
Decarbonizing Refuse Collection Vehicles: discussion of potential options

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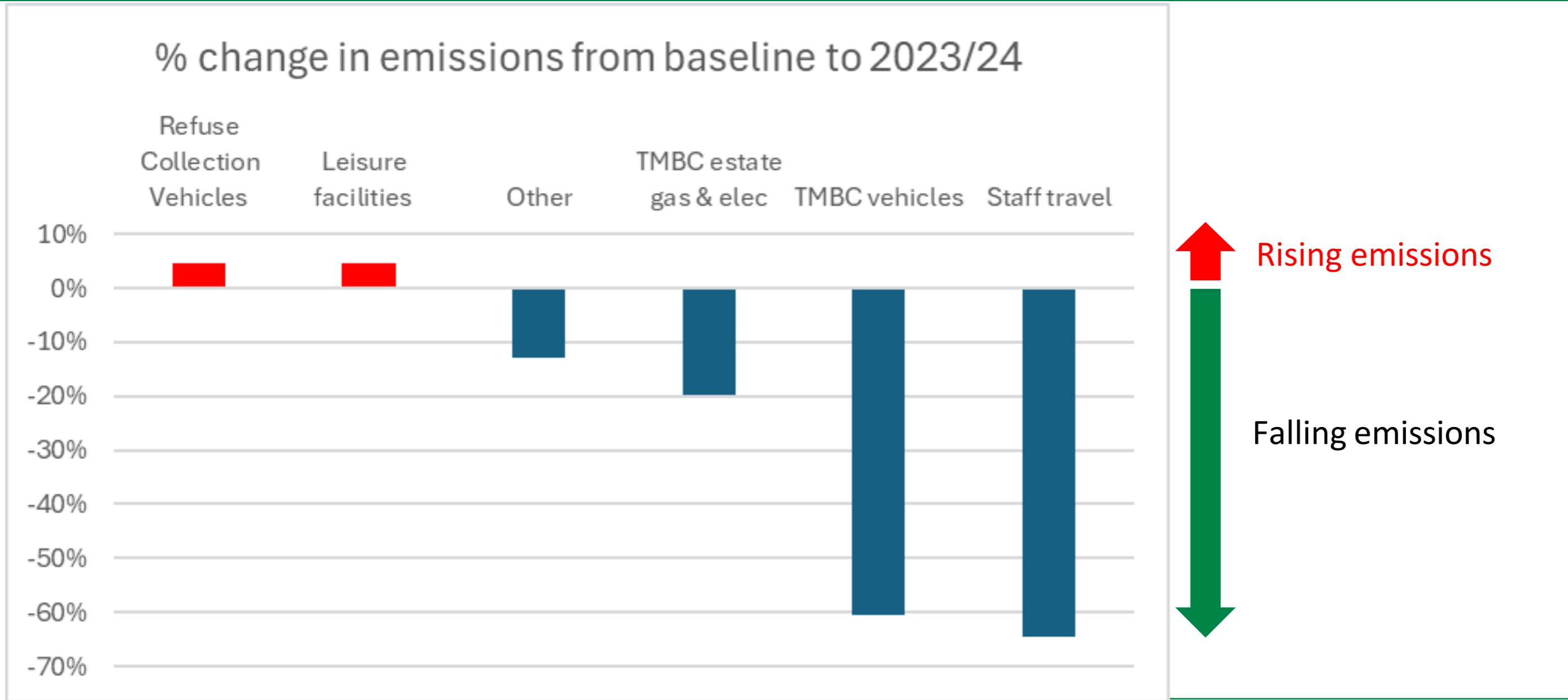


