

Ultra-Low Emission Vehicle (ULEV) Waste and Recycling Vehicles Programme

2023 Q3 (July-September)

Summary Deployment and Performance Report



Document Control

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Introduction to the Programme and Aim of the Report

The Ultra-Low Emission Waste and Recycling Vehicles programme aims to accelerate and de-risk the transition to ultra-low emission vehicles (ULEVs) within the Welsh public sector waste fleets by 2030. The programme helps local authorities (LA) to transition to ULEVs by:

- Providing business case justification for additional capital funding.
- Deploying vehicles in Welsh waste and recycling operations.
- Supporting charging and refuelling infrastructure installations.
- Increasing the availability of viable ULEVs.

This report summarises the performance of ULEV waste and recycling vehicles deployed by Welsh local authorities based on data collected between July and September 2023. Results from the previous quarter (April-June 2023) are also shown for comparison.*

* During the reporting period, some vehicles did not produce a complete set of data due to telemetry system issues. For these vehicles, data has been extrapolated based on the remaining vehicles for which reliable data was available to estimate their real-world performance. Any missing data throughout the report is shown by a dash (-).



Summary





Project Highlights July-September 2023

- **35** zero emission vehicles deployed (30 RCVs, 4 RRVs, 1 Sweeper)
- **37,700 miles** reported including the first data from an electric RRV¹
- **88 tonnes of WTW CO₂e** emissions saved^{1 - 4}
- **176 kg of NOx** and **742 g of PM** emissions avoided^{1, 2, 3}
- Electric RCVs travel **31 miles per day** and have a **usable range of 59 miles**^{1,5}
- The electric RRV travelled **32 miles per day** and has a **usable range of 53 miles**^{1,5}
- The electric sweeper travelled **25 miles per day** with a **usable range of 31 miles**^{1,5}



¹ Extrapolated average from all operating vehicles with useable data during the reporting period. ² Compared to a diesel equivalent truck. Baseline fuel consumption figures for the sweeper (including auxiliary engine fuel use) and RRV were not available so emission savings for the electric equivalent cannot be reported ³ CO₂ emissions stated on a well-to-wheel base which considers of all emissions from the fuel extraction until its final use in a vehicle. CO₂ stated as CO₂e which includes other GHG emissions on a CO₂ equivalence basis. ⁴ Estimated as per guidance of the TAG data book (May 2023). ⁵ Usable range is calculated for 80% battery usage.

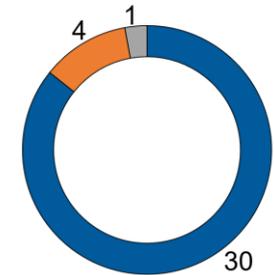


Summary Deployment Status 2023Q3

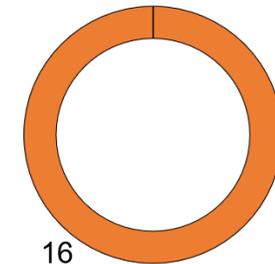
35 ULEVs Deployed So Far

Deployed This Period (0)

Deployed So Far (35)



Pending Delivery (16)



- RCVs
- RRVs
- Sweepers



Detailed Deployment and Reporting Status 2023Q3

Local Authority	Type of Vehicle	Delivered	Pending Delivery	Reporting Data ¹
Cardiff	RCV	12	0	12
Carmarthenshire	RCV	3	0	3
Conwy	RRV	1	6	0
Denbighshire	RCV	2	0	2
	RRV	0	3	-
Flintshire	RRV	2	0	-
Merthyr Tydfil	RRV	0	3	-
Neath Port Talbot (NPT)	RRV	1	0	1
	Sweeper	1	0	1
Newport	RCV	7	0	7
	RRV	0	2	-
Powys	RCV	1	0	1
Swansea	RCV	1	0	1
Torfaen	RCV	2	0	2
Vale of Glamorgan	RRV	0	2	-
Wrexham	RCV	2	0	0

¹ Vehicles that have been delivered but are presented with a dash have not yet finished their bedding in period which is a month after the vehicle was fully deployed.



