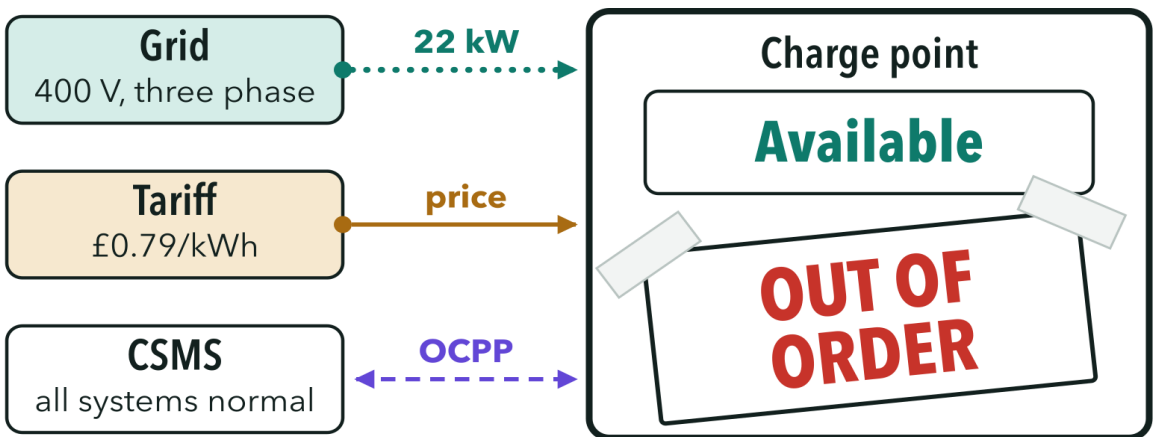


How EV Charging Actually Works

A guide to the technology, business, and operations of electric vehicle charging



Charles O'Donoghue

How EV Charging Actually Works

A guide to the technology, business, and operations of electric vehicle charging

Charles O'Donoghue

This book is available at

<https://leanpub.com/how-ev-charging-actually-works>

This version was published on 2026-10-13



This is a [Leanpub](#) book. Leanpub empowers authors and publishers with the Lean Publishing process. [Lean Publishing](#) is the act of publishing an in-progress ebook using lightweight tools and many iterations to get reader feedback, pivot until you have the right book and build traction once you do.

© 2026 Charles O'Donoghue

Contents

Dedication	i
Preface	ii
Who this book is for	ii
How this book is structured	ii
A note on voice	iv
An AI-forward book	v
How this book was fact-checked	vi
Acknowledgements	viii
Part 1: The EV Landscape	1
Chapter 1: Electric Vehicles: A Second Dawn	2
The Long Silence and the Slow Revival	3
The 2020s: The Decade That Tipped	5
The Business of Electric Vehicles	7
The Value Chain Is Shifting	11
The EV Charging Industry Is No Longer a Niche	13
Chapter Summary	14
Chapter 2: The EV Market Landscape	16
Three Sectors, One Disruption	16
The Blurring of Boundaries	19
Charging Segments	20
The UK Market in Numbers	23
Chapter Summary	25
Chapter 3: The EV Charging Network	26
The Wider EV Ecosystem	26
The Three Layers of an EVCN	26
The EVCN at a Glance	26

CONTENTS

The Eight Actors	26
How the Layers Connect to the Actors	27
From Theory to Practice	27
Chapter Summary	27
Chapter 4: CPO and eMSP: The Two Roles That Run Everything	28
The Charge Point Operator (CPO)	28
The e-Mobility Service Provider (eMSP)	28
The Blurring of Boundaries	29
Who Plays Which Role?	29
The eMSP Revenue Model	29
Looking Ahead: The Evolution of Roles	29
Chapter Summary	29
Chapter 5: The Site Host: Whose Land Is It Anyway?	30
The Many Faces of the Host	30
Five Deal Shapes	30
Who Sets the Tariff	30
The Lease	30
How CPOs Choose Sites	30
The Rules That Land on the Landowner	30
What the Host Needs From the CSMS	31
Chapter Summary	31
Chapter 6: Data Types and Relationships	32
Key Data Types in an EVCN	32
Entity Relationships	33
How Data Flows in Practice: A Charging Session Walk-Through . . .	33
Key Identifiers	34
Data Quality and Governance	34
From Data to Insight	34
Chapter Summary	34
Part 2: Charging Operations	35
Chapter 7: Charging Fundamentals	36
What's Really Happening Between These Two Things?	36
AC vs DC Charging	36
Power Levels	36
IEC 61851 Charging Modes	36

CONTENTS

Connector Types	37
The Control Pilot: How Charger and Vehicle Talk	37
Vehicle Architectures: 400V vs 800V	38
Emerging Charging Technology	38
Chapter Summary	39
Chapter 8: The IoT Backbone	40
The Charge Station as a Connected Device	40
Hops 2 to 7: Inside the Charger	40
Hops 8 and 9: The Mobile Network	41
Hop 10: Watching the Chain from the CSMS	42
Offline Operation: When the Air Fails	42
Chapter Summary	42
Chapter 9: The EV Protocol Zoo	43
A Tower of Babel, Solved	43
OCPP: The Language Chargers Speak	43
OCPP 1.6J: The Foundation	43
OCPP 2.0.1: The Modern Standard	44
OCPP 2.1: The Cutting Edge	44
OCPI: The Roaming Protocol	44
ISO 15118: The Vehicle Protocol	44
How the Protocols Fit Together	45
The Real-World Complexity	45
Chapter Summary	45
Chapter 10: The Charging Station Management System	46
Head Office	46
What Does a CSMS Actually Do?	46
Buy or Build	47
Architecture Patterns	47
CSMS and OCPP Versions	48
Fleet Management Features	48
The CSMS in Context	48
Choosing a CSMS: What to Look For	48
Chapter Summary	49
Chapter 11: Roaming & Interoperability	50
The Vodafone Problem	50
What Roaming Actually Means	50

CONTENTS

How Roaming Works End-to-End	50
OCPI: The Roaming Protocol	50
The Protocol Landscape: OCPI vs OICP vs eMIP	51
The Convergence Story: Hubject Joins OCPI	51
Roaming Hubs: The Exchanges	51
The Business Case for Roaming	51
Challenges in Roaming	52
The Future of Roaming in a Contactless World	52
What This Means for You	53
Worked Example: One Session, Module by Module	53
Chapter Summary	53
Chapter 12: A Multi-Faceted Computer System	54
Not an Electrical Box, a Computer	54
What's Inside: The Hardware Architecture	54
Multiple Processes, One Machine	55
Logging and Diagnostics: Your Forensic Evidence	55
Firmware Management: The Soul of the Device	56
Observability: Seeing Inside the Machine	57
The Human Interface in Depth	57
Surviving the Elements	58
Chapter Summary	58
Chapter 13: Billing for the EV Space	59
How Hard Can It Be?	59
Pricing Models	59
The Charge Detail Record (CDR)	60
Payment Methods	61
The Contactless Payment Mandate	62
Roaming Billing	62
VAT and Tax Considerations	63
Fleet Billing	63
The Future of Billing	64
Chapter Summary	65
Chapter 14: Problem Solving	66
The Reliability Question	66
A Troubleshooting Mindset	66
Common Failure Modes	66

CONTENTS

The Vehicle Side	67
Remote vs On-Site Troubleshooting	67
Building a Knowledge Base	67
Monitoring and Prevention	68
Tools of the Trade	68
Worked Example: Debugging a Stuck Charger	68
Chapter Summary	68
Part 3: The New Frontier	70
Chapter 15: Smart Charging & Energy Management	71
The Grid Was Never Designed for This	71
Why Smart Charging Is Not Optional	71
The Energy Trilemma	71
Load Management: The Foundation	71
Demand Response: Talking to the Grid	72
Time-of-Use Tariffs and Charging Behaviour	72
UK DNO Constraints and Flexibility Markets	72
Battery-Buffered Charging Sites	72
OCPP 2.1 and Distributed Energy Resources	72
Real-World Smart Charging in Action	73
What This Means for You	73
Chapter Summary	73
Chapter 16: V2G / V2X: Charging in Reverse	74
A Battery on Wheels	74
The V2X Family	74
How Bidirectional Charging Works	74
The Standards Making It Happen	74
The Economics: Why Would Anyone Do This?	74
The Virtual Power Plant	75
What Vehicles Support V2G Today?	75
Battery Degradation: The Elephant in the Room	75
Regulatory Enablers and Barriers	75
The Behavioural Challenge	76
Where V2G Is Heading	76
Worked Example: A V2G Driver's Day	76
Chapter Summary	76
Chapter 17: Plug & Charge: Just Plug In	77

CONTENTS

The App Problem	77
The Vision	77
How It Works: The Technical Foundation	77
The PKI Chain of Trust	77
What the Certificate Says	77
Hubject: The Ecosystem Operator	77
ISO 15118 Versions: What You Need to Know	78
Current OEM Support	78
The EU AFIR Mandate	78
Challenges: Why Is This Not Everywhere Yet?	78
What Plug & Charge Means for the Industry	79
The Bigger Picture	79
Chapter Summary	79
Chapter 18: Cybersecurity in EV Charging	80
A Computer on Every Street Corner	80
The Threats	80
Key Security Standards and Frameworks	81
Real-World Vulnerabilities	82
Defence in Depth	82
UK Regulatory Context	83
Supply Chain Security	83
The Human Factor	83
A Pragmatic Approach	83
Chapter Summary	83
Chapter 19: Regulation & Compliance	84
From the Wild West to the Rule of Law	84
Why the Pressure Built	84
The UK Rules, Failure by Failure	84
Europe Fixed the Same Failures	85
The Patchwork Problem	85
Chapter Summary	85
Chapter 20: Where This Book Ends	87
What to Read Next	87
Where to Learn in Practice	87
What to Watch	87
Chapter Summary	87

CONTENTS

Appendix A: Glossary & Acronyms **88**

A 88

B 88

C 88

D 88

E 88

F 88

G 89

H 89

I 89

J 89

K 89

L 89

M 89

N 90

O 90

P 90

Q 90

R 90

S 90

T 90

V 91

W 91

Z 91

Appendix B: Industry Actors **92**

The Market Players in 2026 92

Consolidation: The Story of the 2020s 92

Charge Point Operators (CPOs) 92

eMSPs and Roaming Providers 92

Site Hosts 93

CSMS Vendors 93

Hardware Manufacturers 93

Roaming Hubs 93

Industry Bodies and Standards Organisations 93

Energy Companies in EV Charging 93

Appendix C: Protocols & Standards Reference **95**

The Protocol Family by Category 95

CONTENTS

OCPP: Open Charge Point Protocol	95
OCPI: Open Charge Point Interface	96
ISO 15118: Vehicle-to-Grid Communication Interface	96
IEC 61851: Electric Vehicle Conductive Charging System	97
IEC 62196: Plugs, Socket-Outlets, Vehicle Connectors and Vehicle Inlets	97
OpenADR 3: Open Automated Demand Response	97
OICP: Open InterCharge Protocol	97
eMIP: e-Mobility Inter-operation Protocol	97
MQTT: Message Queuing Telemetry Transport	97
OCPP Version Comparison	97
Appendix D: Useful Links & Resources	99
Standards Bodies & Protocol Organisations	99
Industry Associations	99
Roaming Platforms	99
UK Government & Regulation	99
EU Regulation	99
US Regulation & Programmes	99
Market Data & Statistics	100
Learning Resources & Technical Guides	100
Industry News & Analysis	100
Open-Source Tools & Projects	100
Cybersecurity	100
Appendix E: References & Further Reading	101
Foundational protocols and networking	101
EV charging protocols and standards	101
Smart charging and grid integration	101
Cybersecurity	101
UK regulation	101
EU regulation	101
Site hosts, land and leases	102
Market data	102
Industry references	102
Appendix F: Regulation Reference	103
The UK ZEV Mandate	103
The Public Charge Point Regulations 2023	103

EU AFIR 103

UK Grants 103

Planning and Grid Connection 103

Consumer Protection 103

Data Protection 104

Safety Standards 104

Compliance Checklist 104

Dedication

For Linda, my first boss, who showed me my first electric car.

