

CHARGING-AS-A-SERVICE – WHAT CUSTOMERS EXPECT FROM CHARGING

Charging needs to be fast, efficient,
convenient, and sustainable



INTRODUCTION:

The transition to electric vehicles (EVs)¹ as an alternative to common internal combustion engine vehicles (ICEs) is happening at full speed, with the global EV market share increasing at a compounded annual growth rate (CAGR) of 43% within the last five years.²

One of the integral parts and major challenges in the transition to EVs is the change from the process of refueling an ICE to the process of charging an EV, and the related customer experience. This is also reflected in the extensive coverage and discussion across media, politics, and automotive communities. Major discussions that currently arise are circling around charging as a whole and the range and battery capacity of the EVs. This report focuses on the charging experience and charging expectations. Beyond that we are at the forefront of a broad array of topics in the (e-)Mobility ecosystem with previous and upcoming publications and projects around our global Smart Mobility Connect offering: **Smart Mobility Connect**

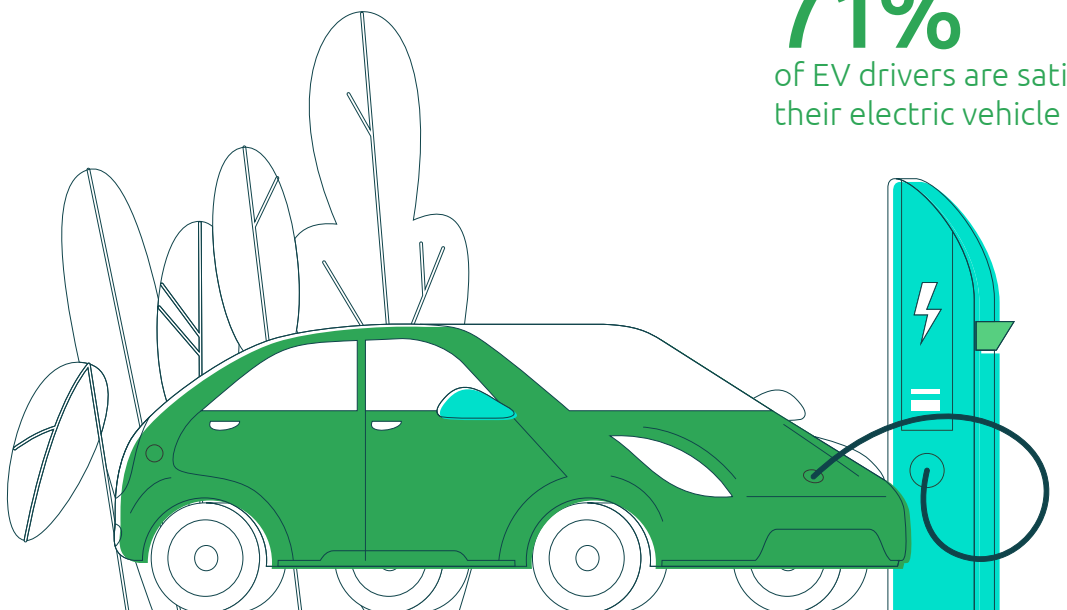
With a focus on charging, this report will explore some of the key questions of car manufacturers (OEMs), including current developments:

- With the current uptake of EVs, what is important for current and potential EV drivers related to charging EVs?
- What are differentiation potentials related to charging and are there potentials for OEMs that can be leveraged related to the charging experience?
- Are customers willing to pay more for specific charging functionalities and solutions around charging?

To generate first-hand insights and experiences to these questions we conducted a survey among current and potential EV drivers regarding selected topics around the charging experience and related expectations, including a cross-check on their respective willingness to pay. Therefore, we conducted structured interviews with close-ended questions with more than 180 participants.

Considering the overall EV experience, we found that contrary to a variety of current media reports the majority of current EV drivers (71%) are satisfied with their EV and charging experience.

