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LOCAL PARTNERSHIPS

cenex

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

2024 H2 (July-December)

Summary Deployment and Performance Report

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Document Control

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Introduction to the Programme and Aim of the Report

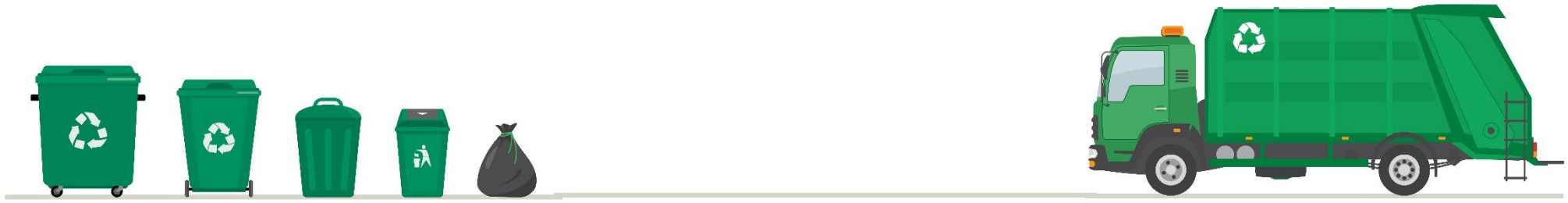
The Ultra-Low Emission Waste and Recycling Vehicles programme aims to accelerate and de-risk the transition to ultra-low emission vehicles (ULEVs) within the Welsh public sector waste fleets by 2030. The programme helps local authorities (LA) to transition to ULEVs by:

- 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 December 2024.*

* 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 2024H2

- **54** zero emission vehicles deployed (33 RCVs, 18 RRVs, 3 Sweeper)
- **56,000 miles** reported[1]
- **149 tonnes of WTW CO_2e** emissions saved[1 - 4]
- **240 kg of NOx** and **1,100 g of PM** emissions avoided[1, 2, 3]
- In 2024Q4:
  - Electric RCVs travelled **37 miles per day** with a **usable range of 64 miles**[1,5]
  - Electric RRVs travelled **32 miles per day** with a **usable range of 50 miles**[1,5]

[1] Extrapolated 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] CO_2 emissions stated on a well-to-wheel base which considers of all emissions from the fuel extraction until its final use in a vehicle. CO_2 stated as CO_2e which includes other GHG emissions on a CO_2 equivalence basis. [4] Estimated as per guidance of the TAG data book (May 2023). [5] Usable range is calculated for based on manufacturers' reported values or to 80% battery usage.

Summary Deployment Status 2024H2

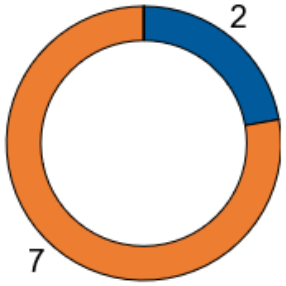
54 ULEVs Deployed So Far

RCVs Deployed: **33**

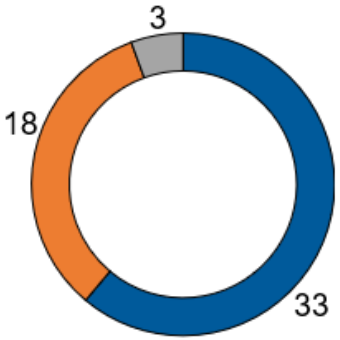
RRVs Deployed: **18**

Sweepers Deployed: 3

Deployed This Period



Deployed so far



Pending Delivery

Detailed Deployment and Reporting Status 2024H2

Local Authority	Type of Vehicle	Delivered	Pending Delivery	Reporting Data[1]
Cardiff	RCV	12	0	12
Carmarthenshire	RCV	3	0	3
Conwy	RRV	7	9	0
Denbighshire	RCV	2	0	2
	RRV	3	0	3
Flintshire	RRV	2	0	-
Merthyr Tydfil	RRV	3	0	0
Neath Port Talbot (NPT)	RRV	1	0	1
	Sweeper	1	0	0
Newport	RCV	8	0	7
	RRV	2	0	0
Powys	RCV	1	0	1
Swansea	RCV	3	0	1
	Sweeper	2	0	0
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) average[1]:

0.25

Energy efficiency (miles/kWh) range of values[1]:

0.16 – 0.36

RRV:

Energy efficiency (miles/kWh) average[1]:

0.44

Energy efficiency (miles/kWh) range of values[1]:

0.37 – 0.50

[1] Measured average from all vehicles with usable data during the reporting period. Data from only one RRV was available for this report.