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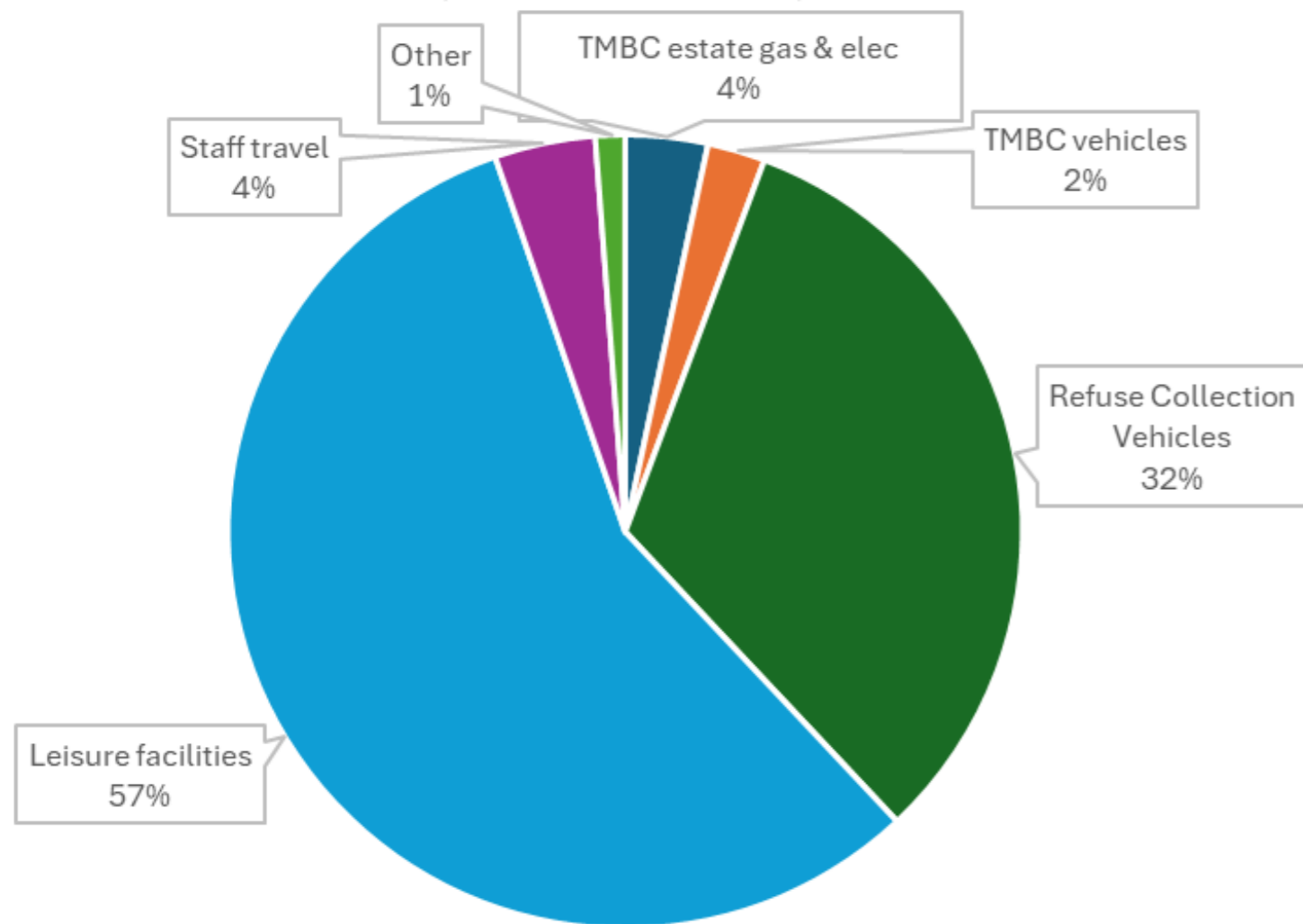
Annex: Refuse Collection Vehicle decarbonisation by other Local Authorities

TMBC has made good progress on reducing emissions in most areas but decarbonising major emitters is challenging



Refuse Collection vehicles produce a third of all emissions from TMBC's estate and operations – and rising

Carbon emissions from TMBC estate and operations
(2023-24, tCO₂e)



- Refuse Collection Vehicles (RCVs) are the second largest source of greenhouse gas emissions from TMBC's estate and operations.
- With a growing population and housing developments in the borough, emissions from RCVs will only continue to rise without action to decarbonise.

Decarbonising Refuse Collection Vehicles at contract renewal is essential for carbon neutral 2030 and corporate strategy priorities

- The contract for household waste & recycling collections is currently shared with Tunbridge Wells and fulfilled by Urbaser.
- The Urbaser fleet is mainly diesel vehicles, producing both carbon and particulates that contribute to poor air quality and associated health issues.



