



Ubico Limited

Hydrotreated Vegetable Oil (HVO) Option in the Stroud District Council Diesel Vehicle Fleet

Report: Briefing Paper

To: Mike Towson – Stroud District Council

From: Ian Bourton - Head of Fleet Operations, Ubico

1. Background

- 1.1. During recent discussions with Mike Towson at Stroud District Council (SDC) concerning alternative fuels, Ian Bourton, Head of Fleet Operations at Ubico presented opportunities for SDC to reduce their carbon footprint within their existing and future vehicle fleet.
- 1.2. Discussions were based around industry knowledge and the current expectations concerning battery electric vehicles and first and second generation bio-fuels.
- 1.3. Ubico talked through various options for SDC where its geographical location, infrastructure and nature of the operational activities currently prevent the use of zero emission battery electric vehicles. Hydrotreated Vegetable Oil (HVO) was of particular interest to SDC due to its 'drop in fuel' capabilities and well to wheel greenhouse gas emissions savings that could be realised within a significant part of both the existing vehicle fleet and future vehicle fleet, relatively quickly. Ubico's Head of Fleet Operations was requested to produce a briefing paper document on HVO use for the SDC vehicle fleet.
- 1.4. This is that document, and explores the option of introducing HVO (a second generation bio-fuel) into SDC operational fleet of diesel vehicles.
- 1.5. Ubico currently operates 77 road registered vehicles and 76 trailers and plant to deliver front line services for SDC. The vast majority of SDC road registered vehicles currently run and operate on diesel fuel.

- 1.6. The majority of heavy use diesel vehicles owned by SDC and operated by Ubico use the latest Euro 6 engine technology. Euro 6 is the name given to a set of limits for harmful emissions produced by a vehicles internal combustion engines. The Euro 6 limits are the most stringent in reducing harmful emissions from engines that are available today, when burning traditional mineral B7 diesel.
- 1.7. In 2021/22 SDC used 412,838 litres of fuel. Diesel fuel being the most significant fuel at 397,514 litres. To give a sense of volume, using the UK Government GHG Conversion factors for 2021/22, this would calculate to approximately 1259 tonnes of CO₂e emissions per year.
- 1.8. It is widely accepted by experts that emissions created by petroleum based mineral B7 diesel (traditional diesel) used in all engines have a negative effect on air quality, are harmful to human health and to the environment.
- 1.9. Two biofuels potentially available to SDC to operate the diesel vehicle fleet are Traditional FAME biodiesel (Fatty Acid Methyl Ester) – a first generation bio-diesel; and HVO bio-fuel (Hydrotreated Vegetable Oil) – a second generation bio-fuel.
- 1.10. Biodiesels and bio-fuels are a replacement for traditional mineral B7 diesel fuel. Biodiesels and bio-fuels are produced from any carbon source that is easy to replace. Natural vegetable oils and fats are probably the most well-known example or renewable organic materials used to create bio-fuels.
- 1.11. Biodiesel and bio-fuel is a liquid fuel produced from these renewable organic materials.
- 1.12. Biomethane is a renewable equivalent biofuel for vehicles that run on natural gas. None of SDC vehicles currently run on natural gas. Therefore, Bio-methane is not considered in this document.
- 1.13. Biodiesels and bio-fuels used in vehicles burn much cleaner than petroleum based diesel fuel and produce lower harmful emissions.
- 1.14. FAME biodiesel and HVO bio-fuel are different products even though they can both be produced from renewable organic materials. FAME is a first generation biodiesel and can retain moisture in its production process that when used in higher blended percentages may not be ideal for modern engines. FAME is also not supported by the majority of the manufacturers of vehicles that SDC own.

