MARCH 2019 DANEL TURK & KUMAIL RASHID

E-Mobility Solutions & Implementation

EP Asia VIP Customer Event Hong Kong 8 – 10 March 2019

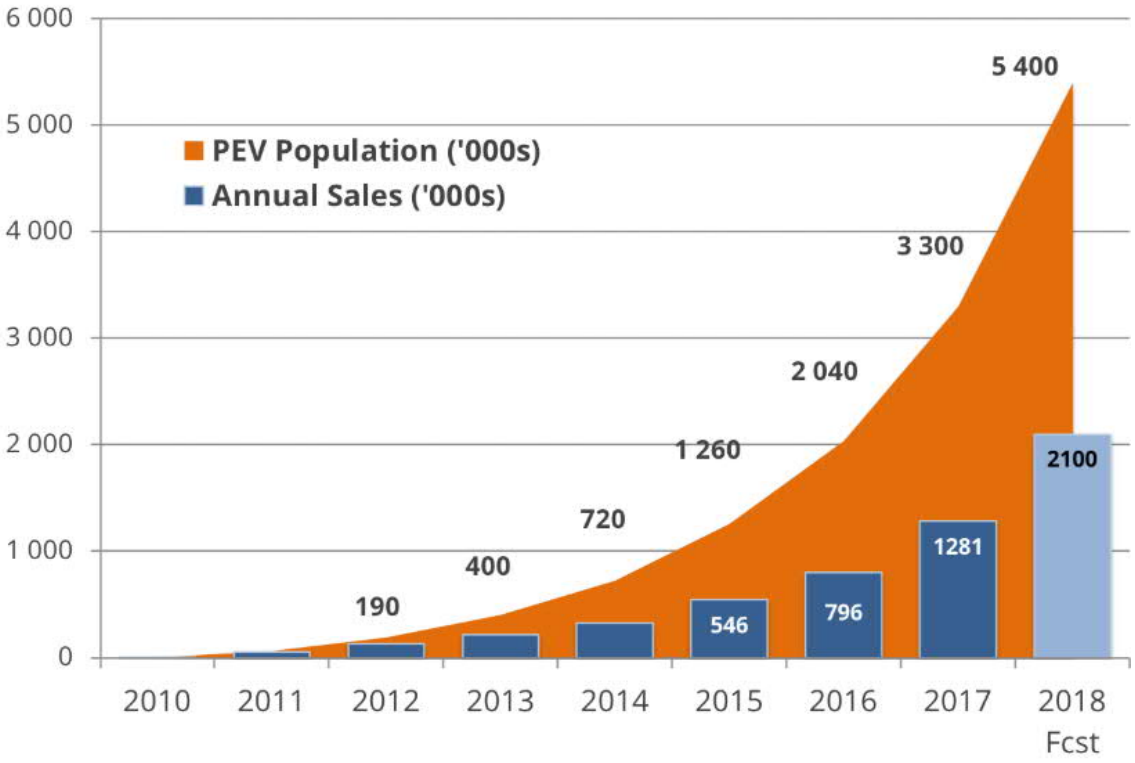
Questions and Giveaways!

