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Facilitating zero emission logistics through a knowledge and action agenda for logistics charging

Robert van den Hoed[1], Mark van Kerkhof[2]
[1]*NKL Netherlands, rvandenhoed@nklnederland.nl*
[2]*APPM, kerkhof@appm.nl*

Executive Summary

The logistics sector is likely to spur a new wave of electrification for its vans and trucks. Driven by increased national and European targets to reduce global emissions and stimulated by clean air objectives by cities the next decade the logistics sector is required to transition to zero emission alternatives. Electrification of logistics requires distinctly different charging infrastructure than personal vehicles, leading to challenges related to grid impact, integration in logistics operations and general lack of knowledge both in the sector as well as for policy makers how to stimulate e-logistics. This paper describes a set of national initiatives on logistics charging that is aimed at anticipating bottlenecks in charging infrastructure for the logistics sector, which is intended to create favorable conditions for electric vans and trucks in the future.

1 Introduction

In the past decade electric mobility has accelerated at a significant pace. So far the logistics sector has seen limited growth of zero emission alternatives. Given the large mileage and consequently high contribution to local and greenhouse gas emissions, the logistics sector is increasingly pushed to adopt more sustainable drive trains, including biofuels, hydrogen and battery electric alternatives.

The European Commission laid out the objective for trucks in its mobility strategy to have approximately 80,000 zero emission trucks on the road by 2030[1] [2] [3]. Also member states and cities are stimulating zero emission logistics. In the Netherlands includes 30-40 zero emission zones will only allow zero emission vehicles starting in 2025 [4]. The electrification of trucks will lead to major demands for charging infrastructure, which is likely to be different from personal vehicle charging.

A major challenge for national and local policy makers is how to facilitate charging for the logistics sector. Within the Dutch Climate Agreement a national program charging infrastructure (NAL [5]) was set up to anticipate prerequisites for charging infrastructure for all types of vehicles (from personal vehicles to logistics and buses). Within the NAL program, a working group for logistics was set up to focus specifically on requirements and barriers related to charging infrastructure for logistics so that the infrastructure itself would not become the limiting factor.

This paper describes a knowledge and action agenda for logistics and charging that was developed within this NAL working group. It is intended to share experiences and pinpoint major hurdles regarding charging infrastructure for logistics and as such aims all policy makers on national and local level that are faced

with challenges to stimulate appropriate charging infrastructure for future electric logistics.

2 Electrification of logistics in the Netherlands

2.1 Logistics Fleet in the Netherlands

Table 1 shows an overview of the logistics fleet in the Netherlands for the categories delivery vans (N1), light-duty trucks (N2) and heavy-duty trucks (N3) [6]. By 2021 there are close to a million logistics vehicles on the road, most of which are delivery vans (852 thousand). By 2022 around 9 thousand electric delivery vans were sold, representing just over 1% of the total market [7]. Penetration rates for N2/N3 category trucks are even lower, 0,25% and 0,1% respectively. This is largely due to a more limited set of available models, as well as a less favorable total cost of ownership (TCO) vis-à-vis diesel powered trucks. 0.3 percent of the logistics vehicles is currently electric. Delivery vans (due to sheer numbers) and heavy-duty trucks (due to high mileage) both contribute more than 40% to the total CO2 emissions in the sector.

Table 1: Overview of the Dutch logistics fleet and level of electrification (CBS, 2021)

Type		Weight	Category	Numbers	Percentage electric (2022)	CO_2 emission (Mton)
	Delivery vans	<=3,500 kg	N1	852 thousand	~ 1%	4.29 (43%)
	Light-duty trucks	>3,500kg <=12,000kg	N2	62 thousand	~ 0.25 %	1.48 (18%)
	Heavy-duty trucks	>12,000 kg	N3	74 thousand	< 0.1 %	4.15 (42%)

2.2 Growth scenarios for electric vans and trucks

Several forecasts for the growth of electric vans and trucks are available, one of which is developed by ElaadNL in their so-called Outlooks [9]. Figure 1 shows three scenarios for the growth of the electric van market up to 2035, where the medium scenario indicates an accumulated amount of 250,000 e-vans by 2030. This translates to roughly the same amount of chargers, assuming that every electric vans will require a separate charger. Similar uptakes are estimated for the N2/N3 categories, albeit at a slower pace: it is expected that the TCO for more heavy-duty electric trucks will reach cost parity at a later stage (>2027) than delivery vans.

