

Charging up – China is currently the champion of the electric vehicle industry

EV Charging Index
Edition 2 | 2022

Roland
Berger



The Roland Berger
Center for Smart Mobility

Introduction

Although only half a year has passed since our first EV Charging Index, this important market is developing at a rapid pace. For example, EV sales have increased by 55% over the last half year alone. In that same time, the total number of available charging stations has grown by 58%. While China, the Netherlands and UK still lead the world in charging infrastructure, countries such as US and Germany are quickly catching up.

After conducting over 10,000 customer surveys in 27 key global markets (which represent more than 96% of global EV sales), dozens of expert interviews, and comprehensive industry research, Roland Berger has ranked the nations on 28 leading indicators to paint a vivid picture of the EV charging industry across the globe. Based on an evaluation of maturity and future potential, we have identified four market categories. A total of seven markets are currently identified as "Champion" markets, with China and the USA leading the cluster. These markets are highly mature in terms of passenger adoption and leading infrastructure, with significant growth developments coming in the near future.

In the global landscape, East Asia is positioned as an infrastructure and device production center. When it comes to the next generation of new EV OEMs, the United States and China are the leaders with high-tech OEMs like Tesla and NIO. Europe appears to be the front runner in the world for EV penetration and EV infrastructure.

Here's what you need to know about the current market, and how to act on it.

Index overview

After evaluating our 27 focus countries on 28 specific criteria, total maturity scores ranged between 15 and 78 out of a total of 100. China retained its leading position in this edition, followed by the US and Germany. Notable laggards included many Middle Eastern countries, where the electrification trend is slowly picking up in the local markets.

EV Charging Index scoring results
[total of 100 points available from 28 ranking indicators]

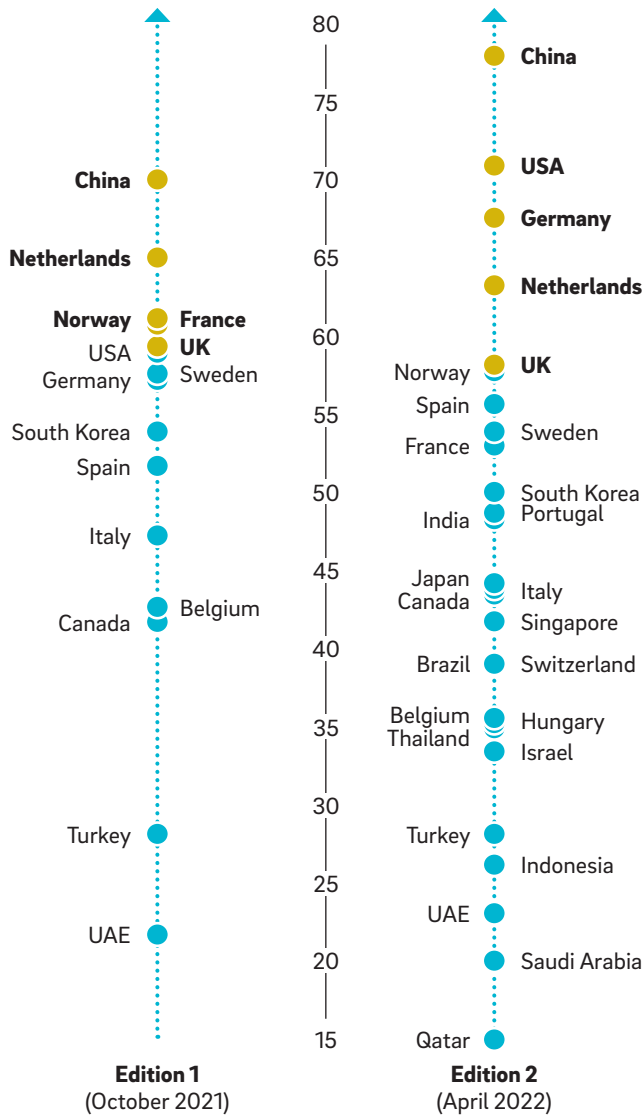


Source: Roland Berger EV Charging Index

Compared to the first edition of our EV Charging Index, the average country score dropped slightly due to the addition of several new criteria and emerging countries. But the rapid growth trend in leading countries remained evident. China, the Netherlands and UK stayed in the top five, while the USA and Germany rose rapidly over the last six months to enter the top five of our latest index.

