

GEVO 2020 - Helsinki

Introduction to the Helsinki region

The Helsinki region has a combined population of about 1,49 million inhabitants, with around 650 000 living in the city of Helsinki. Approximately 370 million journeys are made annually in the region using public transport services. The public transport modalities in the Helsinki region include buses, trams, Metro, ferries and commuter trains. Walking is the most common modality (36%) with public transport as a close second (33%), with buses as the most common (13%) means of public transport, followed by Metro (10%), trams (7%) and trains (3%). In comparison, cycling has a share of 11%. The goal for future transport needs growth is to increase the share of walking, cycling and public transport.

Public transport sector organization in the Helsinki region

The regional public transport authority, Helsinki Region Transport (HSL), organizes public transport in the Helsinki region. Helsingin kaupungin liikenneliikelaitos (HKL), a public transport operator wholly owned by the city of Helsinki, operates and maintains the Metro and tram networks as well as the busiest ferry route. The bus routes are planned and scheduled by HSL, while the operation contracts are typically awarded for seven-year periods to public transport operators based on open tenders. There have been minimum quotas for electric buses in the tenders to increase the inception rate, but already the operators have offered more electric buses than the minimum required. The reasoning behind this can be twofold: on one hand the tenders favor electric buses slightly over other types and the operation contracts have both environmental bonuses as well as penalties for operation with lower quality equipment than specified. On the other hand the operators might see benefits in larger fleets of electric buses: better price per bus, more efficient use of electrical maintenance personnel and facilities and the benefits to be gained in future tenders with the operational insights gained from early adoption.

HSL also plans the locations and organizes for the basic infrastructure for the fast charging stations, with the operation contracts then awarded based on open tenders with the Charging-as-a-Service (CaaS) business model to charging operators, who supply the actual chargers. The fast charging solution selected for Helsinki region is the pantograph mounted on the bus roof as described in the ASSURED 1.0 -report. Each fast charging location also has a CCS-type charging cable available for back-up purposes.

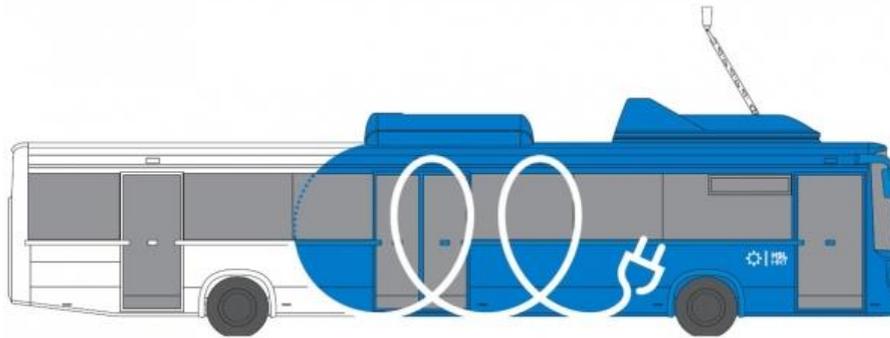


Figure 1. An electric bus with HSL colours and a pantograph on the roof

Electric buses now and in the near future

Currently there are 48 electric buses from three manufacturers (Linkker, Yutong Bus and VDL Bus & Coach) operating in the region, serving multiple routes alongside diesel buses. 15 of these buses are opportunity charged with 5 fast chargers (350kW) available at a terminal. 13 additional electric buses will be starting operations during the year 2020. In 2021 a further 132 electric buses will start operating on 23 routes, of which 12 will be fully operated with electric buses. 22 fast chargers (450kW) in eight locations will be added to the charging infrastructure in 2021 should the operating public transport operators select opportunity charging as the charging strategy. According to the strategy of HSL, by 2025 30% of the bus fleet (currently numbering some 1400) will be operated using electric buses, so a further increase of around 227 electric buses will be seen over the course of 2022-2024. The rest of the bus fleet will continue to be operated with Euro VI -equipment.

