ABB E-mobility

Leading the future to zero-emission mobility

SEPTEMBER 2023, / ABB E-MOBILITY

The EV Infrastructure, with the right charger

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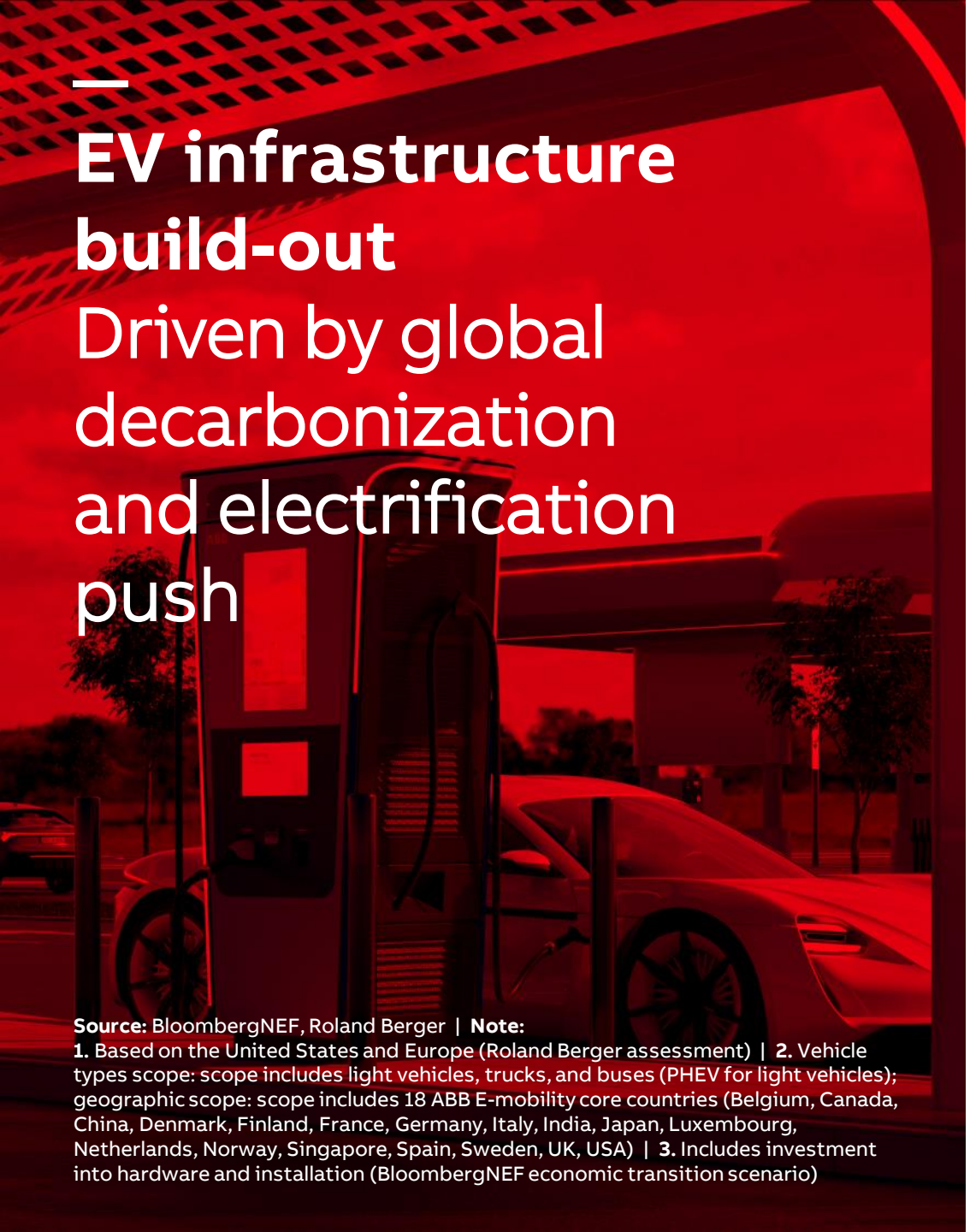
The e-mobility opportunity



EV infrastructure build-out

Driven by global decarbonization and electrification push

Source: BloombergNEF, Roland Berger | **Note:**
1. Based on the United States and Europe (Roland Berger assessment) | **2.** Vehicle types scope: scope includes light vehicles, trucks, and buses (PHEV for light vehicles); geographic scope: scope includes 18 ABB E-mobility core countries (Belgium, Canada, China, Denmark, Finland, France, Germany, Italy, India, Japan, Luxembourg, Netherlands, Norway, Singapore, Spain, Sweden, UK, USA) | **3.** Includes investment into hardware and installation (BloombergNEF economic transition scenario)