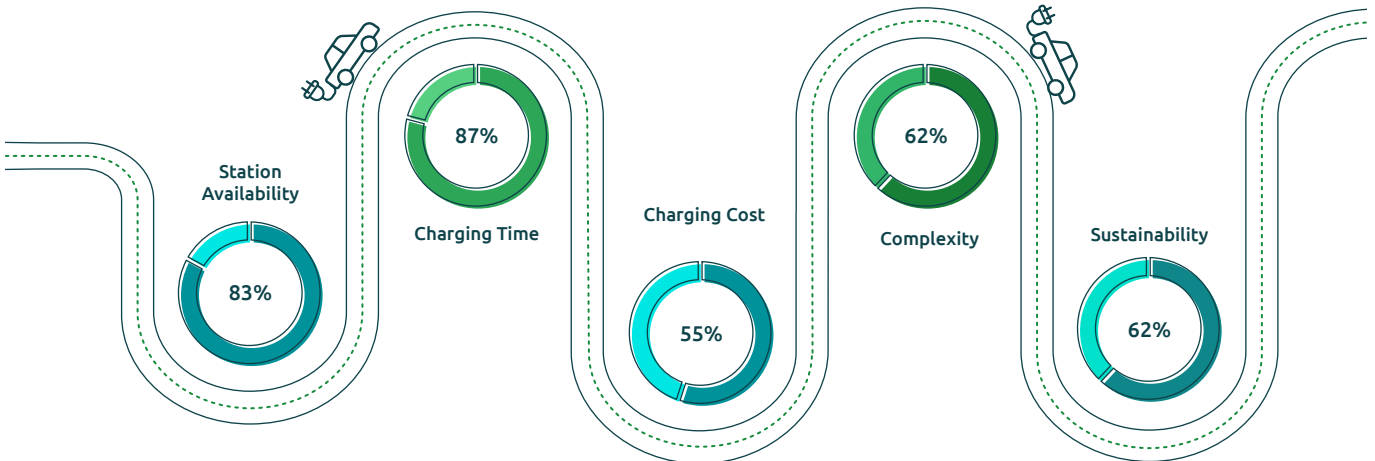
71%
of EV drivers are satisfied with their electric vehicle experience



¹ EVs equal plug-in electric vehicles: BEVs (battery-electric vehicles) and PHEVs (plug-in hybrid electric vehicles)

² IEA 2021

Looking at the EV driving and charging journey in more detail, there are several aspects that are highlighted by the survey respondents as particularly important.



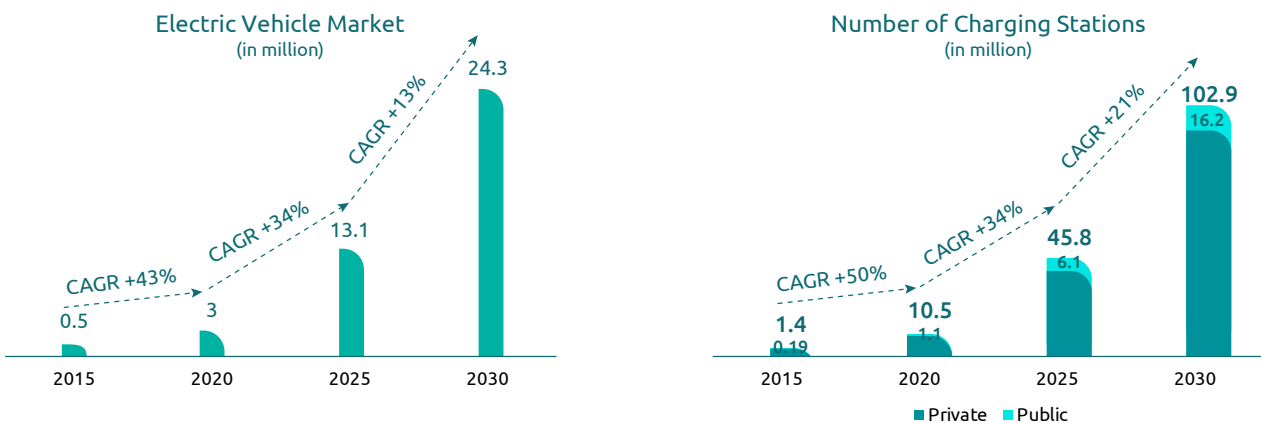
Out of the five charging aspects, charging station availability (83%) and charging time (87%) are perceived as especially important. Consequently, the supply and expansion of necessary charging infrastructure is a top priority on the agenda of the relevant industry players, particularly regulators, energy companies, and car manufacturers. Even though the broad availability of charging stations has increased at a fast rate, a potential undersupply is projected comparing the uptake of EVs with the buildup

of related charging infrastructure.³ This scenario is particularly relevant for public charging infrastructure with projected needs (in ratios) of 1 charging station per 10 vehicles, as guided by the European Union.⁴ While the current European ratio already accounts for 11 EVs per charging point, the predicted EV market growth will soon outpace the development of public charging infrastructure, as the public charge point ratio will rise to 15 within the next decade.^{5,6} In spite of that, it has to be considered that this

ratio is related to public infrastructure and the fast uptake of charging at home solutions along with an increase of high-power chargers might lower its validity or require a recalculation.

Further identified priorities related to charging are seen in the provision of sustainable solutions (62%), a reduced complexity of charging processes (62%) and the related cost of charging (55%).