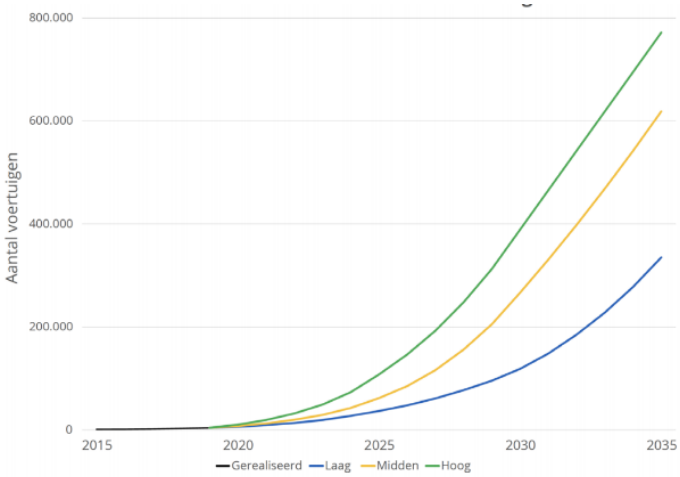

Figure 1 Growth scenarios in electric vans (n1 category) (ElaadNL)

2.3 Zero Emission zones

A major driver for the logistics sector to shift to zero emission is the national ambition to set up 30 to 40 zero emission zones (ZE zones) in major Dutch cities by 2025. This practically means that logistics vehicles (ranging from service logistics, postal services, retail logistics to waste disposal) cannot access these zones without zero emission. Battery electric drivetrains are the most likely candidate to enable this transition at this point. In Figure 2 the regulation on ZE zones depicted, including exemptions towards 2030 [11].

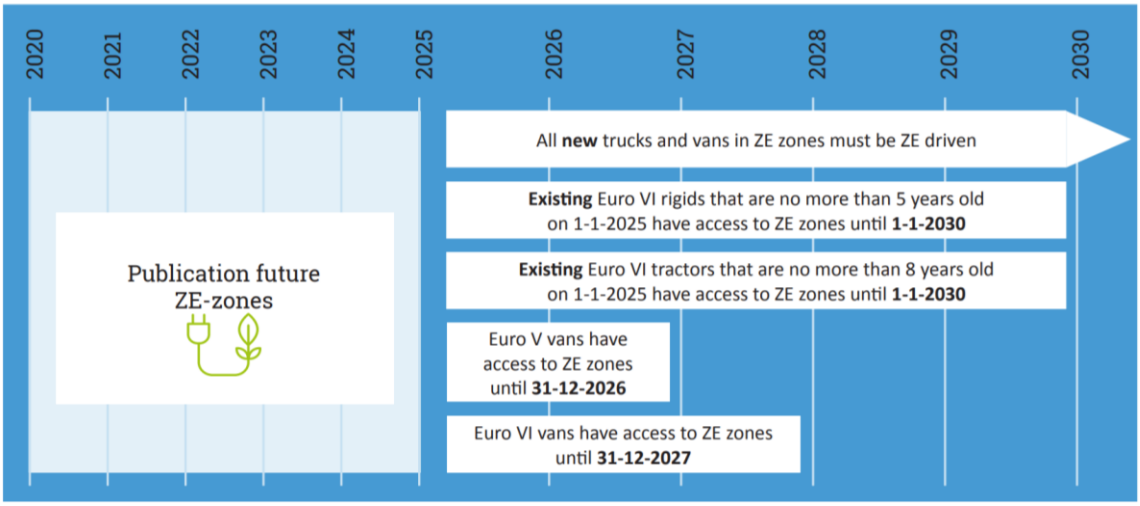

Figure 2 Dutch policy on Zero Emission zones (2020)

The majority of logistics vehicles are likely to charge at business and industry parks, or depots for logistics operations, according to ElaadNL more than 50% of all delivery vans, and close to 90% of trucks (light-duty and heavy-duty) [9]. The remainder of delivery vans will be taken home and will require charging close to homes, either on own driveways or (if not present) on public charging facilities. Trucks will not charge in neighborhoods and will likely rely on fast charging infrastructures along corridors for occasional longer trips. But all in all, the major challenge lies in facilitating sufficient charging infrastructure on industry parks and depots, particularly given the additional power demand and necessary grid improvements to facilitate logistics charging. For national governments with high ambitions to facilitate zero emission logistics, such as the Netherlands, focusing on these industry parks and anticipating future growth in power demand is key. This is one of the reasons to set up a knowledge and action program aimed at anticipating charging demand for logistics, identifying knowledge gaps and facilitating the industry with knowledge, incentives and proper instruments.

