NetZero Chem Ltd. HYDROGEN USAGE CASE STUDY FOR WASTECO Ltd, April 2020.

Background.

This study (this is a précis only) looks at the advantage to a waste collection and recycling company of using some of their waste stream to make green hydrogen using the NetZeroChem technology.

The company provides waste collection services to a city of 400,000 people and a larger metropolitan area of some 1M people. They also run waste sorting to support the local authority in its drive to improve recycling rates. Of particular interest for this case study, they recover over 150 tons of scrap aluminium from the waste stream per month. They have a fleet of HGV's; 20 3-axle Dennis waste compactor trucks, 2 8-wheel bulk tipper-trucks, and on the non-HGV side 10 3.5 ton skip transporters as well a small number of service vans and staff transport vehicles.

The Problems.

1. The company is under pressure from their local government contract provider to improve their green credentials and from city inhabitants to improve air quality, especially in the central zone.

2. The city they serve is introducing a clean air zone (CAZ) and a partial 'diesel ban zone' in March 2021.

3. Rising fleet fuel, renewal, and maintenance costs due to tightening legislation and a weak pound

4. Falling resale value of materials recovered from the waste stream due to restrictions in export markets and lack of UK buyers, aggravated by persisting global shut-downs.

The Solutions.

1.Replace the Diesel fuelled fleet with hydrogen/air fuel-cell vehicles (FCV's). They have looked into using battery-powered trucks, but are not convinced of their suitability. They are however concerned about the cost and availability of hydrogen.

2. Clean air zones; Using the zero-emissions NetZeroChemsystem to make fuel and changing the fleet to HFCV's would enable them to comply with the highest standards of vehicle emissions in perpetuity.

3. The change-over to zero-emissions HFCV's running on cheap green fuel generated from the city's waste is hugely valuable in PR terms and provides assurance of waste-contract renewal. Also the life span and maintenance cost of FCV's is better than those of conventional trucks.

46. The pandemic and changes in export rules have shown the fragility of our national supply lines and the trade routes for recycled materials. Using recycled scrap aluminium at source to make clean hydrogen and valuable by products that are currently all imported improves the UK's economic resilience and energy security.

Present Diesel Fleet Fuel Consumption. *

Whole fleet daily demand:- 417 gal, weekly demand 2085 gal, weekly mileage 12800, CO2 weekly emissions, 5560kg. Weekly cost (April 2020) for bulk Diesel at mid-price for fleet purchases is low at £1.10 = £2,300

* WRAP report on fuel consumption of diesel waste-collection vehicles.
http://www.wrap.org.uk/sites/files/wrap/WRAP%20FH%20and%20Premier%20Trial%20Draft%20Report%20Final%20for%20approval%2006_07_10%20HG.pdf

Projected Hydrogen Fleet Fuel Consumption. **

For the current fleet mileage (see above) this equates to a weekly hydrogen requirement of 2200 kg. This would require the consumption of 20 tons of Al scrap, and produce 58 tons of aluminium hydroxide. CO2/NOx emissions are of course zero, and fleet maintenance costs are projected to fall by up to 50%. The lost (gross) re-sale value of the scrap collected for use is £150/ton, a total of £3000/week. The value of the hydroxide produced is in the region of £30,000/week.

**** By 2025, Hyundai intends to bring a total of 1,600 fuel cell trucks onto the market and the first 50 Hyundai H2 XCIENT will be delivered next year.
The Hyundai H2 XCIENT fuel cell truck is powered by a new 190 kW FC , with a storage capacity of almost 35 kg of hydrogen, which give the truck a range of around 400 kilometres (250 miles).
See:- https://www.electrive.com/2019/09/25/hyundai-announces-details-for-swiss-h2-plans/

Operator's Choice - Battery vs Hydrogen Fuel Cell Lorries.

1. Risks, Problems, Solutions. ***

Problems:-Waste fleets need an average battery capacity of around 200kWh weighing up to 3 tons. To re-charge over a period of 10 hours requires a 25kW charging point for each truck, an 800kWh grid supply. This will not be possible in this location without major infrastructure work, or the use of a large fossil-fuel back-up generator which negates any environmental gains.

Solution ;- Using hydrogen/air fuel cells coupled with the NetZeroChem on-site hydrogen generation system requires negligible grid power, so no infrastructure problems. A 180kW hydrogen-air fuel cell system with all ancillaries weighs 2.5 tons less than the battery, around 520 kg. This means there is an extra 2.5 tons available for payload.

EU report on Electric Fleets.***

https://www.transportenvironment.org/sites/te/files/publications/20180725_T%26E_Battery_Electric_Trucks_EU_FINAL.pdf

Thank you for reading – full report available from alan@hydrogenmine.com