Look what you started.

Roads? Where we're going, we don't need roads.

Dr Emmett Brown, *Back to the Future* (1985)

Preface

In 1900, around a third of the cars on America's roads were electric. Electric was the smart money. History had other ideas: cheap Texas crude, the electric starter motor and Henry Ford's assembly line sent the electric car into a century-long hibernation.¹

Now it's back, and this time it has brought an entire ecosystem with it.

This book is about that ecosystem: the infrastructure and operations that make electric vehicle charging work. Not the vehicles (there are plenty of books about those), and not the electrical installation (that is a trade in its own right). Everything in between: the software, protocols, business models, actors and technology that connect a driver plugging in a cable to electrons flowing from the grid.

Who this book is for

Anyone joining a Charge Point Operator, an eMSP, a Charging Station Management System vendor, an energy company moving into EV charging, or any of the dozens of businesses that orbit the industry. It takes you from “I know EVs exist” to “I understand how this industry actually works” in the time it takes to read it.

It is also for the curious. If you work in energy, transport, telecommunications or technology and wonder why everyone is suddenly talking about OCPP, ISO 15118 and vehicle-to-grid, this book gives you the full picture from the ground up.

How this book is structured

Part 1: The EV Landscape sets the scene: the history, the market, the key players, the site hosts whose land the chargers stand on, and how they all relate. Who does what, who pays whom, and why the industry looks the way it does.

¹US Department of Energy, [The History of the Electric Car](#) (15 September 2014), for the one-third share, cheap Texas oil, the electric starter and the mass-produced Model T; Ford Motor Company, [Highland Park: birthplace of the moving assembly line](#) (17 December 2021).

Part 2: Charging Operations is the technical backbone: charging fundamentals, the IoT layer, the protocol ecosystem (OCPP, OCPI, ISO 15118), the Charging Station Management System, roaming, the charger as a computer system, billing and troubleshooting. This is the core of the book, and the content hardest to find anywhere else.

Part 3: The New Frontier is where the industry is heading: smart charging, vehicle-to-grid, Plug & Charge, cybersecurity and regulation. These topics are turning EV charging from “a thing that gives cars electricity” into a critical piece of the energy system. A short closing chapter draws the threads together.

One charging session runs through the whole book. Sarah taps her card on a 150 kW charger run by one company, Kestrel, using an account with another, Wayfarer, and drives off 25 minutes later with 35 kWh and a £19.25 bill. Both companies are made up; the parts they play are real. Between the tap and the bill, the session crosses eleven hops: her app, her eMSP, a roaming hub, the operator’s backend, the mobile network, the charger, the cable, the car, the site it stands on, the grid behind that, and the record that turns energy into money. The map below shows them all. Part 1 tours the whole map, and Chapter 6 walks the session twice: first with one company doing everything, then with Wayfarer added. From Part 2 on, the book builds the session one hop at a time, and most chapters open with the map so far, so you always know where you are.

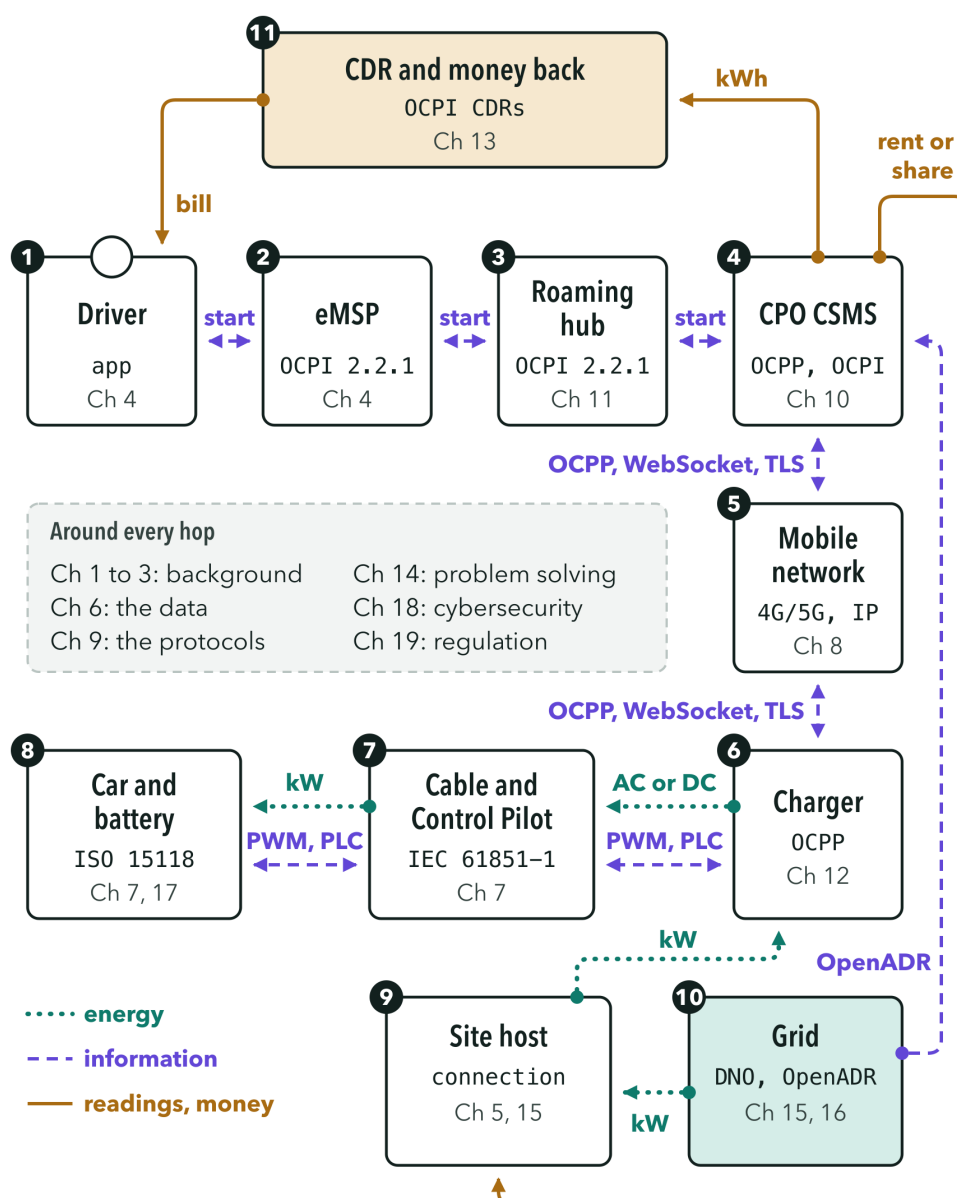


Figure 1. One session, eleven hops: what each one speaks and the chapter that teaches it

The appendices hold a glossary of the terms and acronyms you will meet daily, a reference of industry actors, a summary of protocols and standards, links for further reading, and the references behind the facts in the text.

A note on voice

I wrote this book the way I would explain things to a colleague over coffee: technical where it needs to be, never obscure for its own sake. I use analogies and real company names, and I build understanding step by step rather than dumping a wall of specifications on you. If something is genuinely complicated, I will say so and then break it down.

The industry moves fast. This edition reflects its state as of October 2026. Where things are still evolving (in almost every area), I give you the principles that will hold as the specifics change.

That speed is why the book is on Leanpub. Buy it once and every new edition is yours, free. When the industry moves, I update the book, and your copy moves with it.

An AI-forward book

I want to coin a term for what this book is: an AI-forward book. AI did some of the work on it, and you should know which part.

The knowledge is mine, and I learned it the slow way. Since September 2017 I have opened up chargers, chased sessions that would not start, argued over tariffs, and taught a training course to colleagues and customers. No automation did that learning for me, and none can do it for you. That is what this book is for.

I automated part of the writing and much of the research. Claude drafted and tightened many of the sentences, and I argued over them, checked them and rewrote them until they said what I meant. A writing skill I built, called *crisp*, strips out padding and holds every chapter to one plain voice. AI agents did most of the source reading: they opened each source and reported whether it said what the text claims.

I won't pretend any of that is a tool I wielded, the way I wield a screwdriver.² I asked, and it produced. So I treated what it produced like a new colleague's work: fast, useful, and not to be trusted until checked.

²Rich Hickey, *'AI' is Not a Tool* (LinkedIn, 12 October 2026). The distinction is his: a tool is something you wield, with control and feedback, and using one teaches you; an LLM is automation, which acts on a request instead.

In a 1990 film interview, Steve Jobs describes a study of the locomotive efficiency of various species. The condor came out top. Humans were unimpressive, until you put one on a bicycle: then the result blew the condor away. “That’s what a computer is to me,” he said. “It’s the most remarkable tool that we’ve ever come up with, and it’s the equivalent of a bicycle for our minds.”³

AI is not that bicycle. A bicycle only moves when you pedal, and the pedalling is what makes you fit. AI is closer to a taxi: you say where you want to go, and it drives. Taxis are useful, and this book took a lot of them. But nobody gets fit in the back of a cab. The fitness in this book came from years on the bicycle, since 2017. The taxi got the words onto the page.

The judgement stayed with me. I chose the topics, the structure, the order, the examples and the diagrams, and I decided what stayed and what went. The figures follow one diagramming system I designed for teaching: boxes are things, wires are what flows, and the colour of a wire tells you whether it carries energy, information or money. Every figure was checked against the text it explains.

Why automate any of it? I’m a practitioner with a full-time job, not a full-time author, and this industry moves fast. Automating the typing is how the book got written while it is still current, and how it will stay current.

That is what I mean by an AI-forward book: a practitioner’s knowledge, written with automation, and open about which part is which. You can judge whether it works.

How this book was fact-checked

A book about a fast-moving industry is only useful if you can trust it, so I want to be open about how I checked this one.

The first full fact-check ran through May and June 2026. Every chapter was read against sources, claim by claim, and the errors it found were fixed: dates that were wrong, figures that had gone stale, a fine quoted in the wrong currency, a regulation said to come into force a year after it did.

³Steve Jobs, interviewed for *Memory & Imagination: New Pathways to the Library of Congress* (Michael Lawrence Films, 1990), transcribed by Maria Popova, [Steve Jobs on Why Computers Are Like a Bicycle for the Mind \(1990\)](#), The Marginalian (21 December 2011). Jobs’s full sentence: “What a computer is to me is it’s the most remarkable tool that we’ve ever come up with, and it’s the equivalent of a bicycle for our minds.”

In October 2026 a second pass went back over every figure, quote and attributed claim and asked four questions of each. Can it be traced to a source? Is that source still current? Does the book measure what the source measures? Has the wording drifted from what the source says? Separate checkers then tried to knock down each finding before I accepted it, and the seventy that survived were fixed. The epigraphs that open each chapter were checked against the original texts too.