3 Knowledge and action program: charging infrastructure for logistics

A knowledge and action agenda was developed within the NAL working group logistics with the aim to safeguard that charging infrastructure is not to become the limiting factor in facilitating the logistics sector to shift to zero emission vehicles.

The knowledge and action plan “Charging infrastructure for logistics” was presented in 2021 and includes five action lines by which research and actions are programmed: (i) understanding and forecasting charging behavior of logistics, (ii) providing guidelines for policy makers to anticipate (public) charging infrastructure for logistics, (iii) developing practical tools and guidelines for logistics companies to lower barriers related to charging infrastructure, (iv) developing a base network of publicly available charging points for heavy duty and (v) facilitating charging infrastructure on building grounds. Taskforces have been set up per action line to discuss progress on a regular basis, put relevant knowledge questions on the agenda, and also prioritize new research to be commissioned. In the paper we shortly discuss the challenges, objectives and early results and examples for these particular action lines which are worked out by the taskforces.

3.1 Taskforce 1: Forecasting logistics charging demand

Problem definition

Municipalities, grid operators and logistics partners lack insight into where, when and what type of charging facilities (e.g., in capacity) to expect. This can lead to ad hoc installation of logistics charging infrastructure or suboptimal planning (too late or too early) with the consequent risk that any network upgrades will not be completed in time. Public parties (municipalities, provinces), grid operators, and logistics companies must know the expected demand for charging infrastructure due to increasing electric freight transport in public and private domains. This insight could be provided in the form of a forecast or planning chart showing the geographical distribution of the charging demand.

Assignment taskforce "forecasting"

The taskforce's assignment for this theme is to contribute to the realisation of more detailed forecast and planning charts, for example geographical location, peak charging times, capacity needed and others. The objective is to enable grid operators, municipalities, and logistics parties to start as soon as possible to prepare locations for required charging facilities and any grid reinforcements, as these changes to the grid can take up to 5 or 6 years from planning to implementation due to the intensive process of reinforcing the power grid and in particular because high power involves long lead times.

Practical results

Together with ElaadNL the NAL working group developed more insight in the future charging demand of logistics vehicles, particularly at industry parks. For this purpose ElaadNL will publish an updated outlook for logistics, while the working group developed a so-called storymap [12] that provides a map of all industry parks in the Netherlands (3700 in total) and provides information on (i) registered amount of delivery vans (N1) and trucks (N2/N3 combined), and gives an estimation of (ii) amount of electric vehicles per industry park (based on ElaadNL projections) and (iii) the consequent expected charging demand. Figure 3 provides a screenshot of the public available tool, which is intended to support policy makers, grid operators and companies in identifying industry parks where charging demand may make a large impact and may require upfront grid investments.