The contract is due for renewal in 2027, offering a crucial opportunity to decarbonise this service by 2030.

Refuse Collection is TMBC's main service, is highly visible and matters a great deal to residents as a sign that their Council is working effectively and efficiently.

For each decarbonisation option, factors to consider include:

- Costs
- Benefits
- Carbon emissions
- Air quality / human health
- Infrastructure
- Operational impact
- Supply chain (vehicles and fuels)

In general switching to biodiesel is seen as the lowest risk, lowest additional cost option to achieve significant emissions reductions.

The main source of greenhouse gas emissions from refuse collection vehicles is burning fossil fuel. Decarbonisation involves switching to an alternative power train (e.g. electric) or a lower emission fuel (e.g. biofuel).

This table provides an indicative RAG (red/ amber/ green) summary of the factors to consider in waste decarbonisation.

	Costs*	Benefits	Ease of switch**	Emissions reduction	Infrastructure	Supply chain (fuel and vehicle)
Biodiesel	A	G	G	G	A	A
Electric	A	G	A	G	A	A
CNG or LPG	A	A	R	R	A	A
Hybrid	A	A	A	A	A	A
Hydrogen	R	G	R	G	R	R

The evidence for each suggested rating is discussed in more detail in the following slides.

Air quality: lower emissions options also bring health benefits

- The Council's Air Quality Action Plan highlights the co-benefits of tackling air quality and climate change pollutants for statutory duties to better public health.
- Road transport emissions are the main source of air pollution that has caused the declaration of AQ management areas across the borough.
- Reducing transport emissions is a key priority in the air quality action plan, focussing on areas where the council has direct control.

At tailpipe, HVO, electric and hydrogen vehicles produce lower air pollutants than diesel fuelled vehicles.

Electric and hydrogen vehicles are both zero emissions at tailpipe, including air pollutants.

From an initial investigation, HVO seems to reduce air pollutants by 30-50% relative to existing diesel refuse collection vehicles, depending on engine design.

However, some particulates that have negative human health impacts are caused by tyres and braking. These sources of air pollutants would remain.

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Biodiesel: costs and operational changes

The most commonly used biofuel for refuse collection vehicles is HVO (hydrotreated vegetable oil)

HVO is seen as the lowest risk, lowest additional cost, and easiest route to decarbonization as existing vehicles can usually be used and there is little change in operating an HVO fleet.

As a 'drop-in diesel', various HVO: diesel blends can be used to manage price shocks through short-term changes in fuel mix.

HVO costs 10-30% more than diesel per litre, but the benefits typically outweigh additional costs when climate and health impacts are accounted for.

Sense check: LA experience and supplier feedback

In November 2023, Urbaser indicated a bulk rate for HVO 20% more than diesel per litre at that time. A switch to 100% HVO was estimated to add £202k to the fuel bill for the remainder of the current contract.

Some Local Authorities using HVO have invested in a stand-alone refuelling tank. In 2023, Tunbridge Wells BC estimated a tank at around £30,000 capital cost.

Supplier feedback sought through the Waste Contract process confirms HVO as more expensive than diesel, but as a good option for achieving emissions reductions easily and quickly, potentially together with some electric vehicles.

Biodiesel: supply chain

Biofuels can be produced from organic materials, including wood, crops, and food waste, leading to concerns over wider environmental and sustainability impacts.

The Department for Transport sets biofuel sustainability criteria. Suppliers must comply with the sustainability criteria to receive Renewable Transport Fuel Certificates.

Sustainability criteria require that biofuels:

- meet minimum carbon emission reductions, ‘chain of custody’ through the supply chain,
- must not originate from land with high biodiversity value or carbon stock, such as, forests, or peatland.

Sense check

In the UK, crop or forest feedstock is usually not used. In 2022, 75% of certified biodiesel was produced from used cooking oil.

