Transport

Energy Infrastructure

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Welsh ZE Waste and Recycling Vehicle Programme

– Transition Support and H_2 for Waste Fleets–

Session Chair, Vicente Jofré

10th July 2024

ZE Waste and Recycling Vehicle Project

Llywodraeth Cymru Welsh Government

Catrin Roberts, WG Programme Lead

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LOCAL PARTNERSHIPS

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Peter Speers, Project Manager
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Vicente Jofré, LA Liaison Officer and Technical Support
Sophie Naylor, Data Analyst
Lewis Johnstone, Technical Support

- Aims to Accelerate and De-Risk
- **Vehicle and Infrastructure Support**
- WG Net-Zero Target
- Try Before you Buy
- Vehicle Purchase Grant Support
- Shared Learning and Dissemination

Objectives for Day

- **Uncover** challenges of deployment and how to best overcome them
- **Share** learnings from deployment of eRRVs in Newport
- **Discuss** current opportunities and limitations for H_2 in waste fleets

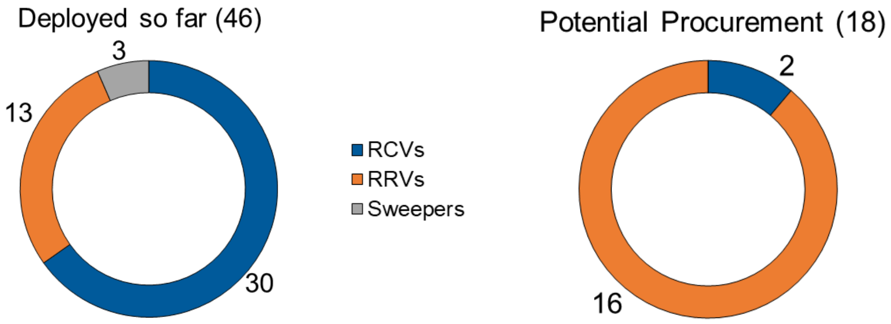
Agenda

- 10:30 Welcome and Programme Status
- 10:35 Transition Process and Implementation Support
  - Outline recommended deployment strategy and support provided
- 11:05 Experience Sharing – eRRV Deployment
  - Hear of the learnings Newport's eRRV deployment
- 11:25 Hydrogen in Waste and Recycling Fleets
  - Deeper look into the market state and capabilities of this technology for waste fleets
- 11:45 Close

Programme Update

Deployment Status

Local Authority	Deployed	Potential Procurement
Cardiff	12	
Carmarthenshire	3	
Conwy	6	10
Denbighshire	2	3
Flintshire	2	
Merthyr Tydfil	2	1
Neath Port Talbot	2	
Newport	9	
Powys	1	
Swansea	1	2
Torfaen	2	
Vale of Glamorgan		2
Wrexham	2	



62 Vehicles Delivered or Pending Procurement

13 Different Local Authorities

Deployment Status

26t eRCV

- Providers:
  - Dennis Eagle (26) (2)
  - Electra (3)
  - RVS/Emoss (1)

12t eRRV

- Providers:
  - Romaquip (6) (12)
  - Terberg (7) (4)

eSweeper

- Providers:
  - Bucher (3)

Blue: Deployed
Orange: Potential

Zero Emission Vehicle Fleet Transition Process and Implementation Support

by Carl Christie

The Challenge – Government Targets

2025

2035

UK Government plans for all new cars, vans, and HGVs up to 26 tonnes to be zero emission vehicles (ZEV) by 2035.

Ambition for the Welsh public sector to reach net zero by 2030.