Global EV Market Growth Drives Worldwide Charging Station Market⁷



³ Economist 2021
⁴ European Union 2021
⁵ IEA 2021
⁶ Capgemini 2019
⁷ IEA 2021

In summarizing the perception of current and potential EV customers, we identified four dimensions of major importance. The key topics

for providing a seamless charging customer experience are fast, efficient, convenient and sustainable recharging.



Fast

Charging time should match average time spent at location



Efficient

Leveraging charging time with amenities and entertainment solutions



Convenient

Charging and payment solutions as standard offerings



Sustainable

Recharging with green electricity as key enabler of sustainable eMobility

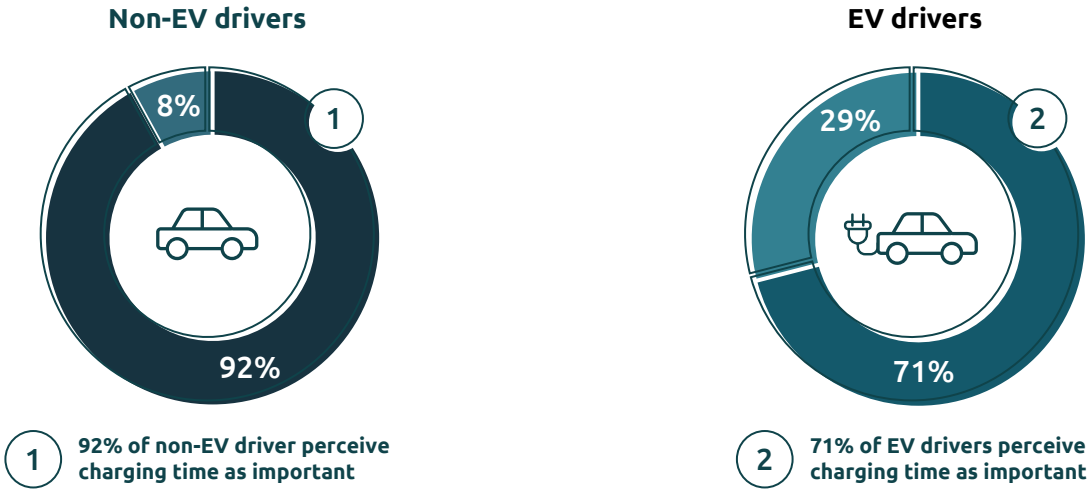
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FAST RECHARGING

One of the central customer pain points within the EV charging experience is the required time to recharge an EV.⁸ To identify customer perceptions related to the charging time, it is foremost important to differentiate the various charging use cases. While the general call is toward continuously increasing charging speeds, “the faster the better” differs in relevance depending on charging locations and use cases. The demand for higher charging speeds is prominent, especially at locations where the charging time significantly exceeds regular “stop-times”, such as

when comparing EV recharging with ICE refueling time at highways. On the contrary, in locations such as at work or at home, where a car parks on average for longer periods of time, a lower charging speed can be “fast enough”, compared to high power charging (HPC) stations at highways. This is independent of any technical barriers e.g., due to limited power grid capabilities, that could hinder higher charging speeds to a certain extent at given locations or require comparably large investments to increase charging speed.

CHARGING TIME SHOULD MATCH AVERAGE TIME SPENT AT A LOCATION, WHICH VARIES FOR DIFFERENT CHARGING LOCATIONS



We recognized a high importance was placed overall on the general perceived value of charging speed. Yet, by having an in-depth look at the difference between non-EV drivers and EV drivers, the relative importance of charging times is lower among EV drivers (92% for non-EV drivers and 71% for EV drivers). This difference indicates that for some publicly perceived pain points, a real-world EV driving and charging

experience could be of great value to help create a deeper understanding of the everyday usage of EVs.

Another aspect we analyzed is the willingness to pay a premium (WTPP) for comparably faster charging solutions. Overall, the expected result, with 75% of customers willing to pay a premium, could be validated. It is particularly important to take this into consideration when regarding the

infrastructure build-up of comparably more expensive fast- and HPC-charging solutions along highways and at public destinations.



⁸ Capgemini, Hyve 2019

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EFFICIENT RECHARGING

As discussed in the first chapter, fast charging with today's technology still takes a significant amount of time. Due to technical restrictions, charging times can be relatively long, especially if compared to the time required to refuel gasoline engines. Typical charging sessions at highway fast chargers last about 25 minutes.⁹ For a lot of use cases longer charging is acceptable, e.g., while charging at home during the night or while being at a shopping center for several hours. But if the vehicle needs to be

charged during long-distance trips on the highway, (e.g., HPC Use Case) or customers do not have the possibility to charge at home, customers using fast charging in cities would like at least to have an efficient use of their time spent at the charger. Within this chapter, various options are shown and discussed. Many of these options for in-car entertainment or on-site amenities are also a potential business opportunity for OEMs, Charge Point Operators (CPO) or Mobility Service Provider (MSPs).

