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In business for charging electric buses solutions for timely installation of the charging infrastructure at the lowest social costs

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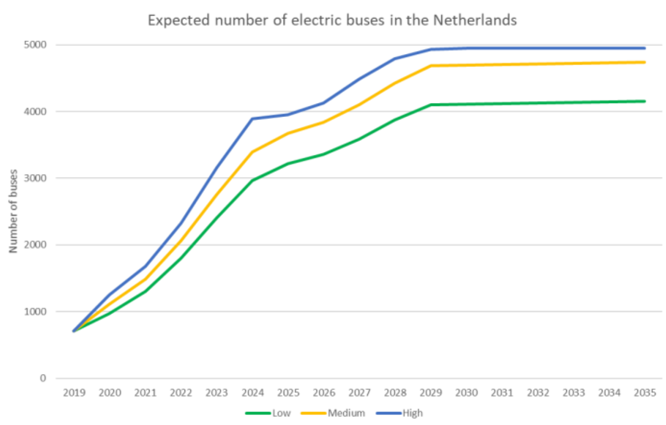
Summary

In 2030, emissions from the public bus transport in the Netherlands must be reduced to zero ('zero emission'). This must yield in more than 300 kton CO2 reduction compared to the current emmission level. Electric bus transport is expected to deliver one important contribution to this transition. For the functioning of an electric public bus transport system, charging infrastructure and optimal capacity connections to the electricity grid are crucial. A timely roll out strategy of this energy transition in the public transport must be cost efficient to keep public transportion cheap and reliable. Effective cooperation in the chain between muncipalities, transportation companies en grid operators is crucial for timely availability of charging infrastructure against the lowest social costs.In this research we point out the main steps in order to facility the transition towards zero emission bus transportation.

Keywords: *Electric buses, charging, roll out, scale up, social costs*

1 Roll out of zero emission buses

Electric transport is expected to be the most chosen technology for zero emission bus transport in the next decade. This leads to a strong growth of electric bus transport in the coming years. Recent study for the Netherlands shows that already in 2025 about 75% (about 3750 buses) of fleet within the public transportation sector could be electric. Furthermore, in 2030 one could expect between 4,100 (low scenario) and 5,000 (high) within the Dutch public transportation sector [1].



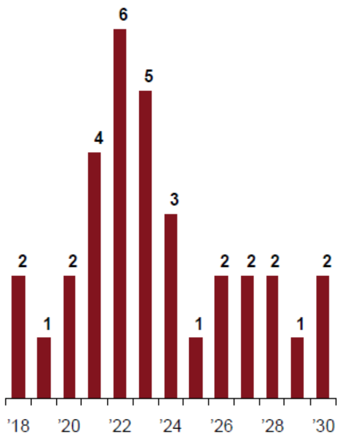


Figure 1 & 2: Potential growth scenarios for zero emission buses in the Netherlands [1] & concessions of public transportation till 2030

The main reason behind the growth path is related to the ending periode of several number of bus concessions in the coming years.

2 Charging infra workgroup

The public transport authority will initiate a timely procedure 'Charging infrastructure working group' with the involved municipality (s) and network operator (s). The consultation aims at the complexity of determine possible loading locations.
Bottleneck analysis of loading locations
The parties determine the complexity of loading locations by input of information
from each party:
• The public transport authority shares possible loading locations o.b. the timetable / circulation information (often endpoints, nodes and depots).
• The network operator determines the available network capacity at the locations (also can obvious implementation challenges are shared The municipality defines challenges in the integration into public space and possible soil contamination.
c) Sharing results in tender The information is provided by the public transport authority
in the tender documentation included. If necessary, the public transport authority can appoint preferred locations (where space is left to the carrier to select other locations).
d) Looking forward The parties share the problem areas able to anticipate:
• Complex locations can be part part of the carrier's plan
2. The carrier knows that during the implementation closely with the grid operator must be cooperated to find innovative solutions.
• The grid operator is better informed of the possible capacity demand its area what investment decisions can optimize in grid reinforcement

The electrification of public bus transport requires installation of charging infrastructure in the near future. Research shows that at least 110 depot chargers (overnight charging), and about 260 charging hubs (opportunity charging) will be needed by 2025. Figure 3 shows the potential locations of the 110 depots, and the required grid connection capacity.