2030

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Keys to Success

1. **Leadership**
2. **Teamwork**
3. **Planning**
4. **Commitment**

Senior Leadership

Roles and Responsibilities

Stakeholder Engagement

High Quality Data

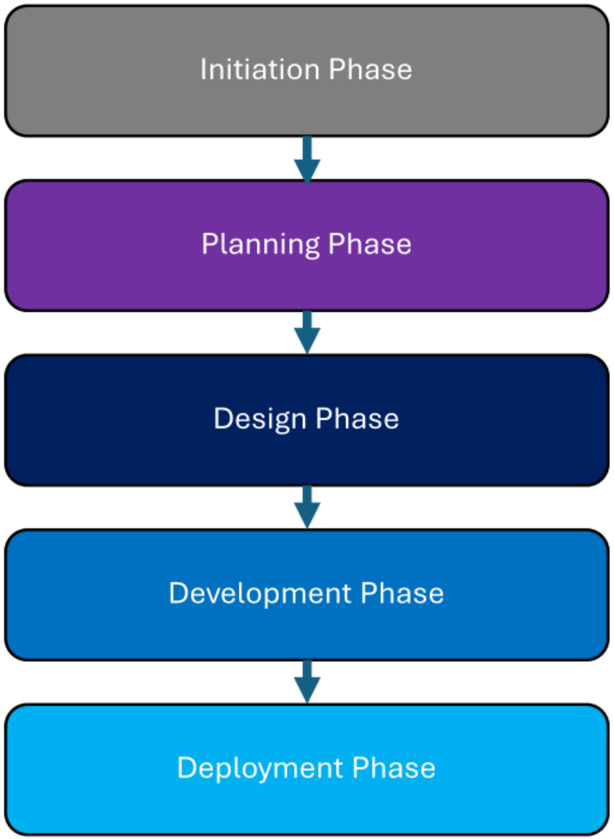
Fleet Transition Plan

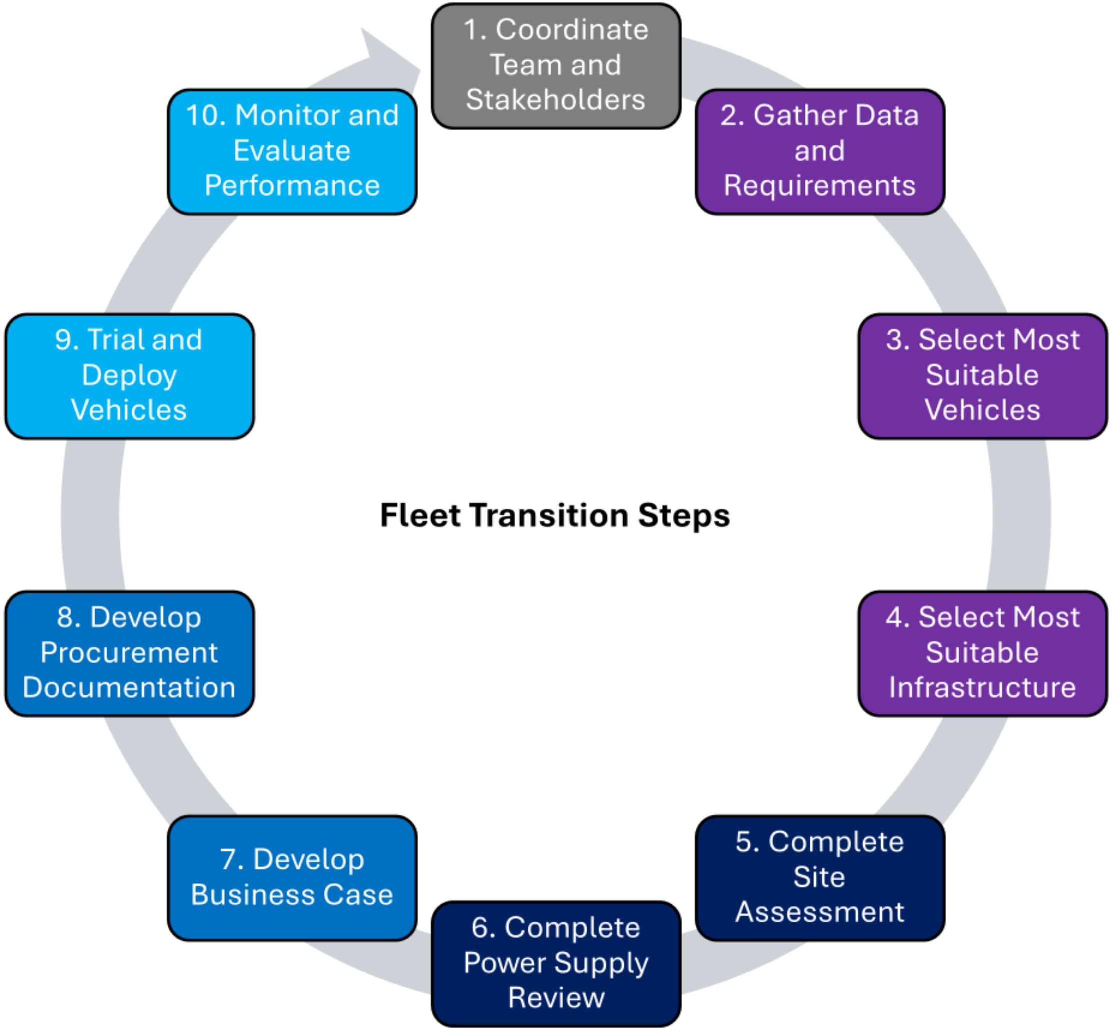
Infrastructure Transition Plan

Business Case for Investment

Change Management

Fleet Transition Phases





1. Coordinate Team and Stakeholders

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- **Define team roles and responsibilities:**
  - **Responsible**: who will do the work?
  - **Accountable**: who will manage the overall success of the project?
  - **Supporting**: who will help support the work?
  - **Consulted**: who will be asked for their expert knowledge and opinions?
  - **Informed**: who will be kept up to date on progress and project outcomes?

	Fleet	Procurement	HR	Risk	User
Acquire fleet vehicles					
Needs analysis	R	I	I	I	C
Develop RFP	C	A/R	I	I	C
Provide vehicle spec	R	I			C
Evaluate bids	C	A/R			C
Select vehicle	A/R	I	I	I	C
Driver training	R		C	C	C
Policy amendments	C		R	C	C
Receive vehicle	R	I	I	I	C
Inspect vehicle	R	I			C

1. Coordinate Team and Stakeholders

- **Identify and engage with key stakeholders:**

Project Lead

Sustainability Manager

Fleet Manager

Facilities Manager

Waste Manager

Energy Manager

Supervisors

Drivers and Operators

Workshop

Finance

Procurement

Comms and Marketing

Planning Phase

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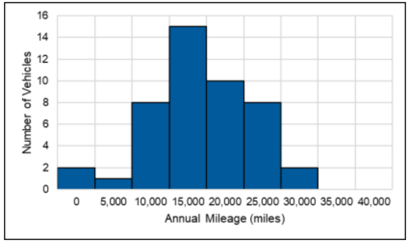
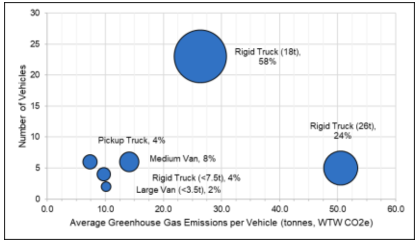
2. Gather Data and Requirements

- **Baseline your fleet**
  - Fleet list
  - Mileage
  - Fuel consumption and euro standards
  - Emissions factors
- **Determine your requirements**
  - Vehicle, body and equipment specifications
  - Operational range and round characteristics
  - Charging / refuelling requirements
  - Data systems





An example output specification for a battery electric RCV is shown below, this should be specified for the most demanding day and should also factor in seasonal variation and performance over time:

Requirement	Possible Output Specification
Operating range	Up to 50 miles on a single charge with 20% battery capacity remaining
Maximum operating time	10.5 hours
Maximum payload	10 000 kg
Maximum speed	56 mph / 90 kph
Charging time	no longer than 12 hours (0 to 100%) with the capability to also charge in less than 75 minutes (from 20 to 80%) if required.
Minimum operational lifetime	5 days a week, 52 weeks a year, for 7 years (1,820 days)
Operating temperature range	-10°C to 35°C with cabin temperature set to 18°C.

Knowledge Hub > Guidance on Procurement & Deployment > **Minimum Technical Specifications Document**

https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

3. Select Most Suitable Vehicles

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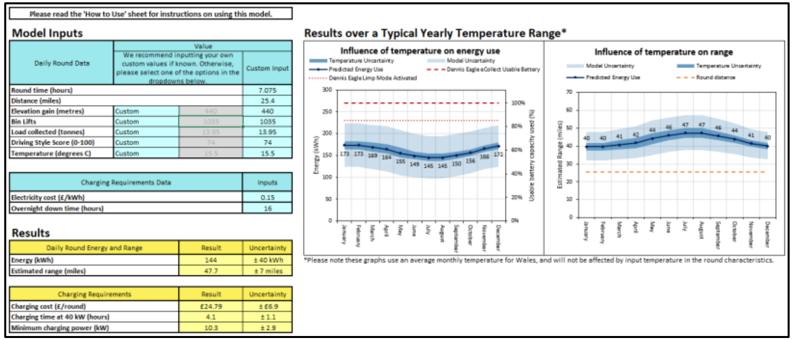
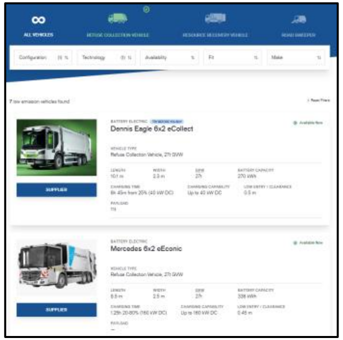
- **Assess the suitability of zero emission vehicles using real-world data, modelling or technical specifications** to determine which vehicles and rounds are already best suited to transitioning to ZEVs.

- **Things to consider**:
  - ZEV type
  - Supplier type
  - Specs vs. requirements
  - Daily energy consumption and operating times



Knowledge Hub > Vehicle Performance & Planning Tools > **Vehicle Energy Model**



Vehicle Catalogue

4. Select Most Suitable Infrastructure

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- How much **energy** is required each day (kWh)?
- How much **time** is available for charging each day (h)?
- Select the appropriate chargepoint **power** (kW)
- Select the appropriate chargepoint **type**:
  - AC, DC, or both?
  - Standard, distributed, or mobile?

Battery Size (kWh, usable)		140	210	140	210
State of Charge Required (%)		60%	60%	100%	100%
Energy Required (kWh, vehicle)		84	126	140	210
Energy Required inc. 85% Charging Efficiency (kWh, depot)		99	148	165	247
Time Available for Charging (h)	0.5	198	296	329	494
	1	99	148	165	247
	2	49	74	82	124
	4	25	37	41	62
	6	16	25	27	41
	8	12	19	21	31
	10	10	15	16	25
	12	8	12	14	21
	14	7	11	12	18
	16	6	9	10	15

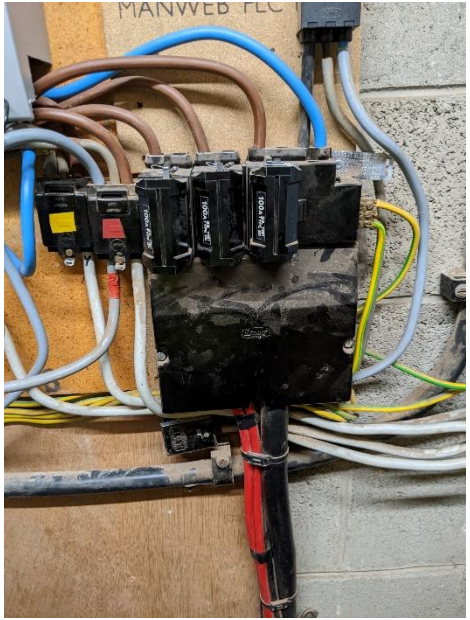
Key
Min Charging Power
<7.4 kW
<22 kW
<25 kW
<50 kW
<150 kW
>150 kW

Knowledge Hub > **Infrastructure Guidance Documents**

https://welshulev.cenex.co.uk/assets/knowledge-repository/quarterly-reports-and-workshops/6-welsh-ulev-workshop-0711.pdf

