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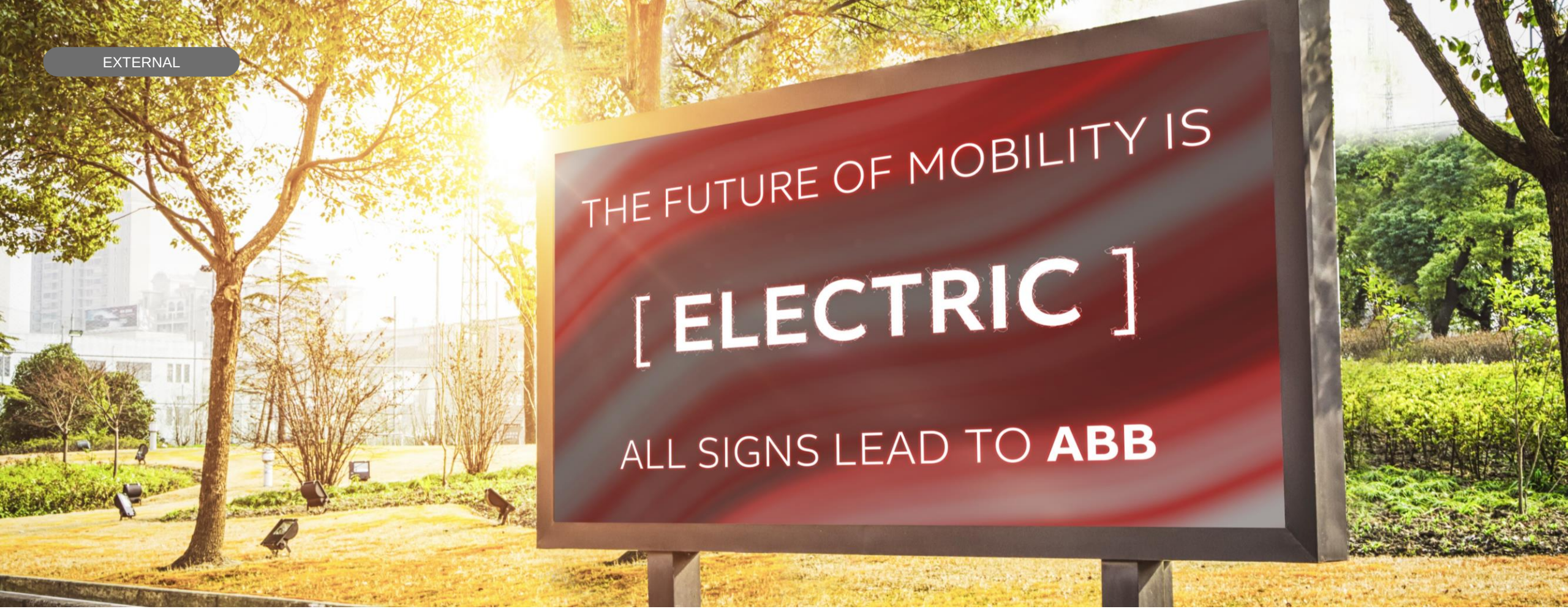


EXTERNAL PRESENTATION

E-mobility Fleet Electrification Solutions

Electrification - Packaging and Solutions

Agenda

- Market size and growth
- Charging infrastructure basics
- ABB e-mobility infrastructure solutions for fleets
  - Bus depot
  - Bus en route charging
  - Industrial fleets
  - Commercial fleets
- Other considerations
- Digital options
- Value of ABB offering
- Detailed solutions by application

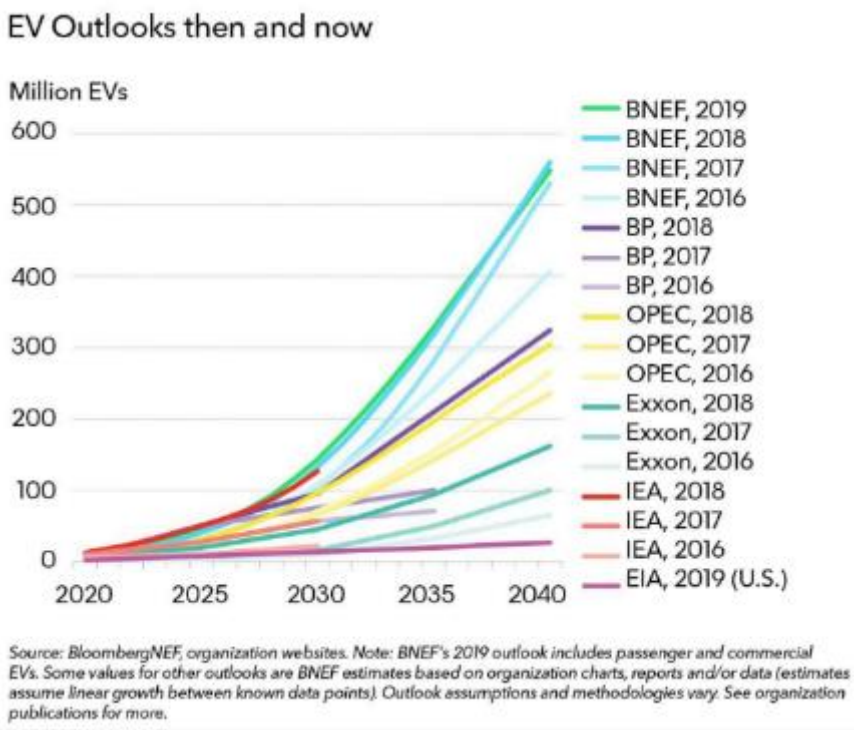
Market size and growth

Trends in the industry

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

- Environmental - 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
- Initial cost of electric vehicles has decreased as battery costs have decreased

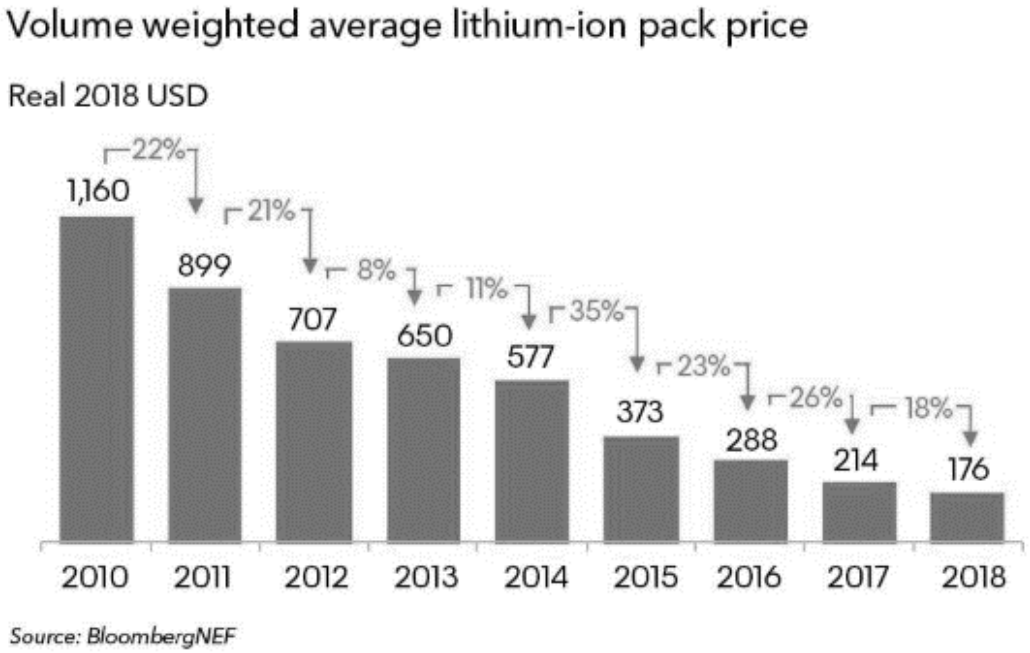
Drivers for retail, industrial, municipals and private companies

