

Powering the future of electric vehicles: The global charging imperative

- 4 Introduction
- 6 Key findings
- 8 Chapter 1: Investor appetite and risks
- 20 Spotlight: Driving sustainability in the EV industry
- 28 **Q&A with Christopher Hook, Global Head of Sustainability, Uber**
- 30 Chapter 2: Markets and equitable access
- 44 **Q&A with Asif Ghafoor, CEO & Co-Founder, Be.EV**
- 50 **Q&A with Anthony Headlam, CEO and Co-Founder, NewVolt**
- 52 Chapter 3: Innovation and AI
- 62 **Q&A with Carl-Adam Wählstedt, Business Owner Scania Charging Access, Scania**
- 64 Outlook
- 65 Methodology and respondent profile
- 68 Appendix



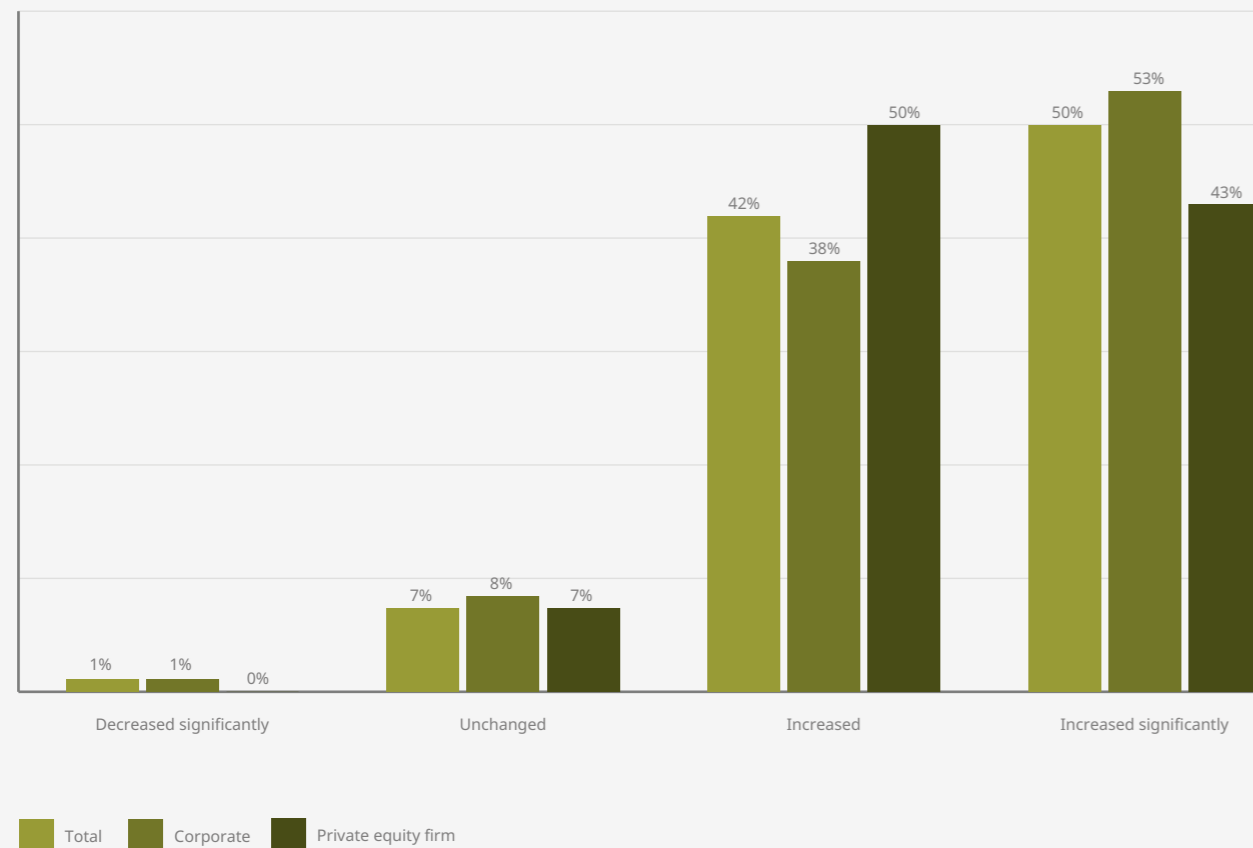
Introduction

The electrification of the automobile industry represents a monumental and necessary shift for the transportation sector and the global economy. Several catalysts for change, from technological advancements and environmental concerns to changing consumer preferences, have crystallised a global consensus on the need to transition towards low-carbon economies worldwide. Governments, too, are taking matters seriously, with net-zero targets being announced and many countries phasing in bans on internal combustion engine (ICE) automobiles.

Transportation is a major source of greenhouse gases, accounting for 20% of global CO₂ emissions, primarily from ICE vehicles. Widespread adoption of electric vehicles (EVs) is seen as the most promising pathway to curtail CO₂ emissions, with the potential to reduce them by 80% by 2050, according to the National Renewable Energy Laboratory. The uptake of hydrogen as an alternative fuel, especially for heavy-goods vehicles, may also play an increasingly important part in the energy transition, though respondents to our survey are nearly unanimous in their belief that EVs' role will be considerably more meaningful.

EVs' share of the overall car market has risen significantly across all geographies in recent years. Accounting for less than 5% of new cars sold in 2020, that share almost doubled to 9% in 2021 and climbed again to 14% in 2022, according to the International Energy Agency (IEA). China contributed around 60% of global EV sales last year, and in August 2023 more than one in four cars sold in the country were electric (26%), according to CleanTechnica statistics. That market is followed by Europe, where more than one in five of all new cars sold was electric last year, and then the US, where EVs accounted for 8% of car sales.

To what extent has investor appetite for electric vehicle (EV) charging infrastructure increased or decreased over the last 12 months? (Select one)



Per IEA forecasts, 14 million EVs will be sold worldwide in 2023, a 35% increase year on year, and now accounting for 18% of total car sales. Looking further ahead, the IEA projects EVs comprising 60% of vehicles sold globally by 2030, necessitating vast investment in charging stations and related infrastructure.

This significant growth, combined with DLA Piper's global legal presence and regular interaction with clients active across the whole EV supply chain, was the catalyst for our carrying out an independent survey in Q3 2023 of more than 100 senior executives in the industry. Their insights paint a detailed picture of how the EV space is likely to evolve in the near and medium term.

An abundance of opportunities

While consumer sentiment and purchasing trends are on an upward trajectory in terms of EV adoption, charging infrastructure remains a key enabler, which requires major further investment. Though there remains a diverse set of challenges for different players in this sector, the need for growth is clear and, along with it, opportunities for investment.

The urgency to decarbonise the transportation industry has given rise to supportive regulation, fiscal incentives and subsidies, buttressing demand for EVs and attracting private sector investment. There is, however, a mixed picture across the globe in terms of the scale and type of support being provided. That said, interest in EV charging infrastructure has surged, with

92% of respondents to the survey that underpins this report noting an increase in investor appetite over the last 12 months, driven on by numerous factors.

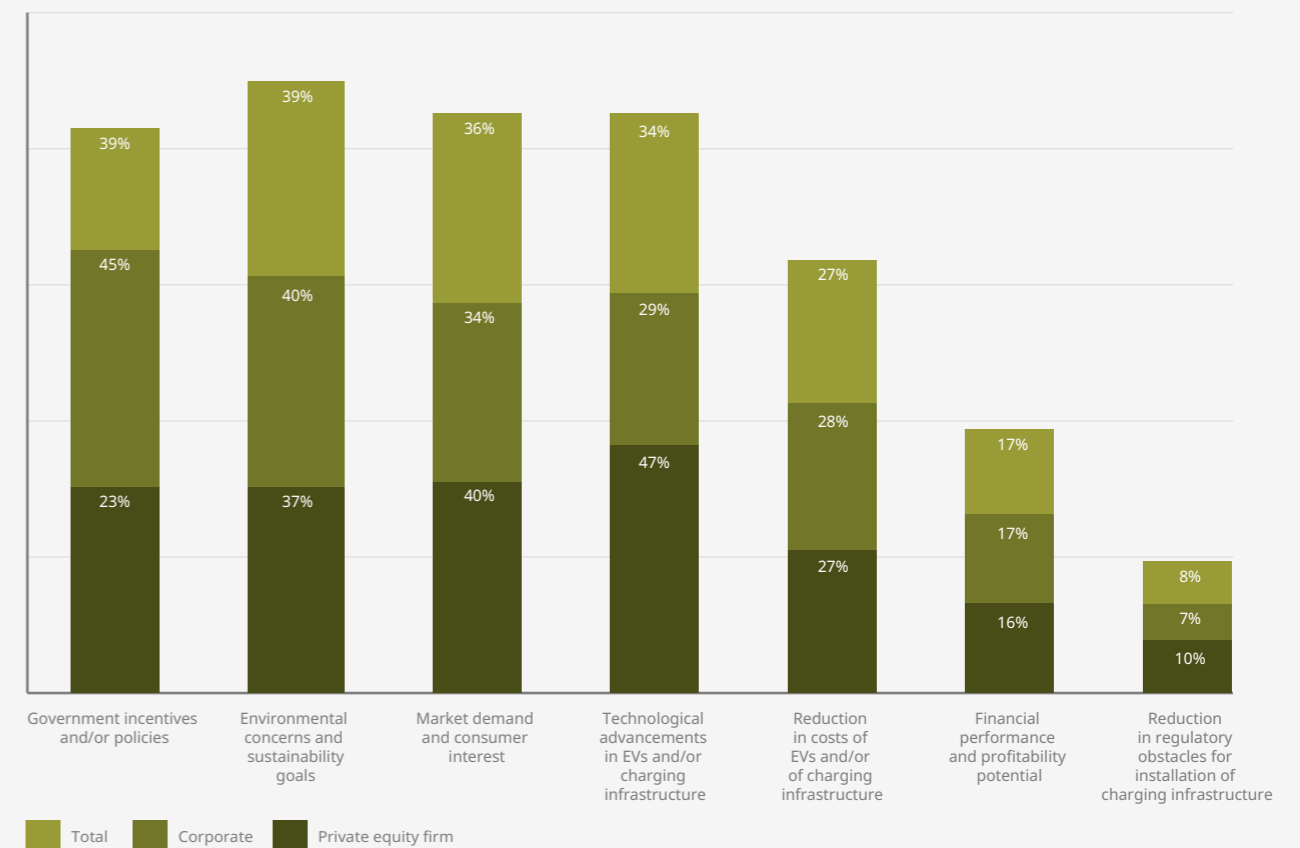
Nearly half of corporate respondents (45%) attribute the increase in investor appetite to government incentives and policies that promote EVs and charging infrastructure, whereas only 23% of investors share this perspective, with the largest share of these respondents (47%) instead emphasizing the positive influence of technological advancements in the sector. Both respondent groups broadly agree on the positive impact of environmental concerns and sustainability goals (39% of top-two votes overall) in driving market demand, as well as mounting consumer interest and market demand (36%).

Our survey of a wide range of participants, from investors and manufacturers to logistics companies and government entities, among other expert parties, is intended to capture the evolving sentiments around and expectations for the EV and charging infrastructure sectors.

This in-depth report addresses [1](#)) investor appetite and risks; [2](#)) markets and equitable access; and [3](#)) innovation and artificial intelligence (AI).

By casting a spotlight on stakeholders' positions on these themes, we hope to improve all parties' understanding of the key trends that will define the EV sector in the years to come.

Of the following factors, which have had the most significant positive influence on investor appetite for EV charging infrastructure over the last 12 months? (Select top two)



Key findings

Before delving into the details of the report, some of the key findings from our survey include:

1. Nearly all respondents (92%) anticipate increased investor appetite for EV charging infrastructure in the next 12 months, with a third expecting significant growth.
2. PE investors focus on battery technology and energy storage capabilities (53%) and fast-charging technologies (57%) as attractive investment areas, while corporate investors prioritise charging network expansion and scalability (58%). This suggests differing business cases, where investors appear to be seeking a well-calibrated revenue stack with multiple income streams and corporates focusing on addressing user access.
3. Government subsidies and incentives are considered to be the most critical factor for achieving equitable access to EVs and charging infrastructure by 62% of respondents. This suggests EV users are still, at least in terms of optics, viewed as more affluent, with investment being skewed to locations accordingly. Conversely, intervention will be required for other areas to ensure wider access.
4. As a real life example of the profound impact of a favourable regulatory environment with attractive government incentives, almost all respondents (97%) believe the tax incentives stipulated by the Inflation Reduction Act have led to an increase in cross-border investment interest in the US EV industry.
5. Europe is expected to attract the largest share of EV and related infrastructure investment (42%), followed by North America (35%) and APAC (23%). This despite the fact that the European market remains relatively modest compared to other geographies and some of the aggressive policy interventions, such as in the US, suggesting that Europe is perceived to be a relatively mature market, at least in the short to medium term.
6. The main investment risks are operational and maintenance costs (46%) and high upfront financial investment (44%) reflecting that much of the charging infrastructure space is a consumer-facing business which requires users not only to buy an EV but also to have confidence that public charging infrastructure is working and available for use.
7. Social impact objectives prioritise the reduction of air pollution and greenhouse gas emissions (60%).
8. AI is seen as especially significant in enabling predictive maintenance and diagnostics for vehicles (45%) and optimising fleet management and electric mobility services (42%).



Chapter 1:

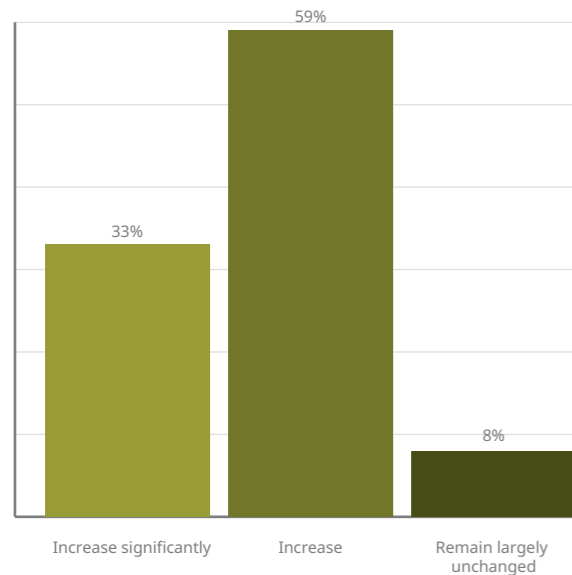
Investor appetite and risks

Investor sentiment in the EV and charging infrastructure spaces remains exceptionally strong. The global EV market is experiencing remarkable growth, buoyed by a confluence of favourable tailwinds, including supportive regulation, subsidies and incentives across major car markets worldwide, ambitious corporate environmental, social and governance (ESG) goals, and shifting consumer preferences.

Recent dealmaking activity is one indicator of this growth over the last few years. According to Inframation statistics, just one EV infrastructure deal was announced globally in 2018, rising to 19 two years later and more than quadrupling to 77 in 2022, with that latter set worth a combined USD12.5 billion. Notwithstanding the general downturn in M&A in 2023 in light of considerably tighter financial conditions and the broader macroeconomic malaise, the first nine months of the year saw 83 EV infrastructure deals announced globally, worth more than USD21.1 billion in aggregate.

“We’ve seen mega growth in the industry and whilst most of that activity has been in terms of M&A and equity investment, we are starting to see project financed deals, which is the sign of a maturing market and greater appreciation of the associated revenue flows,” says Rubayet Choudhury, Partner

To what extent do you expect investor appetite for EV charging infrastructure to increase or decrease over the next 12 months? (Select one)



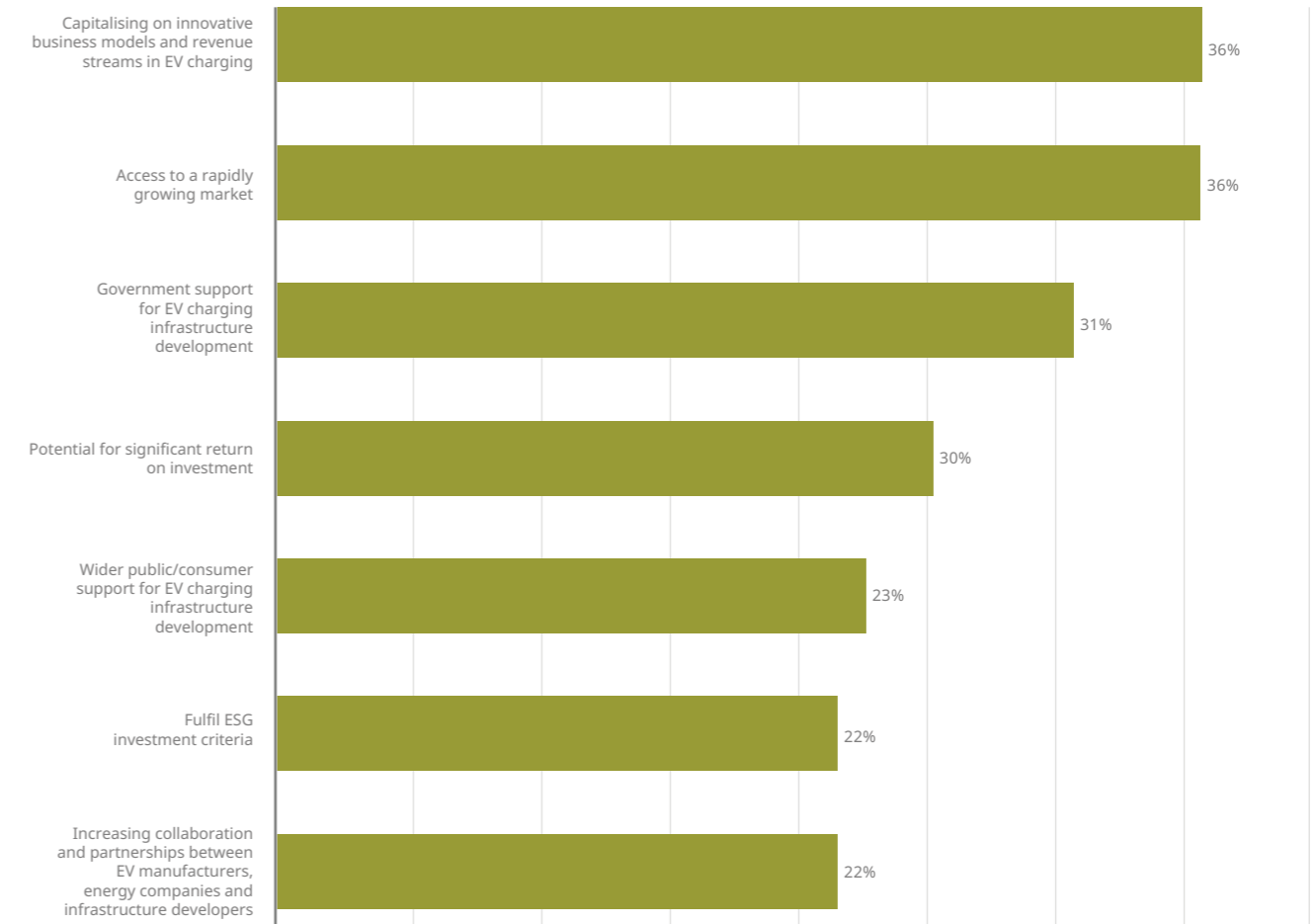
in DLA Piper’s London office. “That said, with a diverse set of business models out there, players will need to understand the different revenue streams available and target the correct opportunities with credible operating plans. . This remains, for the moment, a rather fragmented sector, and we can expect to see consolidation in due course.”

Surging demand for EVs correlates to demand for and investment in EV charging stations and related technologies. This positive growth outlook is reflected in our survey, in which almost all respondents (92%) say they believe investor appetite for EV charging infrastructure will rise over the next 12 months, including 33% who say it will increase significantly. According to our respondents, the two most compelling reasons to invest in EV charging infrastructure are access to a rapidly growing market and to capitalise on innovative business models and revenue streams in EV charging, with each answer option accruing 36% of top-two votes overall.

“Given how critical the automotive sector is for the global economy writ large, there will be significant investment needed to make that infrastructure a reality,” adds Peter Armstrong, Partner in DLA Piper’s Tokyo office.

92%
of respondents believe investor appetite for EV charging infrastructure will increase over the next 12 months

What are the most compelling reasons to invest in EV charging infrastructure? (Select top two)



“We’ve seen mega growth in the industry and increasing valuations and levels of competition in terms of M&A and investment, and even in project financings, which is the sign of a recognised and relatively mature market. It remains a rather fragmented sector, and we can expect to see consolidation in due course.”

Rubayet Choudhury
Partner, Project Finance – London

Colossal funding requirements

The uptake of EVs promises a large customer base who can provide long-term recurring revenue opportunities tied to sustainability objectives in support of a low-carbon economy. The US EV charging infrastructure market, the third largest globally, provides a clear picture of emerging investment trends. In the US, almost USD40 billion will need to be invested in public charging infrastructure by 2030 to provide capacity to support 100% passenger EV sales by 2035, according to Atlas Public Policy. This investment requirement balloons to between USD100 – USD166 billion to support the electrification of medium- and heavy-duty vehicles.

A whitepaper published in 2022 by the European Automobile Manufacturers' Association puts the total investment required by 2030 for its 'EV Charging Masterplan for the EU-27' at up to EUR280 billion – divided between private and public charging infrastructure, grid upgrades and renewables – to facilitate the transition to EVs among personal vehicles, light commercial vehicles, trucks and buses.

The scale of the funding required presents significant investment opportunities over the next decade. Private investment in public EV charging has increased from less than USD200 million in 2017 to nearly USD13 billion by early 2023, spurred by proceeds from initial public offerings and investment commitments from leading automakers. In July 2023, seven major automakers formed a joint venture to accelerate the installation of a high-powered EV charging network, constructing more than 30,000 chargers in North America. As the head of EVs at a French charging infrastructure company puts it, network expansion "is the need of the hour".