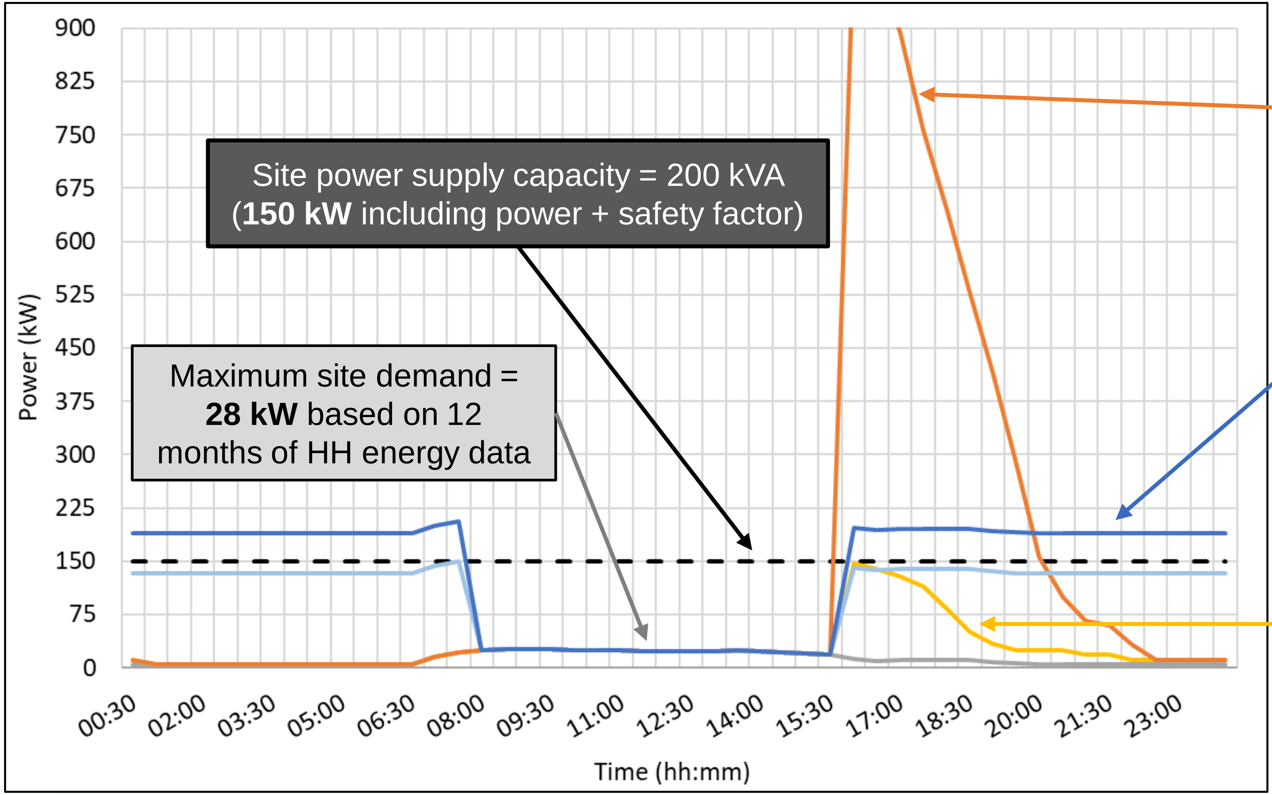
5. Complete Site Assessment

- Where is the site's electrical power supply?
- What is the power supply capacity available (kVA)?
- What is the site's electricity usage? (max. demand)
- Where do the vehicles park?
- Are there any existing EV chargepoints on-site?
- Does the site have any other large electricity loads?



6. Complete Power Supply Review

Design Phase



>1 MW (1,000 kW) would be required for all 88 vehicles without load management (~6h charging)

~200 kW (+50 kW) would be required for all 88 vehicles with load management (~16h charging)

Up to **21 vehicles** can already be charged without using load management systems

7. Develop Business Case

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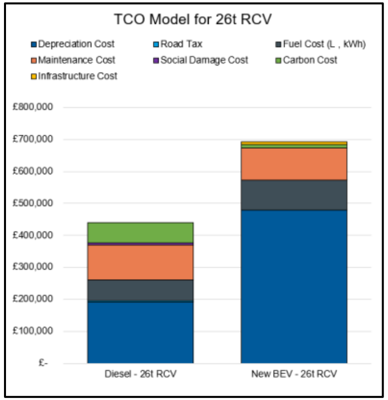
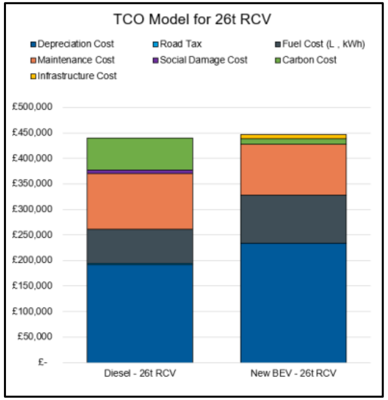
1. **Strategic fit**: how the proposals fit with wider strategic priorities
2. **Well-being**: what are the wider impacts of the proposals on well-being
3. **Affordability**: capital and revenue costs over the life of the project
4. **Deliverability**: how the project will be delivered and by whom
5. **Management**: how the project will be overseen, managed and delivered



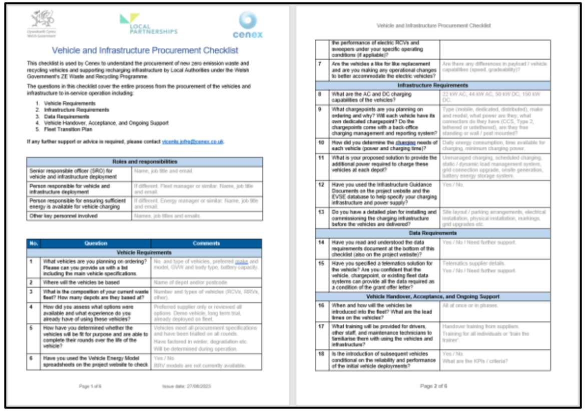


Knowledge Hub > Vehicle Performance & Planning Tools > **Total Cost of Ownership Tool**

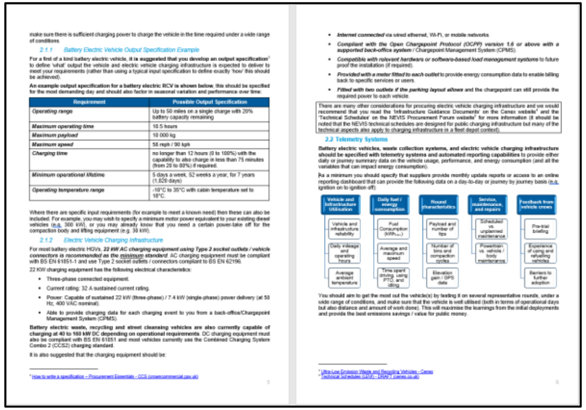
https://www.gov.wales/welsh-transport-appraisal-guidance-weltag

8. Develop Procurement Documentation

- **Key considerations**:
  - Use output specifications
  - Engage with suppliers
  - Evaluate supplier capabilities
  - Specify warranty and service levels



Knowledge Hub > Guidance on Procurement & Deployment > **EV & Infrastructure Procurement Checklist**



Knowledge Hub > Guidance on Procurement & Deployment > **Minimum Technical Specifications Document**

Deployment Phase

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9. Trial and Deploy Vehicles

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- Install and **commission infrastructure** before vehicles arrive.
- **Build in time for testing** and resolving issues before sign off.
- Deploy vehicles across a **selection of representative rounds and conditions** to maximise learnings.
- Use trials and deployments to **optimise vehicles, rounds and operations** for zero emission vehicles.

