MarshMcLennan

Time to recharge: Accelerating the rollout of EV charging infrastructure

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Executive summary

Getting electric vehicle (EV) charging right is essential for meeting national EV targets — and, consequently, a crucial component in achieving national net-zero ambitions. Progress in many countries remains patchy, and even the best performers have ways to go in meeting forecasted levels of charge-point demand in 2030 and beyond.

By one estimate, the world will need to invest over US$1 trillion[1] in EV charging infrastructure by 2030, in line with commitments to the Paris Agreement. Unlocking this investment within that timeframe is dependent on **concerted and coordinated action from various stakeholder groups** to overcome the triad of critical challenges our research has shown to be slowing EV charging rollouts.

Firstly, in the public sphere, roles and responsibilities are often not well defined, leading to the duplication of authority or gaps in guidance and coverage. These inefficient public processes put the onus on local authorities or charge point operators (CPOs) to chart their own paths, leading to suboptimal outcomes for users.

To avoid this, **national governments must clearly delegate these roles and responsibilities, ensuring full coverage of planning and the administration of funding, and the installation and maintenance of charging infrastructure.** On the ground, **local authorities should be supported with capacity- and skills-building efforts to help them create local targets and processes** that help themselves, and CPOs, to deliver against them.

The second roadblock is the uncertain commercial and risk dynamics facing CPOs. High upfront costs and low levels of utilization means that many CPOs are struggling to turn a profit. To cushion this, **governments have a central role to play in incentivizing investments** but must do so strategically; **subsidies should push private operators to address the specific needs of the local market,** like rural charger coverage, or exorbitant installation costs.

Concurrently, **CPOs must explore all routes to develop a sustainable competitive advantage** in the short and medium term. One way to do this is to find **opportunities to extend services up and down the value chain.** In parallel, **insurers should engage with CPOs to better understand risks,** enabling them to offer coverage that will further enable investment.

Finally, grid management issues underpin the speed of charge point deployment. Worries about grid reliability and capacity can be mitigated through the adoption of **smart charging** — a technology that allows the unidirectional charging of EVs to start and stop in response to electricity supply and cost factors at any given point in time.

EV uptake may even **switch from being a strain on the grid to a critical supporter, if regulations allow vehicle batteries to store excess power that can be sold back to the grid during peak demand.** As it stands, a lack of public policies, national standards and uneven stakeholder awareness is slowing down progress in this space. These inhibitors must be prioritized as the pressure on the grid grows with rising electricity demand and climate-related stressors.

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Introduction

Transport relies more greatly on fossil fuels than any other sector, accounting for 37% of CO2 emissions from end-use sectors in 2021. It comes as no surprise, then, that in an era of net-zero commitments, governments have made sustainable transportation a key policy objective and are pressing for quick results. The widespread adoption of electric vehicles (EVs) is a part of this journey, but one that will need to be complemented by investments in hydrogen fuel-cell vehicles and sustainable fuels.

The lifecycle emissions of EVs today in Europe are already 66%-69% lower than a comparable internal combustion engine vehicle (ICEV), according to research from the International Council on Clean Transportation (ICCT)[2] published in 2021. But a more accurate calculation of the potential environmental benefit of EVs over traditional gasoline-powered vehicles requires that the lifecycle analysis be conducted on a country-by-country basis (see sidebar on left).

Backed by strong national government and supranational support, the global EV market has seen tremendous growth over the past 10 years and is poised to grow at 21% annually until 2026.[3] To power this transition, governments will have to address the biggest bottleneck to e-mobility — the availability of charging infrastructure (see Exhibit 1 below).

Exhibit 1: Top consumer concerns when considering purchasing an EV

	Brazil n=184	Canada n=193	China n=302	France n=167	Germany n=188	Italy n=236	Mexico n=202	Spain n=200	UK n=176	US n=208	Global n=2056
Availability of charging stations	41%	54%	54%	46%	56%	61%	51%	54%	52%	45%	52%
Distance the vehicle can travel on a single charge	23%	37%	40%	28%	39%	23%	28%	36%	39%	32%	33%
Availability of financial incentives	26%	36%	28%	36%	29%	43%	27%	32%	26%	26%	31%

Source: Oliver Wyman Forum Global Consumer Sentiment Survey March 2022

Given the complex interplay between stakeholders, no one group can single-handedly change the speed of an EV charging rollout in a given country.

Charging infrastructure refers to the equipment that connects EVs to an electricity source to recharge its battery. While much of EV charging takes place at home through a regular wall socket, readily accessible public-charging infrastructure remains a key enabler that will ensure more EVs are bought by individuals who don't have personal parking spots.

The ratio of EVs to charge points varies tremendously across countries, largely due to assorted approaches to regulation, incentivization, planning, and differences in the quality of underlying energy systems. Today, there are only roughly half a million public fast-charging points globally and just over a million slow chargers. The world will need 5.4 million publicly available fast chargers and 10 million slow chargers[4] in order for countries to fully implement their national targets for 2030 and 2050, according to the International Energy Agency's Announced Pledges Scenarios, introduced in 2021 to show to what extent announced ambitions and targets are on path to deliver emissions reductions in line with 2050 net-zero goals. For most countries, meeting the needs of their targeted EV fleets will require a much more aggressive rate of deployment of chargers over the next few years.

Given the complex interplay between stakeholders, no one group can single-handedly change the speed of EV charging rollout in a given country. Some stakeholders act as enablers of the rollout, such as public-sector actors like national and local authorities, utilities, and insurers. For their part, EV manufacturers and charge point operators (CPOs) (comprising an increasingly diverse group of sub-actors) will move up and down the value chain to offer vehicle charging and add-on services to a wide-ranging set of customers.