There are many UK accredited HVO suppliers. Local authorities already using HVO in refuse collection or other fleet vehicles have already committed to using accredited suppliers through the Sustainability and Carbon Certification Scheme (ISCC) that ensures compliance for Renewable Transport Fuel Certificates. The company Zemo Partnership runs a similar Renewable Fuels Assurance Scheme (RFAS).

In 2022, 97% of all UK certified renewable fuel complied through the ISCC.

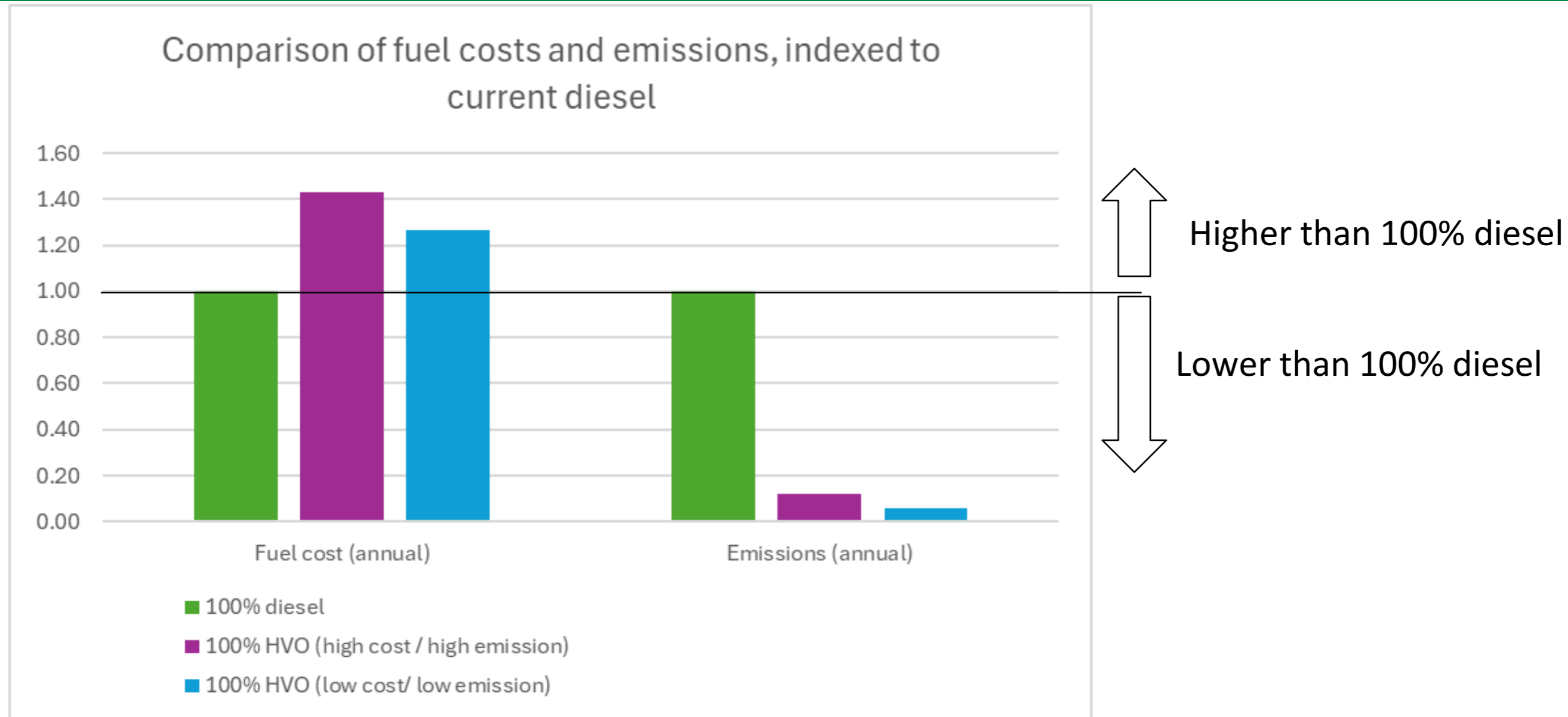
Sources: Renewable Transport Fuel Obligation: Compliance Guidance 2024

https://assets.publishing.service.gov.uk/media/667d486fc7f64e23420900ae/rtfo-compliance-guidance_2024.pdf