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

Industry trends driving growth

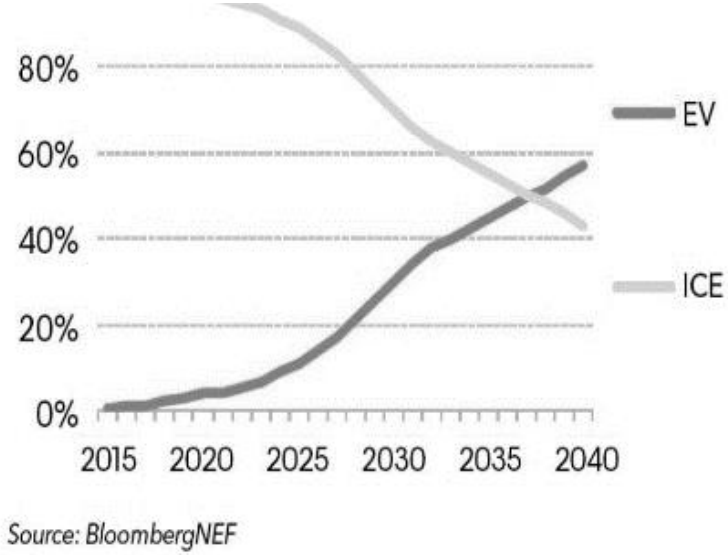
Lower battery pricing and tighter emission regulations continue to drive the trend towards EVs

Battery prices keep falling

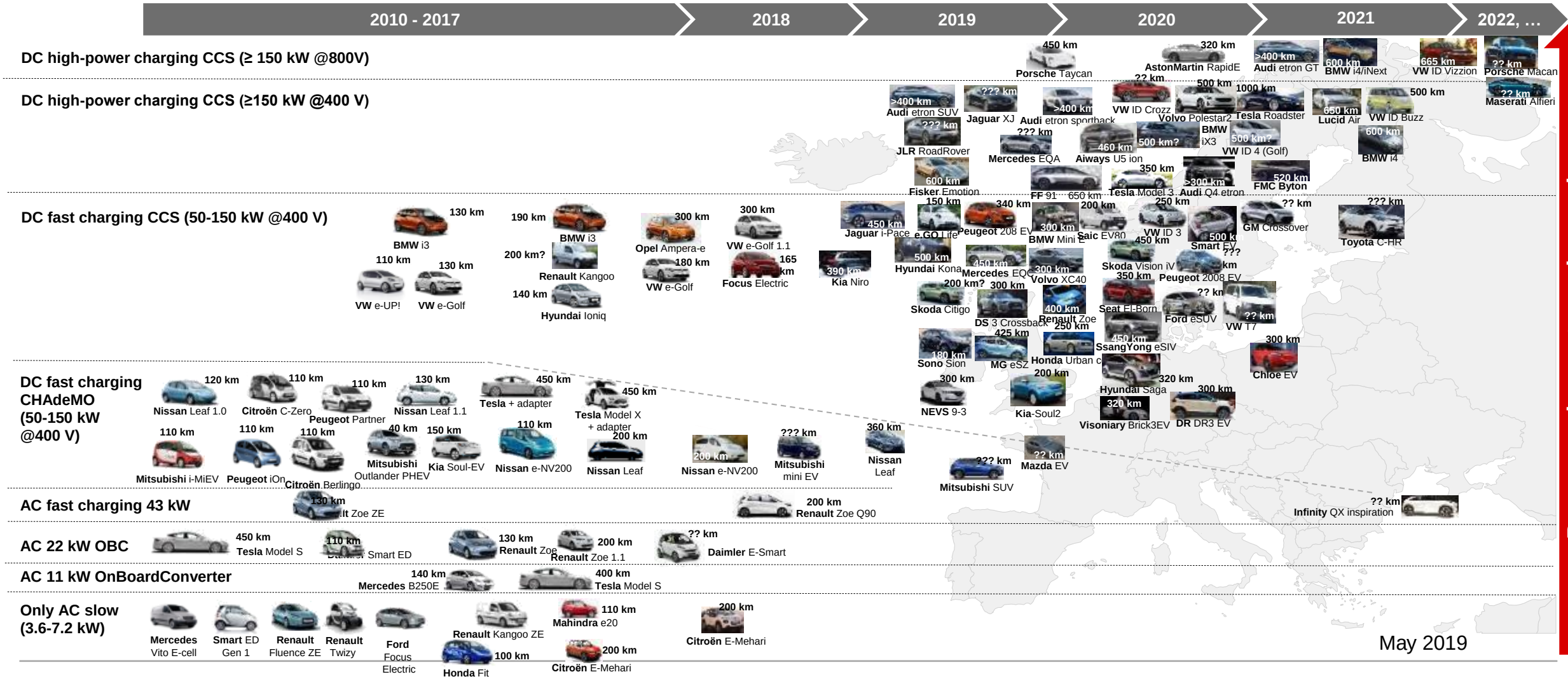


Emission regulations getting tighter and tighter

Global Electric Vehicle (EV) and Internal Combustion Engine (ICE) share of long-term passenger vehicle sales



Trend towards bigger cars with higher power requirements



Trends toward faster charging times and higher power

As electric vehicles increase in use, quicker and higher power charging infrastructure is needed

Bus depot

Medium Voltage
Typically overnight

eBus en route charging

Medium Voltage
Typically 10-20 mins

Industrial fleet

Medium Voltage
Typically overnight

Commercial fleet

Medium Voltage
Typically overnight

Roadside stations

Medium Voltage
Typically 10-20 min

Public commercial parking

Medium Voltage
Typically 20-90 min

Office/apartment charging

Low Voltage
Typically 8 hours

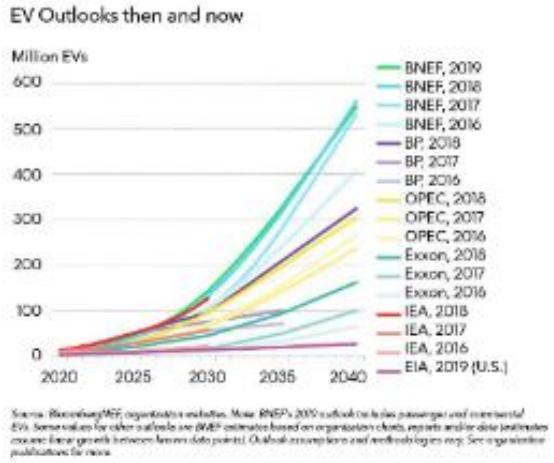
Residential charging

Low Voltage
Typically overnight

Trends in electrical infrastructure

Movement towards higher power chargers and faster charging times = MV grid connection

Ever-increasing # of electric vehicles



+

Bigger cars, higher power needs, longer ranges

2007

Only AC slow (3.6-7.2 kW)

Honda Fit
100 km

2019

DC high power charging CCS (≥150 kW @400 V)

Audi etron SUV
>400 km

+

Faster charging times

Overnight charging
8+ hours

High power charging
10-20 mins

Different electrical infrastructure is needed to support the load:

- **Leading to more MV grid connection installations**
- **Energy storage to allow fast charging in LV grid connection**
- **High safety requirements for equipment in public installations**
- **Relocatable energy storage allows site locations to be evaluated without premature permanent infrastructure costs**