- 1.15. HVO is a second generation bio-fuel produced where contaminants are removed during the hydrogen saturation production process creating the same chemical composition as traditional mineral diesel.
- 1.16. The use of Palm oil in biofuels is believed to have been a driver for deforestation of tropical rain forests around the world. Deforestation can have a large negative impact on greenhouse gasses and harmful to wildlife. Biofuels can be manufactured from Palm oil, but it doesn't have to be and there are manufacturers that do not use Palm oil in the manufacture of bio-fuel.
- 1.17. The EU Renewable Energy Directive (RED ii) bans all Palm oil in biofuels in stages, by 2030. Ubico only source and use HVO that has not been manufactured from Palm oil.
- 1.18. The production of renewable fuels is highly complex and environmental performance varies significantly with feedstock. Ubico only use biofuels that are produced from renewable feedstocks.
- 1.19. Hydrogen is not a naturally forming substance and has to be manufactured. In the case of HVO, Ubico would seek to only use procurement routes where the hydrogen had been manufactured from renewable technologies.
- 1.20. UK legal requirements for current traditional mineral B7 diesel is a 7% FAME blend (known as B7, which means the fuel is made up of a *maximum* 7% FAME and 93% mineral diesel)
- 1.21. The potential problems associated with FAME biodiesel and the lack of vehicle manufacturer support of the existing SDC vehicle fleet make up, effectively meaning that FAME biodiesel in any high blend above 7% should not be considered by SDC or Ubico as a replacement for traditional mineral B7 diesel. The carbon saving impact would therefore be nil, unless SDC decided manufacturers vehicle warranties should be dispensed with, which would present a significant financial and resource risk.

2. HVO Bio-fuel

- 2.1 HVO biofuel is a paraffinic based liquid diesel fuel. It is a 'drop in fuel' - a fuel that doesn't require any adaption to the operational fuel infrastructure, the vehicle (where manufacturer use is approved) or the vehicle maintenance regime.

- 2.2 The hydrogen treatment removes all oxygen from the oil; this gives the advantage of avoiding oxidation. HVO that Ubico use is required to meet specific European and UK fuel specifications (EN15940).
- 2.3 The feedstock can be the same or of a lower quality than FAME biodiesel enhancing sustainability.
- 2.4 The temperature level that HVO bio-fuel can still operate normally in is less of a consideration than FAME bio-fuel. HVO operates at temperatures of less than minus 20°C.
- 2.5 HVO is readily available in formats that have not included Palm oil in its manufacture. Manufacturers can identify the origin of the raw material to verify the credentials of the HVO product and provide Zemo or similarly approved Renewable Fuel Declarations (RFD) Certificates.
- 2.6 The UK market and vehicles using HVO is relatively small, but increasing. However, HVO has been in use regularly over the past five years in Europe and has increased by 50% globally over the past 5 years.
- 2.7 The Governments renewable transport fuel statistics (Renewable Transport Fuel Obligation statistics: Period 10 (2017/2018), report 6 [DfT 2019]) show that the average GHG emission savings using pure HVO biofuel (HVO100) is 91% when compared to petroleum based mineral diesel. 91% is the total 'well to wheel' saving including feedstock, production and tail pipe emissions.
SDC should be confident in saving a total of between 80% and 90% well to wheel greenhouse gas emissions by vehicles using HVO as their fuel. Where a net zero carbon is a future requirement, the remaining carbon could be subject to any future SDC carbon offsetting programme.
- 2.8 Not all manufacturers approve the use of HVO, but a significant number of SDC fleet do. The non-approval does not necessarily mean that that HVO has been tested and failed, but more likely that certain manufacturers have not tested the product at all, and this will come in the future. It is important to note that non approval is often because the test procedure for the manufacturers to approve everything is extremely time-consuming and expensive. Recent models of Mercedes, Volvo, Dennis Eagle, DAF, Ford, Citroen, Peugeot, Isuzu and Renault are makes of vehicles that SDC operate that have been approved for HVO use, as

long as it meets EN15940 standards. Fuso vehicles have not yet been approved for HVO use.

- 2.9 To control this risk a separate fuel tank and systems would be required for all vehicles that could operate on HVO. HVO use vehicles would continue to use the existing 30,000 litre bulk fuel tanks located at Gossington Depot. The 6000 litre bulk fuel tank would need to be increased in size to accommodate Non-HVO use. The dispensing of the correct fuel would be controlled by the fuel management system.