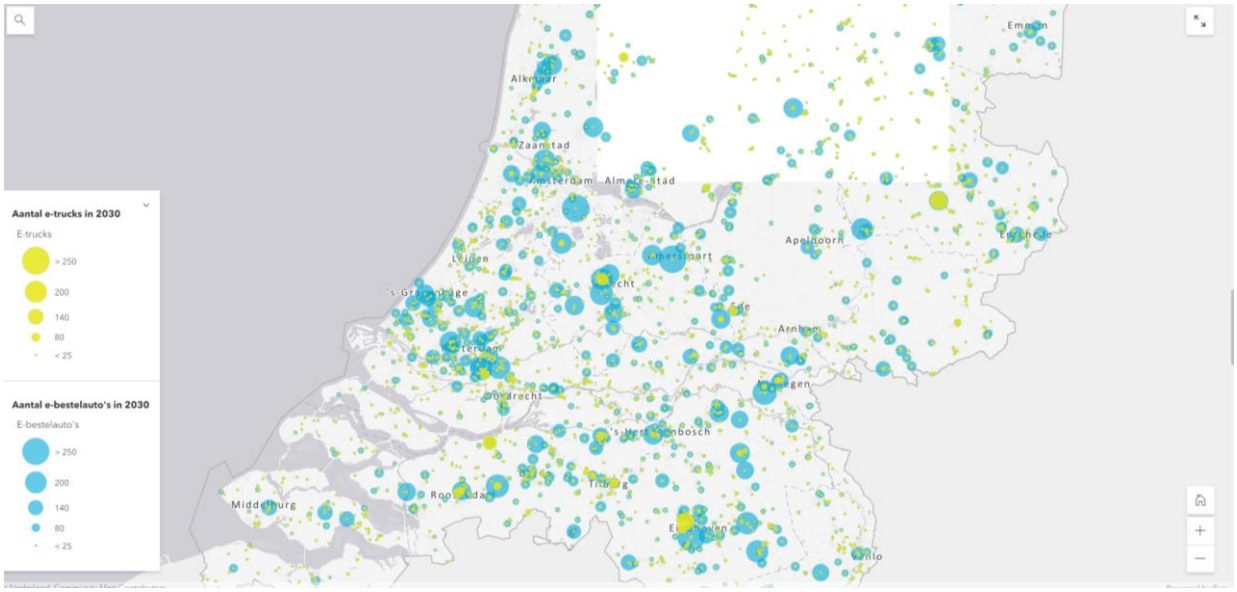

Figure 3 Storymap of additional power demand due to logistics charging in 2030

3.2 Taskforce 2: Public stimulation of charging infrastructure for logistics

Problem definition

Realizing charging infrastructure for the logistics sector is challenging for many road authorities (municipalities, provinces, Department of Public Works, and Water Management). Where should this public charging infrastructure be located? How do you translate logistics charging into implementation plans and tenders? Which (basic) requirements should you include in tenders? And how can municipalities encourage charging at depots and rapid charging, and what role should they play? How does it fit into urban planning? There are a lot of questions about how to include logistics in planning, implementation, and tendering. The risk here is that every municipality and region might have to reinvent the wheel.

Assignment taskforce "public"

This taskforce's assignment is to ensure that regional and local policy makers make progress in the field of logistics charging infrastructure (public, semi-public and private). This can be achieved by providing them with the right knowledge, network, and expertise in the best possible way. Within the taskforce, the focus will initially be on ZE-zones and long-distance transit (logistics) traffic, including the service areas and related charging stations on the main highway network.

Practical results

A first result of this taskforce was the publication of a guide for policy makers concerning the topic of charging infrastructure for logistics [7]. State of the art knowledge was compiled in order for policy makers to get a first insight in relevant topics to consider when devising a policy plan for ZE logistics and related charging infrastructure. Where policy programs for charging infrastructure typically focus on public charging in neighborhoods, the requirements for facilitating charging infrastructure at industry parks requires different approaches and incentives. The guide provides a first overview of relevant aspects to consider. In a later stage the guide will be complemented with particular policy recommendations how to facilitate charging at industry parks, which stakeholders should be involved, how logistics companies can be informed and incentivized and how/when grid operators should be engaged.

3.3 Taskforce 3: Private logistics charging (on depots/industry parks)

Problem definition

Logistics companies are faced with challenges in switching to electric, urging these companies to invest in knowledge in both ZE drivetrains as well as charging infrastructure. Charging at industry parks/depots is crucial for achieving emission-free logistics. It is expected that depot charging will meet almost 80% of the electric charging demand of trucks and 40% of delivery vans in a few years' time. As a result, most of the charging infrastructure necessary for the logistics sector must be set up at or near private business locations. For individual businesses, it is complex to realize an electric charging infrastructure on their premises and could lead to many issues. Besides the individual challenges, there are also issues at industry parks where multiple businesses will be charging their vehicles.

Assignment taskforce "private"

This taskforce supports companies in the logistics sector in realizing suitable charging facilities. The objective is to ensure that the introduction of charging infrastructure at businesses (distribution centres, offices, depots, ports) does not hinder the rollout of emission-free delivery vans and trucks. The taskforce gathers and disseminates knowledge about developments, possibilities and possible barriers related to realizing charging infrastructure for logistics vehicles, from delivery vans to trucks and inland shipping, in close cooperation with relevant sector organizations.

Practical results

Most prominent results that was published in May 2022 is a guide for transport companies that have an interest to develop charging infrastructure on their own premises. The guide covers the spectrum of questions (and answers) these companies have, ranging from basic knowledge on charging infrastructure (sockets, power requirements), costs aspects (fixed and variable costs), standards (interoperability, roaming), energy integration (with energy management systems, smart charging technology, synergies with solar and wind) and safety standards. It also includes references to complementary documents relevant for realizing private charging infrastructure such as a list of specifications required for high power charging systems (DC charging specifications, [13]), developed by the National Knowledge Platform Charging infrastructure in the Netherlands.

3.4 Taskforce 4: Primary network of public chargers (for heavy duty trucks)

Problem definition

Many entrepreneurs are hesitant to purchase battery electric vans or trucks if charging infrastructure is not available. Although there is already quite an extensive network of public high power charging stations in the Netherlands, these locations are mostly restricted to passenger vehicles (and delivery vans). Electric trucks can not access the charging stations for instance due to limitations in drive-through height, foundation (particularly for heavy-duty trucks) and/or power levels (150kW is minimal; preferably 350-700kW required).