Then I went further. For this edition I set out to give every factual claim (a number, a date, a price, a standard, a regulation, a company fact, a quote) a footnote to a source.

AI agents did most of that reading: they opened each source and checked it said what the text says, and separate agents tried to knock down each finding. I reviewed most of the findings, though not all. My rule was simple: if a claim has a source behind it, you can check it yourself.

Where the text and the source disagreed, the text changed. I preferred primary sources: legislation, regulators, official statistics, the standards bodies and companies' own announcements, then trade bodies and established analysts. Where no source could be found, the sentence was softened or cut. Where a figure is my own calculation from published data, the footnote says so. Separate checkers then opened a sample of the footnoted sources in each part of the book, and read the text for claims still left without one. The result is close to 680 footnotes, drawing on more than 450 sources, and Appendix E holds the full reference for each one, with its link. The figures had the same treatment: the connector faces, for example, were traced from reference drawings and measured against them, not drawn from memory.

Some things are deliberately not footnoted. My own experience in the field since 2017, including the stories in the From the Field boxes, is testimony, not citation, and so is what I have learned from interviewing people across the industry. Where those people are not yet named, it is because I have not yet asked them to be, and I will not name anyone without their agreement. Nor are the explanations and analogies I use to make an idea land, or the worked examples: Sarah, Kestrel and Wayfarer are invented, so their numbers are illustrative.

None of this makes the book error-free. Some claims will have slipped through without a footnote. Figures date, companies change hands and standards get revised, sometimes between my writing a sentence and you

reading it. If you find a mistake, or a source that says something different, please tell me and I will fix it in the next update. Keeping the book current is part of the point.

Acknowledgements

This book grew out of a training course I developed in the EV charging industry. I am grateful to the colleagues, operators and engineers who taught me what I know, often by patiently answering obvious questions, sometimes by letting me make mistakes and learn from them.

I wrote it in the margins of a full-time role at AMPECO (in my view, the best charge station management platform in the industry) and being a dad. Neither leaves much spare time. Without modern tools, this book would not exist.

I had a course, a job, a family, and a topic nobody else was writing the book on. Automating part of the writing meant I did not have to choose between the book and the rest of my life. The learning behind it was the part I could not automate, and I would not have wanted to.

Charles O'Donoghue October 2026

Part 1: The EV Landscape

Context-setting: where we've come from, where we are, and who the players are.

Chapter 1: Electric Vehicles: A Second Dawn

Only that day dawns to which we are awake. There is more day to dawn. The sun is but a morning star.

Henry David Thoreau, *Walden* (1854)

Car makers in the UK are now legally required to sell a rising share of electric cars, so the drivers are coming whatever the market does.¹ This book is about the network that has to be ready for them. It starts more than a century ago, because we have been here before.

If you had counted the cars on America's roads in 1900, you would have been surprised. Around a third of them were electric, according to the US Department of Energy, and New York City had a fleet of more than 60 electric taxis.² Others ran on steam, which, if you have ever seen a Victorian steam car in action, is exactly as dramatic and impractical as it sounds.

Electric cars at the turn of the twentieth century were quiet, smooth and easy to drive. They needed no hand crank to start (a crank that kicked back could break the operator's arm) and belched no exhaust. For city dwellers, and especially for women, they were the obvious choice.³

In 1900 Ferdinand Porsche, a name that would become rather famous in automotive circles, built the first working hybrid car, the Semper Vivus, and a year later its production version, the Lohner-Porsche Mixte. A combustion

¹HM Government, [Updates to the Vehicle Emissions Trading Schemes \(VETS\) Order 2023](#) (17 October 2025). The ZEV mandate's rising targets for new cars: 28% in 2025, 33% in 2026, 38% in 2027 and 80% by 2030.

²US Department of Energy, [The History of the Electric Car](#) (15 September 2014). Cars came in steam, petrol and electric versions; electric cars were around a third of all vehicles on US roads by 1900, and New York City had more than 60 electric taxis.

³US Department of Energy, [The History of the Electric Car](#) (15 September 2014), on the hand crank and the early popularity of electric cars with urban residents, especially women; IEEE History Center, [Charles F. Kettering](#) (Engineering and Technology History Wiki), on cranks kicking back and breaking arms and jaws.

engine drove a generator that powered electric motors in the wheel hubs, much like a modern range-extender.⁴ Porsche was over a century ahead of his time.

So what happened? Why did the electric car vanish for a hundred years?

Three things converged. Henry Ford's Model T, launched in 1908 and mass-produced on assembly lines by 1913, made gasoline cars astonishingly cheap. By 1912 a gasoline car cost \$650 while an electric roadster sold for \$1,750, and by 1925 a basic Model T cost just \$260. In 1912 Charles Kettering introduced the electric starter motor, which ended the dangerous hand crank and with it one of the combustion engine's biggest disadvantages. And vast oil discoveries in Texas (most notably the Spindletop gusher of 1901) made petrol absurdly cheap and widely available.⁵

The combination was lethal. By the 1920s America had a better network of roads between its cities, and drivers needed range that batteries could not provide. Electric vehicles had all but disappeared by 1935.⁶

The Long Silence and the Slow Revival

For decades the electric car was a curiosity. General Motors began leasing the EV1 in 1996, built to meet California's requirement for emission-free vehicles, then controversially took the cars back and crushed most of them after California relaxed its mandate in 2003. The documentary *Who Killed the Electric Car?* tells the story, and is well worth watching for the politics around this industry.⁷

The revival came from somewhere unlikely: consumer electronics. Lithium-ion batteries reached the market in 1991, light, rechargeable and

⁴Porsche Newsroom, [History of Porsche electric drive](#) (Taycan history). The 1900 Semper Vivus, the world's first functional hybrid, and the production-ready Lohner-Porsche Mixte a year later.

⁵US Department of Energy, [The History of the Electric Car](#) (15 September 2014), for the Model T's 1908 launch, the 1912 prices, Kettering's starter and cheap Texas oil; Ford Motor Company, [Highland Park: birthplace of the moving assembly line](#) (17 December 2021), for the moving assembly line from October 1913; The Henry Ford, [1925 Ford advertisement](#) (collections), which lists the Model T Runabout at \$260; Texas State Historical Association, [Spindletop Oilfield](#), Handbook of Texas (revised 2 April 2019), for the discovery on 10 January 1901.

⁶US Department of Energy, [The History of the Electric Car](#) (15 September 2014). By the 1920s the US had a better system of roads connecting its cities, and electric vehicles had all but disappeared by 1935.

⁷Smithsonian National Museum of American History, [GM EV1 electric car, 1997](#) (collection record, archived December 2022), on leasing from 1996 to meet California's requirement; NPR, [Movie Plumbs the Demise of the Electric Car](#) (1 July 2006), on the 2003 recall, the cars demolished and the film; California Air Resources Board, [Zero-emission Vehicle Regulation](#), on the mandate's amendments in 1996, 2001 and 2003.

powerful, and went on to power the world’s mobile phones and laptops.⁸ Crucially, they also got cheaper. A battery pack cost more than \$1,100 per kilowatt hour in 2010. By 2025 the average had fallen to \$108, and packs for battery electric cars to \$99 (BloombergNEF).⁹ (A kWh is a unit of energy; Chapter 7 explains how it differs from kW.) That single trend underpins everything since.

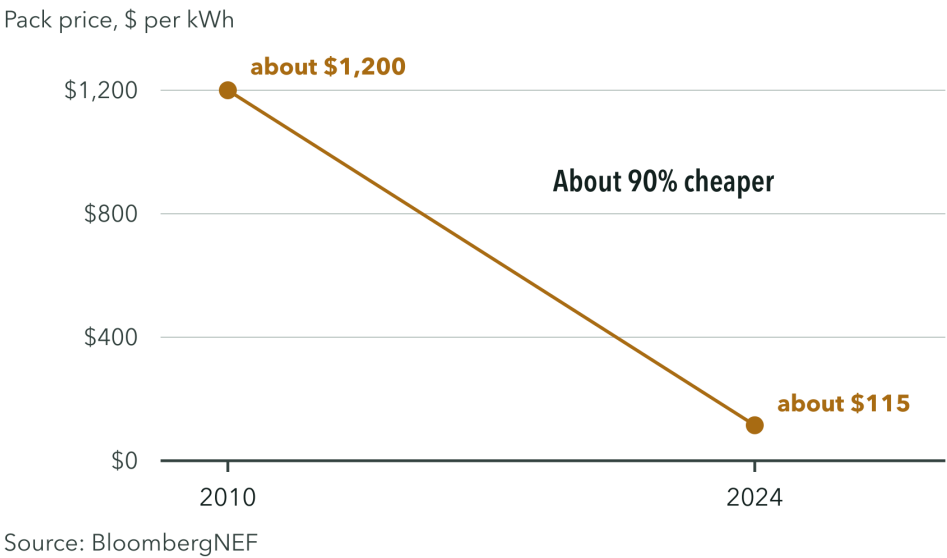


Figure 2. Battery pack prices fell about 90% between 2010 and 2025

Tesla, founded in 2003, bet that batteries were now good enough for an electric car people would *want* to drive. Its 2008 Roadster was expensive and built in tiny numbers, but it made electric aspirational rather than apologetic. Nissan’s LEAF (2010) proved ordinary people would buy one too. Volkswagen, stung by the Dieselgate scandal of 2015, pivoted hard to electric with its 2017 Roadmap E, and other manufacturers followed with electric launches and plans

⁸The Royal Swedish Academy of Sciences, *The Nobel Prize in Chemistry 2019* (press release, 9 October 2019): lithium-ion batteries first entered the market in 1991, and this “lightweight, rechargeable and powerful battery” is used “from mobile phones to laptops”.

⁹BloombergNEF, *Battery pack prices cited below \$100/kWh for the first time in 2020, while market average sits at \$137/kWh* (16 December 2020), for prices above \$1,100 per kWh in 2010; BloombergNEF, *Lithium-ion battery pack prices fall to \$108 per kilowatt-hour despite rising metal prices* (9 December 2025), for the 2025 average and the \$99 battery electric car pack.

of their own.¹⁰

A note on terminology

In this book, “electric vehicle” or “EV” generally means a **battery electric vehicle (BEV)**, which runs entirely on electricity with no combustion engine. We will say so when we mean **plug-in hybrids (PHEVs)**, which have both a battery and a petrol or diesel engine. The charging network serves both, but the dynamics differ. A BEV driver *depends* on the charging network. A PHEV driver merely *prefers* it.

The 2020s: The Decade That Tipped

When the original version of this course was written in 2020, we called the 2020s the *tipping decade* for electric vehicles. Range anxiety, high purchase prices, patchy charging infrastructure and long charging times held EVs back. Falling battery costs, tightening emissions regulation, improving range and growing consumer awareness pushed them forward. Nobody could say which way the balance would fall.

Half a decade on, we can: **the decade tipped.**

¹⁰Tesla Motors, [Form S-1 registration statement](#) (SEC, January 2010): formed in July 2003, Roadster deliveries from early 2008, and only 937 cars sold by the end of 2009; US Department of Energy, [The History of the Electric Car](#) (15 September 2014), for the LEAF's US release in late 2010; US Environmental Protection Agency, [EPA, California notify Volkswagen of Clean Air Act violations](#) (18 September 2015); Volkswagen AG, [Roadmap E: full of energy!](#) (Annual Report 2017), for an electrified version of all some 300 Group models by 2030.