This report tackles three of the biggest challenges that are holding back the rollout of charging infrastructure around the world: Inefficient public processes, an uncertain commercial and risk landscape, and grid management issues. After exploring the drivers for the EV market, the following chapters explore each challenge, identifying obstacles and matching them against recommendations for key stakeholders, supported by examples of action taken from around the world.

DO EVS HAVE LOWER EMISSIONS THAN PETROL- OR DIESEL-POWERED VEHICLES OVER THEIR LIFECYCLE?

European Environment Agency research states that most life cycle assessments (LCAs) show that EVs have lower life-cycle greenhouse gas (GHG) emissions than internal combustion engine vehicles (ICEVs). In general, although GHG emissions associated with the raw materials and production stage of EVs are 1.3-2 times higher than for ICEVs, this can be more than offset by lower per-kilometer use-stage emissions — depending on the electricity generation source.

The electricity generation mix of a country has an influence on the carbon intensity of all life-cycle stages, but most strongly on use-stage emissions. Charging EVs with electricity generated from coal results in higher life-cycle emissions than those produced by ICEVs, whereas using wind power life cycle emissions of an EV could result in emissions almost 90% lower than an equivalent ICEV.

Source: EEA[55]

WHAT'S THE DIFFERENCE BETWEEN FAST AND SLOW EV CHARGERS?

There are four main charging speeds for EVs, as seen in *Exhibit 3*, but most people refer to either slow or fast chargers. Slow chargers are best equipped for personal use and can be easily plugged into a socket in people's homes for overnight charging.

Fast chargers can take as little as 30 minutes to get a car to fully charged. These high-powered chargers are designed for commercial and industrial use, requiring a direct connection to the grid. Given their speed, fast chargers are more commonly seen at public sites, for en route charging.

As EVs penetration increases and countries electrify more use cases, accessibility to fast chargers will be especially important to support this.

Understanding the drivers of the global EV market

Government incentivization and increasingly environmentally conscious car-owners have been the catalysts for the recent fast growth of the EV market. To ensure the continued rise in levels of EV-adoption, the rollout of EV charging points must speed up considerably.

While it may seem obvious to most observers that EVs are here to stay, many people would be surprised to learn that the electric vehicle is not a completely new innovation and that interest in EVs has come and gone before.

First invented around 1830, EVs gained in popularity in the 1890s and by the turn of the century accounted for about one-third of vehicles in the United States. At the time, EVs had several advantages over gasoline-powered vehicles, which had to be cranked by hand to start and were noisy to drive. Over time, though, EVs' disadvantages came to the fore. Those included long charging times, a lack of charging infrastructure, and concerns about the distances these vehicles could travel — concerns that sound familiar to anyone with an interest in the EV sector today.

WHAT REALLY IS AN EV?

An electric vehicle (EV) is a vehicle that uses an electric motor instead of an internal combustion engine (ICE). While EVs may be an umbrella term referring to any vehicle powered by electricity from a battery, for the purpose of this report, EVs refer only to plug-in electric vehicles, including plug in hybrid EVs (PHEVs), and battery EVs (BEVs), excluding fuel cell electric vehicles or hybrid electric vehicles.

There have been two drivers of the growth of the EV market in recent years: Government-funded incentives and consumers' increased environmental awareness.

Governments around the world have been encouraging EV sales through the presence of financial and non-financial incentives to help manage consumer concerns about higher upfront costs, electricity prices, or range anxiety. These incentives are intended to help EV adoption stay on track to meeting government targets, which in turn are aligned to national net-zero ambitions (see Exhibit 2 for more details).

Consumers are becoming increasingly conscious of their own environmental footprint and the reduced emissions from an EV rank highly in decision-making of current and prospective EV owners. One study from the US shows that almost 50% of current owners[5] rank environmental reasons as their number one factor for purchasing an EV, whilst another study shows that 70% of potential EV buyers[6] view environmental reasons as the key convincing factor. Given that outside of China, EV prices have been holding firm or increasing of late, consumer sentiment will continue to play an important role in further adoption.

However, for EV adoption targets to be realized, there needs to be a step change in EV-charging infrastructure in most countries. In the past five years, the rollout of charging infrastructure in many countries has gathered pace; but this has been from a low base, and progress has been uneven. For example, nearly 50% of charging points in the EU can currently be found in just two countries — Netherlands (29.4%) and Germany (19.4%). The other half is split between the other 25 EU nations, which collectively account for 90% of the EU's surface area[7] — or 77% in passenger car parc (passenger cars in use) and about 70% in new passenger car registrations, to put this into automotive terms.

Exhibit 2: National progress against EV adoption targets in selected countries

COUNTRY	EV TARGETS	EV SALES SHARE (CARS, 2021)	TOTAL EV SALES FROM 2017-2021	SELECTED EV ADOPTION INCENTIVE MEASURES
Norway	All new cars sold by 2025 should be zero-emission (electric or hydrogen)	**86%**	**329,879**	No annual road tax (1996-2022) Free municipal parking No toll fees Access to bus lanes
Iceland	All new passenger cars should emit zero emissions, by around 2027	**72%**	**9,364**	Exempt from import duties Exemptions and discounts for VAT Free municipal parking Ban of petrol and diesel vehicles by 2030
Sweden	National target of becoming carbon-neutral by 2045 will require 2.5 million EVs and PHEVs	**43%**	**113,279**	Rebates for EV purchase (2012-2022) Ban of new petrol or diesel car sales after 2030
Denmark	1 million zero-emission light duty vehicles by 2030	**35%**	**46,953**	Exemptions from registration tax Exemptions from ownership tax Subsidies parking fees Subsidies for the purchase of EVs by municipalities and companies
Netherlands	100% share of ZEVs in passenger LDV sales by 2030	**30%**	**231,084**	Subsidies for purchase of EVs Tax exemptions for leasing €2000 incentive for the purchase of used BEVs
Germany	15 million BEVs on the road by 2030	**26%**	**674,843**	Subsidies for the purchase of BEVs
United Kingdom	All sales of passenger cars to be BEVs or FCEVs by 2035	**19%**	**366,947**	Phase out passenger ICEV sales by 2030 Phase out ICE small trucks by 2035 and larger trucks by 2040 Discount on London Congestion Charge Exemption from vehicle excise duty
France	End sales of new fossil-fuel powered passenger cars and light commercial vehicles by 2040	**19%**	**380,701**	Grants for purchase of EV for individuals and companies
China	20% share of new EVs in LDV and HDV sales by 2025 and 40% of all vehicles sold to be EVs by 2030	**16%**	**5,783,371**	Zero emissions vehicle mandate: Vehicle manufacturer and importer must make/import at least 10% EVs Subsidies to manufacturers of EVs Subsidies for purchase of EVs Exemption from sales tax
USA	EVs should make up 50% of new vehicle sales by 2030	**5%**	**1,282,638**	Tax reductions in various states Rebate program for EVs in various states Free parking in various states

