

Decarbonising the highway

We need hydrogen for large vehicles

Reducing harmful emissions from the transport sector, which accounts for about a quarter of Norway's total greenhouse gas emissions, becomes more difficult the larger the vehicles get.

"There are in principle a number of options if we want to reduce emissions, including denser cities, more bicycling and walking, and more use of public transport," according to Lasse Fridstrøm, senior research economist at the Institute of Transport Economics (TØI).

"But the only thing that would really make a big difference is technology transfer in the sense of replacing the present combustion engine vehicles with battery or fuel cell electric ones."

Norway's transition to electric cars has been a success. It has been encouraged by a central government committed to curbing climate change, and by regional governments and city authorities concerned with local air quality and congestion.

But when it comes to reducing emissions from heavier vans and trucks, alternatives or supplements to batteries will be required.

Hydrogen made from renewable hydroelectric sources is emerging as a viable solution.

Hydrogen fuel cells can be effective, either as a stand-alone zero emissions technology or as part of a hybrid propulsion system where they are used in conjunction with batteries that capture energy during braking, while also



Vehicles must be electrified, using batteries or fuel cells, according to Fridstrøm.

delivering acceleration and extra pulling power when required.

"Heavy duty trucks are actually fairly energy efficient, and their emissions are generally released away from urban areas," observes Gunnar S. Eskeland, professor of environmental economics at the Norwegian School of Economics, NHH.

"But if we want to reduce emissions from long distance cargo hauling to zero, it will require more hybridisation"

Øystein Ulleberg, principal scientist at the Renewable Energy Systems Department at the Institute for Energy Technology, IFE, agrees.

“Hybrid solutions are ideal when it comes to optimising heavy vehicles, with batteries delivering power while more energy-dense hydrogen fuel cells deliver range. We will see both technologies employed together.”

Business case

A long-term commitment to hydrogen as a technological solution is essential to facilitate a shift from diesel in trucks.

Subsidies and other government support will be required to encourage initial investment in a hydrogen fuelling infrastructure. This should initially be built along Norway’s main transport corridors, before expanding until a national network of fuelling points has been completed.

The infrastructure requirements will be roughly the same whether two or 20 trucks are served, hence the fuelling points will be under-utilised until truck manufacturers have ramped up production and sales of suitable vehicles, and the truck operators have begun using the technology.

This is not optimal from an economic point of view, as it will take time before the infrastructure starts paying for itself, but once that happens the subsidies can be phased out.

“Commercial stakeholders in both Europe and the US see a business case once some 1,000 trucks are using the infrastructure,” says Ulleberg.

Hydrogen produced through electrolysis based on solar, wind or hydro power can be an integral part of an environmentally friendly energy system.

The energy transition from fossil fuels to renewables not only demands it, but also helps make the production economically viable.

“Hydrogen has long been considered an



Hydrogen is linked to Norwegian resources, it is flexible, and it may play a central role in many sectors.

inefficient way to produce a ‘fuel’, or rather to store energy, but this doesn’t really matter if the price is zero when producing it, and electricity is very cheap or perhaps even free during periods when we have high wind or solar power production,” explains Pernille Seljom, scientist at the Institute for Energy Technology in Norway.

As hydrogen has a storage capability, it can help integrate the renewable power that comes into the system for deployment elsewhere.

As a result, fuel cells can play a major role in the decarbonisation of the transport indus-

try, and indeed of industry more broadly.

But there is an additional reason to be optimistic about hydrogen.

“If carbon capture and storage is also developed, another corridor opens up where hydrogen can be produced from natural gas,” observes Asgeir Tomasgard, director of CenSES and professor at the Department of Industrial Economics and Technology Management at the Norwegian University of Science and Technology, NTNU.

“This brings Norway into a unique position, where we have very good resources to develop, for example wind power and the competence to produce hydrogen on a large scale from electrolyzers.”

In addition, there are the industrial value chains around natural gas, carbon capture and

storage and hydrogen from steam reforming.

Hydrogen is linked to Norwegian resources, it is flexible, and it may play a central role in many sectors.

“So from a Norwegian perspective, hydrogen is a very exciting energy carrier,” concludes Professor Tomasgard.

“Hybrid solutions are ideal when it comes to optimising heavy vehicles”

~ Øystein Ulleberg, IFE.

Our recommendations:

- Encourage commercial operators to adopt fuel cell electric and hybrid vehicles, expanding into commercial and heavy vehicles.
- Support the creation of a hydrogen fuelling infrastructures and early establishment of value chains for production and transport for hydrogen.
- Stimulate the demand side for hydrogen with zero emission transport policies and public purchasing policy.



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