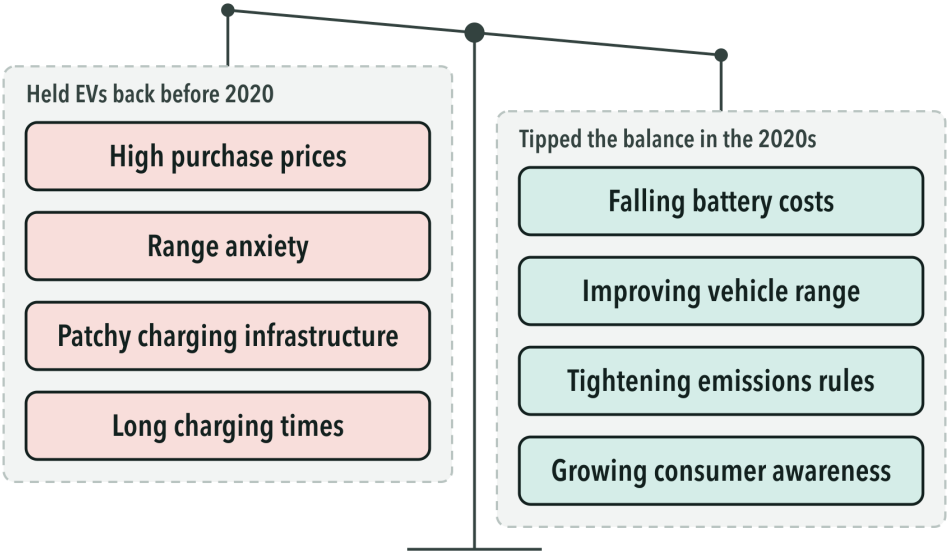


Figure 3. The 2020s tipped the balance decisively toward electric vehicles

The barriers have not disappeared. Range anxiety has shifted from “can I get to work and back?” to “can I drive to Scotland without too much planning?” Charging is brilliant in some areas and frustrating in others. But the trajectory is unmistakable.

By the end of January 2026 the UK had **1.86 million** fully electric cars on the road, and more than 2.86 million plug-in cars including plug-in hybrids. BEVs took **23.4%** of the 2025 market: nearly one in four new cars sold was fully electric. In December 2025 alone, battery electric cars took 32.2% of new registrations, about one in three, and plug-in hybrids took another 11.6%.¹¹

The UK’s public charging network grew from roughly 20,000 charging devices at the end of 2020 to over **88,500** by the end of January 2026, more than a fourfold increase in about five years. More than 18,000 of them are rapid or ultra-rapid (50 kW and above), the high-powered chargers longer journeys

¹¹Zapmap, [EV market statistics 2026](#) (updated 13 February 2026, archived copy): 2,865,284 plug-in cars at the end of January 2026, over 1,860,000 of them battery electric; SMMT, [UK new car market breaches two million as almost one in four buyers go electric](#) (6 January 2026): 473,348 BEVs and 23.4% for 2025, and 32.2% BEV and 11.6% PHEV in December 2025.

need.¹²

And the regulation is locked in. The UK's Zero Emission Vehicle (ZEV) mandate requires manufacturers to make **80% of new car sales zero-emission by 2030**. Miss the target and they face fines of up to £12,000 per non-compliant vehicle (cut from £15,000 in the 2025 ZEV mandate review).¹³ That is not a suggestion. It is a legal obligation with real financial teeth.



The ZEV mandate matters more than you think

The ZEV mandate is the single most important policy driver for the EV charging industry. It guarantees millions more EVs on UK roads over the next five years, whatever happens to oil prices, consumer sentiment or government rhetoric.¹⁴ For a career in EV charging, the mandate is your foundation: the demand is coming whether the market is ready or not.

The Business of Electric Vehicles

The shift to electric is an environmental story: cutting tailpipe emissions from millions of vehicles matters. It is also an enormous economic story, and you need the economics to work in this industry.

¹²Department for Transport, [Electric vehicle charging device statistics: January 2021](#) (10 February 2021): 20,775 public devices on 4 January 2021; Zapmap, [EV charging statistics 2026](#) (updated 26 February 2026, archived copy): 88,513 devices at the end of January 2026, 18,077 of them rapid or ultra-rapid.

¹³HM Government, [Updates to the Vehicle Emissions Trading Schemes \(VETS\) Order 2023](#) (17 October 2025). The 80% target for 2030, and the per-car payment cut from £15,000 to £12,000 from 2025.

¹⁴The UK registered 2,020,520 new cars in 2025 (SMMT, [SMMT Motor Industry Facts 2026](#), July update); mandate targets of 33% in 2026 rising to 80% by 2030 (HM Government, [Updates to the VETS Order 2023](#), 17 October 2025) put well over half a million zero-emission cars a year on the road even at today's market size. The arithmetic is mine.



Misconception: EVs are worse for the planet because of battery manufacturing

The premise is true. The conclusion is not. Building an EV produces more emissions than building a petrol car, and the battery accounts for most of the difference. An EV starts life in carbon debt.¹⁵

Then it pays the debt back. A petrol car burns fuel every mile. An EV draws electricity, and on a grid like the UK's, with coal gone and wind and solar growing, each mile emits far less. Lifecycle analyses, which count manufacturing as well as driving, consistently find lower lifetime emissions for the EV. The International Council on Clean Transportation (ICCT) found that a medium-size battery electric car sold in the EU in 2025 produces 73% lower lifetime emissions than a petrol car, and up to 78% lower on renewable electricity. How fast the debt clears depends on the grid mix and the mileage: a cleaner grid and more miles clear it sooner.¹⁶

The money at stake is large. UK automotive turnover was £85.4 billion in 2025, and the wider industry employs about 830,000 people, 188,000 of them making vehicles (SMMT). Draw the circle wider, to everything a car touches (finance, insurance, fuel, repairs, roads and the taxes on all of it), and Deloitte put the UK's extended mobility ecosystem at about £500 billion of annual turnover in 2014-15, around 15% of the country's gross output. Its next sentence was blunt: the stakes are high. Deloitte expected connected, self-driving and shared cars to drain value from carmakers, from fuel and from the public purse, and to pour it into transport services and technology.¹⁷

Ten years on, we can check (figure below). After inflation, the public sector's take from motoring is down about 16%, because fuel duty has fallen by a third

¹⁵International Council on Clean Transportation (Marta Negri and Georg Bieker), *Life-cycle greenhouse gas emissions from passenger cars in the European Union: A 2025 update* (8 July 2025). Battery electric cars have about 40% higher production emissions than petrol cars, because of the battery.

¹⁶Department for Energy Security and Net Zero, *UK Energy in Brief 2025*: the last coal power station, Ratcliffe-on-Soar, closed on 30 September 2024, and offshore wind and solar capacity grew; ICCT (8 July 2025, as above): 73% lower life-cycle emissions for a medium battery electric car sold in the EU in 2025, up to 78% on renewable electricity, with the extra production emissions offset after about 17,000 km.

¹⁷SMMT, *SMMT Motor Industry Facts 2026* (July update): £85.4 billion automotive turnover, 830,000 employed and 188,000 in manufacturing in 2025; Deloitte (Bornstein, Rakow and Clemente), *Development of self-driving vehicles in the United Kingdom* (Deloitte Insights, 6 April 2017), for the £500 billion, the 15% of gross output and "The stakes are high"; Deloitte (Corwin, Vitale, Kelly and Cathles), *The future of mobility* (24 September 2015), for the expected value shifts.

in real terms.¹⁸ The government expects fuel duty to fall to “near zero by 2050” and will charge electric cars 3p a mile from April 2028 to fill part of the gap.¹⁹ Household spending on fuel is down too, but in price, not in litres: the UK still burns as much petrol and diesel as it did in 2014–15. Everywhere else the money has held or grown. Making cars shrank, while selling, financing, leasing and repairing them grew; car finance alone supported £55 billion of purchases in 2025.²⁰ The disruption Deloitte described is real. It has simply not arrived at scale yet, and public charging, at roughly 1.4 TWh a year, perhaps £1 billion at the pump on Zapmap’s figures, is still small beside the £34 billion households spent on fuel in 2025.²¹ That gap is the opportunity this book is about.

¹⁸My estimate, in 2014–15 prices using the ONS GDP deflator (series YBGB). Fuel duty fell from £27,156 million in 2014–15 to £24,360 million in 2024–25 (HMRC, [HMRC tax receipts and National Insurance contributions for the UK](#)), a third lower in real terms. The public sector total adds Vehicle Excise Duty, an estimate of VAT on fuel and car purchases, and roads spending (HM Treasury, [Public Expenditure Statistical Analyses 2026](#)). Appendix E lists every source behind the figure.

¹⁹HM Treasury, [The introduction of electric Vehicle Excise Duty \(eVED\): consultation response](#) (July 2026), for “near zero by 2050”; HM Treasury and HMRC, [Electric Vehicle Excise Duty \(eVED\)](#) (policy paper, 13 July 2026), for 3p a mile from 1 April 2028.

²⁰HMRC, [Hydrocarbon Oils Bulletin](#) (tables to June 2026): road fuel volumes in 2024–25 matched 2014–15; ONS, [Annual Business Survey](#) (2024 results, 26 May 2026), for sector turnover; Finance and Leasing Association, [Consumer car finance new business volumes grew by 2% in 2025](#) (5 March 2026), for £55 billion.

²¹Zapmap and Green Finance Institute, [EV charging utilisation report](#), edition 3 (11 May 2026): 350 GWh delivered in Q4 2025, about 1.4 TWh a year at that rate; Zapmap, [Zapmap Price Index](#) (September 2026): 54p per kWh on slower chargers and 79p on rapid ones, which puts that energy at roughly £1 billion; ONS, [Consumer Trends](#), series CDDY (30 September 2026): £33,974 million household spending on vehicle fuels in 2025.