VAT = Value Added Tax, LDV = Light Duty Vehicle, HDV = Heavy Duty Vehicle, PHEV = Plug-in Hybrid Electric Vehicle, FCEV = Fuel Cell Electric Vehicle
Source: IEA[8]

#1: Inefficient public processes

The actions of public sector authorities can hinder the efficient rollout of EV-charging infrastructure. National-level responsibilities should cover demand planning and the setting of key standards to ensure charge point usability and safety. Local authorities must be supported to ensure they have the capacity and skills to localize targets and create an enabling environment for CPOs to deliver against them.

1.1 Sub-challenge: Poorly defined responsibilities at national level

What's the challenge?

Public-sector roles and responsibilities are sometimes not clearly enough defined, which can result in authorities duplicating efforts or leaving gaps in guidance. This leads to stakeholders such as local authorities or CPOs charting their own path, resulting in sub-optimal outcomes for users. Examples include countries that have so many different EV charging-station payment platforms that it can put off consumers from buying an EV, or instances where details of charger locations are not available in a single open-source platform. Also, as more charging points come online, cyberattacks targeting these assets will inevitably increase, and so delays in setting national standards increase the risk to users, CPOs, and the grid.

Recommended actions

Ensure coordination and a clear delineation of roles and responsibilities

National governments must ensure there is a clear delegation of roles and responsibilities to support EV charging rollouts.

To date, governments have tailored approaches to charging rollouts based on their existing competencies and precedents for rolling out infrastructure such as broadband. For some countries, this may mean the creation of new working groups and coordination platforms that tackle charging as a subsector of its own, working in parallel to related sectors such as energy, transport, and industry. Many countries have benefitted from involving local leadership in helping set the national agenda; however, governments with strong central coordination may see a more efficient rollout by designating roles for local stakeholders that satisfy overall domestic agendas.

In the Netherlands, the Dutch government took responsibility for bringing together stakeholders that represented public interests in infrastructure and national enterprise, grid operators, knowledge platforms, and the association of municipalities. Private-sector stakeholders were also involved in the government-led process to create the Netherlands National Charging Infrastructure Agenda.[9] The Agenda sets out a multiyear plan to deliver on EV charging infrastructure targets, with clear actions for stakeholders to proceed in areas such as ensuring that targets are localized and executable, charging data and pricing are transparent, and grid impacts are anticipated and mitigated.

China took a different approach in its 2021-2035 NEV Industrial Development Plan.[10] The plan not only includes clear targets for charging infrastructure, it also assigns implementing entities, with the Ministry of Industry and Information Technologies as lead, alongside other ministries, commissions, government departments, industry and research leaders, and a clear role for local governments. More centralized in nature, this plan also has a view of likely shifts in the industry, with guidance on expected convenience levels of technologies including battery swapping (where charging infrastructure comes in the form of swapping stations for depleted batteries to be automatedly replaced with fully charged ones).

In the United States, the 2021 Bipartisan Infrastructure Law (BIL) set an ambitious target to increase EV sales by 50% by 2030. Formula funding of US$7.5 billion was dedicated to building a national charging network of 500,000 charging stations. In support of this agenda, BIL[11] directed that a new body, the Joint Office of Energy and Transportation, be created jointly by the Department of Energy and the Department of Transport. The new body will maximize this funding by supporting and overseeing a range of investments in new transportation infrastructure, including EV charging in rural, disadvantaged, and hard-to-reach areas. The body will work on topics including the designation of national EV charging standards, as well as providing guidance and support to states and local authorities.

Prioritize the usability and safety of charging platforms

Government authorities should take preemptive measures to ensure that charging points are easy to use and that the interests and safety of users are protected through regulation and legislation. Different manufacturers equip their cars and chargers with connectors that are not universally compatible. Government-mandated standards for charge point plug interoperability are key to building owner confidence. Exhibit 3 shows some current charging specifications across regions and brands, mapped to different charging speeds. Such variations cause some anxiety for potential EV owners, so steps to improve in-country or in-region interoperability would go a long way to overcoming such concerns.

Exhibit 3: Charging specifications across regions

SPEED	LEVEL	CURRENT	REGION				
			Japan	China	USA/Canada	Europe	Tesla
Slow 3-5 kW	**Level 1** 1-3 kW	AC					
↓	**Level 2** 8-25 kW		**Type 1** J1772	**GB/T**	**Type 1** J1772	**Type 2** Mennekes	
Fast 7-25 kW	**Level 3** 50-350 kW	DC					
↓							
Rapid >50 kW	**Level 4** >1000 kW		**CHAdeMO**	**GB/T**	**CCS 1**	**CCS2**	

Note: All CHAdeMO are naturally DC chargers, they require an additional J1772 connector to achieve Level 1 or 2 charging; Currently, the only company to manufacture Level 4 chargers is Tesla; Teslas sold in China have dual charging ports to comply with mandatory charging standards.