Electric Vehicle Uptake

1. How many Electric Vehicles Globally?
2. How many Vehicles in Hong Kong?
3. How many Electric Vehicles in Hong Kong?

Growth Trends and Regional References

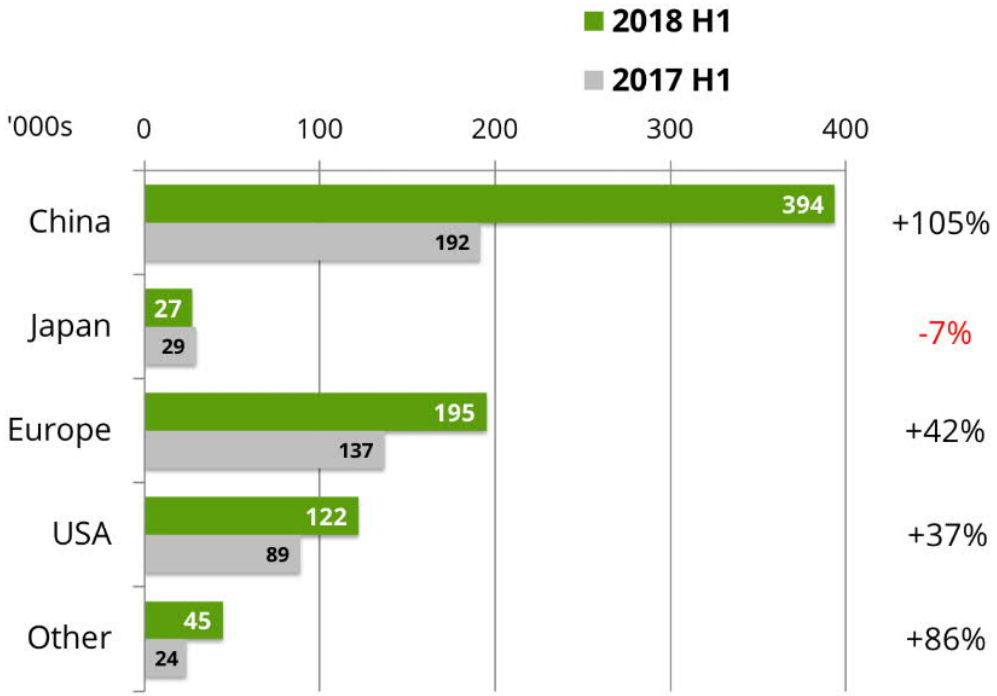
Global EV Volumes



Ref: EVvolumes.com

EV Growth in this Region

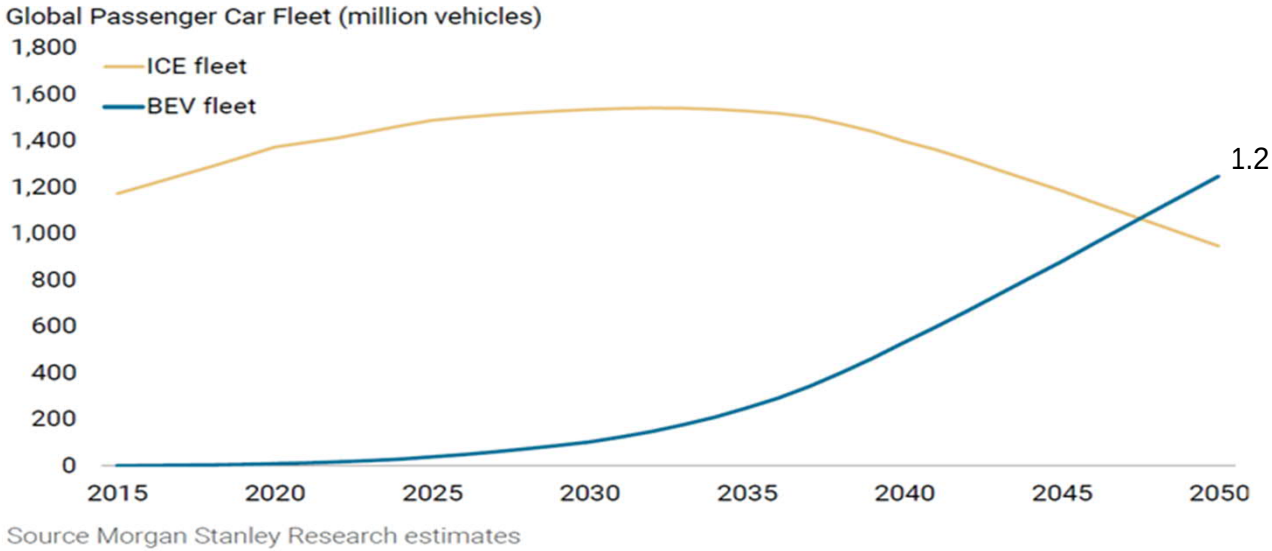
Plug in Sales and % Growth



Ref: EVvolumes.com

EV Projection

Morgan Stanley



1.2 Billion by 2050

“EVs Will Reach Price Parity With ICE By 2025”

https://insideevs.com/morgan-stanley-evs-price-parity-ice-2025/

ABB to power e-mobility in Singapore

Group press release Zurich, Switzerland, 26 September 2018

SP Group has chosen ABB's charging stations to drive Singapore's sustainable mobility revolution