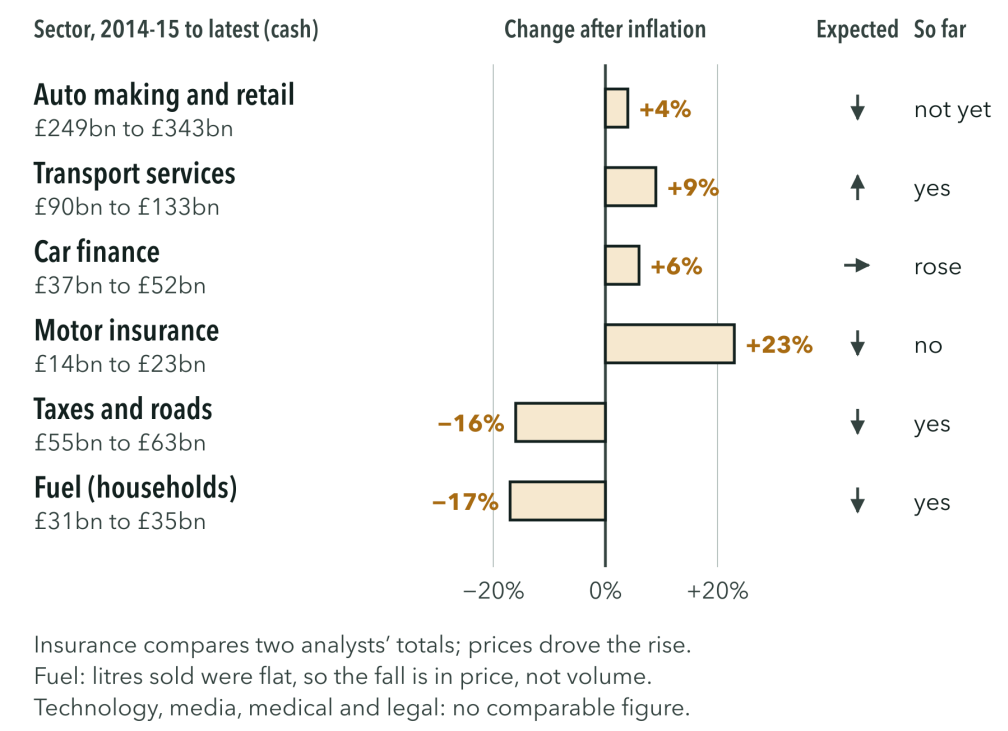


Figure 4. Deloitte's 2014-15 mobility sectors ten years on: the change in turnover after inflation, the direction Deloitte's analysis expected as cars became connected, self-driving and shared, and what has happened so far (sources in Appendix E)

The cause is a mega trend called **e-mobility**, made of four interlinked forces known as **CASE**.²²

- **Connected:** Vehicles are becoming always-online computing platforms. A modern EV sends telemetry to its manufacturer, receives over-the-air software updates and talks to charging infrastructure in real time.
- **Autonomous:** Self-driving technology is advancing steadily, and EVs are its natural platform: a simpler drivetrain, plenty of power for sensors and computers, and a software-centric architecture.
- **Shared:** Car clubs, ride-hailing and mobility-as-a-service platforms are growing, particularly in cities. A shared vehicle that works all day needs charging more often than one that sits on a driveway, so shared fleets matter disproportionately to charging infrastructure.

²²Daimler, [CASE: Intuitive Mobilität](#) (archived January 2022). The carmaker's framing of Connected, Autonomous, Shared and Electric as the forces reshaping the industry.

- **Electric:** The shift from fossil fuels to electricity as the energy source for transport. This book is about this one, but all four reinforce each other.

E-mobility covers all transport, from electric micro-scooters and e-bikes through cars to vans, trucks and buses, plus the ecosystem behind the CASE model. Charging infrastructure is a central piece of it, connected to everything else (see [Chapter 3: The EV Charging Network](#)).

The Value Chain Is Shifting

Over the last decade the CASE ecosystem has tried, tested and often discarded one business model after another. One of the biggest challenges is **scale**.

E-mobility is a substitution technology. It replaces the internal combustion engine, which has moved goods and people for over a century. Supply chains, fuel distribution, maintenance, the skills base, consumer habits: all of it is built around combustion. That does not change overnight.

Regulation has driven the switch: the ZEV mandate, clean air zones, company car tax incentives.²³ So have consumers drawn by lower running costs, zero tailpipe emissions, an increasingly superior driving experience and, let us be honest, the sheer fun of instant torque. But until recently the volumes were small, and most e-mobility business models are low margin and need scale to make money.

That left the pioneers with a painful dilemma. Chargemaster, Ecotricity (which built the Electric Highway) and Pod Point invested heavily in infrastructure when there were few EVs on the road. They built ahead of demand, burned cash and hoped the vehicles would come. Some survived. Some did not. Gridserve eventually bought Ecotricity's Electric Highway and invested heavily in upgrading and expanding it.²⁴

²³HM Government, *Updates to the VETS Order 2023* (17 October 2025), for the mandate; GOV.UK, [Drive in a clean air zone](#), for the charging zones in English cities; GOV.UK, [Calculate tax on company cars](#), which keeps electric cars outside the optional remuneration (salary sacrifice) rules.

²⁴BP, [BP to acquire the UK's largest electric vehicle charging company](#) (28 June 2018), on Chargemaster's network of over 6,500 charge points; What Car?, [Best home EV chargers on sale in 2026](#) (updated 21 August 2026), on Pod's founding in 2009; EV Infrastructure News, [Ecotricity "hands the baton" to GRIDSERVE as it acquires the Electric Highway](#) (9 June 2021), on the network's founding about a decade earlier, the sale, and Gridserve's plan to replace every charger.

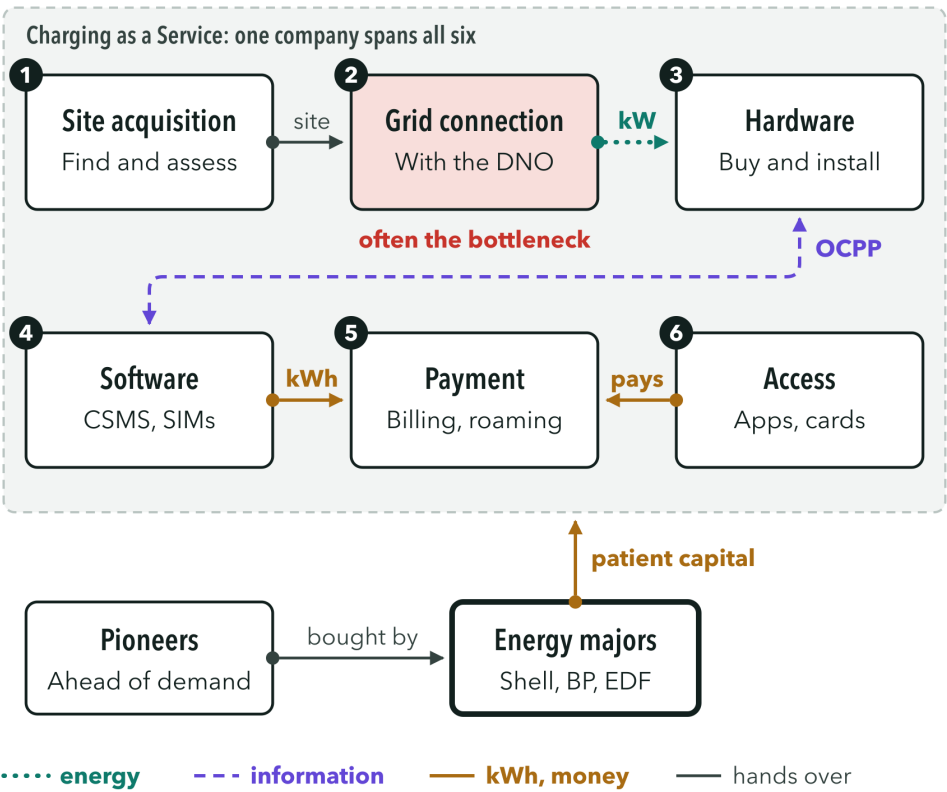


Figure 5. The EV charging value chain, from infrastructure to operations

The Charging Value Pipeline

To see where value is created and where the money flows, picture the charging business as a pipeline with distinct stages:

1. **Site acquisition and feasibility:** Finding locations, negotiating access, assessing power supply and modelling commercial viability. It is surprisingly complex. A great location with too little grid capacity is useless. So is one with abundant power and no passing traffic.
2. **Grid connection:** Securing enough electrical capacity from the local Distribution Network Operator (DNO). This can be slow, especially for high-power sites, and the cost ranges from very little for a small site to £250,000 or more for a hub. It is often one of the biggest bottlenecks in

deploying charging infrastructure.²⁵

3. **Hardware procurement and installation:** Choosing, buying and installing the charge points. The hardware has matured enormously: ABB, Kempower, Alfen and dozens of others make everything from wall-mounted units for homes and businesses to DC systems of several hundred kilowatts.²⁶
4. **Software and connectivity:** The Charging Station Management System (CSMS) that monitors, controls and manages the chargers, plus the connectivity layer (SIM cards, modems, network management) that keeps everything talking to the backend.
5. **Payment and billing:** Processing transactions, managing subscriptions, settling roaming between operators, and the unglamorous but essential job of getting money from the driver's bank account to the operator's.
6. **Access and customer experience:** The apps, RFID cards, contactless payment terminals, wayfinding signage and support phone lines. Everything that makes a driver's experience smooth or infuriating.

Some companies do only hardware, some only software, some only installation. The most ambitious try to span the whole chain and offer what the industry calls **Charging as a Service (CaaS)**. It is a turnkey deal: a site host (say, a supermarket or a hotel) gets chargers installed and operated without needing to understand the complexity underneath.

Why the Energy Majors Moved In

Building a charging network takes patient capital and a tolerance for early losses, and the energy majors have both. Shell, BP and EDF bought their way in between 2017 and 2025; [Appendix B](#) has the deals.²⁷

²⁵HM Government (OZEV), *Taking charge: the electric vehicle infrastructure strategy* (March 2022), p. 48: connecting chargepoints “can be an expensive and often slow process”, and connection costs were the second most quoted barrier in a survey of local authorities; Savills, *EV Charging: Maximising Opportunity* (Autumn 2024): £250,000 to £1,000,000 for the power a hub of 8 to 24 bays needs.

²⁶ABB E-mobility, *Car charging and truck charging* product range; Alfen, *EV charging* (home, business and public solutions); Kempower, *DC fast charging solutions*, with systems from 560 kW to over 1 MW for heavy vehicles.

²⁷Tech.eu, *Shell acquires Dutch electric vehicle charging network NewMotion* (12 October 2017); BP, *BP to acquire the UK's largest electric vehicle charging company* (28 June 2018); Pod, *EDF completes acquisition of Pod* (4 August 2025).

The EV Charging Industry Is No Longer a Niche

Take stock. Electric vehicles are not coming: they are here, and the mandate and the charging network say they are staying.

Four kinds of player are fighting over the market ([Appendix B](#) names the operators). Energy majors: Shell, BP, EDF, TotalEnergies. Automotive OEMs: Tesla, and carmakers including Volkswagen, BMW and Mercedes-Benz through their IONITY joint venture. Technology companies, providing the software platforms that tie everything together. And financial investors backing networks for the long term: Global Infrastructure Partners, part of BlackRock, in IONITY; TPG and Infracapital in Gridserve.²⁸

It is also an industry with real careers. Every new charging hub needs people to plan, build, commission, operate, maintain and improve it. Every CSMS needs product managers, software engineers and data analysts. Every CPO needs operations managers, customer service teams and commercial leads. Every eMSP needs designers, marketers and partnership managers.



What this means for you

You might join a CPO, an eMSP, an energy company or a technology provider. Wherever you land, understanding the full ecosystem, from the SIM card in a charger to the regulatory framework governing it, is what separates someone who can do a job from someone who can shape the industry. That is what this book is for. The chapters that follow cover the market, the structure of a charging network, the roles that run it, and the data and relationships that hold it together.

Chapter Summary

- Electric vehicles are not new. Around a third of the cars on America's roads in 1900 were electric, until cheap petrol and mass-produced com-

²⁸Zapmap, [Rapid charging: Top 10 network pricing](#) (updated 5 October 2026), which lists Tesla's open locations among the largest rapid networks; IONITY, [About IONITY](#): a joint venture of BMW Group, Ford, Hyundai Motor Group, Kia, Mercedes-Benz and Volkswagen Group with Audi and Porsche, with Global Infrastructure Partners, part of BlackRock, as financial investor; Zapmap, [GRIDSERVE raises £100m in new capital from existing shareholders](#) (17 July 2025), capital committed by TPG, Infracapital and Mitsubishi to support "long-term opportunities"; Zapmap, [TotalEnergies and Transport for London to roll-out EV chargers](#) (20 February 2026), on TotalEnergies' contract for up to 43 rapid and ultra-rapid chargers in London.

bustion cars displaced them.