Source: Marsh McLennan Advantage

The UK has a holistic guidance regulation[12] that sets device-level requirements that must be met for all smart charge points for sale in the country. It regulates the data transfer of chargers, enforces electricity supplier interoperability, establishes safety provisions and cybersecurity standards, and requires a measuring system that is visible to the owner. These regulations enable a minimum level of access, transparency, and security for users.

Rolling out national payment platforms will give EV drivers open and easy access to all charging stations, while also serving as a source of data to better understand the user habits and needs from EV charging infrastructure. Norway's EV Association gives users access to charging units all across Europe through a single charging chip[13] that allows drivers to charge at more than 275,000 charging points, after which they receive a single bill to be paid through the Ladeklubben mobile application. Governments should also focus on alleviating customer concerns about pricing in a user-friendly way. The Netherlands' Charging Without Any Surprises program[14] sets service and price transparency benchmarks, and defines clear complaints and reporting processes, as well as having strong compliance and monitoring standards.

Cybersecurity is critical to EV charging infrastructure, where such incidents can result in risks to user safety, commercial loss for charging hubs, and compromises to various types of data including customer and payment systems as well as vehicle data such as telematics. Governments must be proactive in specifying common standards and best practices for the security of devices used in the charging control systems. The Netherlands has set basic requirements for cybersecurity[15] with respect to communication protocols, like the Open Charge Point Protocol (OCPP) and Open Charge Point Interface (OCPI) as well as the safety of charging through proof of identification. Other requirements have been made for charging infrastructure regarding future-proofing design, cryptographic algorithms and protocols, system-hardening measures, and enhancing resilience.

1.2 Sub-challenge: Limitations on local authority capability

What's the challenge?

Local authorities are often underfunded and overstretched, limiting their skills and understanding of the most efficient and effective strategies and processes to deploy a charger rollout across their jurisdictions, affecting the cost, timeline, and ease of planning, installing, and maintaining charge points. This is often due to a mismatch in the technical and planning skills of the workforce, delays in approvals, and trouble getting access to the grid, amongst other roadblocks.

Recommended actions

Enhance municipal authority capabilities to ensure efficient local rollouts

Creating resources and platforms for charge point installers to easily understand the procedures, authorities, costs, and associated timelines will address confusion in the market over the processes involved in charge point deployment.

National governments must ensure that local authorities are well supported in developing a localized EV charging roadmap that is aligned with national ambitions. Failure to do so will result in critical bottlenecks, which could ultimately slow adoption of EVs. Although some municipal authorities have been early leaders in incentivizing, managing, and delivering EV charging in their jurisdiction, many others are playing catch-up. This can be seen in the UK where, until recently, only 28% of local authorities had published rollout strategies despite the national government having set national EV charging targets in 2020. In response, the UK government announced in early 2022 a new fund[16] that would both provide funding for infrastructure provision to local authorities and set aside 10% of funding to focus solely on upskilling the authorities themselves. This includes a dedicated effort towards assisting

departments that are responsible for planning and delivering charging infrastructure. Further support will follow in the form of a knowledge hub for local authorities that will contain guidance and toolkits to support community engagement, procurement, and stakeholder management.

In Australia, the New South Wales government has invested $131 million in developing its charging network through its Electric Vehicle Strategy.[17] The strategy prioritizes empowering local councils to nurture pilot schemes of roadside charging infrastructure. The outcome of these pilots will be used to inform the future development of EV parking-and-charging guidelines for local councils in the state. To give the workforce the skills and resources to underpin this rollout, $318 million is being invested in skills partnerships with the Commonwealth and its JobTrainer program to create future-focused careers in the transport sector.

A capable and supported local authority will be able to ease local EV charging hassles in many areas, including streamlining permitting processes, updating building codes to include EV-charging requirements, and designating standards for technical matters such as data collection and use. It is, of course, incumbent on CPOs to ensure they are fully aware of local regulations and to work with authorities, where appropriate, to refine and improve processes over time.

Combining leadership at the national level whilst also arming local authorities with the capabilities to plan and execute municipal charging infrastructure deployment will speed up the development of a robust and accessible charging network.

#2: Uncertain commercial and risk dynamics

As the EV charging industry evolves and matures, it is essential that stakeholders find ways to speed up investment in the face of short-term challenges in achieving financial returns. Governments must continue targeted incentivization; CPOs need to innovate with their business models; and insurers need to engage with CPOs to further their understanding of key risks.

2.1 Sub-challenge: Charge point operators struggle with return on investment

What's the challenge?

High upfront costs and low levels of utilization are two key reasons why many CPOs are struggling to make a profit. The International Council on Clean Transportation (ICCT) estimated that, in 2020, the US had an average charger utilization rate of a mere 1.8 hours per day.[18] Real-world data[19] from 2021 has shown usage intensity of charging stations in Germany to be between 15%-20%. These are just some reasons why many traditional sources of private investment in infrastructure have been hesitant to commit to the sector to date. As a result, governments have had to intervene and incentivize private participation through subsidies and grants.

Recommended actions

Government incentives for private operators must match incentive type, size, and conditions to specific market needs

While installation costs remain high and many charging points have low utilization levels, governments must continue to incentivize private participation in national charging infrastructure rollouts. However, interventions should be targeted to provide the greatest incentive to deliver charging points that otherwise wouldn't happen, such as rural or socioeconomically disadvantaged areas, and sites requiring expensive grid upgrades or high-powered chargers for freight vehicles. Where technologies and demand are proven, and CPO competition is high, governments can consider scaling back or removing incentives — so an ongoing review of measures is essential. Examples of government incentives that focus on specific market needs are shown in Exhibit 4.