China, Netherland and UK remain in top 5 while USA, Germany achieve quick ramp-up

Overall score evolution through 2 editions (points out of 100)



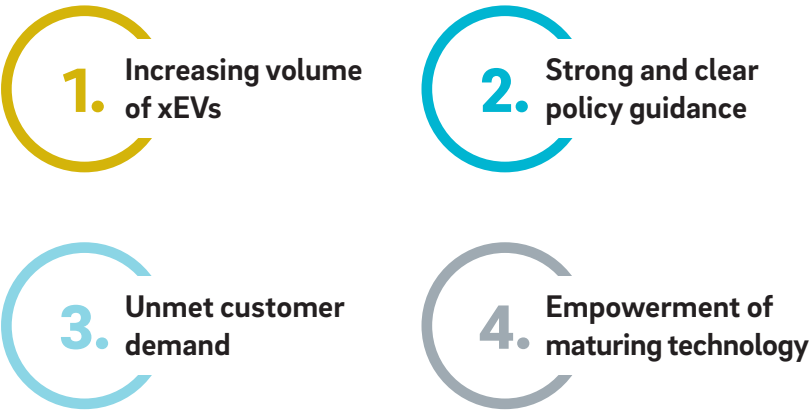
Source: EV Volume; Roland Berger EV Charging Index

What's driving growth?

There are four factors determining growth in our index and industry:

- 1. Volume of EVs.** With the help of regulation and increasing practicability, there has been a significant adoption of passenger and commercial EVs, in addition to rising demand for charging infrastructure.
- 2. Clear policy guidance.** Most countries have set ambitious targets in terms of the number of charging stations they plan to install, in addition to reductions in CO₂ emissions and ICE vehicle sales. In order to facilitate the process, most countries also support subsidy programs for both vehicle sales and charging infrastructure development.
- 3. Unmet customer demand.** Customers' charging demand is not fully met. Leading concerns include insufficient charging infrastructure and low charging efficiency. Over half of respondents (57%) from our focus countries believe that current charging times are too long and 54% express doubts around the number of available charging stations.
- 4. Maturing technology.** As the capacity of battery technology increases so too does the demand for fast charging stations. And as technology improves the efficiency of both batteries and charging stations, costs will fall and alternative solutions will grow.