The future of mobility is electric

Now is the time to future-proof your electrical infrastructure

The key to future-proofing is investing in the right combination of traditional and smart solutions, ensuring the infrastructure can be scaled in close alignment with growing demand

- E-mobility is coming, and its **tipping point will arrive much sooner** than most people expect
- Experts predict that just a couple of decades from now, **there will be more than 540 million electric vehicles crowding our roads** – and their energy needs will be much more intense than today's first generation of electric vehicles.
- To make your investment count and to earn the full ROI on the electrification of transport, the technology you install has to be both **scalable and futureproof**
- New long-range EVs demand fast-charging at higher power levels. Make sure that your e-mobility solution is **ready to grow both in size and sophistication.**
- Smart, connected technologies, such as energy management or battery energy storage, provide a means of **utilizing current electrical infrastructure** and avoiding or delaying costly grid expansions in markets where e-mobility is still in early stages.
- Fleet operators and transportation authorities are facing challenges, such as technological uncertainty, large up-front investment, and need for new capabilities. ABB's holistic approach provides a **complete e-mobility solution** helping fleet operators effectively outsource many of these uncertainties.

Charging infrastructure basics

Types of charging infrastructure and application

E-mobility solutions landscape for cars and fleets

Applications, charging times and power options

Public and commercial EV Charging

AC destination	DC destination	DC (and AC) Fast	Depot Charging	DC High Power
3-22 kW	20-25 kW	50-180 kW	Several units 50 to 175 kW+	150 to 350 kW+
4-16 hours	1-3 hours	20-90 min	hours	10-20 min
				
– Office, workplace – Home – Multi-family housing – Hotel and hospitality – Overnight fleet – Supplement at DC charging sites for PHEVs	– Office, workplace – Hotel and hospitality – Parking structures – Dealerships – Urban fleets – Public or private campus – Sensitive grid applications	– Retail, grocery, mall, big box stores, restaurant – High turnover parking – Convenience fueling stations – Highway truck stops and travel plazas – OEM R&D	– Bus depot charging private campus – Specific bus fleet hard & software – High number of units – Central bus depots and bus-line turning point	– Highway corridor travel – Metro “charge and go” – Highway rest stops – Petrol station areas – City ring service stations – OEM R&D

E-mobility solutions landscape for cars and fleets

ABB has a complete portfolio of EV chargers span across multiple charging applications

Public and commercial EV Charging

AC destination	DC destination	DC (and AC) Fast	Depot Charging	DC High Power
3-22 kW	20-25 kW	50-180 kW	Several units 50 to 175 kW+	150 to 350 kW+
4-16 hours	1-3 hours	20-90 min	hours	10-20 min

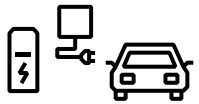
For car For bus

Alternate use-cases for depots

E-mobility solutions landscape for DC charging

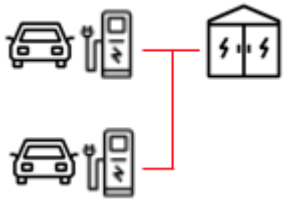
Typical topologies available for car and fleet charging

DC destination charging



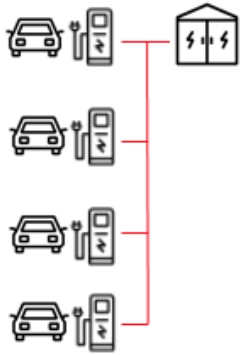
- DC charging up to 25 kW
- Substation up to 1250 kVA
- Charging time 1 – 3 hours
- Ideal for multi-family homes, offices, urban fleets, dealerships, hotels, and parking structures

DC fast charging



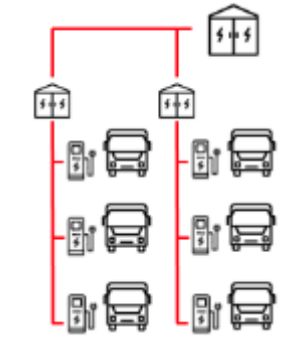
- DC chargers up to 50-180 kW
- Substation up to 1250 kVA
- Charging time 20 – 90 mins
- Ideal for retail, malls, high turnover parking, highway truck stops

DC high power (HP) charging



- High power charging up to 350 kW
- Substation up to 2MVA
- Charging time 10 – 20 mins
- Ideal for highway corridors and rest stops as well as heavy vehicles

Fleet or depot charging



- Fleet or e-bus charging up to 175 kW
- Substation up to 4 MVA
- Ideal for overnight fleet or bus charging requirements

E-mobility and energy storage solutions landscape

For this presentation, we will focus on the following types of e-mobility infrastructure

DC Fast	Depot Charging	DC High Power
50-180 kW	Several units 50 to 175 kW+	150 to 350 kW+
20-90 min	hours	10-20 min
		
– Retail, grocery, mall, big box, restaurant – High turnover parking – Convenience fueling stations – Highway truck stops and travel plazas – OEM R&D	– Bus depot charging Private campus – Specific bus fleet hard & software – High number of units – Central bus depots and bus-line turning point	– Highway corridor travel – Metro “charge and go” – Highway rest stops – Petrol stations – City ring service stations – OEM R&D

ABB e-mobility electrification infrastructure solutions

Overview

ABB Electrification has the complete line of charging infrastructure solutions

Your one-stop shop for e-mobility infrastructure

DC fast chargers

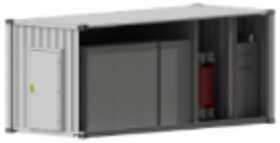
– Terra systems

E-bus chargers

– HVC

Service

– Asset management
– Extensions, upgrades, retrofits
– Installation, commissioning



Energy storage

– ESM

Electrical power

– Integrated electrical and charging

Electrical power

– Electrical only

Charging network software services

– ABB Ability

Components

– DIN rail, distribution boards
– Switchgear, switchboards

Distribution Solution Components

– LV and MV switchgear
– Relays

Renewable integration

– Solar, wind

ABB Electrification Packaging and Solutions

Providing the building blocks needed for your electrification, energy storage and charging needs

The Packaging and Solutions group offers:

– Pre-engineered product packages
– Customized eHouses, skids and mobile substations
– Standardized eHouses and skids
– Compact Secondary Substations (CSS)
– Energy Storage Modules (ESM)
– Integrated electrical and charger solutions

ABB’s e-mobility integrated solutions

Benefits of integrated electrical and charging infrastructure

- Modular and scalable, plug-and-play solutions **reduce complexity and are 60% faster to deploy**, helping customers turn ideas about sustainability into quick action.
- Factory assembled, pre-wired and pre-tested solutions assure a smooth startup **reducing risk by over 90%** that modifications will be required on site
- Internally arc tested unit offers the **highest safety for people and equipment**, with solutions tested according to IEC requirements for public installations
- The ability to place this solution in public spaces can **save 30% on installation costs** — no fencing or security required.
- Relocatable solution provides means **proposed site locations are evaluated temporarily without disruptive and costly grid connection expansions.** The permits required for temporary solutions are also often easier and faster to obtain.
- Transportable solution provides **flexibility** to move between sites with **simplified logistics.**
- Energy storage can easily be added in the future to cover higher peak demand and/or **resolve grid limitation issues.**
- Easy to transport and handle or relocate; many designs are stackable, **reducing land space requirements;** some designs fit into standard parking space.
- Digital connectivity, intelligent energy management, predictive maintenance, and deep insights and statistics at the charger, the site, and the network level **optimize e-mobility charging operations.**

