Case Study

Hydrogen Dual-Fuel Refuse Collection Vehicles (RCVs)

Situation

South Derbyshire District Council (SDDC) is committed to achieving net-zero carbon emissions and identified its refuse collection vehicles (RCVs) as the largest source of fleet tailpipe emissions. As a rural authority, SDDC required a decarbonisation solution that was both operationally practical and cost-effective, given the long routes and heavy-duty demands placed on RCVs.

With funding support from the D2N2 Innovation Low Carbon Fund and collaboration with expert partners including ULEMCo, SDDC launched a Hydrogen Innovation Project to evaluate hydrogen dual-fuel (hydrogen and diesel blend) as a low-carbon alternative to diesel. The project aimed to test operational feasibility, emissions reduction, and commercial viability within a real-world rural waste collection setting.

Hydrogen was of particular interest due to local industry knowledge and partnerships with Toyota Manufacturing, a pioneer in hydrogen fuel cell vehicle technologies.

Challenge

SDDC faced several key challenges in decarbonising its heavy fleet:

- **High fleet emissions:** RCVs generated the majority of fleet CO_2 emissions.
- **Limited rural EV suitability:** Electric RCVs were significantly more expensive (around three times the cost of diesel vehicles) and had limited range for rural routes.
- **Infrastructure constraints:** Hydrogen supply, storage, and refuelling infrastructure for small fleets was limited and costly.
- **Commercial uncertainty:** Proof was required whether hydrogen dual-fuel could deliver meaningful emissions reductions without compromising vehicle performance or operational efficiency.
- **Need for safe integration:** Introducing hydrogen required robust safety, training, and operational procedures for staff.

SDDC needed to determine whether hydrogen dual-fuel could realistically function as a scalable, low-carbon transition solution for its waste fleet.

Solution

ULEMCo played a central role in delivering the hydrogen dual-fuel trial and enabling proof of concept. Two Dennis Eagle RCVs owned and operated by SDDC were selected for the work. These had Euro 6 diesel engines, 26t gross vehicle weight (GVW) and were fitted with electric bin lifts.

Key contributions from ULEMCo included:

- **Dual-fuel conversion technology:** Supplied and installed hydrogen-diesel conversion units, enabling existing RCVs to be retrofitted rather than replaced.
- **Technical expertise:** Provided specialist guidance on hydrogen vehicle integration and system optimisation.
- **Training and safety support:** Delivered driver and operator familiarisation, hydrogen handling training, and health and safety guidance.
- **Telematics and performance analysis:** Supported data collection and analysis to assess fuel displacement, emissions reduction, and vehicle performance.
- **Hydrogen procurement support:** Assisted with soft market testing for hydrogen supply and infrastructure options.

The converted dual-fuel RCVs operated on standard waste collection routes using mobile hydrogen refuelling equipment. Vehicles could seamlessly revert to 100% diesel if hydrogen was unavailable, ensuring operational resilience.

Benefits

Operational and environmental outcomes

- Demonstrated that hydrogen dual-fuel RCVs can operate safely and effectively in live residential waste collection.
- Achieved an average 34% displacement of diesel, delivering a corresponding reduction in CO_2 tailpipe emissions.
- Maintained comparable or slightly improved fuel efficiency versus diesel-only vehicles.
- No compromise to operational performance, route completion or service delivery.
- Positive feedback from drivers and crews, citing improved responsiveness and acceleration.
- Positive public perception of sustainable waste collection.

Safety and usability

- No hydrogen safety incidents during the project.
- Refuelling times of 8–15 minutes using mobile infrastructure.
- Minimal changes required to daily operations aside from refuelling procedures.

Strategic and commercial insights

- Validated hydrogen dual-fuel as a technically viable and safe transitional decarbonisation solution.
- Demonstrated the value of retrofit conversion as a lower-cost alternative to full vehicle replacement.
- Highlighted infrastructure and supply chain limitations as the primary barrier to commercial viability at small scale.
- Provided critical data and learning to inform future local authority fleet decarbonisation decisions.

Conclusion

ULEMCo's technology, training, and technical support were instrumental in proving that hydrogen dual-fuel can deliver meaningful emissions reductions without disrupting operations. SDDC was able confidently to assess hydrogen's role as a practical fuel in heavy-duty municipal fleets, while identifying the infrastructure and cost conditions required for wider adoption.