10. Monitor and Evaluate Performance

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- **Utilisation**
  - Uptime and Downtime
  - Service Completion
- **Maintenance and Repairs**
  - Scheduled vs. Unscheduled
  - Time to Repair
- **Performance**
  - Speed, hills, payload etc.
- **Daily Energy Consumption**
  - Vehicle (miles / kWh)
  - Infrastructure (kWh)
- **Costs and Emissions**
  - Ownerships and running costs
  - Greenhouse gas and air quality
- **Driver Feedback**
  - Performance and issues

Knowledge Hub > Guidance on Procurement & Deployment > **LA Data Provision Requirement**

10. Monitor and Evaluate Performance

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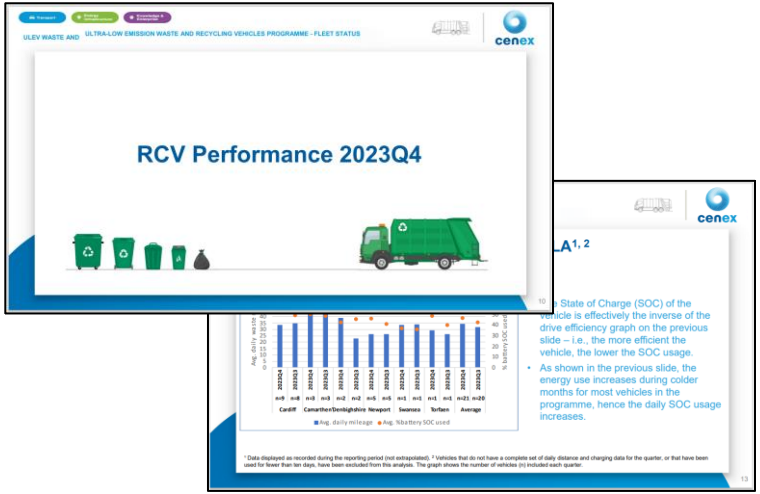
		RCV	Sweeper	RRV[1]
Vehicle Performance[2] Yearly Average		0.23 miles/kWh ENERGY EFFICIENCY	0.17 miles/kWh ENERGY EFFICIENCY	0.33 miles/kWh ENERGY EFFICIENCY
		62 miles DRIVE RANGE[3]	31 miles DRIVE RANGE[3]	42 miles DRIVE RANGE[3]
Emission Savings[4] Yearly Average	CO_2	8.2 tonnes WTW CO_2e[5,6]	3.6 tonnes WTW CO_2e[5,6]	4.8 tonnes WTW CO_2e[5,6]
	NO_x	22 kg NO_x[7]	20 kg NO_x[7]	10 kg NO_x[7]
	PM	91 g PM 2.5[7]	66 g PM 2.5[7]	36 g PM 2.5[7]



Performance Updates

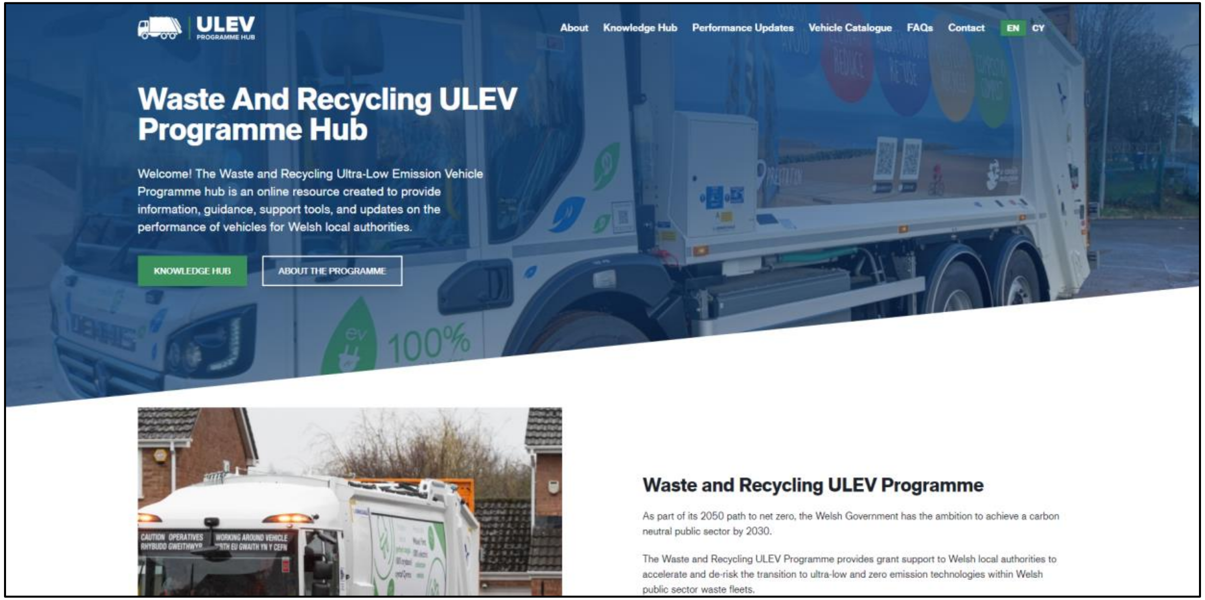
Knowledge Hub > **Quarterly Reports and Workshops**

FY24/25 Implementation Support

Current and future fleet charging requirements, site assessments and depot power supply reviews

Cyngor Sir Ynys Môn Isle of Anglesey County Council	Caerphilly County Borough Council / Cyngor Bwrdeistref Sirol Caerffili; Cyngor Sir Gâr Carmarthenshire County Council
In Progress	Initial Scoping

ULEV Programme Hub Website



https://welshulev.cenex.co.uk/

Transition Process and Implementation Support Survey

1. Which local authority are you from?

2. Where are you on your waste fleet transition journey? (select one)

3. Which steps of the fleet transition process have you already completed? (select all that apply)

Please download and install the
Slido app on all computers you use

Process and Implementation Support Survey

ⓘ Start presenting to display the poll results on this slide.

Thank you For Listening

Any questions are welcome!

Wastesavers eRRV Operating Experience

Wastesavers

Introduction & Service Background

- 64,000 hh
- 90 ltr sack for card & paper
- 90 ltr sack for cans & plastics
- 55 ltr box for glass &SDA
- 55 ltr caddy for food
- 20,000 tonnes collected 2023-24

