Developing a Zero Emission Bus Delivery Plan for the West Midlands

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Today’s presentation:

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1. Background and overview of TfWM
2. Methodology for developing a ZEB Delivery Plan
3. Work to date
4. What a ZEB transition in West Midlands might look like
5. Emerging themes
6. Discussion on main challenges

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West Midlands Overview

- The largest Mayoral Combined Authority in the country
- 2.5% annual growth between 2010 – 2018
- Home to 3 million residents
- ¼ residents aged under 19
- Supporting 91,150 businesses which employ 1.3 million people
- 440,000 additional people by 2035
- £70.3 billion GVA per annum
- 215,000 additional homes by 2030

- Buses carried 4 of every 5 trips by public transport in the region pre-Covid.
- Investing in buses in the West Midlands is an investment in levelling up our economy.
- Buses are the integrator of our transport network and working collaboratively for a single integrated system is essential for the whole network to succeed.

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TfWM – our role

- Transport arm of West Midlands Combined Authority
- Local Transport Authority with responsibility for subsidised services, concessionary reimbursement and Local Transport Plan
- Close partnership working required with bus operators and Highway Authorities

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TfWM – the bus network

- Largest bus network in England (outside London)
- 248 million boardings in 2019/2020
- 2,000 buses in service
- 300 routes
- 12 managed bus stations
- National Express largest operator (94% market share)

TfWM bus network in numbers

2,079 Total fleet size serving the West Midlands	**300** Registered bus routes	**1,688** Buses based in the West Midlands	**391** Buses based outside TfWM boundary serving the West Midlands
26 Bus depots	**16** Bus depots in the West Midlands	**10** Bus depots outside TfWM boundary	**14** Bus operators
74% Euro VI or better	**953** Buses retrofitted to Euro VI standard	**54** Zero emission buses in operation	**29** New electric buses in service
5 Repowered electric buses in service	**20** Hydrogen fuel-cell buses in service	**2.6%** Zero emission share of total fleet	**130** Electric buses on order for Coventry

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Bus decarbonisation

- Target of 100% zero emission bus fleet in our region by 2030
- Creating the UK's first All Electric Bus City in Coventry
- Introducing 124 hydrogen buses in 2024 through ZEBRA funding
- With Coventry and ZEBRA, around a quarter of the West Midlands bus fleet will be zero emission
- Long-term zero emission bus delivery plan in development…

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Why the need for a Zero Emission Bus Delivery Plan?

Biggest change to bus operations since the 1950s

1904: Trams start to replace horses

1953: Buses replace trams

2020: West Midlands' first electric buses enter service in regular operation

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The current situation:

- One-off funding opportunities
- Patchwork of projects
- Differing approaches and technologies: AC, DC, OppCharge, depot charge, hydrogen, etc
- Fleets to fit available budgets rather than operational needs
- Approach led by bus operators
- No holistic long-term plan or prioritisation

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The ambition:

- Holistic, long-term bus decarbonisation strategy to 2030
- Prioritisation of depots and routes based on evidenced need and technical viability
- Programme identified with timescales for implementation
- Standardisation of fleet and infrastructure specifications
- Guiding principles and policies adopted
- TfWM's role clearly defined

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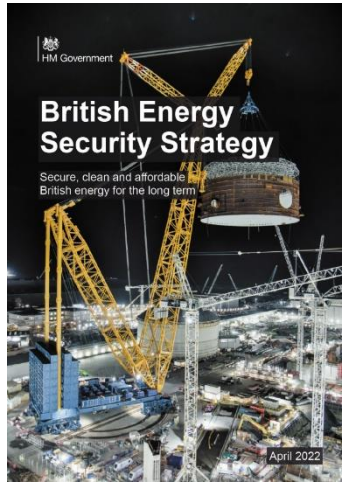
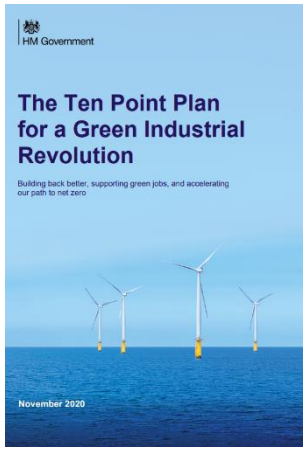
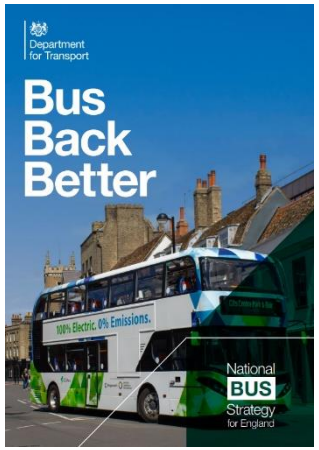
How do we get there?