- The revival began in the 2000s, driven by improvements in lithium-ion batteries first developed for consumer electronics.
- The 2020s were the tipping decade: the UK now has 1.86 million fully electric cars on the road, BEV market share reached 23.4% in 2025, and the public charging network passed 88,500 charging devices.
- The ZEV mandate requires 80% of new car sales to be zero-emission by 2030, a regulatory guarantee of continued growth.
- Four forces define the e-mobility disruption: Connected, Autonomous, Shared and Electric (CASE).
- The charging value chain spans site acquisition, grid connection, hardware, software, payment and access, and different companies focus on different stages.
- Energy majors (Shell, BP, EDF) have entered through major acquisitions, bringing patient capital and long time horizons.
- EV charging is no longer a niche. It is a large and growing market with careers in technology, operations, commercial and customer-facing roles.

Chapter 2: The EV Market Landscape

ALLIANCE, n. In international politics, the union of two thieves who have their hands so deeply inserted in each other's pockets that they cannot separately plunder a third.

Ambrose Bierce, *The Devil's Dictionary* (1911)

The EV market is not one market. It is three markets colliding, and to make sense of it you need to know where you sit, who your neighbours are and where the boundaries are blurring.

Picture a wedding where three large families meet for the first time. Goodwill, awkwardness, misunderstandings, and the occasional territorial dispute over who sits where. That is transport, energy and technology right now, except the stakes run to billions of pounds, not seating arrangements.

Three Sectors, One Disruption

Electric vehicles hit three sectors at once (transport, energy and technology), each with its own history, culture and assumptions about how the world works. EV charging sits where they meet.

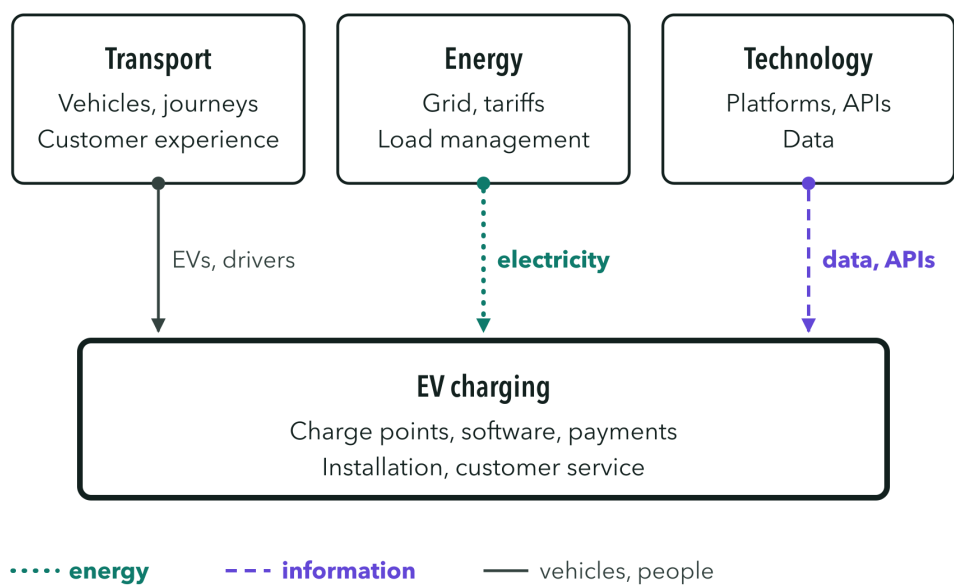


Figure 6. Three sectors colliding: EV charging sits where transport, energy and technology meet

The Transport Sector

Transport covers vehicle manufacturers (OEMs, or Original Equipment Manufacturers), dealerships, leasing companies, fleet operators, and the vast aftermarket of parts, maintenance and accessories. For over a century its skills, supply chains and business models have assumed a petrol or diesel engine with thousands of moving parts that need regular servicing.

Electric breaks that assumption. A battery electric drivetrain has a small fraction of the moving parts of a combustion engine and gearbox. No oil changes, no timing belts, no exhaust systems, no clutches. Less to service is great for the driver, and hard on the dealerships and independent garages built on servicing revenue.

Meanwhile the car is becoming a software platform. The industry likes to call cars “computers on wheels”. The phrase is overused, but true. Modern EVs take over-the-air updates that improve performance, add features and fix bugs without a workshop visit. The car is a connected device, and that changes charging in ways we will see throughout this book.

The Energy Sector

Energy has its own upheaval: electricity generators, transmission owners (National Grid, SP Transmission and SSEN Transmission in Great Britain), distribution network operators (DNOs such as UK Power Networks, National Grid Electricity Distribution (formerly Western Power Distribution) and SP Energy Networks), and retail energy suppliers.¹

The grid was built to move power one way: from large centralised power stations, through high-voltage transmission lines and distribution networks, into homes and businesses. It was emphatically *not* built to fuel transport. Millions of EVs, each drawing several kilowatts for hours at a time while charging, are an enormous challenge and a vast commercial opportunity.

The challenge is simple. If millions of people come home at 6pm and plug in, the spike could overwhelm local distribution networks. So smart charging (scheduling and modulating sessions around grid conditions) is an operational necessity, not a nice-to-have: since 2022 new home and workplace charge points in Great Britain must come set to charge outside the weekday peaks of 8am to 11am and 4pm to 10pm, unless the owner changes it.² We cover it in detail later.

The opportunity is as big: a huge new source of demand, and part of it is flexible. A kettle or a television draws power the moment you turn it on. An EV that needs a full battery by 7am can draw its energy at any point overnight. That makes EVs a potential tool for grid balancing: soaking up cheap, abundant renewable energy when the wind blows or the sun shines, and backing off during peaks. Vehicle-to-grid (V2G) goes further, letting vehicles export stored energy back to the grid when demand is high.

The Technology Sector

Technology brings the platforms, APIs and data: CSMS vendors, payment processors, app developers and the mobile networks that connect every charger.

¹Ofgem, [Electricity transmission infrastructure: what's changed](#) (13 December 2024), for the three transmission owners; Ofgem, [RIIO-2 Electricity Distribution Summary Annual Report 2023-24](#) (April 2025), for the DNO groups; Companies House, [National Grid Electricity Distribution \(West Midlands\) plc](#) (company 03600574), named Western Power Distribution (West Midlands) plc until 20 September 2022.

²[The Electric Vehicles \(Smart Charge Points\) Regulations 2021](#) (SI 2021/1467), regulation 10: pre-set default charging hours outside peak hours, defined as 8am to 11am and 4pm to 10pm on weekdays, which the owner can accept, change or remove.

Its instincts come from software: ship fast, update over the air, and treat every device as connected. To a technologist, a charge point is an IoT device with a very large power supply.

Where They Meet: EV Charging

Where transport, energy and technology meet, drawing talent and capital from all three, sits EV charging: the charge points, the software that manages them, the payment systems that monetise them, the teams that install them, and the customer service behind the drivers.

The sector has grown fast. ChargeUK's members alone have committed more than £6 billion of investment by 2030, and it has its own trade bodies, conferences, jargon and recruitment problems.³ If you are reading this, you probably work in it or plan to.

Where do you sit?

Come from transport and you probably think about vehicles, journeys and customer experience. From energy, grid capacity, tariffs and load management. From technology, platforms, APIs and data. The most effective people in EV charging think across all three. Helping you do that is one of this book's aims.

The Blurring of Boundaries

What makes EV charging fascinating, and complicated, is that these boundaries are dissolving fast.

Shell is both an energy company and a Charge Point Operator. Tesla is both a vehicle manufacturer and a charging network operator. Octopus Energy sells electricity tariffs, home chargers, and public charging access through its Electroverse app. Gridserve develops solar farms, runs its own charging network and has a vehicle leasing business. MFG (Motor Fuel Group), which

³ChargeUK, [ChargeUK](https://www.chargeuk.co.uk/) (home page): "Over £6bn in investment by 2030" from the trade association's members, who "operate tens of thousands of public chargers".

runs some 1,200 petrol station forecourts, has deployed EV chargers as part of its transition strategy.⁴

Cross-sector integration is accelerating. Companies are expanding from one sector into the next, through acquisition (Shell buying ubitricity) or organic growth (Octopus building its charging business from scratch). Your competitor today might be your partner tomorrow, and the winners work across the old sector lines.

Who runs which network changes every year, so the operator profiles and the timeline of the 2020s consolidation live in [Appendix B](#). This chapter sticks to what lasts: the segments.

Charging Segments

How long a car stays sets how much power a charger needs, and that one trade decides the economics of every segment below. Each segment has its own users, technology and competition.

Home Charging

Most EV charging happens at home: the government's 2022 infrastructure strategy, *Taking charge*, expects the vast majority of drivers to do most of their charging there, overnight.⁵ A driver with a driveway and a home charger (typically a 7 kW unit costing around £900 installed)⁶ plugs in on getting home, charges overnight on a cheap tariff, and leaves with a full battery. Convenient, cheap, and no contact with public infrastructure.

The business model is straightforward: sell the hardware, install it, and optionally provide ongoing software services. Pod (formerly Pod Point), Ohme,

⁴ubitricity, [Shell agrees to buy ubitricity](#) (25 January 2021); Zapmap, [Rapid charging: Top 10 network pricing](#) (updated 5 October 2026), on Tesla's network; Octopus Energy, [Explore our EV chargers](#) and [Octopus Energy's Electroverse skyrockets to 1 million public EV chargers](#) (press release), on Electroverse's launch in summer 2020; GRIDSERVE, [Sun-to-Wheel energy explained](#) (28 March 2023), on its hybrid solar farms, charging network and GRIDSERVE Car Leasing; Electrifying.com, [MFG hits 1,000 ultra-rapid chargers](#) (14 July 2025), on MFG's 1,200-site portfolio and its EV Power network.

⁵HM Government (OZEV), [Taking charge: the electric vehicle infrastructure strategy](#) (March 2022), p. 5.

⁶Which? (Dino Buratti), [Electric car charging at home](#) (25 February 2026): a home charger typically costs £500 to £1,200 to buy and install, and a 7 kW unit around £900.

Hypervolt, Andersen, myenergi and Wallbox are among the best-known home charger brands in the UK.⁷

Home charging sets the baseline. Drivers who charge at home expect charging to be easy, cheap and reliable, and they measure public charging against that. It does not always compare well.

Workplace Charging

Workplace charging complements home charging. For drivers who park at work all day, an AC charger has the whole working day to deliver its energy. Employers install chargers as a benefit (like cycle-to-work schemes), for their sustainability commitments, or to support company fleet vehicles.

The economics often work: the employer can claim capital allowances on the installation, the electricity is relatively cheap (especially with solar panels on the building), and the chargers help recruit and retain staff. Salary sacrifice schemes, where employees lease an EV through their employer with favourable tax treatment, bring more EVs into the staff car park.⁸

Destination Charging

Destination charging serves drivers while they do something else: shopping, eating, staying at a hotel, visiting a leisure centre. The charger is an amenity, not the destination. Power is matched to the expected dwell time: Savills puts destination sites such as hotels, retail parks, leisure sites and offices at 7 to 100 kW, for stays of one to eight hours.⁹

Site hosts' business models vary. Some see chargers as a footfall driver: "come to our shopping centre, charge your car for free while you shop." Others charge per kWh and earn revenue from the electricity. Some take a revenue share with a CPO, who installs and operates the chargers for a cut of the charging income.

