CHARGING INFRASTRUCTURE FOR LONG-HAUL TRUCKS

Greenhouse gas emission targets and sustainability awareness are putting pressure on OEMs to provide electric vehicles. As a natural enabler of electric vehicles' adoption, a charging infrastructure network must be developed at a similar pace. The electric car market has come quite far in the transformation towards sustainable transportation means. However, there are several challenges related to the upscaling of charging infrastructure for long-haul trucks which have been identified and investigated in a recent Triathlon study. These challenges are outlined in this newsletter along with a short interview with an e-road actor.

Electric cars are no longer a rare sight on our streets. Both regulations and society are pushing OEMs to produce emission-free vehicles. However, having a wide enough infrastructure to cover charging needs, is a major enabler for customers to purchase these electric cars. In a previous newsletter, Triathlon has written about public charging infrastructure from the customer perspective, addressing aspects such as charging anxiety and range anxiety. These anxieties are likely to be dependent on the type of application; cars, buses, light trucks and long-haul trucks.

Charging a commercial vehicle will differ from charging a private car since the uptime is of much higher importance than for private cars. Long-haul trucks are set on schedules and cannot afford to stand still for long periods. In order for electric long-haul trucks to become a viable option for fleet-owners, charging cannot be time-consuming. Therefore, the required charging power using plug-in needs to be at 1000-3000 kW for trucks, which is significantly higher than what is considered as powerful fast charging for cars (~350 kW).

The road transport sector is characterized by low margins. In 2018, the average profit margin for long-haul trucks was at approximately 2%. Taking this into consideration, it is essential for transport actors to be as time efficient as possible. Freight forwarders cannot afford to decrease uptime, decrease margins or to lose business opportunities when switching to electric trucks. Hence, it is of increasing importance to develop an efficient and widespread fast-charging infrastructure, as an enabler of the transition towards electric vehicles.

In the beginning of 2020, Triathlon conducted a study with the purpose to investigate the challenges related to scaling up the charging infrastructure for long-haul trucks. The three major challenges that were highlighted are:

- Technology development
- Business impact
- Investment dilemma

These challenges will be further elaborated upon in the following part of this newsletter.

Triathlon study: Upscaling of charging infrastructure for long-haul trucks

Purpose: To examine the challenges and enablers for upscaling of charging infrastructure for electric long-haul trucks from a business perspective

Sectors represented: Automotive, Energy, Vehicle Charging, Power & Engineering, Research Institutes and Authorities

CHALLENGES FOR SCALING UP CHARGING INFRASTRUCTURE

WHAT WILL BE THE TECHNOLOGY OF THE FUTURE?

There are several different emerging technologies to charge electric vehicles. Stationary or dynamic charging could be combined with direct contact (conductive) or wireless (inductive) charging. The study shows that there is no natural choice in terms of technology for electric long-haul truck charging.

Plug-in charging, which is a stationary technology using direct contact between the vehicle and the station, may seem to be the only solution. Plug-in technology has the maturity benefit since it is already used in the car industry. However, it is not yet designed for heavy duty vehicles which will need significantly higher charging power. Such charging power may require extra support, for example large energy storage, to be viable for service stations. Energy representatives in the study pointed out that the current grid lacks capacity to enable simultaneous charging of multiple trucks at the same location. Even though there are several challenges related to plug-in charging for heavy vehicles, ~90% of the interviewees in the study believed that this technology will be the most common short term and a part of the future charging solutions.

Another emerging technology is the **Electric Road System**, which is a dynamic charging system, also referred to as e-roads. There are different designs for e-roads, either wireless or direct contact charging, from below or above. E-roads would enable charging while driving and were initially designed with heavy duty electric vehicles in mind.

For the e-roads, charging from below would be the most flexible option as charging from above is made dependent on the height of the vehicles. Automotive actors point out that a disadvantage with the technology is lack of flexibility due to fixed charging corridors. Others consider the business model as most challenging since there is a lack of natural infrastructure owners as well as proven revenue models for charging.

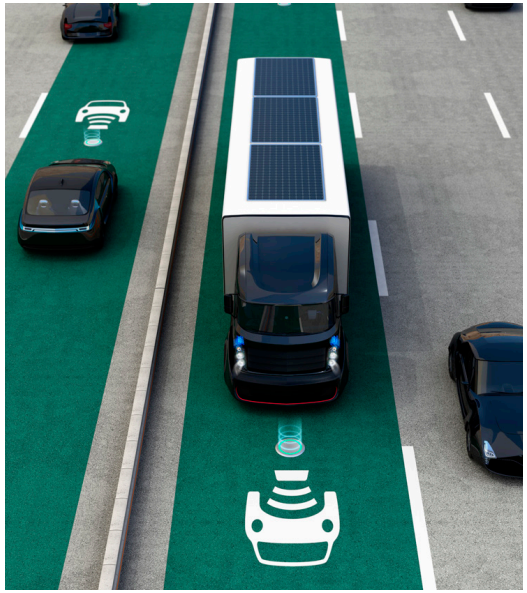
However, as highlighted in the study, e-roads would require a lower grid capacity than a large-scale roll-out of stationary solutions since the load would be evenly spread over time.

