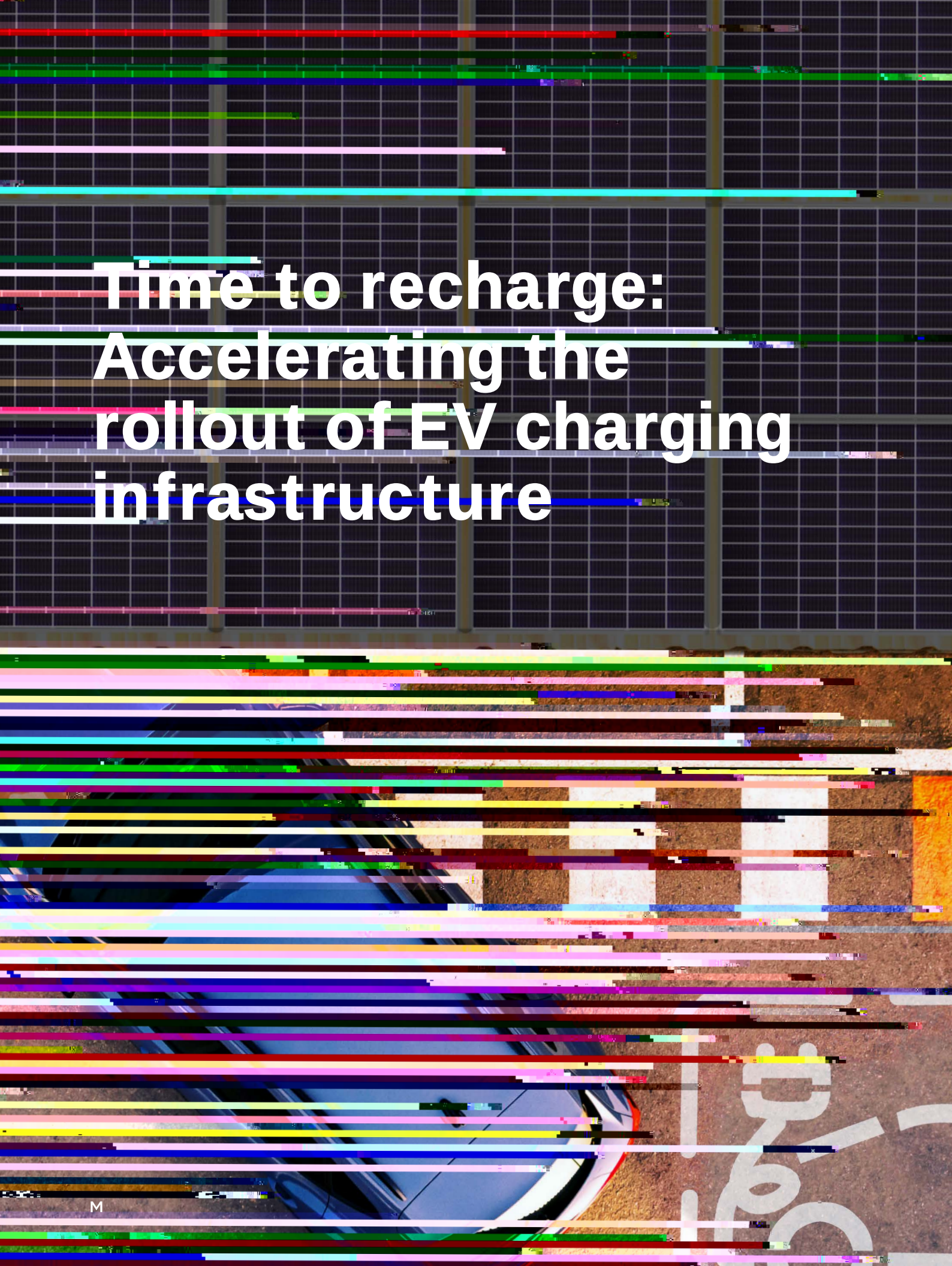
Time to recharge: Accelerating the rollout of EV charging infrastructure



Executive summary

Getting electric vehicle (EV) charging right is essential for meeting national EV targets — and, consequently, a crucial component in achieving national net-zero ambitions. Progress in many countries remains patchy, and even the best performers have ways WR JRbLQ PHHWLQJ IRUHFDVWHG OHYHOV RI FKDUJH SRLQW demand in 2030 and beyond.