Fleet

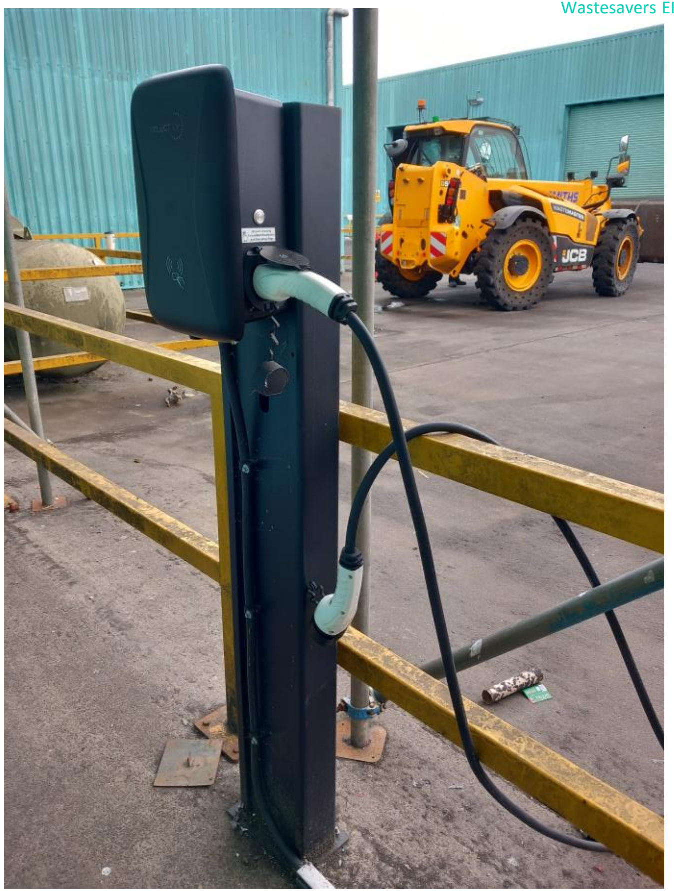
2 x 7.5 tonne Isuzu Romaquip

2 x 12 tonne Iveco E Terberg

22 x 12 tonne Iveco Romaquip

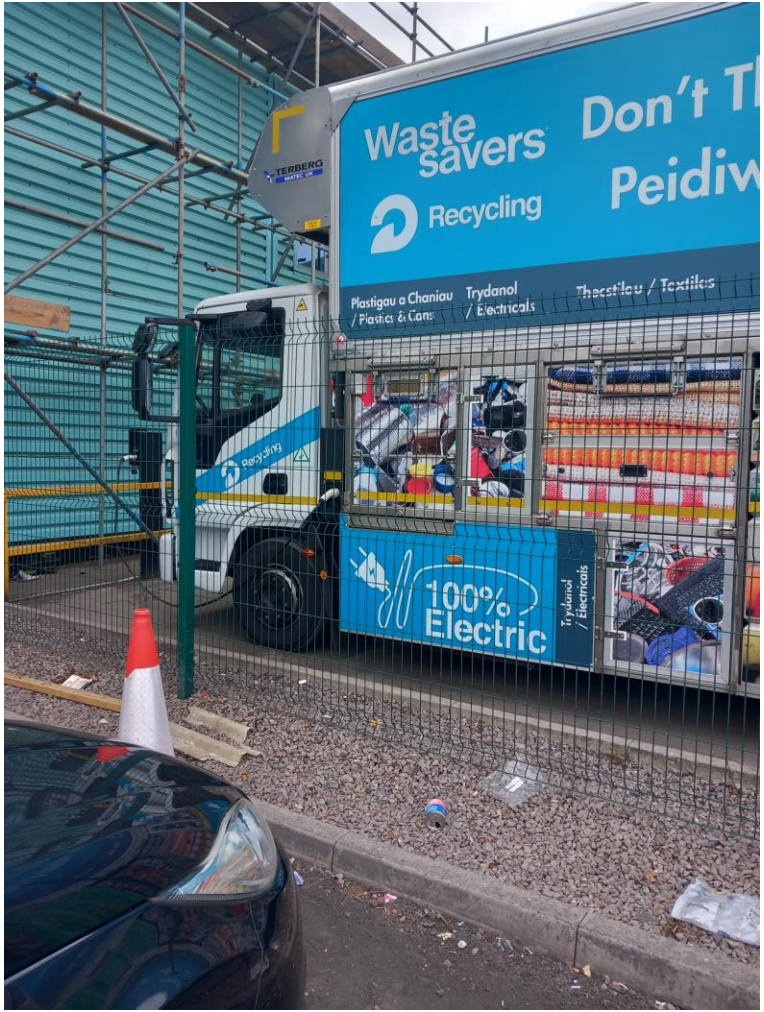
EV Charge Point Spec

- 32 amp 3 phase with 5 mete lead type 2
- Project EV NOVO-EVA-22S-SE 22kw
- 4 way 125 amp MCB board (This board will accommodate future charge points)



ERRV Charge point Stipulations

- 2 metres away from buildings
- 2 meters distance between parked vehicles.



Newport City Boundry

From our collection depot, all corners of the City are within a 7 mile radius

Wastesavers

Vehicle performance

- Operating since March 2024
- Six week inspection costs to date
- 33 miles per day
- 7 hr operating time
- Av 2 tonne payload per trip
- 2 trips per day
- 35% charge usage
- Max payload 3 tonnes

Weighbridge extract

11,520 kg	27/06/2024 09:34:54	2,520 kg
11,120 kg	27/06/2024 12:57:35	2,120 kg
11,000 kg	28/06/2024 09:35:48	2,000 kg
10,620 kg	28/06/2024 13:08:59	1,620 kg
11,020 kg	01/07/2024 09:08:55	2,020 kg
11,220 kg	01/07/2024 12:46:42	2,220 kg
11,060 kg	02/07/2024 09:37:39	2,060 kg
10,860 kg	02/07/2024 12:32:16	1,860 kg

Thank You

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Welsh ULEV – LA Engagement Workshop

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Hydrogen in Waste and Recycling Fleets

by Dr. Peter Speers,

Principal Technical Specialist & Project Manager

Deploying ULEV Waste & Recycling Vehicles

Although it might seem as simple as buying some new vehicles, changing a waste & recycling fleet involves a large amount of planning and resources

- *More space required*
- *Range & Suitability*
- *Infrastructure & Grid Upgrades*
- *Vehicle Availability*
- *Maintenance Training*
- *Driver Training*
- *Reliability*

We know deploying electric waste and recycling vehicles is hard and challenging

LAs are Deploying ULEVs

- Carl’s presentation showed a process that can be followed to get an LA to a workable deployment target for electric waste & recycling vehicles and, importantly, infrastructure.
- Newport’s presentation gave early experience that showed of eRRVs are working for them.

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But … is There Another Option?

- Zero emissions
- Fast fuelling
- Long range
- Integration with the wider energy system
- **Wales Commercial Vehicle Decarbonisation strategy** to decarbonise both heavy and light-duty commercial vehicles operating in Wales currently under development includes a hydrogen workstream.

https://ecostandard.org/news_events/ensuring-the-right-definition-of-low-carbon-hydrogen/;
https://www.zemo.org.uk/news-events/news,welsh-government-allies-with-zemo-partnership-to-accelerate-commercial-vehi_4641.htm

Coming Up

- Fuel cell electric waste & recycling vehicles (FCEVs)
- Hydrogen refuelling stations (HRS)
- Hydrogen and the wider energy system
- Summary & conclusions

Hydrogen Fuel Cell Electric Waste and Recycling Vehicles

Fuel Cell Electric Vehicle (FCEV) – Maturity (Low)

- **OEM suppliers**: R&D (heavy duty long haul e.g. 1,000 km).
- **Low volume suppliers**: Faun Zoeller, HYZON.
- **Configurations available:** 26t RCVs demonstrated in UK and Europe.
- **Typical specifications:** 25kg hydrogen at 350 bar.
- **Operational suitability:** High mileages / double shifts (in theory).
- **Number of FCEVs in the UK**: <250, mostly cars and buses,
  1 RCV in St Helens.



Vehicle Market Availability (By Available Alternatives)

RCV		
Vehicle Type	Battery Electric	Hydrogen FC
26 tonne	7	2
18 tonne	5	1
32 tonne	2	0

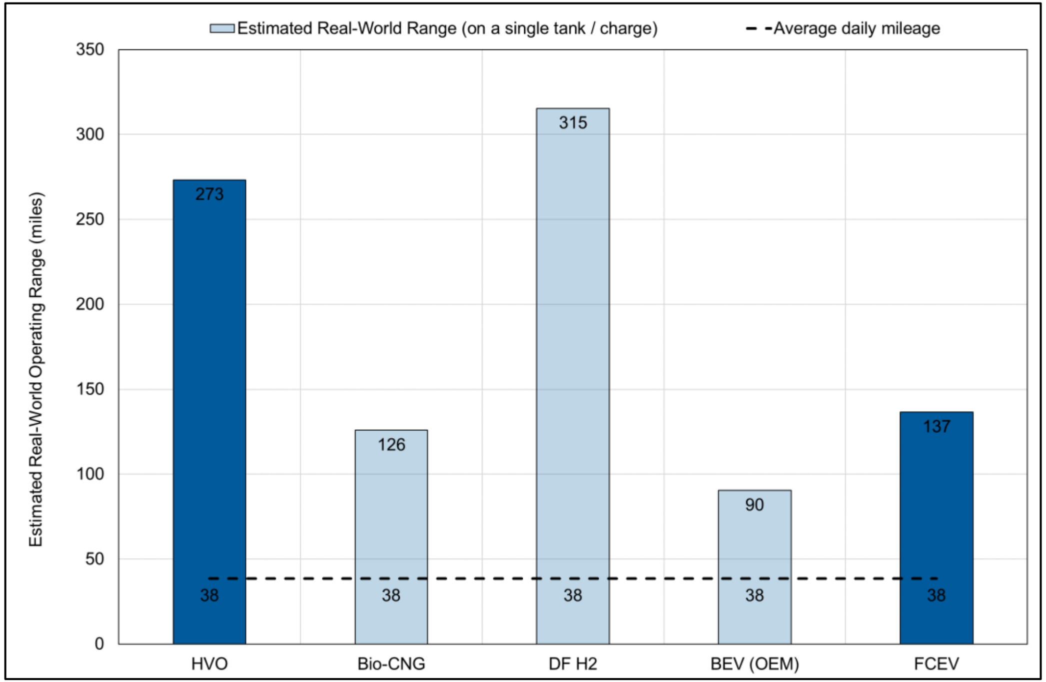
RRV		
Vehicle Type	Battery Electric	Hydrogen FC
12 tonne	2	0
14 tonne	2	0

