



NOVEMBER 27<sup>TH</sup>, 2020, CRISTIAN MARTIN

# Innovation and best practices in bus charging

Seminario Internacional: Electromovilidad para Latinoamérica, 2020



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# Overview

## Innovation and best practices in bus charging

### Introduction

#### Sample projects innovation and best practices

- CCS Depot Charging
- Panto Up charging, energy management, interoperability
- Autonomous driving and automatic charging
- Battery energy storage and local energy management



# Powering e-mobility forward with unmatched experience



ABB has a decade of experience in E-mobility



14,000+ chargers sold



Chargers installed in +80 countries



~ 332.000 MWh of charging delivered



~ Europe's first commercial DC fast charging station in 2010



~ with bus projects in operation >5 years

Leuven, BE



Trondheim, NO



Gothenburg, SE



Hamburg, DE



Harrogate, UK



Leiden, NL



La Rochelle, FR



Groningen, NL



Luxembourg



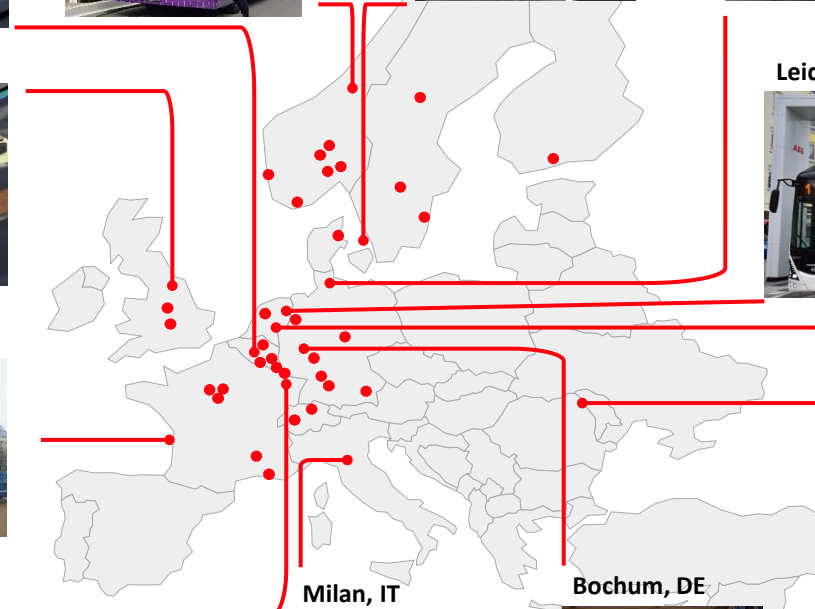
Milan, IT



Bochum, DE



Suceava, RO



# Trusted partner to the world's biggest brands

## Partner OEM



## Interoperability and pre-conditioning

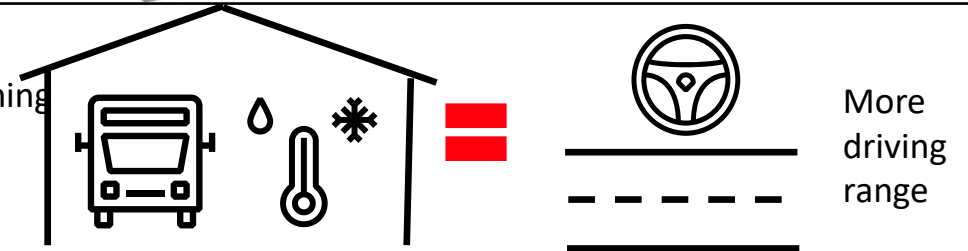
Consultancy for standardized and open communication and data exchange between buses and infrastructure