Trends in charging infrastructure

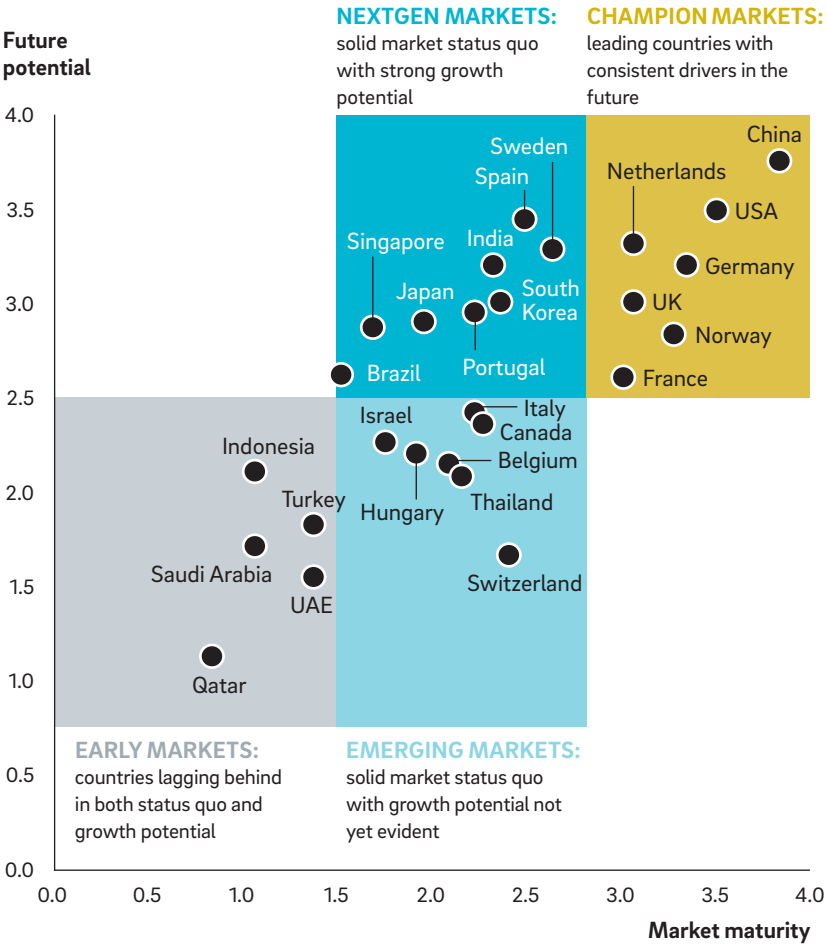


Source: Roland Berger

How did we score focus countries?

After evaluating the maturity and future potential of 27 focus markets, we identified four market categories: Champion, NextGen, Emerging, and Early. A total of seven "champions" were identified, with China and the USA leading the cluster. Scoring on market maturity was based on EV market maturity, charging infrastructure maturity, and customer charging satisfaction. Future potential was based on EV market growth potential and charging infrastructure growth potential.

Overview of market categories



Source: Roland Berger EV Charging Index

1. **Champions** have highly mature EV markets in both sales and charging infrastructure. Improving the speed and quality of charging is the next step in development.
2. **NextGen** markets have considerable volume in EV adoption and charging infrastructure, and clear policies and plans in place to fuel market growth, but their infrastructure growth potential is still lacking.
3. **Emerging** markets lag behind in EV adoption and charging infrastructure, but due to their latecomer advantage, they are developing with quality in mind, which is resulting in higher user satisfaction from the outset. Increasing growth in both sales and infrastructure is the immediate challenge.
4. **Early markets** currently have very limited EV volumes, charging infrastructure, and potential. Faced with such a considerable lag, systematic planning is a key challenge.

Each category of market has its own characteristics and future challenges/opportunities

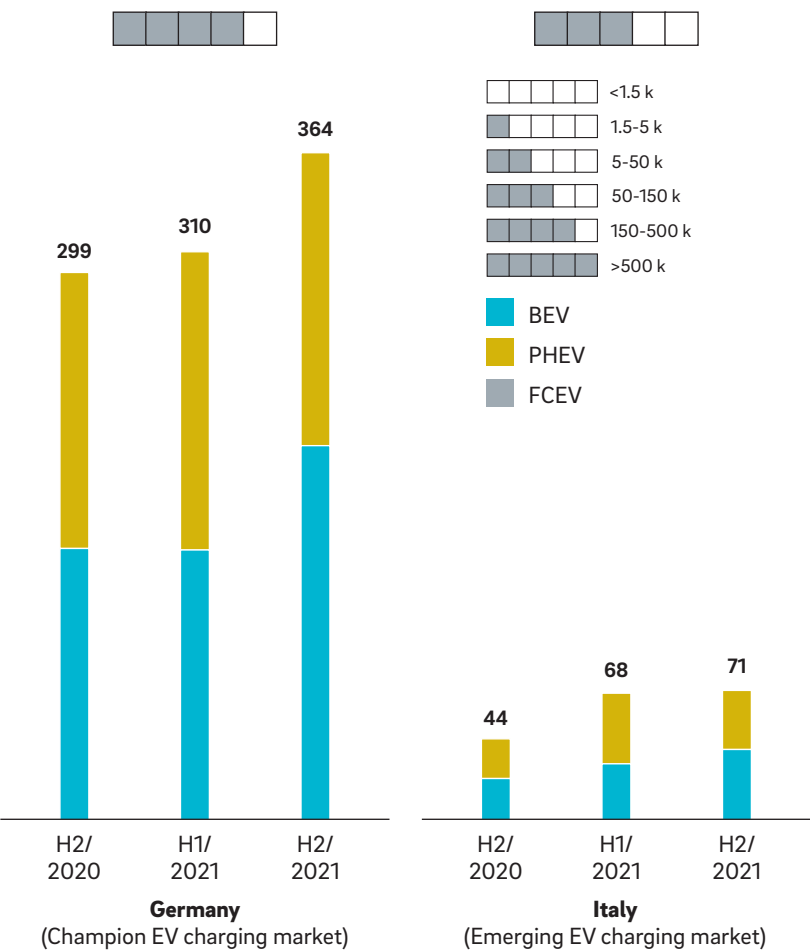
	CHAMPION MARKETS	NEXTGEN MARKETS	EMERGING MARKETS	EARLY MARKETS
Market characteristics	<ul style="list-style-type: none">• Highly mature EV market• Leading charging network with strong growth potential	<ul style="list-style-type: none">• Solid status quo in the EV and charging market• Strong momentum in EV growth	<ul style="list-style-type: none">• EV and charging lag slightly behind the NextGen• High user satisfaction	<ul style="list-style-type: none">• Market as a whole is in the early stages• No obvious growth potential
Market challenge/opportunity	Balance quality with rapid development	Lacking in infrastructure growth potential	EV and charging growth potential are not yet evident	Plan systematically to catch the wave of electrification
Countries	China Germany France Netherlands Norway UK USA	Brazil India Japan Portugal Singapore South Korea Spain Sweden	Belgium Canada Hungary Israel Italy Switzerland Thailand	Indonesia Qatar Saudi Arabia Turkey UAE