Renewable Fuel Statistics 2022: final report [Renewable fuel statistics 2022: final report - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/114444/renewable-fuel-statistics-2022-final-report.pdf)

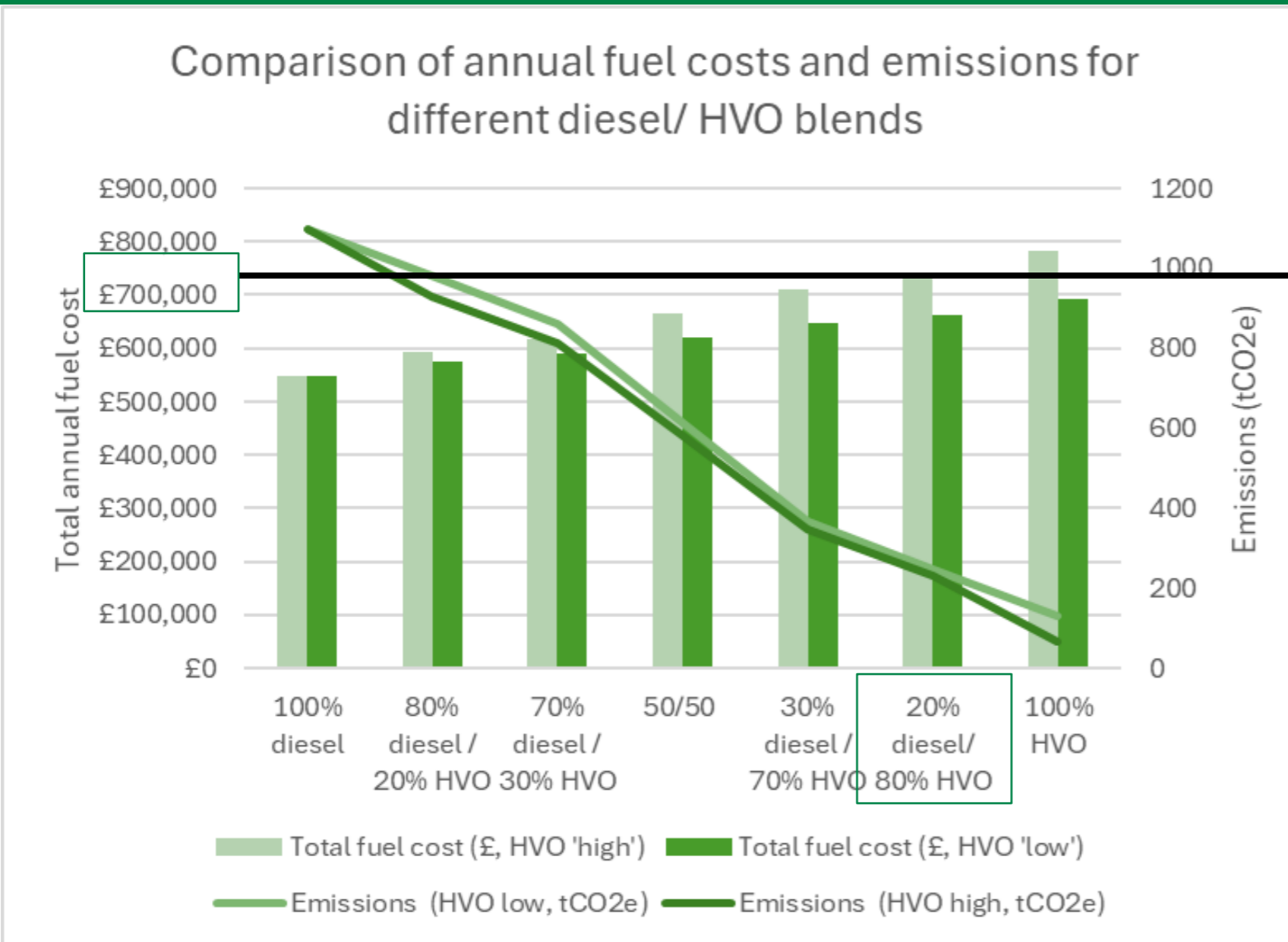
<https://www.iscc-system.org/>

Switching to HVO entails a slightly higher cost to achieve significant emissions reductions



Switching does not have to mean 100% HVO.