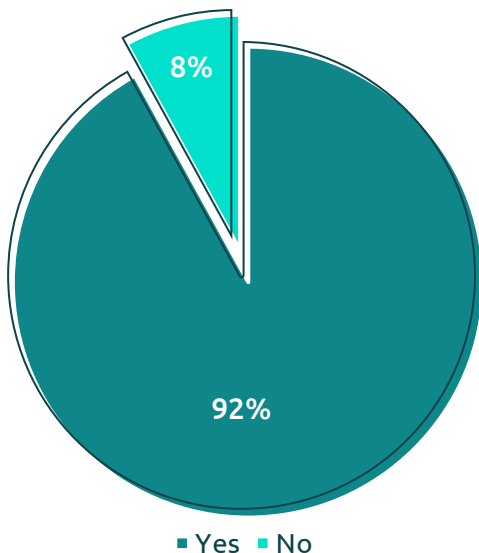
ON-SITE AMENITIES AND IN-CAR ENTERTAINMENT SOLUTIONS CAN INCREASE THE TOLERANCE FOR WAITING LONGER AT CHARGING STATIONS

In general, customers could seek entertainment or activities either on-site or in-car. Therefore, these two options are regarded within this

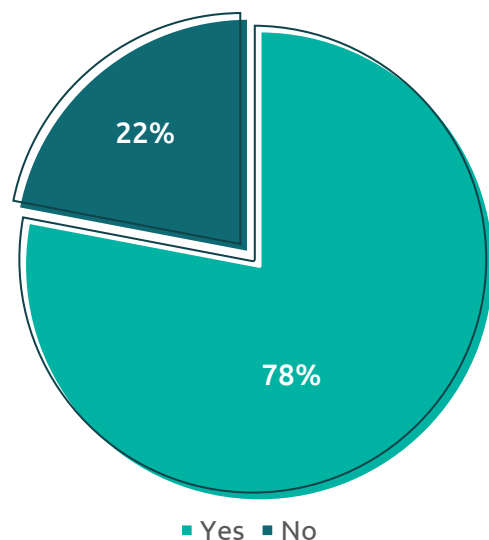
chapter. On-site amenities could extend the willingness to wait for 92%, while in-car entertainment

solutions could increase the willingness to wait for 78% only.

Willingness to wait longer due to **on-site amenities**



Willingness to wait longer due to **in-car entertainment solutions**



⁹ Ionity 2020

In-car entertainment solutions would extend the willingness to wait for several customers. As discussed in our “20-minute-challenge” blogpost, there are various options car makers could opt for to improve the charging experience via entertainment.¹⁰ And there are many reasons to further develop solutions for in-car entertainment.

To use online and in-car entertainment solutions, CPOs and automotive OEMs need to provide state-of-the-art technology for all technical prerequisites. Free Wi-Fi access for example, already available at some premium fast charging hubs, enables customers to stream videos, browse the web or attend business virtual conferences on their own devices. Enabling the car for convenient

video streaming and enhanced entertainment could be a great step towards a better charging experience: It can be much more convenient to use state-of-the-art in-car screens and speakers or in-car VR/AR (head up) displays or glasses than relatively small tablet or smartphone screens for content. Further, many OEMs already offer in-car entertainment video or high-end audio systems.

On-site amenities

The willingness to wait at the charger can be improved by offering different amenities.

Restaurants and grocery shops are the most influential, maybe also due to the fact that these are already very common at highway gas stations today.

A relaxing area or exclusive lounge access is only mentioned as an attractive solution by one third. Therefore, some OEMs started real-life experiments to prove whether customers are interested in the lounge-like concepts that are already established in rail stations or airports.

Shopping options, e.g., for clothing, were only mentioned by 28% of the participants in the panel; customers possibly expect their car to charge while shopping - and not the other way around.