Estimated Annual Vehicle Performance

RCV:

Energy efficiency (miles/kWh) average¹:

0.27

Energy efficiency (miles/kWh) range of values¹:

0.20 – 0.38



Sweeper:

Energy efficiency (miles/kWh) average¹:

0.19

Energy efficiency (miles/kWh) range of values¹:

0.19



¹ Extrapolated average from all operating vehicles during the reporting period.



Estimated Annual Vehicle Emission and Diesel Savings

RCV:

Yearly Emissions Savings¹⁻³:

WTW CO ₂ e ³	NOx	PM2.5
11 t	27 kg	101 g

Annual Social Damage Cost Savings^{2, 4}:

£3,000

Yearly Fuel Cost Savings^{2, 5}:

£2,200



¹ Extrapolated averages from all operating vehicles during the reporting period and the previous three quarters. Baseline fuel consumption figures for the sweeper (including auxiliary engine fuel use) were not available so emission and cost savings for the electric equivalent cannot be reported. ² Compared to a diesel equivalent truck. ³ CO₂ emissions stated on a well-to-wheel base which considers of all emissions from the fuel extraction until its final use in a vehicle. CO₂ stated as CO₂e which includes other GHG emissions on a CO₂ equivalence basis. ⁴ Values obtained as per guidance of the WeITAG data book (Jul 2023). ⁵ Long-term prices based on 7-year estimate from HM Treasury: Green Book 2023 – 2030 (18.3 p/kWh, 1.27 £/L).



RCV Performance





RCV Summary Quarterly Reporting per LA¹

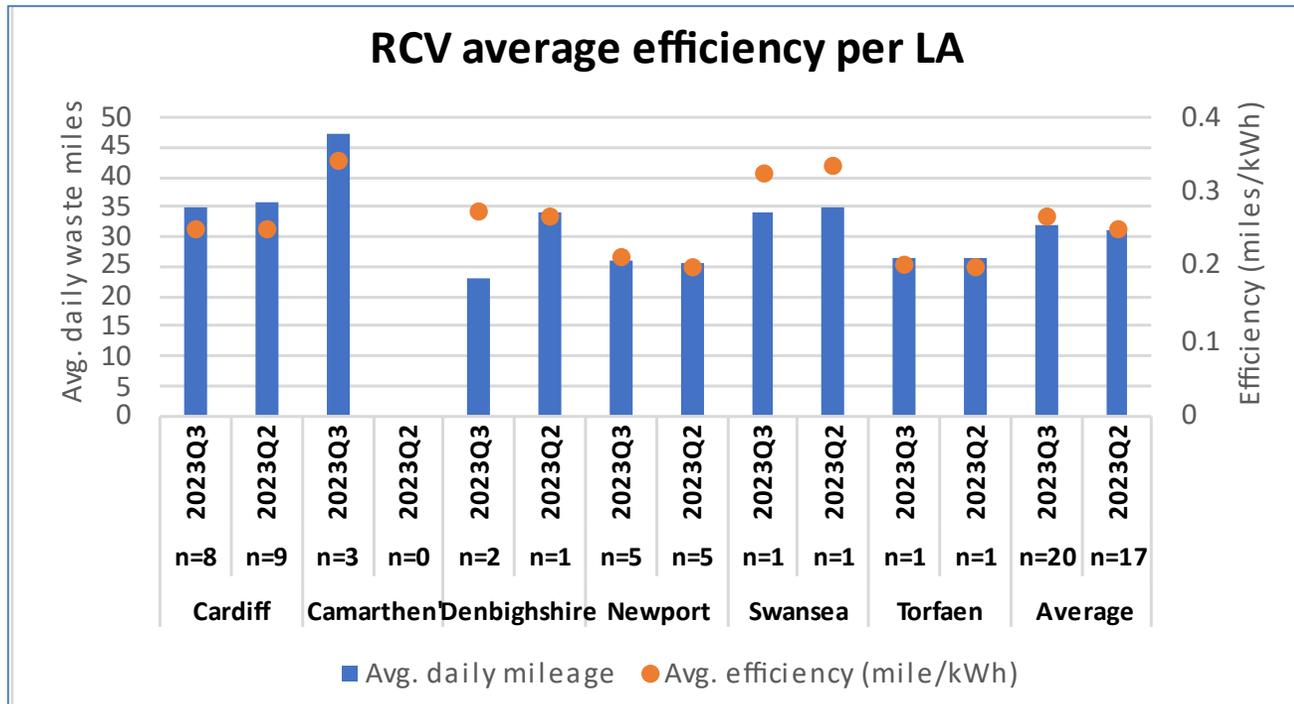
LA	2023Q3					2023Q2				
	# Vehicles deployed	# Vehicles reporting	Waste miles	# Bins emptied	Waste collected (t)	# Vehicles deployed	# Vehicles reporting	Waste miles	# Bins emptied	Waste collected (t)
Cardiff	12	12	12,408	216,233	3,785	12	12	13,560	218,237	4,090
Carmarthenshire	3	3	4,402	-	-	0	0			
Denbighshire	2	2	3,534	74,986	973	2	2	2,793	75,469	905
Newport	6	6	8,087	242,032	3,373	6	6	6,678	207,826	2,904
Powys	1	1	2,988	30,191	560	1	1	3,471	35,626	665
Swansea	1	1	2,038	11,318	531	1	1	1,388	6,769	325
Torfaen	2	2	1,045	32,610	402	2	2	1,623	42,261	520
Wrexham ²	2	0				2	0			
Totals	29	27	34,501	607,370	9,624	26	24	29,513	586,189	9,408