⁷What Car?, [Best home EV chargers on sale in 2026](#) (updated 21 August 2026): a survey of 6,231 owners ranking Hypervolt, Wallbox, Ohme, myenergi and Pod, and naming Andersen among the brands that "might already ring a bell"; EV Infrastructure News, [Pod Point rebrands to launch new charging service offer](#) (28 May 2025).

⁸GOV.UK, [Claim capital allowances: first-year allowances](#): 100% first-year allowance on new equipment for electric vehicle charge points bought before April 2027; GOV.UK, [Calculate tax on company cars](#), which keeps electric cars outside the optional remuneration (salary sacrifice) rules.

⁹Savills, [EV Charging: Maximising Opportunity](#) (Autumn 2024), "Types of charging hubs": destination sites with dwell times of 1 to 8 hours and chargers of 7 to 100 kW.

On-Street and Residential Charging

This serves the roughly 30% of car-owning households in England that have no off-street parking.¹⁰ Live in a terraced house in London, Manchester or Edinburgh and you park on the street. A cable trailed across the pavement is a trip hazard and may breach highways law, though some councils now permit cable channels set into the pavement.¹¹

The options include lamppost-integrated chargers (the approach of ubitricity, now owned by Shell), bollard-style units, pop-up chargers that retract into the pavement, and dedicated on-street bays with wall-mounted or post-mounted units. Power is modest (Savills puts urban residential charging below 7 kW, for stays of eight hours or more), enough for an overnight charge.¹²

It is one of the hardest segments to deploy (planning permissions, pavement excavation, often a new electricity supply) and one of the most important for equitable access to the EV transition.

Rapid Hubs

Rapid hubs are the workhorses of public charging. Usually at retail parks, supermarkets or dedicated charging sites, they offer 50 to 150 kW DC charging that can add 100 miles of range in somewhere between 10 and 45 minutes, depending on the power.¹³ InstaVolt, Osprey and BP Pulse are strong here.¹⁴

Pricing is per kWh: UK rules require the total price at a public charge point to be shown in pence per kWh.¹⁵ The economics hinge on utilisation: how many

¹⁰HM Government (OZEV), [Taking charge](#) (March 2022), p. 20: around 70% of households with a vehicle in England have access to private, off-street parking.

¹¹Department for Transport, [Cross-pavement solutions for charging electric vehicles](#) (24 December 2024): trailing cables “can cause a trip hazard” and “may amount to a breach of Part IX of the Highways Act 1980”; the decision to permit cross-pavement solutions rests with the local authority.

¹²ubitricity, [Shell agrees to buy ubitricity, a leading provider of on-street charging for electric vehicles](#) (25 January 2021), on lamp posts and bollards; Urban Electric Networks, [Pop up EV charging hubs](#) (home page); Savills, [EV Charging: Maximising Opportunity](#) (Autumn 2024), which puts urban residential charging below 7 kW with dwell times of eight hours or more.

¹³BP, [BP to acquire the UK's largest electric vehicle charging company](#) (28 June 2018): 150 kW chargers deliver “100 miles of range in just 10 minutes”; Savills, [EV Charging: Maximising Opportunity](#) (Autumn 2024), Figure 1: 97 to 169 miles in 45 minutes from a 50 to 149 kW charger.

¹⁴Zapmap, [Rapid charging: Top 10 network pricing](#) (updated 5 October 2026), which counts InstaVolt among the ten largest rapid networks; Osprey Charging, [Delivering exceptional reliability](#) (18 August 2025); bp pulse, [Pricing for public EV charging](#) (accessed October 2026), with rapid and ultra-fast tariffs.

¹⁵[The Public Charge Point Regulations 2023](#) (SI 2023/1168), regulation 11: the total price must be clearly displayed in pence per kilowatt hour.

hours a day each charger is in use. A rapid charger idle most of the day loses money. One that is busy for a good part of the day can make a healthy profit.

Ultra-Rapid and Highway Charging

For en-route charging (drivers on motorways or A-roads who need range fast), the chargers are ultra-rapid. Savills counts anything above 150 kW as ultra-rapid, puts en-route hubs at 100 to 450 kW for stays of 30 minutes at most, and notes a significant rise in ultra-rapid installations.¹⁶

Gridserve, IONITY, Tesla Supercharger and Fastned compete here.¹⁷ Capital costs are high (the grid connection alone for a hub of 8 to 24 bays can cost £250,000 to £1 million, before the chargers), but so is the revenue potential at premium, high-throughput locations.¹⁸

Fleet and Depot Charging

Commercial fleet operators (delivery companies, bus operators, logistics firms, emergency services) need guaranteed availability, managed charging schedules to minimise energy costs and grid impact, and integration with fleet management systems. Depot charging mixes slower overnight charging with high-power top-ups, and electric buses and trucks need the most power.

Heavy-Duty and Megawatt Charging (up to 3,750 kW)

The frontier. The Megawatt Charging System (MCS) is built for heavy-duty trucks and buses and is specified up to 1,250 V and 3,000 A, or 3,750 kW. At that power, a long-haul electric truck could charge during the 45-minute break a driver must take after four and a half hours at the wheel. The technology is still early, but it is the future of heavy-duty electrification. CharIN, the industry association, has driven the MCS specification, which the IEC has now published as IEC TS 63379.¹⁹

¹⁶Savills, *EV Charging: Maximising Opportunity* (Autumn 2024), Figure 1 (ultra-rapid above 150 kW), Figure 2 and “Types of charging hubs” (en-route hubs of 100 to 450 kW, dwell time 30 minutes at most).

¹⁷GRIDSERVE, *About us*, on its Electric Super Hubs on motorways; IONITY, *About IONITY*; Zapmap, *Rapid charging: Top 10 network pricing* (updated 5 October 2026), on Tesla’s open locations; Fastned, *Help Fastned get locations for new charging stations*, on its highway hubs.

¹⁸Savills, *EV Charging: Maximising Opportunity* (Autumn 2024): 800 kVA to 2 MVA for a hub of 8 to 24 bays, “costing in the region of £250,000 to £1,000,000”.

¹⁹CharIN, *Megawatt Charging System (MCS)*: a maximum of 1,250 V and 3,000 A DC, and the official publication of IEC TS 63379; GOV.UK, *Drivers’ hours: goods vehicles*, section 1.4: a break of at least 45 minutes after no more than 4.5 hours of driving.

The UK Market in Numbers

The numbers that define the UK market as of early 2026:²⁰

- **87,796** public charging devices at the end of 2025, holding **116,052** chargers (EVSEs), each able to charge one car at a time
- **18,077** rapid or ultra-rapid devices (50 kW and above) by the end of January 2026
- **1.86 million** fully electric cars on UK roads at the end of January 2026
- **2.86 million+** plug-in cars, including plug-in hybrids
- **23.4%** BEV market share for full year 2025
- **473,348** new BEVs registered in 2025
- **14,316** new charging devices added in 2025 alone, a 19.5% increase in one year
- **~5.4%** of all cars on UK roads are now fully electric

Growth continues, though more slowly than the mandate asks. SMMT's spring 2026 outlook expected battery electric cars to take 26.8% of new sales in 2026 and 32% in 2027, short of the mandate targets of 33% and 38%.²¹ Every one of those cars will need to charge, and that infrastructure is the subject of this book.

Putting it in perspective

At the end of 2020 the UK had about 20,000 public charging devices and about 206,000 fully electric cars: roughly one device for every 10 cars. By early 2026, with about 88,000 devices and 1.86 million fully electric cars, it was roughly one for every 21.²² The network is growing, but the fleet is

²⁰Department for Transport, [Electric vehicle public charging infrastructure statistics: January 2026](#) (26 February 2026): 87,796 devices and 116,052 chargers on 1 January 2026; Zapmap, [EV charging statistics 2026](#) (updated 26 February 2026, archived copy): 18,077 rapid or ultra-rapid devices at the end of January 2026; Zapmap, [EV market statistics 2026](#) (updated 13 February 2026, archived copy): over 1,860,000 battery electric cars and 2,865,284 plug-in cars at the end of January 2026, about 5.4% of the car parc; SMMT, [UK new car market breaches two million as almost one in four buyers go electric](#) (6 January 2026): 473,348 new BEVs, 23.4% of the market; Zapmap, [Zapmap releases 2025 EV charging statistics](#) (press release, January 2026): 14,316 new charge points in 2025, a 19.5% increase. (The release's own table gives a net 14,097 and 19.1%.)

²¹SMMT, [Industry investment drives new EV milestone](#) (8 May 2026).

growing faster. That gap, and the industry's race to close it, is one of the central tensions in EV charging.

Chapter Summary

- The EV market sits where three sectors meet (transport, energy and technology), with EV charging where they meet, and the boundaries are blurring fast.
- The operators, and the consolidation since 2017 that shaped them, are in Appendix B, because that list changes fast.
- How long a car stays sets the power a charger needs, and with it each segment's economics. Segments run from the home charger on the driveway to megawatt charging of up to 3,750 kW for heavy trucks.
- By early 2026 the UK had about 88,000 public charging devices (116,052 chargers) and 1.86 million fully electric cars, with the network growing about 19.5% a year.
- Know your segment, your competitors and your partners.

²²Department for Transport, [Electric vehicle charging device statistics: January 2021](#) (10 February 2021): 20,775 public devices on 4 January 2021; Zapmap, [UK EV market share tops 10% for 2020](#) (6 January 2021): approximately 206,000 battery electric vehicles on UK roads at the end of 2020. The ratios are my arithmetic.

Chapter 3: The EV Charging Network

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Wider EV Ecosystem

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Three Layers of an EVCN

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Business Layer

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Operations Layer

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Technology Layer

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The EVCN at a Glance

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Eight Actors

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

How the Layers Connect to the Actors

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

From Theory to Practice

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 4: CPO and eMSP: The Two Roles That Run Everything

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Charge Point Operator (CPO)

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What a CPO Needs to Operate

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

CPO Business Models

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

CPO Obligations Under UK Regulation

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The e-Mobility Service Provider (eMSP)

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What an eMSP Provides

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Blurring of Boundaries

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Who Plays Which Role?

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The eMSP Revenue Model

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Looking Ahead: The Evolution of Roles

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 5: The Site Host: Whose Land Is It Anyway?

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Many Faces of the Host

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Five Deal Shapes

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Who Sets the Tariff

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Lease

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

How CPOs Choose Sites

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Rules That Land on the Landowner

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What the Host Needs From the CSMS

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 6: Data Types and Relationships

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Key Data Types in an EVCN

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Location Data

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

EVSE Data

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Session Data

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Charge Detail Records (CDRs)

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Tariff Data

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

User and Token Data

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Firmware and Configuration Data

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Diagnostics Data

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Energy and Grid Data

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Entity Relationships

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

How Data Flows in Practice: A Charging Session Walk-Through

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Simplest Version: One Company

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

One Change: Someone Else's Card

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Key Identifiers

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Data Quality and Governance

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

From Data to Insight

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Part 2: Charging Operations

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 7: Charging Fundamentals

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What's Really Happening Between These Two Things?