Exhibit 4: Examples of tailored government incentives to support specific EV charging objectives

TARGET	INITIATIVE	SUMMARY
Encourage fast charging	Infrastructure Subsidies, Austria (2022)[20]	Subsidies for EV infrastructure are granted based on charging speed. To encourage fleet charging, companies and public entities will receive a highest amount of maximum of €30,000 for the purchase and installation of DC-charging stations designed to accommodate heavy goods, with power greater or equal to 100kW.
	Low Emission Transport Fund, NZ (2022)[21]	A co-funding initiative that targets the demonstration of vehicles and technology or the adoption of public infrastructure. It includes an explicit focus on hyper power and destination chargers and public charging hubs.
Increase rural access	USDA Rural Development for EV Infrastructure, US (2017-2022)[22]	As an array of programs, the US Department of Agriculture (USDA) has integrated eligibility mechanisms targeting EV infrastructure within existing finance and funding programs related to electric infrastructure, community facilities building, and other infrastructure loans and projects that promote funding for EV chargers in rural areas.
Mitigate utilization risks	EV charging initiative (CHRI), Canada (2022)[23]	In this $500 million financing initiative, the Canada Infrastructure Bank (CIB) shares utilization risk by aligning loan repayment with utilization levels. In compensation for sharing the risk, the CIB benefits from upside participation through increased interest rates when utilization levels exceed expectations.
	Land lease through revenue sharing, India (2022)[24]	To address land access and utilization risk, public land is being made available for the installation of public charging stations, on a revenue-sharing basis instead of fixed rental costs, at a stable rate of ₹1/kWh of electricity used for charging to be paid to the landowner.
Overcome prohibitively high costs	Rapid Charging Fund, UK (2020)[25]	A £500 million commitment to EV charging infrastructure, the fund aims to roll out fast charging across motorways and major roads. Funds can be used to partially cover the prohibitively high costs of upgrading grid connections necessary for high-powered access.
	Tariff reductions (TURPE) reduction, France (2020)[26]	France has introduced a tariff reduction where up to 75% of grid connection costs may be assumed by the grid operator to lower costs of connecting to the grid.

Source: Marsh McLennan Advantage analysis

CPOs should explore new opportunities to gain maximum competitive advantage

CPOs must target actions that set them on a path to profitability. There is no one-size-fits-all solution, so CPOs must determine a strategy that best complements their existing positioning. Emphasis should be placed on anticipating how their customer's needs will develop, as well as reacting to shifts in the competitive landscape. In laying out a path to profitability, CPOs must consider three avenues in particular.

1. Bundling of services to offer a more rounded customer proposition

One potential path to CPO profitability in the medium term may be found via developing or acquiring solutions that allow the firm to move up or down the EV-charging value chain. Research has shown that the US' EV charge point installation needs will require 22,720 job-years[27] (ideal amount of work done by one person in one working day) nationwide, from 2021 to 2030, where contractors, including electricians and utility-line workers, make up 65% of these needs. It is no surprise to see CPOs look to proactively secure workforce capacity. In August 2022, Wallbox acquired COIL[28], a charging-installation firm which allowed the CPO to both secure vital workforce headcount and skills, as well as offer clients a one-stop solution.

Another example can be seen in the case of ChargePoint's acquisitions of has·to·be[29] and ViriCiti.[30] Through its purchase of has·to·be, ChargePoint gained easy compatibility with Europe's existing charging platforms, systems, and hardware. The ViriCiti deal on the other hand helped with their fleet offerings, including route planning, battery monitoring, charge-point monitoring, and vehicle maintenance. Fleet offerings factored into Ford's 2021 acquisition of Electriphi[31], a provider of charging management and fleet monitoring software. Ford stated the reason for the purchase was to deliver a single-source solution for commercial fleet depot-charging customers.

2. Leverage synergies with owner/investor portfolio businesses

Given the fast-moving competitive landscape, CPOs should ensure they can identify and maximize potential synergies with owners and investors. For firms like BP and Shell, this may involve using the footprint of their existing portfolio of petrol stations to provide a faster route to rolling out charging solutions at those same sites.