- **Policy and strategy review:** making connections, understanding where our plans fit in the overall pathway to Net Zero
- **Baselining of current bus fleet and depot estate:** establishing the current emissions profile of the region to identify priority areas
- **Zero emission bus technology and trends:** Reviewing the current options available for battery electric and hydrogen propulsion and identifying preferred approaches
- **Stakeholder engagement:** understand trends in the bus industry
- **Delivery Plan:** Devising a programme for delivery

Policy and Strategy – no Zero Emission Bus Delivery Plan exists in isolation!





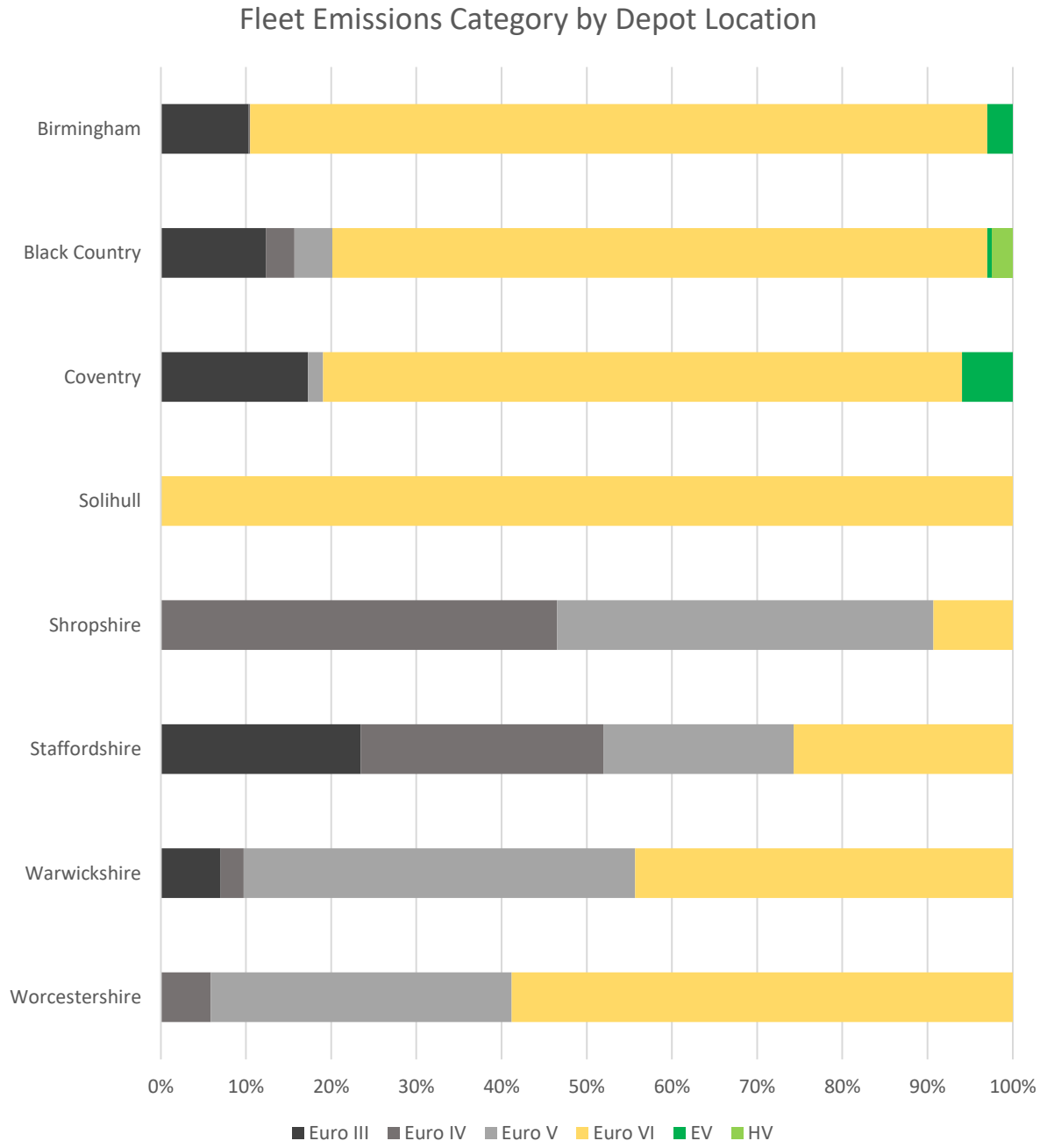


Local, Regional and National policy and strategy relating to zero emission vehicles

Baseline of current bus fleet and depot estate

A ZEB Delivery Plan needs to identify:

- Operators and operating centres (depots) serving the region
- The number and type of vehicles at each depot, whether single deck, double deck or minibus – different battery sizes and energy requirements
- Fleet emissions profile at each depot – good indicator of overall fleet condition, since closely linked to the vehicle age, but must account for retrofits.



ZEB Tech and Trends

- **ZEB technology choice:** Battery electric, hydrogen fuel-cell, or a mix of both; role of repowers
- **Charging strategy:** Crucial decision early on in any ZEB deployment. Pursue OppCharge, or focus on depot charging. TfWM strategy increasingly towards depot charging.