Transportation: a major emission source

Transportation is accounting for **27%-29% of total greenhouse gas emissions**[1]

Increased regulation globally

Societal push towards emission targets accelerating shift to EVs

Lower cost through better technology

Strong improvements in battery technology and EV infrastructure **increasing EVs competitiveness vs. ICEs in terms of total cost of ownership**

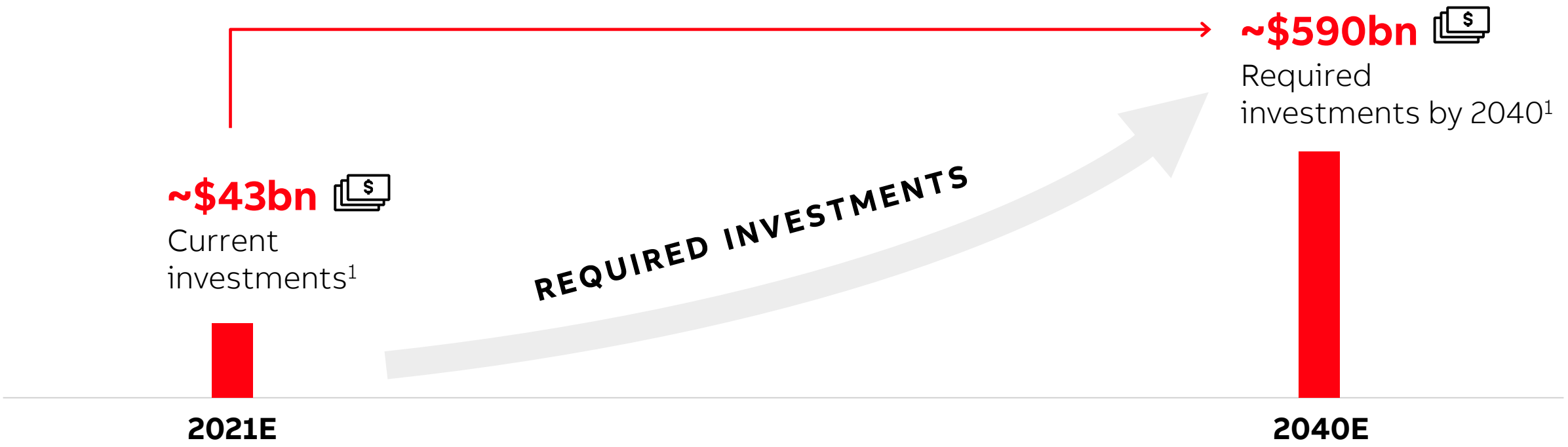
Rising demand for EVs

~130 mn new EVs expected from 2021E to 2030E[2]

Significant EV infrastructure investments

~$590 bn investment in **EV charging infrastructure** by 2040E required to meet global emissions targets[3]

Significant investment need for EV infrastructure expected to create a massive opportunity

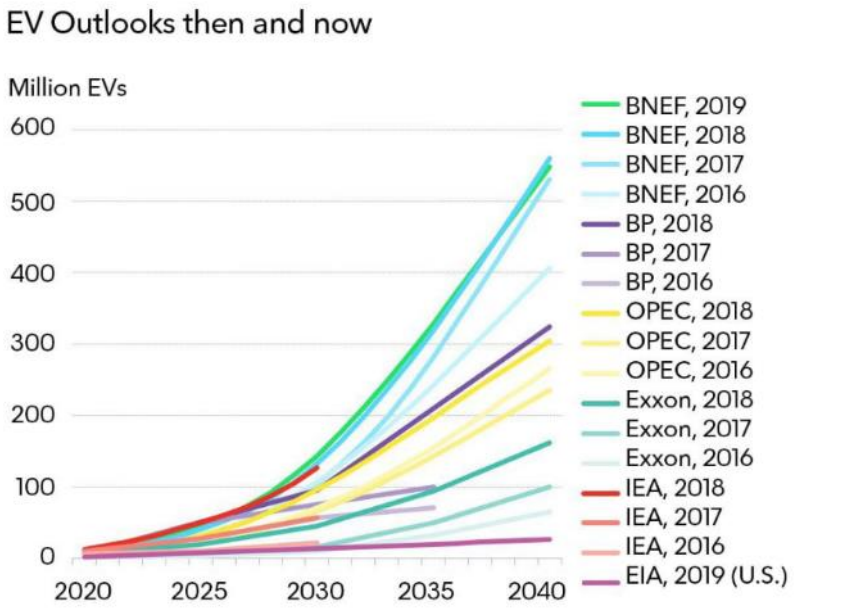


Source: BloombergNEF
Note:
1. Includes investment into hardware and installation (BloombergNEF economic transition scenario)

