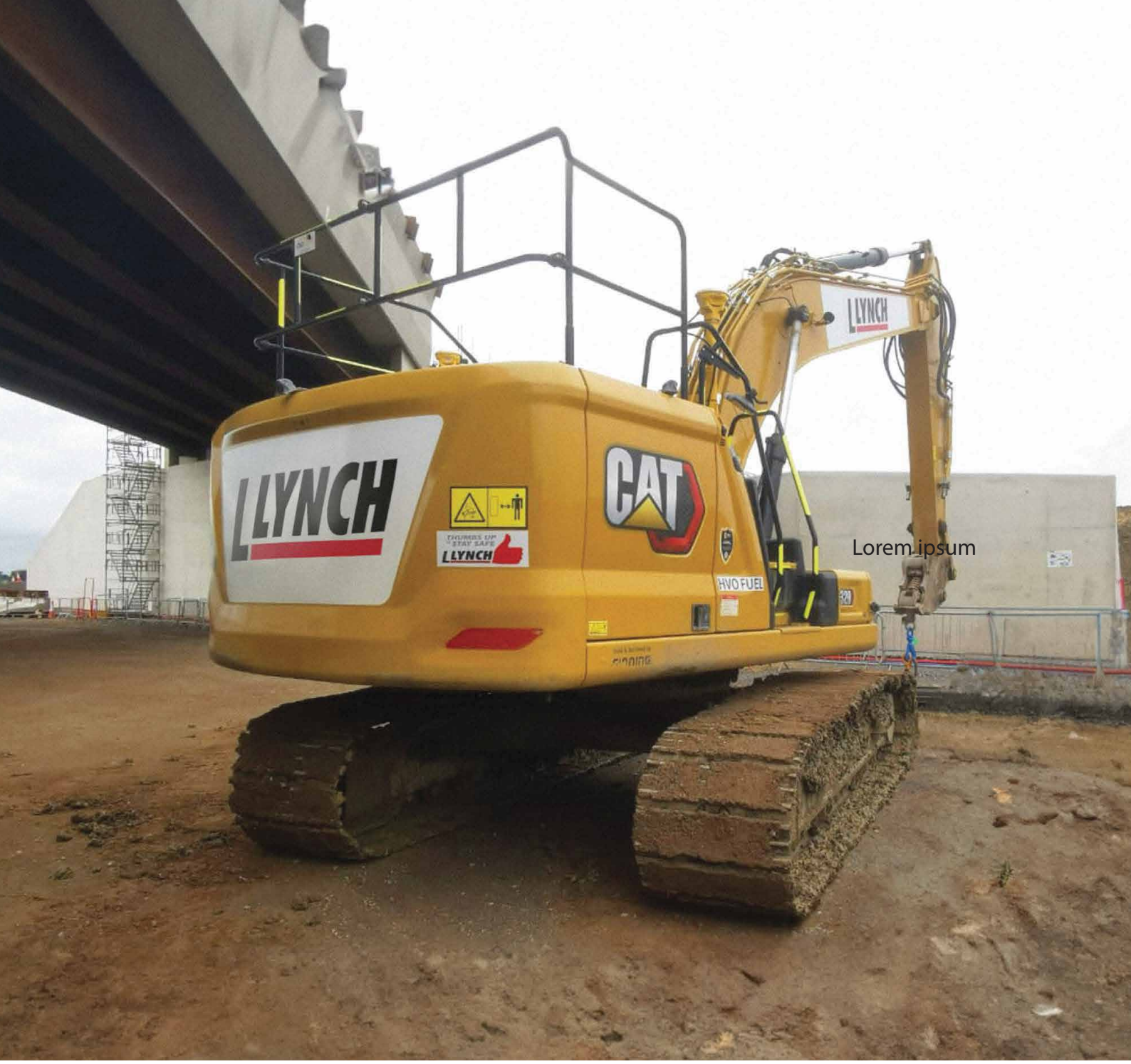
ULTIMATE CELL

CASE STUDY

KIER

ULTIMATE CELL

LYNCH



BACKGROUND

Lynch is committed to helping our customers reduce carbon emissions and meet their sustainability goals. By embracing cutting-edge technologies and leading innovative initiatives, we support our clients on their journey toward a **greener future**, all while working towards our goal of achieving **Net Zero Carbon**.

GOALS & OBJECTIVES

During early engagement between Lynch and Kier Transportation at EKFB supplier events, we proactively sought the latest technology to reduce carbon emissions on the HS2 project in the Calvert Area.

We wanted a cost-effective solution that would successfully reduce carbon emissions without impacting on operational efficiency.

RESEARCH & DEVELOPMENT

Between Oct-Dec 2023, Lynch and Kier Transportation conducted biweekly workshops, identifying the Ultimate Cell Truck Engine V3.0 as an innovative technology suitable for application in Calvert. We aimed to retrofit this to a heavy excavator, running it alongside a standard Tier V diesel engine, gather data, and demonstrate significant benefits. We worked with Caterpillar, the OEM, to ensure the installation would not void any machinery warranties.