Similar sentiments echo throughout our survey interviews, emphasising the appeal of scaling charging networks for improved returns. "Charging network expansion and scaling is

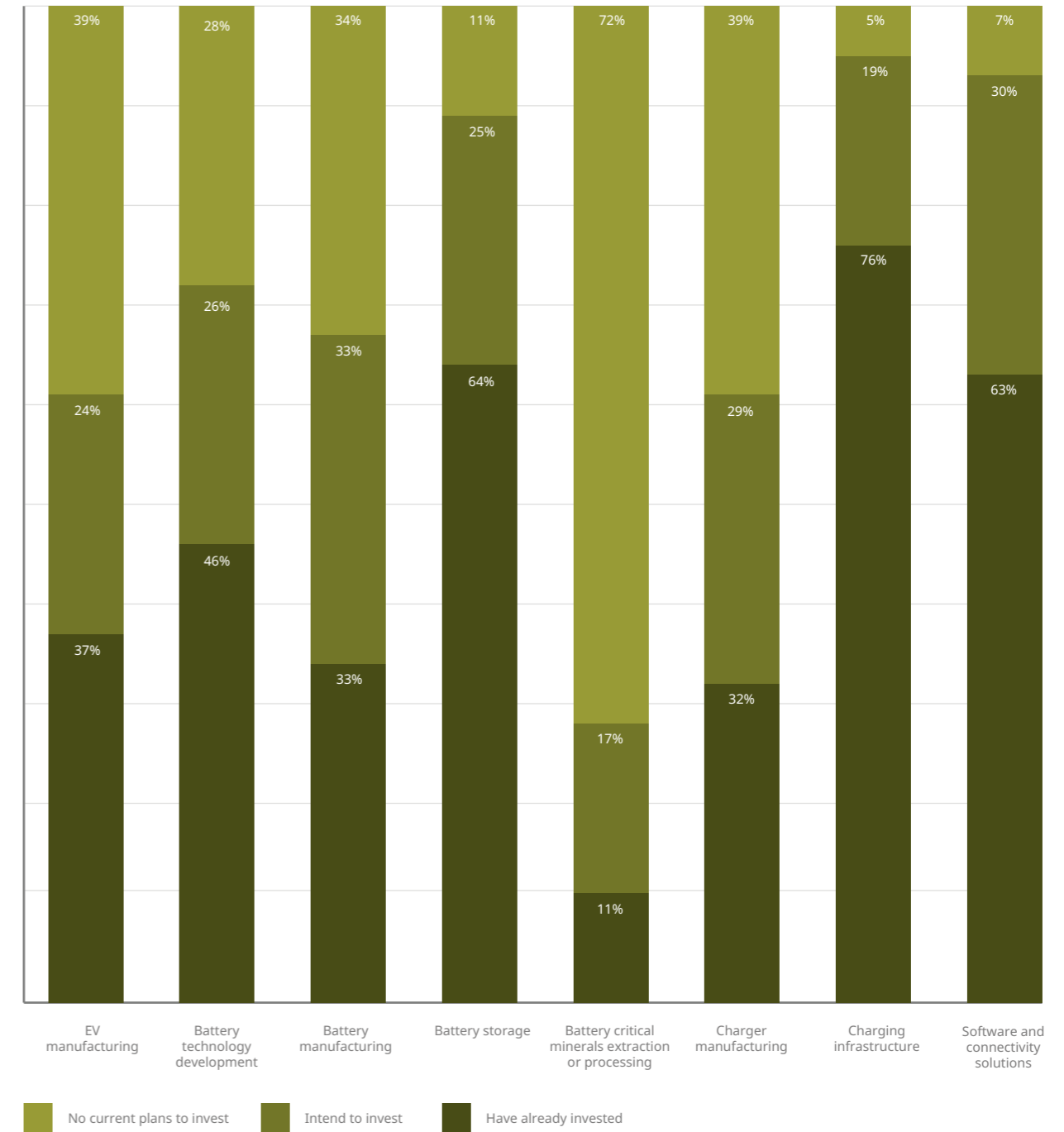
more attractive," says the head of group strategy and corporate development at a landlord contracting with EV charging companies, based in Australia. "For greater investment value with fewer risks, these are the ideal investment opportunities."

The US government is expected to invest more than USD6 billion in charging infrastructure through legislation such as the Infrastructure Investment and Jobs Act and the Inflation Reduction Act. Cumulative funding committed to public EV charging stations has surged from around USD300 million in 2018 to more than USD1.6 billion by early 2023. Electric utilities are also set to play a pivotal role, with investor-owned utilities seeking state commission approvals for ratepayer-funded programmes that promote public EV charging stations. These initiatives involve utilities offering rebates to customers, investing in charging infrastructure, and building and operating charging stations.

USD100 – USD166 billion
of investment is required to support the electrification of both passenger and heavy-duty vehicles in the US.



Of the following core areas of the broader EV industry, which: have you already invested in; do you intend to invest in; or have no plans to invest in? (Select one for each area):



Fast-growth areas

More than three-quarters of respondents (76%) say they have already invested in EV charging infrastructure, while almost two-thirds have invested in both battery storage (64%) and software and connectivity solutions (63%).

“Fast-charging technologies promise more returns for investors,” explains the managing director of a PE firm based in France. “In the next couple of years, there will be more companies working on faster-charging technologies. These technologies do exist but are used on a smaller scale at present. Expansion will require more investments and create new opportunities for investors.”

Energy storage capabilities at charging stations and in remote locations, as well as battery innovation, are also considered attractive investment prospects. Elsewhere, further growth areas include battery manufacturing (in which 33% have already invested and a further 33% say they intend to invest) and charger manufacturing (32% have already invested and 29% intend to invest).

Moreover, growing energy storage capabilities and ancillary services tied to EV charging infrastructure allow investors to develop multiple income streams and, in turn, mitigate against energy price volatility. Diversified business models with well-calibrated revenue stacks are on the rise in many markets, including Germany, Italy and the UK.

More than half of investors identify battery technology and energy storage capabilities (53%) and fast-charging technologies and ultra-fast charging networks (57%) as the two most attractive areas for investment relating specifically to EV charging infrastructure. The corporate respondent group, meanwhile, predominantly identifies charging network expansion and scalability (58% of top-two votes, versus 27% of investor respondents) as the most attractive area for investment. This suggests that investors are taking a holistic view on energy transition opportunities by seeking to create portfolios of investments that complement each other.

Moreover, growing energy storage capabilities and ancillary services tied to EV charging infrastructure allow investors to develop multiple income streams and, in turn, mitigate against energy price volatility. Diversified business models with well-calibrated revenue stacks are on the rise in many markets, including Germany, Italy and the UK.

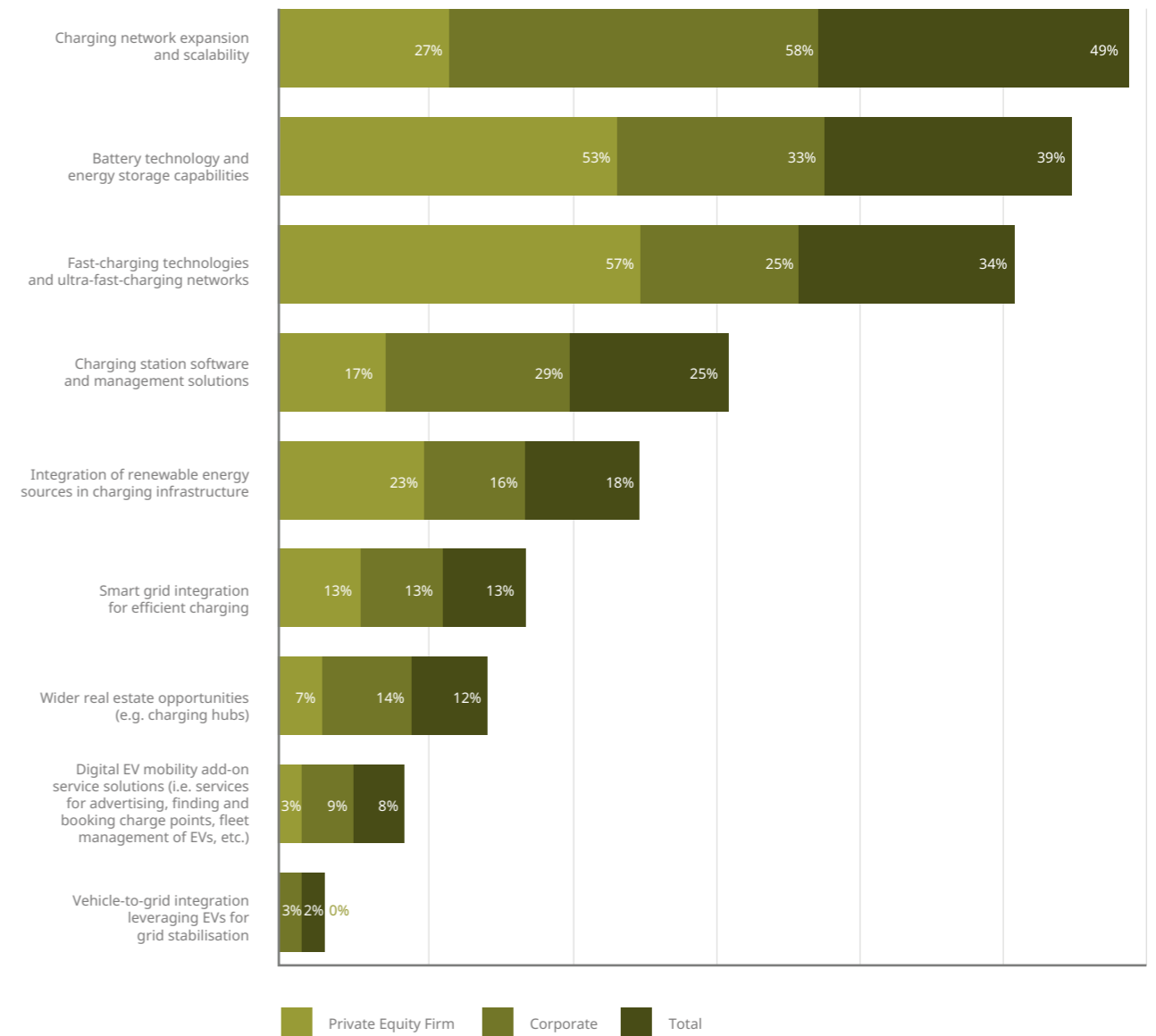
“Making energy accessible near remote locations would increase the demand for EVs. At present, many potential consumers are sceptical about energy availability. If we strengthen storage capabilities, the demand for these vehicles will be stronger, and provide better returns,” explains the head of implantation and operations at logistics company that uses EV delivery fleets in Germany.

Private capital is strongly motivated to align its investment strategies with the long-term energy transition agenda. A striking 92% of respondents anticipate EVs playing the most significant role in driving the energy transformation of the automotive sector, spanning light vehicles, trucks, buses, and heavy-duty vehicles. IEA forecasts support this outlook, projecting that EVs will displace over five million barrels of oil per day by 2030.

In contrast, hydrogen receives only 6% of first-choice votes in terms of enabling the energy transformation in the automotive sector, but garners 71% of secondary ballots, followed by biofuels and synthetic fuels. Further innovation may see these alternative energy solutions grow in esteem, but for the moment EVs present the clearest route forward in facilitating the energy transition in the transportation sector.



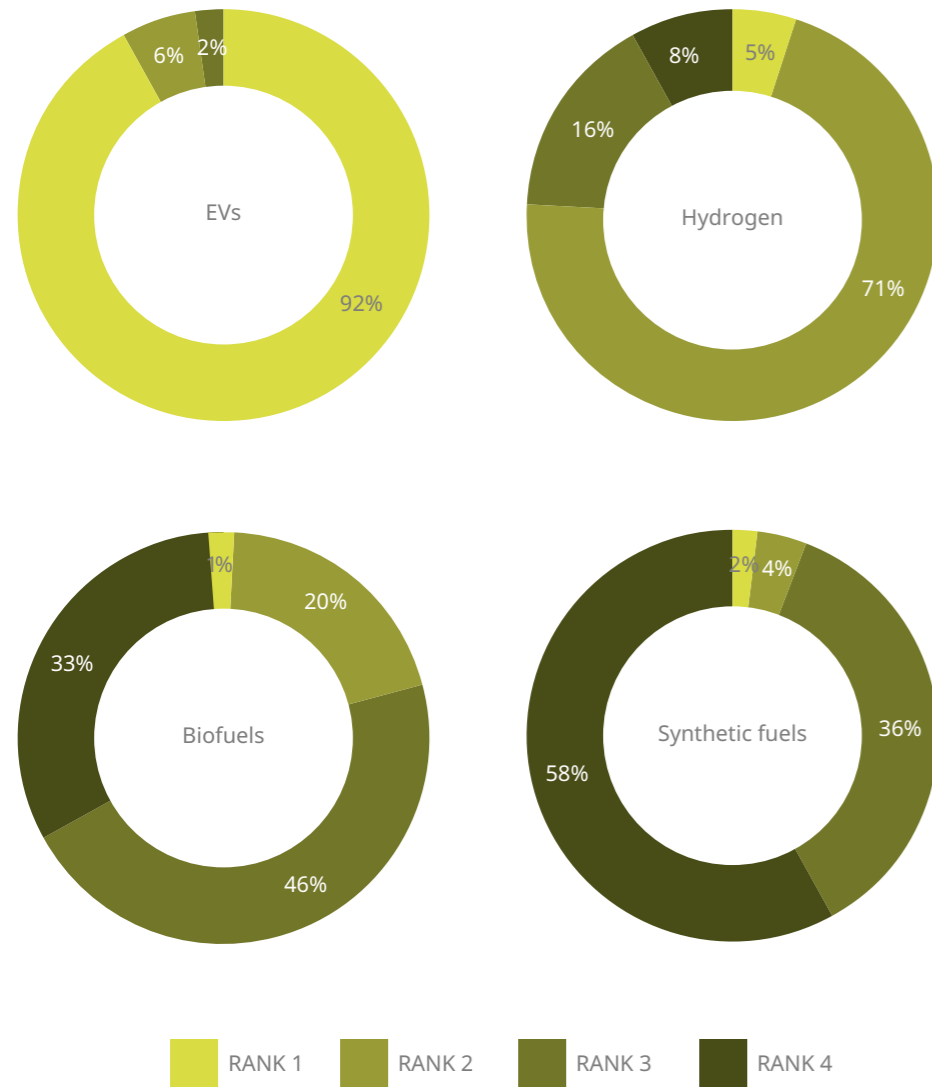
Of the following areas relating to EV charging infrastructure specifically, which are the most attractive for investment? (Select top two)



“Given how critical the automotive sector is for the global economy writ large, there will be significant investment needed to make that infrastructure a reality”

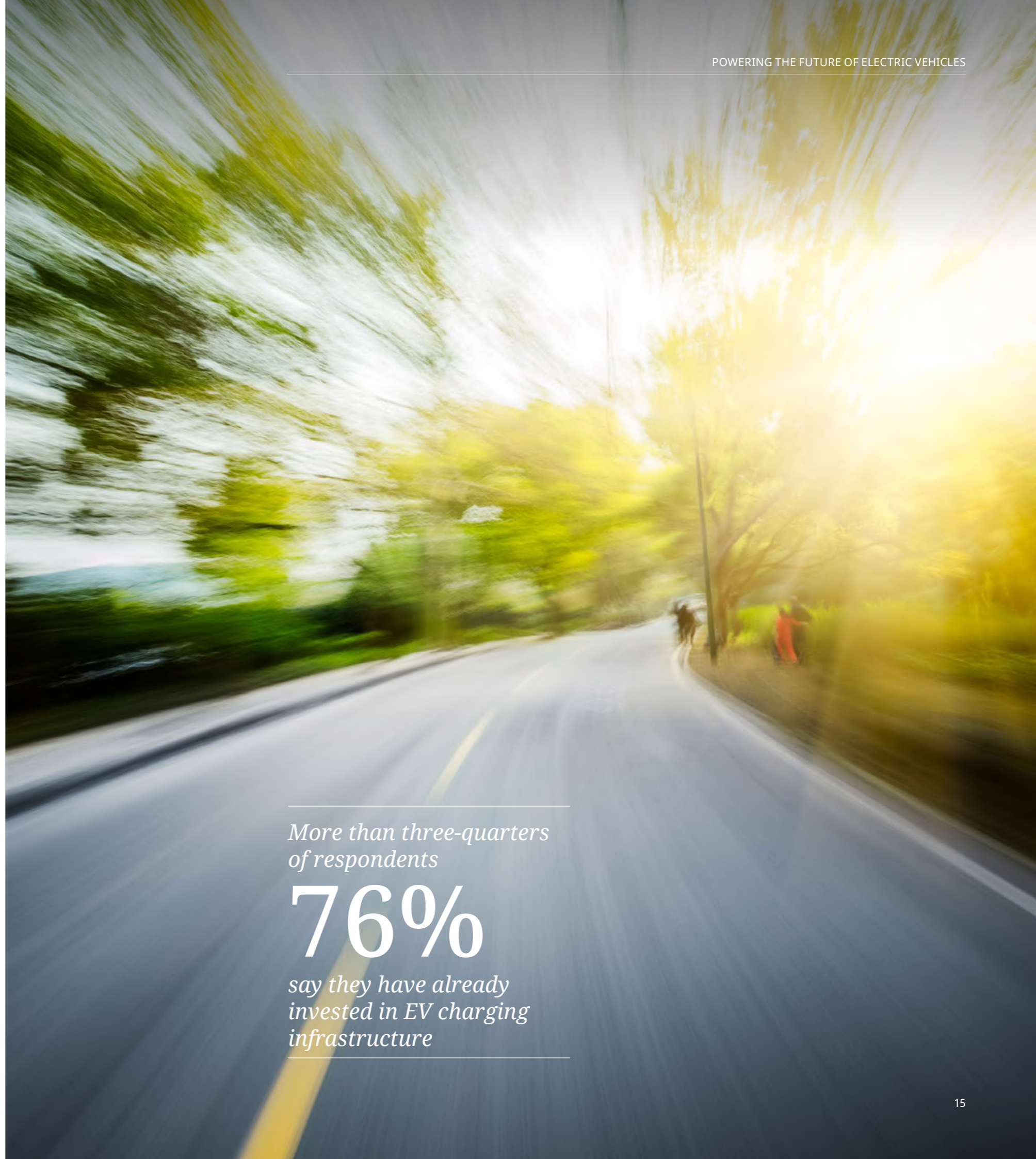
Peter Armstrong
Partner, Corporate – Tokyo

Of the following technologies and alternative fuel solutions, which do you believe will play the biggest role in enabling the energy transformation in the automotive sector in relation to light/passenger vehicles?



“Fast-charging technologies promise more returns for investors. In the next couple of years, there will be more companies working on faster-charging technologies. These technologies do exist but are used on a smaller scale at present. Expansion will require more investments and create new opportunities for investors.”

Managing Director
PE firm based in France



More than three-quarters of respondents

76%

say they have already invested in EV charging infrastructure

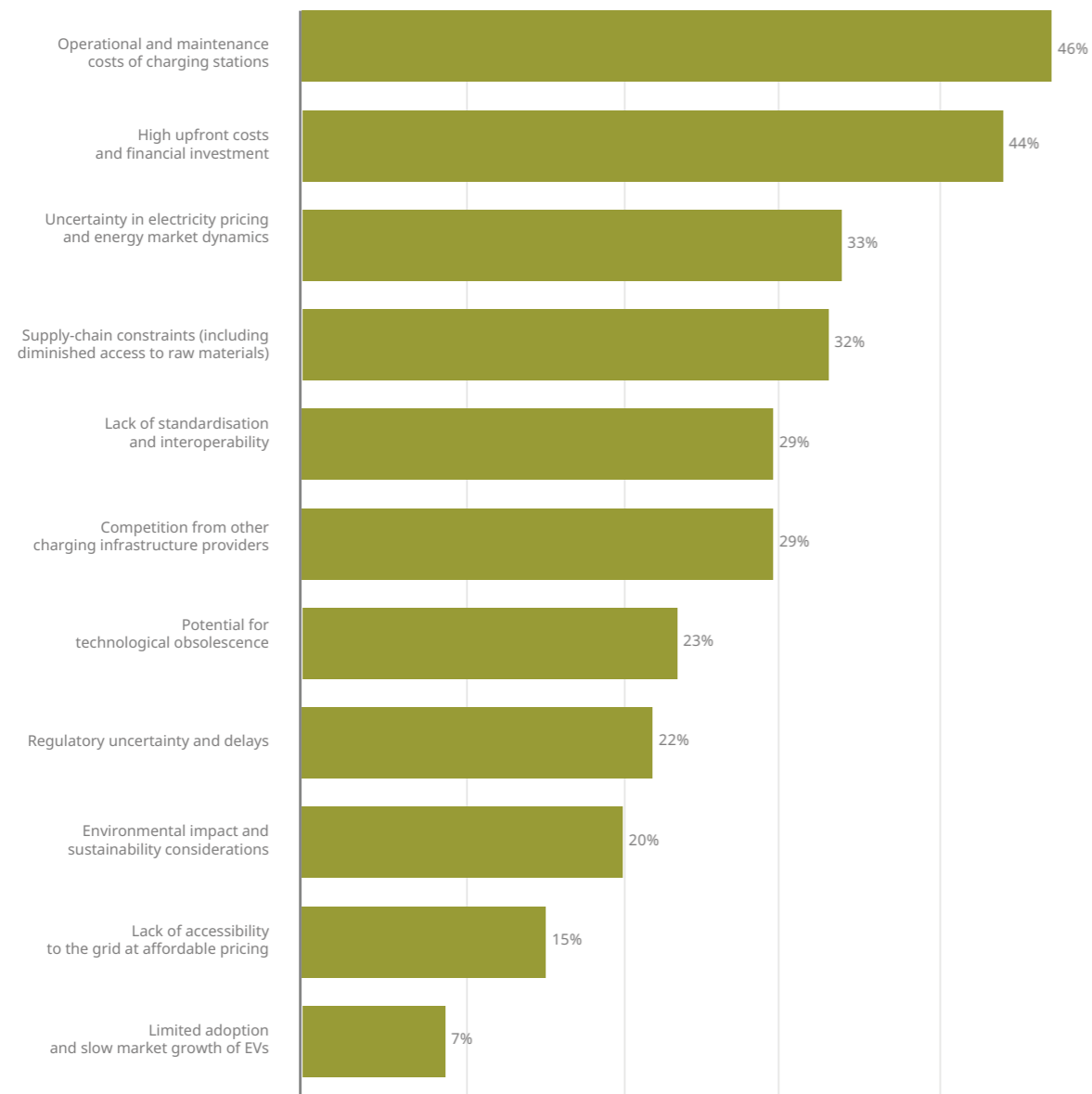
Risks inevitable in new markets

Investing in still-nascent sectors inherently carries risk. Our survey respondents believe the primary risks associated with investing in EV charging infrastructure are the operational and maintenance costs of charging stations (46% identify this as a top three risk) and the high upfront costs and financial investments required (44%). In a distant third place is uncertainty in electricity pricing and energy market dynamics (33%).

On maintenance, this is an interesting concern for respondents to have raised, given that the technology involved is not especially elaborate. However, in this budding consumer-facing business, any failure on the part of the charging technology could lead to a significant loss in user confidence, in addition to practical concerns on the business side.

“There is a lot of uncertainty regarding EV charging stations,” explains the head of strategy at an EV manufacturer in Japan. “Fleet customers have not been able to define a good business model for managing longer journey transport with EVs. There is an issue with the charging infrastructure availability, which has not been addressed fully.” A lack of revenue certainty must also be addressed, though the emergence of increasingly sophisticated business models as the sector matures will help to mitigate this concern.