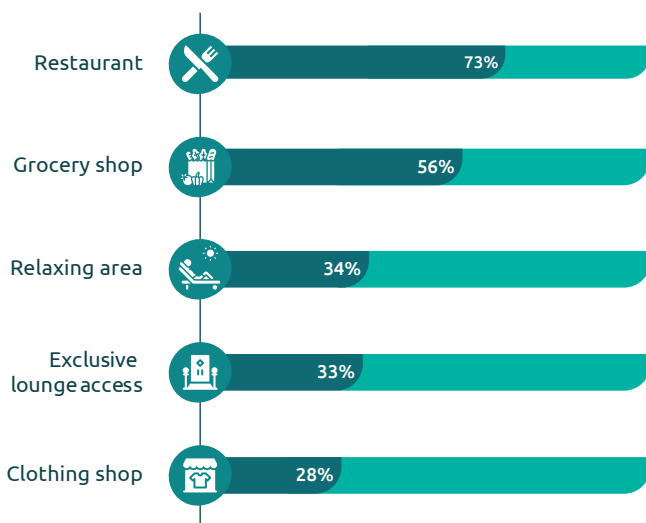
In-car entertainment solutions

Spending time in the car can be a large business opportunity for OEMs, because the services used can be customized and enhanced for each customer. As an OEM there is additional data available, which further improves the experience. It is possible to include suggestions to fit the content for each charging break and individual user habits. By combining vehicle and charging data with entertainment needs, OEMs could achieve strategic benefits that even the streaming companies lack. When discussing the different content, film and news seem particularly interesting to drivers. For both categories it seems feasible to offer content by the OEM or streaming to third parties.

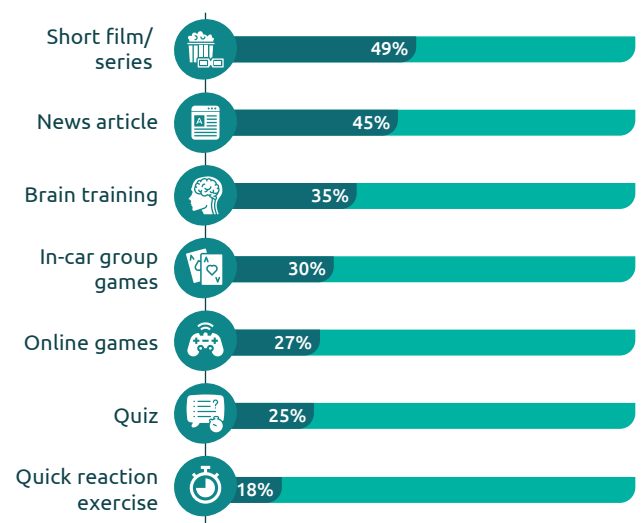
Displaying news articles or clips works great, in various lengths from 30-second snippets to 15-minute news shows.

Also even reading content, which is fitted to short time boxes, e.g., with concepts such as Blinkist, can fit the charging gap.

Respondents that are willing to wait longer due to **on-site amenities**



Respondents that are willing to wait longer due to **in-car entertainment solutions**



¹⁰ Capgemini 2019

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CONVENIENT RECHARGING

Today, recharging the vehicle is not always as hassle free and convenient as it could be. In addition, customers perceive several functions and services as potentially necessary, such as automated payment options, authentication, predictive routing and easing the charging process. Different aspects for providing convenience are discussed in the following chapter.

There are also services such as reservation (pre-booking charging stations) and exclusive charging access within a network, often discussed as customer requirements. But the perceived value of pre-booking and exclusive access – especially along EV drivers – is very low.

CONVENIENT CHARGING AND PAYMENT SOLUTIONS ARE EXPECTED AS STANDARD OFFERINGS

Drivers do not expect to adapt their lifestyle by planning charging stops ahead. Also, customers do not want to worry about charging or experience range anxiety.

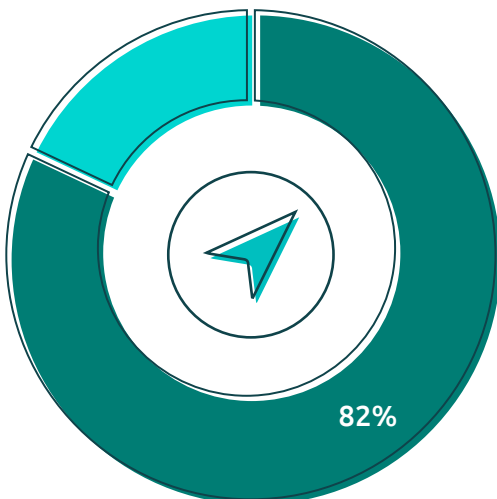
Consumers expect to receive various information when selecting a charging station, such as charging time, charging cost, on-site amenities, and occupancy rate. These are reasons why predictive routing with adaptive

charging station suggestions is perceived as very valuable by 82% of all customers. Even if already offered by OEMs, the improvement of routing and navigation seems to be one of the strategic action fields to improve charging convenience. Drivers are not willing to pay for enhanced navigation features, rather they expect it.