Estimated Annual Vehicle Emission and Diesel Savings

RCV:

Yearly Emissions Savings[1–3]:

WTW CO_2e [3]	NOx	PM2.5
7 t	12 kg	54 g

Annual Social Damage Cost Savings [2, 4]:

£1,700

Yearly Fuel Cost Savings[2, 5]:

£1,400

[1] Extrapolated averages from all operating vehicles during the reporting period and the previous two 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] CO_2 emissions stated on a well-to-wheel base which considers of all emissions from the fuel extraction until its final use in a vehicle. CO_2 stated as CO_2e which includes other GHG emissions on a CO_2 equivalence basis. [4] Values obtained as per guidance of the WelTAG 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).

Estimated Annual Vehicle Emission and Diesel Savings

RRV:

Yearly Emissions Savings[1–3]:

WTW CO_2e [3]	NOx	PM2.5
3 t	5 kg	24 g

Annual Social Damage Cost Savings [2, 4]:

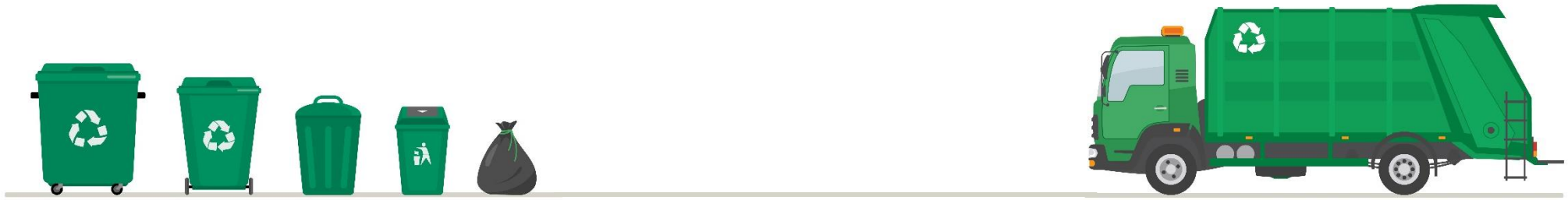
£900

Yearly Fuel Cost Savings[2, 5]:

£500

[1] Extrapolated averages from all operating vehicles during the reporting period and the previous half year. 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] CO_2 emissions stated on a well-to-wheel base which considers of all emissions from the fuel extraction until its final use in a vehicle. CO_2 stated as CO_2e which includes other GHG emissions on a CO_2 equivalence basis. [4] Values obtained as per guidance of the WelTAG 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 2024H2



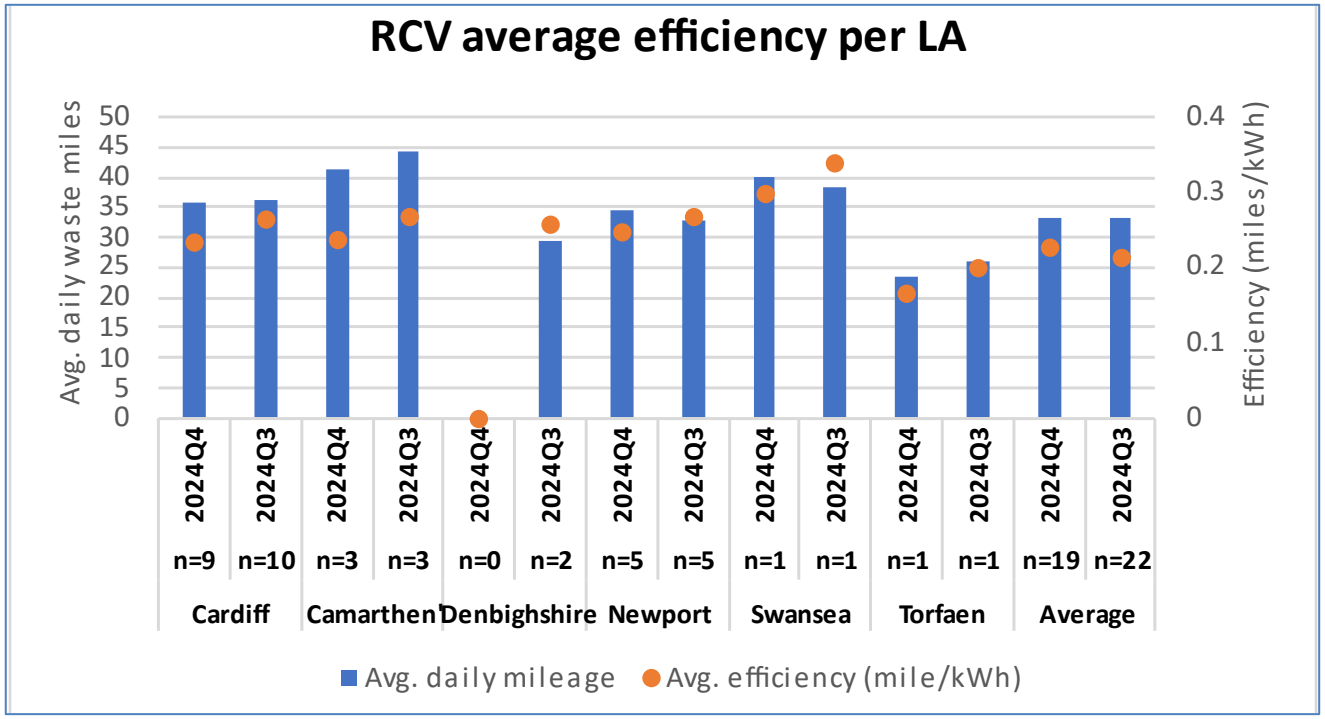
RCV Summary Quarterly Reporting per LA[1]