By one estimate, the world will need to invest over US$1 trillion [1] in EV charging infrastructure by 2030, in line with commitments to the Paris Agreement. Unlocking this investment within that timeframe is dependent on concerted and coordinated action from various stakeholder groups to overcome the triad of critical challenges our research has shown WRbEH VORZLQJ (9 FKDUJLQJ rollouts.

Firstly, in the public sphere, roles and responsibilities DUH RIWHQ QRW ZHOO GH¯QHG OHDGLQJ WR WKH GXSOLFDWLRQ of authoritedemaps im812.6 (u)--19 (i)-10.9d(m)-6.1 (a)-8 (n)-10.1c(i)-4.2e(s a)-8 (n)-11.6 ((c)-3.7 (o)-9.4 (v)-4.1 (e)-17.6 (r)-4.2 (a)-12.

Contents

Introduction

Transport relies more greatly on fossil fuels than any other sector, accounting for 37% of CO2 H P L V V L R Q V I U R P H Q G ± X V H V H F W R U V L Q , W F R P H V D V Q R V X U S U L V H b W K H Q W K D W L Q D Q H U D R I Q H W] H U R F R P P L W P H Q W V b J R Y H U Q P H Q W V K D Y H P D G H V X V W D L Q D E O H transportation a key policy objective and are pressing for quick results. The widespread adoption of electric vehicles (EVs) is a part of this journey, but one that will need to be complemented by investments in hydrogen fuel-cell vehicles and sustainable fuels.

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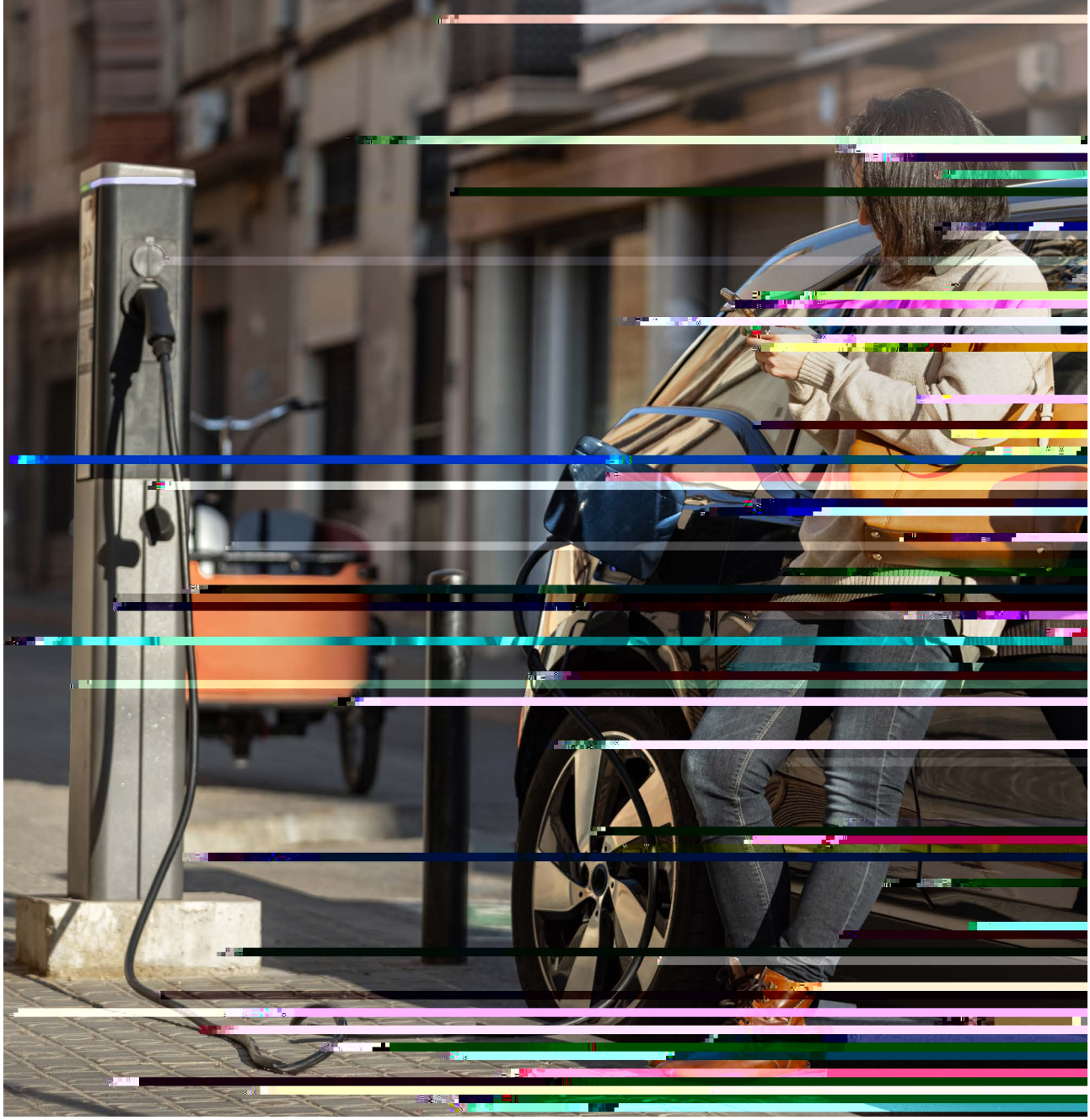
= The Canada global emissions of EVs fue6Vs fp60.8 (t 3.1 (-18.9 (f)-1146>-3ue6).7 2e)-13n10.2 (m)-13.7 (-6(eh)).8 (en)120b801 Tw [(b801 () n=184