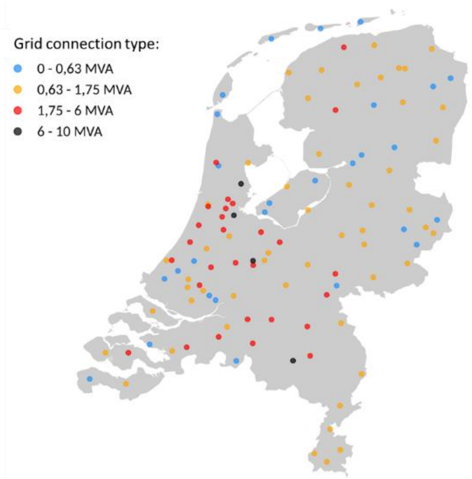


Figure 3: Connection capacity for depots in 2025 [1]

3 Extend implementation term

In practice, there should be an extend implementation term. In a public procurement for the zero emission concession, it might take time between the network operator and municipality to identify possible locations for charging since many options might have complex execution conditions. Often an implementation period of 1.5 years handling is required. The public transport authority should set the implementation period prior to setting the tender conditions, so no one is surprised by another.

4 By catch

During our research, a number of other solution directions emerged. These have fallen due to the deviation of the current legislative and regulatory framework (tenders to enable market forces and innovation, regulation of the network operator). Elaad also identified possible solutions:
1 Possibly combined with smart design of the tender to reward rapid implementation
2 Communicate a realistic implementation time for each individual stakeholder for zero emission bus transportation
3 Align innovative solutions for sites where there is grid reinforcement, both for the buscarrier, the network operator, public transport authority and municipality in consultation

5 Follow up research

The improvements can be desirable in the longer term; follow-up research is needed.
1) The impact of regulation on investments in electricity networks needs a fresh up. Tariff regulation encourages network operators to demand efficient. The incentive may be so strong that network operators are waiting with grid reinforcement to the marginal application that makes the aggravation necessary. The question is whether this conclusion is valid in view of the current growth demand for capacity driven by electrification of mobility.
2) Desirability configuration legal realization term on realistic implementation times. For the true realisation of the connection (excluding the grid reinforcement), a statutory realization period of 18 weeks must apply. In reality, realization for e-bus charging infrastructure has a longer turnaround time. It is important that the duration of the realization of these connections is better monitored in order to substantiate the desirability of the adaptation.
3) At the junction of different concession areas there might be different times in tendering. Apart from that, also different kinds of loading infrastructure (including the connection) are applied. This results in non-interoperability and is accompanied by a repeated demand of the public space (such as excavation works and road deposits).
4) The charging infrastructure, and with it the charging location, are new assets in the bus transport chain. If tactically advantageous locations in the award of a carrier, this may play a role in the award of the next concession. Further research is needed into the impact of choices regarding ownership in tenders for fair competition in later tenders. The role of loading point providers (charging infrastructure managers) can also be included.

6 Conclusion

In 2030, emissions from the public bus transport in the Netherlands must be reduced to zero ('zero emission'). For the functioning of an electric public bus transport system, charging infrastructure and optimal capacity connections to the electricity grid are crucial. A timely roll out strategy of this energy transition in the public transport must be cost efficient to keep public transportion cheap and reliable. Effective cooperation in the chain between muncipalities, transportation companies en grid operators is crucial for timely availability of charging infrastructure against the lowest social costs.

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Baerte de Brey is the Chief International Officer within ElaadNL. ElaadNL is the knowledge and innovation centre in the field of (smart) charging infrastructure and is owned by the Dutch DSOs. Responsible for analyzing the long-term effect of electric mobility on the electricity grids, Baerte helps building a sustainable business case around this transition. This includes vehicle2grids, EV-storage and customer behavior research. He graduated from Leiden University in 2001 with a law degree and received a MBA from Nyenrode Business University in 2006. As an expert for the European Commission he sometimes reviews collective European programs concerning EV interoperability and smart charging. In his spare time he is a member of the Provincial Council of Utrecht.

Nazir Refa received his Master of Science degree in 2015 from Utrecht University, Netherlands. Currently, he is working as a data scientist at ElaadNL. His primarily research interests are in the field of EV grid impact, and smart charging studies. Within ElaadNL he is responsible for monitoring, and analysis of various smart charging pilots in collaboration with the Dutch grid operators, and research institutes. He has co-developed several bottom-up models for EV diffusion, and deployment of EV charging infrastructure.