilities of shared charging initiation.

In the graphic below, we have divided the above innovations into product (front end) and process (back end). The product side relates how the above concepts facilitate the users’ experience of the charging location, and how they answer our working group’s expectations of a shared charging location. The process side aligns the provision of the front-end experience with practical matters related to their facilitation.

Innovation	Digitization	Site Configuration	Composition
Product / Front End	Allows fleet owner to reserve charging, pay bills, and monitor vehicle status.	Accessibility maintained with accommodations to match fleet composition(s).	Likely determined by operating structure, options provide possibility to meet operating requirements.
Process / Back End	Allows operator to align, manage and optimize a range of parameters across multiple fleet management systems.	Planning for MCS capacity, offering services to minimize operational disruption.	Range of options for operating structure reflects specific requirements of participating companies.

Table 2. Innovation in Shared Charging Sites

Conclusions

In the BET transition, shared charging should be embraced as a key resource to advance the much-needed rollout of charging infrastructure. Given that the infrastructure component is a massive hurdle to BET adoption, this solution offers answers to the widespread challenges of overstretched energy grids, high investment costs, and a general lack of space available. If successfully realized, shared charging offers a clear solution path. The graphic below illustrates a solution space as a summary of this concept note.

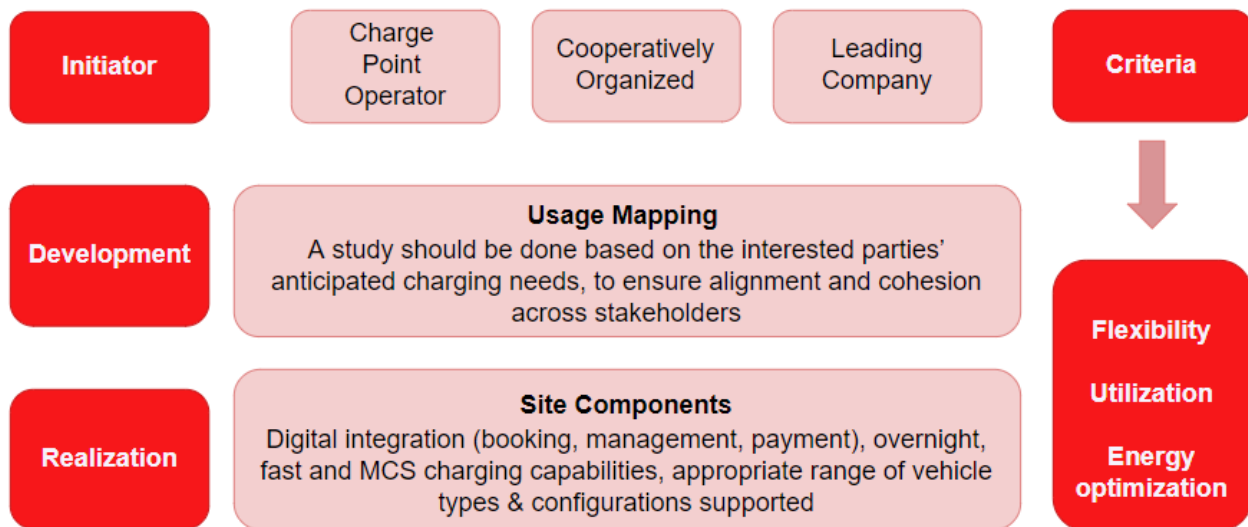


Figure 1. Summary of Concept Note Knowledge

Future research on shared charging should include investigation of financing and should include discussions on lease agreements, utilization commitment levels, acceptable levels of investment risk. Additionally, there is need for clarity in the rules and regulations which will govern shared charging, and these must be addressed and made visible to allow maximum support for a collaborative endeavor.

In addition to the calls for further research, Smart Freight Centre will plan to investigate opportunities for shared charging in our proof-of-concept projects. These opportunities include:

Port of Rotterdam – the objective of this project is to electrify drayage operations in one of Europe's busiest ports. In doing so, we will identify barriers to drayage electrification and build upon the experience to scale the project to electrify freight beyond the radius of drayage, into road freight. Shared charging will be explored in the working group discussions as a solution to enable charging amongst participants.

Poland Corridor – the goal is to establish a first-to-market zero emission corridor(s) in Poland, building on upcoming EV incentives for trucks and charging. Shared charging will again be discussed as a measure to increase infrastructure utilization and availability.

For further literature on shared charging, please see the following:

- The United States' National Zero-Emission Freight Corridor Strategy <https://driveelectric.gov/files/zef-corridor-strategy.pdf>
- Dutch government's National Agenda on Charging Infrastructure (pg. 12) *Dutch Language <https://www.agendalaadinfrastructuur.nl/ondersteuning+gemeenten/documenten+en+links/documenten+in+bibliotheek/handlerdownloadfiles.ashx?idnv=2301859>
- The Green Finance Institute has focused on numerous financial considerations around the BET transition <https://www.greenfinanceinstitute.com/programmes/cdrt/>

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



Contact

Smart Freight Centre
Keizersgracht 560, 1017 EM
Amsterdam, Netherlands

P.O. Box 11772, 1001 GT
Amsterdam, Netherlands

Tel. office: +31 6 4695 4405
www.smartfreightcentre.org
info@smartfreightcentre.org