Charging infrastructure refers to the equipment that connects EVs to an electricity source to recharge its EDWWHU\ :KLOH PXFK RI (9 FKDUJLQJ WDNHV SODFH DW home through a regular wall socket, readily accessible public-charging infrastructure remains a key enabler that will ensure more EVs are bought by individuals who don’t have personal parking spots.

The ratio of EVs to charge points varies tremendously across countries, largely due to assorted approaches to regulation, incentivization, planning, and GL®HUHQFHV LQ WKH TXDOLW\ RI XQGHUO\LQJ HQHUJ\ systems. Todaosms



:KLOH LW PD\ VHHP REYLRXV WR PRVW REVHUYHUV WKDW EVs are here to stay, many people would be surprised to learn that the electric vehicle is not a completely new innovation and that interest in EVs has come DQG b JHFQH before.

First invented around 1830, EVs gained in popularity in the 1890s and by the turn of the century accounted for about one-third of vehicles in the United States. $W bWKH WLPH (9V KDG VHYHUDO DGYDQWDJHV RYHU JDVROLQH powered vehicles, which had to be cranked by hand to start and were noisy to drive. Over time, though, EVs' disadvantages came to the fore. Those included long charging times, a lack of charging infrastructure, and concerns about the distances these vehicles could travel — concerns that sound familiar to anyone with an interest in the EV sector today.

WHAT REALLY IS AN EV?

An electric vehicle (EV) is a vehicle that uses DQbHOHFWULF PRWRU LQVWHDG RI DQ LQWHUQDO FRPEXVWLRQ HQJLQH ,&(:KLOH (9V PD\ EH DQ umbrella term referring to any vehicle powered by electricity from a battery, for the purpose of this report, EVs refer only to plug-in electric vehicles, including plug in hybrid EVs (PHEVs), DQG EDWWHU\b(9V %(9V H[FOXGLQJ IXHO FHOO HOHFWULFbYHKLFOHVbRU K\EULG HOHFWULF vehicles.

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

Governments around the world have been encouraging EV sales through the presence RIb¯QDQFLDO DQG QRQ ¯QDQFLDO LQFHQWLYHV WR KHOS

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

COUNTRY	EV TARGETS	EV SALES SHARE (CARS,	TOTAL EV SALES FROM	SELECTED EV ADOPTION INCENTIVE MEASURES
Norway	All new cars sold by 2025 should be zero-emission (electric or hydrogen)	86%	329,879	No annual road tax (1996-2022) Free municipal parking No toll fees Access to bus lanes
Iceland	All new passenger cars should emit zero emissions, by around 2027	72%	9,364	Exempt from import duties Exemptions and discounts for VAT Free municipal parking Ban of petrol and diesel vehicles by 2030
Sweden	National target of becoming carbon-3(E)-20.2030 8 cles			

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skills to localize targets and create an enabling environment for CPOs to deliver against them.

