

Electric vehicles & charging infrastructure.

Table of contents

1. Foreword.....	8	3.3 Sector analysis.....	17
Executive Summary.....	9	ix. Light commercial vehicles: passenger cars, small trucks and vans	17
1.1 Overall EV adoption to grow over the next 5 years, and policy	9	x. Commercial vehicles: electric HGVs, large vans and trucks, and	17
can play a major role.....	9	buses	17
1.2 Charging infrastructure needs to keep pace.....	9	Case Study: Tesla Semi.....	18
2. Introduction to EVs and charging infrastructure	11	xi. Battery technology.....	19
2.1 Driving change	11	a. Lead-acid	19
Figure 1: The top 5 polluting industries	11	b. Lithium-ion	19
2.2 Country analysis	12	c. Nickel-metal Hydride	19
Figure 2: Key dates and targets for the phasing out of ICE vehicles	12	d. Solid-state	20
in major economies.....	12	e. Ultracapacitors.....	20
Figure 3: Global transport emissions by country (%).....	13	f. Na-NiCl ₂	20
i. Canada	13	xii. Challenges and constraints	20
ii. China	13	a. Range anxiety & consumer opinion	20
iii. European Union	14	b. Energy consumption & grid pressures	21
iv. India	14	c. Environmental impact & recycling.....	21
v. Japan	14	4. Electric Vehicle Charging Infrastructure	22
vi. South Korea.....	14	4.1 Introduction	22
vii. United Kingdom	15	4.2 The technology.....	22
viii. United States.....	15	DC vs AC	22
3. Electric vehicles.....	16	i. EV charger station types	22
3.1 Introduction	16	Figure 4: Table of EV charger station types	23
3.2 Electric vehicles.....	16		

ii.	EV connectors	24	5.1	BMW Group	39
	Figure 5: Common EV connectors.....	24	i.	Corporate overview	39
4.3	Charging Infrastructure Trends.....	25		Figure 8: Key financial data for BMW Group	39
i.	EV charging markets	25	ii.	Geographic spread	39
ii.	Charging networks	25	iii.	Products and services	39
iii.	Private (home & workplace) EV charging	26	iv.	Sustainability practices	39
iv.	Public EV charging.....	27	5.2	BYD.....	40
	Figure 6: Number of electric LDVs (Light Duty Vehicle) per public charging point worldwide (2022).....	28	i.	Corporate overview	40
	Case Study: Charge Fairy.....	30		Figure 9: Key financial data for BYD.....	40
v.	Pressure on power grids	31	ii.	Geographic spread	40
5.	Company Profiles & leaderboards	35	iii.	Products and services	40
	Introduction	35	iv.	Sustainability practices	40
	Leaderboard methodology	35	5.3	Ford.....	41
	Electric vehicles.....	36	i.	Corporate overview	41
	Heatmap.....	36		Figure 10: Key financial data for Ford.....	41
	Electric Vehicles Leaderboard.....	37	ii.	Geographic spread	41
	i. Emulators.....	37	iii.	Products and services	41
	ii. Disruptors.....	37	iv.	Sustainability practices	41
	iii. Leaders.....	38	5.4	Hyundai Motor.....	42
	BMW, BYD, Stellantis, and Toyota	38	i.	Corporate overview	42
	Electric vehicles vendor scoring & sizing	38		Figure 11: Key financial data for Hyundai.....	42
	Figure 7: Electric vehicles vendor scoring & sizing	38	ii.	Geographic spread	42
			iii.	Products and services	42

iv.	Sustainability practices	42	ii.	Geographic spread	46
5.5	Tesla	43	iii.	Products and services	47
i.	Corporate overview	43	iv.	Sustainability practices	47
	Figure 12: Key financial data for Tesla	43	5.9	SAIC motor	47
ii.	Geographic spread	43	i.	Corporate overview	47
iii.	Products and services	43		Figure 16: Key financial data for SAIC Motor	47
iv.	Sustainability practices	43	ii.	Geographic spread	47
5.6	Toyota Motor Corporation.....	44	iii.	Products and services	47
i.	Corporate overview	44	iv.	Sustainability practices	48
	Figure 13: Key financial data for Toyota Motor Corporation (Financial year runs Apr to Mar)	44	5.10	Stellantis.....	48
ii.	Geographic spread	45	i.	Corporate overview	48
iii.	Products and services	45		Figure 17: Key financial data for Stellantis.....	48
iv.	Sustainability practices	45	ii.	Geographic spread	48
5.7	Volkswagen Group	45	iii.	Products and services	48
i.	Corporate overview	45	iv.	Sustainability practices	49
	Figure 14: Key financial data for Volkswagen Group	45	Electric vehicle chargers.....		50
ii.	Geographic spread	45	EV chargers Leaderboard		51
iii.	Products and services	46	i.	Leaders	51
iv.	Sustainability practices	46	ii.	Disruptors.....	51
5.8	Renault-Nissan-Mitsubishi Alliance	46	iii.	Emulators	52
i.	Corporate overview	46	EV charging vendor scoring & sizing		53
	Figure 15: Key financial data for RNM Alliance.....	46		Figure 18: EV charging vendor scoring & sizing	53
			5.11	ABB Ltd.....	54