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

AC vs DC Charging

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Onboard Charger

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The DC Shortcut

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Why Both Matter

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Power Levels

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

IEC 61851 Charging Modes

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Connector Types

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Type 2 (Mennekes)

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

CCS Combo 2

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

CHAdeMO

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Tesla NACS

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

MCS (Megawatt Charging System)

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Control Pilot: How Charger and Vehicle Talk

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Duty Cycle: Encoding Available Current

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Proximity Pilot

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Vehicle Architectures: 400V vs 800V

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Emerging Charging Technology

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Megawatt Charging System (MCS)

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Battery-Buffered Charging

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Liquid-Cooled Cables

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 8: The IoT Backbone

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Charge Station as a Connected Device

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Hops 2 to 7: Inside the Charger

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Hops 2 to 5: From Message to Packets

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Hop 4 Fails Quietly

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Hop 6: The Modem

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Hop 7: The Antenna

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Signal Strength: Understanding dBm

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Hops 8 and 9: The Mobile Network

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The SIM Card

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Rise of eSIMs

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Generational Shift

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Network Architecture

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Bandwidth and Latency

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Data Costs

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Hop 10: Watching the Chain from the CSMS

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Connectivity Monitoring

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Device Registry

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Alerting

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Offline Operation: When the Air Fails

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 9: The EV Protocol Zoo

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

A Tower of Babel, Solved

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPP: The Language Chargers Speak

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

How OCPP Works: The Transport Layer

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Message Structure

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPP 1.6J: The Foundation

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Messages

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

A Charging Session, Message by Message

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPP 2.0.1: The Modern Standard

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Key Architectural Changes

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

New Capabilities

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPP 2.1: The Cutting Edge

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPI: The Roaming Protocol

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

ISO 15118: The Vehicle Protocol

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Plug & Charge Concept

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

ISO 15118-2 vs ISO 15118-20

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

How the Protocols Fit Together

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Convergence Trend

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Real-World Complexity

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 10: The Charging Station Management System

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Head Office

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What Does a CSMS Actually Do?

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Device Management

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Transaction Management

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

User and Token Management

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Smart Charging

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Roaming Integration

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Reporting and Analytics

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Buy or Build

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Open Source as a Learning Tool

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Architecture Patterns

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Multi-Tenant SaaS

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Single-Tenant

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

On-Premise

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Microservices vs. Monolith

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Importance of APIs

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

CSMS and OCPP Versions

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Fleet Management Features

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The CSMS in Context

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Choosing a CSMS: What to Look For

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 11: Roaming & Interoperability

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Vodafone Problem

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What Roaming Actually Means

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

How Roaming Works End-to-End

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPI: The Roaming Protocol

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPI Modules

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPI 2.2.1: The Current Standard

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPI 2.3: What Is New

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Protocol Landscape: OCPI vs OICP vs eMIP

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Convergence Story: Hubject Joins OCPI

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Roaming Hubs: The Exchanges

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Business Case for Roaming

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

For CPOs

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

For eMSPs

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Challenges in Roaming

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Tariff Transparency

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Real-Time Availability

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Cross-Border Billing

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Session Reliability

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Data Quality

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Future of Roaming in a Contactless World

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What This Means for You

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Worked Example: One Session, Module by Module

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 12: A Multi-Faceted Computer System

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Not an Electrical Box, a Computer

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What's Inside: The Hardware Architecture

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Main Controller

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Power Electronics

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Metering Unit

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Human Interface

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Connectivity Module

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Local Storage

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Multiple Processes, One Machine

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Logging and Diagnostics: Your Forensic Evidence

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Types of Logs

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Retrieving Logs

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Log Storage and Retention

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Common Log Patterns That Signal Problems

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Firmware Management: The Soul of the Device

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What Firmware Updates Deliver

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Update Process via OCPP

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Risks

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Best Practices for Firmware Rollouts

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Over-the-Air Is the Norm

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Observability: Seeing Inside the Machine

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Key Metrics

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Distributed Tracing

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Anomaly Detection

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Digital Twins

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Human Interface in Depth

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Screens and Displays

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Contactless Payment

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Accessibility

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Surviving the Elements

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

IP Ratings

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Temperature

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Physical Durability

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 13: Billing for the EV Space

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

How Hard Can It Be?

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Pricing Models

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Per kWh (Energy-Based)

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Per Minute (Time-Based)

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Per Session (Flat Fee)

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Subscription + Reduced Rate

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Free Charging

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Dynamic Pricing

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Overstay and Idle Fees

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Charge Detail Record (CDR)

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What a CDR Contains

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

CDRs in OCPP

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

CDRs in OCPI

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

CDR Accuracy and Reconciliation

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Payment Methods

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

RFID Cards

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Mobile Apps

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Contactless Bank Cards (Open-Loop Payment)

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Plug & Charge (ISO 15118)

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Fleet Cards

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

AutoCharge

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Contactless Payment Mandate

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What It Means Technically

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Pre-Authorisation Problem

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Evolving Solutions

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Roaming Billing

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Roaming Chain

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Settlement Cycles

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Price Transparency

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

VAT and Tax Considerations

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The UK VAT Disparity

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Cross-Border VAT

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Fleet VAT Recovery

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Fleet Billing

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What Fleet Managers Need

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Fleet Management Platforms

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Home Charging Reimbursement

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Future of Billing

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Dynamic Pricing Becomes the Norm

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Smart Charging Incentives

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

V2G Credits

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Open Banking and Real-Time Payments

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Standardisation and Transparency

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 14: Problem Solving

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Reliability Question

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

A Troubleshooting Mindset

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Common Failure Modes

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

1. Charger Shows as Offline

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

2. Session Fails to Start

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

3. Session Stops Unexpectedly

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

4. Wrong Amount Charged (Billing Disputes)

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

5. Contactless Payment Fails

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

6. Connector Lock Issues

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

7. Charger Stuck in “Preparing” or “SuspendedEVSE”

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Vehicle Side

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Remote vs On-Site Troubleshooting

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Building a Knowledge Base

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Monitoring and Prevention

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Key Metrics to Watch

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Predictive Maintenance

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Scheduled Preventive Maintenance

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Tools of the Trade

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Worked Example: Debugging a Stuck Charger

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Part 3: The New Frontier

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 15: Smart Charging & Energy Management

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Grid Was Never Designed for This

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Why Smart Charging Is Not Optional

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Energy Trilemma

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Load Management: The Foundation

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Static Load Balancing

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Dynamic Load Balancing

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Demand Response: Talking to the Grid

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OpenADR 3

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Carbon-Responsive Charging

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Time-of-Use Tariffs and Charging Behaviour

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

UK DNO Constraints and Flexibility Markets

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Battery-Buffered Charging Sites

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPP 2.1 and Distributed Energy Resources

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Real-World Smart Charging in Action

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What This Means for You

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 16: V2G / V2X: Charging in Reverse

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

A Battery on Wheels

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The V2X Family

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

How Bidirectional Charging Works

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Standards Making It Happen

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Economics: Why Would Anyone Do This?

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Energy Arbitrage

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Frequency Regulation

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Capacity Market

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Demand Charge Reduction

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Virtual Power Plant

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What Vehicles Support V2G Today?

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Battery Degradation: The Elephant in the Room

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Regulatory Enablers and Barriers

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Behavioural Challenge

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Where V2G Is Heading

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Worked Example: A V2G Driver's Day

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 17: Plug & Charge: Just Plug In

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The App Problem

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Vision

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

How It Works: The Technical Foundation

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The PKI Chain of Trust

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What the Certificate Says

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Hubject: The Ecosystem Operator

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

ISO 15118 Versions: What You Need to Know

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

ISO 15118-2

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

ISO 15118-20

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Current OEM Support

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The EU AFIR Mandate

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Challenges: Why Is This Not Everywhere Yet?

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Interoperability Between PKI Ecosystems

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Certificate Management at Scale

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

AC Charging

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Legacy Infrastructure

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What Plug & Charge Means for the Industry

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Bigger Picture

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 18: Cybersecurity in EV Charging

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

A Computer on Every Street Corner

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Threats

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Communication Interception

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Charger Compromise

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Backend Compromise

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Grid Manipulation

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Payment Fraud

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Supply Chain Attacks

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Key Security Standards and Frameworks

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPP Security Profiles

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

ISO 15118 TLS Evolution

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

NIST IR 8473

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

IEC 62443

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Real-World Vulnerabilities

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Defence in Depth

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Network Security

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Device Security

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Application Security

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Monitoring and Response

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Penetration Testing

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

UK Regulatory Context

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Supply Chain Security

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Human Factor

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

A Pragmatic Approach

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 19: Regulation & Compliance

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

From the Wild West to the Rule of Law

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Why the Pressure Built

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The UK Rules, Failure by Failure

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Five Networks, Five Apps: Contactless

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Dead Chargers: The 99% Rule

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Stranded at 11pm: The Helpline

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Walled Gardens: Roaming

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Price You Learn Afterwards: Pence per kWh

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Maps That Lie: Open Data

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Unusable Bays: Accessibility

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Europe Fixed the Same Failures

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Patchwork Problem

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter 20: Where This Book Ends

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What to Read Next

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Where to Learn in Practice

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

What to Watch

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Chapter Summary

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Appendix A: Glossary & Acronyms

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

A

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

B

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

C

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

D

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

E

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

F

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

G

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

H

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

I

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

J

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

K

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

L

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

M

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

N

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

O

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

P

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Q

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

R

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

S

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

T

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

V

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

W

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Z

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Appendix B: Industry Actors

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Market Players in 2026

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Public Charging Operators (UK)

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

European and Global Context

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Consolidation: The Story of the 2020s

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Charge Point Operators (CPOs)

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

eMSPs and Roaming Providers

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Site Hosts

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

CSMS Vendors

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Established Players

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Hardware Manufacturers

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Roaming Hubs

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Industry Bodies and Standards Organisations

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Energy Companies in EV Charging

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Appendix C: Protocols & Standards

Reference

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Protocol Family by Category

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPP: Open Charge Point Protocol

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPP 1.6J

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPP 2.0.1

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPP 2.1

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPP 1.6J Messages

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPP 2.0.1 Functional Blocks

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPI: Open Charge Point Interface

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPI 2.2.1

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPI 2.3

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

ISO 15118: Vehicle-to-Grid Communication Interface

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

ISO 15118-2

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

ISO 15118-20

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

IEC 61851: Electric Vehicle Conductive Charging System

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

IEC 62196: Plugs, Socket-Outlets, Vehicle Connectors and Vehicle Inlets

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OpenADR 3: Open Automated Demand Response

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OICP: Open InterCharge Protocol

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

eMIP: e-Mobility Inter-operation Protocol

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

MQTT: Message Queuing Telemetry Transport

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

OCPP Version Comparison

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Appendix D: Useful Links & Resources

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Standards Bodies & Protocol Organisations

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Industry Associations

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Roaming Platforms

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

UK Government & Regulation

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

EU Regulation

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

US Regulation & Programmes

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Market Data & Statistics

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Learning Resources & Technical Guides

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Industry News & Analysis

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Open-Source Tools & Projects

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Cybersecurity

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Appendix E: References & Further Reading

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Foundational protocols and networking

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

EV charging protocols and standards

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Smart charging and grid integration

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Cybersecurity

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

UK regulation

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

EU regulation

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Site hosts, land and leases

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Market data

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Industry references

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Appendix F: Regulation Reference

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The UK ZEV Mandate

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

The Public Charge Point Regulations 2023

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

EU AFIR

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

UK Grants

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Planning and Grid Connection

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Consumer Protection

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Data Protection

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Safety Standards

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.

Compliance Checklist

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/how-ev-charging-actually-works>.