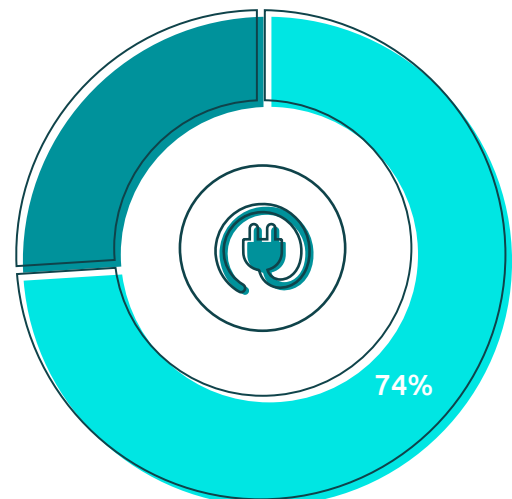
Besides routing, customers perceive automated payment options such as

Plug-and-Charge (PnC) as very valuable (74%). Today, payment authentication leads to frustration due to errors or multiple attempts required before successful charging. EV drivers are less likely to pay for automated payment services. But automated payment services need to be further rolled out, because they are already expected as a basic requirement.

Percentage of Respondents who Perceive **Predictive Routing** as Valuable



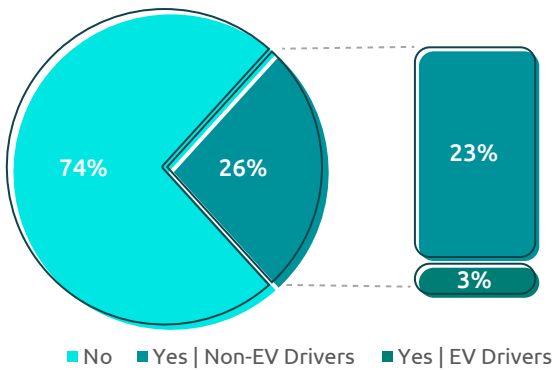
Percentage of Respondents who Perceive **Plug-and-Charge** as Valuable



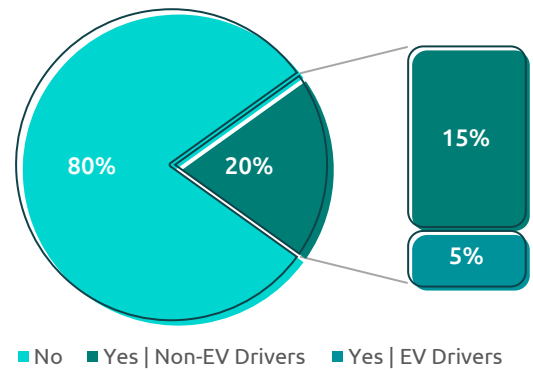
While WTPP for predictive routing and information about charging services is relatively high, reservation of charging stations and exclusive access show lower WTPP – especially among

current EV drivers. Customers possibly fear that limiting access through pre-booking or exclusive networks leads to less accessible charging stations overall.

Willingness to pay a premium for pre-booking options



Willingness to pay a premium for exclusive charging access

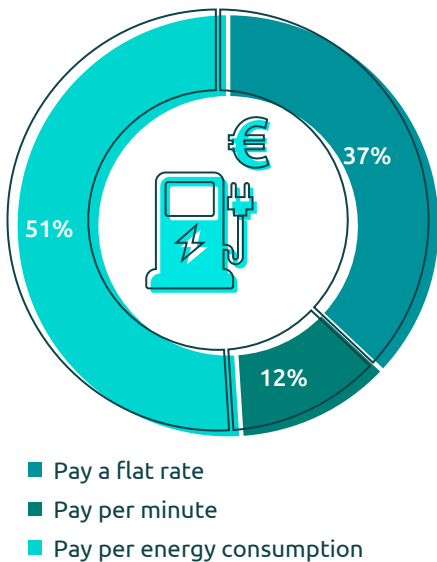


Looking at the different billing models, most customers stick to the known billing model of paying per energy consumption. But almost every

second customer considers alternative billing models. 37% of the participants even prefer flat-rate pricing. Flat-rate tariffs are already offered by regional

service providers or startups, while established or nationwide MSPs mostly offer tariffs with fixed prices per kWh.

Preferred Charging Price Compositions



51%

stick to the known billing model by preferring to pay per energy consumption

49%

prefer alternative pricing compositions

4

SUSTAINABLE RECHARGING

Sustainability is on top of everyone's agenda and poses challenges to the board members of leading companies. Given an increase of public interest and rising pressure from CO₂ regulators, law makers and investors, sustainability has gained a new level of importance in the business context. Car manufacturers have defined sustainability as a strategic priority for the industry. With the development and launch of electric vehicles, OEMs try to tackle the challenge of emissions and fuel economy.