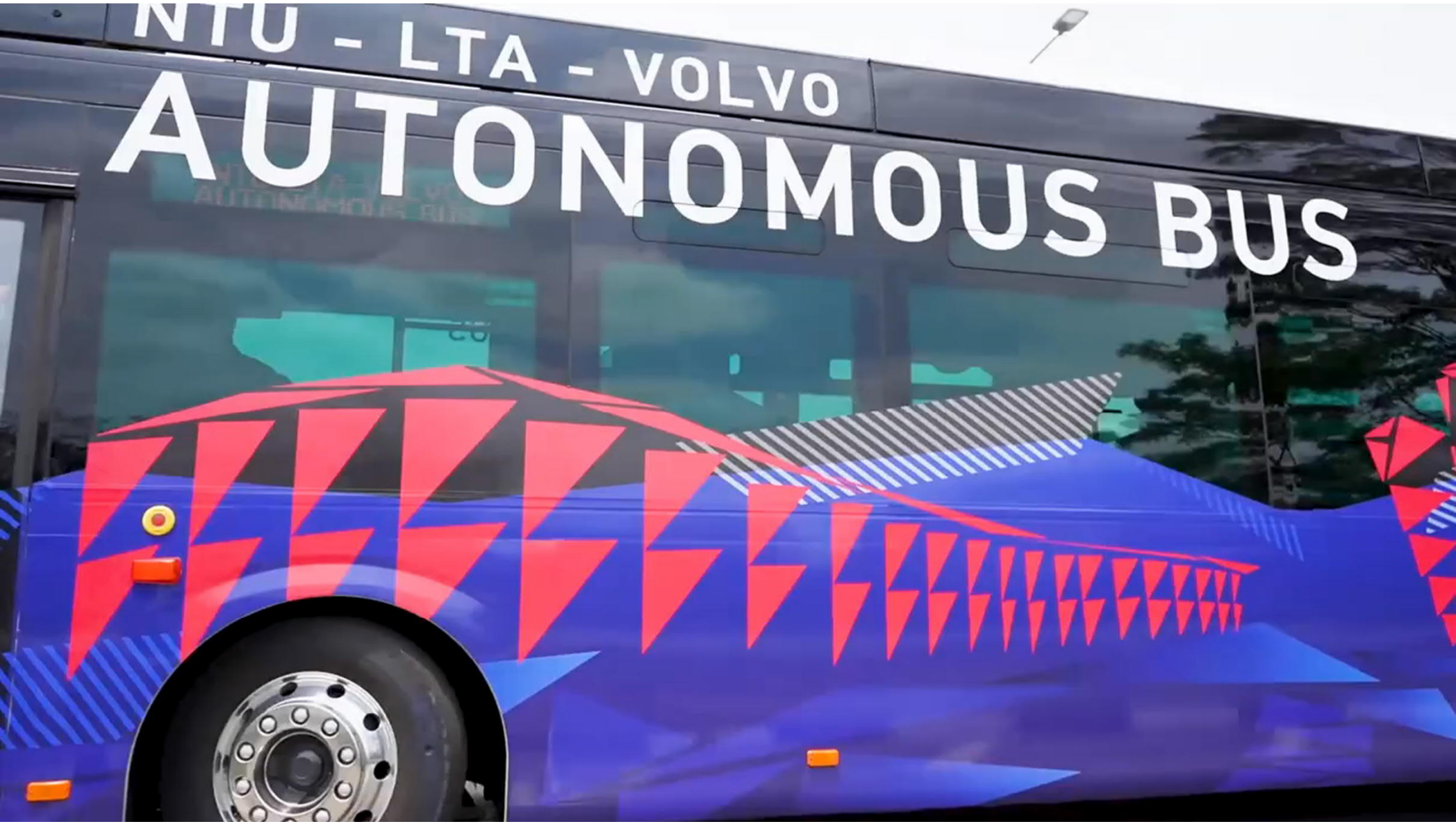
ABB has been selected to supply its DC fast charging stations as part of an ambitious electric vehicle (EV) infrastructure initiative in Singapore to accelerate the adoption of EV in the city-state. SP Group has selected the chargers, which can recharge EV batteries in about 30 minutes, as part of its deployment of 500 EV charging points across Singapore by 2020

ABB charges world’s first 12m fully electric Autonomous Bus

Singapore, March 05, 2019

300 kW OppCharge

- NTU and Volvo launch the world’s first fully electric Autonomous Bus
- Two autonomous driving electric buses in 2019
- One bus to be used at Centre of Excellence for Testing and Research of Autonomous Vehicles (CETRAN)
- ABB Recharges the batteries in 3 to 6 minutes