What are the main risks associated with investing in EV charging infrastructure? (Select top three)

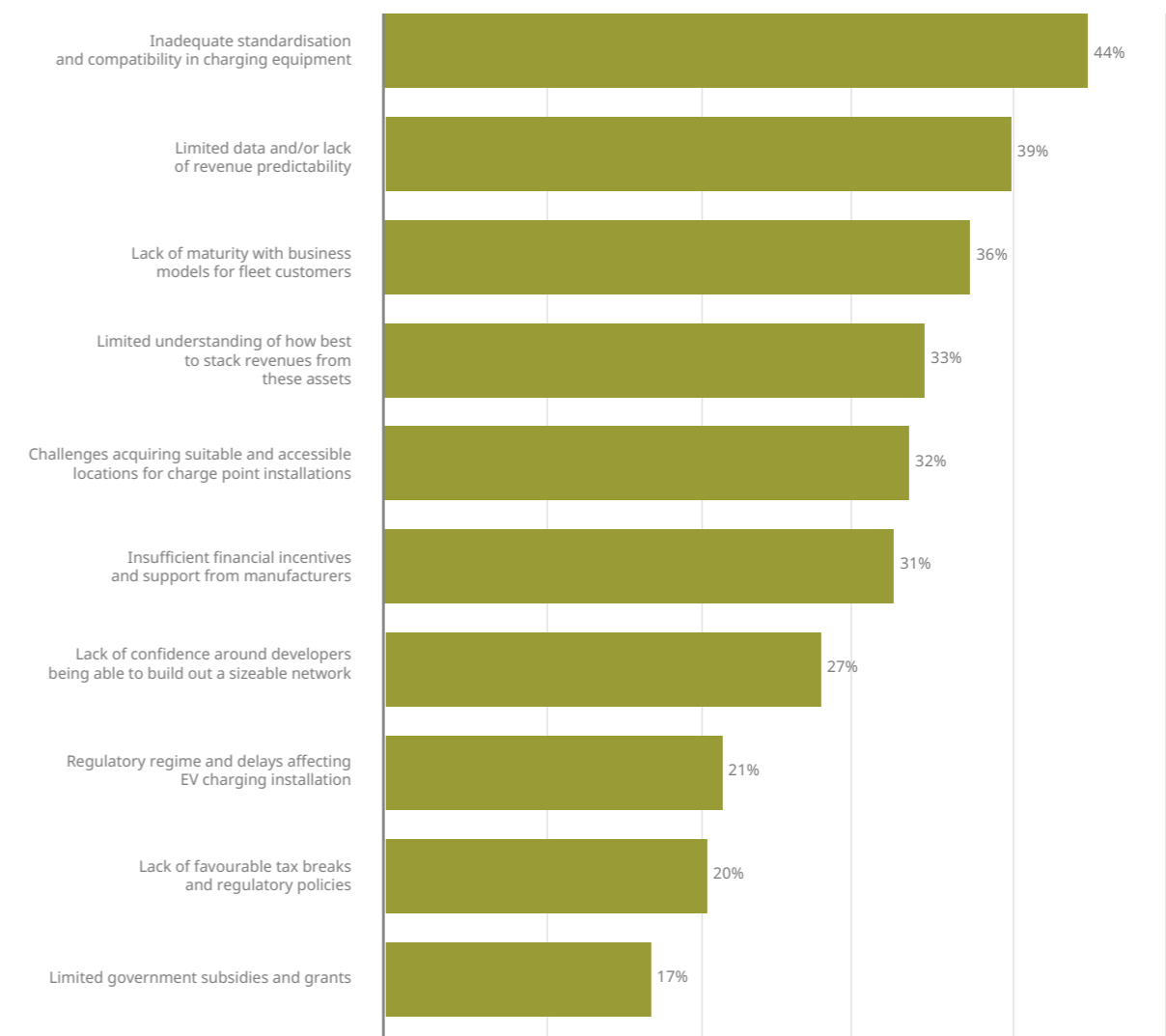


On a positive note, only 7% of respondents identify limited adoption and slow market growth of EVs as a notable risk. Demand is very strong, but practical concerns cannot be brushed under the rug. “The industry faces challenges regarding who installs and maintains EV infrastructure, whether it’s the private or public sector,” explains Susan Samuel, Partner in DLA Piper’s Leeds office. “With limited opportunities for local authority or public sector investment in this space, the industry is reliant on private investors, major land occupiers and the energy suppliers to find ways to provide this infrastructure. The motivation for introducing EV infrastructure differs according to each sub sector and is largely focussed around the broader benefits of the transition towards clean and green energy.”

“The industry faces challenges regarding who installs and maintains EV infrastructure, whether it’s the private or public sector. With limited opportunities for local authority or public sector investment in this space, the industry is reliant on private investors, major land occupiers and the energy suppliers to find ways to provide this infrastructure.”

Susan Samuel
Partner, Real Estate – Leeds

What factors are inhibiting greater investment in EV charging infrastructure? (Select top three)



What is inhibiting greater investment?

Inadequate standardisation and compatibility between charging equipment is thought to be the biggest barrier to greater investment in EV charging infrastructure, with 44% of our survey participants citing it as a top-three obstacle.

“Lack of standardisation of charging equipment will increase the challenges of enhancing the EV charging infrastructure,” says the strategy director of an Australian government entity. “The cost of installations might be higher to adapt the equipment at certain locations. There are unexpected complications because of different charging functions.”

Some industry players have taken steps to address this concern. Tesla, for instance, is beginning to allow for interoperability in certain countries, and ‘roaming’ models arranged between charging service providers are becoming more common, especially in Europe.

The lack of data for predicting revenues is also a significant obstacle to investment (cited by 39%), as investors seek accurate analyses to assess their financial potential. Also in the top three concerns is the immaturity of business models (36%) which present concerns about the effectiveness of EVs for fleet customers, hampering investment value. As the head of operations in Germany of a landlord contracting with EV charging companies explains, “If the charging stations do not operate on a good margin, it’s a loss for investors. The unpredictable nature of investments is a big hurdle here.”

This tension is something that Choudhury and DLA Piper have already observed closely: “Utilisation data is absolutely key. Some investors are finding it difficult to pick the winners particularly when there is a lack of historic data. However, successful fundraises continue and quality data is what distinguishes the best operators and unlocks the potential for fulfilling successful business plans and raising further investment. Ultimately, the the credibility of the target business and making sure the investor’s risk profile

is properly attuned to what’s being offered is critical. Given the wider macro trends around rising interest rates and the need for higher returns for investors, there may well be an increasing number of players who view any potential volatility as an opportunity.”

Overall, the short-term risks in the EV charging infrastructure industry are outweighed by the potential upside. Investors willing to take on risk have the opportunity to capitalise on the growing demand for this infrastructure and develop solutions that overcome challenges. The lack of standardisation and compatibility in charging equipment, and limited data to help predict revenue, are largely a function of the nascent stage of the industry’s maturity. Obstacles present opportunities for entrepreneurs in this transformative industry.

44%
of survey participants cite inadequate standardisation and compatibility between charging equipment as biggest barrier to investment in EV charging infrastructure



Spotlight: Driving sustainability in the EV industry

ESG issues are woven into the fabric of the EV industry's mission: to help facilitate the global economy's transition away from high-carbon energy to cleaner solutions.

Almost inevitably, ESG principles provide a foundation of trust among investors, shareholders, employees, and consumers, bridging the gap between a business's bottom line and responsible progress. For the EV industry, this transformation recognises that ESG issues are inseparable from environmental concerns (such as reducing greenhouse gas emissions and improving air quality), social aspects (including job creation and road safety), and governance matters (such as business transparency, responsible supply chains, and managing technological risks.) Put simply, proper ESG management offers a way to mitigate risk and create value.

Social impact objectives are at the intersection of core ESG drivers. In our survey, 60% of respondents overall say they prioritise the reduction of greenhouse gas emissions and air pollution as the most important social impact objective in relation to EV and EV charging infrastructure investment, production and development. Somewhat surprisingly, given the scope for job creation in the construction and operations of Gigafactories for EVs, no other social impact objective is identified by more than half of respondents; this suggests a divergence in the investment opportunities for EV manufacturing and the associated charging infrastructure.

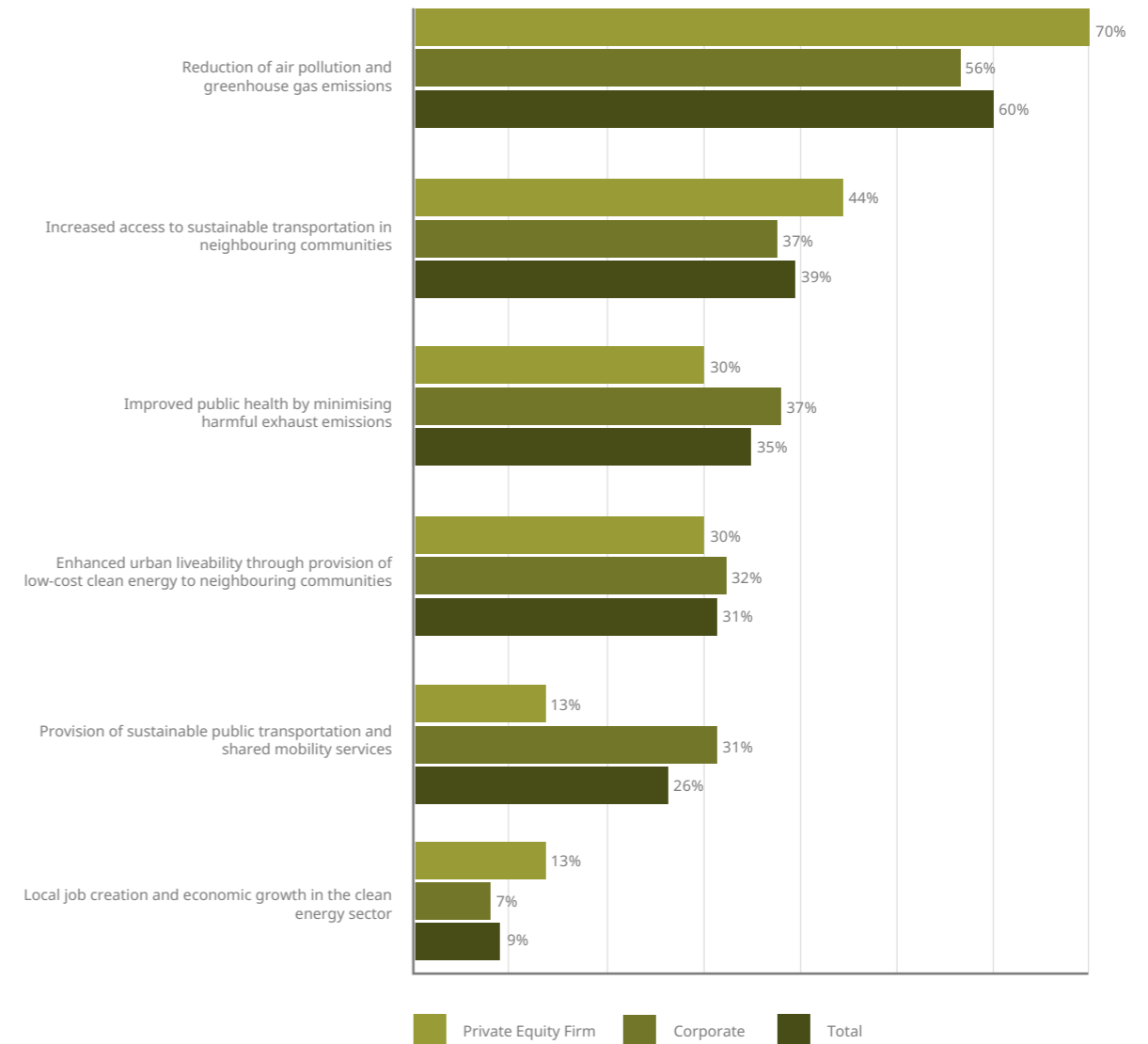
60%
*of respondents prioritise
the reduction of air
pollution and greenhouse
gas emissions*

“We’ve launched many ESG initiatives to minimise carbon emissions through the EV lifecycle: we have a zero-carbon plant and we are also pursuing strong decarbonisation goals by the year 2025”

Strategy Director

EV battery manufacturer – Japan

What social impact objectives do you prioritise in relation to your investment in, production and/or development of EVs and EV charging infrastructure?
(Select top two)

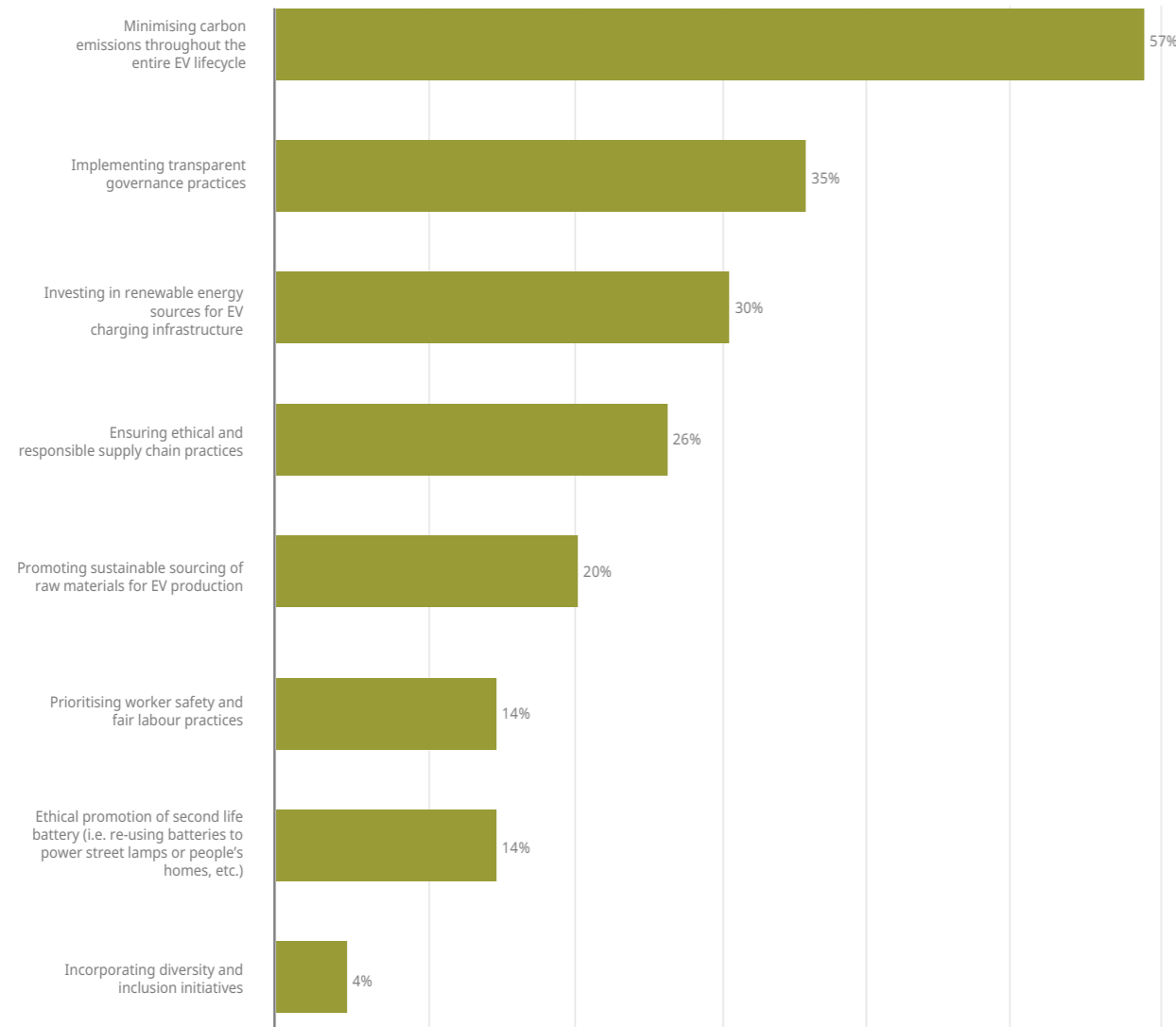


Over half of all respondents say they are considering minimising carbon emissions throughout the entire EV lifecycle as a potential ESG strategy (57%). Additionally, 35% are weighing up implementing more transparent governance practices, and 30% are exploring investments in renewable energy sources for EV charging infrastructure.

These strategies reflect a broad commitment to environmental sustainability and responsible governance. As the managing director of an institutional investor in the US says:

“Our strategy is to lay the foundation for clean and reliable energy. We know that this is a continuous effort and minimising emissions through the EV lifecycle will take a while. Investment allocations will be made considering all our long-term goals”

What ESG strategies are you considering in relation to your investment in, production and/or development of EVs and EV charging infrastructure? (Select top two)



57%

Over half of all respondents say they are considering minimising carbon emissions throughout the entire EV lifecycle as a potential ESG strategy



Supply chains

Most corporates surveyed believe that the EV industry should prioritise monitoring and reducing the environmental impact of the supply chain (58% of top-two selections). Notably, this was considered less of a priority among PE respondents (just 34% of top-two selections). Instead, investors emphasise collaborating with suppliers to enhance environmental and social performance (47%) and ensuring sustainable sourcing of raw materials for EV production (43%).

A development director at a logistics company in Uruguay stresses the importance of responsible growth, saying: “We work in a dynamic industry, and it can be easy to forget our ESG goals as we accelerate growth. However, we’ve chosen to be more conscious about our impact on the environment. Renewable investments and steps to reduce carbon emissions reiterate these goals.”

Building ethical supply chains is a complex challenge for the EV industry, involving the development of supplier codes of conduct, performance benchmarking, and ongoing support for improvements.

“In Japan for example, to mitigate economic security risks supply chains are being diversified.” says Armstrong. “Some jurisdictions that are rich in natural resources, such as lithium and cobalt, present greater ESG risks than others which gives rise to new ESG risks that must be considered and factored into pricing.”

There is a clear trend, too, among some governments towards promoting the onshoring of supply chains, especially in Europe and the US. Curtailing the reliance on overseas supply chains and mitigating potential human rights concerns are key motivating factors, as is the potentially massive scope for job creation in these markets.

Governance challenges

According to the largest share of respondents, the most significant governance-related challenge for investment in the EV industry is adapting to sustainable business models and practices (49%). This relates to the broader concern among some industry participants about the need to build up diverse business models with multiple revenue streams addressed earlier in this report. High-quality and specialised management teams are crucial to achieving these sustainable goals.

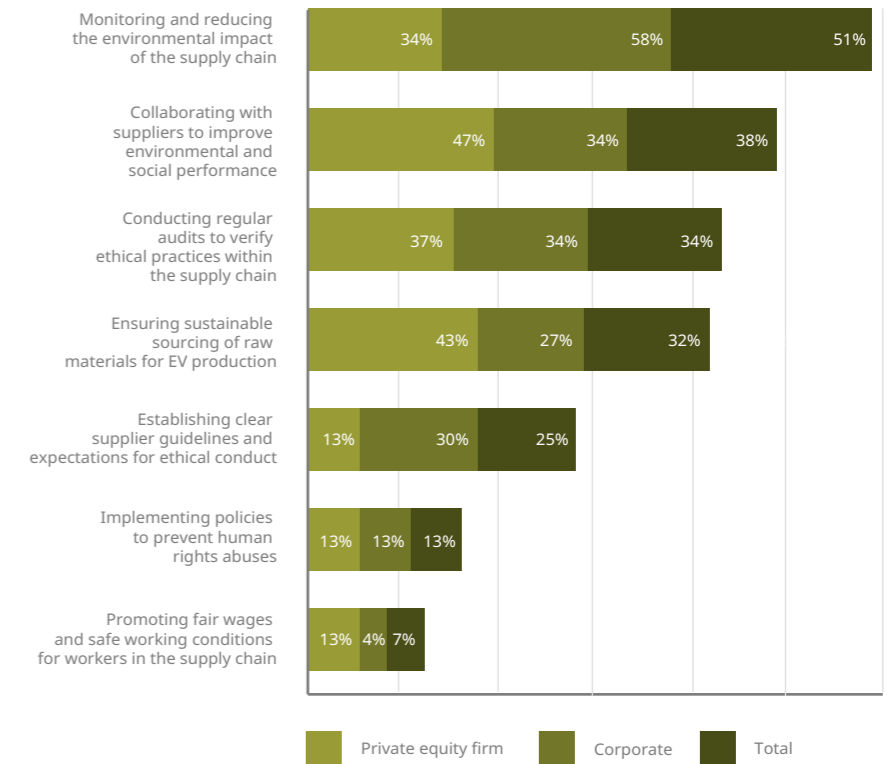
Managing responsible practices across the EV supply chain (40%) and assessing and mitigating technological and innovation risks (38%) are the next biggest governance-related challenges cited by respondents.

“Some jurisdictions that are rich in natural resources, such as lithium and cobalt, present greater ESG risks than others which must be factored into pricing.”

Peter Armstrong
Partner, Corporate – Tokyo



Which of the following aspects of ethical and responsible supply chains for EVs should the industry prioritise? (Select top two)



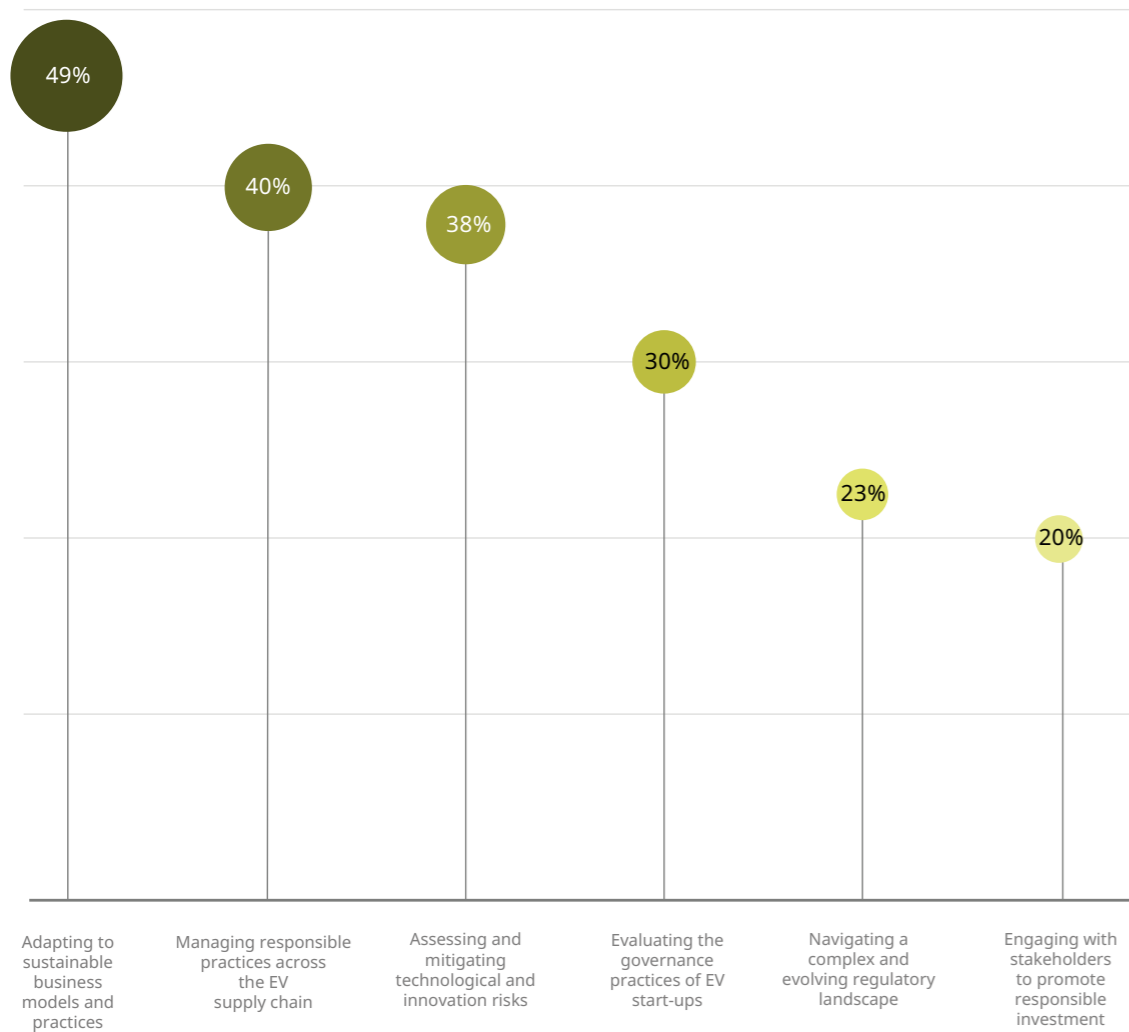
51%

Over half of respondents say they are monitoring and reducing the environmental impact of the supply chain

The vice president of strategy at a US logistics company using EV delivery fleets emphasises in particular the importance of transparent governance practices, saying: “We ensure maximum data-related transparency, uphold data ethics, and prioritise supplier codes of conduct. Safety measures for workers are also integral to our ESG goals.”

