Institute of Transport Economics
Norwegian Centre for Transport Research

ENGLISH Summary

User experiences from the first series-produced battery-electric trucks

Interviews in 2021 with the first Norwegian users

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While battery-electric passenger cars now make up the majority of new car sales in Norway and electric vans are quickly gaining market share, the electrification of truck transport is still in an earlier phase. After the first series-produced battery-electric trucks were introduced on the Norwegian market in June 2020, their adoption has accelerated, amounting to 75 trucks in August 2021 and 231 by August 2022. This report synthesizes the first relevant user experiences that may influence further vehicle adoption, based on interviews performed up to the summer of 2021. Feedback indicates that the adoption of electric trucks has largely been strategic and affected by (previously limited) model availability. With some adjustments in operations, much of local and regional transport can be operated with existing battery-electric vehicle technology. User experiences have largely been positive, with some exceptions and particular improvement areas. Efficient operation and larger-scale adoption requires access to fast chargers, range improvements, towbars, and stable, predictable and longer-term framework conditions.

In November 2021, TØI published the report "Green Trucking? Technology status, costs, user experiences" (in Norwegian only). The report contained a chapter on the experiences of the first Norwegian users of series-produced battery-electric trucks. The current report constitutes an English version of these user experiences, complemented with a number of smaller updates to reflect developments since analyses were performed in 2021.

TØI previously interviewed some of the first Norwegian users of battery-electric trucks to collect real-world user experiences (Hovi et al., 2019). At that time, battery-electric trucks were generally all rebuilt from diesel to electric drivetrain by independent third-party converters, but from the summer of 2020, the first series-produced battery-electric trucks from major truck manufacturers started arriving in Norway. Although this has given a boost to their adoption, there were still only 74 Norwegian-registered

battery-electric trucks as of August 2021, mainly used by major actors and in the Greater Oslo area. By August 2022, this number has increased to 231 trucks.

For the present work, we interviewed five of the first Norwegian firms that operate series-produced battery-electric trucks (three distributors and two contractors), in addition to a vehicle supplier and the Norwegian Public Roads Administration. The interviews were performed between April-June 2021 (and findings in this report must be interpreted keeping this in mind). At this point in time, the firms had recently started operating 28 series-produced battery-electric trucks from several large truck manufacturers, both 2- and 3-axled distribution trucks and 3-axled construction trucks with a distribution truck chassis. The objective of the interviews was to gain insights into their first relevant user experiences that may influence further vehicle adoption, such as the purchasing process, charging systems, use compared to diesel vehicles, incentives, challenges, and what would be necessary to attain larger scale electrification to achieve the National Public Transport Plan's target of 50 % of new trucks being zero-emission by 2030.

Drivers behind choosing battery-electric trucks

Early users state that investments in battery-electric trucks have largely been strategic. Important drivers have been the firms' own climate and environmental objectives, in addition to passionate key staff. For construction firms, the environmental weighting in public tenders, especially from the City of Oslo, has been a very important driver. Distributors report increasing demand for greener transports, but with limited willingness to pay the added cost by customers.

Choice of vehicle manufacturer and investment cost premium vs. diesel

The firms' choice of vehicle model and supplier was largely steered by availability, with choice alternatives until recently being few and delivery times long, with a preference for well-known suppliers. Price was considered, but not a decisive factor due to the investments largely being strategic.

Small and larger battery-electric distribution trucks were stated to have been 2-2.6 times and 3-4.6 times more expensive than similar diesel trucks, and battery-electric construction vehicles 3-3.5 times more expensive, respectively. Prices have gone down somewhat between 1st and 2nd generation series-production. Due to high investment costs and uncertainty about residual values, the firms interviewed often employ longer depreciation periods for battery-electric trucks than conventional vehicles or plan to use them longer. All firms received ENOVA (a national clean energy funding agency) subsidies for part of the additional investment costs (vs. a similar diesel vehicle). This is stated to be very important, even though there have been several challenges due to ENOVA's design of the grant scheme.

Use patterns for battery-electric vs. diesel trucks

Both distributors and contractors made operational adjustments for the phase-in of their battery-electric trucks. In some cases, relatively small changes were sufficient, while in other cases, larger parts of the operations were reorganized, although not all changes would strictly speaking have been necessary. Distributors mainly use their

battery-electric trucks for urban distribution. Here, the battery-electric trucks approach one-on-one replacements of diesel vehicles, especially after the establishment of fast charging at depots, which allows an increase in the number of shifts and attainable annual mileages.

Use flexibility is somewhat limited due to the inability to drive with trailer and on longer routes. Bergen is stated to have more demanding topography and geographical surroundings, so that achieving fully electric city distribution will take longer than in Oslo, where separate city terminals have been established from which electric distribution transports are organized.