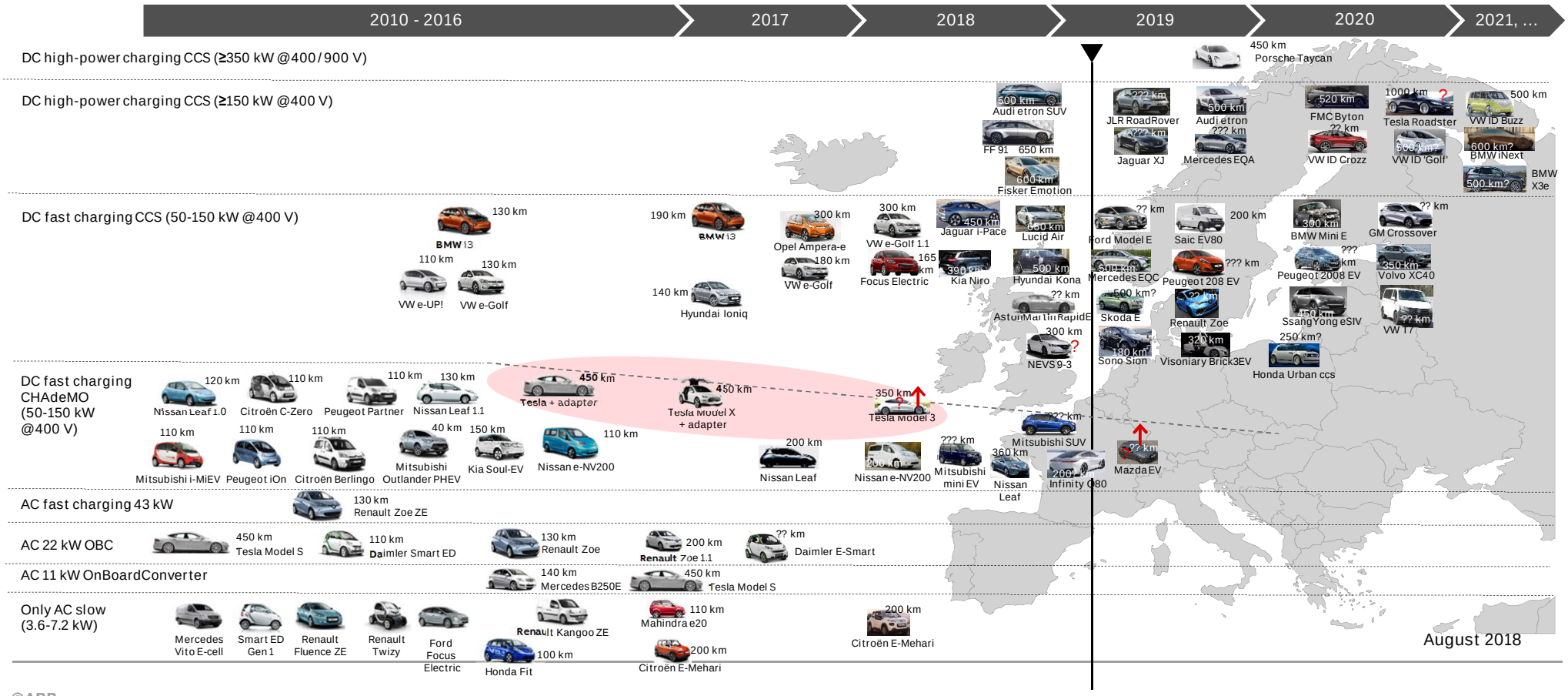

NTU - LTA - VOLVO
AUTONOMOUS BUS

Car Availability and Charging Technology

ABB is global charging partner for Car, Bus and Truck OEM's

Strong presence in China, USA and Europe

Car availability and standards



Public and commercial car charging – Use cases

Charging service should match charging application and demand

Public and commercial EV Charging

AC destination	DC destination	DC Fast	DC High Power
3-22 kW	20-25 kW	50 kW	150 to 350 kW+
4-16 hours	1-3 hours	20-90 min	10-20 min
			
– Office, workplace – Multi family housing – Hotel and hospitality – Overnight fleet – Supplement at DC charging sites for PHEVs	– Office, workplace – Multi family housing – Hotel and hospitality – Parking structures – Dealerships – Urban fleets – Public or private campus – Sensitive grid applications	– Retail, grocery, mall, big box, restaurant – High turnover parking – Convenience fueling stations – Highway truck stops and travel plazas – OEM R&D	– Highway corridor travel – Metro ‘charge and go’ – Highway rest stops – Petrol station area’s – City ring service stations – OEM R&D

Public and commercial car charging – Use cases

Charging service should match charging application and demand

Public and commercial EV Charging			
AC destination	DC destination	DC Fast	DC High Power
3-22 kW	20-25 kW	50 kW	150 to 350 kW+
4-16 hours	1-3 hours	20-90 min	10-20 min
			