- **Funding and Financing:** Preferred acquisition and ownership models; should Local Transport Authority take a more active role in providing operational assets such as buses and chargers?

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Stakeholder engagement

- Engagement with bus operators and local stakeholders crucial in shaping any ZEB delivery plan
- Secure support for and buy-in to our future approach to ZEBs.
- Expand understanding of new options around technology, funding, financing
- Meet with new players and specialist suppliers entering the bus market
- Potential move to franchising could see new operators / suppliers in the West Midlands

Mapping out a ZEB Delivery Plan

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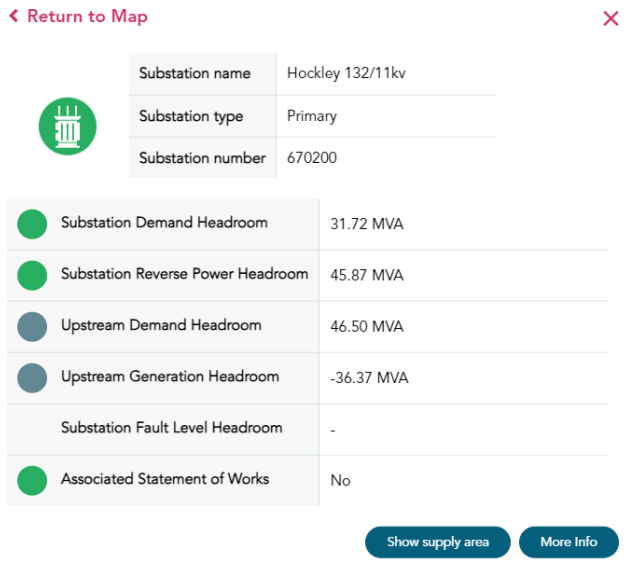

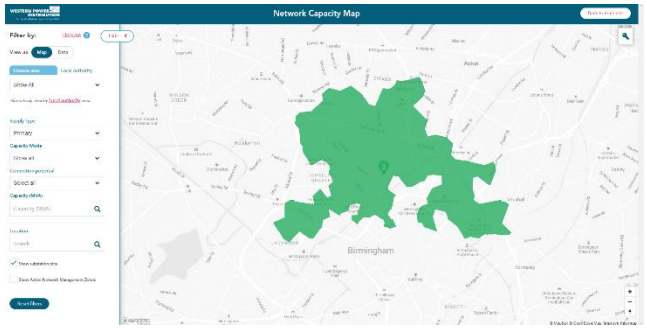

- **Depot power supply assessment:** Using published data from DNO to identify headroom at substations for each depot in the region, based on number and size of buses at each depot
- **Air quality considerations:** Mapping Air Quality Management Areas, Clean Air Zones and emissions profile of the fleet in the area
- **Prioritisation and programming:** Establish programme for bus decarbonisation per depot and area based on evidenced need and technical viability, with numbers of buses required to be replaced each year to meet 2030 target clearly identified