Sweeper		
Vehicle Type	Battery Electric	Hydrogen FC
Compact	12	1
Truck Mounted	1	1

- *Very limited UK ULEV availability from large manufacturers (OEMs).*

Fuel Cell Electric Vehicle (FCEV) – Range Suitability

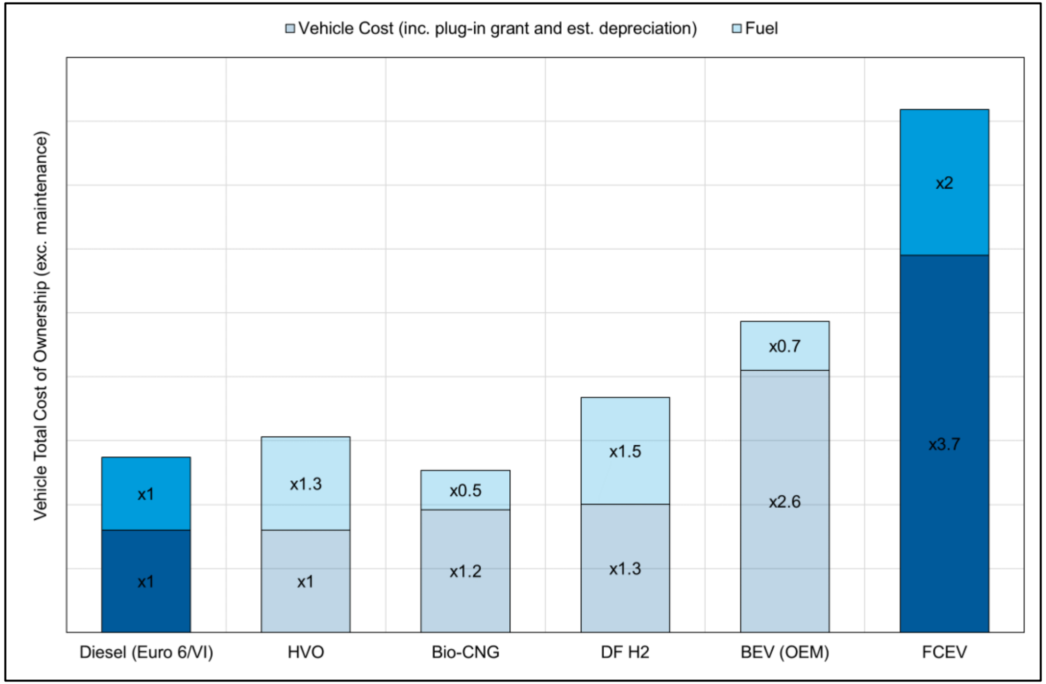
- **Theoretically suitable for most applications including the most energy intensive** and those requiring the shortest refuelling times (e.g. 15 mins).
- Longer range than eRCV
- **See Cenex-authored HECTOR handbook** for how to specify, procure, and deploy fuel cell waste trucks.



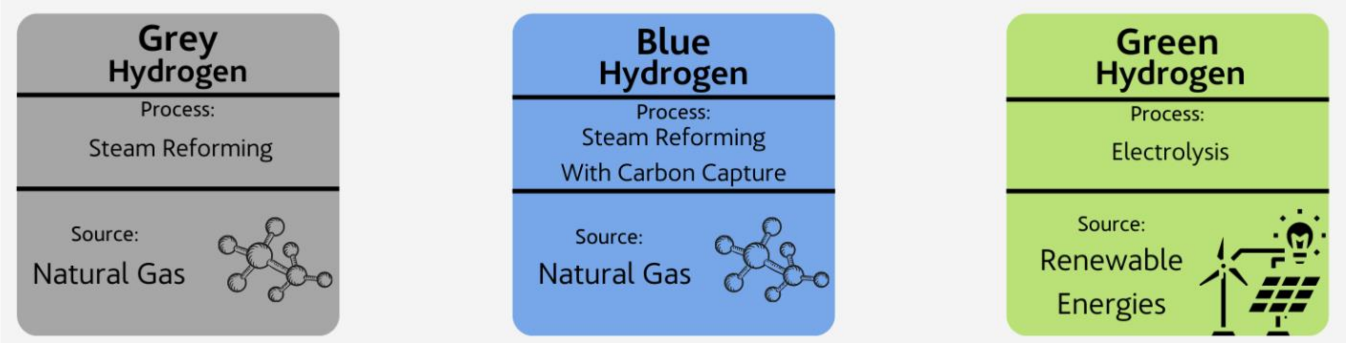
https://vb.nweurope.eu/projects/project-search/hector-hydrogen-waste-collection-vehicles-in-north-west-europe/news/hector-operational-handbook/

Fuel Cell Electric Vehicle (FCEV) – Total Cost of Ownership

- **FCEVs currently cost 3.5 times more to buy than a diesel vehicle.**
- **Fuel costs can be twice diesel,** depending on the price of hydrogen.
  - Best case scenario would be fuel cost parity.
- Maintenance costs are likely to be similar or higher than diesel.



Hydrogen Production for Transport



Grey hydrogen is currently produced from natural gas and used in industrial purposes.

Blue hydrogen uses natural gas but with carbon capture, this technology is largely unproven at scale.

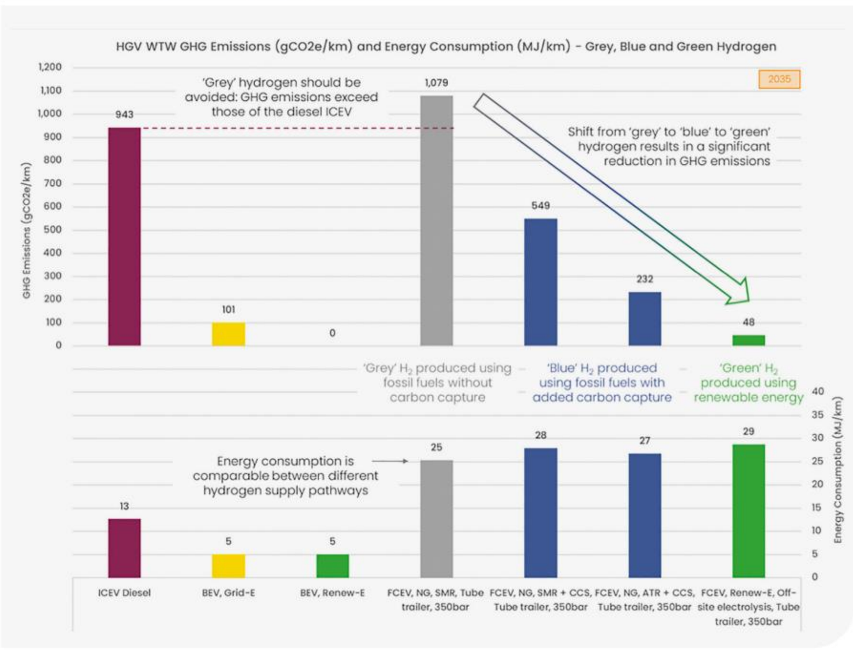
Green hydrogen is produced using renewable electricity and electrolysis but is currently expensive.

https://www.acciona.com.au/updates/stories/what-are-the-colours-of-hydrogen-and-what-do-they-mean/?_adin=01833301559

FCEV – Emissions

- **Grey hydrogen should be avoided** as well-to-wheel greenhouse gas emissions can be higher than diesel.
- **Green hydrogen provides significant reductions in greenhouse gas emissions** and is preferred to using blue hydrogen.
  - Using grid electricity to produce hydrogen also only provides marginal savings.