Electrification Packages

Speaker

Danel Türk

Global Segment Manager
E-Mobility and Data Centers

Tallinn, Estonia

Contents

Packaging solutions for E-Mobility and Data Centers

Content

Landscape

E-Mobility

- Packaging
- Packaging typical solutions
- Electrification solutions

Data Centers

- Applications
- Electrification solutions
- Packaging

Summary

Segmentation

ABB Key customer segments

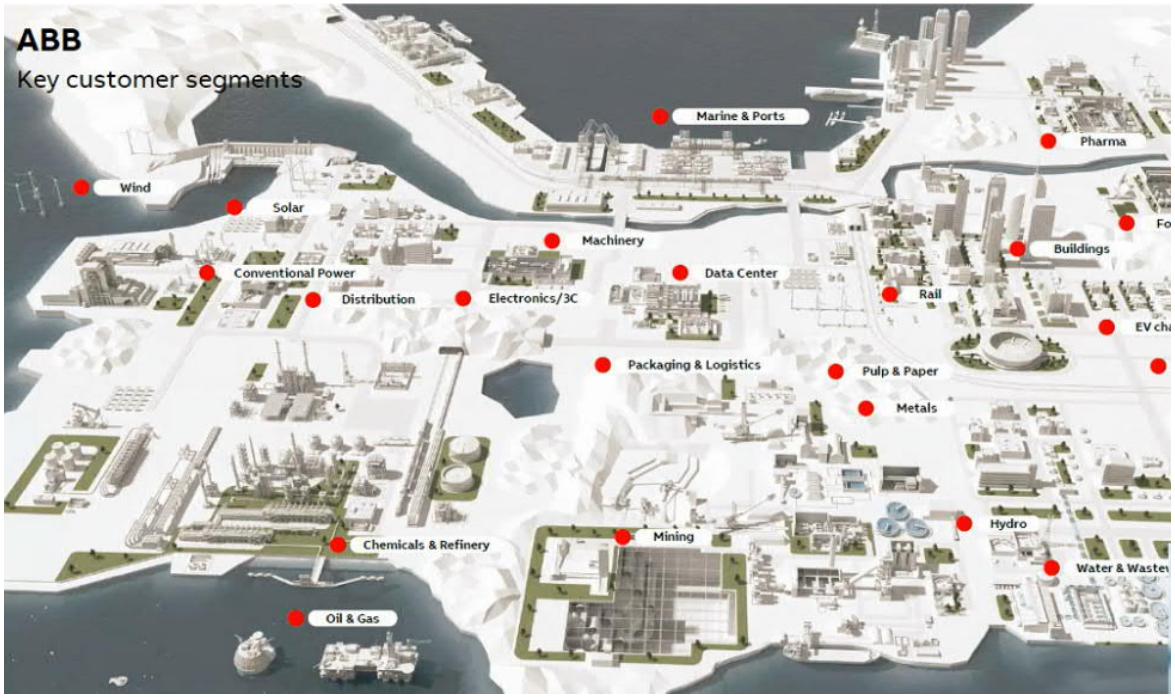
ABB is focused to take care customer needs in best way. Segmentation allows to focus on specific needs and offer best possible portfolio and technical solutions.

ABB products are reach to market via simple product sales, packages or system installations.

Session focus:

E-Mobility

Data Center



Why packaging

30 centers around the world, and growing….

Why Packaging

Optimized resource utilization

- Pre-engineered packages
- Reduced negotiation cost
- ABB project management

Reduced risk

- Lower number of suppliers
- Coordinated logistics
- Product selection experience

Reduced complexity

- Single Terms and conditions
- Simpler Communication
- Simpler project handling

Locations

Asia
AU: Moorebank (Sydney)
CN: Shanghai
ID: Jakarta
IN: Nashik
JP: Tokyo
KR: Chonan
MY: Kuala Lumpur
PH: Manila
SG: Singapore
TH: Bangkok

Footprint

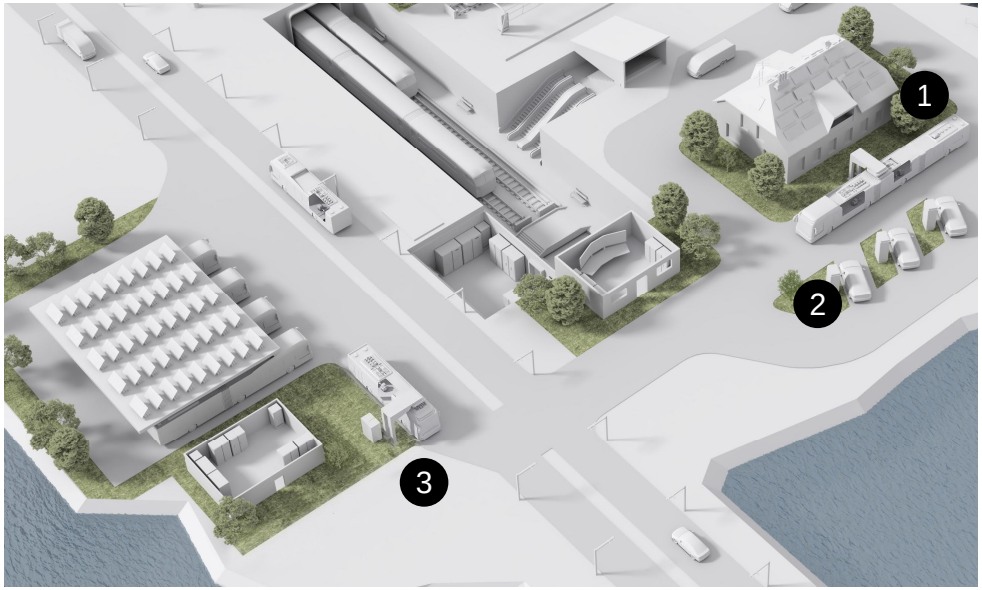
Electrification Packages

eMobility

Landscape

E-Mobility

Landscape



1 AC charging

AC charging is used for long time charging, with lower power levels – typically home installations with charging time ca 8 hrs

2 DC charging

DC charging is generally used in public charging areas; charging will be performed with higher power in a short time. Charging time in the range of 15min to 1h.