Across multiple connection solutions

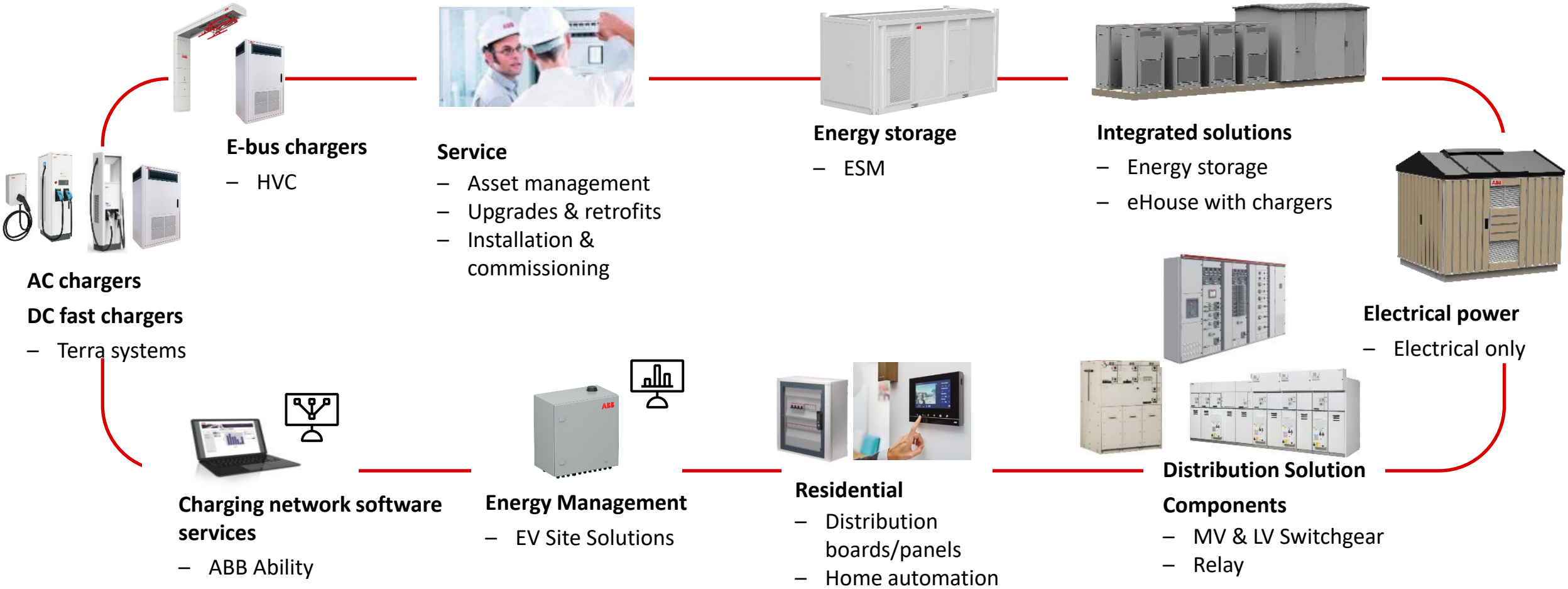


Bus preconditioning at depot



# ABB Electrification has the complete line of charging infrastructure solutions

Your one-stop shop for e-mobility infrastructure



# ABB and Qbuzz power progress in Dutch e-mobility adoption

## APPLICATION

High-power and fast chargers

## COUNTRY / CUSTOMER / SITE

The Netherlands / Qbuzz

## CUSTOMER NEEDS

As the Netherlands aims to deliver a 95 percent reduction in emissions by 2050, ABB has been appointed to provide more than 100 connected high-power and fast chargers for the Qbuzz fleet of 99 fully electric buses.

## SOLUTION

- **Dordrecht**
  - 6 High-power 300 Pantograph-Down bus charger delivers 300kW of charging power and will charge the bus for 3 to 6 minutes
  - 38 Terra 54 50kW depot-fast chargers with a voltage range of 150-920V
- **Groningen-Drenthe**
  - 62 100kW high-power charging stations across Qbuzz depots in Emmen

 [Link to online story](#)



6 x 300kW  
Pantograph  
down



Dordrecht

38 x 50kW  
CCS



62 x 100kW  
CCS



Groningen-Drenthe

# ABB and BYD: evolution of public transport in Germany



## APPLICATION

Public transit

## COUNTRY / CUSTOMER / SITE

Germany

## CUSTOMER NEEDS

The customer needed a consistent, automatic connection means for 2 depots and en-route charging to support drivers. Additionally the electric buses chosen were not from a European bus manufacturer and there were concerns about reliable interoperability with DC fast chargers . Lastly, as the total charging capacity required was 3.6MW, they needed an intelligent way to manage energy to reduce operating costs.

