



Hydrogen fuel cell shunting locomotive

Background

Clayton Equipment Ltd and the University of Derby worked together to assess the feasibility of **converting a diesel-hybrid shunting locomotive into a fuel-cell hybrid system**. The goal was to **reduce emissions, improve air quality**, and align with the **UK's net zero targets**.



The challenge

Shunting locomotives often operate at low speeds and idle for long periods, producing **high levels of air pollution and up to 10 tonnes of CO₂e per day**.

Electric locomotives are impractical due to infrastructure cost and safety constraints. Battery-powered locomotives also face challenges with range, recharging, and peak power demand.

Hydrogen fuel cells offer a promising alternative — they produce zero local emissions, have fast refuelling times, and can deliver diesel-comparable power and range.

What's innovative about this project?

The project carried out a feasibility study to assess how a fuel-cell hybrid system could work in a shunter.

- **Developed simulation models** to estimate daily energy use, hydrogen storage requirements, and potential CO₂ reductions.
- Explored an integrated fuel cell and battery system, where **batteries meet peak demand and regenerative braking stores extra energy**, while the fuel cell maintains battery charge.

Next steps

A consortium has been formed to explore the **creation of a full-scale demonstrator by converting an existing shunter locomotive**, with plans to seek follow-on funding to support design, component development, and testing.

Why this matters for the East Midlands

This project supports **regional strengths in zero-emission propulsion, clean energy, and sustainable advanced manufacturing**. It could deliver the **UK's first fuel-cell shunter**, which will create **supply chain opportunities** for regional SMEs as well as **job creation and skills growth** in hydrogen technology. The innovation will also result in **improved air quality** in urban and industrial areas.

Key achievements

- Proved hydrogen fuel cell technology is **technically feasible** for shunters
- Demonstrated potential for over **90% reduction in life-cycle CO₂ emissions**
- Identified a path to a **physical demonstrator and commercial rollout**

“Developing and expanding our export markets and ensuring a **centre of excellence in Derbyshire** for technological development is key, and **this success will be reflected in our UK supply chain** and filter through to building up the local and national economy. We look forward to the continued work between the University of Derby and ourselves in the innovation to bring a **cleaner and brighter future in rail technology**.” - Clayton Equipment Ltd