ZEB Delivery Plan: work to date

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1. Policy and strategy review **complete**
2. Baselining of current bus fleet **complete**
3. Review of ZEB technology and trends **complete**
4. Stakeholder engagement **complete**
5. Programme for ZEB deployment **in progress**
6. Next steps: delivering our plan **not started** *(but in a way already has!)*

Work to date: policy & strategy review

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Key findings:

- **The need to consider all technologies fairly:** new battery electric, new hydrogen and repowers all have a place;
- **The need for place-based solutions** with ZEB deployment targeted to particular areas and generators of transport emissions, linked to provision of required charging/fuelling infrastructure which need to be in the right places for the right users;
- **Alternative approaches to financing and ownership** of operational assets will increasingly be required, including vehicles and potentially depots;
- **Link infrastructure plans to other parts of the transport sector** such as HGVs, municipal fleets and rail – especially for hydrogen.

Work to date:
Assessing power needs by depot and operator

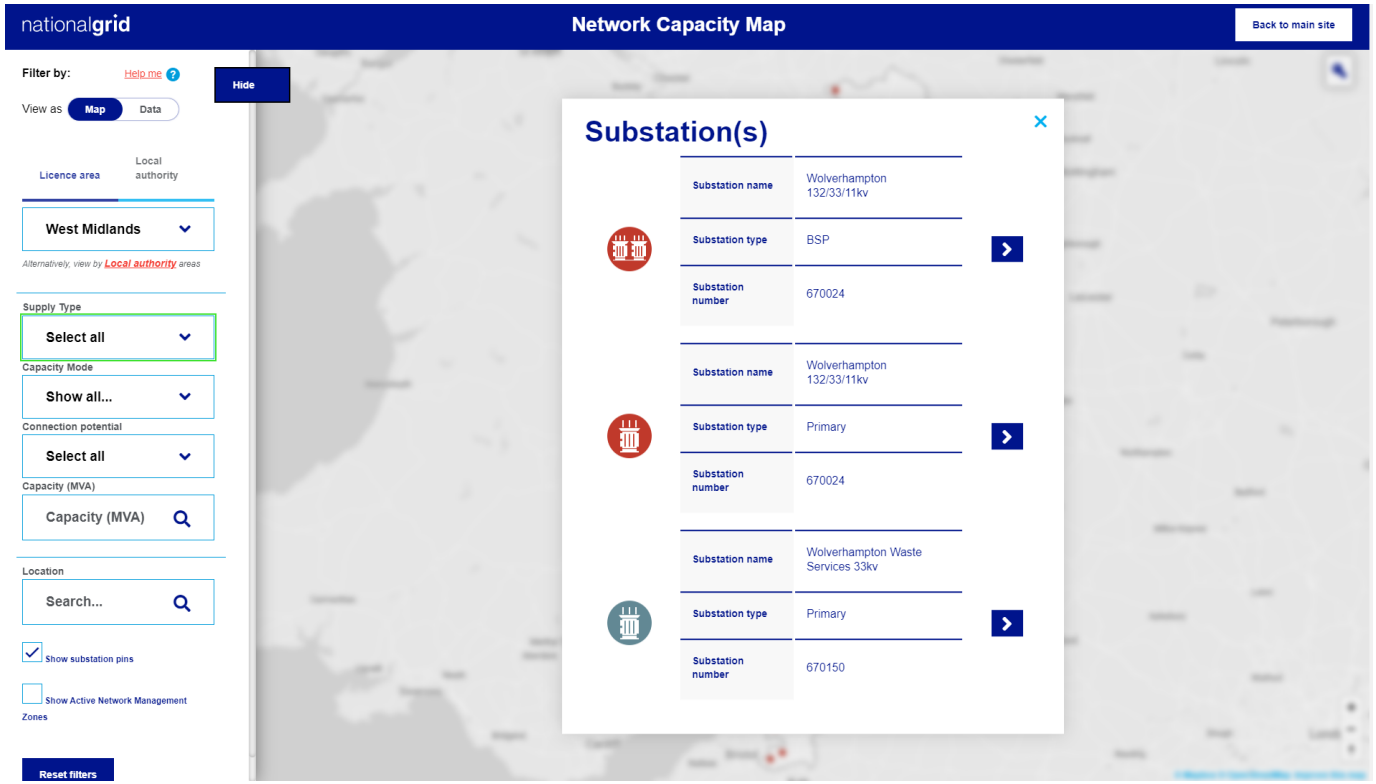
DEPOTS IN WMCA							See explanatory notes:		A	B	C	D				Pr
Operator	Depot Name	Address	Capacity	Fleet	Single Decks	Double Decks	Peak load at 100kW / bus (MW)	Nightly energy required at 80% per bus (MWh)	Load with smart charging over 8 hours (MW)	Power supply size required (MVA)	% of headroom at nearest substation	Primary Substation	Supply Area Verified	HV		
Banga Buses	Wolverhampton	Chillington Industrial Estate, Hickman Ave, Wolverhampton WV1 2BS	10	13	13	0	1.30	3.62	0.45	0.5	1.84	Wolverhampton 132/33/11kv	Yes	133		
Coventry Minibuses	Coventry	Unit 10, Portway Close, Coventry CV4 9UY	10	6	6	0	0.60	1.67	0.21	0.2	4.43	Torrington Avenue 33 11kv S S	Yes	33		
Diamond	Tividale	Hallbridge Way, Tipton Road, Tividale B69 3HW	140	137	136	1	13.70	38.17	4.77	4.8		Tividale 132/11KV	Yes	132		