Offering by application

Fleets

Bus depot

Medium Voltage
Typically 8 hours overnight

eBus en route charging

Medium Voltage
Typically 10-20 mins

Industrial fleet

Medium Voltage
Typically 8 hours overnight

Commercial fleet

Medium Voltage
Typically 8 hours overnight

Bus depot

Bus depot

Overnight charging

- After operation most buses will go back to the depot, an ideal time to charge the bus overnight.
- Average parking time is between 6-8 hours
- Depending on the battery capacity and the targeted charging times, charging power is between 25kW to 150kW
- Before start of route, most buses will require pre-conditioning to either heat up or cool down the interior
- Charging can be done 1:1 (1 charger per bus) or 1:3 (1 charger per 3 buses) combined with sequential charging.
- Supported connection to bus
  - Connectors
  - Pantograph Up
  - Pantograph Down

Bus depot

Integrated solution

		Voltage rating	Power rating	Applicable standards	Standard components	Key solution features
	**EcoFlex with HP chargers**	Up to 1kV		IEC, ANSI	LV protection equipment, energy management system, high power charging posts	Expandable uses with ES and HP chargers, quick start from LV connection, movable
	**UniSub with HP chargers**	Low voltage connection		IEC, ANSI	LV switchboard, HP chargers	For plug-and-play charging requirements with only LV connection, visually appealing

Bus depot

Battery energy storage building blocks

		Voltage rating	Power rating	Applicable standards	Standard components	Key solution features
	**EcoFlex with energy storage**	2.4 – 40.5kV Typical rating (kVA): up to 2000 kVA	Up to 1800kW/1800kWh	IEC, ANSI	MV switchgear, transformers, LV switchboard, energy storage	Easy to ship and install, BESS for reliable power and peak power demand control
	**CSS with energy storage**	2.4 – 40.5kV Typical rating (kVA): up to 1250 kVA	Up to 1000kW/1000kWh	IEC, ANSI	MV switchgear, transformers, LV circuit breakers, energy storage	Ideal for scalable solutions with power demand buffering and energy backup
	**EcoFlex Energy Storage Modules**	Up to 1kV	Up to 500kW/500kWh	IEC, ANSI	LV switchboard, energy storage	Plug-and-play low voltage energy storage solution, easy to ship and set up

Bus depot

Electrical infrastructure building blocks

		Voltage rating	Applicable standards	Standard components	Key solution features
	**Multi-module EcoFlex**	Up to 40.5 kV	IEC, ANSI	MV switchgear, transformers, UPS, LV connections, battery rack, charger, RTU	Modular solution, scalable design for futureproofing, fast installation
	**EcoFlex**	2.4 – 40.5kV Typical rating (kVA): up to 4000 kVA	IEC, ANSI	MV switchgear, transformers, LV circuit breakers	Designed for transport, remote locations, fast installation, expandable uses including energy storage
	**Compact Secondary Substation (CSS)**	2.4 – 40.5kV Typical rating (kVA): up to 3150 kVA	IEC, ANSI	MV switchgear, transformer, LV switchboard	Versatile configurations and functions with quick setup and pre-engineering

Complete e-mobility solution for high power large bus depot

With vertically integrated and connected solution from grid to charging point

ABB delivered complete depot electrification and charging solution

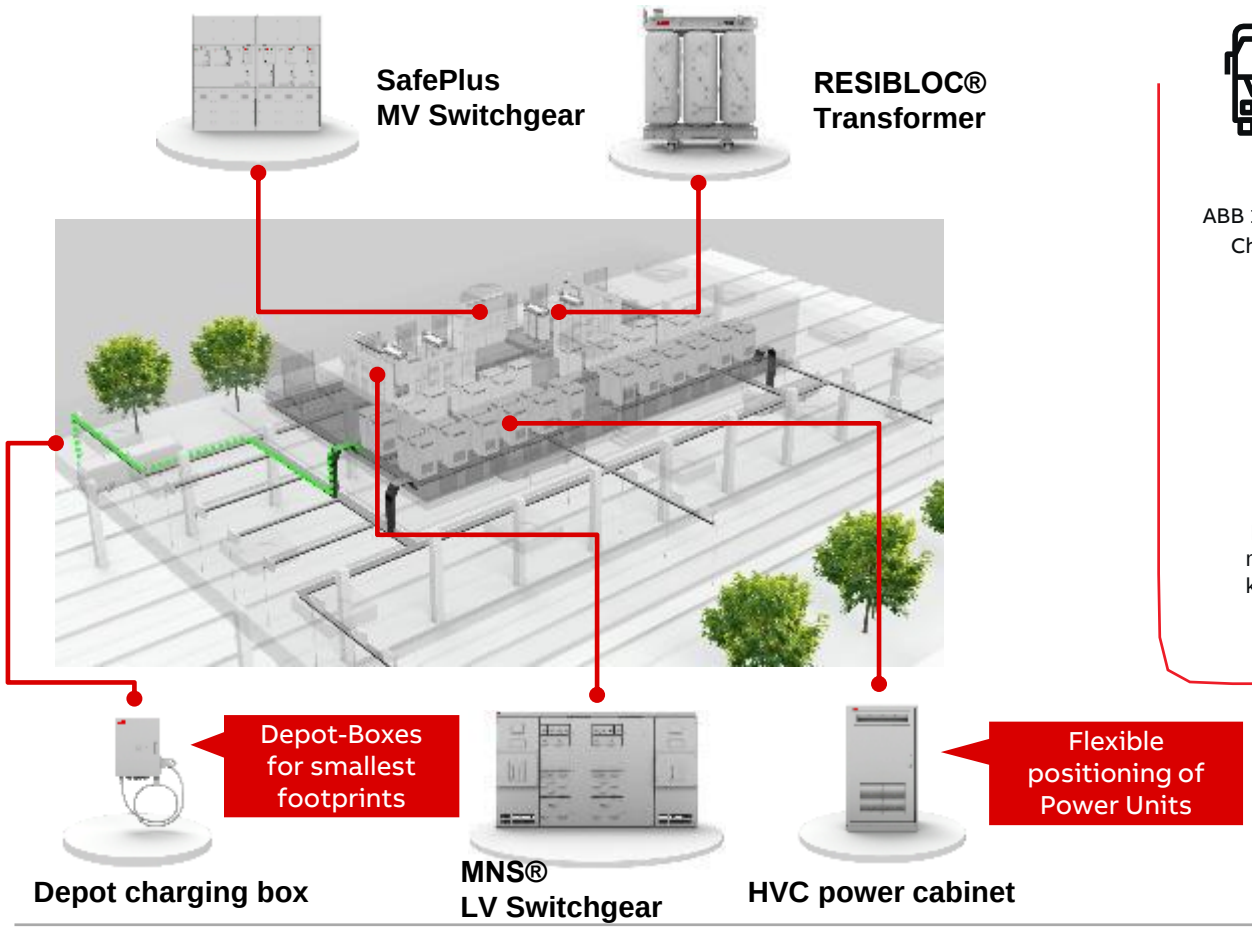
Digitalization | **Low and medium voltage power** | **High power chargers**

Value proposition and customer benefits

- **Complete solution** from grid connection to charging point, including a pre-fabricated building
- **Increased uptime** thanks to digital service support
- **213 million passengers** transported each year
- **110 bus lines** electrified, covering **more than 920 km**
- **100% fleet electrification**
- **Emissions-free operations**