Growth of e-mobility market

The e-mobility market is growing at a record pace

Global EV outlook



Source: BloombergNEF, organization websites. Note: BNEF's 2019 outlook includes passenger and commercial EVs. Some values for other outlooks are BNEF estimates based on organization charts, reports and/or data (estimates assume linear growth between known data points). Outlook assumptions and methodologies vary. See organization publications for more.

Drivers for consumers to buy electric vehicles

- Consumers desire to change to electric cars charged by clean, renewable energy
- Electric vehicles are approximately 3X-5X cheaper to charge/fuel
- Electric vehicles have 25% lower maintenance costs than internal combustion engine vehicles
- Electric vehicles can last 2.5X longer than internal combustion engine vehicles
- Costs have decreased as battery costs have decreased

Drivers for companies to support e-mobility

- Attract people to their stores, companies and cities
- To serve their customers, employees, and consumers
- Increase sales as consumers wait for their cars to charge outside
- Environmental stewardship
- New business models for petrochemical industry and store fronts
- To decrease traffic and parking within cities (buses, light rail)

ABB E-mobility

A world leader in EV charging solutions

~ 1500 employees

~ 400 R&D engineers

50,000+
DC chargers sold

100 million+
charging sessions enabled

1 TWh+
power delivered

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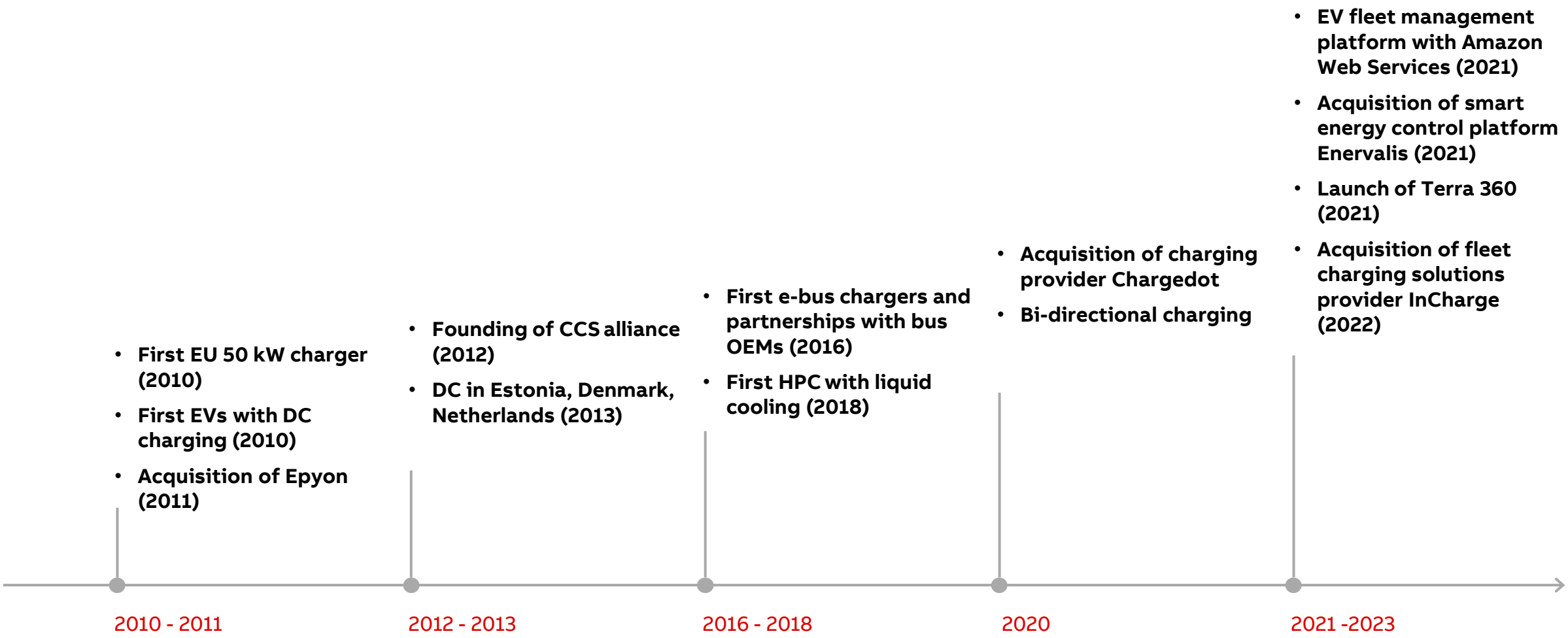
Acquisitions and investments in the e-mobility sector*