## SOLUTION

- Repeated interoperability testing with bus OEM in ABB's E-mobility Innovation lab in Delft.
- 20 x 150kW Pantograph up chargers for depot
- 3 x 450kW Pantograph up en-route chargers
- Safe and efficient grid connection: ABB UniPack-G compact substations
- Profitability and cost efficient energy management with ABB Ability™ OPTIMAX®

## BENEFIT

**18000**

tons

carbon dioxide emissions savings over next 20 years





## Automatic connection system for depot in Edmonton



### APPLICATION

Electric bus depot

### COUNTRY / CUSTOMER / SITE

Canada / Edmonton Transit Service

### CUSTOMER NEEDS

Customer wanted to launch their first electric bus program with redundancy and future scalability. They needed an automatic connection solution which simplified the charging process for drivers, as well as allowed charging to be initiated remotely at anytime without driver involvement.

### SOLUTION

ABB and Proterra, the bus provider, collaborated with ETS to create the first-of-its-kind automatic overhead charging solution for depot. ABB provided 26 150kW HVC chargers with Pantograph down connection. Due to the close proximity of the overhead chargers within the depot, a special RFID, Wi-Fi, and 2-step authentication solution was developed to ensure that each bus communicates readiness to its respective pantograph down charger.



[Link to online story](#)





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Customized pairing solution needed for multiple Pantographs in close proximity



[Link to online story](#)

# Autonomous driving demonstration, Volvo and ABB

Göteborg, Sweden, October 2019

## Towards a driverless depot, demonstration

- At arrival the driver gets out of the bus
- The bus drives autonomously on the depot premises
- Fast and overnight charging handled automatically
- Automatic driverless washing of busses



# Full site solution for public transit

## Milan, ATM



**APPLICATION**  
Electric Bus Depot

**COUNTRY/CUSTOMER / SITE**  
Italy / ATM

### CUSTOMER NEEDS

ATM had limited space in the depot to add charging infrastructure needed a compact solution. They also wanted an energy storage solution so they can study future use-case of using bus batteries for storage. They needed a sophisticated energy management solution to manage charging in combination with BESS.

### SOLUTION

The T124 EV chargers offer dual CCS connectors which enable two buses to be charged at once with a single charger. To deliver power to the chargers, ABB provided a fully engineered electrification solution from MV, including energy storage system, down to the CSS connectors.

The whole solution is enclosed in ISO enclosures occupying just a single bus parking spot.

EVSS Control 200 provides advanced energy optimization between T124 chargers and the EcoFlex 324kWh BESS.

### BENEFIT

**15%**

space savings for charging infrastructure



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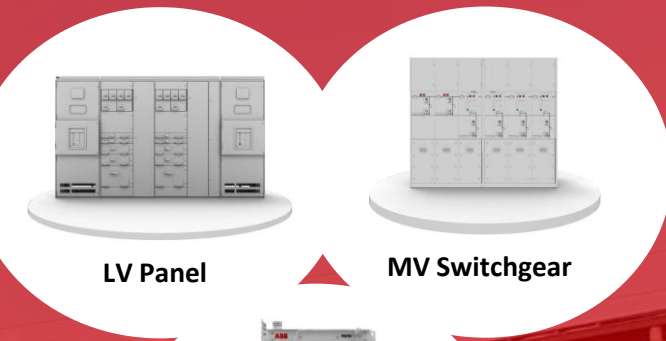
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LV Panel

MV Switchgear



MV Transformer



EcoFlex BESS



EVSS Control 200



Terra T124 EV Chargers  
charges 2 buses with 60kW at same time

# First fully electric bus depot

Germany, Hamburg Hochbahn



## APPLICATION

Electric Bus Depot

## COUNTRY/CUSTOMER / SITE

Germany / Hamburg Hochbahn / Public transport depot

## CUSTOMER NEEDS

Conversion of an existing depot with limited space for charging equipment and with full integration into on-site management systems

## SOLUTION

44 x 150kW HVC chargers with separate ceiling-mounted depot boxes and advanced ISO15118 interoperability with e buses. Roof-top electrical infrastructure solution with LV and MV gear and transformers

## BENEFIT

**83000**

tons  
carbon dioxide emissions savings



[Link to online story](#)