Reference case: Hamburg Hochbahn

The first fully electric bus depot in Germany



44
ABB 150C Heavy Vehicle Charging Systems

150 kW
Charging Power per Charging System

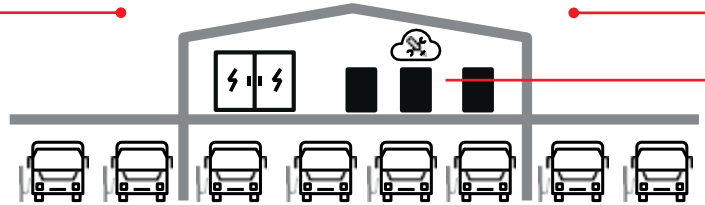
— ABB HVC 150-C

110
Bus lines and more than 921 km of distance

>213 Mio.
Passengers every year

100 %
Total electrification of fleet until 2030

83.000 t
Zero emissions in bus and tram fleets until 2030*



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Lost space

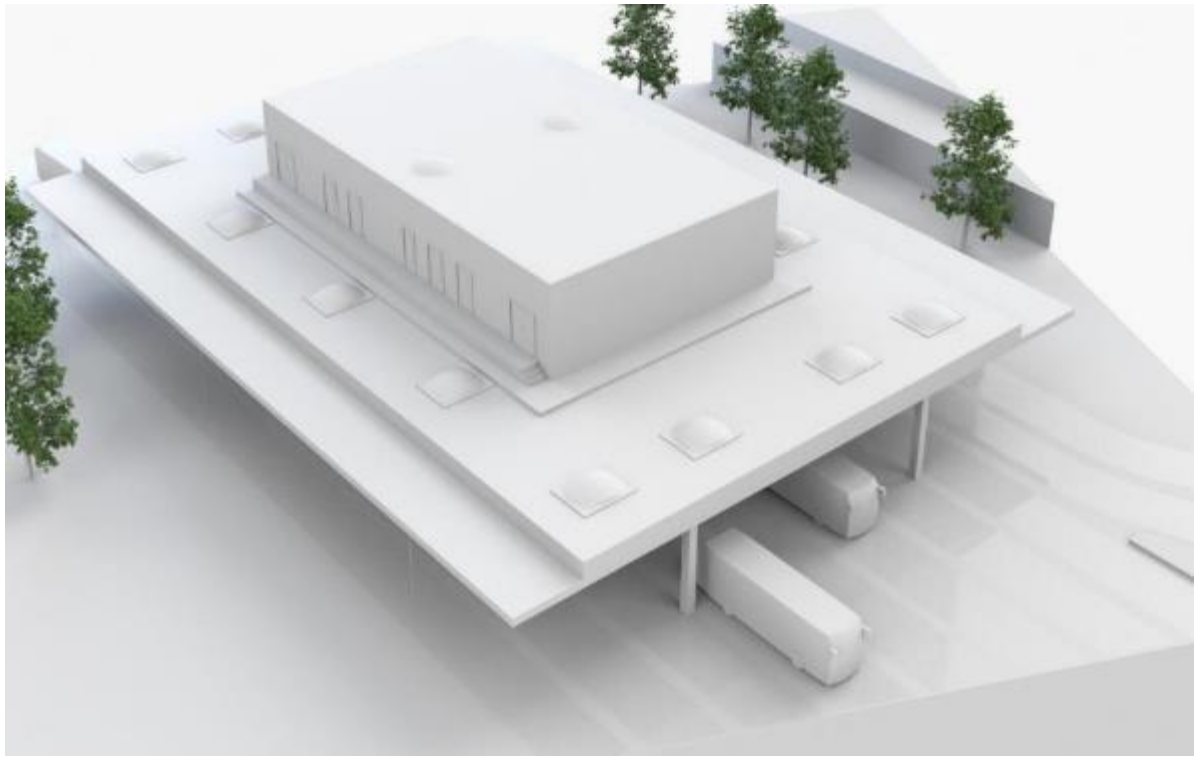
—
Ladestationen, elektrotechnische Infrastruktur und Netzanschluss werden im bestehenden Raum über den Bussen im Depot installiert.

E-mobility solutions for high power depot applications

Simulation of reference case implementation

Side view

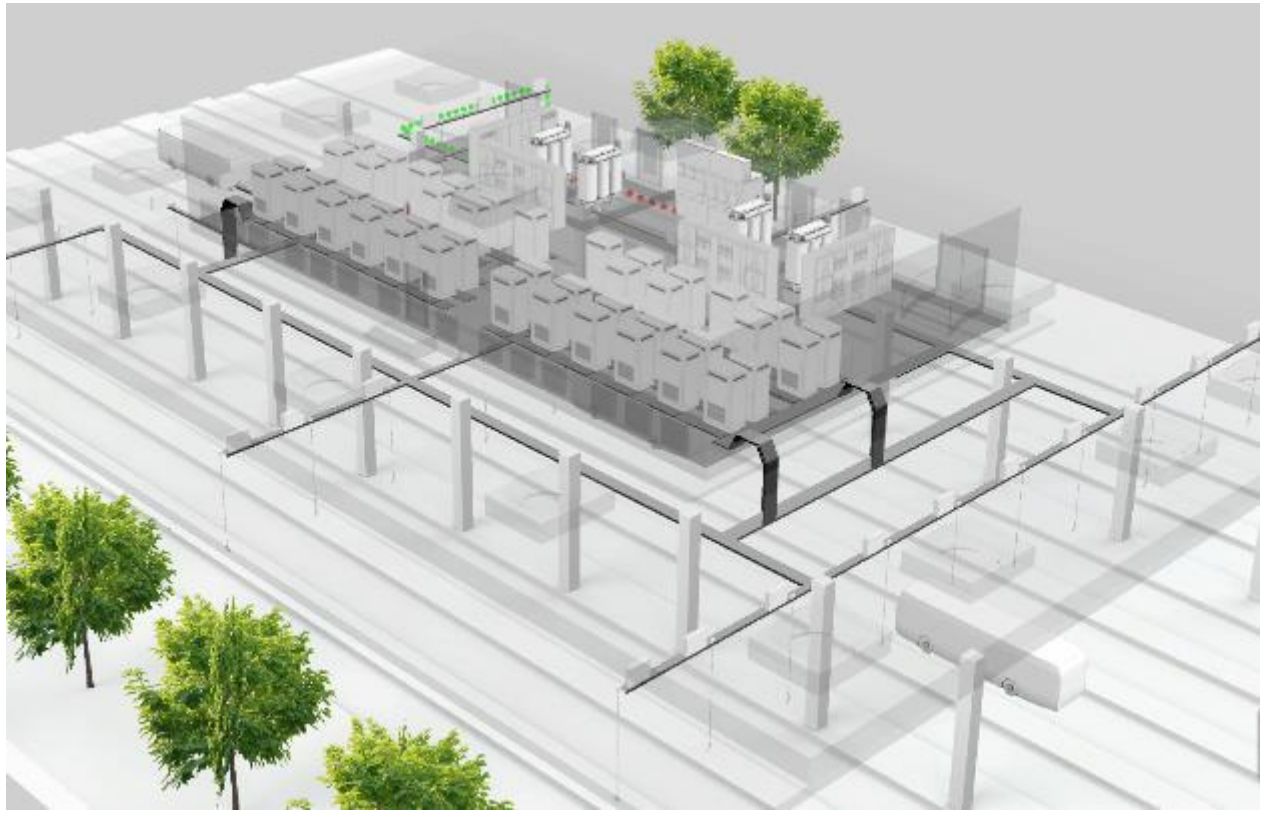
Top view



Bus depot

Rooftop solution

Topview/x-ray mode



- Complete electrical infrastructure included in one e-room
- E-room comprising of MV-Switchgear, Dry type transformers, LV-Switchgear, 44 units of 150kW power cabinets, RTU based communication system, UPS, Aircon ,
  depot boxes beneath floor level
- ABB providing a “one-package” solution, with coordination of interfaces between products and partner-scope
- “One package” solution gives the highest degree of control for timeline and interoperability
- Pre-assembled configurations (Skid/eHouse) can further support quick and hassle-free installation / commissioning at site

eBus en route charging

eBus en route charging

- Charging during daily operation at any given stop or rest opportunity.
- This offers an ideal solution to ensure zero-emission public transit during the day without impacting on the normal operation of the route.
- Charge time typically is between 3 and 6 minutes and requires an automated connection device and high power charging.
- Charging power is between 150kW to 600kW.
- Supported connection to bus
  - Pantograph down
  - Pantograph up