3 Bus / truck

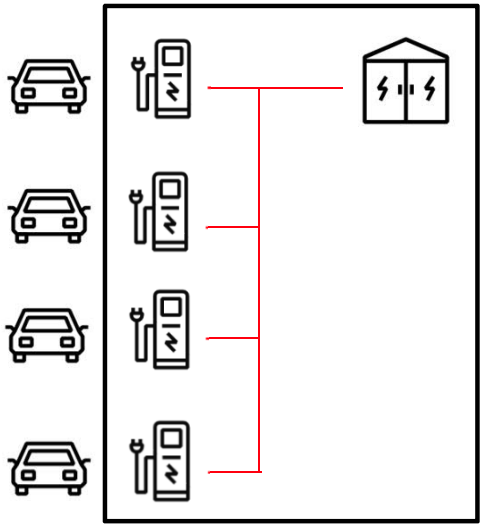
Bus charging will be either in Bus end stations (depots) or at bus stops, called opportunity charging. Time can vary from minutes to hours.

Typical E-Mobility diagrams

Typical diagrams for car charging and bus charging

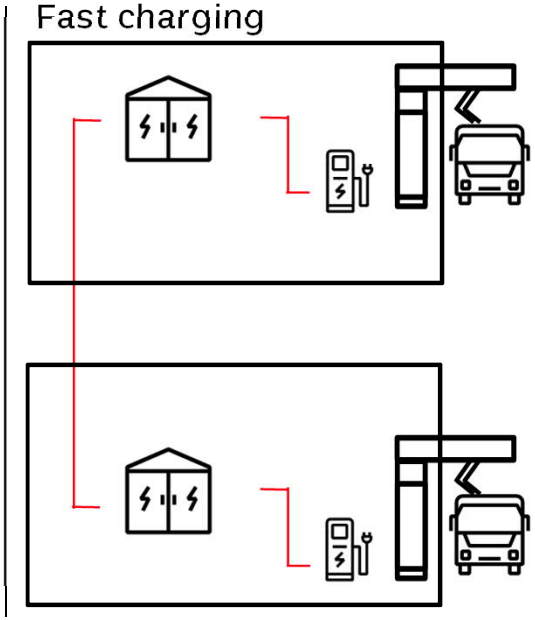
DC charging

Fast charging



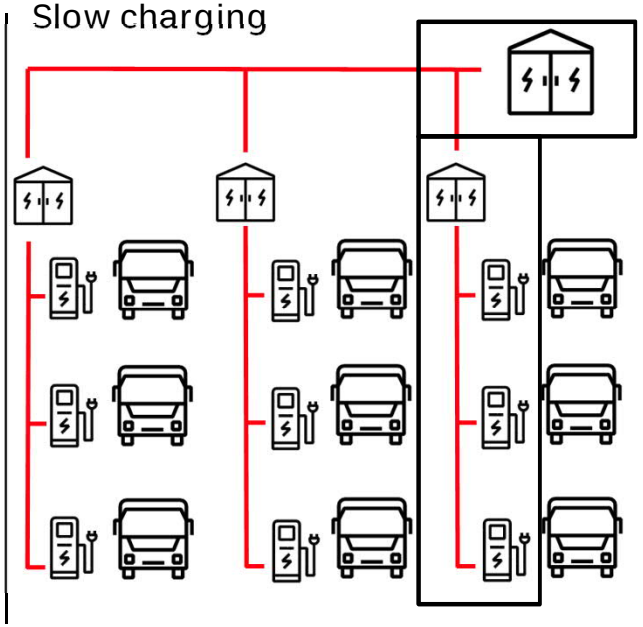
Opportunity charging

Fast charging



eBus depot charging

Slow charging



Typical packages

E-Mobility

Typical packages

E-Mobility

Products and service combination for customer specific needs

	 Electrification solution	 External converter	 Integrated converter	 Remote charger	 Integrated charger	 Installation/ maintenance
Electrical only	√					*
Electrical plus external converter and remote charging	√	√		√		*
Electrical plus integrated converter and remote charging	√		√	√		*
Electrical plus integrated converter and integrated charging	√		√		√	*

*Installation services, commissioning and maintenance are available for any package.

Typical packages – 1 of 4

Electrification solution only

Package content

Products	Sample
Secondary substation	Skid or Compact Secondary Substation (CSS) or EcoFlex
Transformer	Oil or dry
Ring main units	SafeRing, UniSec
LV switchboard	LVS or proE power
LV switches	InLine 2
LV breakers	Tmax
Cable pillars for LV	Kabeldon
Services	Install, commission
Energy storage	cESM, CES, DES

Outlook

Main features, use area

- Safety - Internally arc tested
- Suitable for harsh environment installation
- Quick installation

Use area:

- Extension of medium voltage network to ensure power required for charging.