3. HVO Financials

- 3.1 HVO carries a premium over traditional B7 diesel. Over the previous four years the price of HVO has varied when compared to traditional B7 diesel. During these four years the price differential varied between 15p and 26p per litre. The recent war in Ukraine has pushed this margin up to 53p per litre (31.01.2023). There is an expectation this will return to more normal premiums, or even lower when the war is over.

- 3.2 For SDC there would be a Capital expenditure to purchase a bulk fuel tank and locate it in Gossington Depot. An additional 20,000 litre fuel tank, fuel pumps, telemetry points, dispensing ID and integration with the existing fuel management software system (Triscan) would attract a budget price of approx. £45,000.

- 3.3 Financial impact:

	ppl	Fuel Used (Litre)	Year 1	Year 2	Year 3
Estimated Cap Ex - Fuel tank etc		397,514	£45,000.00		
HVO Min Cost Differential	0.15		£59,627.10	£62,012.18	Year 2 + Inflation
Total Cost			£104,627.10	£62,012.18	Year 2 + Inflation
HVO Max Cost Differential	0.26		£103,353.64	£107,487.79	Year 2 + Inflation
Total Cost			£148,353.64	£107,487.79	Year 2 + Inflation
HVO Current Inflated Cost Differential	0.53		£210,682.42	£174,109.72	Year 2 + Inflation
Total Cost			£255,682.42	£174,109.72	Year 2 + Inflation

Year 2 Hypothesis Inflation	4%				
-----------------------------	----	--	--	--	--

- 3.4 Traditional B7 Diesel and HVO prices are subject to constant variation and the cost differential is not a certainty.
- 3.5 There is the opportunity to use the existing 6000 litre fuel tank for storing the existing requirement of traditional B7 diesel that is already installed on site that previously held the now redundant rebated fuel (red diesel). This would require regular deliveries of fuel and may attract a 'small load charge' premium on each delivery and constant monitoring.
- 3.6 Lessening the impact on price differentials is possible with a programme of eco-driver performance utilising on-vehicle telematics systems. This will create a fuel saving, further environmental savings and reduce the net effect of increased HVO cost. This programme is highly recommended and has been proven successful.

4.0 Assumptions

- 4.1 Decisions and discussions with Ubico on alternative fuels (bio, electric, hydrogen, etc) form part of the wider SDC strategy on carbon and air pollution reduction. SDC will decide the relevance, appropriate infrastructure and achievability of SDC targets.
- 4.2 Ubico's expertise on vehicle fleet will interact and inform part of SDC environmental team/expert's decisions of SDC's route to nett carbon.
- 4.3 Governance and approvals of any Ubico recommendations on vehicles and alternative fuels remains with SDC environmental team/experts to ratify that it meets with SDC's vision and future infrastructure.

5.0 Options

Option 1

Do nothing. Continue to use traditional mineral bio-fuel, up to 7% FAME. Publically relying on the fact that majority of SDC operated vehicles will be the latest 'Euro 6' engine technology that is available today and SDC will embark on a programme of

improving driver environmental performance by utilising vehicle telematics systems and managing driver development programmes in eco-driving techniques.

Option 2

Switch to HVO bio-fuel where possible providing a nett 80%-90% (plus) saving on 'wheel to well' greenhouse gas emissions, accepting the additional expenditure required in section 4 above. Option 2 would have a significant effect on reducing nett greenhouse gases. HVO is available as a 'drop in' fuel with no changes required to the infrastructure or exiting manufacturer approved vehicles, but is usually (pre Ukraine war) an average of cc15-20% more expensive to purchase, having a negative effect on revenue budgets. Mitigate some of the increased HVO costs is possible by managing the environmental performance of drivers, which reduces fuel consumption.

Author	Ian Bourton, Head of Fleet Operations, Ubico Email: Feb 2023
---------------	--

OPTIONS FLOW CHART