- The average eRCV being tracked by the programme travelled just under 1,250 miles, collected from 22,500 properties, and tipped a total of 360 tonnes of refuse during Q2 of 2023.
- As new vehicles were deployed during 2023, their usage increased over the course of 6 months recorded above: mileage was up ~17% and properties collected by ~4%.
- 2 out of the 29 RCVs are currently not reporting data for the programme.

¹ Extrapolated average from all operating vehicles during the reporting period. ² Local Authority did not provide data during this reporting period.



RCV Average Efficiency Per LA^{1, 2}

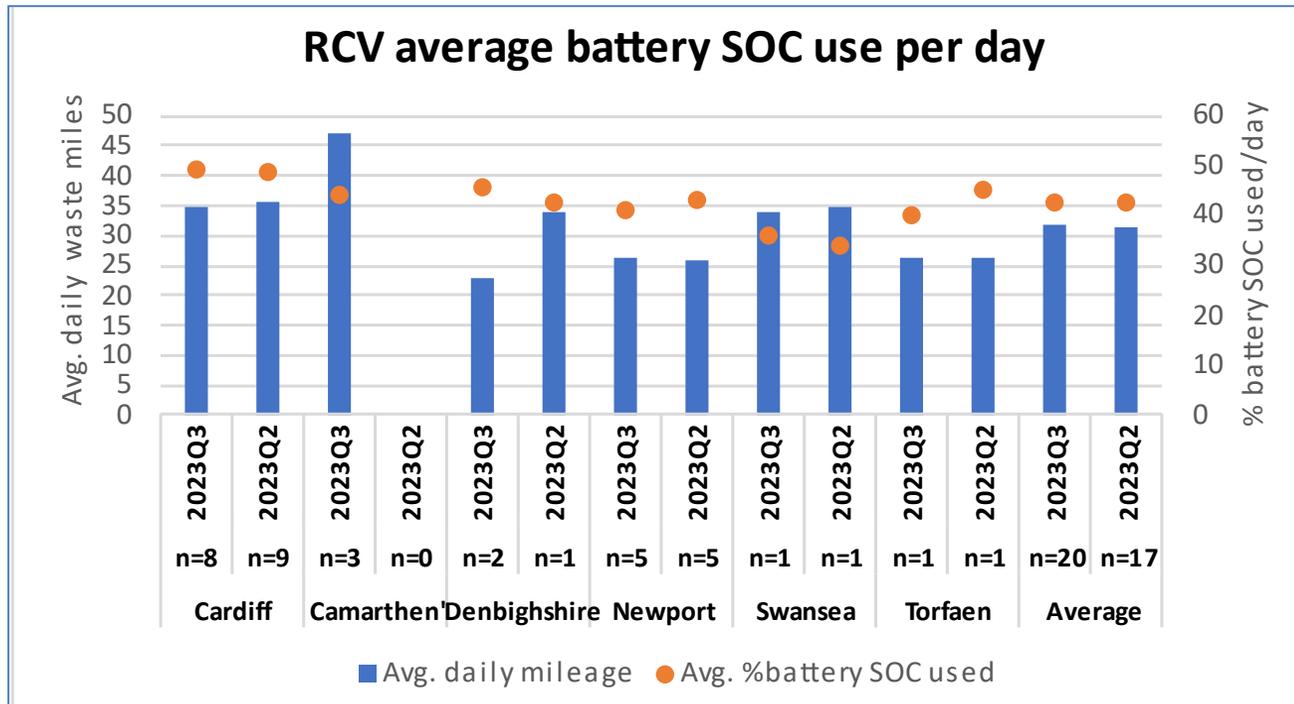


- eRCV driving efficiency (measured as number of waste miles per battery kWh used) was seen to improve for most LAs between Q3 and Q2.
- Increased efficiency is expected with warmer weather: less cabin heating and lighting is required, and air and rolling resistance decrease with higher temperatures.
- Ongoing data collection will give a clearer picture of the factors that affect performance through the seasons as the number of vehicles in the programme increases and the dataset grows.

¹ Data displayed as recorded during the reporting period (not extrapolated). ² Vehicles that do not have a complete set of daily distance and charging data for the quarter, or that have been used for fewer than ten days, have been excluded from this analysis. The graph shows the number of vehicles (n) included each quarter.



RCV Average Daily Battery SOC Use Per LA^{1, 2}