As a drop-in fuel, HVO can be used with diesel in any blend ratio.



With HVO, the sunk capital cost of infrastructure is required, but then it is possible to flexibly manage ongoing contract costs of fuel.

For example:

A cap on *additional* fuel costs of £200,000 p.a. would allow an 80% HVO fuel blend, achieving emissions reductions of at least 850 tonnes of CO₂e per year.

An HVO price-cap approach, with an option to trial an EV in appropriate areas / routes is one possible way of decarbonising with control of service costs.

Local Authority experiences: HVO, or mixed HVO/ diesel / electric services are the most common low emissions solutions

20 local authorities in England are currently operating low emissions refuse collection vehicles.

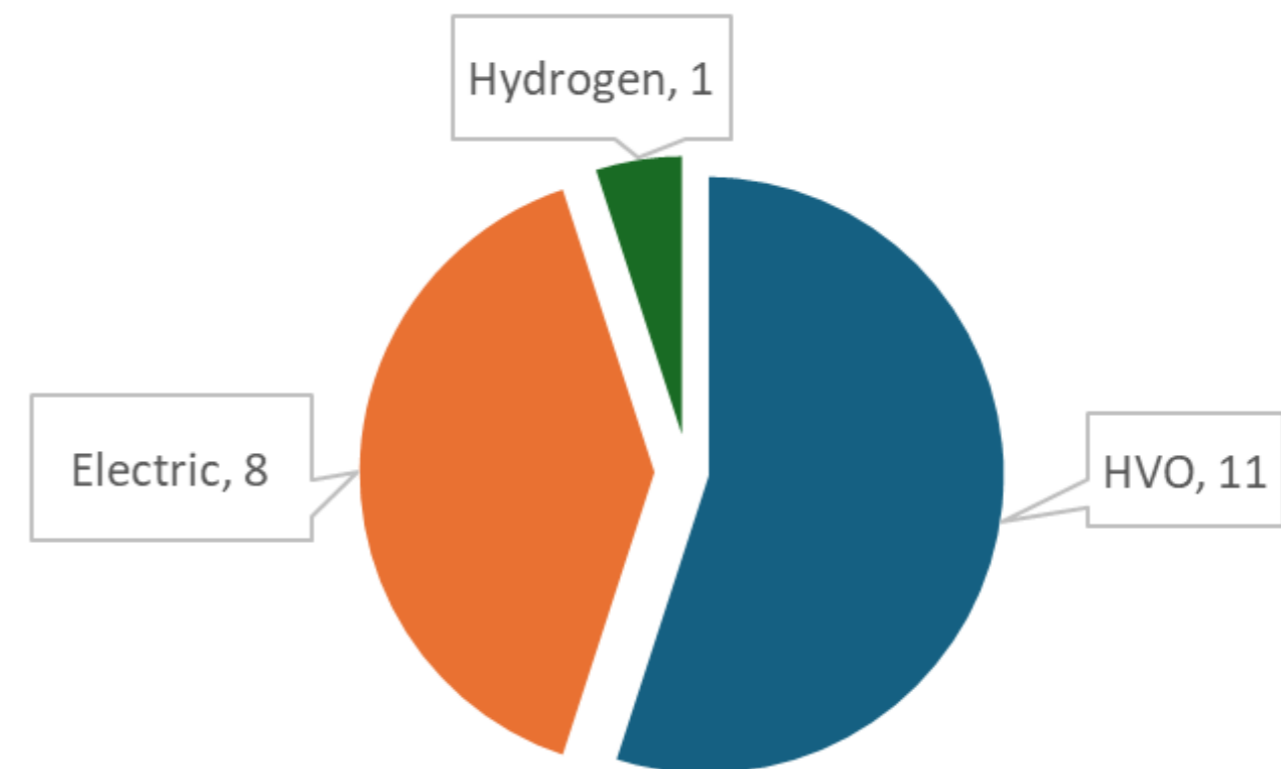
8 LAs already have HVO in operation for the full RCV fleet. A further 2 LAs have approval for full HVO through the fleet that is being rolled-out. One LA is currently reviewing their 2024 HVO trial.