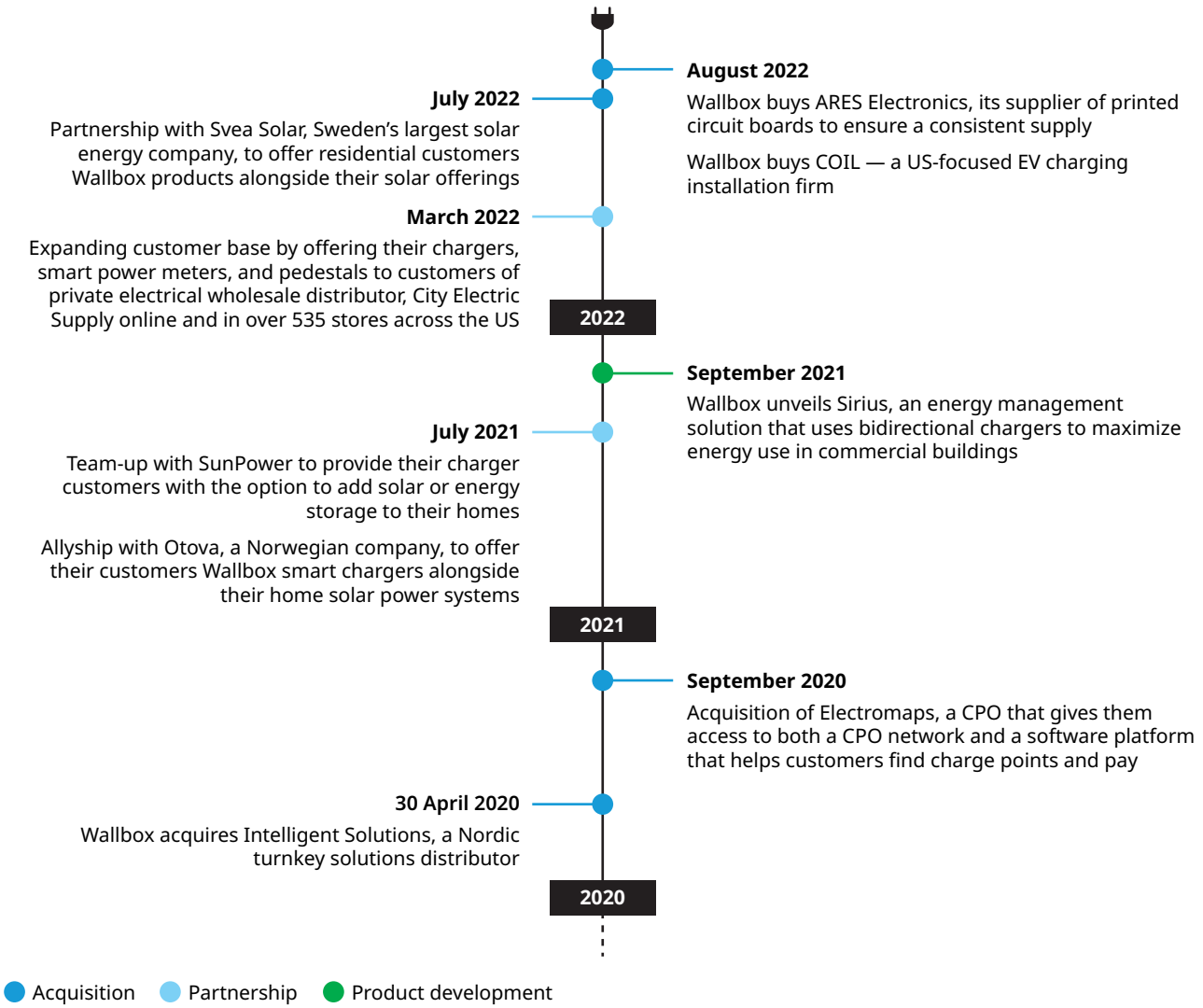
One CPO, Connected Kerb, acted to tie new investment[32] in their own business with access to the investor's other assets. In September 2022, Aviva Investors committed £110 million to the CPO, but also gave access to its pan-European real estate portfolio for charging points to be installed. Another example is Voltera[33], a newly launched turnkey charging operator focused on fleets. A spinoff from the data center company EdgeConneX, which is owned by EQT Infrastructure, Voltera will benefit from EdgeConneX's experience in delivering data centers that face similar challenges of site identification, land acquisition, permitting, and high-power grid access.

3. Strategic de-risking of key risks

Identifying and mitigating strategic risks is another route to competitive advantage. CPOs must develop an understanding of the risks their specific business models face and then consider potential actions to address them. Ionity[34] is an example of an alliance of original equipment manufacturers (OEMs) working together to create their own charging network in Europe. By creating the single-brand alliance, the constituent firms were able to help alleviate customers' range anxiety because they were delivering charge points that were all built to a common standard. In November 2021, BlackRock became a shareholder in Ionity with investment that is expected to see the alliance operate over 7,000 charge points by 2025 (from over 1,900 in November 2022).

Similarly, in 2021 Wallbox acquired ARES Technology[35] to pursue vertical integration to shore up the supply of key components (printed circuit boards) in a time of ongoing supply chain uncertainty chain (see Exhibit 5 for examples of how Wallbox has changed its competitive positioning since 2020).

Exhibit 5: Highlights from the competitive strategy of charge point manufacturer Wallbox



Source: Wallbox, Marsh McLennan Advantage analysis

2.2 Sub-challenge: Relative immaturity of the EV-charging insurance market

What's the challenge?

CPOs have found that securing insurance coverage for their operations can be a slow and complicated process, with a severely limited set of options to choose from. This stems from insurers lacking sufficient operational data to assess, combined with the initial sense that EV-charging technologies and use cases bring unknown or misunderstood risks.

Recommended actions

The insurance market must engage with EV-charging stakeholders to better understand business models and true risks

In some markets, insurers have been slow to offer EV-specific products, citing a lack of understanding of the technologies and uncertainties linked to evolving government legislation and regulations. Insurers should become more proactive in engaging with CPOs, public authorities, EV manufacturers and brokers to develop a better understanding of the true risk profile of charging operations. These discussions will give insurers a detailed grasp of the required coverage across EV-charging stations, street charging, home/office solution, and depots, given their different EV technologies and use cases.

One way to build comfort with EV coverages is for insurers to identify existing coverage proxies from other assets or businesses that have similar risk profiles. Examples of this include viewing street lighting as a proxy for street charging or petrol stations as a proxy for EV equivalents. Risk profiles will never be identical, however. One key difference is the extended and often unmanned period that EV charging takes versus traditional vehicle refueling, which creates additional third-party liabilities that need to be considered and priced correctly. Such risks could include slips, trips, and falls from passers-by over charging cables and damages presented by thermal events involving consumer vehicles.

Given increasing EV demand and government support for EV charging around the world, CPOs are growing quickly thanks to more-efficient installation of charge points. To allow CPOs to move fast enough, insurance coverage needs to apply for all installations, and it isn't practical for CPOs to update insurers on progress on a real-time basis. To combat this, one UK-based insurer agreed to cover a CPO's operations following the payment of an upfront premium, followed by receiving a quarterly declaration from the CPO about chargers in operation.

Regular engagement with CPOs will also allow insurers to educate CPOs on the risks driving premium costs and to discuss ways to mitigate them. One example may involve the risk of lithium-ion battery fires. EV-charging station operators could be encouraged to provide a way to mitigate the exposures presented by a burning vehicle at a charging point.