LA	2024Q4					2024Q3				
	# 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	9,356	136,995	3,031	12	12	7,749	184,278	3,426
Carmarthenshire	3	3	5,441	-	-	3	3	3,641	-	-
Denbighshire	2	0				2	2	676	6,885	123
Newport	6	5	9,100	142,982	2,257	6	5	5,157	142,498	2,232
Powys	1	1	1,438	14,678	278	1	1	3,366	33,932	629
Swansea	1	1	3,061	11,564	593	1	1	2,590	9,618	540
Torfaen	2	1	1,424	51,744	729	2	1	1,557	55,180	755
Wrexham[2]	2	0				2	0			
Totals	**29**	**23**	**29,819**	**357,962**	**6,887**	**29**	**25**	**24,736**	**432,393**	**7,705**

- The average eRCV being tracked by the programme travelled just under 1,300 miles, emptied 15,500 bins, and tipped 300 tonnes of refuse during Q4 of 2024.

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

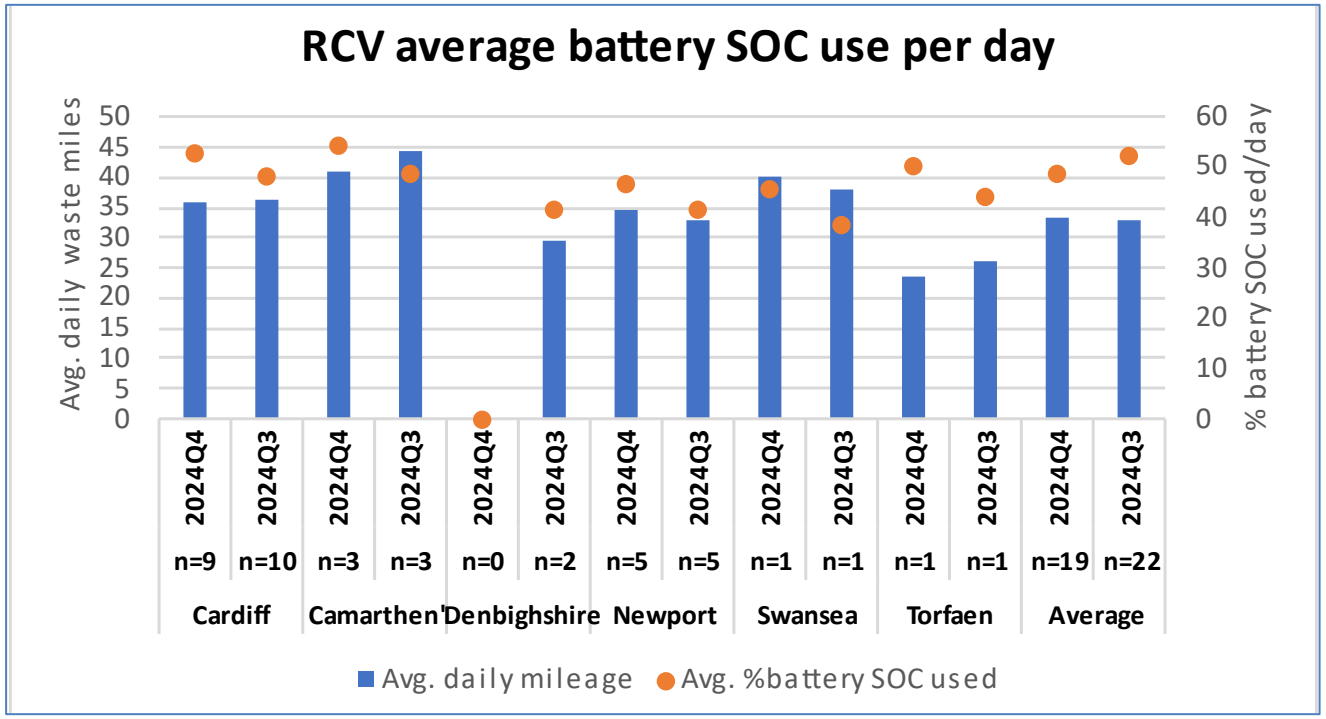
RCV Average Efficiency Per LA[1, 2]