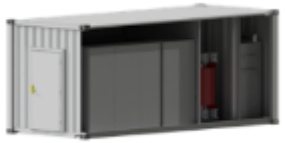
eBus en route charging

Integrated solution

		Voltage rating	Power rating	Applicable standards	Standard components	Key solution features
	**EcoFlex with HP chargers**	Up to 1kV		IEC, ANSI	LV protection equipment, energy management system, high power charging posts	Expandable uses with ES and HP chargers, quick start from LV connection, movable
	**CSS with HP chargers**	2.4 – 40.5kV Typical rating (kVA): up to 1250 kVA		IEC, ANSI	MV switchgear, transformer, LV switchboard, HP chargers	Quick setup solution for plug-and-play charging requirements
	**UniSub with HP chargers**	Up to 1kV		IEC, ANSI	LV switchboard, HP chargers	For plug-and-play charging requirements with only LV connection, visually appealing
	**EcoFlex w/ energy storage & HP chargers**	2.4 – 40.5kV	Up to 400kW/400kWh	IEC, ANSI	MV switchgear, transformer, LV switchboard, energy storage	Easy to ship and install, BESS for reliable power and peak power demand control
	**Bus charging station**	2.4 – 40.5kV Typical rating (kVA): up to 1250 kVA		IEC	MV switchgear, LV circuit breakers, transformers	Single piece delivery, connects to local monitoring

eBus en route charging

Battery energy storage building blocks

		Voltage rating	Power rating	Applicable standards	Standard components	Key solution features
	**EcoFlex with energy storage**	2.4 – 40.5kV Typical rating (kVA): up to 2000 kVA	Up to 1800kW/1800kWh	IEC, ANSI	MV switchgear, transformers, LV switchboard, energy storage	Easy to ship and install, BESS for reliable power and peak power demand control
	**CSS with energy storage**	2.4 – 40.5kV Typical rating (kVA): up to 1250 kVA	Up to 1000kW/1000kWh	IEC, ANSI	MV switchgear, transformers, LV circuit breakers, energy storage	Ideal for scalable solutions with power demand buffering and energy backup
	**EcoFlex with energy storage & HP chargers**	2.4 – 40.5kV	Up to 400kW/400kWh	IEC, ANSI	MV switchgear, transformer, LV switchboard, energy storage	Easy to ship and install, BESS for reliable power and peak power demand control
	**EcoFlex Energy Storage Module**	Up to 1kV	Up to 500kW/500kWh	IEC, ANSI	LV switchboard, energy storage	Plug-and-play low voltage energy storage solution, easy to ship and set up
	**Charging station with energy storage**	2.4 – 40.5kV Typical rating (kVA): up to 1250 kVA	200kWh/200kW – 300kWh/500kW	IEC	MV switchgear, LV circuit breakers, transformers, energy storage	Ideal for weak grid supply, energy storage, fast installation

eBus en route charging

Electrical infrastructure building blocks

		Voltage rating	Applicable standards	Standard components	Key solution features
	**EcoFlex**	2.4 – 40.5kV Typical rating (kVA): up to 4000 kVA	IEC, ANSI	MV switchgear, transformers, LV circuit breakers	Designed for transport, remote locations, fast installation, expandable uses including energy storage
	**Compact Secondary Substation (CSS)**	2.4 – 40.5kV Typical rating (kVA): up to 3150 kVA	IEC, ANSI	MV switchgear, transformer, LV switchboard	Versatile configurations and functions with quick setup and pre-engineering

Industrial fleet

Industrial fleet

Combination of overnight and fast charging, depending on application

- As battery technology advances, major truck and heavy duty vehicle manufacturers are already releasing their line up of low-noise, low-carbon producing electric vehicles.
- These high-power vehicles need high power infrastructure, with a strong focus on safety, especially in critical environments such as mining or for autonomous driving applications
- Charge time can range between 10 minutes to 3 hours.
- Charging power is between 50kW to 600kW.
- Supported connection to electric vehicle
  - Cable connector
  - Pantograph up and down
  - Customized connectors, such as pin-type plugs

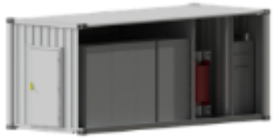
Industrial fleet

Integrated solution

		Voltage rating	Power rating	Applicable standards	Standard components	Key solution features
	**EcoFlex with HP chargers**	Up to 1kV		IEC, ANSI	LV protection equipment, energy management system, high power charging posts	Expandable uses with ES and HP chargers, quick start from LV connection, movable
	**CSS with HP chargers**	2.4 – 40.5kV Typical rating (kVA): up to 1250 kVA		IEC, ANSI	MV switchgear, transformer, LV switchboard, HP chargers	Quick setup solution for plug-and-play charging requirements
	**UniSub with HP chargers**	Up to 1kV		IEC, ANSI	LV switchboard, HP chargers	For plug-and-play charging requirements with only LV connection, visually appealing
	**EcoFlex w/ energy storage & HP chargers**	2.4 – 40.5kV	Up to 400kW/400k Wh	IEC, ANSI	MV switchgear, transformer, LV switchboard, energy storage	Easy to ship and install, BESS for reliable power and peak power demand control
	**CSS with HP chargers**	2.4 – 40.5kV Typical rating (kVA): up to 2000 kVA		IEC, ANSI	MV switchgear, HP charger LV switch board, transformers	Skid-mounted, ideal for highway rest areas, immediate charger installs

Industrial fleet

Battery energy storage building blocks

		Voltage rating	Power rating	Applicable standards	Standard components	Key solution features
	**EcoFlex with energy storage**	2.4 – 40.5kV Typical rating (kVA): up to 2000 kVA	Up to 1800kW/1800kWh	IEC, ANSI	MV switchgear, transformers, LV switchboard, energy storage	Easy to ship and install, BESS for reliable power and peak power demand control
	**CSS with energy storage**	2.4 – 40.5kV Typical rating (kVA): up to 1250 kVA	Up to 1000kW/1000kWh	IEC, ANSI	MV switchgear, transformers, LV circuit breakers, energy storage	Ideal for scalable solutions with power demand buffering and energy backup
	**EcoFlex w/ energy storage & HP chargers**	2.4 – 40.5kV	Up to 400kW/400kWh	IEC, ANSI	MV switchgear, transformer, LV switchboard, energy storage	Easy to ship and install, BESS for reliable power and peak power demand control
	**EcoFlex Energy Storage Module**	Up to 1kV	Up to 500kW/500kWh	IEC, ANSI	LV switchboard, energy storage	Plug-and-play low voltage energy storage solution, easy to ship and set up

Industrial fleet

Electrical infrastructure building blocks

		Voltage rating	Applicable standards	Standard components	Key solution features
	**Multi-module EcoFlex**	Up to 40.5 kV	IEC, ANSI	MV switchgear, transformers, UPS, LV connections, battery rack, charger, RTU	Modular solution, scalable design for futureproofing, fast installation
	**Compact Secondary Substation (CSS)**	2.4 – 40.5kV Typical rating (kVA): up to 3150 kVA	IEC, ANSI	MV switchgear, transformer, LV switchboard	Versatile configurations and functions with quick setup and pre-engineering