Apart from risk understanding and modelling, the investment arm of large insurers should further explore investments into EV-charging infrastructure as a positive contribution to their asset-management strategies — helping them to relocate exposures and meet decarbonization targets. One example of this in action is the recent £110 million Aviva Investors backing for CPO Connected Kerb, as mentioned earlier in this report.

#3: Grid Management Issues

Concerns about electricity grid reliability and capacity have slowed private investment in EV-charging infrastructure. In the short term, it is important to use strategies to minimize EV charging's strain on the grid; and, in the medium term, needed new investment in net-zero friendly power generation can be moderated by utilizing EV batteries to store energy temporarily and feeding it back into the grid when needed.

3.1 Sub-challenge: EV charging places an increasing strain on the grid

What's the challenge?

The growing number of EVs in circulation means that demand on the electricity grid is rising. Levels of spare capacity in an electricity grid vary by location but, in all cases, peak-hour demand is when the strain is greatest. EV charging leads to strain on the grid in two ways. The first is during peak hours (usually late afternoon to mid-evening) when users return from work and charge their car. The second is due to the installation of fast chargers, which require significant supporting investment to ensure that the local grid can remain functioning and resilient. The impact of extreme weather events on overall energy demand and efficiency of supply may even increase this strain in the future.

Recommended actions

Use smart charging to shift EV-charging demand from peak hours

Broad sets of stakeholders must work collaboratively to scale the uptake of smart-charging solutions. Smart charging refers to technology that allows one-directional charging of EVs to start and stop in response to factors linked to electricity supply and cost at a given point in time. Various research projects estimate that the adoption of basic smart charging technology could reduce EV-led increases in peak-period electricity demand by 14%-40%, depending on the time of day, the total number of EVs on the roads, and the technologies involved.

In its simplest form, EV owners can receive prompts from the grid operator when to charge their vehicles so that they benefit from non-peak tariffs and/or align with on-site renewable energy generation via solar panels or on-site battery storage.

However, a range of practical, technical, and regulatory factors means that smart charging is currently not ubiquitous. Governments should take the lead in providing an environment for smart charging. Recent UK government legislation[36] ensures that all charge points will have smart functionality, with particular standards defined that cover points including default settings to charge at non-peak times, technical communication protocols, cyber-risk protection, user safety, and electricity supplier interoperability.

Governments can also lead collaboration efforts among stakeholders to widen smart charging uptake. One public-led program[37] in the UK has brought together stakeholders from the public and private sector, including CPOs, energy providers, and research bodies, to deliver on-street, public, smart-charging solutions in the country for the first time.

Owners of multi-residence or commercial buildings may find the adoption of smart charging to be essential. Combining smart charging with smart-building management software can allow site managers to ensure that site-level electrical load limits are not breached when multiple EVs are connected simultaneously.

Finally, authorities should ensure that smart charging is available without the need for expensive investment. In August 2022, the California Public Utilities Commission approved the use of statewide sub-metering[38] to allow an EV's energy consumption to be measured independently of an electricity meter's broader consumption. This lets EV owners access reduced tariffs targeted solely for EV energy consumption without having to go through the expense of installing an EV-specific meter.

Exhibit 6: Benefits of smart charging

£225

Household savings annually in the UK by using smart charging technologies to optimize electricity use in EV charging[39]

$120-690 million

Spending to be avoided in California grid operating costs annually (up to 10% of total costs)[41]

85%

Reduction of carbon dioxide emissions from electricity generated for EVs in a fully managed charging scenario[43]

59%

Power peak reduction of total EV load in commercial buildings through smart charging, compared to unmanaged charging[40]

50%

Potential reduction in investment required to update the distribution network necessary in an ambitious EV uptake scenario in Germany[42]

40%

Reduction in renewable energy curtailment, relative to unmanaged EV charging[44]

Explore charging hardware that minimizes grid strain

CPOs should invest in fast-charging solutions that can be used either off-grid or via existing low-voltage grid connections. This ensures these services can be made available faster and cheaper than alternatives that require costly and time-consuming grid enhancements.

Pilot projects around the world are driving significant innovation in this space. In Europe, one example is E.ON and VW's solution, Drive Booster, which can be installed without civil works and uses a normal power connection to charge two vehicles simultaneously at a rate of up to 150kW.[45] Alterative solutions include those by L-Charge[46], which offer mobile charging and fixed, off-grid charging that is powered by an LNG- or hydrogen-powered generator.

Similarly, battery energy storage systems (BESS) can be co-located[47] with charging points to offer more flexibility. In New York City, Centrica and Con Edison are working together to deliver BESS-powered fast charging. Centrica will charge the batteries overnight to take advantage of lower tariffs.

Charging points that can be co-located with solar energy generation should also be prioritized, though such solutions may not qualify as fast charging. One offering by Paired Power[48] delivers Level 2 charging to consumers and can be installed by just two workers in less than a day. An innovation by US-based Rivian[49] makes use of both BESS and on-site solar power through their off-road DC fast chargers at state and national parks and beaches. These publicly assessable chargers make use of BESS that charge using on-site photovoltaics during off-peak hours, storing the power for peak charging times.

3.2 Sub-challenge: The lack of clarity over V2X roadblocks, costs, and benefits inhibits investment

What's the challenge?

Vehicle-to-everything, or V2X, is an overarching term referring to the bi-directional transfer of energy from the battery of an EV to other energy-consuming destinations, including the grid (V2G), homes (V2H), and buildings (V2B). It means that energy that is generated during one part of the day can be stored with an EV battery and then discharged back to a building or the wider grid when it is needed at a later point.