ESG factors have gained immense importance in the EV industry, offering both opportunities and challenges to overcome. Effective adoption of an ESG framework can facilitate access to capital, reduce the risk of regulatory interventions, enhance corporate reputation, and foster trust. Those businesses that successfully integrate ESG into their strategies will be best-placed to attract investment, customers, and talent. Conversely, companies neglecting ESG risks may face increasingly severe reputational damage, financial setbacks, and regulatory scrutiny.

What are the most significant governance-related challenges for investment in the EV industry? (Select top two)



We are trying to get everybody into EVs

Christopher Hook, Global Head of Sustainability, Uber



According to our survey, 62% of respondents believe government subsidies and incentives are the most critical factor for achieving equitable access to EVs and charging infrastructure. Do you agree?

That sounds about right. In our experience, part of the industry is able to stand on its own economically and make the investment case to private capital to secure funding for infrastructure investment, but this tends to be focused in areas of high demand. The equitable access point is crucial, because if we are going to achieve the energy transition equitably, infrastructure must be available as widely as possible across cities and communities. There are very different levels of penetration of this infrastructure across different parts of cities.

At Uber, we are trying to get everybody into EVs. The drivers who work on our platform don't tend to live in the richer parts of the city and so their access to charging infrastructure is often more limited. The government subsidies and investment programmes that provide start-up capital into those spaces are crucial.

Overall, the playing field doesn't feel level at the moment, and there is a risk that – absent those subsidies and incentives – you get a doubling down on investment in places where it already makes sense and other areas get left behind.

What are your observations of how different economies and governments tackled equitable infrastructure access through incentives, subsidies and regulation?

The two examples that come to mind are the US and the UK. In the US, there has been a focus on incentivising underserved communities with the Justice 40 Initiative, which is a White House designation. The US federal government is trying to fill the gaps that the market isn't going to fill by saying, "We're going to disproportionately provide funding to those communities."

In the UK, the Local EV Infrastructure Fund is about empowering local authorities to make decisions, and there are advantages and disadvantages to that approach. As an investor, or in our case someone dependent on the infrastructure getting built, you have to spend a lot of time understanding who is making decisions, where those decisions are made, and how you can try and be helpful in that process.

How do you think about social impact?

Sustainability is business critical for Uber. We want Uber to be the cleanest platform on earth because it is the right thing for our riders and drivers, and it is increasingly part of our licence to operate in cities around the world.

Our motivation is to try and get every driver on Uber to be driving a net-zero emissions vehicle, which is dependent on EV infrastructure materialising. We think about our responsibilities to reduce our emissions footprint, that's crucial. As a large company, we have a responsibility, along with everybody else, to try and transition to a low-carbon economy. We have made various pledges and commitments to do so.

Uber has a commitment to be a net-zero emissions company by 2040. We have set milestones on the way. By 2030, all rides on Uber will be in net-zero emissions vehicles in the US, Canada and Europe. By 2025, we aim to be 50% of the way there in seven capital cities across Europe, including London. Today, we are at 5.6% in the US and Canada, 8.4% in Europe and over 20% in London – our leading city globally.

We believe this makes business sense for us in the short, medium and long term. For a company with professional drivers, it makes sense for us to move to low-emissions vehicles as quickly as possible. Customers who use the Uber platform also expect us to be moving in that direction. There is a business imperative along with a social imperative to do so. As an urban-oriented company, air pollution, and the impact of traffic in people's neighbourhoods is a real concern. We try to find programmes that can reduce those problems in a way that makes economic sense.

What is Uber's strategy to reach your net-zero targets?

Our strategy includes working with the industry to make the vehicles as cheap as possible for drivers to buy, rent or lease. We work closely with the charging infrastructure industry, and those funding infrastructure, to install EV charging stations in the neighbourhoods that our drivers work and live in, as rapidly as possible. We invest a lot of time supporting education and engagement on the topic itself, to demystify what transitioning to an EV is like in practice. If we can do those steps well, that is broadly in line with what our consumers want and expect of us, as well as what local authorities and regulators want businesses and consumers to do. Ultimately, climate action is a team sport. We will only make progress if a lot of different actors can collaborate.

Our strategy combines influence with our scale and targeted investment. We financially support drivers to buy or lease EVs, in a cost-effective way that utilises available incentives, subsidies and discounts in all markets we operate. We also selectively invested in pilot programmes that install infrastructure. For example, in the UK, we provided funding of GBP5 million in three London boroughs to deliver 700 new public charge points where we could see demand from our drivers.

How is Uber approaching the long-term trend towards autonomous vehicles?

Our autonomous vehicle strategy is partnership-focused across both rideshare and delivery. We believe the future is shared and electric and, while we believe there will be more drivers on our platform in 10 years' time from now, there will also be autonomous trips for the journey to which autonomous is better suited.

Chapter 2:

Markets and equitable access

The proliferation of EVs is a global phenomenon. These vehicles promise greater efficiency compared to ICE vehicles, will help curtail our reliance on fossil fuels and improve air quality.

However, widespread adoption of EVs will require regulation that advances the availability of reliable and convenient EV charging stations in residential and commercial buildings as well as public spaces. In the short term, the growth of the attendant charging sector will be driven by EV adoption rates and government incentives that support infrastructure development. The declining cost of charging stations and related infrastructure in the medium to long term will help cement EVs' position and upward adoption rates.

In recent years, EV adoption and investment has been led by China, Europe and the US, unsurprising given that these are the world's largest consumer markets. The EV industries in each of these regions owe a share of their success to supportive government policies and incentives that reduce costs for consumers, offer tax incentives for manufacturers, and promote broader market awareness and EV acceptance.

These measures have been instrumental in boosting EV adoption. As the head of an EV charging infrastructure company in France clarifies: "Promoting EVs can be done more effectively if there are government subsidies and incentives available. Access to charging infrastructure should be reasonable enough for consumers to justify the purchase of EVs in the future."

"In terms of charging infrastructure, we shouldn't see blanket government intervention as the sole solution," says Choudhury. "The private sector has demonstrated, across the world, that it has the ability to rollout networks efficiently and at pace without subsidies. Interventions should be targeted, for example, to help with rollouts in rural areas or where grid connection costs are prohibitively expensive".

As we look ahead to the remainder of this decade, the dynamics of EV investment, charging infrastructure development and adoption trends will become more nuanced. EV adoption will increasingly be influenced by environmental concerns related to legacy ICE vehicles, manufacturers' ability to capitalise on technological advancements, and the impact of fuel prices on the relative value between EVs and ICE vehicles.

"Government interventions should be targeted to help with rollouts in rural areas, for example, or where grid connection costs are prohibitively expensive."

Rubayet Choudhury
Partner, Project Finance – London



Goal-oriented industry

Our findings illustrate clearly how Europe is regarded as a world leader in setting ambitious EV adoption objectives. In February 2023, the European Commission set a target for all new cars sold in the European Union (EU) to produce zero CO₂ emissions by 2035. Meanwhile the current UK government intends for the sale of petrol and diesel-powered cars in the country to be banned by 2035.

“In the EU, the fact that Europe is embracing the shift to zero-emission mobility is evidenced by the fact that the EU institutions and the EU Member States generally seem to be pulling in the same direction on big-picture targets,” says Daniel Colgan, Partner in DLA Piper’s Brussels office. “The aspects of the ‘Fit for 55’ deal concerning targets for zero-emission vehicles are a case in point, as are the approvals by the European Commission of relevant State aid packages.”

The brighter outlook for faster EV uptake in Europe is consistent with these broad pledges to adoption targets, attractive subsidies and incentives, the EU’s financial commitment to charging infrastructure development, and already-high levels of consumer awareness and acceptance. However, it is worth noting that changes in the political sphere may have an adverse knock-on effect on EV targets, at least in some countries. UK Prime Minister Rishi Sunak, for instance, in September 2023 rolled back the country’s

target to ban the sale of new petrol and diesel vehicles by 2030 to 2035.

“Despite the recent announcements by the UK government, the scale of charging infrastructure needs is still so great, we do not expect a slowdown in the expansion of networks. Investor appetite remains buoyant. There may, however, be an impact, in the medium-term, on very large investment decisions from the automotive industry in terms of where to locate production facilities and Gigafactories,” says Choudhury. “More broadly, geopolitical unrest could have an impact on supply chains but this is no different to any other industry and there is a clear trend from governments, particularly in Europe and the US, to address these concerns by introducing protectionist policies that help onshore manufacturing.”

Some of these tailwinds, including industry incentives and strong public support, are present in China and the US, albeit to a less extent in some cases. Underscoring Europe’s lead in this regard, 42% of our survey respondents cite Europe as the region that is likely to receive the largest share of EV and related infrastructure investment worldwide, followed by 35% who earmark North America and 23% who cite APAC (excluding Australia).

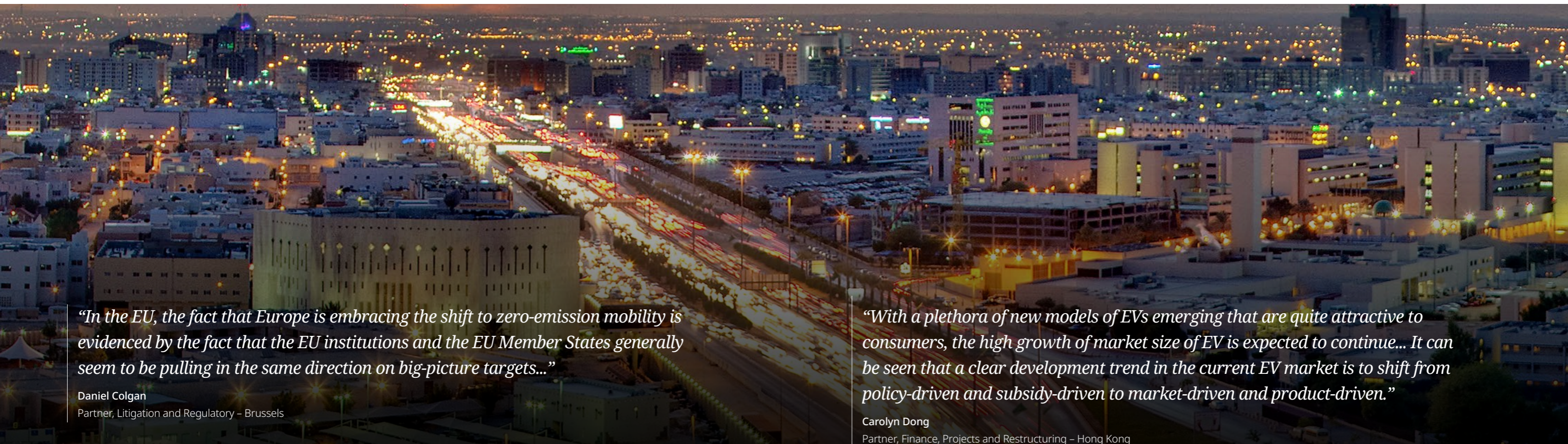
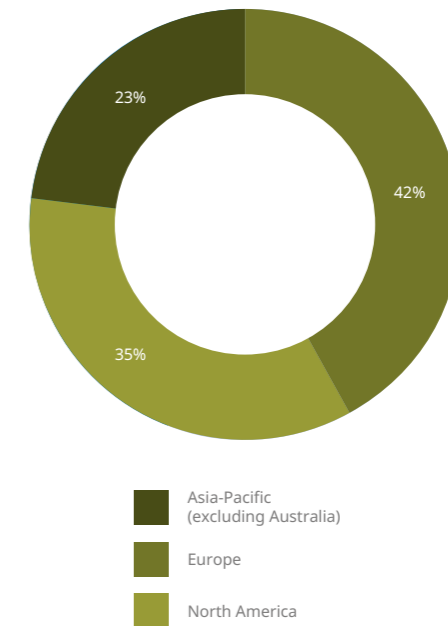
To date the US federal government has not set such a comprehensive objective. While the current administration has set a goal that the majority of all

new vehicle sales in the US be electric by 2030, this is not a binding target, and no specific deadline has been set for phasing out ICE vehicles. Moreover, disparities in financial incentives at the state level may exacerbate unequal adoption rates and impact charging infrastructure investment in the US.

China, as the world’s largest EV market, has made considerable strides, with electric cars reportedly approaching one in three total vehicle sales in several cities. Electric cars represented 29% of total domestic car sales in 2022, surpassing the 20% target set by the government for 2025. By the end of 2025, 50% of new car sales in China are expected to be EVs, which would make it the first major economy to reach that milestone. However, China does not have a formal target for 100% domestic EV sales or a policy to phase out ICE vehicles. After several rounds of reductions, the country’s EV subsidies were scrapped at the end of 2022, from which we might infer that the government believes China’s EV market has matured sufficiently to grow independently.

“With a plethora of new models of EVs emerging that are quite attractive to consumers, the high growth of market size of EV is expected to continue,” says Carolyn Dong, Partner in DLA Piper’s Hong Kong office. “It can be seen that a clear development trend in the current EV market is to shift from policy-driven and subsidy-driven to market-driven and product-driven.”

In what region of the world do you expect the largest share of EV and related infrastructure investment to be targeted? (Select one)



“In the EU, the fact that Europe is embracing the shift to zero-emission mobility is evidenced by the fact that the EU institutions and the EU Member States generally seem to be pulling in the same direction on big-picture targets...”

Daniel Colgan
Partner, Litigation and Regulatory – Brussels

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Carolyn Dong
Partner, Finance, Projects and Restructuring – Hong Kong

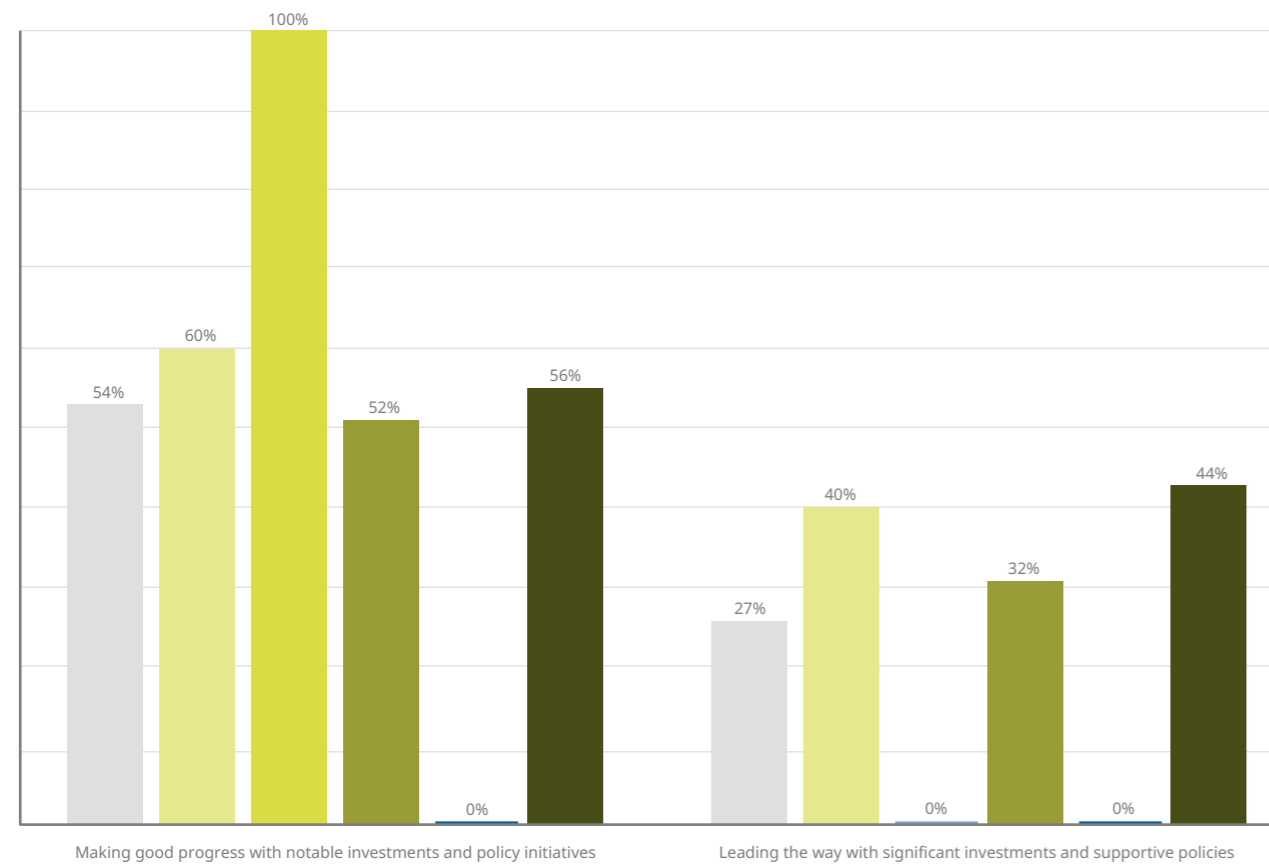
Making progress at home

Dividing our pool of respondents according to where they conduct the majority of their business enables us to cast a light on different parts of the world's comparative successes in terms of EV investment and adoption rates.

Respondents who operate primarily in North America are especially enthusiastic about its progress, with 44% stating that the region is "leading the way" with significant EV investments and a supportive policy environment. The remaining 56% of this cohort said North America was "making good progress".

"Major federal legislation enacted in the last two years provides unprecedented US government funding, incentives and credits to manufacturers and purchasers of EVs and equipment, batteries, clean energy projects, charging infrastructure, and related projects and activities, including approximately USD370 billion in the 2022 Inflation Reduction Act alone," says Paul Hemmersbaugh, Partner and Chair of the Transportation Regulatory Practice in DLA Piper's Washington, DC office.

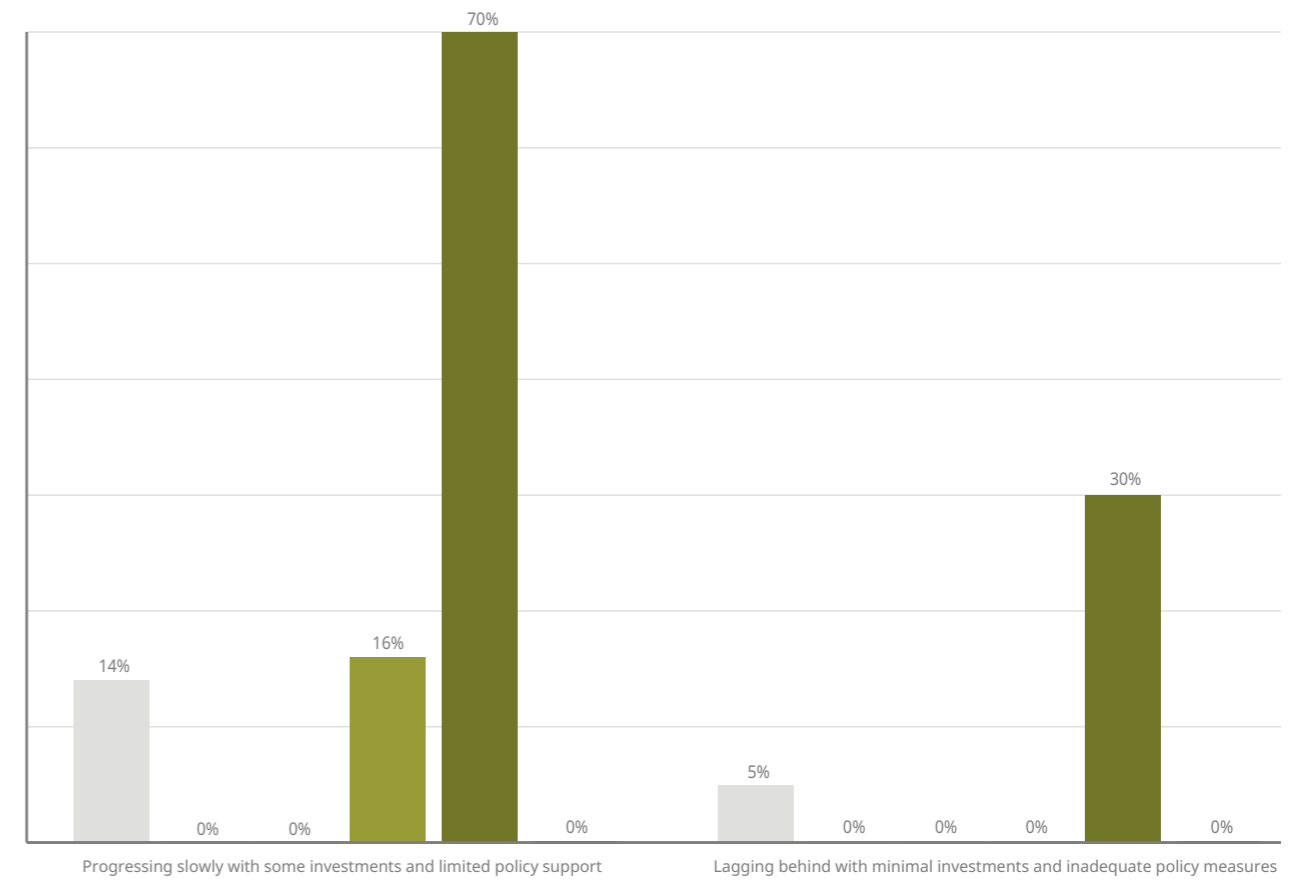
How would you compare progress made in the country in which you primarily do business/operate in terms of investment in and adoption of EVs to progress made in other countries? (Select one)



Legend: Total, Asia-Pacific (Excluding Australia), Australia, Europe, Latin America, North America

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Paul Hemmersbaugh
Partner and Chair of the Transportation Regulatory Practice, Washington, DC



Legend: Total, Asia-Pacific (Excluding Australia), Australia, Europe, Latin America, North America

The optimism around North America is well founded. In 2022, EV sales in the US increased by 55% over the previous year, according to IEA figures, and 17% of all new car sales were electric in California. The government, at both the federal and state levels, and businesses are investing heavily in EV charging infrastructure. The number of public EV chargers in the US increased by 30% in 2022, including more than 40,000 public EV chargers in California alone. EV adoption and charging infrastructure investment is supported by a raft of policies, including the Inflation Reduction Act, which offers an array of tax incentives.

Nonetheless, even with these favourable conditions in mind, the transition to EVs will not be simple for US car giants. For example, Ford has slowed its EV production ramp-up due to the struggle to reduce the cost of its first-generation battery EVs. This challenge is representative of many mainstream automakers, underscoring the necessity of policy support to facilitate the EV transition in these still-early stages.

After North America, the next most optimistic regional group among respondents is APAC (excluding Australia), with 40% believing this market is “leading the way” and the remaining 60% saying it is “making good progress”. European respondents also express optimism, with 32% believing their market is “leading the way” and 52% saying it is “making good progress”.