Source: Roland Berger EV Charging Index

Who's winning?

With so many indicators, what are the key factors that make the champion markets stand out from the rest of the countries? In market maturity, the key contributors for leading champions are mature EV market and charging infrastructure, even though customer satisfaction was not necessarily higher than in other markets. In terms of market maturity, Champion countries significantly outperform NextGen, Emerging, and Early countries across all indicators. For example, Germany, which was identified as one of the champion markets, sold over 364,000 EVs over the last half year, much higher than Italy's 70,000 sales during the same period. China, for its part, sold over 2.1 million.

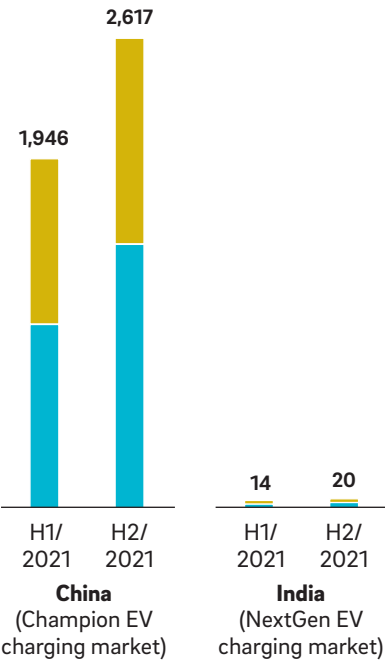
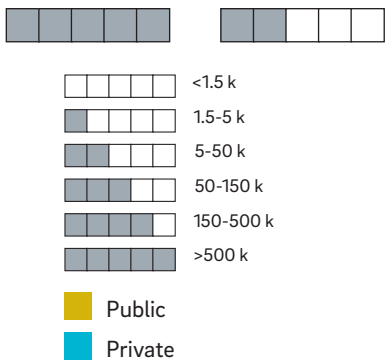
Research indicator 1: EV (PV) sales volume ['000 units]