- The State of Charge (SOC) of the vehicle is effectively the inverse of the drive efficiency graph on the previous slide – i.e., the more efficient the vehicle, the lower the SOC usage.
- As shown in the previous slide, the energy use decreases during warmer months for most vehicles in the programme, hence the SOC usage decreases.

¹ Data displayed as recorded during the reporting period (not extrapolated). ² Vehicles that do not have a complete set of daily distance and charging data for the quarter, or that have been used for fewer than ten days, have been excluded from this analysis. The graph shows the number of vehicles (n) included each quarter.



RRV Performance





RRV Summary Quarterly Reporting per LA

LA	2023Q3			2023Q2		
	# Vehicles Deployed	# Vehicles Reporting	Distance (miles)	# Vehicles Deployed	# Vehicles Reporting	Distance (miles)
Conwy	1	0	0	1	0	0
Neath Port Talbot	1	1	1,903	0	0	0
Totals	1	1	1,903	0	0	0

- Only one RRV in Neath Port Talbot currently reporting sufficient data to be analysed.
- The vehicle reported its first data in 2023Q3.



Sweeper Performance





Sweeper Summary Quarterly Reporting per LA

LA	2023Q3			2023Q2		
	# Vehicles Deployed	# Vehicles Reporting	Distance (miles)	# Vehicles Deployed	# Vehicles Reporting	Distance (miles)
NPT	1	1	1,279	1	1	1,019
Totals	1	1	1,279	1	1	1,019

- There is only one sweeper at Neath Port Talbot currently being analysed in Wales.
- During Q3 the vehicle travelled ~25% further than in the second quarter.