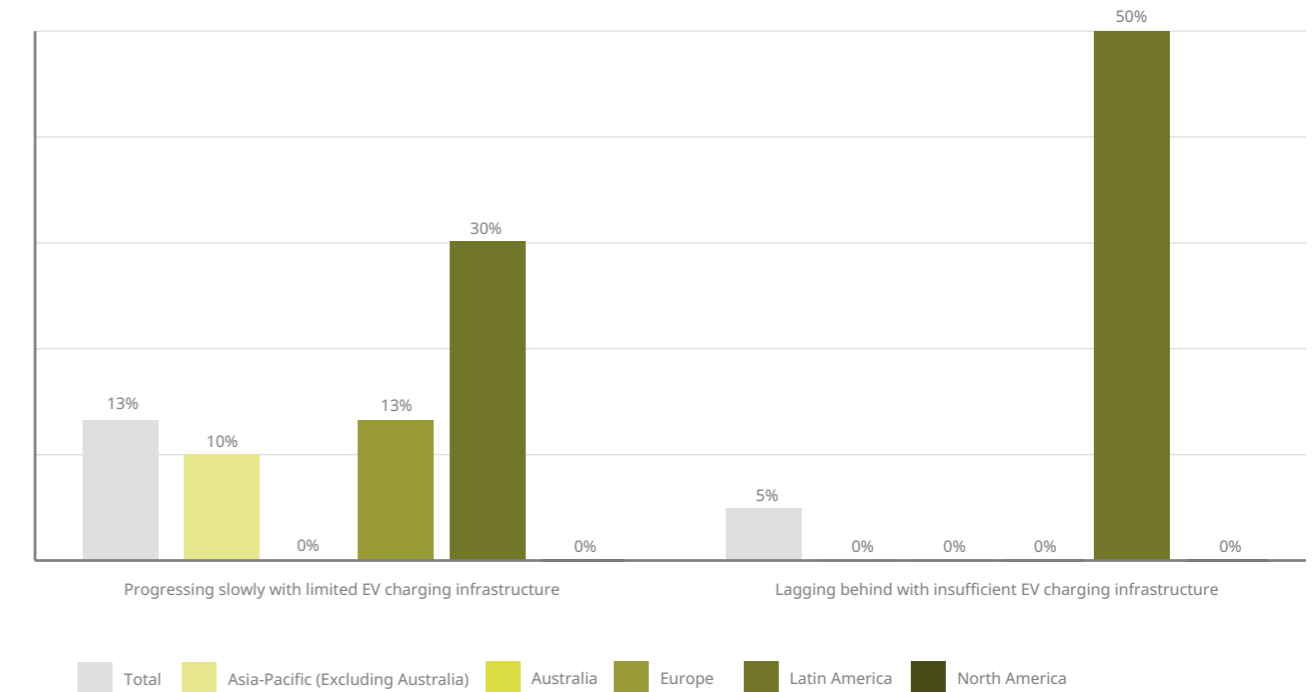
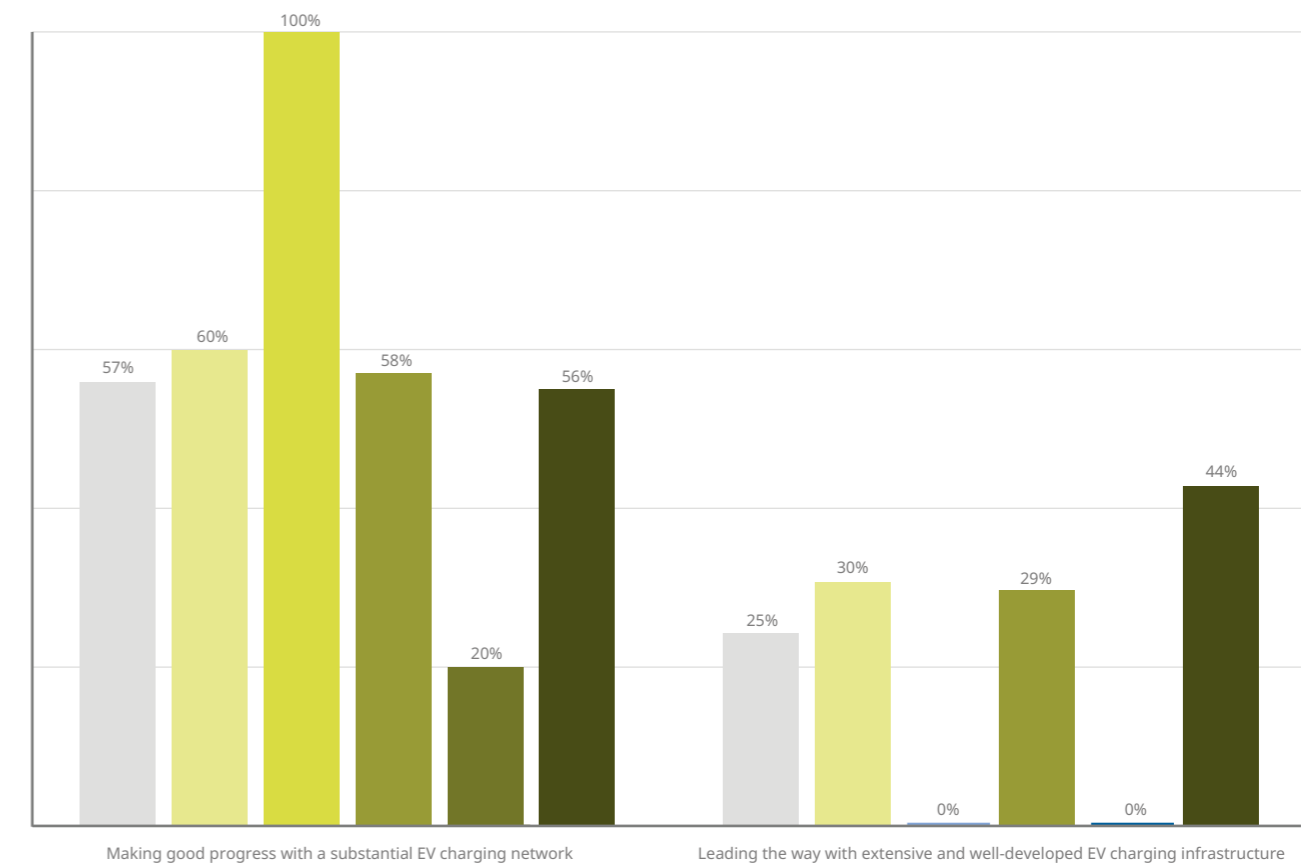
Given its broadly accepted position in the vanguard of EV development and as a favoured destination for future investment, it is somewhat surprising that European respondents are not at least as ebullient as their peers in North America about the region’s performance on EVs. That being said, this may simply reflect that, having long been in the vanguard, EV industrialists in Europe consider the raft of supportive measures and high levels of investment as typical, rather than worthy of special commendation.

In Australia, respondents generally agree that the country is “making good progress” on EV investments, but none consider it to be a market leader. Chris Mitchell, Partner in DLA Piper’s Melbourne office, details how the picture is slowly but surely changing in Australia: “The take-up of EVs in Australia has not been as rapid compared to Europe and North America, due in part to local availability of EVs and consumer concerns regarding their practicality outside Australia’s relatively dispersed urban centres. But the tide is certainly turning, and the increasing number of EVs on Australian roads is placing increased pressure on our rather nascent network of charging infrastructure, and a number of institutional investors have spotted opportunities to invest in the growing pool of early-stage technology companies. In our experience, these investors are having to be adopt a patient, long-term mindset to achieving expected returns for this asset class.”

Meanwhile in Latin America, 70% of respondents view their market as “progressing slowly”, with the remaining respondents acknowledging that the region is “lagging behind” though steps are being taken to improve EV adoption in the region. In Colombia, for instance, several policies have been adopted to promote the energy transition in transportation. In 2017, the country’s ministry of commerce, industry and tourism issued a regulation allowing the import of EVs with a 0% tariff to encourage more EVs to enter the country at more affordable prices. Currently, however, as Olga Lucía Ramírez, Partner at DLA Piper Martínez Beltrán observes, “the level of investment in EV infrastructure is quite low, and it is essential to increase this to ensure the effective operation of EVs in urban areas”.

Additionally, there is a near-perfect correlation between these results on broad EV adoption and perceptions of EV charging infrastructure development between respondents’ home and international markets.

How would you compare efforts in the country in which you primarily do business/operate in developing EV charging infrastructure to those of other countries? (Select one)



In Colombia “the level of investment in EV infrastructure is quite low, and it is essential to increase this to ensure the effective operation of EVs in urban areas”.

Olga Lucía Ramírez
Partner, DLA Piper Martínez Beltrán

World leaders in infrastructure

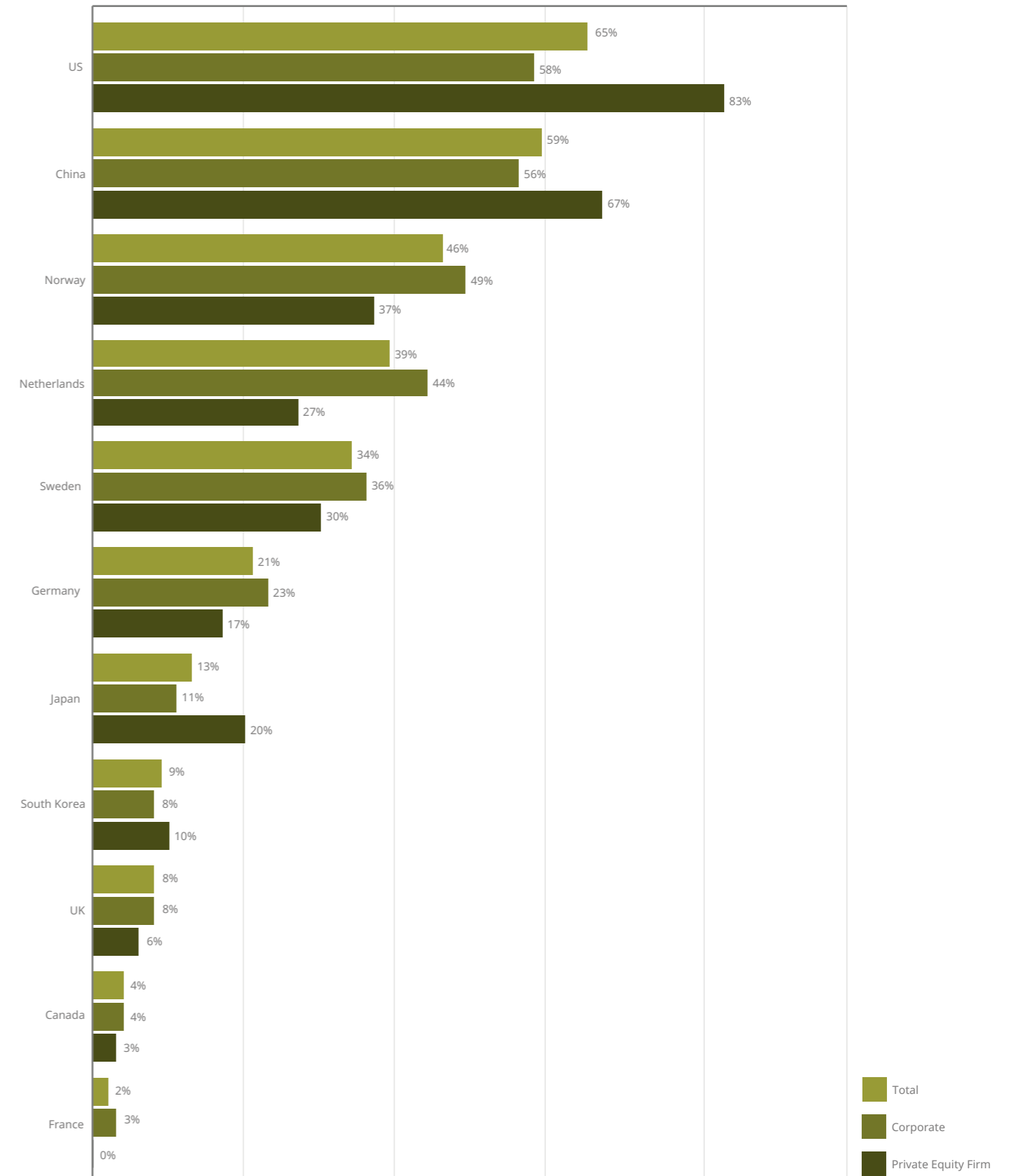
When it comes to the rollout of EV charging infrastructure over the last three to five years, the largest share of respondents overall identify the US (65% of top-three selections) as having made the most significant progress, followed closely by China (59%). Investors are notably more bullish about EV charging infrastructure progress in the US (83% of top-three selections) compared to corporate respondents (58%), indicating that investors view the fragmented EV charging market as a significant consolidation opportunity.

China’s EV manufacturing dominance extends across the supply chain, providing an estimated 80% of battery cells worldwide, backed by a strong domestic mining and processing chain. The country’s dominance of battery production and components has allowed its manufacturing capacity to produce homegrown EVs cheaper than is the case elsewhere in the world. This has prompted considerable concern among regulators in the West, leading to an EU subsidy investigation into Chinese-manufactured EVs. Reducing reliance on China in the EV supply chain is expected to be a significant challenge for some time for Europe and North America.

“In addition to USD50 billion in direct federal funding for charging infrastructure, many new EV, battery and infrastructure credits and subsidies are contingent on US domestic sourcing, content, manufacture, and production. Those incentives, combined with anticipated rapid growth in demand for EVs and chargers, have catalysed large private investments in charging infrastructure by various joint ventures and coalitions of EV and charger manufacturers and others,” explains Hemmersbaugh. “The focus of those new investments on US supply and manufacturing, may spur rapid growth of US-based EV charger and infrastructure manufacturing and installation industries and capacity.”



Which of the following countries do you believe have made the most significant progress in the rollout of EV charging infrastructure over the last 3-5 years? (Select top three)



After the US and China, survey respondents identify several European markets as having made significant progress in EV charging infrastructure, especially Norway (46%), the Netherlands (39%) and Sweden (34%). Reflecting on the key drivers of progress in EV charging infrastructure, respondents are quick to cite supportive government policies and regulations as the most significant factor, with 65% overall selecting it among their top-three influences.

Strong consumer demand and market readiness comes in second place overall, with 42% of respondents selecting it among their top-three drivers. Smaller markets in Europe, such as Sweden, in particular attributed progress to sufficient investment and funding (39%), while financial incentives and subsidies are said to have played a vital role in Norway (35%) and the Netherlands (37%).

As discussed earlier in this report, the largest share of survey respondents believe Europe is the region that will receive the largest share of EV and related infrastructure investment worldwide. But Sylvia Ebersberger, Partner in DLA Piper's Munich office and Global Co-Chair of the firm's automotive subsector, warns that over-regulation risks stifling innovation.

"In Europe, under the Green Deal and the "Fit for 55" concept a series of proposals have been made to revise and update EU legislation and new initiatives are under discussion to ensure that EU action is in line with the climate targets and the net-zero goal can be reached. However, many OEMs and Tier 1 suppliers have told us that innovation gets lost due to regulators setting too many requirements, and that they fear a competitive disadvantage in comparison to requirements set by the governments of China and Japan, though they also have ESG agendas and emissions-reduction goals", says Ebersberger.

42%

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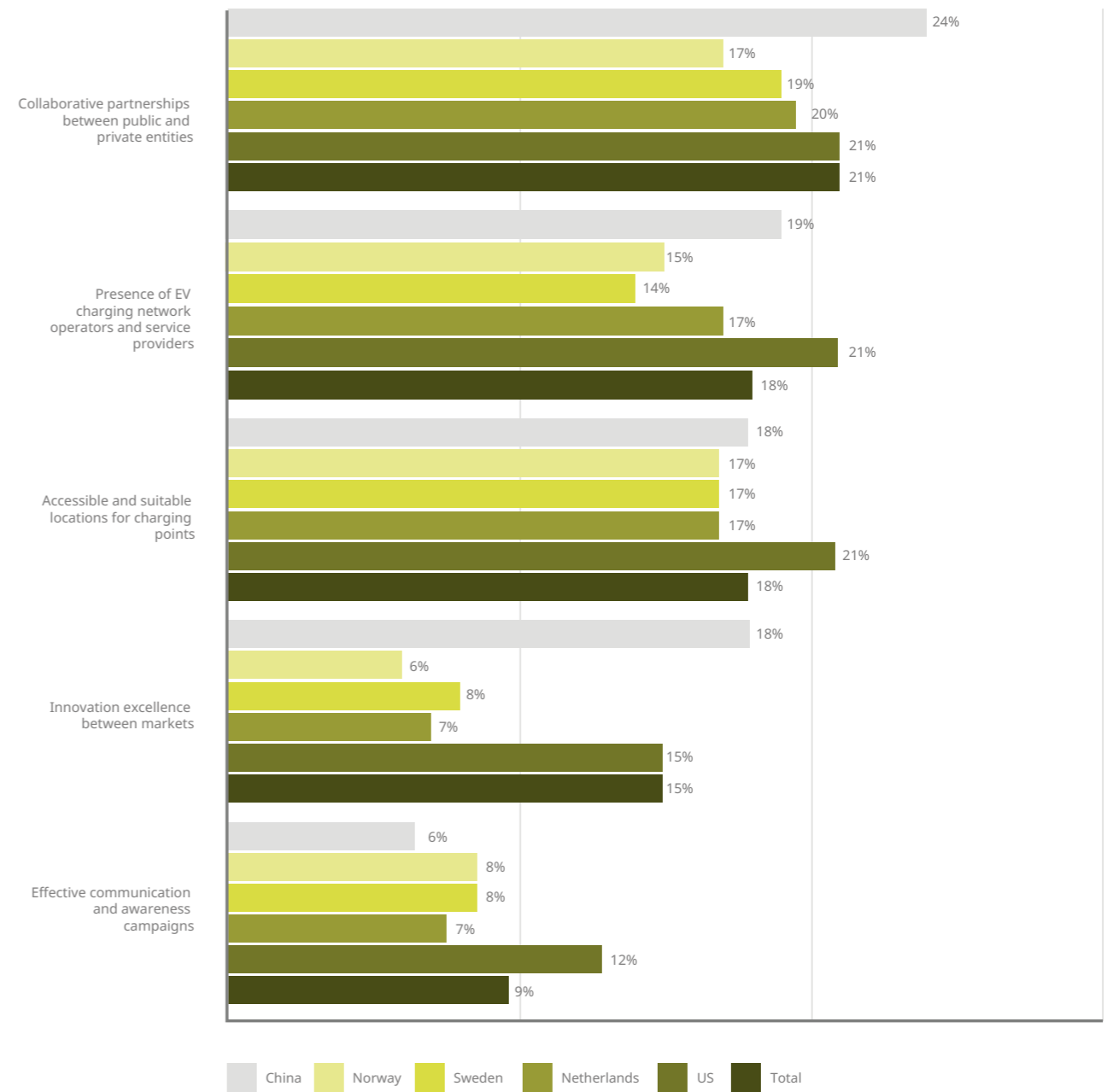
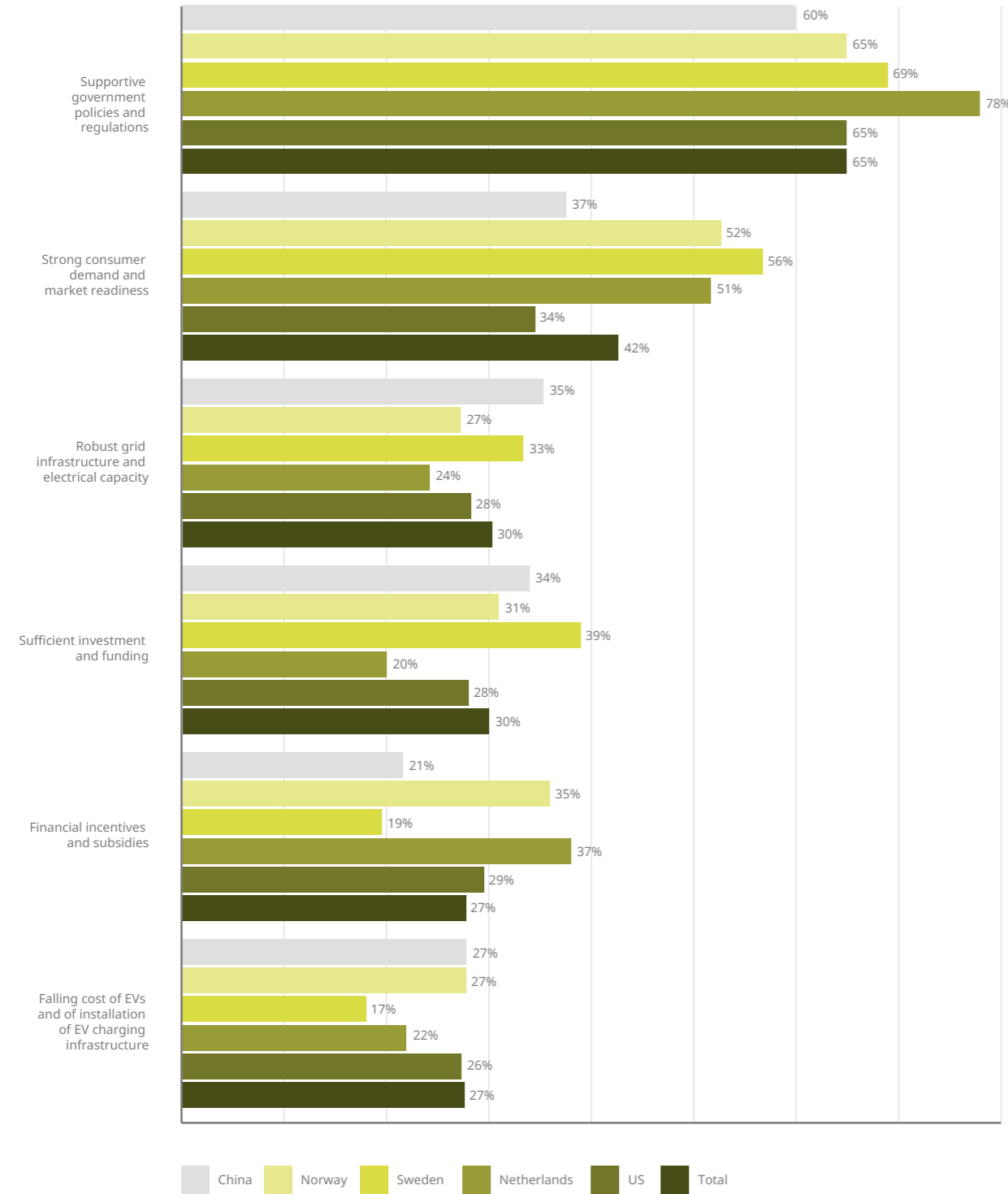
65%

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Sylvia Ebersberger
Partner and Global Co-Chair of the automotive subsector – Munich

Which of the following factors do you believe have been most important in helping to make the rollout of EV charging infrastructure especially successful in the countries that you cited in Part A of this question? (Select top three)



EV charging stations can be a catalyst for regeneration

Asif Ghafoor, CEO & Co-Founder, Be.EV



Our survey shows universal anticipation of increased investor appetite in EV charging infrastructure over the next 12 months. How do you see the trends shaping up?

The challenge is that while there is increased investor appetite, I'm not sure there's increased investor understanding of the industry. If you couple that with increased financing costs, which is evident across all economies, there may not be as much investor activity as the headline level of appetite implies.

There is no denying that the EV juggernaut has kicked off. Automobile manufacturers are not going to switch production back to combustion engine vehicles. However, increased uncertainty from governments will impact actual EV uptake. The risk is around government subsidies in the wider EV market.

How do you think about investment risks within EV charging infrastructure?

The principal investment risk for public charging is utilisation. This is something we spend a lot of time considering in our business: when we install a public EV charger, will drivers go there? It is not as simple as installing charging stations at existing petrol stations—often they are privately-owned and there is not sufficient space to install charging infrastructure. We use data tools to identify the best locations and predict the rate of demand. When looking at what makes a public charging station work, the primary factors are accessibility and social impact.