Consumer interest and willingness to pay for sustainable products have been constantly on the rise in recent years.¹¹ In the context of automotive sustainability, consumers highly value the satisfaction of expectations around sustainability. However, the environmental friendliness of electric vehicles is being questioned, regarding battery production and the energy supply for charging. This chapter shows the importance of sustainable recharging and discusses potential business opportunities for industry players.

RECHARGING WITH GREEN ELECTRICITY IS A KEY ENABLER OF REAL SUSTAINABILITY

In general, electric vehicles can be charged with the energy created from fossil fuels or renewable electricity. At the beginning of 2020, renewables only accounted for one-third of the

electricity in Europe.¹² However, the majority perceives recharging with green electricity as highly important, regardless of the location. While 59% perceive charging with renewable

energy along highways as valuable, two-thirds prefer sustainable recharging in public over fossil fuel powered chargers and more than 75% consider it in private.

74%



highly value charging with green electricity at **home**

76%



perceive charging with renewable sources at **work** as very valuable

67%



like to charge green electricity at **public** charging stations

59%



consider green electricity along **highways** as very valuable

The consumer preferences presented underline the rising demand for environmentally friendly solutions. While electric vehicles powered with electricity generated by the

combustion of fossil fuels are not more sustainable than traditional internal combustion engines, sustainable recharging reduces the operating footprint by 75%.¹³ Thus,

green electricity is a main enabler of real sustainability and represents an inevitable topic for automotive companies to provide a truly sustainable experience.

¹¹ Capgemini 2020

¹² IEA 2020

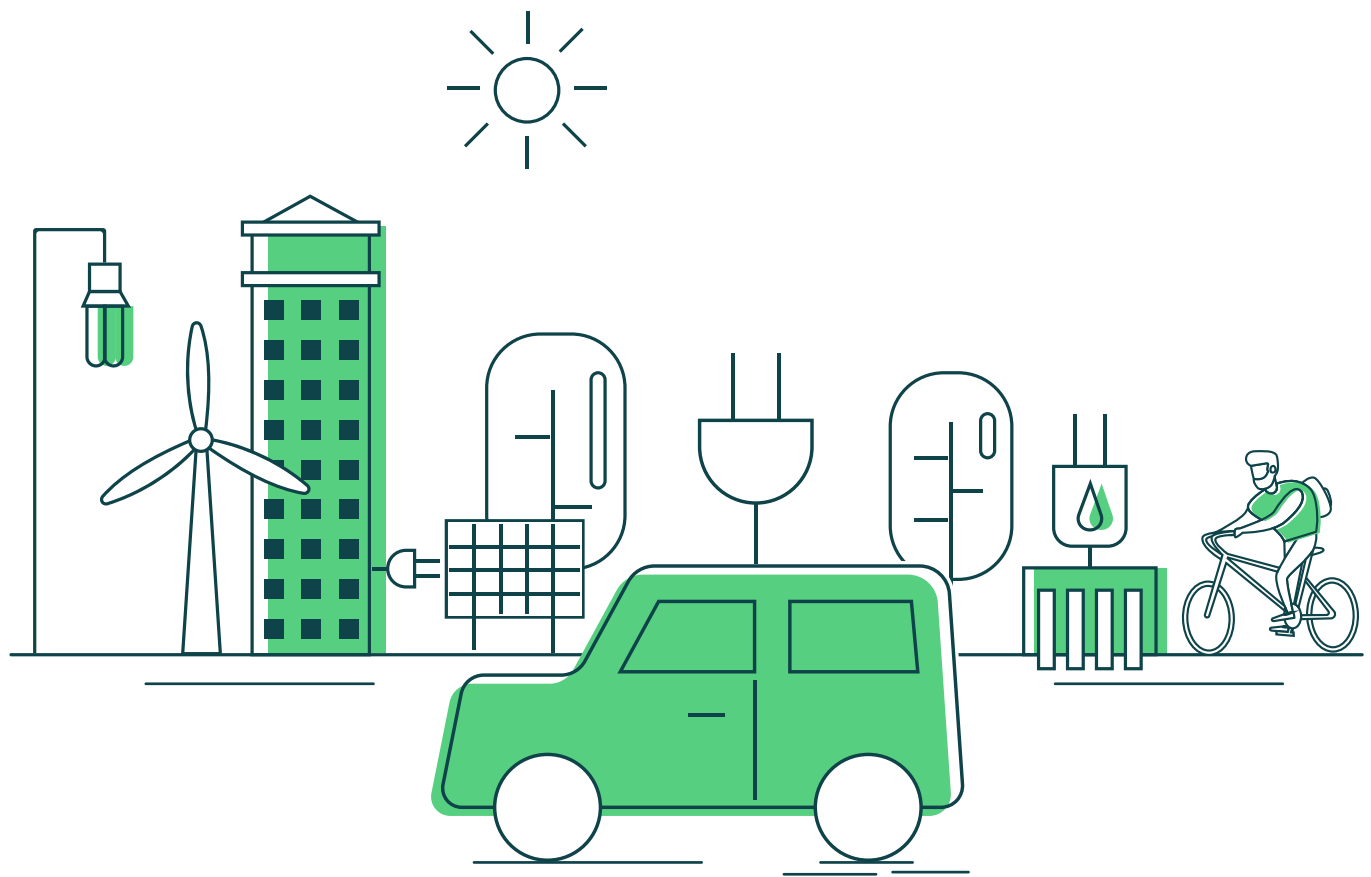
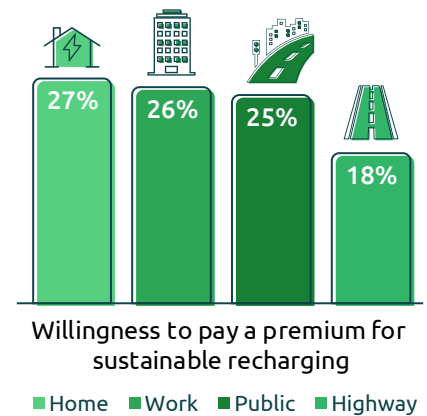
¹³ Capgemini 2020