Source: EV Volume; Roland Berger EV Charging Index

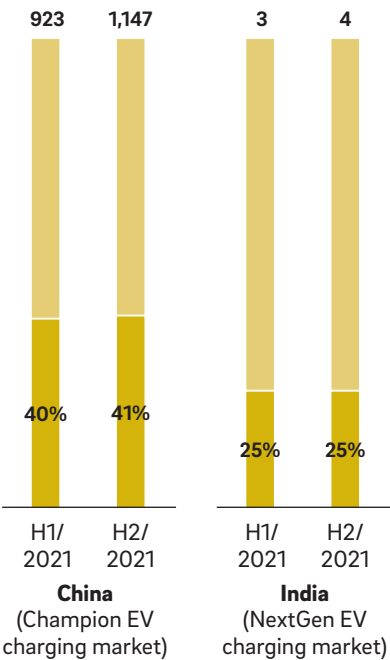
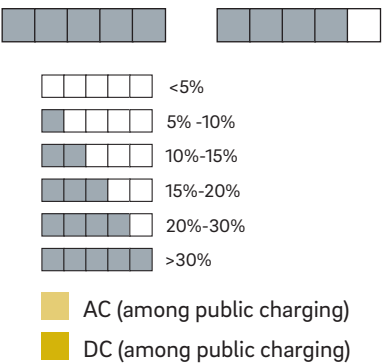
In terms of public charging infrastructure, Champion countries demonstrate clear leadership on volume along with the aggressive growth in the past 6 months. For example, China has 2.6 million charging points in total (1.1 million of them public), while India as a typical NextGen market only has 20,000 charging points. On other indicators like AC/DC split, champion markets like China are clearly pushing for faster charging solutions in the public network, with as many as 41% of public charging points being DC.

Research indicator 7: Charging infrastructure – Public/Private ['000 units]



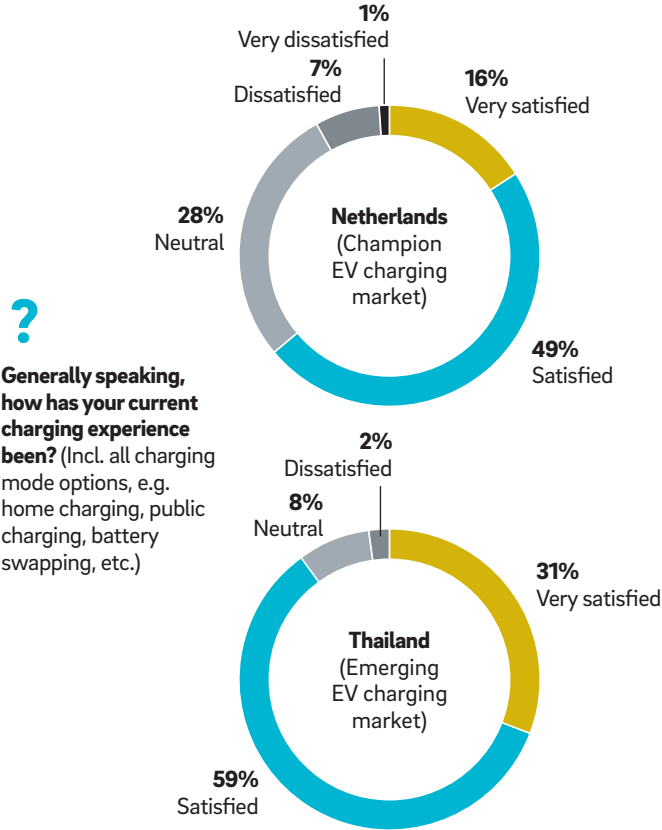
Source: National Govt./Statistics Bureau; secondary research; Roland Berger EV Charging Index

Research indicator 11: Public charging – AC/DC ['000 units, % split of AC and DC charging points]



Compared to Emerging markets, Champion markets do not necessarily have the highest satisfaction among customers due to the dramatically increasing EV volume and thus higher requirement for the parallel development of charging infrastructure. For example, 65% of Dutch users are "satisfied/very satisfied" with charging, whereas 90% of Thai users are "satisfied/very satisfied" with charging. We anticipate this will change as markets mature.

EV range and overall charging experience – Current charging experience



In terms of growth potential, Champions are still in a leading position on charging infrastructure, but some NextGen and Emerging countries demonstrate higher growth potential, especially with indicators such as combustion engine bans and willingness to pay premiums for EVs. In Norway, for example, only 18% of users are willing to pay more for EVs. But in Italy, 50% users are willing to pay more for EVs when compared to ICE vehicles. Still concerns remain for less developed nations. India, for example, has little to no charging technology available at the moment.

