Horizon
The EU Research & Innovation Magazine

European Commission



Heavy-duty trucks drive clean hydrogen to the next level

Greenhouse gas emissions have been declining steadily in the EU in recent years, dropping by over a quarter between 1990 and 2019. However, transport is one sector that has bucked the trend, despite advances in technology.

14 December 2022 - By GARETH WILLMER

Long before city dwellers complained about air pollution and carbon emissions, they moaned about mounds of manure lining the streets and attracting clouds of flies. In the 19th century, horse-drawn vehicles were used to move freight long distances. While carbon emissions were practically non-existent, horse manure was a big sticking point.

It topped the agenda during the first International Urban Planning Conference in New York in 1898. Unfortunately, there was no solution to the horse pollution crisis.

Eventually, horses were replaced by other modes of transportation made possible by the combustion engine – trading one type of pollution for another.

From horses to horsepower

It's been a long ride from there to here. However, the transport sector continues to create a huge amount of pollution, with road transport accounting for around one-fifth of the EU's total CO2 emissions.

Reducing greenhouse gas emissions from heavy-duty vehicles like freight and refuse trucks, as well as buses and coaches, is a priority. This sector, which is responsible for a quarter of the EU's CO2 emissions from road transport, saw emissions rise by 29% between 1990 and 2019.

Moreover, emissions from trucks are set to grow as a proportion of the total, said Andrew Flagg, a senior consultant and project manager at Element Energy, part of multinational consultancy firm Environmental Resources Management. This is due to other vehicles being further ahead with low-emission technology, through the likes of traditional electric batteries in cars.

'With decarbonisation taking place at quite a pace now for cars and buses, the share of heavy goods vehicles in terms of emissions is going to grow,' he said. 'So there's a particular need to accelerate the decarbonisation for those vehicles.'

But trucks face challenges when it comes to using electric power compared with lighter vehicles. 'The problem is that this sector is particularly difficult to decarbonise,' said Flagg.

The long distances that trucks need to travel, for example, creates issues for how often batteries need charging, how fast they charge, as well as the available charging infrastructure. Truck batteries can also be heavy and large, affecting the amount of transportable cargo and how far they can travel before they need recharging.

Harnessing hydrogen

One answer is to use hydrogen power, using a process whereby hydrogen and oxygen gas are fed into a fuel cell to produce electricity. 'With the higher energy density with hydrogen, you can have fewer batteries on a truck,' said Flagg. 'This enables you to travel those longer distances and cope with the heavier payloads.'

Hydrogen-powered vehicles can also rapidly refuel in minutes. 'As a fleet operator, you would not want to spend a long time charging a vehicle,' said Flagg. 'Hydrogen enables you to refuel much quicker and therefore enables operational flexibility.'

While the technology has shown promise, it has so far often tended to be deployed in smaller-scale demonstrations of limited truck numbers, said Flagg. The H2Haul project that he leads plans to take things to the next level by deploying a fleet of 16 new heavy-duty hydrogen fuel-cell trucks.

These will be rolled out in Belgium, France, Germany and Switzerland in collaboration with two major European truck manufacturers, IVECO and VDL. The technology's performance will be assessed by driving the trucks for more than a million kilometres during normal operations.

The first trucks will be on the road in the coming months, with all expected to be in operation by the end of 2023. Performance data will then be collected and analysed.

16 trucks, 6 fuelling stations

'H2Haul is groundbreaking in that it's 16 trucks,' said Flagg. 'I would say it's the next step in terms of getting trucks deployed by European manufacturers, upscaling the number of trucks being developed, and deploying fleets in a range of different countries and operating environments.'

To demonstrate their viability, H2Haul is also developing six hydrogen fuelling stations. Two are already operational in Switzerland, while others are expected in Belgium and France in the coming months, and two in Germany by the end of 2023.



© Colruyt Group

Researchers are now employing a similar approach for waste-collection trucks. The REVIVE project is integrating fuel-cell technology into 14 waste trucks operating in real-world conditions for at least two years at a total of 8 sites in Belgium, Italy, the Netherlands and Sweden.

With waste trucks, hydrogen technology has tended to be deployed by smaller manufacturers so far, said Dimitri Van den Borre, a project manager at Tractebel Engineering in Brussels, Belgium, and project lead for REVIVE. ‘What we need is bigger manufacturers stepping into this market,’ he said.

Waste benefits

Using the technology in refuse trucks is expected to have several advantages. One is that they tend to drive a pre-defined route from a single depot. ‘The vehicles operate within a confined area, and in this early stage of hydrogen rollout such operations are useful because they don’t need a lot of refuelling stations,’ said Van den Borre.

Waste trucks also often run in urban areas with low air quality and are highly visible to the public. This means residents get to experience the benefits for pollution and noise reduction first-hand.

Furthermore, organic waste from incinerators can be used to generate hydrogen, creating a circular ‘waste-to-wheels’ model. And excess energy can be used to power other vehicles or industrial applications.

At present, REVIVE has five trucks on the road that have driven over 13 500 kilometres in total so far. However, operational data is limited in the early stages and more extensive results are likely to start emerging from next summer, said Van den Borre.

Nevertheless, the trucks are performing well. ‘It’s a nicer driving environment and they produce less noise than conventional waste collection trucks,’ he said, adding that drivers have reacted positively so far. ‘I think in

general, they are quite happy with the trucks and the technology. On a technological level, everything is fine and the trucks are doing what they should be doing.'

Achieving traction

But a variety of challenges remain at this stage of development. Van den Borre listed the lack of regulation and directives on truck maintenance, as well as the limited current number of hydrogen-equipped truck depots as issues.

However, the industry has called for a scaling-up, while the EU moved to accelerate hydrogen development in October. Adopting rules to spur alternative refuelling infrastructure, MEPs called for hydrogen refuelling stations every 100 kilometres by 2028 – ramping up a previous target of one every 150 kilometres by 2031.

Van den Borre thinks that projects like REVIVE can open the door for bigger initiatives, potentially leading to the market for hydrogen trucks properly taking off within the next decade. But to boost traction for hydrogen-fuel-cell technology in trucks, drivers themselves should not be forgotten, he added.

'It's not just about dropping the truck and the keys with the driver, but getting them involved in the process,' he said. 'You have to find motivated people, engage with them early on and set their expectations right.'

The H2Haul project received funding from the Clean Hydrogen Partnership. The REVIVE project received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership). If you like this article, please consider sharing it on social media.

Watch the video

More info

Follow the links below to learn more about the projects featured in this article.

- H2Haul
- REVIVE