Figure 6. Shift to low carbon hydrogen pathways in 2035



https://www.zemo.org.uk/work-with-us/fuels/projects/examining-hydrogen-production-pathways-and-use-in-vehicles.htm

Hydrogen Refuelling Stations (HRS)

- **The UK does not have a network of public hydrogen refuelling stations** but does have a target to produce 10 GW of hydrogen by 2030.

Mobile HRS (Offsite Production)

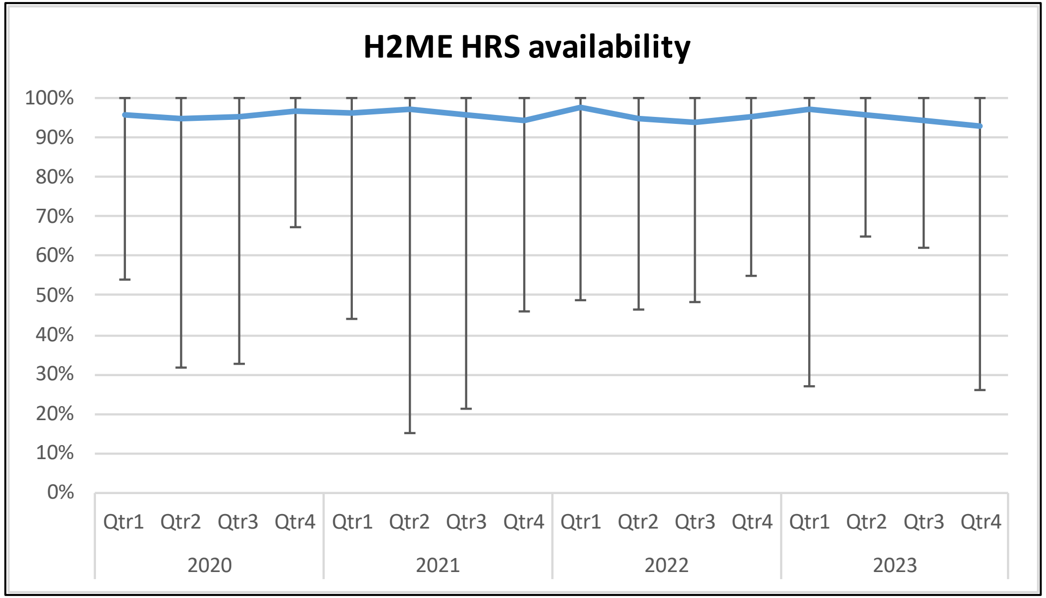
- <400 kg / day.
- Low capital £ (can be leased)
- 230 V power supply.
- Site survey.
- Small footprint.

Public HRS (Onsite Production)

- >1,000 kg / day.
- High capital £££
- Large grid connection.
- Planning permission.
- Large footprint.

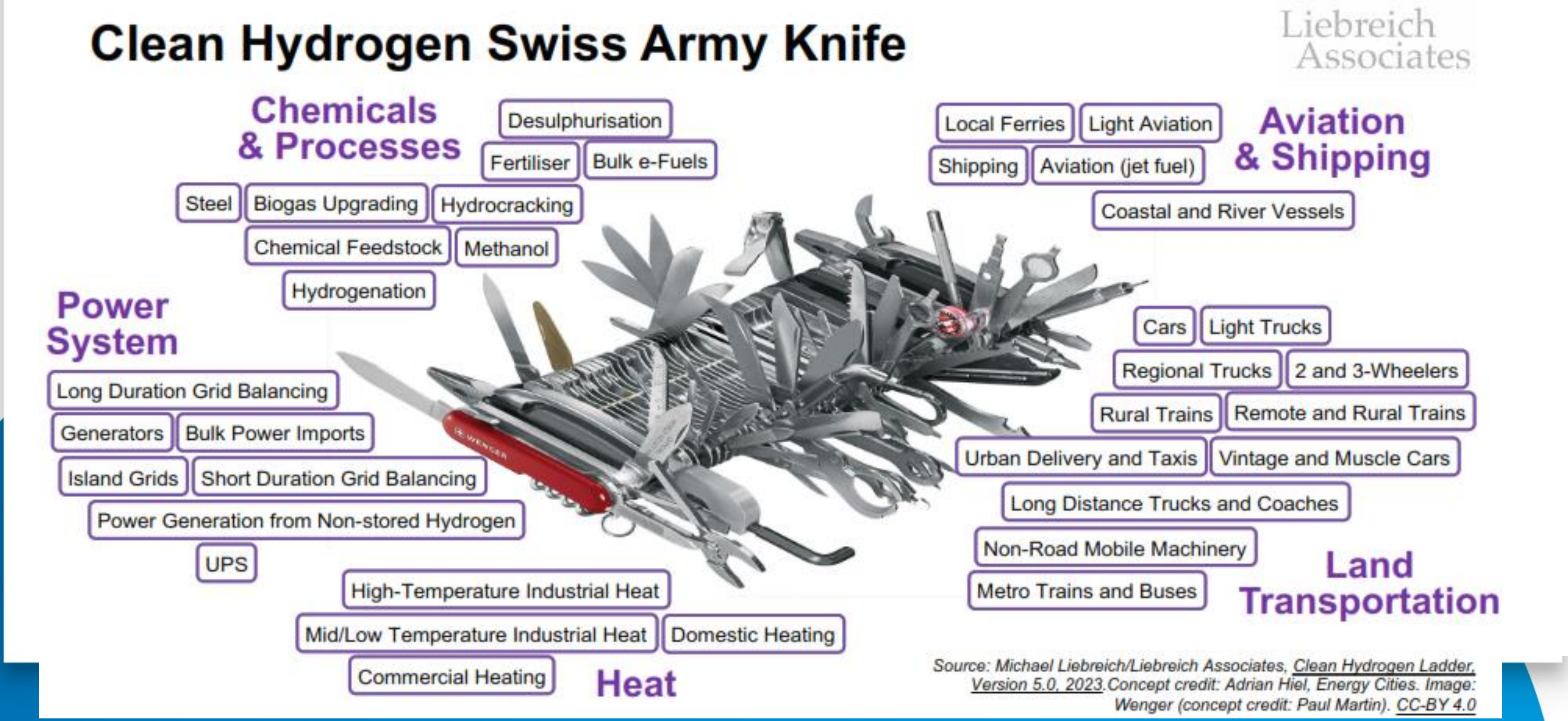
Like FCEVs, HRS are Immature

- Hydrogen Mobility Europe (H2ME, 2015-24) was the largest FCEV and HRS demonstration project in Europe.
- Over the period, **HRS availability** ranged between **93% and 96%.**
- HRS with on-site H_2 generation via electrolysis often displayed the lowest availability



https://h2me.eu/wp-content/uploads/2021/11/H2ME2-D5.17-Public-FV-Report-4-Interim-and-final-summary-%E2%80%A6-1.pdf/