Source: RB online survey 2022

Comparison of Champions and other markets – Future potential outlook

Typical indicator	Champion markets (selective)	NextGen/Emerging markets (selective)
Charging infrastructure growth potential	Target – Home charging	In France, home charging is a national requirement and property owner gets 50% of total amount as a co-subsidy
	Players – Valuation	In USA, there are 4 unicorns valued at USD 11.3 bn in total
	Key charging technologies – Pilot project	NL has large-scale commercialization of several key technologies, e.g. smart charging
EV market growth potential	Target – EV sales/ICE ban	National NEV penetration of new car sales to reach 40% by 2030 in China
	Expectations on bottom-line price of EV	In Norway, only 18% of users would accept a higher price point for EV than ICE
	EV purchase willingness (for non-EV owners)	In GER, only 44% of non EV owners would consider buying an EV for their next car

Selective key indicators from evaluation framework

What's more, Champion countries hold a significant lead as they are more eager to expand their infrastructure across a relatively large EV market. Take home charging, for example. In France, home chargers are a national requirement with co-subsidies provided to the property owner. By comparison, Brazil and Singapore have no mandatory requirements, which limits the immediate potential for NextGen and Emerging markets.

Source: Roland Berger EV Charging Index

Challenges and opportunities

Faced with the dynamic characteristics and challenges across different markets worldwide, the charging unicorns, most of which are from Champions markets, are actively expanding their business globally in both geographic and charging availability. With so much opportunity at stake, electric vehicle stakeholders must take appropriate actions to maximize their investments. To that end, we predict the following:

- 1. A steady shift towards electrification.** To combat climate change, particularly in the transportation sector, world governments are tightening regulations and incentivizing markets to support the shift towards electrification. As a result, many OEMs have already developed a plan for phasing out combustible engine in the near future, and consumer attitudes towards electric vehicles are favorable across all regions.
- 2. Charging infrastructure will mature by 2040.** As prices drop, AC charger sales are expected to dominate overall sales volume, accounting for 75% of the total market through 2040. DC chargers below 50 kW and HPC chargers (150-350 kW) are expected to contribute the most value, however. Looking forward, the Chinese market is estimated to account for around 50% of the public charging market.
- 3. Value of energy management to rise.** We believe energy management solutions could reach USD 6 billion by 2030, with smart charging (V1X) and V2G presenting opportunities to reduce peaks by 20-30% in residential applications. Added to that, there is expected to be a significant increase in V1X adoption and additional value could be derived from avoided grid investments.



The shift towards electrification will continue to require significant investments in EV charging infrastructure

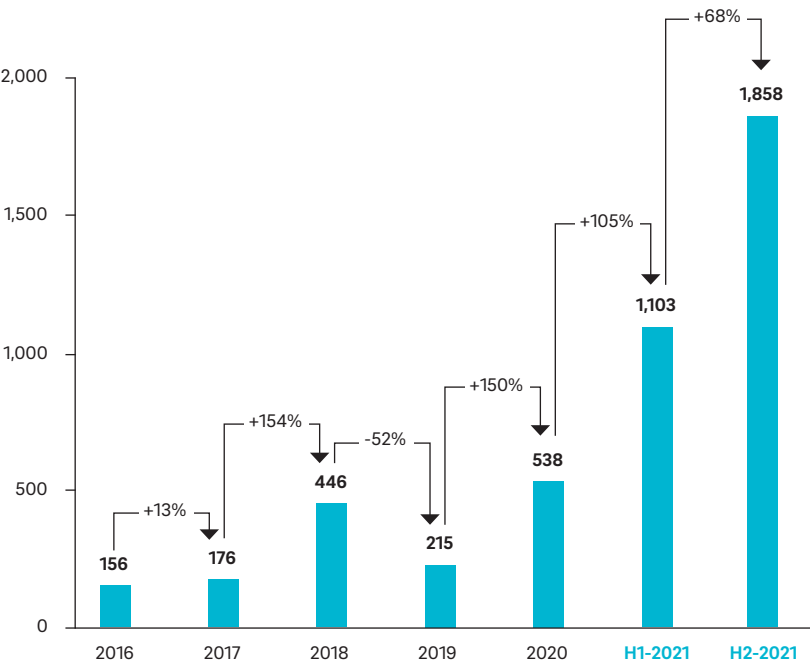


Due to high sustained sales volumes, the installed base of charging infrastructure is expected to grow >15% p.a. until 2040