*since 2010

1 million+
AC chargers sold, including via Chargedot

10+ years of technology and innovation leadership



EV fast charging and global standardization

ABB leading in major developments this decade

2010 — **Pilots**
First EU 50 kW charger
Proprietary standard, no consumer EV's available

2010 — **CHAdeMO**
Founding of CHAdeMO
ABB was involved from the start

2010 — **First EV's**
First EV's with DC charging
Nissan Leaf & Mitsubishi iMieV

2012 — **CCS alliance**
First demo of CCS charging
ABB & CCS alliance at EVS26 Los Angeles USA

2012 — **CCS alliance**
Founding of CCS alliance
ABB involved from the start, basis for IEC standard

2012 - 2013 — **IEC 61851-23**
First nationwide DC networks
ABB in Estonia, Denmark Netherlands

2013 — **Multi-standard**
Launch CCS & multi-standard Terra 53
CCS + CHAdeMO + AC

2012 > — **Global EV spread**
ABB leading Connectivity & uptime
ABB has industry leading uptime by remote mnmnt

2013-2015 — **Multi-standard**
Launch global variants Terra 53
China, USA, APAC

2014 > — **Global EV spread**
DC networks spread globally
Europe, USA, Asia

2016 — **E-bus**
First eBus chargers
Global partnerships with bus OEMs

2017 — **OppCharge**
Launch of high power for cars
150-350kW charging for next generation EV's

2018 — **E-bus**
First eTruck chargers
Global partnerships with Truck OEMs

2018 — **Higher power**
Gen2 charge post and Terra 54HV
Next steps in High Voltage charging

2019 — **Higher power**
DC Wallbox
24kWp, 920V

2020 — **High Voltage**
Terra AC
7.4 - 22kW

2020 — **High Voltage**
Terra 184(HC), Terra 124(HC), Terra 94
Dual DC charging in Terra 184 and Terra 124. Up to 300A CCS

2021 — **Smart AC**
Terra 360
DC high power All-in-One 90 to 360 kW

Near future

The right charger a way moving forward

Evolution of EV Charging Infrastructure in Malaysia

Charging points

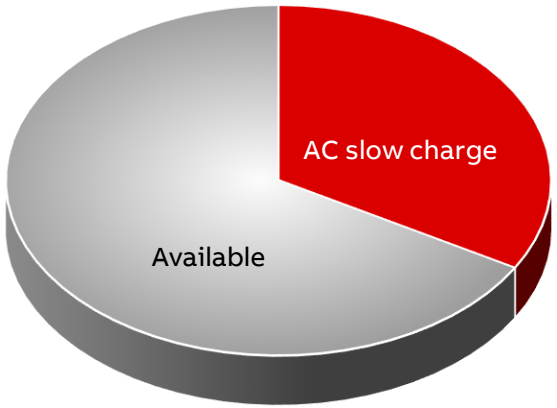
				10-80% Charging				
	AC, kW	DC, kW	Battery Size, kWh	11kW AC	22kW AC	24kW DC	180kW DC	360kW DC
BMW iX xDrive50	11	195	105.2	7-8 hours	7-8 hours	~2 hours	30-40mins	~30mins
Mercedez Benz EQS 500	11	207	107.8	7-8 hours	7-8 hours	~2 hours	30-40mins	~30mins
Tesla Model 3	11	170	57.5	4-5 hours	4-5 hours	~ 1 hour	<30mins	<30mins
Tesla Model Y	11	170	57.5	4-5 hours	4-5 hours	~ 1 hour	<30mins	<30mins
Tesla Model 3 Long Range	11	250	75	5-6 hours	5-6 hours	1-2 hours	<30mins	<20mins
Tesla Model Y Long Range	11	250	75	5-6 hours	5-6 hours	1-2 hours	<30mins	<20mins
BYD Atto 3	7.4	89	60.5	6-7 hours	6-7 hours	~ 1 hour	40-50mins	40-50mins
BYD Dolphin Standard	7.4	60	44.9	4-5 hours	4-5 hours	~ 1 hour	40-50mins	40-50mins
BYD Dolphin Premium	7.4	80	60.5	6-7 hours	6-7 hours	~ 1 hour	40-50mins	40-50mins
Porsche Taycan Turbo S	11	268	83.7	6-7 hours	6-7 hours	1-2 hours	~30mins	<20mins
				Est. Value based on data from https://ev-database.org/				