i.	Corporate overview	54
	Figure 19: Key financial data for ABB.....	54
ii.	Geographic spread	54
iii.	Products and services	54
iv.	Sustainability practices	55
5.12	Allego B.V.	55
i.	Corporate overview	55
	Figure 20: Key financial data for Allego	55
ii.	Geographic spread	55
iii.	Products and services	56
iv.	Sustainability practices	56
5.13	BP Pulse.....	56
i.	Corporate overview	56
	Figure 21: Key financial data for bp pulse.....	56
ii.	Geographic spread	56
iii.	Products and services	57
iv.	Sustainability practices	57
5.14	Charge +	58
i.	Corporate overview	58
ii.	Geographic spread	58
iii.	Products and services	58
iv.	Sustainability practices	58
5.15	ChargePoint.....	59

i.	Corporate overview	59
	Figure 22: Key financial data for ChargePoint.....	59
ii.	Geographic spread	59
iii.	Products and services	59
iv.	Sustainability practices	59
5.16	Ionity	60
i.	Corporate overview	60
ii.	Geographic spread	60
iii.	Products and services	60
iv.	Sustainability practices	60
5.17	Osprey	60
i.	Corporate overview	60
ii.	Geographic spread	61
iii.	Products and services	61
iv.	Sustainability practices	61
5.18	Shell Recharge Solutions.....	62
i.	Corporate overview	62
	Figure 23: Key financial data for Shell.....	62
ii.	Geographic spread	62
iii.	Products and services	62
	Figure 24: Shell Recharge public charging tariffs.....	62
iv.	Sustainability practices	63
5.19	StarCharge.....	63

i.	Corporate overview	63	Figure & table 29: Total number of ICE car registrations per annum (million), split by 7 key regions	70
ii.	Geographic spread	63	6.6 Total new PHEV vehicle registrations per annum.....	71
iii.	Products and services	63	Figure & table 30: Total number of PHEV car registrations (million), split by 7 key regions	71
iv.	Sustainability practices	64	6.1 Total new BEV vehicle registrations per annum	72
5.20	Tesla Supercharger.....	64	Figure & table 31: Total number of PHEV car registrations (million), split by 7 key regions	72
i.	Corporate overview	64	6.1 Total new registrations which are electric vehicles (PHEV or BEV) 73	
	Figure 25: Key financial data for Tesla	64	Figure & table 32: Total number of PHEV & BEV car registrations (million), split by 7 key regions	73
ii.	Geographic spread	64	6.1 Total new registrations which are ‘other’ vehicles, per annum	74
iii.	Products and services	64	Figure & table 33: Total number of ‘other’ car registrations (million), split by 7 key regions	74
iv.	Sustainability practices	65	6.2 Total on road vehicles which are PHEV or BEV	75
6.	Market forecasts	66	Figure & table 34: Total number of on road vehicles which are PHEV or BEV (million), split by 7 key regions	75
6.1	Introduction	66	Figure 35: Heatmap showing EVs as a percentage of total on road vehicles for select countries (2023 & 2028).....	76
	Electric vehicles.....	66	6.3 Total Revenue from EV LCVs.....	77
6.2	Methodology.....	66	Figure & table 36: Total revenue from EV passenger cars (\$ billion), split by 7 key regions.....	77
	Figure 26: Methodology for Zero Carbon Academy’s electric vehicles forecasts	67	Table 37: Total revenue from EV LCVs (\$ billion), split by fuel type	77
6.3	Total LCVs on the road (in use)	68	Electric vehicle charging infrastructure	78
	Figure & table 27: Total number of passenger cars on the road (million), split by 7 key regions	68		
6.4	Total new LCVs registrations per annum	69		
	Figure & table 28: Total number of passenger car registrations (million), split by 7 key regions	69		
6.5	Total new ICE vehicle registrations per annum	70		

6.4	Methodology.....	78
	Figure 38: Methodology for Zero Carbon Academy’s electric vehicle charging infrastructure forecasts	79
6.5	Total public and household EV chargers.....	80
	Figure 39: Total public and household EV chargers (m)	80
	Figure 40: heatmap showing density of chargers per 1,000 people for select countries (2023 & 2028)	81
6.6	Total public EV chargers.....	83
	Figure 41: Total public EV chargers (m)	83
6.7	Number of households with an EV car	84
	Figure 42: Number of households with an EV car (m)	84
6.8	Total household EV chargers	85
	Figure 43: Total household EV chargers (m)	85
7.	Strategic recommendations.....	86
	i. Recommendations for businesses	86
	ii. Recommendations for EV manufacturers.....	86
	iii. Recommendations for policy makers and government.....	86
	For consolidated EV charging markets.....	86
	For emerging EV charging markets	86
	For both.....	87
8.	References	88