

## **ELEMENT1 Project Hydrogen Fuel in the Construction Sector**

### **Background**

The ELEMENT1 project (July 2023 – March 2025) was funded through the UK Department for Energy Security & Net Zero's Net Zero Innovation Portfolio, with a total project cost of £6.23 million. Its core objective was to eliminate diesel use on construction sites by developing a scalable, low-carbon alternative based on hydrogen.

Construction remains heavily reliant on diesel-powered plant, particularly excavators and generators, creating significant greenhouse gas emissions. While fully electric and hydrogen-powered equipment represent long-term solutions, these technologies are not yet widely available or commercially viable at scale. As a result, there is a critical need for transitional technologies that can decarbonise existing fleets.

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### **Situation**

A major barrier to decarbonising construction is the vast installed base of diesel-powered machinery, combined with limited hydrogen infrastructure and operational challenges on-site. Remote and rural projects often lack grid access, while urban environments face strict emissions and noise requirements.

The ELEMENT1 consortium set out to address these challenges by developing:

- Dual fuel technology to enable existing diesel equipment to run on hydrogen
- End-to-end hydrogen infrastructure, including production, storage, and refuelling
- Real-world demonstrations to validate performance, emissions, and operational feasibility

ULEMCo played a central role in enabling hydrogen adoption directly within existing construction plant and supporting on-site hydrogen delivery.

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## Solution

ULEMCo led the development and deployment of hydrogen dual fuel solutions for construction equipment, alongside critical refuelling infrastructure.

### Key contributions included:

- **Dual Fuel Conversion of Excavators**  
ULEMCo converted four excavators (two Kobelco SK210 and two CAT320 machines) to operate using hydrogen alongside diesel. This allowed immediate emissions reduction without requiring full equipment replacement.
- **Development of Mobile Refuelling (HyTANKa®)**  
ULEMCo designed and deployed the HyTANKa® mobile hydrogen refueller, enabling flexible on-site hydrogen supply. This was successfully implemented during the final phase of the project.
- **Integration into an End-to-End Hydrogen Ecosystem**  
ULEMCo's technologies were integrated with hydrogen production, storage, and dispensing systems, forming a complete on-site solution. This included collaboration with partners providing hydrogen power units and dispensing systems.
- **Support for Demonstration and Data Collection**  
ULEMCo-supported equipment was deployed across multiple construction sites, including a major demonstration at BAM's Victoria North project in Manchester. Real-time data collection validated both emissions reductions and operational performance.

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## Benefits

Under the benefits for the HyTANKa, it suggests how it enabled hydrogen to be safely and effectively delivered to construction sites, but we should emphasise that this includes the refuelling of the equipment at their point of use, perhaps also mention as already done with diesel today?

ULEMCo's contributions enabled tangible environmental and operational benefits, demonstrating the viability of hydrogen in construction.

### Key outcomes included:

- Significant Diesel and Emissions Reduction
  - Up to 30% diesel displacement achieved on dual fuel excavators
  - 8,586 litres of diesel saved, equivalent to 23 tonnes of CO<sub>2</sub>
  - Total hydrogen consumption of 1,574 kg across plant and power generation
- Maintained Productivity and Performance  
Dual fuel excavators matched the performance of diesel-only machines, confirming that emissions reductions can be achieved without compromising productivity.

- **Scalable Transition Pathway**  
ULEMCo's dual fuel approach provides a practical, near-term solution for decarbonising existing fleets, avoiding the need for immediate full asset replacement.
- **Enabled Hydrogen Infrastructure on Active Sites**  
The HyTANKa® refueller demonstrated how hydrogen can be safely and effectively delivered to construction environments, and then used to refuel the equipment *in situ*, with minimum disruption. This mimics the way diesel equipment is refuelled today from mobile bowzers, reducing reliance on fixed infrastructure.
- **Industry-Wide Impact Potential**  
If scaled across 1,000 machines working 1800 hours p.a., the demonstrated diesel displacement rates could reduce emissions by up to 5,600 tonnes of CO<sub>2</sub> annually, with far greater savings possible across the wider industry.

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## Conclusion

ULEMCo demonstrated that hydrogen fuel can play a pivotal role in bridging the gap between current diesel reliance and a zero-emission future. By enabling hydrogen use in existing construction equipment and developing practical refuelling solutions, the company helped demonstrate a commercially viable and scalable pathway to decarbonisation.

The ELEMENT1 project confirms that hydrogen dual fuel technology is not only feasible, but ready for further deployment, positioning ULEMCo as a key enabler in the transition to low-carbon construction.

*Data source: ELEMENT1 - Leading the construction industry towards a zero emissions future, RDR2-05-BAM, March 2025*