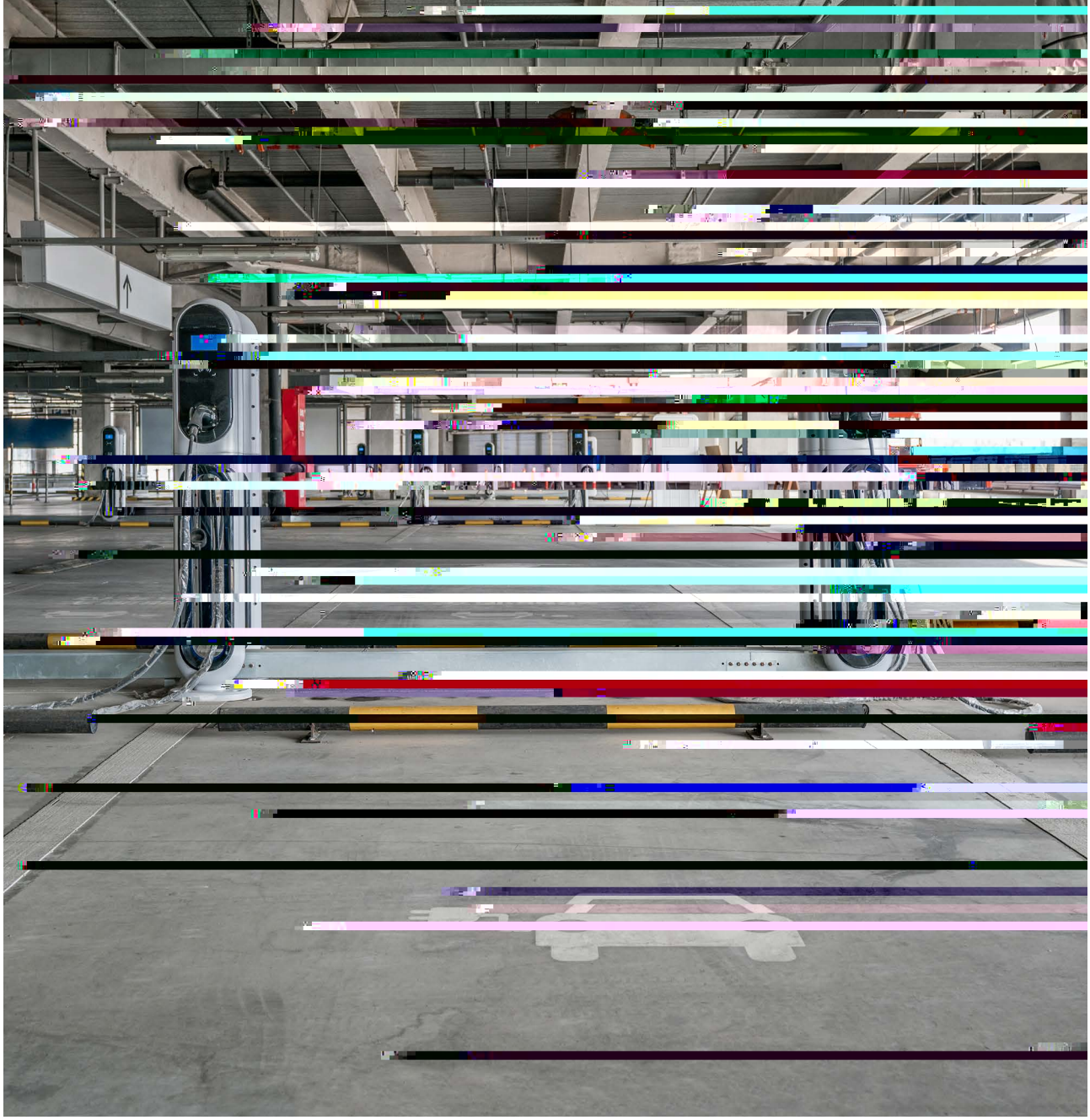
Prioritize the usability and safety of charging platforms

The UK has a holistic guidance regulation [12] that sets device-level requirements that must be met for all smart charge points for sale in the country. It regulates the data transfer of chargers, enforces electricity supplier interoperability, establishes

departments that are responsible for planning and delivering charging infrastructure. Further support will follow in the form of a knowledge hub for local authorities that will contain guidance and toolkits to support community engagement, procurement, D Q G b V W D Nmanagement.U

, Q $ X V W U D O L D W K H 1 H Z 6 R X W K : D O H V J R Y H U Q P H Q W K D V invested $131 million in developing its charging network through its Electric Vehicle Strategy. [17] The strategy prioritizes empowering local councils to nurture pilot schemes of roadside charging infrastructure. The outcome of these pilots will be used to inform the future development of EV parking-and-charging guidelines for local councils in the state.