- eRCV driving efficiency (measured as number of waste miles per battery kWh used) was seen to decrease for all LAs between Q4 and Q3.
- Decreased efficiency is expected with colder weather as more cabin heating and lighting is required, and air and rolling resistance increase with lower temperatures.

[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.

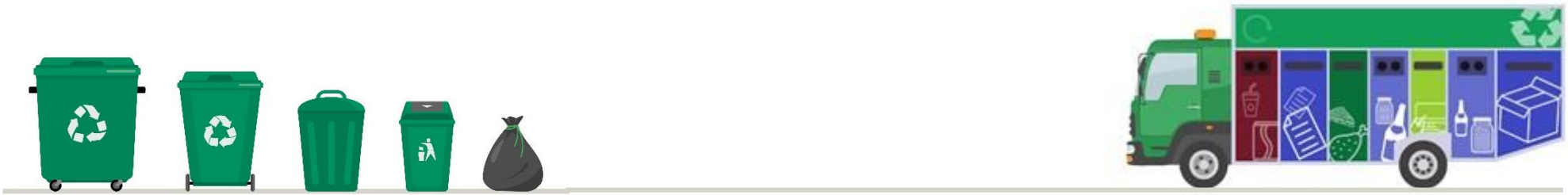
RCV Average Daily Battery SOC Use Per LA[1, 2]



- 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 increases during colder months for most vehicles in the programme, hence the daily SOC usage increases.

[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 2024H2



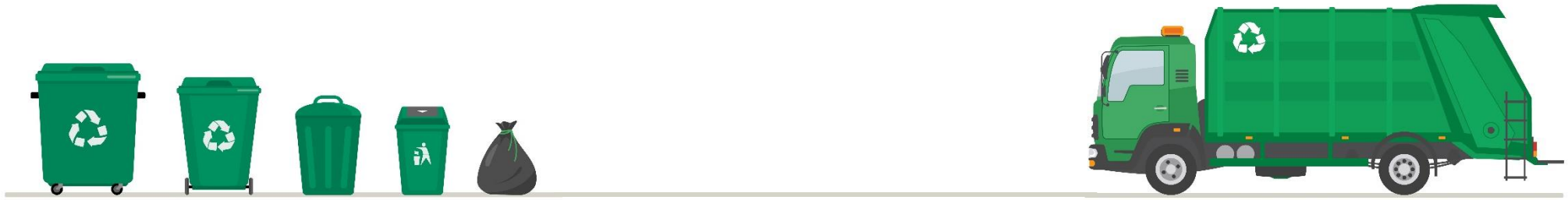
RRV Summary Quarterly Reporting per LA[1]

	2024Q4					2024Q3				
LA	# Vehicles Deployed	# Vehicles Reporting	Distance (miles)	Avg. daily efficiency (miles/kWh)	Avg. daily waste distance & range (miles)	# Vehicles Deployed	# Vehicles Reporting	Distance (miles)	Avg. daily efficiency (miles/kWh)	Avg. daily waste distance & range (miles)
Flintshire	2	2	3,129	0.42	35 (52)	2	2	1,702	0.49	41 (62)
Neath Port Talbot	1	1	1,794	0.37	27 (46)	1	1	1,961	0.48	33 (60)
Total/Avg	3	3	4,923	0.39	32 (50)	3	3	3,663	0.49	38 (61)

- In 2024Q3 RRVs in Flintshire began reporting data to the programme.
- In common with the eRCVs, eRRV driving efficiency (measured as number of waste miles per battery kWh used) was seen to decrease between Q4 and Q3, resulting in a lower daily range.
- Decreased efficiency is expected with colder weather as more cabin heating and lighting is required, and air and rolling resistance increase with lower temperature.

[1] Data displayed as recorded during the reporting period (not extrapolated).