How does social impact integrate into your EV charging station design?

From day one our focus has been to create a community-focused business that facilitates social regeneration. We work collaboratively with local authorities and governments to ensure we are installing EV charging stations in the right places, at the right speeds. For example, in the UK, we have a contract with Greater Manchester and have worked alongside them to distribute charging infrastructure equitably across the county. It's crucial to us that each site we install is functional, delivers regeneration in the local area, looks good, and is tailored to the needs of that particular community.

EV charging stations can be a catalyst for regeneration, adding something beautiful to the local community. We talk a lot about parks and how in urban environments they're places to rest and recharge. We're focussed on bringing those elements to our charging sites.

We take a 'deep green' approach to sustainability. It's more than where our power comes from—it's about making the most sustainable choices at every level of the business.

Our main investor is Octopus Energy Generation, via its Sky Fund, and all the power we use in our chargers is provided by Octopus Energy, who use wind, solar and hydro sources to power their 100% green electricity.

We also make sure we are collecting water or, where relevant, try to attract wildlife to a particular area. Finally, we aim to develop EV charging stations where lone drivers feel comfortable to charge late at night, which makes location and accessibility particularly important.

To what extent has 'range anxiety' been overcome in major markets?

Range anxiety largely remains a perception problem. The reality is that the vast majority of people don't drive more than 30 miles at any one time. Most people don't need to charge every day and when they do, they fit in charging with their lifestyle: they charge when they go to the shopping centre, for example. For most people, range anxiety acts as an initial barrier to buying the EV, but once an EV is purchased, consumers adapt.

Incentivising industry

Government support has played and will continue to play a critical role in supporting the EV and charging infrastructure industries. Our survey finds that 62% of respondents consider government subsidies and incentives to be the most critical factor in achieving equitable access to EVs and charging infrastructure. Public-private partnerships come in a distant second, garnering support from 27% of respondents, while initiatives relating to innovative pricing models accrue just 11% of votes.

“Considering the cost of energy today, there may be some hesitation among users when it comes to EVs,” explains a partner at a PE firm in Singapore. “To reduce their concerns, government subsidies and incentives would have a positive effective. This would enhance the value of EVs for potential users.”

The managing partner of a PE firm in Brazil offers some examples of how these subsidies could take shape: “I’ve noticed many countries introducing lucrative incentives for using EVs. Exemption from registration and fuel taxes should be considered by the government to promote the use of EVs in the market. Consumers should feel that there are more financial benefits of using EVs, apart from environmental benefits.”

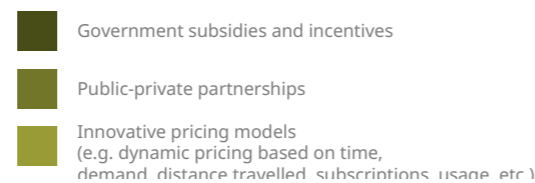
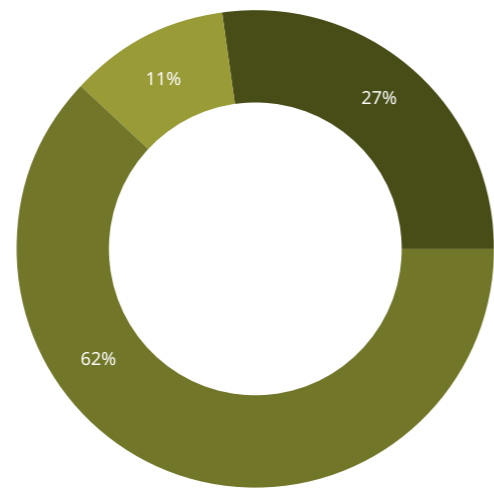
In the US, the Inflation Reduction Act represents a significant effort to accelerate EV adoption. This legislation provides various tax credits and incentives for consumers and businesses to purchase EVs and

install charging stations, including a tax credit of up to USD7,500 per vehicle for zero-emission light-duty EVs. The incentives are especially generous in respect of domestic manufacturing. Moreover, almost all respondents (97%) believe the tax incentives stipulated by the Inflation Reduction Act have led to an increase in cross-border investment interest in the US EV industry, including more than half of the total respondent pool (56%) who say this increase in interest has been significant.

From a European perspective, Choudhury adds: “Biden’s IRA is a game-changer. We are already seeing, both through a diversion of deal-flow and anecdotally, that investors are increasingly turning to the US in search of attractive tax credits particularly where there is local content element. It will be interesting to see whether the EU and UK will respond with retaliatory protectionist measures or whether they will continue with the pragmatic approach taken under the EU’s Green Deal Industrial Plan. With US elections looming, investors will keen to see whether those IRA incentives are here to stay.”

The legislation is expected to support EV sales, investments, domestic innovation, and manufacturing through the remainder of the decade. It also includes policies to strengthen domestic supply chains for EVs, batteries and battery minerals through US-based manufacturing incentives, crucial for mitigating the market’s dependence on supply chains connected to China.

Which of the following initiatives is most important in achieving equitable access to EVs and charging infrastructure? (Select one)



Significant investment, of course, has already been made, and some investors are open to elements of market risk, as this increases future upside. In the longer term, industry expansion and de-risking could precipitate lower potential returns and a changing investor profile, leading to a stronger deal appetite among corporates and to consolidation of the market.

Elaborating on the interplay of government-led support and private investment, Hemmersbaugh says that “in the longer term, the bulk of investment will have to come from the private sector, and investors will need a good potential return in order to commit. At least in the short to medium term, however, the IRA – along with more stringent GHG emissions limits – appears to have catalysed substantial private investment in the US EV industry.

Addressing infrastructure bottlenecks

One of the most significant barriers to EV adoption is limited charging infrastructure, particularly outside of built-up or metropolitan areas. In the case of the US, for instance, Hemmersbaugh explains that “the deployment of charging infrastructure to date has largely focused on higher income areas, and concentrated on the West and East coasts, and a few major cities in the heartland. There is a real risk of an unequal geographic distribution and density of EV charging infrastructure. Limited availability of charging infrastructure across large areas with lower population density could slow the pace of EV adoption in the US.” The IRA and the IJIA aim to help address

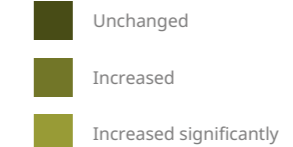
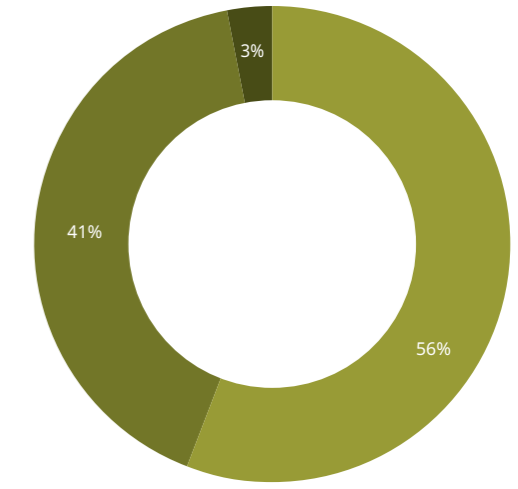
such potential obstacles to widespread EV deployment by targeting significant federal EV infrastructure funding to areas that may otherwise be less attractive for private investment.

To address this challenge, our survey participants identify several strategies. The largest share of respondents (54%) cite the significance of public-private sector collaboration in expanding charging networks. Such partnerships are seen as best placed to bridge charging infrastructure gaps and improve consumer access.

“It’s essential to spread awareness of EVs and increase sales through strategic partnerships,” explains the managing partner of a global technology investor in Norway. “Decarbonisation plans have been set by private and public establishments, but there’s been a disparity in the pace of the net-zero transition. Private companies are working on technology and software developments more. With public companies improving energy infrastructure, PPPs can combine efforts better.”

Initiatives such as these present obstacles of their own, of course, but the positive outcomes are expected to exceed the effort expended. As the head of strategy of an EV manufacturer in Japan says: “Finding the right public-private partnerships may be difficult because of different values and objectives, but this can help deal with the gaps in charging infrastructure. The overall value provided to end users would be better.”

To what extent have the tax incentives stipulated by US Inflation Reduction Act led to an increase in cross-border investment interest in the US EV industry? (Select one)



Three additional strategies each receive around one-third of top-two selections from our respondent set, including: (1) investment in charging efficiency technology to offset grid congestion and high charging costs; (2) standardising charging stations; and (3) partnerships with infrastructure providers to bundle solutions. Grid connection in particular is one of the main capital expenditure costs in these ventures, while wait times can be a decisive factor on whether or not to select a given location to build charging infrastructure. Battery storage and integrated generation/storage solutions and decentralised grids can be deployed to help mitigate these concerns. However, as the increase in renewable energy generation continues and the move to electrification across all sectors accelerates, system-wide re-thinking in terms of grid access and upgrade is likely to be required across most markets.

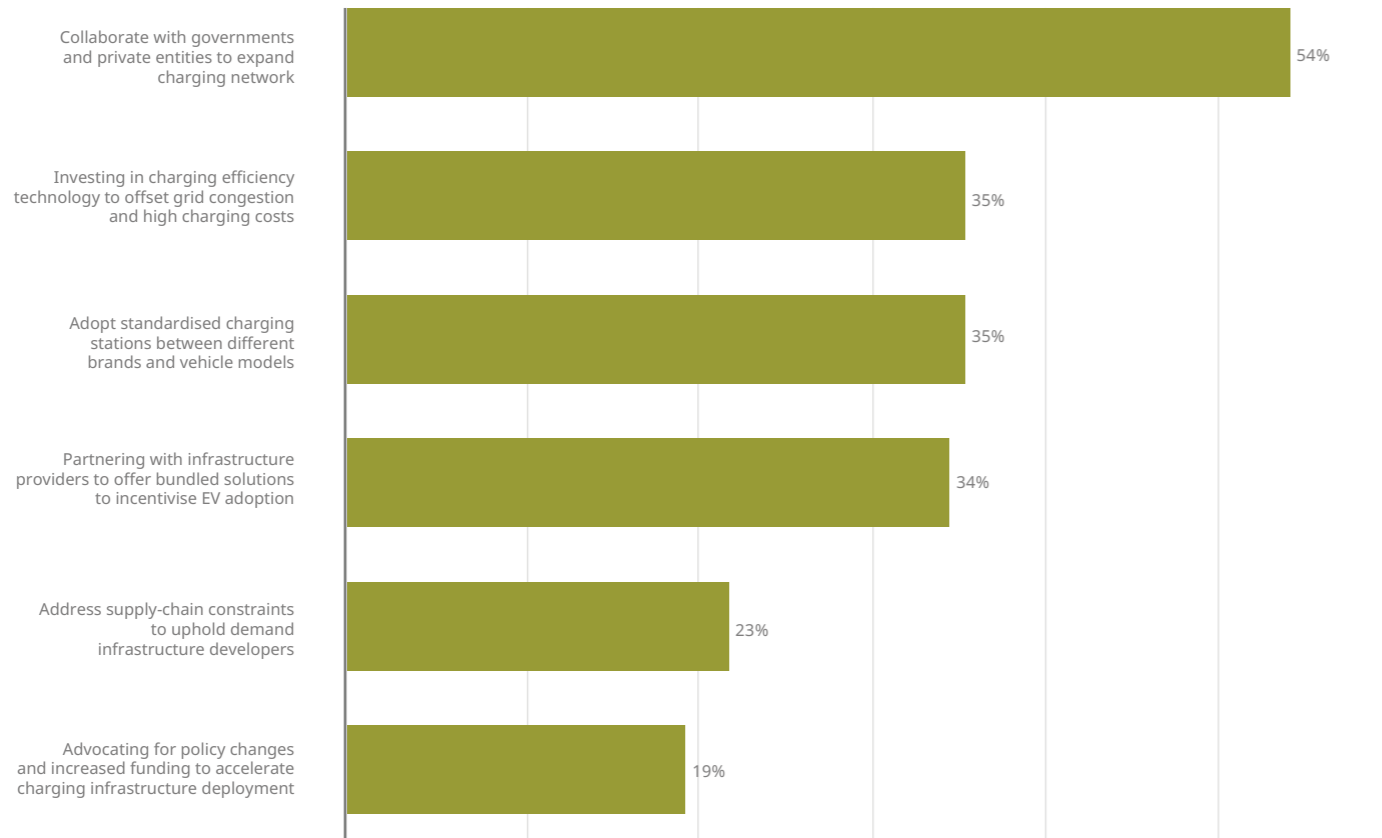
The head of EVs at a charging infrastructure company based in France underscores just how crucial it is for this infrastructure to be advanced: “Already the charging infrastructure in Europe is falling behind. As more EVs are introduced in the market, the infrastructure should be ready to support the demand.” Neither the EV industry itself nor those

supporting it in the public sector can risk becoming complacent about its success to date.

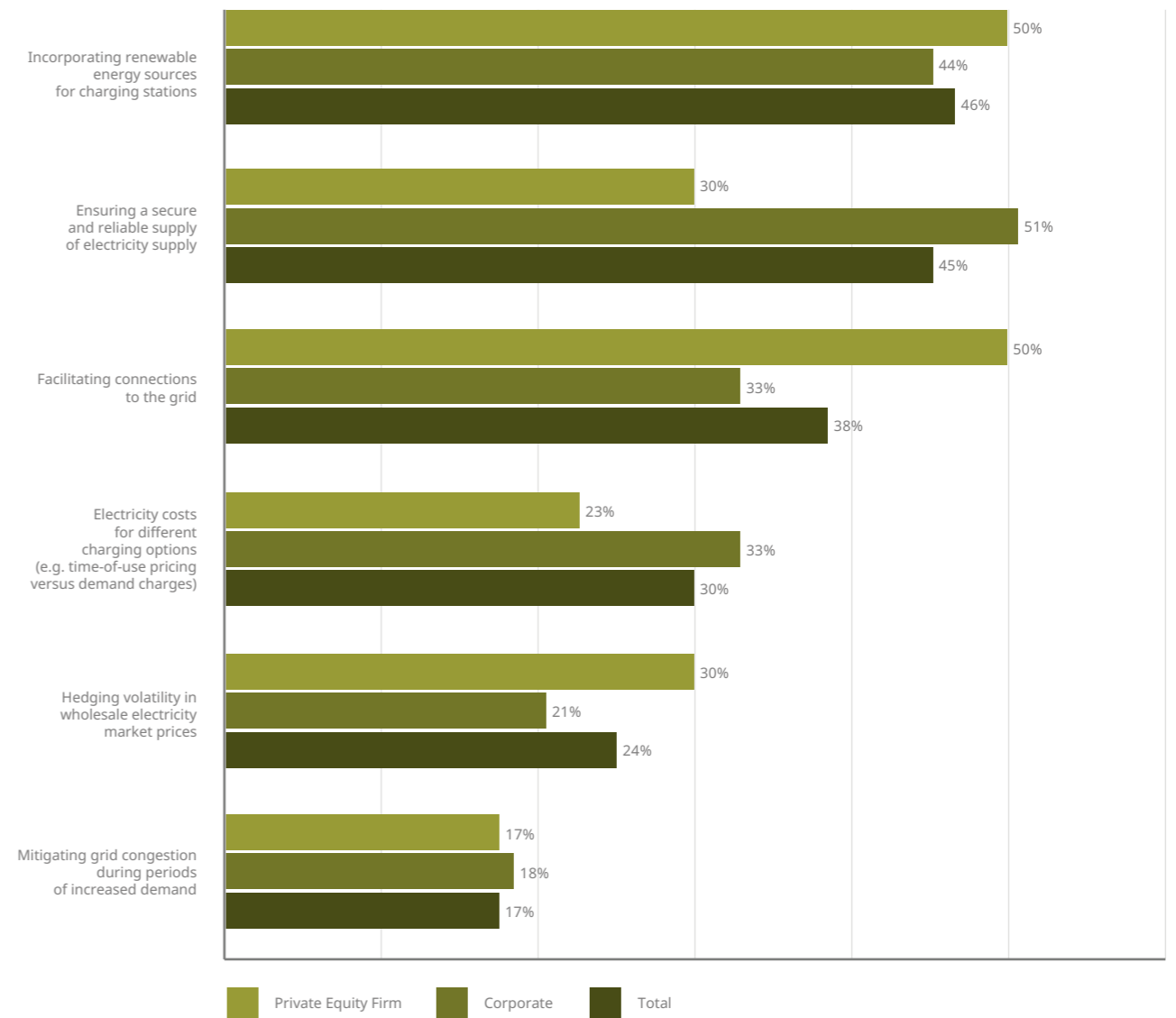
Respondents also emphasise two key considerations specifically in respect of procuring power and grid connectivity for EV charging stations: incorporating renewable energy sources (46% of top-two selections) and ensuring a secure and reliable supply of electricity (45%). Notably, corporate respondents place greater emphasis on facilitating connections to the grid (50%) compared to PE firms (33%).

In the UK, “National Grid has repeatedly asserted its readiness to provide clean, reliable power for EV charging – an extra 100 terawatt-hours from the 300 terawatt-hours currently consumed,” notes Howard Bassford, UK Head of Infrastructure, Construction and Transport at DLA Piper. “As much as anything, the key to EV infrastructure will be supplying sites for charging that suit not only range anxiety, but bladder anxiety, since nobody drives for 500 miles non-stop. In the UK, this means a network of charging points at 200-mile journey intervals (or three hours), bearing in mind that every journey will be different.”

What are the most important steps that the EV industry should take to tackle the challenge of limited charging infrastructure and strengthen consumer interest in EVs? (Select top two)



What are the most important considerations in the procurement of power and grid connectivity for EV charging stations? (Select top two)



“As much as anything, the key to EV infrastructure will be supplying sites for charging that suit not only range anxiety, but bladder anxiety, since nobody drives for 500 miles non-stop.”

Howard Bassford
Partner, UK Head of Infrastructure Construction and Transport – Birmingham

Investors want to engage with these opportunities

Anthony Headlam, CEO and Co-Founder, NewVolt



Can you describe NewVolt's position in the Australian EV infrastructure market?

NewVolt Infrastructure's mission is to enable the transition to electric trucks in Australia by developing a national network of charging hubs along major freight corridors and at key industrial precincts. In parallel, we are developing a commercial model that enables the road transport industry to transact in a way that optimises the business case for freight and logistics companies to jump on board with electric trucks.

We are the first-mover in the Australian market that is purely developing a charging solution for the road transport sector. In that context, there has been a tipping point in the last 12 months. Australia has been a late adopter of EVs, particularly in the heavy vehicle segment. But there has been a change of mood in the passenger vehicle market, and that has now spread across to the heavy vehicle space. Electric trucks are on the horizon, and Australia is going to need the infrastructure to support them.

How is NewVolt approaching the inherent challenges of being an EV infrastructure first-mover for trucks?

Today, there are a very small number of electric trucks in Australia, and no fit-for-purpose charging infrastructure for freight operators other than what is installed by the operator themselves at their depot.

We think the infrastructure needs to be in place, and accessible to industry, before there will be meaningfully high levels of electric truck uptake.

That's the focus of our business: to develop that infrastructure. The primary challenge in terms of attracting capital is that investors have no reference points within the Australian market, and very few internationally for this asset class. So an investor needs to be comfortable, at a macro level, that truck electrification of truck electrification is inevitable. We are finding that investors want to engage which means that the inevitability is widely accepted.

We think an important part of our job as an infrastructure developer is working out a commercial model that enables capital deployment in the context of inherent uptake uncertainty in a new market. Even if infrastructure providers win over investors' hearts, minds will still point to the uncertainty over what percentage of truck fleets will be electric by 2030 and 2035. You have to be willing to work with that uncertainty.

How difficult is it to build EV charging infrastructure for trucks across a country as vast as Australia?

Australia is vast, but we think the first 80% of the problem is pretty easy to solve as most of the population is huddled together in a small number of cities with one major arterial road linking them. For the vast majority of the freight task, the requirement is to electrify those main corridors linking the major cities on the East Coast and by building charging hubs in major hub-and-spoke industrial precincts.

Australia has a concentration of trucks and future energy load that is conducive to securing a higher utilisation rate, which supports infrastructure as an investable asset class. Trucking routes are highly predictable. Typically, trucks run the same route five plus days a week for years at a time, underpinned by a fleet operators' contracts with, for example, a large supermarket chain. This predictability allows us to model the required energy load, where the energy is needed, and forecast utilisation.

How does private capital evaluate the Australian EV infrastructure market?

For infrastructure investors assessing capital-intensive business models, the question is often, 'How much of your revenue is contracted?' Everyone wants to see that a chunk of your assumed base case revenue is contracted. Our commercial model, focused on the trucking market, enables us to secure charging services agreements with our customers, the fleet operators, and provide energy price certainty via access to our charging network. This allows us to lock in contracted revenue, which gives revenue certainty to investors and supports our ability to build the infrastructure.

Our business model is built on first principles: 'how do we deliver renewable energy required by electric fleets at the lowest cost?' That is the starting point. The data is there with a high level of granularity to understand where trucks run and where that energy is required. The challenge is to determine the optimal way to deliver that energy at lowest

cost and in convenient locations. Australia has an abundance of land on which to harvest renewable energy resources, which we think creates a competitive advantage relative to many other markets. Of course, there are other variables that influence cost structure, such as the time of day that energy load is required.

How do you assess the major investment risks in the EV charging infrastructure sector?

Ultimately it comes down to demand risk—how quickly the pace of electric truck adoption accelerates. It is a more significant risk driver than unknowns around asset replacement and maintenance costs or reliability of charging infrastructure. In global terms, Australia is a small market and we are reliant on global trucking original equipment manufacturer (OEMs) to ensure that a sufficient supply of electric trucks are exported to Australia.

I think that an Australian sales manager within a global OEM would say their biggest challenge is to put their market and potential sales on the agenda, so they can get production slots on a global assembly line. That's what we are competing for. This is where the government can be helpful. EV adoption targets help to telegraph the intention of the country globally.

What role will an electrified freight sector play in helping Australia reach its energy transition goals?

The opportunity for Australia to make the transition to zero-emission heavy vehicles and battery-electric trucks is compelling. At the end of this transition, Australia should have created a more efficient road freight sector with lower cost fuel and with energy security. At the moment, Australia's government spends a lot of money on energy security to ensure we have sufficient diesel supplies to run trucks. We think Australia should be far more ambitious in terms of electrifying the freight sector and not think of this as a costly transition, but a transformation from which Australia stands to gain so much including, ultimately, lower cost zero emission road transport.

"We think the infrastructure needs to be in place, and accessible to industry, before there will be meaningfully high levels of electric truck uptake."

Anthony Headlam
CEO and Co-Founder, NewVolt

Chapter 3: Innovation and AI

The EV industry stands at the junction of a transformative era, made possible by advancing technologies from battery innovation to AI. These technologies are the keys to a bright future for the industry, but also present new environmental and cybersecurity risks.

Battery innovation is pivotal for the sector’s long-term growth. Batteries account for a significant portion of the total cost of an EV, and the range of an EV is limited by the capacity of its battery. Some industry estimates put the share of the cost of the battery within the total price of an EV at between 40%-60%, the bulk of which is driven by the high (and frequently volatile) prices of essential minerals such as lithium, nickel and cobalt.

But ongoing advances in battery technology can alleviate key barriers to adoption (whether real or perceived), including range limitations, high costs, safety concerns, and environmental sustainability, as well as improve the overall competitiveness of EVs versus ICE vehicles.