To give the workforce the skills and resources tg7 ( )]iiwese p-21.6 (v)-8.5 (e e)-11.6 (h44.2 .5 (u45.1 (s)20.7 (i)-6. (e)-12.4 10.1 (e o)-1



#2: Uncertain commercial and risk dynamics

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further their understanding of key risks.

CPOs should explore new opportunities to J D L Q b P D [L P X P F R P S H W L W L Y H adv antage

CPOs must target actions that set them on a path W R S U R ¯ W D E L O L W \ 7 K H U H L V Q R R Q H V L] H ¯ W V D O O V R O X W L R Q so CPOs must determine a strategy that best

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

What's the challenge?

CPOs have found that securing insurance coverage for their operations can be a slow and complicated process, with a severely limited set of options to choose from. This stems from insurers lacking V X ± F L H Q W R S H U D W L R Q D O G D W D W R G D Y V H V V E R P E L Q H G Z L W K the initial sense that EV-charging technologies and X V H F D V H V E U L Q J X Q N Q R Z Q b R U P L V X Q G H U V W R R G risks.

G L ® H U H Q F H b L V b W K H H [W H Q G H G D Q G R I W H S H U L R G W K D W (9 b F K D U J L Q J W D N H V Y H U V X vehicle refueling, which creates additional third-party liabilities that need to be considered and priced correctly. Such risks could include slips, trips, and falls from passers-by over charging cables and damages presented by thermal events involving consumer vehicles.

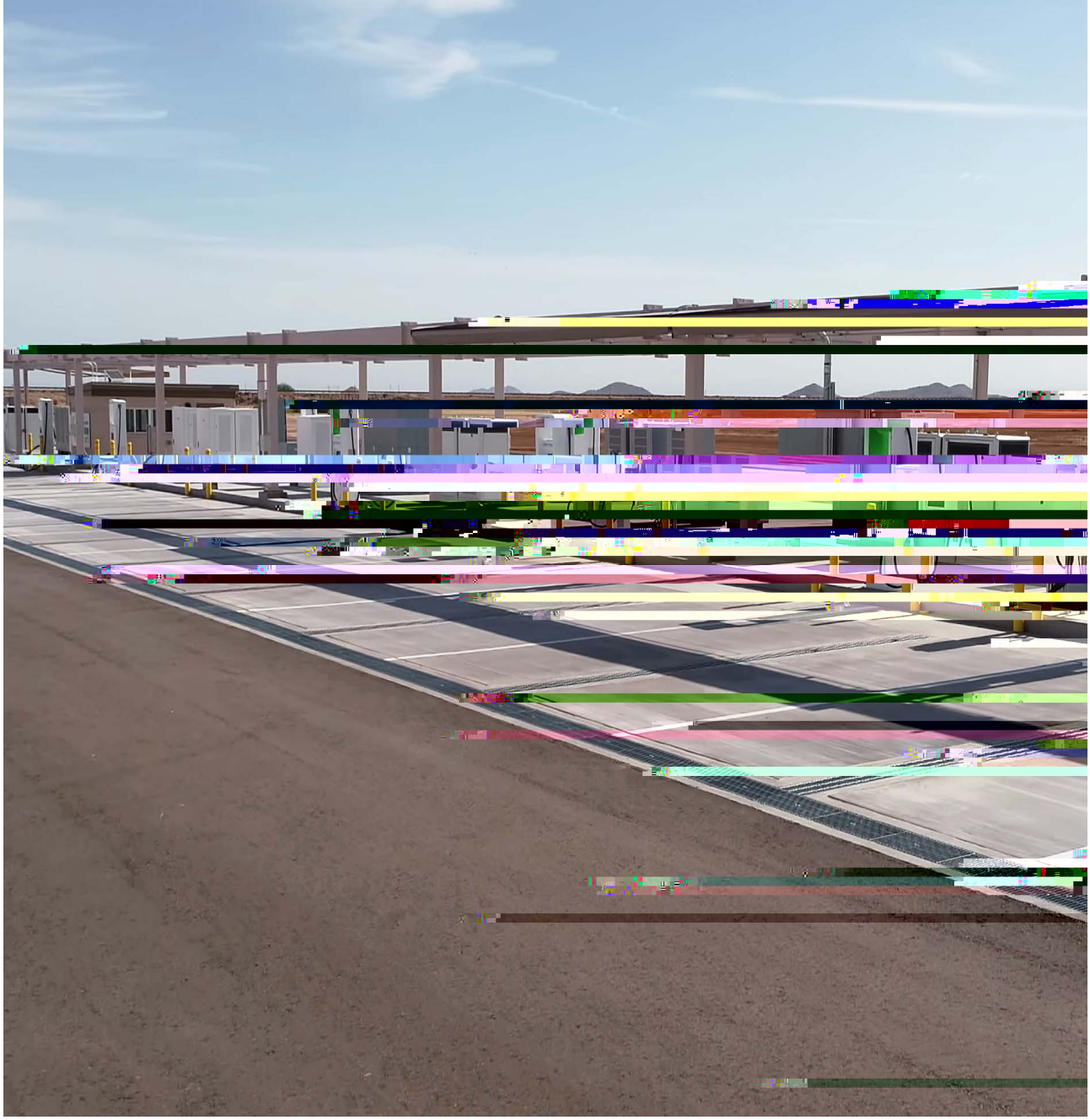
Given increasing EV demand and government V X S S R Uiorr11 <0053>5>-9gi W (g (o)1 [(G)-1.69rj0 50.5 (f)-.5 (e)->