Typical packages – 2 of 4

Electrification solution plus external converter and remote charging

Package content

Products	Sample
Secondary substation	Skid or CSS
Transformer	Oil or dry
Ring main units	SafeRing, UniSec
LV switchboard	LVS or proE power
LV switches	InLine 2
LV breakers	Tmax
Cable pillars for LV	Kabeldon
Charging station	Terra HP 175, Terra HP 350
Services	Install, commission, maintenance agreements
Energy storage	cESM, CES, DES

Outlook

Main features, use area

- Comprehensive solution from charging plug to medium voltage
- Flexible footprint
- Reduced contracting time
- Knowledge of local standards

Use area:

- Site where cabling works are difficult to manage

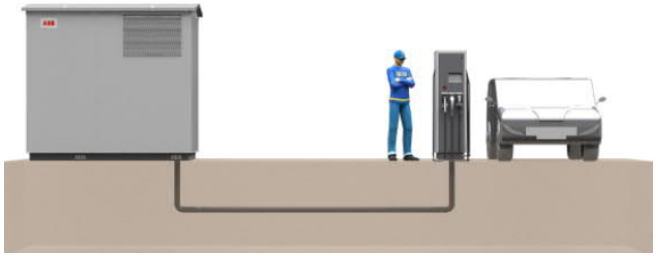
Typical packages – 3 of 4

Electrification solution with integrated converter and remote charging

Package content

Products	Sample
Secondary substation	Skid or CSS or EcoFlex
Transformer	Oil or dry
Ring main units	SafeRing, UniSec
LV switchboard	LVS or proE power
LV switches	InLine 2
LV breakers	Tmax
Cable pillars for LV	Kabeldon
Charging station	Terra HP 175, Terra HP 350
Services	Install, commission, maintenance agreements
Energy storage	cESM, CES, DES

Outlook



Main features, use area

- Compatibility, all products are from same vendor
- Integrated Design for E-Mobility
- Pre tested solution
- Quick installation designs

Use area:

- Site with Harsh environmental conditions

Typical packages – 4 of 4

Electrification solution with integrated converter and charging

Package content

Products	Sample
Secondary substation	Skid or CSS or EcoFlex
Transformer	Oil or dry
Ring main units	SafeRing, UniSec
LV switchboard	LVS or proE power
LV switches	InLine 2
LV breakers	Tmax
Cable pillars for LV	Kabeldon
Charging station	Terra 23, Terra 53
Services	Install, commission, maintenance agreements
Energy storage	cESM, CES, DES

Outlook

Main features, use area

- Standard E-Mobility design
- Quick logistics, installation and handling
- Installation and supervision by experts
- Quick installation designs
- One piece delivery to reduce site works time

Use area:

- Car parking place solution

Electrification solutions

E-Mobility

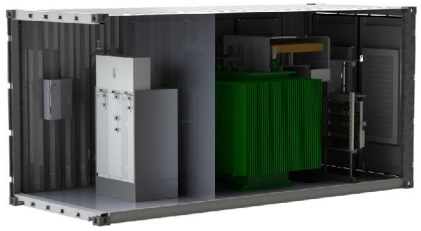
Electrification solutions for E-Mobility

Ready-to-install packages for every need

Secondary Skid Unit

- Open air
- Easy to install
- Pre-engineered
- MV up to 40.5 kV
- TR up to 3150 kVA

EcoFlex



- Robust
- Easy to transport
- Scalable solution
- MV up to 40.5 kV
- TR up to 4000 kVA

CSS

- Internally arc tested
- Modular solution
- Various material choices
- MV up to 40.5 kV
- TR up to 2000 kVA

CSS mounted with skid

- Integrated
- Quick installation
- Light weight design
- MV up to 40.5 kV
- TR up to 1250 kVA

Which electrification solution to use?

E-Mobility

	Solution 1 – Secondary Skid Unit (SSU)	Solution 2 – EcoFlex	Solution 3 – Compact Secondary Substation (CSS)	Solution 4 – CSS + integrated charger
Economic	●			●
Enclosed		●	●	●
Easy installation	●	●	●	●●
Ease of transportation		●		
Arc tested			●	●
Meets local standards			●	●
Relocatable		●●	●	●
Suggested applications	Most economic	For large power or temp applications	High safety, widely accepted	Lowest installation cost and time

Examples

eBus

Packages for complete bus depoo electrification

ABB products from MV equipment to chargers

- ABB has been contacted by customer, a public transportation company, in need to realize a large bus depot charging station
- Requirements were to provide a seamless solution from Grid connection to charging equipment
- ABB has been selected, since able to provide MV & LV switchgears, charging equipment, transformers, scada system.
- ABB has provided entire the electrification, the charging solution and the control.
- Customer trusts ABB, that have the right solutions and the right organization to execute the project

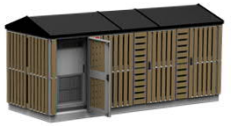
Bus depot charging solution by single supplier

eCar

Environmental friendly solution for high power charging station

Project Challenges:

- Timeframe to execute project
- On site installation – noise due to location too close to hotel
- Environmental friendly and visual look
- Safety – located in public



eCar

Energy storage project

Challenges

Network connection:

- Available power level too small
- Grid upgrade time too long
- Power increase too costly

ABB solution

- Connection to the different voltage level
- Energy storage solution to shift load and manage peak
- Scalable solutions to increase while power increase needed

Summary

E-Mobility

One stop shop for E-Mobility solutions

Electrification packages for Data Centers

Data center applications

Power distribution for all needs

Microscale < 1MW

Individual data centers with lower data requirements, served by an LV feed, up to 1 MW.