Commercial fleet

Commercial fleet

Overnight charging

- In addition to improving corporate sustainability, migrating to an electrical vehicle fleet can generate significant operational savings
- Many governments are offering taxation benefits and upfront grants for the purchase of electric vehicles
- Typically fleets are parked overnight and 6-8 hours charging time with a lower power charger is sufficient
- Charging power is typically between 11-24kW, depending on the size of vehicle battery
- Larger fleets requiring many chargers can require larger grid connection and battery storage solutions

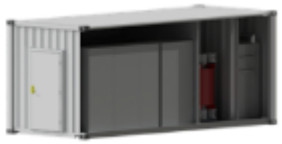
Commercial fleet

Integrated solution

		Voltage rating	Power rating	Applicable standards	Standard components	Key solution features
	**EcoFlex with HP chargers**	Up to 1kV		IEC, ANSI	LV protection equipment, energy management system, high power charging posts	Expandable uses with ES and HP chargers, quick start from LV connection, movable
	**CSS with HP chargers**	2.4 – 40.5kV Typical rating (kVA): up to 1250 kVA		IEC, ANSI	MV switchgear, transformer, LV switchboard, HP chargers	Quick setup solution for plug-and-play charging requirements
	**UniSub with HP chargers**	Up to 1kV		IEC, ANSI	LV switchboard, HP chargers	For plug-and-play charging requirements with only LV connection, visually appealing
	**EcoFlex w/ energy storage & HP chargers**	2.4 – 40.5kV	Up to 400kW/400kWh	IEC, ANSI	MV switchgear, transformer, LV switchboard, energy storage	Easy to ship and install, BESS for reliable power and peak power demand control

Commercial fleet

Battery energy storage building blocks

		Voltage rating	Power rating	Applicable standards	Standard components	Key solution features
	**EcoFlex with energy storage**	2.4 – 40.5kV Typical rating (kVA): up to 2000 kVA	Up to 1800kW/1800kWh	IEC, ANSI	MV switchgear, transformers, LV switchboard, energy storage	Easy to ship and install, BESS for reliable power and peak power demand control
	**CSS with energy storage**	2.4 – 40.5kV Typical rating (kVA): up to 1250 kVA	Up to 1000kW/1000kWh	IEC, ANSI	MV switchgear, transformers, LV circuit breakers, energy storage	Ideal for scalable solutions with power demand buffering and energy backup
	**EcoFlex w/ energy storage & HP chargers**	2.4 – 40.5kV	Up to 400kW/400kWh	IEC, ANSI	MV switchgear, transformer, LV switchboard, energy storage	Easy to ship and install, BESS for reliable power and peak power demand control
	**EcoFlex Energy Storage Module**	Up to 1kV	Up to 500kW/500kWh	IEC, ANSI	LV switchboard, energy storage	Plug-and-play low voltage energy storage solution, easy to ship and set up

Commercial fleet

Electrical infrastructure building blocks

		Voltage rating	Applicable standards	Standard components	Key solution features
	**EcoFlex**	2.4 – 40.5kV Typical rating (kVA): up to 4000 kVA	IEC, ANSI	MV switchgear, transformers, LV circuit breakers	Designed for transport, remote locations, fast installation, expandable uses including energy storage
	**Compact Secondary Substation (CSS)**	2.4 – 40.5kV Typical rating (kVA): up to 3150 kVA	IEC, ANSI	MV switchgear, transformer, LV switchboard	Versatile configurations and functions with quick setup and pre-engineering

Other considerations

Things to consider when selecting the proper electrical infrastructure

Enclosures are specific to power requirements and site considerations.
Below you will find detailed information on selecting the right enclosure.

Solutions

CSS family: Internally arc tested to meet IEC62271-202 standard making it ideal for public spaces


EcoFlex eHouse: Internally arc tested and easy to transport and relocate

Open-air skid: Ideal pre-assembled, pre-tested solution for quick installation and simple mair

Site considerations	CSS	EcoFlex	Open-air skid
Public space	+++	++	
Environmental (moisture, salt, fog, etc.)	+++ (GRP) ++ (Steel)	++	+
Seismic	++	++	++
Wind	++	+++	
High Altitude	++	+++	+
Arc containment	+++	+++	
Transportability	++	+++	++
Relocatable	+	+++	+
Compactness	++	+	+++

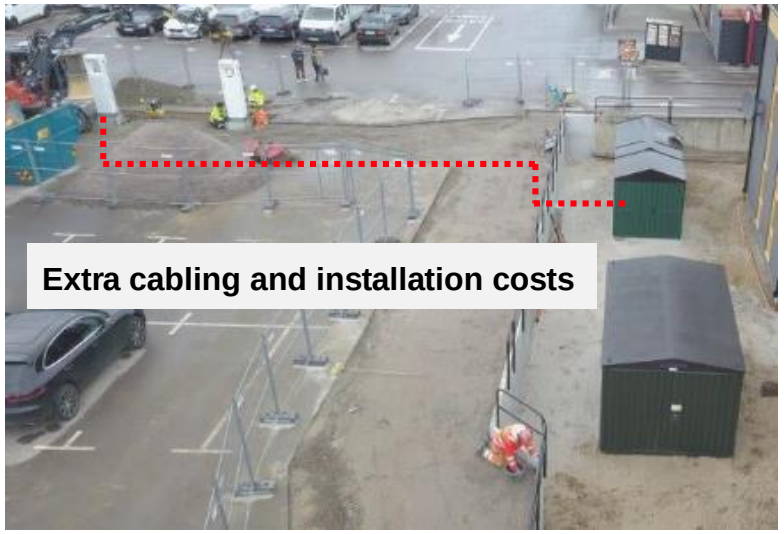
+ Good
++ Better
+++ Best

Advantages of integrated skid-mounted, complete solutions

Eliminate time and cost

For simple, quick installation consider placing high power chargers on the same skid with the enclosure to eliminate:

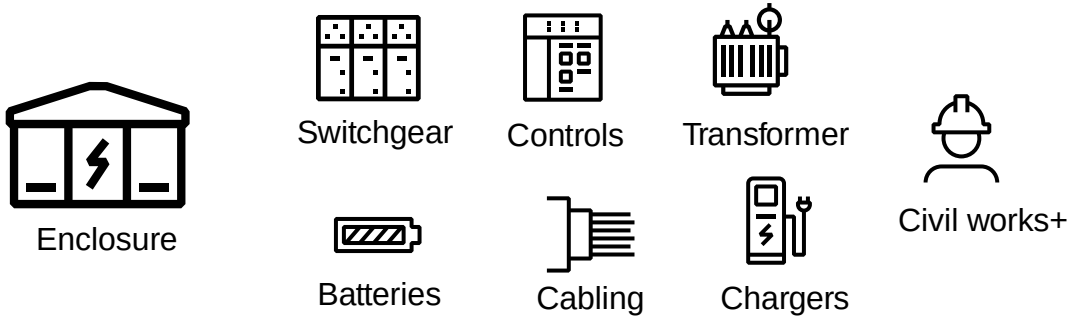
- Placing the enclosure behind a fence
- Cabling and cable trays costs
- Installation costs



Integrated solution provides simple, quick installation

versus

Individual product delivery



E-mobility options

Optional electrical infrastructure selections available

Electrification

Different electrification technologies can be selected:

Products	Sample
Secondary substation	Outdoor Skid, CSS, EcoFlex
Transformer	Oil or dry
MV protection	Gas- or air-insulated, indoor or outdoor, arc and non-arc resistant swgr
LV protection	LV circuit breaker
LV switches	InLine 2
LV breakers	Molded case circuit breaker
LV cable pillars	Fusegear and cable distribution cabinets
Energy storage	As needed

Installation types

There are many types of site specific installations including **skids, compact secondary substations** and **EcoFlex eHouses.**

Service

After sales services and specific service contracts can be provided covering:

- Mechanical packages
- Electrical solutions
- Control systems
- Charging devices
- SCADA systems

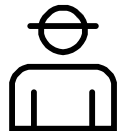


ABB Ability

The packages are ABB Ability enabled

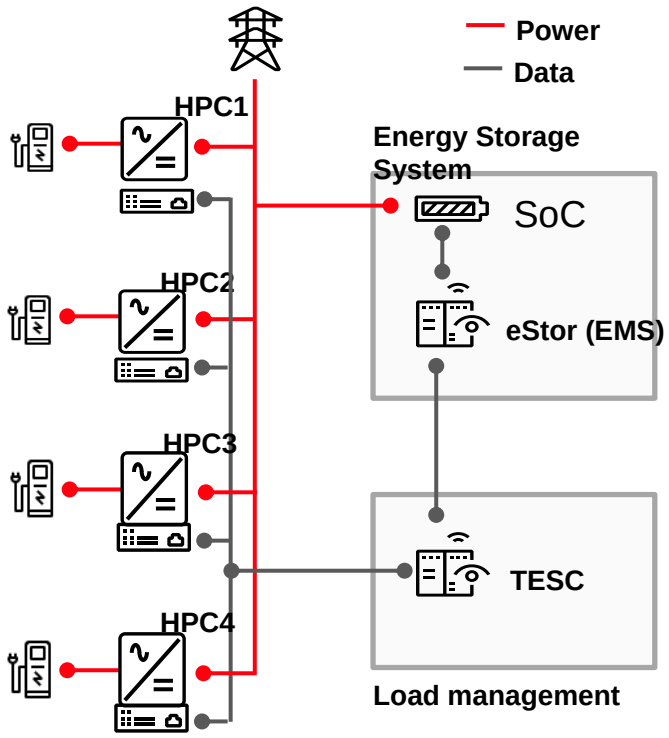
- Electrical equipment can be monitored by a traditional electrical SCADA system for ease of interface between all the electrical equipment.
- The system can also be connected through a broadband cellular network.

Digital options

Digital controls to solve grid constraint issues

Synchronized charging digital solutions

Synchronized charging for e-mobility



Grid constraints can often limit placement of eV charging locations or require long permitting times and infrastructure improvements.

However, with the addition of a Battery Energy Storage Systems (BESS) performing peaking capacity and the eV site controller performing load management, customers are able to synchronize charging for optimized energy flows in order to:

- Keep the grid under the capacity limit
- Provide maximum power to the eV customers
- Deploy eV charging infrastructure more quickly and to test possible locations before investing in costly grid capacity and electrical distribution expansions

Energy storage and synchronized charging digital solutions

Advantages

The energy storage and controlled synchronization allows customer to charge more than their existing power limit on the grid, this is specifically important when facing grid limitation issues.

It can take up to 1 year to obtain permits needed to deploy permanent charging infrastructure. The permits needed for a temporary installation are easier and faster to obtain. This allows a charge station to be deployed quickly and buys more time for the necessary permits to be collected for the permanent charging station. The temporary solution can then be relocated to the next planned site.

The solution allows a possible location to be tested before investing in costly grid capacity and electrical distribution expansions.

This solution prevents undervoltage issues and nuisance trips

The synchronization and voltage control helps prevent frequency excursions

The system can automatically detect load and synchronize

Why choose ABB for your e-mobility needs?

ABB Electrification is your total solution for e-mobility

A one-stop-shop

EV chargers for cars, buses and fleets

E-mobility infrastructure solutions

Financing for e-mobility solutions

ABB can help make your investments scale with needed capacity

ABB can help install your electrical vehicle infrastructure in over 80 countries

ABB will service and maintain the infrastructure for optimal use and availability

We will help you design, install and service your investment

ABB Packaging and Solutions for your e-mobility infrastructure needs

The perfect partner

Trustworthy partner
ABB is a global partner with a focus on advanced technologies

Ensure operability
Pre-engineered, pre-assembled and pre-tested solutions reduces risk

High reliability
Our solutions have undergone extensive risk and failure mode analysis

Flexible modular concept
Modular concept allows for ease of scalability in power and capacity

Safe, easy to install and operate
Pre-assembled and tested at ABB premises to ensure personnel safety and reduce time on-site

Maximize your ROI with highly reliable, scalable and safe solutions

Consider ABB Packaging & Solutions for your e-mobility solution needs

The perfect partner

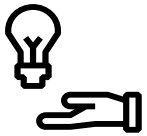
Trustworthy partner

- World leader in digital industries to serve customers
- Pioneering technology leader focused on digital industries
- Strong global team

Ensure operability

- Pre-engineered and industrialized products with reduced project engineering
- Reduced installation and transportation costs
- Maximize uptimes with factory assembled and pre-tested solutions
- Ensures immediate operability
- Can be dropped in parking space – ready to work

High reliability

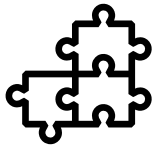


- Protect equipment from environmental influences
- Factory tested solution
- Designed to withstand severe environmental conditions
- Undergone extensive risk and failure mode analysis
- Advanced and efficient temperature control provided for the inverter and battery system.
- IEC compliant

Consider ABB Packaging and Solutions for your e-mobility solution needs

The perfect partner

Flexible



- Modular concept to allow ease of scalability in power and capacity
- From low-voltage to a wide range of AC medium-voltage levels
- Engineered footprint to optimize customer's requests
- Different options of MV switchgear from ABB's SF_6 gas-insulated secondary switchgear portfolio (also available with air-insulated switchgear)

Safe and easy to install and operate

- Internally arc tested for public and service personnel
- No live parts accessible
- Locking system for all enclosure doors prevents unauthorized entry of personnel
- Local and remote monitoring and control, easy integration to customer SCADA and ABB Ability™
- Ease of transportation due to standardize solutions
- Pre-assembled and tested at ABB premises to reduce on-site times
- 24/7 service support available to ensure uptime

Partnering with an expert is critical to success

ABB is a leader in delivering EV charging and electrical infrastructure

The standards for EV charging infrastructure are evolving

– ABB is a founding member to CHAdeMO and CCS standards and are co-developing the next advancements, such as ultra-fast charging solutions.

Interoperability between EV charger and the electric vehicle is not universal

– ABB offers an interoperability consultancy, working directly with all of the major car and bus OEMs to ensure successful interaction between your chosen vehicle and ABB EV chargers.

ISO 15118 can be utilized for advanced services, such as preconditioning

– Allows the vehicle cabin to be brought to the perfect temperature prior to departure from depot, saving valuable battery capacity.

– On-site connectivity solutions can be used to integrate chargers in local control systems, such as for fleet scheduling and energy management.

Cloud-based connectivity is critical:

– To ensure chargers are always working with the latest electric vehicles, software updates are delivered remotely

– To extend charging to public use-case, such as setting up pricing for charge sessions, to accept credit card payments, to authorize new vehicles to use the chargers

– To analyze charging statistics for business insights, such as trends in charging schedule, energy usage, and for testing new business models

– For evaluating the health of the EV chargers, such as any alerts or warnings, and using predictive maintenance to prevent disruption to charging operations


ABB