Cost and Emission Savings 2024H2



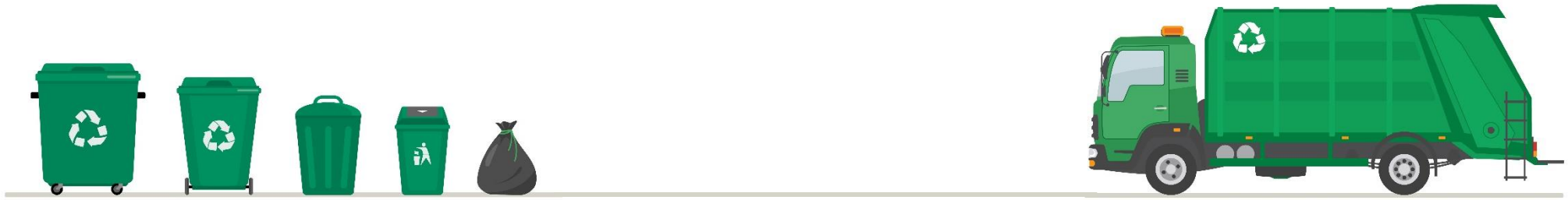
Average Six-Monthly Cost & Emission Savings per RCV & RRV

2024H2	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_2e saved (t)[3,5]	NOx saved (kg)[5]	PM saved (g)[5]
Average per RCV	5,535	1,576	£1,177	£846	£961	3.6	5.6	27.3
Average per RRV	3,948	823	£694	£315	£481	1.6	4.1	16.4

- 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 and eRRVs have the potential for operating cost and emission savings compared to diesel equivalents provided they are charged overnight using cheaper rate electricity.

[1] Extrapolated figures from all operating vehicles during the reporting period. [2] Compared to a diesel equivalent truck. [3] CO_2 emissions stated on a well-to-wheel base which considers of all emissions from the fuel extraction until its final use in a vehicle. CO_2 stated as CO_2e which includes other GHG emissions on a CO_2 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).

Project Totals



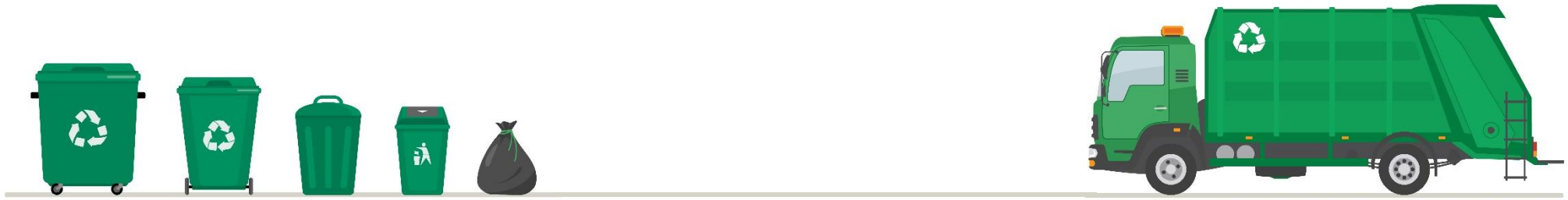
Cumulative Project Totals

Annual totals						Cumulative total
Year		2021	2022	2023	2024	
Vehicles reporting data	RCV	11	25	27	25	
	RRV	0	0	1	3	
	Sweeper	0	1	1	0	
Electricity used (kWh)		79,700	379,900	521,203	584,080	**1,564,883**
Diesel saved (L)		19,300	95,800	136,651	150,367	**402,118**
Emission savings	WTW CO_2 (t)	41	201	304	331	**877**
	NOx (kg)	72	621	620	601	**1,914**
	PM (g)	337	1,943	2,562	2,714	**7,555**
Social damage cost savings (£)		12,038	62,229	79,121	87,591	**240,978**

- Since 2021, the switch to electric vehicles in the programme has avoided the use of over 400,000 litres of diesel in Welsh waste and recycling vehicles, resulting in **almost 900 tonnes of CO_2e savings**.

[1] Extrapolated figures from all operating vehicles during the reporting period. [2] Compared to a diesel equivalent truck. [3] CO_2 emissions stated on a well-to-wheel base which considers of all emissions from the fuel extraction until its final use in a vehicle. CO_2 stated as CO_2e which includes other GHG emissions on a CO_2 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_2e	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 Costs[1]

Carbon Cost (£/tCO$_2$e)	NOx Cost (£/tNOx)	Particulate Matter Cost (£/tPM2.5)
272	11,899	86,119

Emissions From Energy Source[2]

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).