Examples may include small banks, small hospitals, university departments, hotels.

Enterprise level 5-15 MW

Often connected to medium voltage (MV) and sometimes high voltage (HV), 5 MW and above.

Examples: banks, insurance companies, hotel chains, universities, state institutions

Colocation 5-20 MW

Multi-tenant data center, varying from 5-1000 customers per data center.

Often connected to medium voltage (MV), from 5 MW and up.

Hyperscale > 20 MW
Extremely large data centers: Facebook, Apple, Amazon, Netflix, Google, and Microsoft etc.

Special standards often apply, for which ABB have developed solutions.

Classification of data centers

Electrical challenges

Tier classification

Tier 1
– Only one power supply

Tier 2
– Two power supply sources

Tier 3
– Several power supplies
– Redundancy of components

Tier 4
– Several power supplies
– Complete redundancy

Reliable power supply

High power / m² ratio

Effective cooling systems

AVAILABILITY

EFFICIENCY

Stability of voltage

Cost-effective power supply

Flexibility for future expansions

Data centers – What can ABB do for data centers?

A few good questions.

- What are your power requirements? MW, kV, kA?
- What are your uptime requirements?
- Do you have a building for the power distribution equipment? If so, how much space do you have in the building? Or is an outdoor solution an option?
- How much time do you have to get your data center up and running?

Electrification solutions for data centers

ABB portfolio includes different solutions to connect power to the data center. Main solutions can be divided into 6 categories:

eHouse - Metal enclosed and insulated building with distribution equipment , controls, and environmental equipment installed and coordinated in a factory setting.

Outdoor skid - Power distribution components (MV, transformer, & LV) installed and integrated on a steel frame for installation outdoors but not environmentally controlled.

Compact Secondary Substation (CSS) - Prefabricated substation which includes a LV Switchboard, transformer, and MV switchgear installed in a metal enclosure.

Mobile substation - Perfect solution for interim grid connections and temporary power supplies. Equipment are mounted on a trailer or railcar.

Indoor skid - Prefabricated substation which includes indoor rated LV Switchboard, transformer, MV switchgear and required SCADA interfaces, for rapid installation inside a building.

Product packaging - Supply all electrical equipment for final integration on site. (MV switchgear, transformers, battery system, LV switchgear, Protection and Control packages (COM600 and ZENON).

Package #1 – eHouse

Package #2 – Outdoor skid medium voltage connection

Package #3 – CSS

Package #4 – Mobile substation

Package #5 – Indoor skid

Package #6 Product packaging

Product packaging

Values to customers

Packaged solution	Products are coordinated both logistically and interconnections. Technical analysis of the request by the packaging quotation team
Project management:	Design to delivery - single point of contact for all ABB and third party equipment. Order entry, Issue PO's to ABB and third party products, change-orders, scheduling, document control, invoicing, logistics
Worldwide reach:	Global leader with huge installed base, global service coverage and high level of engineering capabilities.
Coordinated solution:	Coordinated delivery schedules avoid delays, mitigate risk, reducing costs, offering a single set of terms and conditions and increase value for the end users.
Reduced overall cost:	Leveraging Global ABB purchasing power.

Examples

Customer success stories – Compact Secondary Substations

Bitcoin mining - Sweden

Background & requirements

- Name of company: Bitcoin mining company
- Location of site : Sweden
- Very short lead time, need up to 15 MVA in steps
- Client had limited resources to manage the project

ABB response and reasons for the success

- Scope of supply : 6 units 24kV CSS, each 2.4 MVA
- ABB responded with first CSS units on site within weeks
- ABB could provide prefabricated and factory tested units on concrete pads, requiring very short on-site lead time.
- Single project manager as contact point for all commercial, technical & logistics coordination

Customer success stories - Product Packaging

Telemaxx – Germany

Project name	IPC 4
Scope	Medium voltage switchgear 3rd party Transformer ABB Resibloc Bus duct 3rd party Low voltage switchgear ABB MNS 3.0 Erection and commissioning
Customer segment	Data center
Country	DE
Status	Delivered 2016

Background
- Scope of supply : 20 kV AIS, transformer, 400 V low voltage switchgear, bus ducts, E&C
- Location of site : Germany

Reason for the success
- Client had limited resources to coordinate the project
- ABB could deliver own and 3rd party product as a single delivery
- ABB could provide an integrated product package on a single contract, with erection and commissioning
- Single project manager as contact point for all commercial, technical and logistics coordination

Summary

One stop shop for Electrification