At the same time, charging infrastructure is not profitable if there are no EVs yet – which poses a classic chicken and-egg problem. It is essential that charging infrastructure is put in place upfront to solve this problem, even though the business case may not be entirely conclusive.

What is observed in the Netherlands is that there are several initiatives from private companies or consortia to develop public heavy-duty charging infrastructure, which may lead to different standards, interoperability issues and/or geographical inefficiencies. A form of coordination on national level can likely benefit the realization of an effective heavy-duty charging infrastructure.

Assignment taskforce "private"

This taskforce focuses on developing a public basic network of rapid chargers where delivery vans and heavy goods vehicles can charge. Initially, the locations will be focused on and around ZE zones, ensuring certainty of charging for the sector.

Practical results

The taskfoce has been involved in a major development in developing a primary high power network, initiated by grid operator Enexis and ElaadNL, called LoLa-network. It is intended to lay the groundwork for a basic network for heavy duty vehicles, and it entails the rollout of 60 public accessible locations with a national coverage in a period of 5 years. The LoLa network is intended to stimulate the network's 'white spots' to create a robust basic network. The taskforce currently functions as an advisory board to the LoLa project.

3.5 Taskforce 5: Charging at construction sites

Problem definition

Charging battery-operated equipment and vehicles in the construction sector is increasingly important. There are various Dutch initiatives in the building sector, such as Emission-free Network Infra (ENI), aimed at achieving a clean and emission-free construction sites. The government and the construction sector are also currently working together on the Roadmap for Clean and Emission-Free Construction to achieve the objectives of the Nitrogen Action Plan, the Climate Agreement, and the Clean Air Agreement.

These initiatives actively encourage the use of zero-emission construction equipment.

The use of battery-operated tools and vehicles is dependent on the practical realization of safe charging facilities. To this end, we can build on knowledge and activities from other sectors. For example, charging construction freight vehicles, on the road or at the depot, is comparable to charging other freight vehicles. But charging or powering mobile equipment (e.g., excavators, pumps, or asphalt pavers) or vehicles at construction sites poses specific challenges.

Construction sites are temporary in nature and operating and charging battery-operated electric equipment must be integrated into the construction process, often involving many different parties. Therefore, the NAL Taskforce Charging at Construction Sites primarily focuses on charging mobile equipment and vehicles on construction sites. Charging logistics construction vehicles at depots or in transit is comparable with charging freight vehicles from other sectors and is therefore assigned to the other taskforces of the NAL Taskforce on Charging Logistics.

Assignment taskforce "private"

This taskforce Charging at Construction Sites contributes to the effective realization of safe charging facilities for battery-operated electrical equipment at construction sites. These can be either civil or utility construction sites or civil engineering sites.

Practical results

A practical result of this taskforce is a process analysis in which barriers have been identified in the implementation of charging facilities for battery-operated equipment and vehicles at construction site. This is currently translated into an action plan for policy makers what they can do to facilitate the development of on-site charging for construction vehicles.

4 Conclusions and recommendations

The paper provides an overview of the knowledge and action agenda that was set up in the Netherlands with the aim to anticipate future charging needs for battery powered delivery vans and trucks. It also describes a number of practical results that were achieved including practical tools (e.g. interactive map with projections on charging needs for all industry parks), guides (for policy makers, logistics companies) and coordination mechanisms (primary network). Collaboration with the sector and support from the Ministry of Infrastructure and Waterworks has been detrimental to foster this program and accelerate development of knowledge relevant for all stakeholders involved. The program may provide elements that may spur zero emission vans and trucks in other countries as well.

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Presenter Biography

Robert van den Hoed works at the National Knowledge Center for Charging Infrastructure in the Netherlands (NKL Netherlands), and is chair of the working group on logistics within the National Agenda Charging Infrastructure under supervision of the Ministry of Infrastructure and Waterworks. Formerly Van den Hoed served as professor at the Amsterdam University of Applied Sciences where his research field focused on optimizing charging infrastructure roll out and utilization.

Mark van Kerkhof is senior strategic consultant zero emission mobility at APPM management consultants (in The Netherlands). As managing director of The New Drive, APPM's sister organization in Belgium, he leads the scale-up activities in Belgium. On behalf of the Ministry of Infrastructure and Waterworks Mark is working as national research director charging for logistics within the National Agenda Charging Infrastructure.