Hydrogen Has Many Potential Uses in a Future Energy System



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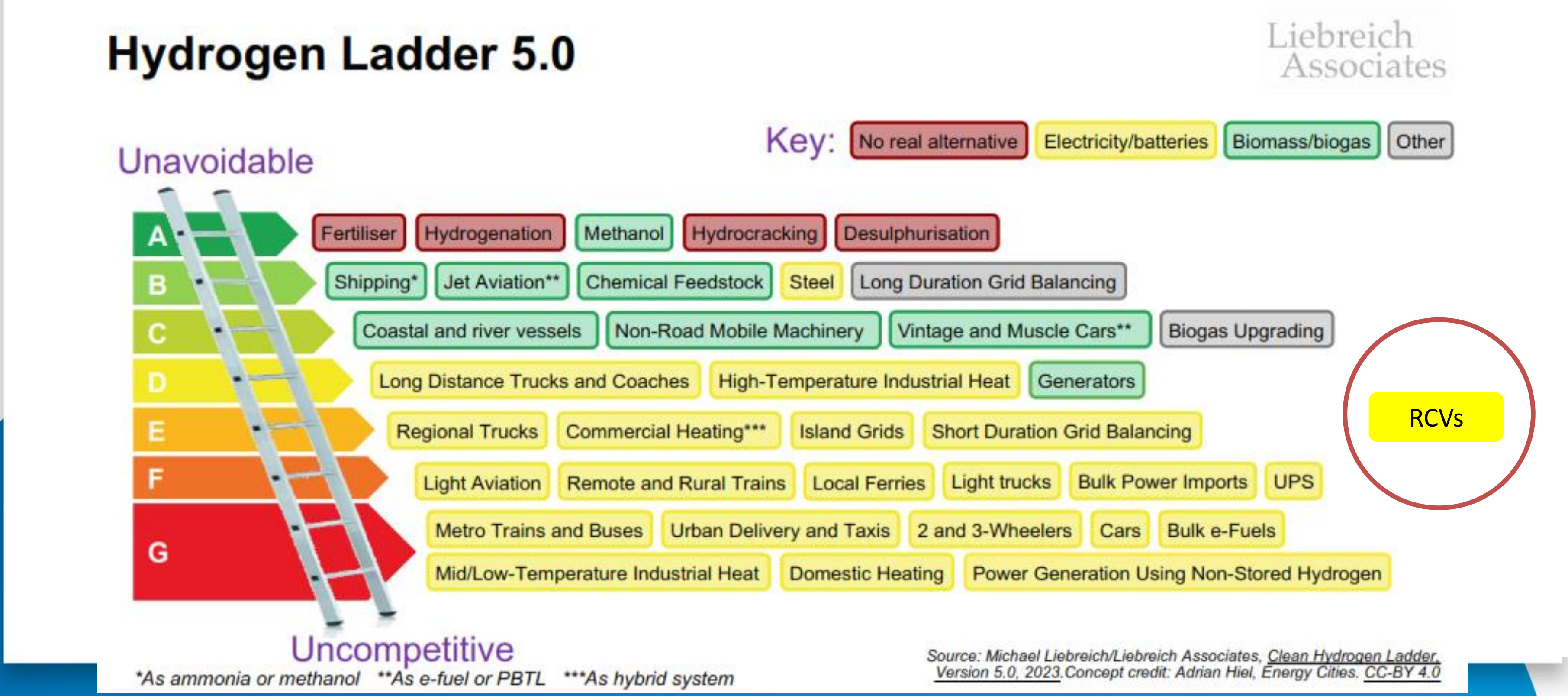
But … If You can Obtain, or Generate Clean Hydrogen, Is Transport (or even an RCV) the Best Way to Use it?



Conclusions

Welsh ULEV – LA Engagement Workshop

https://ecostandard.org/news_events/ensuring-the-right-definition-of-low-carbon-hydrogen/

Hydrogen in Waste & Recycling Fleets. Summary State of Readiness

- **Few H_2 RCVs** (& no RRVs), they're only available from low volume manufacturers, & they are **immature & expensive**.
- The current cost of hydrogen means that it is **in no way TCO competitive with diesel or electricity**
- Infrastructure (hydrogen refuelling stations, HRS) add further complexity and cost:
    - HRS are ***very* expensive** (~ €1m per fueller, more if you want lots of onsite storage)
    - Reliability of even state of art HRS is ~ 95% - i.e., there will be **1 day in 20** where it's likely to **fail**.
    - Adding **onsite generation** such as electrolysis, adds **another point of failure** (unless you have lots of storage, which is very expensive). Which means your fuel availability might at best be 90%.
    - Given the **scarcity of HRS**, if your HRS fails, you're unlikely to have a **backup option**.
    - RCV **trial experience** in EU and UK projects has shown **significant vehicle and HRS issues**.
- **In summary** if you want to trial H_2 vehicles and HRS, **you should treat it as an R&D project, with R&D performance and service level expectations**, and seek funding accordingly (e.g., Innovate or EU Horizon 2020).

Deploying ULEV Waste & Recycling Vehicles

Although it might seem as simple as buying some new vehicles, changing a waste & recycling fleet involves a large amount of planning and resources.

- *More space required*
- *Range & Suitability*
- *Infrastructure & Grid Upgrades*
- *Vehicle Availability*
- *Maintenance Training*
- *Driver Training*
- *Reliability*

We know deploying electric waste and recycling vehicles is hard and challenging

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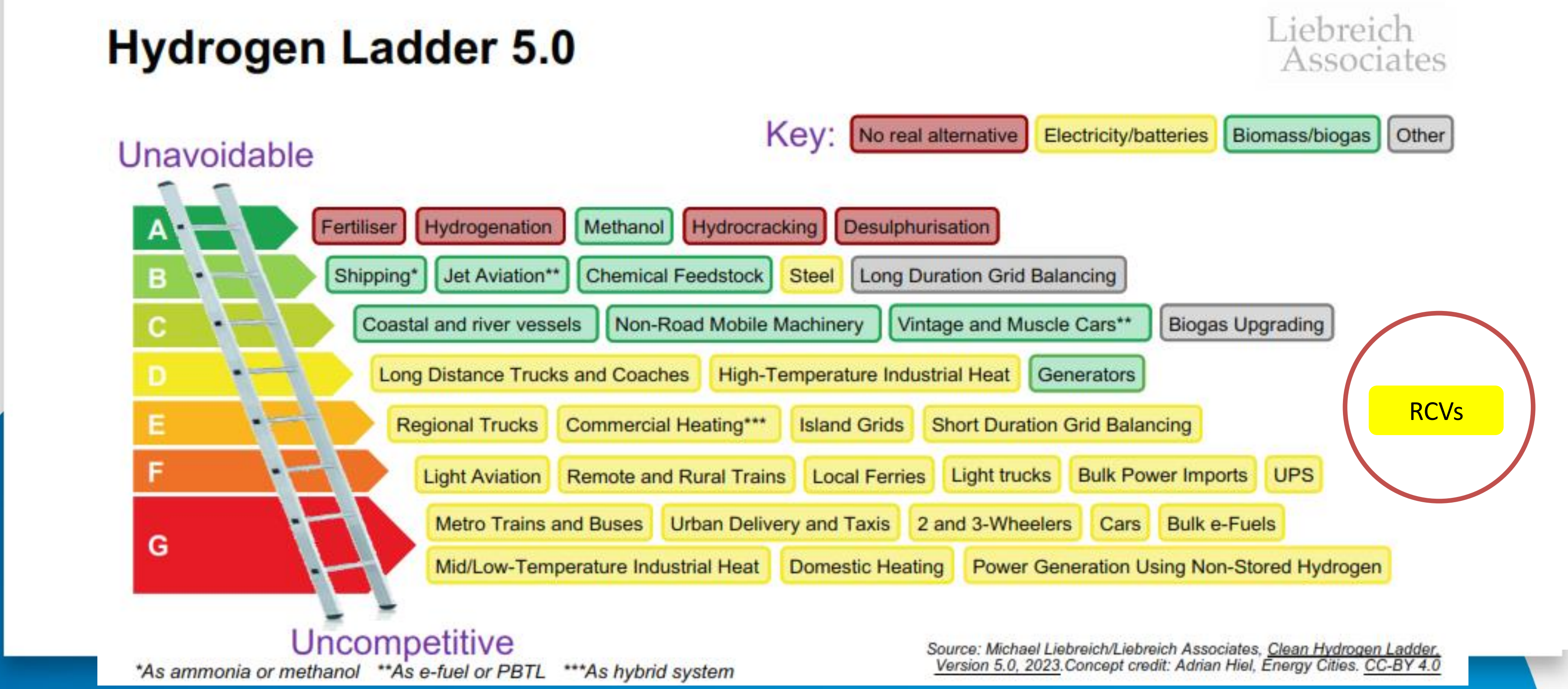
But, at the moment, deploying hydrogen waste and recycling vehicles and infrastructure would be MUCH harder – and very unlikely to work

In the Longer Term (2030+) H_2 May Play a Role

Wales Commercial Vehicle Decarbonisation strategy will be key to this



Thank you For Listening

Any questions are welcome!

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Transport

Energy Infrastructure

Knowledge & Enterprise

Thank you for listening

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