In contrast to the high importance of sustainable recharging, consumers' WTP is comparably low for private and public charging locations. Green energy solutions are rather already expected by car drivers but do not necessarily represent an offer for which customers are willing to pay a premium.

Nevertheless, automotive manufacturers can still differentiate themselves by providing electric vehicles in combination with sustainable recharging contracts as one environmentally friendly ecosystem solution.

The differentiation potential of sustainable offerings is underlined by our recent Sustainable Mobility publication, as 34% would change to a different car brand due to product sustainability and company related activities.¹⁴

Visual signs that designate the energy source of charging stations as sustainable could generate further value for companies, since 59% consider them highly relevant. Clear branding could enhance companies' perception of sustainability.



¹⁴ Capgemini 2021

5

IMPLICATIONS

To highlight the implications of the survey results analyzed, we take another look at the four charging customer priorities; fast, efficient, convenient

and sustainable charging, and the resulting major consequences that can be derived from these four dimensions.



Fast

Charging time should match average time spent at location

As charging speed is one of the points of major importance raised by potential and current customers, it is essential to provide increasingly fast charging solutions. It is nevertheless crucial to monitor charging preferences and charging times

for different charging use cases (e.g., home vs. highway charging) and provide charging solutions and corresponding charging speeds with product-customer (market)-fit considering costs, integration effort and technical performance.



Efficient

Leveraging charging time with amenities and entertainment solutions

Charging solutions, especially those at public or highway intermediate route stops, imply waiting times for the customers where using the time effectively counts. The "new" experienced waiting is one of the major, currently mostly untapped,

business potentials in the transition to EVs, where dedicated entertainment and amenity solutions can turn one of the major charging customer pain points into an exciting customer experience and at the same time realize significant revenue potentials.



Convenient

Charging and payment solutions as standard offerings

OEMs, CPOs and MSPs should further enhance services which improve the charging process. Customers expect in particular enhanced predictive navigation, automated payment, alternative payment and pricing models. Leveraging trends towards convenient charging and payment solutions to increase transparency and create differentiating

products is a key factor for future product offers. Premium access to charging services is a critical point that needs to be monitored closely in terms of relevance and opportunities, while e.g., reservation options are currently considered less valuable by customers.



Sustainable

Recharging with green electricity as key enabler of sustainable eMobility

To enable real sustainability and provide a truly green customer experience, sustainable recharging is an inevitable topic for automotive companies. Sustainable offerings that provide and integrate

charging with green energy as well as all relevant aspects of eMobility can generate a differentiation potential for car manufacturers.

The implications of customer charging expectations from current and potential EV drivers are far-reaching. Only the provision of customer-centric solutions and services that put first-hand customer expectations at the heart of development and operations will and can prevail to lay the foundation for the subsequent success of current and aspiring players in the eMobility ecosystem - OEMs, MSPs, CPOs, energy providers, service, and software providers or any other player that is or wants to play an active role.

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