Respondents to our survey indicate that addressing high prices and assuaging other headline concerns are the key objectives for investors. When it comes to battery innovation, 58% of respondents overall (including 62% of corporate respondents surveyed) say investors are focusing on investment that aims to improve the performance and cost-effectiveness of EVs.

Exploratory research also remains a priority for this nascent sector, with 51% of respondents (including 57% of PE survey participants) reporting that investors are focusing on R&D into further technological advancements relating to battery innovation.

Battery development

A further point of emphasis among investors in particular (50%, versus just 34% of the corporate respondent cohort) is investments into battery manufacturing and supply chains to enhance production and distribution. This disparity between corporate respondents and investors might be rationalised by bearing in mind that many in the latter group may have taken a holistic approach to investing in areas where there is scope of synergies across the

energy transition space, greater tolerance of risk and focus on generating high returns.

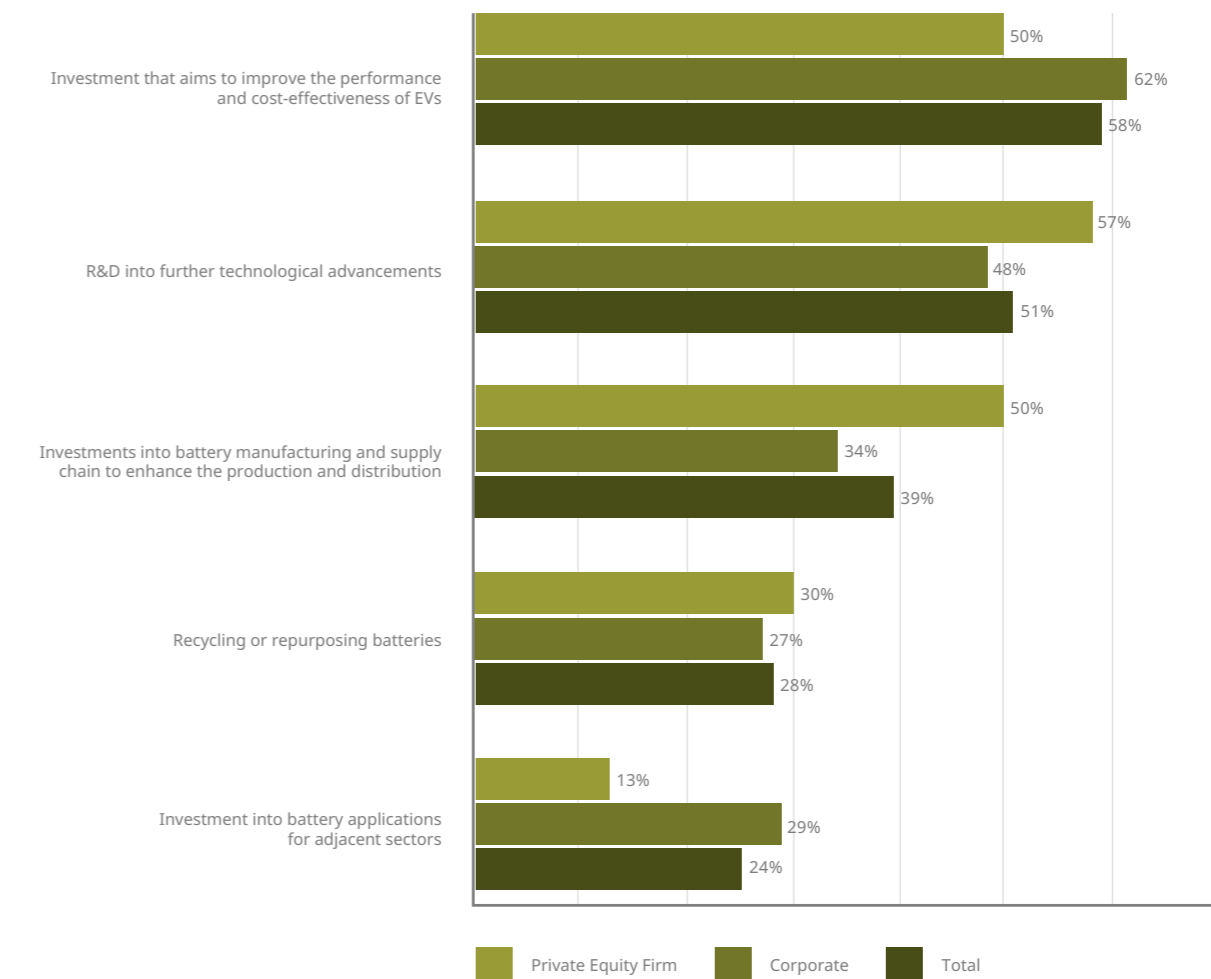
In recent years, major PE funds have invested heavily in the EV battery manufacturing and supply chain space. In early September 2023, an investment group led by Decarbonization Partners, a joint venture between private capital giant BlackRock and Singaporean sovereign fund Temasek, put USD460 million towards US-based Ascend Elements, a leader in the sustainable lithium-ion battery materials arena. Lithium-ion batteries could pave the way for longer lifespans for EV batteries with faster charge times.

Solid-state batteries (SSBs) are the latest promising frontier, offering the potential for even safer and faster charging than lithium-ion batteries. SSBs aim to alleviate the two largest concerns for passenger EV adoption: cost and range anxiety. Investors are exploring R&D avenues that encompass battery performance and utility across the entire life cycle, from production to recycling.

Though still an embryonic subsector of the EV industry, there is clearly an appetite for investment. For instance, Solid Power, a US-based producer of SSBs for EVs, is backed by a throng of PE firms, auto manufacturers and technology giants, including Equinor Ventures, Volta Energy Technologies, UmiCore, Ford, BMW and Samsung. Solid Power recently began large-scale production of EV cells and intends to deliver samples to its automotive partners this year.

More recently Toyota, the world’s largest carmaker by vehicles sold, has said it is close to being able to manufacture SSBs at scale and at the same rate as the current generation of EV batteries. The company contends that its SSBs – which could enter mass production by 2027-28 – would more than double the range of its current EVs and cut charging times to 10 minutes or less.

Where are investors focusing their investments in battery innovation? (Select top two)



Rising to the sustainability promise

The environmental footprint of EVs extends far beyond the road. Mining raw materials for EV batteries can have major adverse ecological impacts. The manufacturing process also generates hazardous waste. Addressing these issues is paramount to ensuring that EVs deliver on their promise of environmental sustainability as the industry grows.

Our survey echoes these apprehensions, with 54% of respondents identifying pollution during battery production as one of their two greatest concerns, followed closely by the lack of proper disposal and recycling of EV batteries, cited by 46%. Corporate respondents are quick to highlight the ethical risks in particular (on which more later in this section) of failing to mitigate the environmental impact of EV battery production, leakage, recycling, and disposal. This is cited by 54% of corporates, versus just 24% of investors.

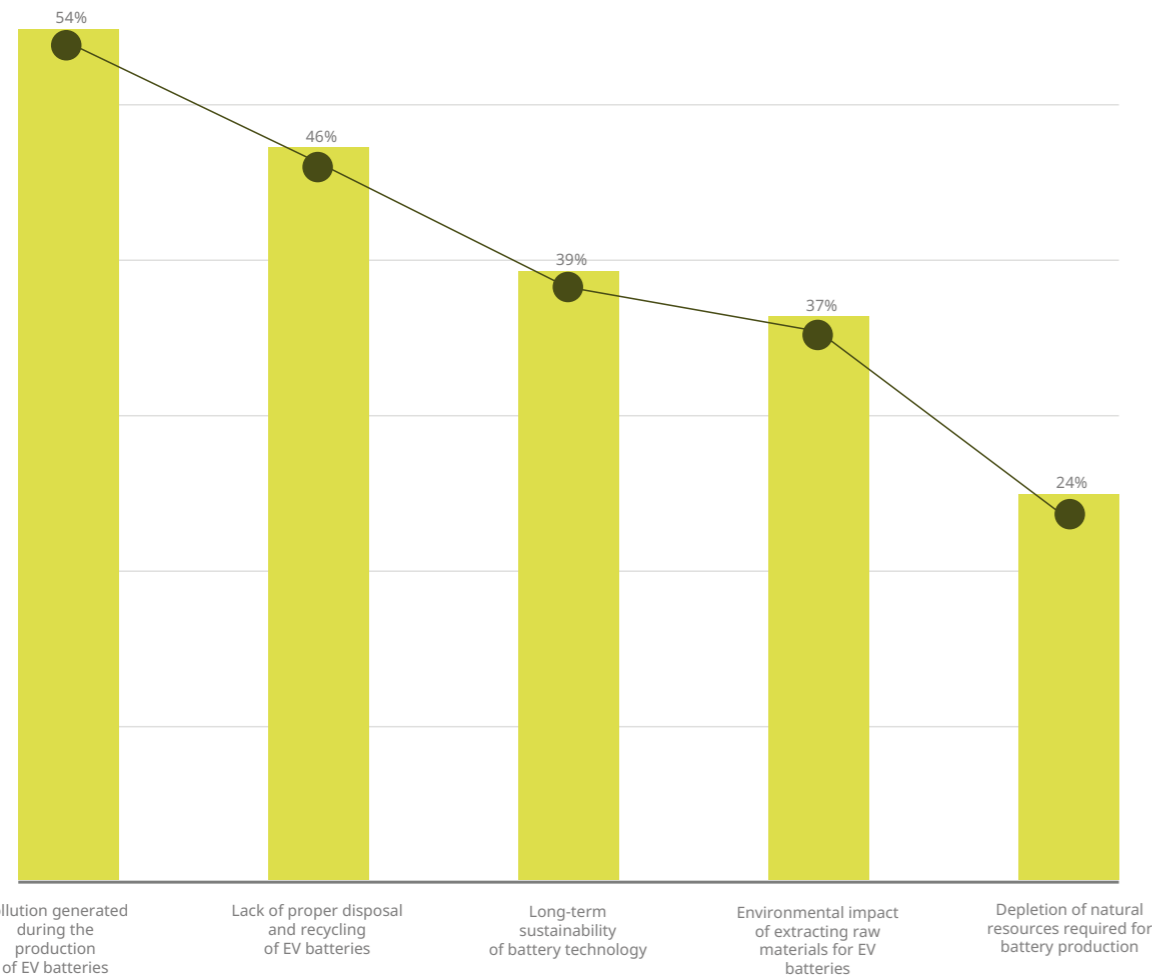
“The environmental impact of EV leakage or disposal could increase over time as more and more people start using EVs,” says the head of strategy at an EV manufacturer in South Korea. “Ideally, more companies with innovative solutions in battery disposal and re-use of batteries would help in reducing the burden on the environment.”

Further research into battery recycling is crucial, as is consumer education. As the managing director of a PE firm in Bahrain puts it, “Governments should also take steps to inform the population of good practices relating to battery disposal.”

Striking an ethical balance

The accelerating adoption and digitalisation of EVs is likely to give rise to elevated cybersecurity and ethical risks. Manufacturers gather extensive data about consumers, opening the possibility for potential data misuse.

What are the greatest environmental concerns relating to EV batteries? (Select top two)



“Data troves, such as the ones expected to be created in the EV context, have long been a focus area for various enforcers, including in the data protection and antitrust space,” says Colgan. “It will be important that the regulatory complexities around handling such information safely are incorporated into robust best practices by industry players.”

Our survey highlights a broad awareness of these vulnerabilities. Almost half of all respondents identify data breaches that compromise personal information and user privacy as a major cybersecurity risk (44% of top-two selections overall, including 45% of corporate respondents, the largest such share.)

In contrast, investors, though still certainly cognizant of the threat posed by breaches of personal data, are considerably more concerned with the lack of cybersecurity standardisation and regulation across the EV industry overall (57%, versus just 34% of corporates surveyed). These two risk factors are, of course, intertwined – cybersecurity standardisation and stronger regulation will buttress corporate accountability for data breaches as the EV sector grows and becomes a more attractive target for hackers.

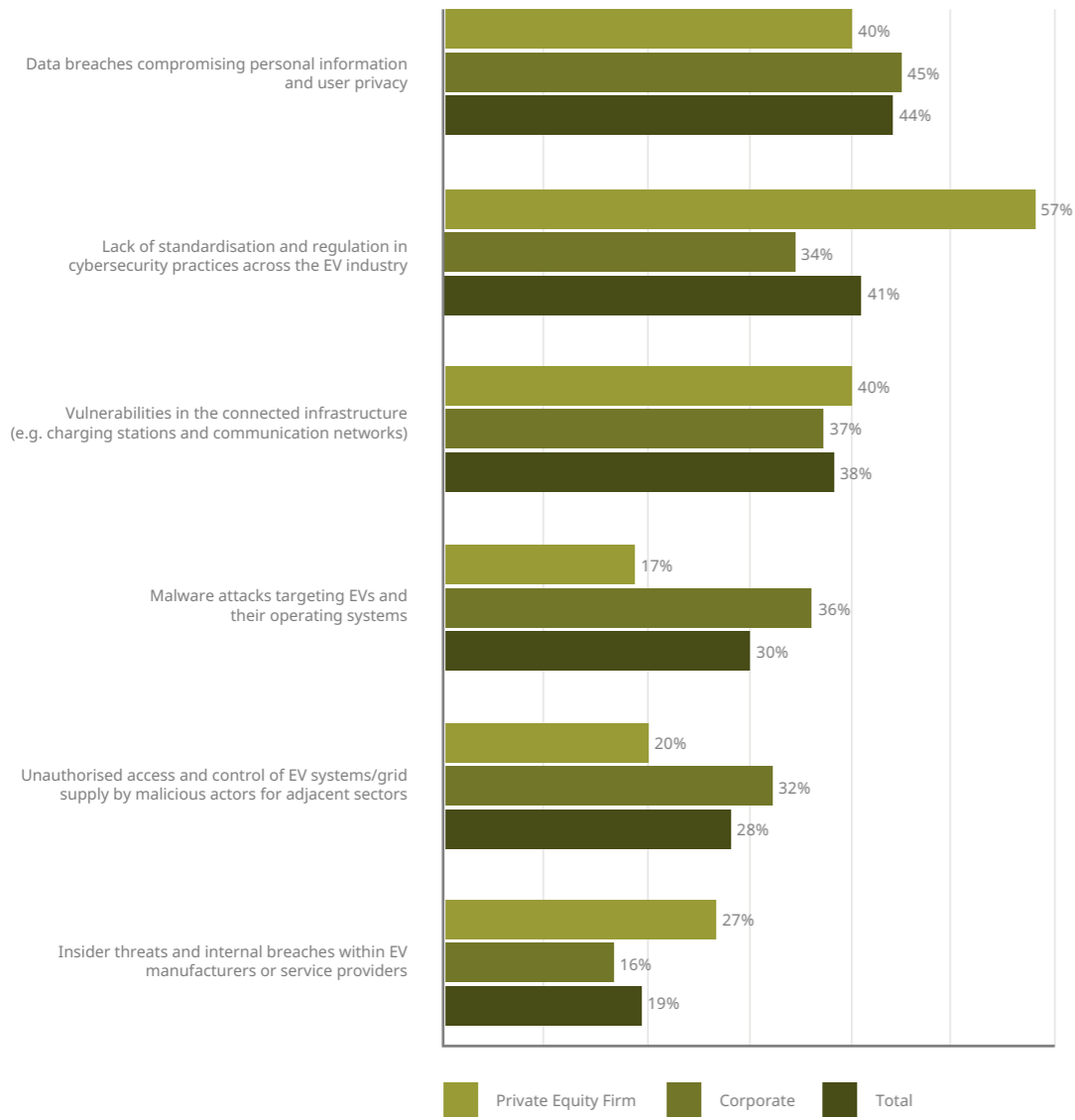
“Privacy issues will increase as more and more data is collected from EV systems,” explains the vice president of strategy at a logistics company that uses EV delivery fleets in the US. “There are bad actors who will misuse the information. Hacking and data breaches may increase if proper cybersecurity controls are not ensured by companies. We will have to wait and see if companies invest in stronger cybersecurity systems in the future.”

As far as ethical risks are concerned, investors in our survey are also especially mindful of the vulnerabilities of current privacy and data collection practices and of the systems that connect EVs. Almost two-thirds of this respondent group (63%) highlight this as a top-two concern, far ahead of any other ethical issue. These concerns appear to reflect wider societal changes in respect of big data and the Internet of Things.

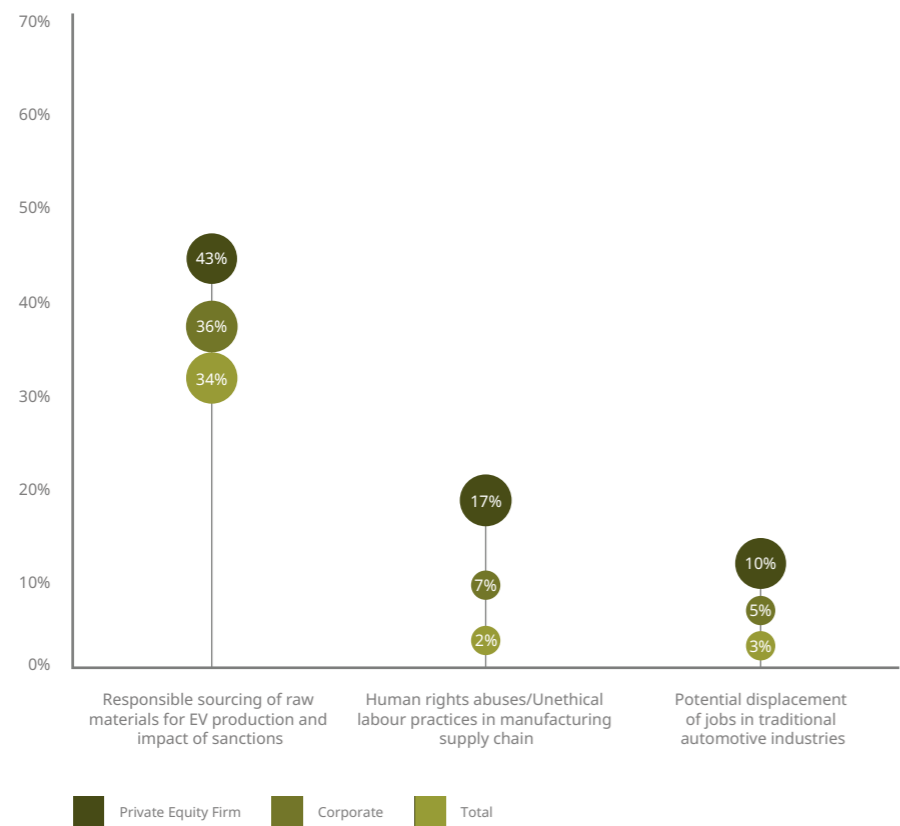
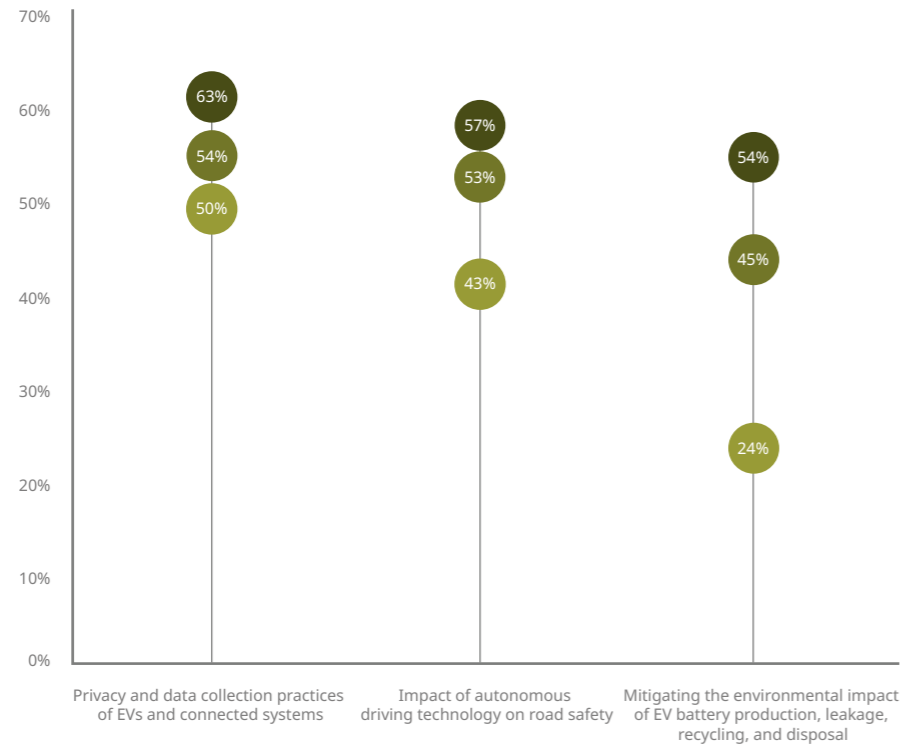
The managing partner of a Norwegian technology investor clarifies this point, saying: “EVs mostly use connected systems, which increases data privacy and security challenges overall. Even after encryptions and data safety measures are taken, the threat of data privacy is high. Information leaks and hacking could increase over time.”



Which of the following issues pose the most significant cybersecurity risks in the EV industry? (Select top two)



Which of the following issues pose the most significant ethical risks in the EV industry? (Select top two)



AI integral to transformation

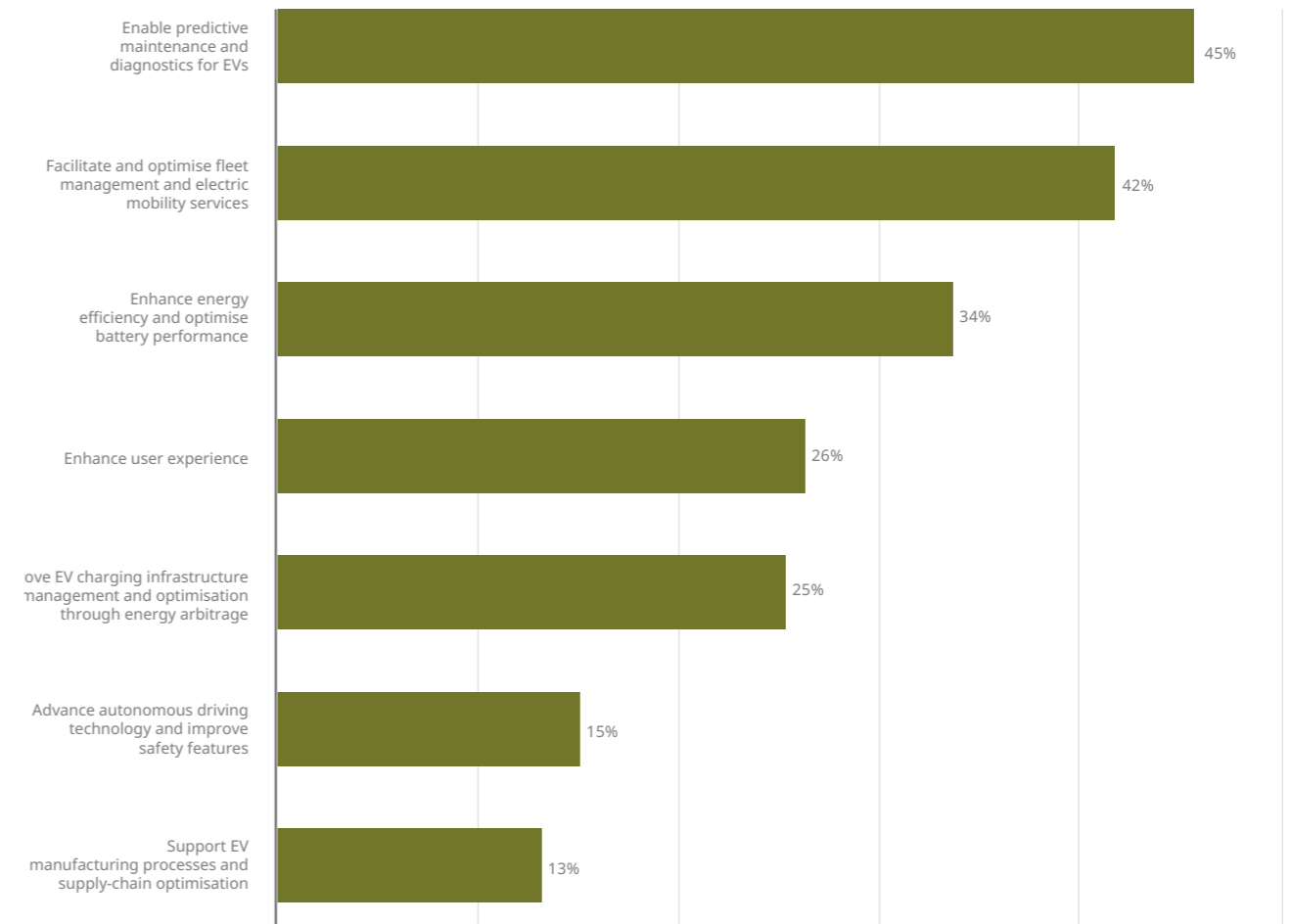
Digitalisation and AI will emerge as a dominant transformation catalyst for EVs and impact the industry in various ways, including improving the experience of individual users and facilitating efficient energy usage. As in other sectors, the application of this disruptive technology will invariably raise challenges of its own.