Between February and May 2024, we assessed the impact of Ultimate Cell on fuel consumption and emissions. We equipped one machine with a Triple Cell Unit, and a similar machine had standard OEM specifications, serving as a control machine. Both machines had the same workload to compare savings accurately.

We briefed the project management teams every four weeks to verify the effectiveness, establish a measurable reduction in carbon emissions and fuel consumption and address any concerns.

THE TECHNOLOGY

This smart retrofit fuel cell technology optimises combustion engines by producing hydrogen on demand and introducing small quantities of hydrogen into the engine air intake via **electrolysis**. It produces hydrogen in response to **driver throttle commands**. The amount of hydrogen produced and **injected into the engine**, through it's **air inlet pipe**, is constantly changing to best match the speed of the vehicle and its engine's load.

It is a simple technology that does not require hydrogen storage tanks on the vehicles or on-site. The unit is as small as a can of beans and can be scaled up to **3 or 6 cells**, depending on the equipment needed.

This patented device is designed to work with all fuels, including **diesel, petrol, LPG**, and **ethanol engines** meeting **US and European Standards**.

THE TRIAL

Between February and May 2024, we assessed the impact of Ultimate Cell on fuel consumption and emissions. We equipped one machine with a **Triple Cell Unit**, and a similar machine had standard OEM specifications, serving as a control machine. Both machines had the **same workload to compare savings accurately**.

We briefed the project management teams every four weeks to verify the effectiveness, establish a measurable reduction in carbon emissions and fuel consumption and address any concerns.

We collected data over the **four months** and utilised statistical methods to compare performance metrics. This innovative approach has resulted in significant cost savings, detailed on the next page.

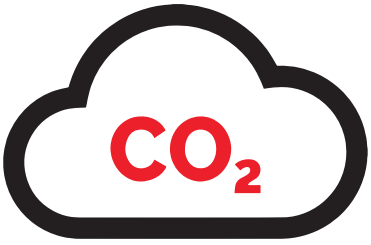
KEY RESULTS

ULTIMATE CELL HELPED REDUCE FUEL USAGE (BURN RATE) BY:

31%

COST SAVINGS BY:

£11.4K PER MACHINE PER ANNUM*



CO^2 EMISSIONS:

FROM 3,576.6 KG TO 2,337.1 KG**

*This is based on a price of **£1.20 per litre of diesel** and a **10 hour working day** for **260 days year**.

This is an average **monthly saving and is based on **average usage as measured in the trial**.

KEY FINDINGS

Hydrogen-on-demand technology helps our excavators operate with greater fuel efficiency, achieving a 31% reduction in fuel usage, a cost saving of **£11.4k per machine per annum**. This lowers operational costs and minimises environmental impact, supporting HS2 sustainability goals. This initiative exemplifies a proactive approach to innovation, with the adoption of solutions offering tangible benefits.

Additionally, Ultimate Cell has proven to be an economically viable option, with a swift payback period of just three months, highlighting its cost-effectiveness.

The test machine equipped with Ultimate Cell technology showed a significant reduction in fuel burn, consuming only **8 L p/h compared to 12 L p/h** for the control machine without the technology, representing a **31% reduction in fuel usage**. Over the four-month testing period, this resulted in a decrease in total fuel consumption from **1,329.6L to 868.8L**. This indicates that the innovative technology meant that the test machine operated more efficiently, using less fuel to perform the same work, leading to cost savings and reduced emissions.

CO2 emissions were significantly reduced. The CO2 emissions of the machine with the Ultimate Cell were reduced from **3,576.6 kg to 2,337.1 kg**, marking a 31% reduction. The projected annual fuel savings for one machine amount to **£11.4k**, demonstrating substantial cost benefits for the project.

Further indirect savings can be made on lower maintenance costs relating to DPF filters and EGR Valves. Although not directly measured, reduced servicing means less downtime and less time spent fuelling the machine saving time and resources.

TESTIMONIAL

"I am inspired to bring this innovative edge technology to life on the HS2 project. By promoting collaboration and supporting our supply chain, we can achieve outstanding results with potentially immense cost and carbon savings. We are shaping a sustainable future for everyone."

JONATHAN PEARCE, PROJECT DIRECTOR
KIER

"This innovation has the potential to evolve and make a substantial impact, generating cost and carbon savings not just Kier, EKFB, and HS2, but also a wide range of companies and industries nationwide."

SEAN MCMANAMON, SENIOR PROJECT MANAGER
KIER

FUTURE PLANS

The introduction of the **Ultimate Cell Truck Engine V3.0** represents a transformative shift in operational practices and environmental stewardship for Lynch projects with Kier Transportation on HS2.

This step-change is a significant leap towards more sustainable and efficient construction practices. We plan to integrate Ultimate Cell devices into **all Lynch machines**. We project that the implementation will result in cost savings of over **£500,000** and a reduction of over **60,000kg of carbon emissions**.

To find out how Lynch can help you with carbon reduction and cost savings, – contact us today!

OUR PILLARS

Our strategic pillars govern everything we do,
Helping Our Customers Build Britain's Infrastructure.

This project aligns to:

NET ZERO CARBON

Delivering **5-star customer service** that exceeds expectations.

HELPING OUR CUSTOMERS BUILD BRITAIN'S INFRASTRUCTURE.

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