5 LAs are in a trial, or have some eRCVs alongside diesel or HVO. 3 LAs have plans for electric vehicles to make up the majority or full fleet.

City of London is the only fully electric fleet in operation (5 vehicles for urban collection routes).

Only 1 hydrogen vehicle is in use alongside other RCVs.

Refuse collection lower emission options currently in use by number of local authorities (England, 2024)



Local Authority experiences in detail are in the Annex.

Note: St Helen's Borough Council has electric RCVs as well as the hydrogen vehicle. Therefore, they have been included in the electric and hydrogen parts of the pie, but not double-counted in the total number of LAs with low emissions vehicles, which is 19, not 20.

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Electric: costs and operational changes

Electric vehicles have a zero tailpipe emissions. Emissions from the electricity grid, if taken into account, are also lower than diesel.

Electrification poses a number of technical challenges for large, heavy vehicles, including for refuse collection.

Trials of electric vehicles on different route rounds are highly recommended to test battery range before adopting for refuse collections.

Vehicle charging infrastructure presents additional costs and risk, as charging problems with vehicles means missed collections (see Annex).

Sense check: LA experience and supplier feedback

The City of York Council purchased new electric Refuse Collection Vehicles (RCVs) in 2022, at a cost of £500,000 per vehicle.

Supplier feedback sought through the Waste Contract process confirms electric vehicles as significantly more costly, in addition to infrastructure and supply challenges and further costs.

However, several suppliers suggested an HVO/ electric fleet mix.

Currently, there are no fully electric Refuse Collection Vehicle fleets in operation. Some councils are phasing in a full electric fleet in time with their emissions reduction goals. Commonly, a small number of electric RCVs are used alongside diesel or HVO vehicles.

Electric: supply chain

The supply chain for electric Refuse Collection Vehicles is uncertain as the market is relatively new and small.

There are wider environmental concerns over the impact of electric vehicle batteries in terms of production and end-of-life disposal.

Source: Research into sustainable and alternative waste collection usage, 2022. CIWM, Frith Resource Management and ISWA.

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Hydrogen: cost, operational changes and supply chain

Hydrogen vehicles have a zero tailpipe emissions, representing a 100% reduction in carbon emissions.

As a new and emerging technology for large, heavy vehicles, there is a high capital cost for the vehicles and infrastructure, as well as ongoing fuel costs.

Benefits of hydrogen fuel cell vehicles include speed of refuelling and vehicle range, compared to other low emissions options.

Sense check: LA experience and supplier feedback

There is currently only one hydrogen Refuse Collection Vehicle in operation in the UK, since 2022. The vehicle was commissioned by St Helens Borough Council and was custom made in Germany.

Hydrogen fuel cell refuse collection vehicles are used in other countries. For example, in the Netherlands these vehicles are in use in some cities at a capital cost for the vehicles 2-3 times diesel equivalents.

In the supplier feedback, only half the responses mentioned hydrogen, noting that it was an emerging low emissions alternative without discussing it as a workable contract option at the current time.

Source: Research into sustainable and alternative waste collection usage, 2022. CIWM, Frith Resource Management and ISWA.

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All decarbonisation options are higher cost but deliver health, air quality and climate change benefits

Summary

HVO	Certified sustainable HVO is the lowest risk, lowest additional cost, and easiest to implement operationally, while achieving ~90% emissions reductions.
Electric	<p>There are larger environmental and air quality benefits to electric refuse collection vehicles.</p> <p>Costs prohibitive to switching entire fleet, although one or two town-centre vehicles could be an option. Trials to test battery range and efficiency on different routes is advised before adopting.</p>
Hydrogen	Currently only 1 hydrogen refuse collection vehicle in operation that was custom commissioned and built in Germany. Hydrogen refuse collection vehicles are likely beyond the financial and risk appetite of the council at this stage.