Reflecting on the potential advantages to widespread AI adoption in the industry, 45% of respondents, the largest such share, cite the ability to facilitate predictive maintenance and diagnostics of EVs as a top-two benefit. This is closely linked with the two other major advantages cited most frequently by respondents, namely using AI to optimise fleet management and electric mobility services (42%) and enhance energy efficiency and optimise battery performance (34%).

Ebersberger explains that for OEMs, in particular those manufacturing heavy duty trucks, the offering of electric mobility services is crucial for increasing the number of trucks sold. "Fleet customers expect not only high quality vehicles with long range but a carefree package around charging including POI research and booking, bundled invoicing and analytics about the fleet charging behaviour."

In addition to more accurate range estimation for individual vehicles and broader "Big Data" transport analytics, AI may be able to maximize charging schedules when multiple EVs are connected to the grid. In conjunction with advances in charging infrastructure, AI could offset grid congestion and bring down charging costs for users. Though the potential benefits of AI to EVs are far-reaching, including in improving the individual user experience (cited by 26% of respondents), among other areas, it is in the below-the-surface arena of energy efficiency and maintenance (which could utilise emerging vehicle-to-grid systems) that the technology will be most useful.

What are the most significant potential advantages of AI adoption in the EV industry? (Select top two)

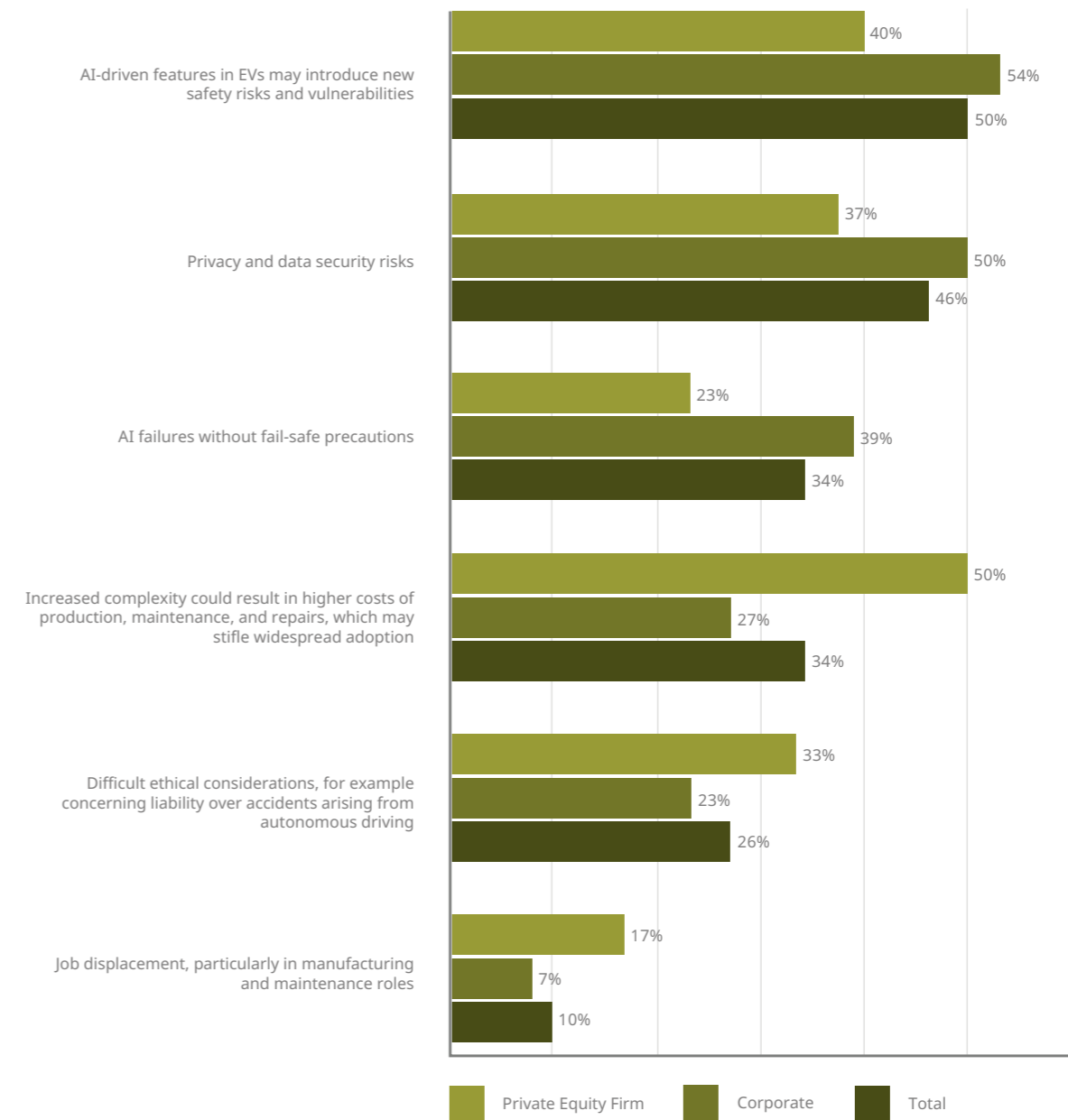


Still, some caution is warranted. Over half of corporate respondents (54%) raise concerns about how AI-driven features in EVs could inadvertently introduce new safety risks and vulnerabilities and 50% of this subset of respondents also cite privacy and data security risks, mirroring the broader anxiety around cybersecurity threats raised earlier in this report.

Investor survey participants are also concerned with these issues, with 37% citing the data security risks attendant with AI and 40% identifying the potential for new safety hazards, though the largest share of this respondent set is most concerned with costs. Half fear that increased complexity relating to AI could result in higher costs of production, maintenance and repairs, which may stifle widespread adoption of EVs.



What are the most significant potential disadvantages of AI adoption in the EV industry? (Select top two)



We are creating something totally different

Carl-Adam Wählstedt, Business Owner Scania Charging Access, Scania



How would you describe the level of investor appetite for EV charging infrastructure?

From my perspective, as a business owner of a customer-facing public charging provider for heavy duty vehicles across Europe, the investment appetite and the funding are there. However, the operational and maintenance costs are difficult to estimate because this has not been attempted on this scale before. Heavy duty trucks operate differently, and more frequently, requiring larger volumes of energy than passenger vehicles. This is the main issue for operators; it can become difficult to assess the business case. For example, they don't know how much to budget for maintenance costs, or what the utilisation will be.

There are circular problems that needed to be addressed. There aren't yet a lot of battery-electric vehicles in the truck market, and customers' hesitation to buy electric trucks comes mostly from uncertainties regarding charging infrastructure and charging operations. So, in 2022, we invested in a joint venture to install and operate a 1,700-strong public charging network, which we are currently building up, for battery-electric, heavy-duty trucks and coaches across Europe. The purpose was to show that it is possible and establish a benchmark for the industry. So, we need to push on both sides: support the investment case and create the conditions necessary for customers to buy electric trucks.

How integral are government incentives and how effective is the regulatory framework in Europe?

There is never an optimal starting point. We are creating something totally different. Subsidies can help to kickstart things, but that doesn't mean they are always capital efficient. What is important though, is that they disrupt in the right way, to push for the actual goal which is to enable a new market space that is also attractive.

What are the most prominent areas of innovation that you expect will attract investors in the years ahead?

We have a lack of grid capacity and energy in Europe, so I expect battery storage will be important. But also, what is really important is for the hardware and back-end software solutions to become more reliable. This has been a problem in the passenger-car market. For us as a truck OEM delivering a promise on operational efficiency to our customers, the standards are higher and we have to deliver on expectations. As demand matures, the hardware and software must be more reliable, so investment is needed there. And not least, we at Scania and TRATON Charging Solutions have to be selective in our partnerships.

What are you optimistic about in the outlook for your market?

We are focused on enabling regional and long-haul journeys for electric trucks across Europe. To use heavy-duty vehicles, we need public charging. And we are starting to see a ramp-up in infrastructure building across Europe. We clearly see the change in attitude and interest from the markets when presenting easy-to-use solutions for their EV journey.

Some customers are buying EVs because it is already beneficial from a cost perspective. But that will grow when public charging networks enable longer ranges. Even though EVs are more costly to buy, they are cheaper to operate, in terms of repairs and maintenance as well as energy costs. When you meet that threshold for certain EV applications, it will become a logical business decision and further adoption will kick-off quite fast.

Outlook:

Supporting a positive ecosystem

The outlook for the EV industry and the charging infrastructure space looks bright. These vehicles promise greater efficiency, reduced reliance on fossil fuels and improved air quality as part of a global transition to a cleaner-energy economy.

The confluence of supportive government policies, strong investor appetite and rising consumer demand suggest the EV industry is poised for substantial expansion through the remainder of this decade and beyond. While there are a number of localised nuances, what are the key trends that are emerging?

Increased global demand complemented by government agendas

Even conservative forecasts for global EV sales say that 30% of all vehicle sales will be electric by 2030. This projected market growth is a strong indicator of sustained demand for EV charging infrastructure, presenting significant investment opportunities as innovative business models and technologies emerge to bridge the gap between novelty and EV ubiquity.

“EVs is where the market has gone – these vehicles are being and will continue to be manufactured at scale,” says Armstrong. “I see there being tremendous development and progress in the near term, as well as a good deal of upheaval and challenges to overcome, but with that comes opportunity. There is a lot of room for growth.”

Respondents to our survey make clear that EVs present the best route forward in the short term to enabling the energy transformation in the automotive sector. Aligning private capital with governments’ long-term goals to reduce carbon emissions is crucial to clear the path towards a sustainable transportation sector, extending not only to light/passenger vehicles but also to heavy-goods trucks and buses.

“Technology will increase EV adoption and usage and create a virtuous circle that will allow the industry to continue to flourish.”

Rubayet Choudhury
Partner, Project Finance – London

Diverse business models and consolidation

Not only are there a large number of players in this market, there is also a range of business models for charging infrastructure. It is clear that developers will need to demonstrate that their particular solutions have long-term credibility in order to gain the confidence of investors and access the required capital to build out the charging networks that are needed to keep up with consumer demand. In time, we can expect to see the consolidation of a fragmented market, which is likely to have an impact on the landscape of investors and corporates in this space.

Role of government and increasingly sophisticated revenue models

While the industry is in its relative infancy, government subsidies and incentives will remain important to delivering equitable access to EVs and charging infrastructure in a cost-conscious and sustainable manner. The examples in the US and Europe, in particular, have shown the profound impact that policy and incentives can have in accelerating investment and the rollout of infrastructure in different parts of the world.

The private sector has, however, shown itself to be adept in developing infrastructure, at scale and efficiently, even when it has not directly accessed government support. As investors seek to optimise business models and revenue streams, we expect to see increasingly sophisticated revenue stacks, particularly as utilisation data becomes more mature. Integrated energy generation and storage solutions as well as vehicle-to-grid technology and access to fleet-wide customers are likely to create further opportunities. Similarly, investors and corporates are also likely to integrate these businesses within their wider energy transition strategy, complementing other business strands.

Reliability and digitalisation key to building customer confidence

Government involvement will likewise be essential as the EV industry moves swiftly to adopt advances in technology, none more potentially disruptive than AI. While these innovations promise greater efficiency for EVs, the industry and relevant regulatory bodies cannot afford to overlook widespread environmental, cybersecurity-related, social and other ethical concerns.

Largely, these concerns are no different to those affecting society more broadly when it comes to the role of big data and digitalisation. However, opportunities for progress appear to outweigh such concerns, with the key driver being the application of these technologies to improve the end-user experience by ensuring that charging infrastructure is functioning and readily locatable, and that charging can happen at the optimum times and cost.

Overall, the insights provided by the executives, investors and regulators who participated in our survey paint a picture of a thriving future for the EV and charging infrastructure industries. Fulfilling that potential will require the whole-hearted participation and support of stakeholders from around the world.

Choudhury adds: “Enhancing consumer confidence is at the heart of progress. Technology should enable increased reliability and ease-of-use; this will increase EV adoption and usage and create a virtuous circle that will allow the industry to continue to flourish.”

System-wide progress

The world of EVs does not and cannot work in isolation. As with the entire energy transition, system-wide issues must be addressed. Delays and costs associated with connection to grid systems is a common challenge across the globe and all stakeholders will need to participate to come up with tangible and sustainable solutions. As the managing director of an alternative investment manager in Bahrain says, “Creating a positive ecosystem is essential, without focusing on current benefits alone.”

“The key nudge points will fall to governments, electricity regulators and infrastructure providers if the ecosystem is to be healthy,” adds Bassford. “We believe they are the counterparty to the EV industry and key to the confidence the market needs to invest.”

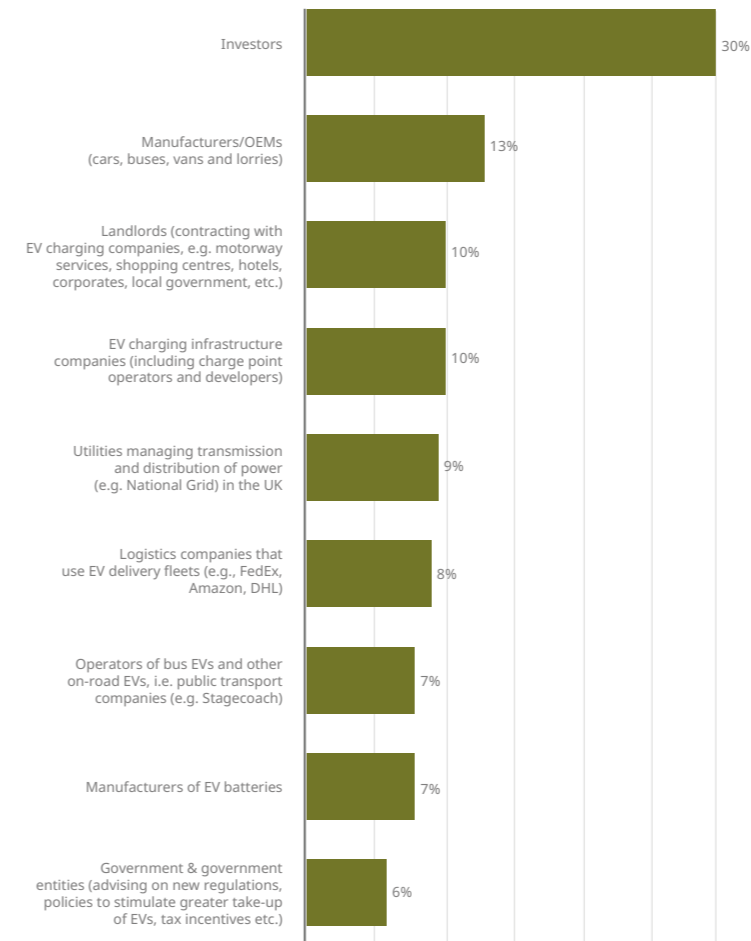


Methodology and respondent profile

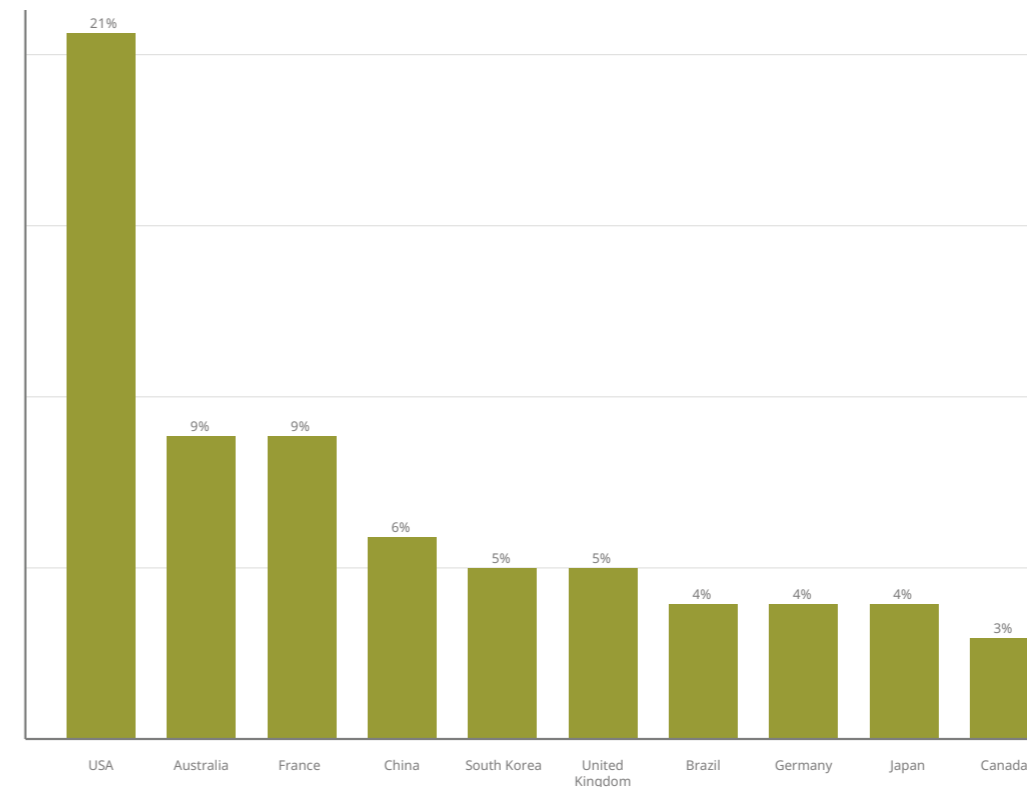
In Q3 2023, Acuris Studios, on behalf of DLA Piper, surveyed 106 senior executives connected to the electric vehicle (EV) industry. Of those, 30 were infrastructure investors and PE firms, and the remaining 76 corporate respondents represented various EV-related businesses as well as government entities from around the world, offering a broad scope of insight into this fast-growing industry.

The survey included a combination of qualitative and quantitative questions, and all interviews were conducted over the telephone by appointment. Results were analysed and collated by Acuris Studios. All responses are anonymised and presented in aggregate.

Which of the following best describes your organisation?



In what country do you primarily do business/operate?



Appendix

Key contributors and global contacts

Europe



Rubayet Choudhury

Partner
Finance, Projects & Restructuring
DLA Piper
London
+44 20 7796 6830
rubayet.choudhury@dlapiper.com



Sylvia Ebersberger

Partner
Intellectual Property & Technology
DLA Piper
Munich
+49 89 23 23 72 136
sylvia.ebersberger@dlapiper.com



Jose Maria Barrios

Partner
Litigation & Regulatory
DLA Piper
Madrid
+34 91 790 1712
josemaria.barrios@dlapiper.com



Howard Bassford

Partner
Real Estate
DLA Piper
Birmingham
+44 20 7796 6969
howard.bassford@dlapiper.com



Daniel Colgan

Partner
Litigation & Regulatory
DLA Piper
Brussels
+32 25 00 65 04
daniel.colgan@dlapiper.com



Michael Cieslarczyk

Partner
Finance, Projects & Restructuring
DLA Piper
Cologne
+49 22 12 77 27 7340
michael.cieslarczyk@dlapiper.com



Khaled Dadi

Advocaat/ Partner
Intellectual Property & Technology
DLA Piper
Amsterdam
+31 205 419 971
khaled.dadi@dlapiper.com



Philippe Danesi

Avocat à la Cour/Country Managing Partner
Employment
DLA Piper
Paris
+33 1 40 15 24 23
philippe.danesi@dlapiper.com



Fabien Ganivet

Partner/Location Head
Litigation & Regulatory
DLA Piper
Paris
+33 1 40 15 24 82
fabien.ganivet@dlapiper.com



Richard Fens

Advocaat/Partner
Corporate
DLA Piper
Amsterdam
+31 205 419 896
richard.fens@dlapiper.com



Francesco Ferrari

Partner
Finance, Projects & Restructuring
DLA Piper
Milan
+39 028 0618505
francesco.ferrari@dlapiper.com



Kjetil Haare Johansen

Country Managing Partner
Litigation & Regulatory
DLA Piper
Oslo
+47 24 13 16 11
kjetil.johansen@dlapiper.com



Susan Samuel

Partner
Real Estate
DLA Piper
Leeds
+44 11 3369 2138
susan.samuel@dlapiper.com



Jacob Sparre Christiansen

Partner
Head of Energy & Natural Resources
DLA Piper
Copenhagen
+45 33 34 08 50
jacob.christiansen@dk.dlapiper.com



Sarah Thomas

Partner
Real Estate
DLA Piper
London
+44 20 7796 6507
sarah.thomas@dlapiper.com



Tiia Ryhänen

Counsel
Energy & Natural Resources
DLA Piper
Helsinki
+358 40 835 5676
tiia.ryhanen@fi.dlapiper.com



Marianne Ramel

Partner
DLA Piper
Stockholm
+46 8 701 78 55
marianne.ramel@se.dlapiper.com

Asia Pacific



Peter Armstrong

Partner
Corporate
DLA Piper
Tokyo
+81 3 4550 2811
peter.armstrong@dlapiper.com



Carolyn Dong

Foreign Legal Consultant
(The People's Republic of China)
Finance, Projects & Restructuring
DLA Piper
Hong Kong
+852 2103 0505
carolyn.dong@dlapiper.com



Chris Mitchell

Partner
Corporate
DLA Piper
Melbourne
+61 3 9274 5145
chris.mitchell@dlapiper.com

Americas



Ian Bendell

Co-Chair, Canadian Projects,
Energy & Infrastructure Group
DLA Piper
Toronto
+1 416 369 5252
ian.bendell@dlapiper.com



Paul Hemmersbaugh

Partner
Government Affairs
DLA Piper
Washington DC
+1 202 799 4590
paul.hemmersbaugh@us.dlapiper.com



Olga Lucía Ramírez

Partner
Infrastructure, Projects & Public Law
DLA Piper Martínez Beltrán
Bogotá
+57 1 3174720 5
olramirez@dlapipermb.com