Discount Travel Solutions	Smethwick	Unit 3, Bridge Street South, Smethwick B66 3DR	4	4	4	0	0.40	1.11	0.14	0.1		Smethwick 132/11KV	Yes	132		
Landflight	Solihull	Argent House, Vulcan Rd, Solihull B91 2JY	25	14	14	0	1.40	3.90	0.49	0.5		Solihull 132KV/11KV	Yes	132		
Let's Go	Wolverhampton	49 Dudley Road, Wolverhampton WV2 3BP	15	14	14	0	1.40	3.90	0.49	0.5	1.81	Coseley 132/11kv	Yes	132		
National Express West Midlands	Acocks Green	189 Fox Hollies Rd, Acocks Green, Birmingham B27 7TZ	140	140	52	88	14.00	41.37	5.17	5.2	14.16	Hall Green 132/11kv	Yes	132		
National Express West Midlands	Pensnett	35 Second Ave, Pensnett Trading Estate, Kingswinford DY6 7UN	107	105	52	53	10.50	30.67	3.83	3.8	30.07	Hinksford 132/33kv 132/11kv &	Yes	132		
National Express West Midlands	Wolverhampton	Park Lane, Wolverhampton WV10 9QG	189	189	76	113	18.90	55.69	6.96	7.0	27.98	Bushbury B-C 132/33kv & 132	Yes	132		
National Express West Midlands	Yardley Wood	Yardley Wood Rd, Yardley Wood, Birmingham B14 4BN	126	126	22	104	12.60	37.91	4.74	4.7	9.28	Highters Heath 132/11kv	Yes	132		
National Express West Midlands	Birmingham Central	Liverpool Street, Birmingham, B9 4DS	199	197	0	197	19.70	60.20	7.53	7.5		Bordesley 132KV/11KV	Yes	132		
National Express West Midlands	Perry Bar	Wellhead Ln, Birmingham B42 2SY	174	174	58	116	17.40	51.60	6.45	6.4		Perry Barr 11KV S/STN	Yes	132		
National Express West Midlands	Walsall	39 Carl St, Bloxwich, Walsall WS2 7BE	206	210	94	116	21.00	61.62	7.70	7.7		Rushall 132/11KV	Yes	132		
National Express West Midlands	West Bromwich	Oak Lane, West Bromwich B70 8PP	154	154	44	110	15.40	45.87	5.73	5.7		Black Lake	Yes	132		
Thandi Coaches	Smethwick	Alma Street Birmingham B66 2RL	15	10	10	0	1.00	2.78	0.35	0.3	1.10	Hockley 132/11kv	Yes	132		
		Totals	1700	1655	617	1038	165.50	488.99	61.12	61.1						

- Total power supply requirement of 61 MVA for all depots in TfWM area excluding National Express Coventry depot.
- 48 MVA for National Express, 4.8 MVA for Diamond, roughly 8 MVA for remaining operators
- Illustrates challenge for transitioning smaller operators with small sites.