WHY ARE ELECTRIC VEHICLES CHALLENGING TO CURRENT BUSINESS?

The adoption of long haul electric trucks disrupts the business in several parts of the value chain. Industry representatives in the Triathlon study acknowledges two main bottlenecks creating resistance to adoption.

For electric truck owners, the transport planning will be dependent on available charging points in addition to current optimization parameters. With an increased complexity in fleet management, the full potential for an electric truck fleet is dependent on smart planning support.

For the truck manufacturers, a major challenge is to find economically viable solutions to utilize existing physical assets and knowledge of diesel-powered trucks. Not only the product portfolio itself will be affected but there is also a transition needed in current aftermarket support which has an even longer time perspective.



INDUCTIVE E-ROADS

Inductive charging uses coils under the road and a receiver on the vehicle. Hence, the charging is triggered when the vehicle and coil align, creating an inductive magnetic field. The technology is under development and currently only exists for short distances. One of the benefits with the technology is that it has a small impact on the structure of the road, as it is placed under it, i.e. there is no need for extra caution when maintaining the road. During road constructions, the technology can easily be integrated in the process. However, it will require extensive work to adjust already existing road network. Another benefit is that this solution prevents exposure to electricity and potentially related hazards. Finally, it has the advantage of potential utilization by other vehicle types, not only by trucks. Nevertheless, one point of concern is related to the uncertainties associated with high magnetic fields.

WHAT IS THE ACTORS' VIEW ON THE INVESTMENT DILEMMA FOR CHARGING INFRASTRUCTURE?

When scaling a new technology, the investment logic can be complex. Customers must be taken into consideration when building a charging infrastructure. Due to being in a low-margin sector, transport companies may not be able to afford a more expensive total cost for electric trucks compared to diesel trucks. To allow for a comparable total cost of ownership, charging should be less expensive than refueling since the purchasing cost for electric trucks is higher than for diesel trucks. Moreover, charging infrastructure providers need to make large investments to develop a technology that is, for now, not wide-spread, leading to the infamous chicken and egg paradox.

Currently, there is a paradox within the public charging sector. Industrial companies perceive the charging infrastructure business as immature, and thus require governmental financial support to implement. On the contrary, public actors perceive the technology as being mature enough for private manufacturers to invest without further public support.

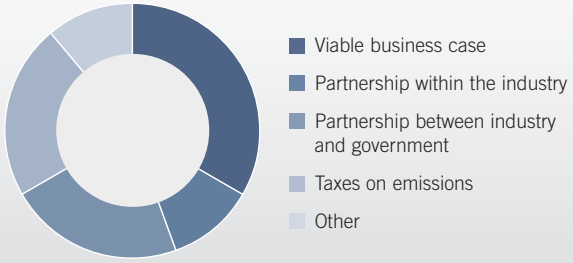
In conclusion, the upscaling of charging infrastructure for long-haul vehicles is very uncertain due to the below rationales:

1. Uncertainties related to technology development
2. Unwillingness to change due to lack of incentives
3. Unproven economical viability

Triathlon contribution

There are several uncertainties among the different actors in the charging infrastructure community and the actual triggers for upscaling is yet to be defined. Triathlon has a deep understanding of the challenges related to electric vehicles and charging infrastructure for different actors. With this in combination with extensive knowledge of the automotive industry, transport and electrification Triathlon supports companies in transforming towards an emission-free vision.

Elements actors consider as most important to initiate scale-up of charging infrastructure



The study showed that there is a lot of diversity on how actors see the potential and challenges of scaling charging infrastructure for long-haul transports. The chart gives the share of actors believing one of these elements as key to scale up charging infrastructure. As previously stated, the business case is of great importance. Furthermore, partnership has been pointed out as key for the upscaling to start. Both in terms of collaborations within the industry (vertically and horizontally) as well as with authorities to support with grants and knowledge.

INTERVIEW ELECTREON

Stefan Tongur, Business Development Manager Nordics, Electreon

Electreon is a global actor, developing and commercializing cost efficient wireless electric road systems (e-roads) that could be used both dynamically and in static mode. By the end of this year Electreon will have demonstrated the solution on public roads in Sweden and Israel through the projects Smartroad Gotland and Smartroad Tel Aviv with a natural next step to develop and implement commercial projects at a larger scale.

How can you overcome the barriers for implementing e-roads?

One of the main challenges of investing in e-roads is to secure that there will be a sufficient amount of users that want to utilize and pay for the charging service. Hence, it will be important to initially focus on business cases such as goods movement corridors and bus traffic in dense cities. The special thing with e-roads compared to other non-systemic innovations is that you cannot do everything alone to achieve success. We work with strategic partners which includes governments and cities, fleet operators and transport buyers, electricity grid operators, road construction companies, and OEMs.

What is your view on the role of inductive e-roads in the overall charging infrastructure?

Our value proposition is initially for transport buyers and operators of commercial vehicle fleets that are facing huge barriers in going fully electric. With e-road solutions, electrifying entire commercial fleets will be cost effective on a TCO basis since there is no need to make large upfront investments in batteries. A great advantage is that this technology is a shared charging solution that could be utilized by all types of vehicles, in urban and intercity application, and for different types of charging modes.

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