Cost and Emission Savings





Average Quarterly Cost and Emission Savings per RCV

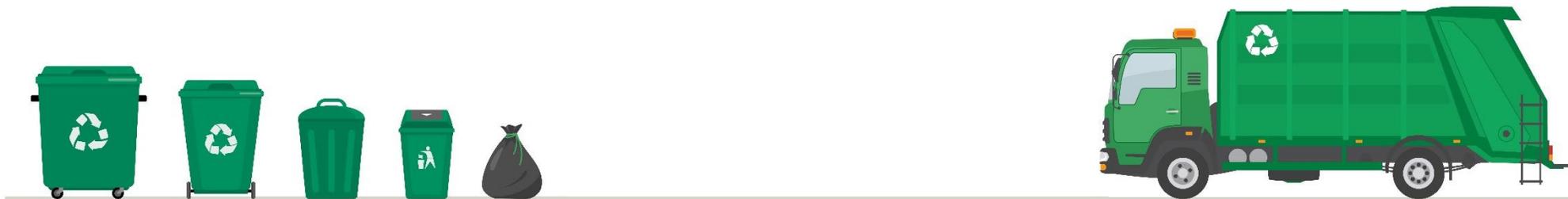
2023Q3	Energy from grid (kWh)	Diesel saved (L) ²	Fuel cost saving (overnight charging) ²	Fuel cost saving (long term) ^{2,6}	Societal damage cost saving ^{3,4}	WTW CO ₂ e saved (t) ^{3,5}	NOx saved (kg) ⁵	PM saved (g) ⁵
Average per RCV	5,266	1,438	£1,037	£722	£868	3.3	6.5	27.5

- Costs are based on **best case energy prices** using lowest-rate overnight charging rate, and **long-term fuel prices** using figures from current Government policy advice.
- Based on these assumptions, eRCVs provide significant operating cost and emission savings compared to diesel equivalents.

¹ Extrapolated figures from all operating vehicles during the reporting period. ² Compared to a diesel equivalent truck. ³ CO₂ emissions stated on a well-to-wheel base which considers of all emissions from the fuel extraction until its final use in a vehicle. CO₂ stated as CO₂e which includes other GHG emissions on a CO₂ equivalence basis. ⁴ Values obtained as per guidance of the WelTAG data book (Jul 2023). ⁵ Values obtained as per guidance of DEFRA for company reporting (2021). ⁶ Long-term prices based on 7-year estimate from HM Treasury: Green Book 2023 – 2030 (18.3 p/kWh ,1.27 £/L).



Appendices





Appendix A – Abbreviations and Annotated Map

Abbreviations

Acronym/Term	Definition
CO ₂	Carbon Dioxide
CO ₂ e	Carbon Dioxide Equivalents
EV	Electric Vehicle
eRCV	Electric Refuse Collection Vehicle
LA	Local Authority
NO _x	Oxides of Nitrogen
PM	Particulate Matter of 2.5 microns or less
RCV	Refuse Collection Vehicle
RRV	Resource Recovery Vehicle
Rural	Steady continuous speed
ULEV	Ultra Low Emissions Vehicle
Urban	Many stops and starts
SOC	State of Charge
WG	Welsh Government
WTW	Well to Wheel

Welsh LAs





Appendix B – Further Information Sources

Guidance Documents

The project web page has further information to help you transition and plan for your ULEV waste and recycling fleet and infrastructure.

<https://www.cenex.co.uk/projects-case-studies/ultra-low-emission-waste-and-recycling-vehicles/>

Additional Help

Free consultation sessions from electric vehicle and infrastructure specialists at Cenex are available to support your planning for deploying waste vehicles and infrastructure. These can be arranged through your Welsh Government contact. Arrange a consultation today!



Appendix C – Greenhouse and Air Quality Emissions Factors

Social Damage Costs¹

Carbon Cost (£/tCO ₂ e)	NOx Cost (£/tNOx)	Particulate Matter Cost (£/tPM _{2.5})
272	11,899	86,119

Emissions From Energy Source²

UK Grid Emissions (WTW kgCO ₂ e/kWh)	Diesel (100% Mineral) (WTW kgCO ₂ e/litre)
0.2913	3.33427

¹ Values obtained as per guidance of the TAG data book (May 2023). ² Values obtained as per guidance of DEFRA for company reporting (2021).