Recommended actions

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

, Q V R P H P D U N H W V L Q V X U H U V K D Y H E H H Q V O R Z W R R ® H U (9 V S H F L ¯ F S U R G X F W V F L W L Q J D O D F N R I X Q G H U V W D Q G L Q J R I b W K H W H F K Q R O R J L H V D Q G X Q F H U W D L Q W L H V O L Q N H G W R evolving government legislation and regulations. Insurers should become more proactive in engaging with CPOs, public authorities, EV manufacturers and brokers to develop a better understanding of the true U L V N S U R ¯ O H R I F K D U J L Q J R S H U D W L R Q V 7 K H V H G L V F X V V L R Q V will give insurers a detailed grasp of the required coverage across EV-charging stations, street charging, K R P H R ± F H V R O X W L R Q D Q G G H S R W V J L Y H Q W K H L U G L ® H U H Q W EV technologies and use cases.

One way to build comfort with EV coverages is for insurers to identify existing coverage proxies from other assets or businesses that have similar U L V N S U R ¯ O H V ([D P S O H V R I W K L V L Q F O X G H Y L H Z L Q J street lighting as a proxy for street charging or petrol stations as a proxy for EV equivalents. Risk S U R ¯ O H V Z L O O b Q H Y H U E H L G H Q W L F D O K R Z H Y H U 2 Q H N H \



#3: Grid Management Issues

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

What's the challenge?

The growing number of EVs in circulation means that demand on the electricity grid is rising. Levels of spare capacity in an electricity grid vary by location but, in all cases, peak-hour demand is when the strain is greatest. EV charging leads to strain on the grid in WZR ZD\V 7KH ¯UVW LV GXULQJ SHDN KRXUV XVXDOO\ ODWH afternoon to mid-evening) when users return from work and charge their car. The second is due to the LQVWDOODWLRQ RI IDVW FKDUJHUV ZKLFK UHTXLUH VLJQL¯FDQW supporting investment to ensure that the local grid can remain functioning and resilient. The impact of extreme weather events on overall energy demand DQG H±FLHQF\ RI VXSSO\ PD\ HYHQ LQFUHDVH WKLV VWUDLQb LQ WKH future.

Recommended actions

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

Broad sets of stakeholders must work collaboratively to scale the uptake of smart-charging solutions. Smart charging refers to technology that allows one-directional charging of EVs to start and stop in response to factors linked to electricity supply and cost at a given point in time. Various research SURMHFWVbHVWLPDWH WKDW WKH DGRSWLRQ RI EDVLF VPDUW charging technology could reduce EV-led increases in peak-period electricity demand by 14%-40%, depending on the time of day, the total number of (9VbRQ WKH URDGV DQG WKH WHFKQRORJLHV involved.