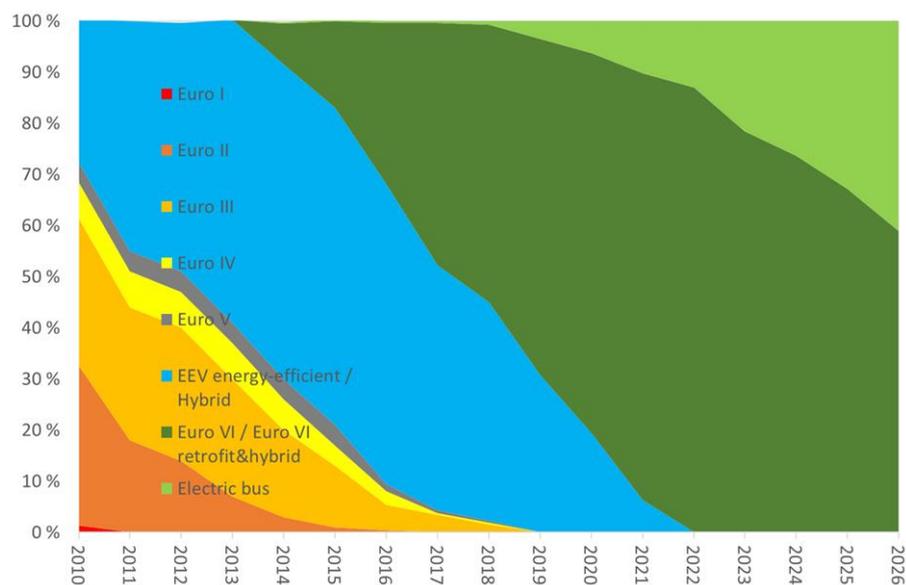


Figure 2. Bus fleet composition estimate

Impact of electric buses

The increasing use of electric buses will reduce local emissions in the Helsinki region considerably. Besides the absence of nitrogen oxides, particle matter and carbon dioxide emissions also the noise levels and vibration for the passengers and bus driver are noticeably reduced. Both passengers and bus drivers have given positive feedback on ride comfort and the general public seems to be eager to see rapidly increasing numbers of electric buses in operation. The energy consumption of electric buses is a quarter of diesel buses, mostly due to more efficient powertrains and regenerative braking.

The public transport operators' long-term costs have not increased from diesel equipment levels, while the public transport authority has absorbed some additional costs related to the charging infrastructure. After a run-in period the reliability of electric buses has been on the same level as conventional buses.

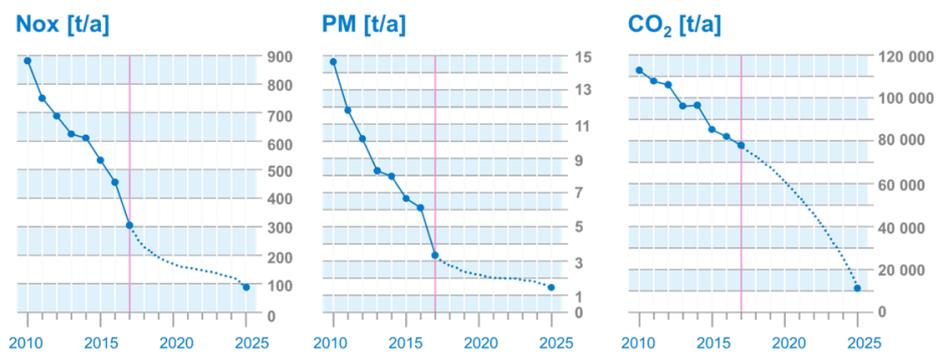


Figure 3. Emission estimate

An identified issue with electric buses in cold climates is the need for passenger area heating. A fully electric heating system will require considerable electric capacity, which will limit the operating range of the bus, while an auxiliary fuel heater will generate local emissions. The electric buses in the Helsinki region will keep the passenger area temperature at a minimum of +13°C with the use of auxiliary bio-fuel heaters allowed when the ambient temperature drops below -5°C.

Conclusions

When transitioning to electric buses, it should be noted that the whole ecosystem is changing. Electric buses bring many benefits for their surroundings through reduced local emissions and increased comfort, but they also have new requirements that must be met and the people who work with them require different skills.

Current electric bus technology poses restrictions on operations through limitations on range (with overnight charging) or service frequency (with opportunity charging) that should be considered when planning electric bus operations. Strict adherence to traditional planning might lead to considerable bus fleet size increases in order to cope with the charging demands.

Charging infrastructure development should be planned in parallel with electric bus procurement, or sometimes even in advance of it, as infrastructure development might take considerably more time than electric bus delivery. In densely built or historical city centers it might even prove practically impossible to find space for charging electric buses. In addition, the electrical grid capacity should be considered well in advance to identify any limitations, for both fast chargers and depot chargers.

Credits

The electrification of public transport in the Helsinki region is supported by the Helsinki Open Charging System project (HOCS), which is co-funded by the ELENA Facility, managed by EIB and financed by the European Commission through the Horizon 2020 Programme.

Tommi Muona, Project Manager (HOCS), VTT Technical Research Centre of Finland

Reijo Mäkinen, Project Director (HOCS), Helsinki Region Transport (HSL)

Mikko Pihlatie, Principal Scientist, VTT Technical Research Centre of Finland

About VTT

VTT is one of the leading research and technology organisations in Europe. Our research and innovation services give our partners, both private and public, all over the world a competitive edge. We pave the way for the future by developing new smart technologies, profitable solutions and innovation services.

We create technology for business – for the benefit of society.

VTT beyond the obvious

www.vttresearch.com