



Zemo Partnership NEWS

12 October 2021

Well-to-wheel study highlights need for inclusion of life cycle energy and GHG emissions in net zero transport plans

A new study by Zemo Partnership recommends that Government policy should increase its focus on the well-to-wheel (WTW) greenhouse gas (GHG) emissions and overall energy efficiency performance of new fuels for transport. While hydrogen, electric and renewable fuels (produced from waste-based feedstocks) can all radically cut emissions compared with their diesel-powered counterparts, there are major variations in their effectiveness and efficiency in terms of cutting emissions depending on choices made over the full well-to-wheel life cycle.

The study warns that a focus solely on mitigating tailpipe emissions can risk neglecting the full impacts and the overall energy consumption of the system.

With limited biogenic resources and renewable electricity supplies, it is critical to adopt energy efficient solutions to maximise full system benefits wherever possible.

The new study looks specifically at hydrogen, extending analysis provided in the recently published (also by Zemo) [Low Carbon Hydrogen Well-to-Tank Pathways Study](#).

The work is timely as it comes shortly after the publication of the Government's [UK hydrogen strategy](#), a potentially important component of the overall decarbonisation plan for transport. Key building blocks of the hydrogen strategy are currently under consultation and the Zemo Partnership work is intended to help inform these.

The Zemo analysis combines GHG and energy consumption data for a variety of hydrogen vehicles - trucks, buses, vans and cars. It presents well-to-wheel results for the most promising hydrogen vehicle powertrain architectures using battery electric, diesel and renewable fuels for comparison.

The study looks at hydrogen produced for transport use through electrolysis, biomass gasification with carbon capture and storage (CCS) and methane reformation with CCS

(all potentially very low carbon and GHG solutions) as well as from fossil fuels without CCS mitigation. The work explores the sensitivity of GHG emissions and energy consumption to a range of inputs and options, with more than 250 well-to-wheel scenarios being modelled in the 2020–2035 timeframe.

The analysis finds that each of the hydrogen vehicle architectures looked at can deliver lower carbon, and in some cases negative, well-to-wheel GHG emissions solutions within the next decade for many vehicle types, but this is predicated on the use of low carbon hydrogen.

Significantly, the work shows that the well-to-wheel energy efficiency of hydrogen vehicles is lower than diesel internal combustion (IC) or battery electric vehicles and those using renewable fuels in IC engines.

In the case of HGVs powered by hydrogen fuel cells – widely mooted as a potential HDV solution because of the technical challenges to battery electrification – the well-to-wheel energy efficiency is four to six times worse than that for comparable battery electric vehicles.

Regardless of how low carbon hydrogen is supplied, the production process is energy intensive and thus significantly worsens the overall WTW energy efficiency.

Zemo Partnership Chief Executive **Andy Eastlake** said: “When we look at the energy efficiency of potential pathways for hydrogen to be used in transport we see challenges. These vehicles will need to demonstrate considerable complementary benefits such as longer range, superior payload or lower operating costs to compensate for the increase in energy consumption compared with other zero emission powertrain solutions such as battery electric vehicles.”

Gloria Esposito, Zemo’s Head of Sustainability and study co-author, said: “Emissions from the hydrogen supply chain are dominated by the fuel production method, with distribution and dispensing having less impact.

“So called ‘green’ hydrogen (produced through electrolysis powered by renewable electricity) currently delivers the lowest WTW GHG emissions for a hydrogen vehicle. However, vehicles using ‘grey’ hydrogen made from current steam methane reformation perform worse than conventional fossils fuelled diesel vehicles on a well-to-wheel GHG basis.”

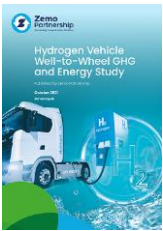
The study recommends that further feasibility work including energy analysis, should be done to assess the suitability of different vehicles for different use cases to inform the potential role of hydrogen in the HGV sector. Relevant factors would include vehicle payload and capacity, range, refuelling/charging time and infrastructure. The work could

potentially be integrated into the Government's ongoing Zero Emission Freight Trials (ZERFT) which Zemo is also supporting .

The choice of carbon intensity factors for grid electricity, both now and in the future, is a critical sensitivity within the analysis and an area needing much more consistent data.

Further recommendations are included in the [study which is available for download here](#).

Related Images can be [downloaded here](#).



NOTES TO EDITORS

Zemo Partnership (www.zemo.org.uk), formerly LowCVP, was established in 2003 as a public-private partnership working to accelerate a sustainable shift to lower carbon vehicles and fuels and create opportunities for UK businesses. Over 220 organisations are engaged from diverse backgrounds, including automotive and fuel supply chains, government, vehicle users, academics, environment groups and others. In February 2021 the organisation changed its name to reflect heightened ambition as the UK embarks on a trajectory to achieve net zero greenhouse gas emissions by 2050.

Follow us on Twitter: [@Zemo_org](https://twitter.com/Zemo_org)

For further information, please contact:

Neil Wallis, Head of Communications. neil.wallis@zemo.org.uk M: 07974 255720