EV Charging Infrastructure development is highly driven by the automotive (BEV) development pace.

Influence on range and availability by AC slow and DC fast charging

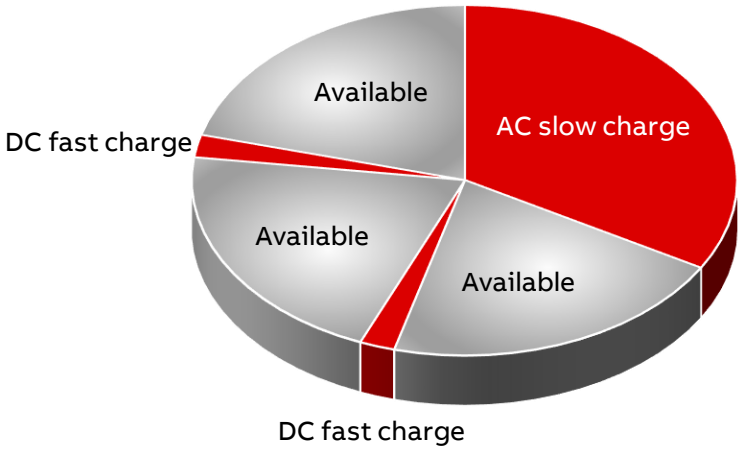
Possibility to strongly extend the range of a BEV by DC fast charging

Only AC slow charge (8 hrs)



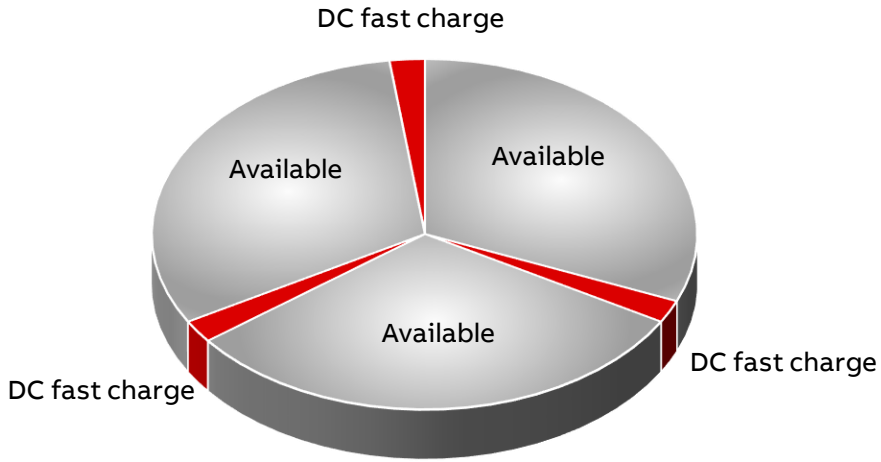
Availability 16 hours
Total range: 300 km

AC slow charge (8 hrs) +
2x DC fast charge (each 30 min)



Availability 15 hours
Total range: 900km

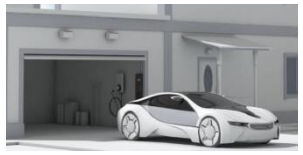
Extreme: for e.g. fleet owners:
3x DC fast charge (each 30 min)