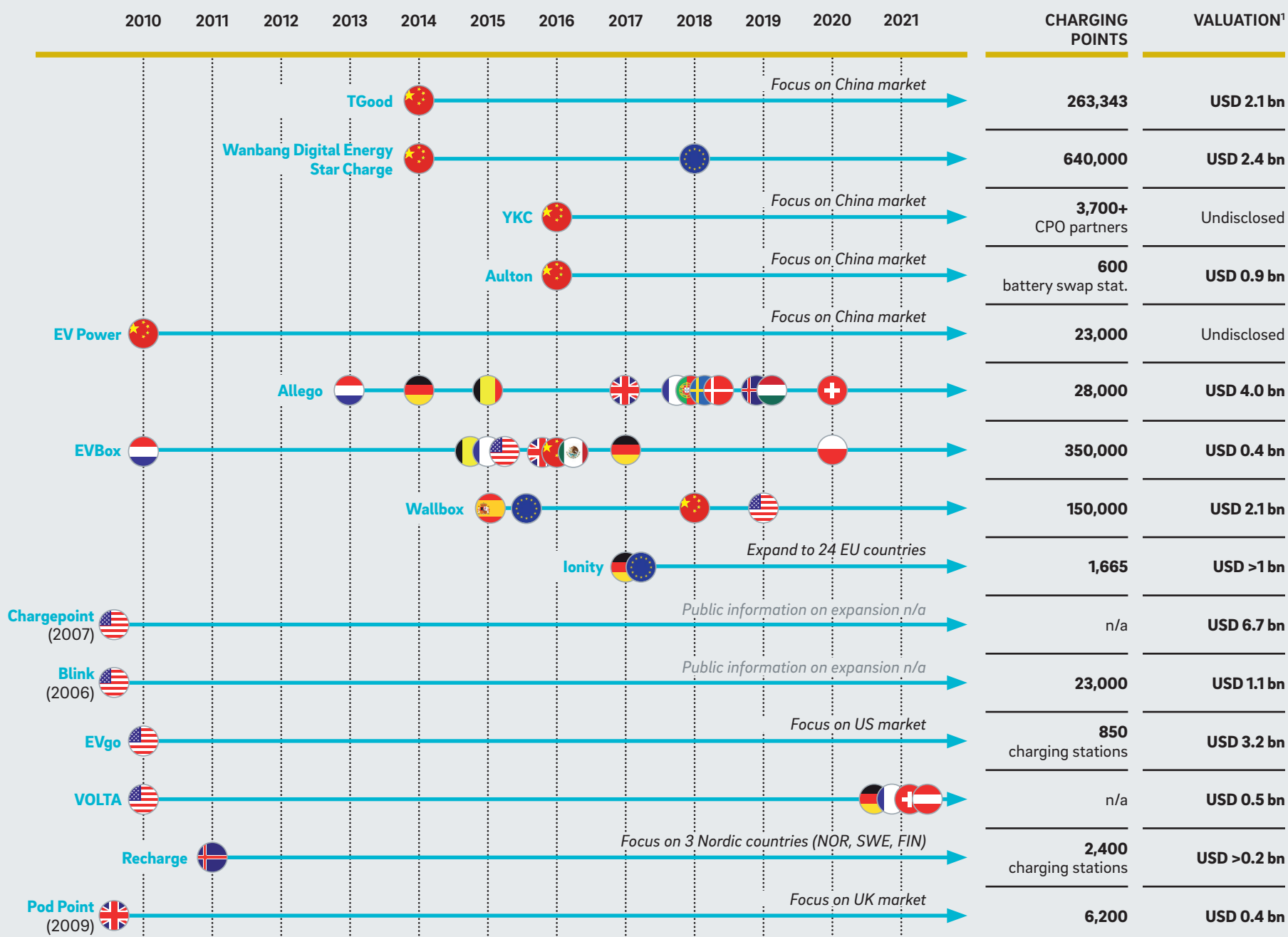
Increasing value will be captured from smart charging and energy management, by various stakeholders

Venture capital activities overview in EV charging [USD m]



Source: Tracxn; Roland Berger EV Charging Index

Unicorns are expanding aggressively, both geographically and in terms of charging network



Source: Company information; Roland Berger EV Charging Index

¹ Valuation is updated by March 31, 2022

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