

CASE STUDY

Transitioning Heavy Duty Vehicles to Zero Emission Technology (TranZET) *Decarbonising freight in the supply chain*

WHO WE ARE

The Connected Places Catapult (CPC) is an independent, trusted, expert broker operating at the intersection between the public and private sectors and between local, regional and national decision making. We promote UK innovation and broker relationships between government, academia and industry providing support and solutions for innovators to commercialise their projects and research. With our deep expertise in technology, we bridge the gap between buyers, suppliers, innovators and industry. Our agile approach enables us to convene our partners to act rapidly to create new market collaborations responding to public funders and industry needs. We boost demand for innovation to unlock wider economic and environmental benefits.



Our client says

This project has provided DfT with both a broader and deeper view of the technology options for HDV decarbonisation and the potential for real world trials to enable this transition. This is a crucial element as we develop the Transport Decarbonisation Plan and seek to decarbonise this traditionally hard to decarbonise segment going forward.



Dr Bob Moran – Deputy Director, Head of Environment Strategy, Department for Transport

Challenge

In June 2019, the UK became the first major economy in the world to pass laws to end its contribution to global warming by 2050. The target requires the UK to bring all greenhouse gas emissions to net zero by 2050, compared with the previous target of at least 80% reduction against 1990 levels. To achieve this target, a shift to zero emission technologies for road vehicles is required, including freight vehicles. This is reflected in the proposed Department for Transport (DfT) Transport Decarbonisation Plan [\[Link\]](#).

The HGV market is heavily fragmented with a wide range of vehicle sizes and body types serving different sectors and duty cycles. Moving to zero emission vehicles will require not just a step change in vehicle technology, but substantial, national-scale investment in the infrastructure to provide 'fuel' to the vehicles, whether that be electricity, hydrogen or some other zero emission fuel.

Various potential solutions are in development around the world, but are not yet in widespread use anywhere. Each has their strengths and weaknesses – and their passionate advocates. Because each option requires significant infrastructure investment and lengthy and expensive vehicle development requirements, it is unlikely that the transition to the final solution will be driven by market forces alone.

Solution

As part of CPC's TranZET (Transitioning to Zero-Emission Transport) project, completed in March 2020, DfT commissioned CPC to investigate decarbonisation options for HGVs. This work built on a previous project which focused on the role of hydrogen in transport. Its aim was to compare three long-haul HGV decarbonisation options: Hydrogen fuel cell, electric road systems (ERS: pantograph/catenary system) and battery electric HGVs.





The project provided objective, back to back comparisons of the three options, including:

- ◆ **Analysis of the expected future cost of ownership of each option.** This used a cost model developed in collaboration with Element Energy [Link], which drew on best-available cost data. The bottom line of this analysis was that there is no clear winner on this basis, with any differences well within the bounds of uncertainties in future costs.
- ◆ **Analysis of Strengths, Weaknesses, Opportunities and Threats.** In many ways the different options complemented each other with, for example, ERS having the highest 'windmill to wheel' efficiency, but the highest infrastructure requirements, whereas hydrogen offers short refuelling time and long range, but lower efficiency.

The project considered the options for commercial demonstration projects for each option, producing Strategic Outline Business Cases (SOBCs) for each. Analysis by the Committee on Climate Change [Link] has shown that commercial roll out of zero emission HGVs needs to start around 2030 to meet Net Zero targets: to achieve that demonstrations need to take place in the mids 2020s.

One key insight from the work has been that there may be too much focus on the options being mutually exclusive with a single 'winner' emerging. In reality all options share the same underlying vehicle architecture (with an electric motor final drive and power electronics), and the final answer may be a mixture of the three.

Anticipated TranZET Impacts

Short Term	6-12 months	Informs DfT's Decarbonisation Plan and COP26 discussions.
Medium Term	1-5 years	Commercial demonstration projects to address transition barriers designed and operating. Establishes the UK as a leading country in decarbonisation of road freight.
Long Term	6 years plus	Full transition to zero carbon heavy duty freight vehicles under way.

Next steps

CPC is now working on a further project to further develop the evidence base on the choices for future HGV decarbonisation. At its centre will be a Strategic Outline Business Case for an integrated demonstration programme addressing the barriers to implementation of zero emission HGV technologies. This will be supported by benchmarking of different models of UK costs of ownership, modelling of freight flows to identify where demonstrations might take place and close collaboration with other key UK organisations working in this space such as the Low Carbon Vehicle Partnership [Link], the Advanced Propulsion Centre [Link] and Energy Systems Catapult [Link].

This next project will take a central role in defining the way forward for the UK decarbonisation of long haul, heavy goods vehicles, recognised as one of the biggest challenges in achieving Net Zero emissions. It will also highlight the opportunities for Green Growth in the UK supply chain.

To find out more about the Connected Places Catapult and how we can help you develop the future skills that address the needs of your organisation please contact info@cp.catapult.org.uk

Outcomes

The project provided a solid basis for further work to help define the way forward for zero emission HGVs. Some clear recommendations for the UK have already emerged from the work.

- ◆ **Develop Electric Drive HGVs:** There will be continuing uncertainty which option(s) are adopted, but all share the need for electric drives which can accommodate a range of power sources.
- ◆ **Learn from International Trials:** UK teams should seek to embed staff within international trials of hydrogen HGV and ERS trials so lessons can be quickly learnt to inform UK plans.
- ◆ **Consider regulations regarding new vehicle designs:** Flexibility on vehicle length and total weight could ensure different approaches can be accommodated.
- ◆ **Establish outline infrastructure requirements:** All solutions will require significant new infrastructure with long lead time due to planning requirements etc.
- ◆ **Prepare full business cases for demonstrators:** The SOBC developed in TranZET will need to be combined and expanded into a full Business Case, as per HM Treasury Guidance.

Benefits

The project has provided valuable insights to DfT, which are being built into their thinking for the Transport Decarbonisation Plan, due out later in 2020. It has brought together CPC's key capabilities in clean mobility, modelling and business planning, and has enabled CPC to develop its position as an independent force for collaboration in this key area.