In its simplest form, EV owners can receive prompts from the grid operator when to charge their vehicles VR WKDW WKH\ EHQH¯W IURP QRQ SHDN WDUL®V DQG RU DOLJQ

Exhibit 6: % H Q H ¯ W V R I V P D U W charging

£225

Household savings annually in the UK by using ¯©•®° Ÿ¤•®£¥ª£ °¡Ÿ¤ª«¨«£¥¡¯ °« «¬°¥¶¥©¡ ¡¨¡Ÿ°®¥Ÿ¥°µ ±¯¡ ¥ª ³‡˜ Ÿ¤•®£¥ª£ [39]

59%

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$120-690 million

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50%

Potential reduction in investment required to ±¬ •°¡ °¤¡ ¥¯°®¥ž±°¥«ª ª¡°³«®§ ª¡Ÿ¡¯¯•®µ ¥ª •©ž¥°¥«±¯ ‡˜ ±¬°•§¡ ¯Ÿ¡ª•®¥« ¥ª ‰¡®©•ªµ

85%

Reduction of carbon dioxide emissions from electricity generated for EVs in a fully ©•ª•£¡ Ÿ¤•®£¥ª£ Ÿ¡ª•®¥« [43]

40%

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Explore charging hardware that minimizes grid strain

&32V VKRXOG LQYHVW LQ IDVW FKDUJLQJ WHFKQRORJ\ WKDW FDQ EH XVHG HLWKHU R® JULGbRU bZLWK ORZHU YROWDJH JULG FRQQHFWLRQV 7KLV LV EHFDXVH VXFK WHFKQRORJ\ can be made available faster and cheaper than DOWHUQDWLYHV WKDW UHTXLUH FRVWO\ DQG WLPH-FRQVXPLQJ grid enhancements.

Pilot projects around the world are driving VLJQL¯FDQWbLQQRYDWLRQ LQ WKLV VSDFH ,Q (XURSH RQHbH[DPSOH LV (21 DQG 9: V VROXWLRQ 'ULYH %RRVWHU bZKLFK FDQ EH LQVWDOOHG ZLWKRXW FLYLO ZRUNVbDQG XVHV D QRUPDO SRZHU FRQQHFWLRQ WR charge two vehicles simultaneously at a rate of up WR ‹N [45] Alterative solutions include those by L-Charge [46] ZKLFKbR®HU PRELOH FKDUJLQJ DQGb¯[HG R® JULGbFKDUJLQJ WKDW LV SRZHUHG E\ DQ /1* RU hydrogen-powered generator.

Similarly, battery energy storage systems (BESS) can be co-located [47] ZLWK FKDUJLQJ SRLQWV WR R®HU PRUH °H[LELOLW\ ,Q 1HZ <RUN &LW\ &RQ Edison are working together to deliver BESS-powered fast charging. Overnight, off-charge the batteries RYHUQLJKW WR WDNH DGYDQWDJH RI ORZ

Charging points that can be co-located with solar energy generation should also be prioritized, though such solutions may not qualify as fast charging.

2QHbYÂHbYq„@€ p q„@PVÜU& u I €•0ðRZ Ha55a55d

Recommended actions

Focus on selecting the right V2X pilot projects

Selecting the right scope and partners for pilot projects will help demonstrate technical and economic viability, as well as building stakeholder trust. In the QHDU WHUP 9 ; SLORW SURMHFWV VKRXOG IRFXVbRQ (9 °HHWV 7KH UDWLR RI GHFLe

Concluding thoughts

The past decade has seen more investment and innovation in electric

Acknowledgements

Authors

Blair Chalmers
0 D Q D J L Q J ' L U H F W R U 0 D U V K 0 F / H Q Q D Q Advantage
blair.chalmers@mmc.com

Iman Reda
5 H V H D U F K $ Q D O \ V W 0 D U V K 0 F / H Q Q D Q Advantage
iman.reda@oliverwyman.com

Contributors

Our thanks go to the following individuals at Marsh McLennan

Marsh: 0 D U W L Q % H Q Q H W W ' D Y L G & D U O V R Q & D U O * X U Q H \ . D V L D / L S L Q V N D * U H J 0 D

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Design led by Tezel Lim, Art Director

Endnotes

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