Availability 22,5 hours
Total range: 900 km

Widest portfolio of EV charging solutions for customers across various use cases

Use case


Single home residential charging


Apartment, hotel & workplace destination charging


Commercial fleet


Public commercial parking


Fast-charging roadside stations


Bus charging

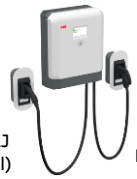

Industrial fleet


Heavy-duty truck charging

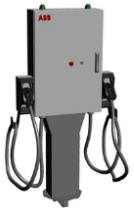
Charging products


Terra AC wallbox 3-22 kW


Terra Nova 11J (bi-directional) 11 kW


Terra DC wallbox 20-25 kW


Terra 124 60-120 kW


Terra HVC 50-180 kW


Terra 184 90-180 kW


Terra High Power (liquid cooled) 175-350 kW


Terra 360 (liquid cooled) 180-360 kW

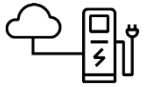

Pantograph (panto up, panto down, connectors) 150-600 kW

To come in 2022


Megawatt charger up to 3 MW

Asset, energy & fleet management


Connectivity and remote software update


Remote support (configuration, troubleshooting)


24/7 network monitoring by ABB


User interface


Plug & charge


Payment module


EV site management


Bi-directional charging


Enable energy trading[1]


Predictive load profiles


e-fleet schedules & management

Source: Company information

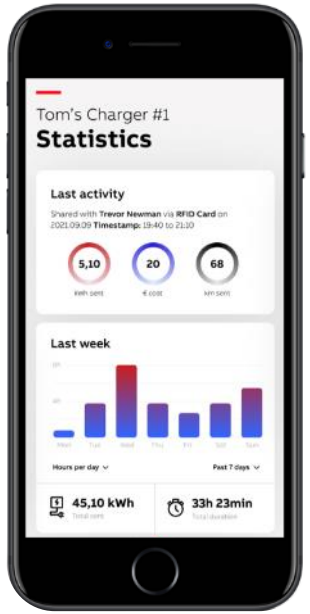
Note:

1. ABB E-mobility does not engage in energy trading but enables customers to do so

Vertically integrated offering across smart and connected EV charging solutions

AC & DC
charging hardware

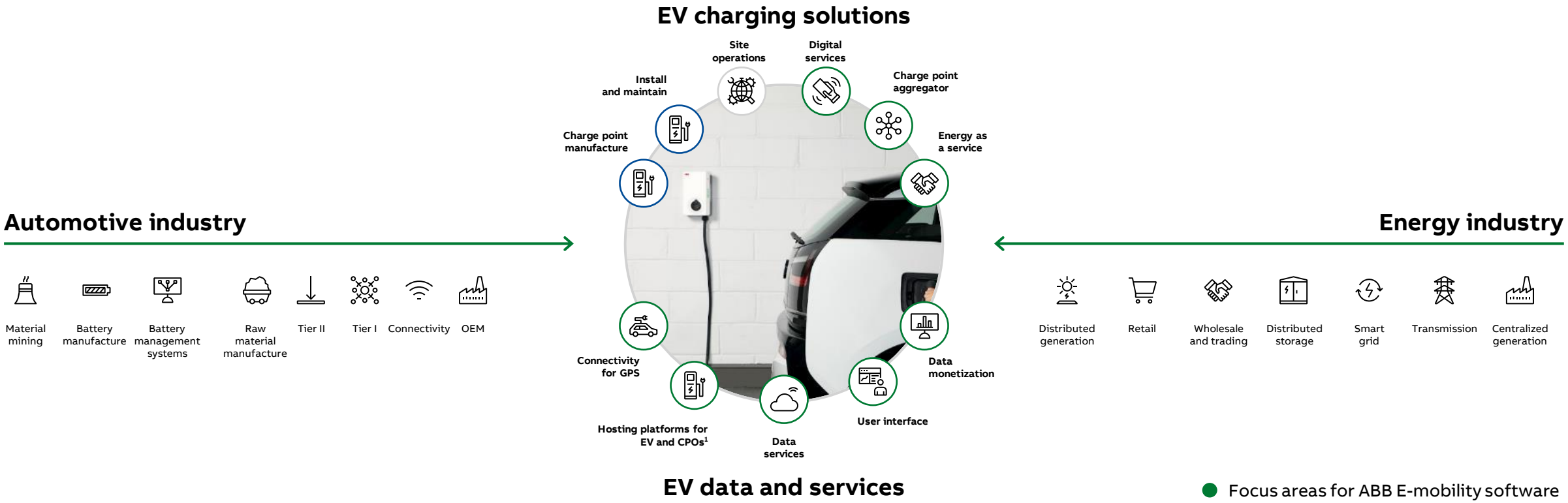
B2C & B2B
digital services



Advanced energy &
fleet management

Mission-critical element of EV consumer experience

Central role in a complex ecosystem



Source: Company information | **Note:** Charge Point Operator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