V2X technology has the potential to deliver wide-ranging benefits that could provide savings to vehicle owners while making the grid greener and more reliable. If V2X adoption issues were resolved, broader EV adoption would likely rise at a faster rate, and investment from the private sector in V2X-enabled charging would follow swiftly. However, a lack of public policy setting, the want of national standards, and uneven stakeholder education has slowed V2X progress in many countries and occasionally allowed some unfounded concerns to manifest among key stakeholders.

Exhibit 7 showcases a theoretical V2X market in action, highlighting the key stakeholders that need to work together to deliver a scaled V2X environment, along with the routes of energy transfer between destinations.

Exhibit 7: An overview of V2X and its benefits

BENEFITS OF V2X

To the grid operator	To the vehicle owner	To the EV manufacturer
A more stable, resilient grid with reduced CAPEX needs to support higher capacity.	Financial rewards gained through participation in V2X charging and peace of mind in knowing that EV battery can support home/office energy needs in event of power outage.	Offering this to customers can be seen as a value added service, which comes at a premium price point.

Source: Marsh McLennan Advantage

Recommended actions

Establish national V2X policies to guide investment and adoption

National and local governments need to lead the development of a framework for the adoption of V2X technologies that fits the needs of its cities and districts. By being proactive and providing clarity on ambitions, standards, and expected timelines, government bodies can bring together key industry stakeholders, such as researchers, hardware manufacturers, EV manufacturers, and grid operators, to break down siloes through education and partnerships.

National-level responsibilities would include the development of technical standards and the identification other policy documentation to align with V2G ambitions. National authorities should also be driving proof-of-concept trials to show the efficacy of V2G for all stakeholders involved. A trial led by Kaluza, a software company owned by UK energy provider Ovo, was supported by funding from the Office for Zero Emission Vehicles (OZEV) and the Department for Business Energy and Industrial Strategy to demonstrate the benefits of V2G for the grid operators and customers (see Exhibit 8).

Local government responsibilities would center on creating an enabling environment for V2G services in their jurisdiction and rely on authorities engaging with the right local stakeholders to discuss and then enact fit-for-purpose guidelines, pilots, and rate structures that would apply to V2X services locally.

Driven by the ambition to capture any excess energy production from renewable sources during the daytime, the Netherlands' city of Utrecht is becoming a leader in promoting V2X adoption. Local authorities began by including incentives for CPOs to install bi-directional charging as part of their rollouts. While the city is trying to transition to a model of increasingly shared-ownership vehicles, V2X can still play a role in reducing strain on the grid. One recent pilot project[50] offers residents in the district of Cartesius the chance to sign up for an EV-leasing service that allows them access to a car for a certain number of days in the month. The leasing service has partnered with the developer of new-build housing to create parking spaces for the vehicles, with accompanying bi-directional charging points. When the vehicles are connected, they help with reducing peak-hour demand on the grid, and the revenue that the service makes from this connection goes partly to ensuring that the subscription fees residents pay for the vehicles are sustainable.

Exhibit 8: Selected benefits of V2G pilot in the UK

£3.5 billion saved annually

in terms of grid infrastructure reinforcement

£725 a year earned

by customers who merely need to keep their cars plugged in when not in use

16 GW of daily flexible capacity

achieved with almost 11 million EVs on the UK's roads, if half of them were V2G enabled

Source: Ofgem[51]

Focus on selecting the right V2X pilot projects

Selecting the right scope and partners for pilot projects will help demonstrate technical and economic viability, as well as building stakeholder trust. In the near term, V2X pilot projects should focus on EV fleets. The ratio of decision-makers (that need to be convinced) to EVs in a pilot is reduced by focusing on vehicle fleets, where the predictability of driving patterns is greater than it is for individual vehicles. The greater volume of potential connected vehicles also means better potential returns for owners, which can help overcome concerns about investment in upgrading EV meters and charge points to support V2X functionality. Helpfully, the main benefits to fleet owners of financial benefits and backup power provision also apply to homeowners with V2X-enabled EVs, so some lessons will carry over.

In the UK, publicly funded research[52] has estimated that annual fleet V2G charging benefits could range between £700-£1,250 per vehicle. This may explain why, in the UK, EDF and Nissan have partnered on the country's first V2G program that hasn't received public funding. The program aims to convince vehicle fleet owners across the country to adopt of Nissan's V2G compatible models.

In May 2022, the California Public Utilities Commission approved[53] funding for multiple pilot projects that will be delivered by Pacific Gas & Electric Co (PG&E). One of the pilot projects will specifically target medium and heavy-duty vehicle fleets, while another will focus on using a mix of EV types to respond to public safety power shutoffs related to wildfires in the state.

Climate change-related risks pose an important follow-up question for EV charging and V2X solutions. Internet connectivity is an essential component of payment systems and real-time demand management in V2X solutions. If a climate event was to sever a wired internet connection, then the CPO must ensure that wireless connectivity is in place as a backup.

While 4G solutions are fully capable of handling charging payments, there is an argument for investment in 5G services to best enable the range of the Internet-of-Things (IoT) technologies that help deliver V2X connectivity tailored to drivers' needs in real-time. This benefit is multiplied when dealing with fleets of EVs, where faster speeds mean reduced latency and true real-time response to grid demand which ensures the greatest return on investment.

Concluding thoughts

The past decade has seen more investment and innovation in electric vehicles than since the first prototype was invented 190 years ago. With so many government targets focused on scaling up adoption by 2030, this trend is likely to grow during the rest of the decade. The journey to widespread adoption of electric cars is well underway, but the speed of implementation is tied to how fast charging infrastructure can be rolled out. Improving charging speeds is essential, especially if electrification is to become more widespread in vans, trucks, buses, and construction vehicles. True success for the industry will not come solely from ensuring there is enough charging infrastructure to support broader EV adoption; instead, it must be combined with investment in the greening of electricity generation.

Acknowledgements

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