For construction trucks, the usage pattern for diesel vehicles varies much, making direct comparisons difficult. The battery-electric construction vehicles are mainly used for light construction work during the day in the inner city of Oslo and between construction sites and disposal sites in Oslo. Usage patterns have been somewhat adapted to increased use of local disposal sites because this fits well with the procurement policies of the municipality of Oslo.

Experiences from use

Generally, energy consumption of the battery-electric trucks is reported to be low, yielding large energy and potentially also cost savings. Both energy consumption and driving range can vary much, depending on various factors, although wintertime reductions in driving range have generally been limited. In practice, the range of battery-electric trucks lies somewhat below the manufacturer-specified range, but much closer than some of the firms previously experienced with battery-electric vans. Newer generations of battery-electric trucks have also shown noticeable efficiency improvements and better driving ranges. Other than some individual cases, the firms have not experienced major technical problems, although experiences with training, service and maintenance, and the pricing of this, are mixed. Drivers are generally satisfied with the vehicles' performance and report an improved working environment.

Even though the weight of batteries negatively affects the vehicles’ payload, this is not considered a major problem in practice because capacity limitations for distribution transport are usually set by volume, while construction activities in the inner city are time-consuming, so that construction trucks often drive before they are filled up to capacity. However, the placement of batteries can yield challenges with regard to axle load, space/placement on 3-axled vehicles and uneven construction site grounds.

Charging

The distributors mainly started with nighttime depot charging, but also want to be able to use more fast-charging during daytime, although the concrete charging strategies differed. The construction firms also use nighttime charging, in addition to several fast charging solutions during the day. While depot charging infrastructure is relatively inexpensive and electricity costs are low, fast charger infrastructure is expensive. A major barrier reported by all firms is that ENOVA subsidies are only given to chargers that are made publicly available. In addition, the establishment of fast chargers may require additional costly investments such as grid upgrades. External fast charging, however, is considered expensive and entails costs for charging time, detours, waiting

in queues, etc. Investments in battery-electric vehicles and the availability of charging solutions are therefore described as a “chicken-and-egg-problem”, because the competitiveness and profitability of the vehicle depends on how optimally the vehicle can be used. In this regard, it is pointed out that infrastructure deployment is going too slowly.

Incentives and framework conditions

All firms point out the importance of stable, predictable and long-term framework conditions. For the time being, subsidies for battery-electric vehicles are considered very important for investments in zero-emission vehicles, while much better schemes for charging infrastructure are called for. In particular, it is noted that maintaining road toll advantages (currently a full exemption) is critical for battery-electric vehicles to compete with other technologies. Further feedback suggests that should road toll advantages also be introduced for biogas vehicles (with an exemption entering into force for Oslo toll roads, from September 1st, 2022), this could lead to a transition to these at the expense of battery-electric solutions.

Other (existing or potential) incentives brought up by the firms are access to public transport lanes, zero/low emission zones, low noise zones and dedicated loading and unloading zones for zero emission vehicles. Such incentives allow more (time) efficient use and improve the competitiveness of zero-emission vehicles. At the same time, it can be discussed whether hybrid trucks or biogas vehicles should receive any of these advantages.

Electrification potential and other propulsion technologies

Distributors are generally positive about the potential for electrifying their fleets. Much of local distribution can already be carried out with battery-electric trucks. Fast charging and relatively small driving range improvements will enable battery-electric operation also for large shares of their regional transports. In addition to range restrictions, there are barriers associated with the (lacking) availability of vans and trucks in some vehicle classes, lack of four-wheel-drive and tow-bar, and some vehicle models not supporting fast charging. The construction firms report a need for improved driving ranges, vehicles with more than 3 axles, and for vehicles with tow-bar, so that more mass disposal sites become practically reachable. On a general note, the vehicle manufacturer states that developments are moving quickly and that larger technological developments are expected in the future. It is also expected that costs can become significantly lower once much of the large development costs has been recovered.

Of other technologies, liquid biogas is considered the most promising alternative to battery-electric operation on heavy trucks. For urban use cases, biogas is competing with battery-electric propulsion. As battery-electric solutions becomes a cheaper option, biogas can gradually be squeezed out of urban areas (although this may be affected by the road toll exemption for biogas in Oslo, starting in September 2022), while liquid biogas can have applications in long-distance heavy transport. Biodiesel has become less competitive after a Norwegian levy was introduced, so that owners of diesel vehicles have started returning to (fossil) diesel operation. This illustrates a

dilemma, where large emission reductions (due to the use of biofuels) can be zeroed out quickly when framework conditions change. Hydrogen is not considered a realistic alternative by the interviewed truck operators in the short to medium term.

Hurdalsplattformen (the Norwegian Government's political platform) puts an increased focus on biobased fuels and targets tax reductions to stimulate increased use of Norwegian-made biofuels. It is uncertain what the final policy will be as the Government does not have the majority in the Parliament behind it. The EU is currently revising the Alternative Fuels Infrastructure Directive and has proposed a stronger regulation with clearer targets for refueling and charging stations. The final ruling will likely not be ready before the end of 2022.