Work to date:
Assessing power supply capacity at a regional level

Area	Substation Name	WPD ID	Firm Capacity (MVA)	Demand Headroom (MVA)	Demand Headroom RAG	Theoretical max no of buses
Coventry	Gulson Road 33 6 6kv S Stn	930043	23.00	14.19	Green	142
Coventry	Hawkesmill Lane 33/6.6kv	930028	14.50	12.79	Green	128
Coventry	Holbrook Lane 33/6.6kv	930038	24.00	3.51	Amber	35
Coventry	Holyhead Road 33 11kv S Stn	930037	23.00	9.71	Green	97
Coventry	Jaguar Browns Lane 33/11kv	930029	20.00	11.68	Green	117
Coventry	Jlr Whitley	939482	°	°	°	0
Coventry	London Road 33 6 6kv S Stn	930027	23.00	19.66	Green	197
Coventry	Sandy Lane 33 6 6kv S Stn	930040	23.00	8.88	Green	89
Coventry	Spon Street 33/6.6kv	930041	23.00	11.08	Green	111
Coventry	Torrington Avenue 33 11kv S Stn	930030	21.80	4.71	Green	47
Coventry	University Of Warwick 33 11kv S Stn	930034	38.00	18.53	Green	185
Coventry	Walsgrave 33 11kv S Stn	930047	36.00	13.68	Green	137
Coventry	Whitley 11kv S Stn	930045	38.00	13.60	Green	136
Dudley	Halesowen 132/11kv	670060	78.00	35.36	Green	354
Sandwell	Bustleholm 11kv Switch House	670139	78.00	42.43	Green	424
Sandwell	Ocker Hill B 132/33kv & 132/11kv	670070	78.00	26.63	Green	266
Sandwell	Oldbury B 33kv	670154	39.00	29.77	Green	298
Solihull	Coventry West 6 6kv S Stn	930025	23.00	13.36	Green	134
Solihull	Shirley 132/11kv	670075	78.00	35.20	Green	352
Wolverhampton	Bushbury B C 132/33kv & 132/11kv	670037	78.00	24.88	Green	249
Wolverhampton	Coseley 132/11kv	670056	69.00	26.92	Green	269
Wolverhampton	Willenhall 132/25kv	670006	78.00	0.00	Red	0
Wolverhampton	Wolverhampton 132/33/11kv	670024	78.00	24.58	Green	246

WPD published data as at 27/09/2022



Work to date:
What a ZEB deployment could look like

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Table 5.4: ZEB Deployment Required Programme

Year	New ZEBs	Technology	Operator	Project / Funding Source	Total ZEB Fleet	ZEB % of Fleet
2022	50	New electric	National Express West Midlands	CEBC	104	5
2023	80	New electric	National Express West Midlands	CEBC		
	6	Repower	Diamond Bus	DEFRA	190	9
2024	46	New electric	National Express West Midlands	CEBC		
	124	New hydrogen	National Express West Midlands	ZEBRA		
	300	New electric	National Express West Midlands	Commercial	660	32
2025	71	New electric	Stagecoach Midlands	CEBC		
	29	New electric	Contracted operators	CEBC		
	5	New electric	Arriva Midlands	TBC		
	126	TBC	Diamond Bus	TBC		
	65	TBC	Contracted operators	TBC		
	162	New electric	National Express West Midlands	Commercial	1,118	54
2026	162	New electric	National Express West Midlands	Commercial	1,280	62
2027	162	New electric	National Express West Midlands	Commercial	1,445	70
2028	159	New electric	National Express West Midlands	Commercial	1,604	77
2029	160	New electric	National Express West Midlands	Commercial	1,764	85
2030	74	New electric	Arriva Midlands	TBC		
	107	New electric	Stagecoach Midlands	TBC		
	134	New electric	Other operators outside TfWM	TBC	2,079	100

< Intervention required in 2025 to stay on target, approx. 220 buses

ZEB delivery plan: dependencies and emerging themes

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1. 100% ZEB target by 2030 unlikely to be achieved without some form of intervention by TfWM;
2. Currently no transition plan in place for approx. 220 buses = 10% of the West Midlands fleet;
3. Intervention to assist ZEB transition could be the same in both a deregulated and franchised scenarios – TfWM acquiring buses;

Dependencies:

- Operators agree to lease buses from TfWM in a deregulated market;
- TfWM able to access significant CapEx or have certainty of revenue;
- National Express needs to turnover 11% of fleet pa for next 7 years – around double the usual replacement rate.

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Questions?

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