

MoZEEES Heavy Duty Workshop 22.10.2019

The objective of the workshop was to provide policy roadmaps on land based heavy-duty transport. Cross-industry stakeholders, policy makers and research institutions met to present and discuss developments in zero emission heavy-duty machinery and vehicles.

As an introduction to the day, Andreas Hedum from the Ministry of Transport said a few words about the government's plan for reducing emissions from transport. Reducing emissions from the transport sector is key in reaching the Norwegian government's climate targets of 40% emission reduction by 2030. Road transport is responsible for 56% of the emissions, and is therefore a crucial focus for emission reduction. However, the government is looking to phase out subsidies and introduce a tax system for zero emission vehicles (ZEVs). The government will not differentiate on technology, and introduce tax on fuel cell vehicles (FCVs) as well. Some participants argued that the government should differentiate on technology and prolong subsidies for FCVs because the technology is less mature than EVs.

Rail

Norway's railway system is largely electrified, and there are plans to make the remaining parts zero emission as well. Hydrogen fuel cells (FCs), batteries and catenary are considered. Costs, safety, maintenance and durability are key issues for the railway when looking into new technologies. Sintef showed that battery and hydrogen have similar performance and are both better than diesel. For the Nordland line, the best technologies appear to be biodiesel today, battery soon and hydrogen from the late 2020s. Catenary only will be much more expensive than batteries and hydrogen.

There are no battery/FC trains in Norway today, but the audience was presented the German Coradia iLint, which is a retrofit of an existing train to hydrogen/FC. The hydrogen tank is 350 bar, which is the same used for buses and trucks and one tank can last for 1000km with 15 min refueling time. With two fuel cells of 200kW each, the train can operate much more efficient than with a diesel engine. The FC train use less than 50% of installed power in conventional diesel trains, because most of the power is used at acceleration. With FC and batteries, it is possible to work at more optimal load.

Bus

The bus sector has come relatively far ahead in different forms of electrification and Ruter is on track to become zero emission in 2028. Testing different solutions, battery capacities and charging solutions has been important to learn more about operating an electric bus fleet.

With five hydrogen buses in 2012 and 115 battery electric buses in 2019, Ruter is getting a lot of experience. Knowledge sharing with operators, Ruter and the public is important.

Ruter is technology neutral and do not favour specific technologies as long as it is zero emission. However, hydrogen buses have been considerably more expensive than battery buses and that is one reason for mainly choosing battery electric vehicles (BEVs). Except for a few "teething problems", Ruter have few problems with the electric buses and are very happy with them.

It is important to have good training of drivers and operating personnel when going electric. In addition, it is important to understand that changing technology might also mean changing mindsets, use patterns and logistics.

Heavy-duty construction equipment

The market for BEVS is growing and mass production has started in the bus market. However, heavy-duty trucks and construction equipment are still in a phase where there are mainly pilots.

A repeating issue at the workshop was that companies that want to buy zero emission vehicles or equipment feel too small alone to have the equipment/vehicle providers to build and offer these products. Norwegian public procurers were also faced with the same issue with contractors, when looking into zero emission construction sites. Several stakeholders realized that it is better to join forces to increase investment budget and security for equipment supplier, so “Fellesinitiativet” was established. This joint initiative to promote zero-emission construction sites has been helpful in joining forces and is a strong alliance towards equipment providers. This initiative has also gained international attention and “Fellesinitiativet” has been taken to Sweden and Denmark in order to learn, and gain more momentum.

Furthermore, ABB showed how electric powertrains in heavy-duty mining applications reduce costs and are much more energy efficient. Braking regenerates energy, which can be stored in batteries or super capacitors. For hybrid applications, the engine operates at optimal load. Even though most heavy-duty electric construction machinery today are retrofits, Volvo is investing heavily in developing zero emission solutions. Both battery and hydrogen will become important in construction, and hydrogen is especially interesting because of waste heat in FC that can be used for building drying.

Trucks

It became clear that today’s trucks do not meet tomorrow’s emission requirements, and that the industry must turn to electric or hydrogen powered trucks to meet emission targets. There are several potential benefits with electrification for truck owners like lower operating costs, although there are few models on the market and there is uncertainty regarding what the most feasible technology is, and what owners should invest in. Current business models can also be an obstacle for investing in zero emission vehicles. Short contracts, small margins and trucks changing owner after 3-5 years does not leave a lot of room to make large investments in zero emission vehicles. As 70% of NLF members are expecting to buy diesel trucks in 2020, a major shift in technology and mindset must be in place in order to reach the government’s goal of 50% zero emission trucks in 2030.

Several presenters pointed to hydrogen as a viable solution for trucks, including NLF. Production of scale is needed for hydrogen to work on a commercial basis and profitability of hydrogen trucks will depend on infrastructure. 2-4 tons per day would be a good start (could serve about 100 trucks) to make hydrogen very competitive.

The NLF believes that the most likely scenario might be battery electric and biofuels for local distribution. For long hauls, HVO, biogas, electric road system and hydrogen can be the solutions.

Electric roads were presented as a successful way of electrifying parts of road stretches that enable more electrification of heavy duty vehicles like trucks and buses, smaller batteries and reduced need for charging stops.

Fast ferries

Electrification of ferries have come a long way, and the ferry sector might be the first fully electrified sector in Norway. Zero emission fast ferries is the next level zero emission challenge. This is an

extremely energy demanding application, requiring low weight and the highest degree of safety. As batteries are heavy and have low energy density, hydrogen and FC can be a feasible solution to get this sector zero emission. Powercell has ongoing marine cycle testing and contracts in marine market. They are running tough cycles on the cells and can achieve 20 000 hours lifetime.

Research and technological development

In MoZEES RA1 there has been interesting developments in cell chemistry that can reduce need for cooling and be particularly relevant for ships and heavy duty machinery. Research avenues include high voltage cathodes and silicon in anodes. Developing new technologies is important for increasing safety, capacity and other properties with the batteries that can make them suitable for more applications and operational modes. Additionally, the current focus on electrification in Norway presents unique opportunities for “green business”. Freyr showed their plans for making a giga factory producing battery cells. Due to Norway’s low carbon and cheap electricity, Freyr will focus on the energy intensive part of producing battery cells. Sintef and NTNU are important partners that will look into how to drive down costs, and get a competitive solution.

In MoZEES RA2 research is being done on how to optimize and find out exactly how gases are behaving and improving conditions in electrolysis. New coatings developed by MoZEES’ user-partner are showing good initial performance.

In order to achieve a zero-emission transport system, it is crucial to develop infrastructure for both battery electric and hydrogen applications. The electrification of ferries and heavy transport is a challenge for the grid, and this is important to remember. A mix of hydrogen and electricity, good quality of equipment and good planning/dialogue between customers and utility companies are important factors for creating good harmony in the grid. Additionally, favorable and stable framework conditions are needed to ensure security for companies making the investments.