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Annex: Local Authority experiences in detail (1 of 3)

	Name of authority	Year	Motivation	Stage of implementation	Infrastructure	Other notes
HVO	Winchester City Council	2024	Carbon neutral Effective services Air quality (health)	In operation (full fleet)	Accredited sustainable sources	Considering 1eRCV and upgrade to depot later in 2024.
	East Suffolk Council	2022	Carbon neutral Air quality (health)	In operation (full fleet)		
	Rushcliffe Borough Council	2024	Carbon neutral Air quality (health)	In operation (full fleet)	Supply from supermarkets and other supplier waste	
	East Cambridgeshire District Council	2023	Net zero carbon council	Approved for full fleet, currently 1 vehicle in operation		2023 trialled HVO if price difference up to 20p from diesel. 2024 Full Council approved HVO for full fleet.
	Wandsworth Borough Council	2023	Carbon neutral Air quality (health)	In operation (full fleet)	Locally sourced from pubs and restaurants (waste cooking oil)	
	Basingstoke and Deane	2024	Carbon neutral Air quality (health)	In operation (full fleet)		Also trialling eRCVs with neighbouring authorities
	Stratford-on-Avon District Council	2024	Carbon neutral Air quality (health)	In operation (full fleet), but capped at £250k additional revenue cost p.a.		

Annex: Local Authority experiences in detail (2 of 3)

HVO	Brentwood Borough Council	2023	Carbon emissions	In operation (full fleet)		Estimate switch from diesel to HVO to increase fuel costs by 34%
	Scarborough Borough Council	2022	Carbon emissions	In operation (two-thirds of fleet)		Also using HVO in range of other vehicles. Keeping track of electric/ hydrogen for future.
	Rotherham Borough Council	2024	Net zero carbon council	Trial	Sustainably sourced.	2024 HVO trial, currently reviewing.
	Gravesham Borough Council	2025	Carbon emissions	Full fleet by April 2025	Existing tanks at depot	24 HGVs plus non-electric vans.
Electric	Manchester City Council	2021 - 2022	Decarbonisation Air quality (health)	In operation (half fleet; other half diesel)		
	Basingstoke and Deane, Hart and Rushmoor	2024	Carbon neutral Air quality (health)	Trial	Working with VEV for charging and data collection on eRCVs during trial	Aim of pilot to explore if worth electrifying fleet. 6 week trial of converted second-hand diesel RCVs
	Oxford City Council (LATCo)	2020	Carbon neutral Air quality (health)	1 eRCV in operation		Trial of eRCV involved a range of different routes to test impact on battery.
	City of York Council	2020	Carbon neutral Noise	2eRCV in operation (rest of fleet diesel) Phased introduction to full fleet 2024	currently commercial waste only?	Charging problems led to missed waste collections.
	Eastleigh Borough Council	2023	Net zero carbon council	3 eRCV in operation within fleet		Completes round on one overnight charge

Annex: Local Authority experiences in detail (3 of 3)

	Name of authority	Year	Motivation	Stage of implementation	Infrastructure	Other notes
Electric	City of York Council	2020	Carbon neutral Noise	2eRCV in operation (rest of fleet diesel) Phased introduction to full fleet 2024	currently commercial waste only?	Charging problems led to missed waste collections.
	Nottingham City Council	2020	Carbon neutral Air quality (health)	Phased introduction. 2 eRCV in 2020 13 eRCV in operation in 2023		Charging problems led to missed waste collections.
	Westminster City Council	2023	Carbon neutral Air quality (health) Noise	In operation (partial fleet). 45 new eRCVs, with plans for full electric fleet	Also funded new depot for charging 54 EVs simultaneously, draws energy from neighbouring EfW plant.	Electrification of full fleet, street sweepers, gritters, vans etc.
	St Helens Borough Council	2022	Net zero carbon council	2 eRCV in operation 1 hydrogen (see below)	Installed more depot charging points	Electrification of full fleet, street sweepers, gritters, vans etc.
	City of London	2021	WHO air quality guidelines	Fully electric waste collection fleet (5 vehs)	Installation of charging points.	Vehicles specially designed for urban centre so <u>can do</u> entire round on one charge (18 tonne and 26 tonne vehicles).
Hydrogen	St Helens Borough Council	2022	Net zero carbon council	1 hydrogen vehicle in operation		Custom made in Germany