# First fully electric bus depot

Germany, Hamburg Hochbahn



## Rooftop Electrical Construction



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

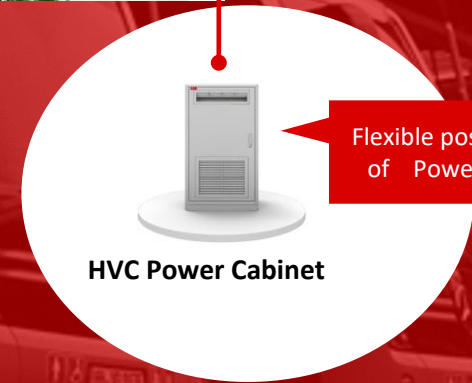
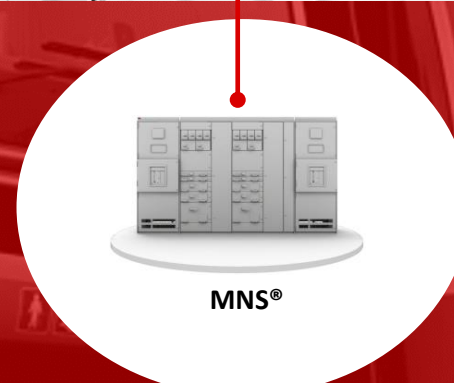
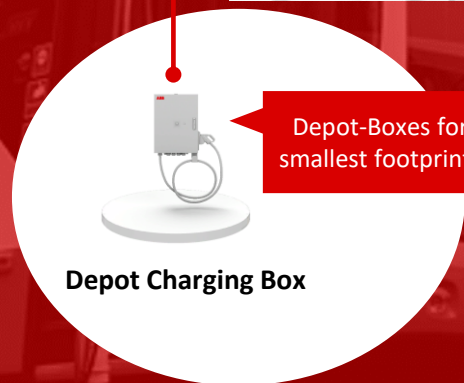
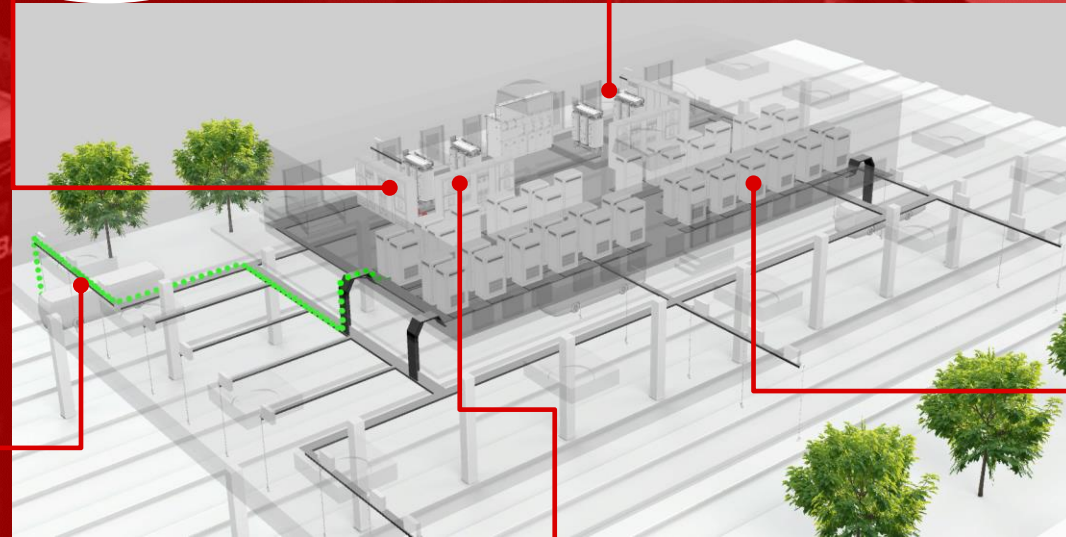
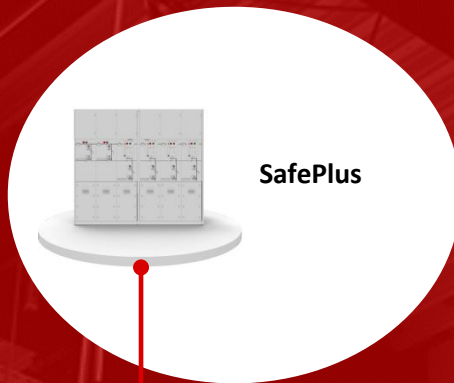
### BENEFIT

0

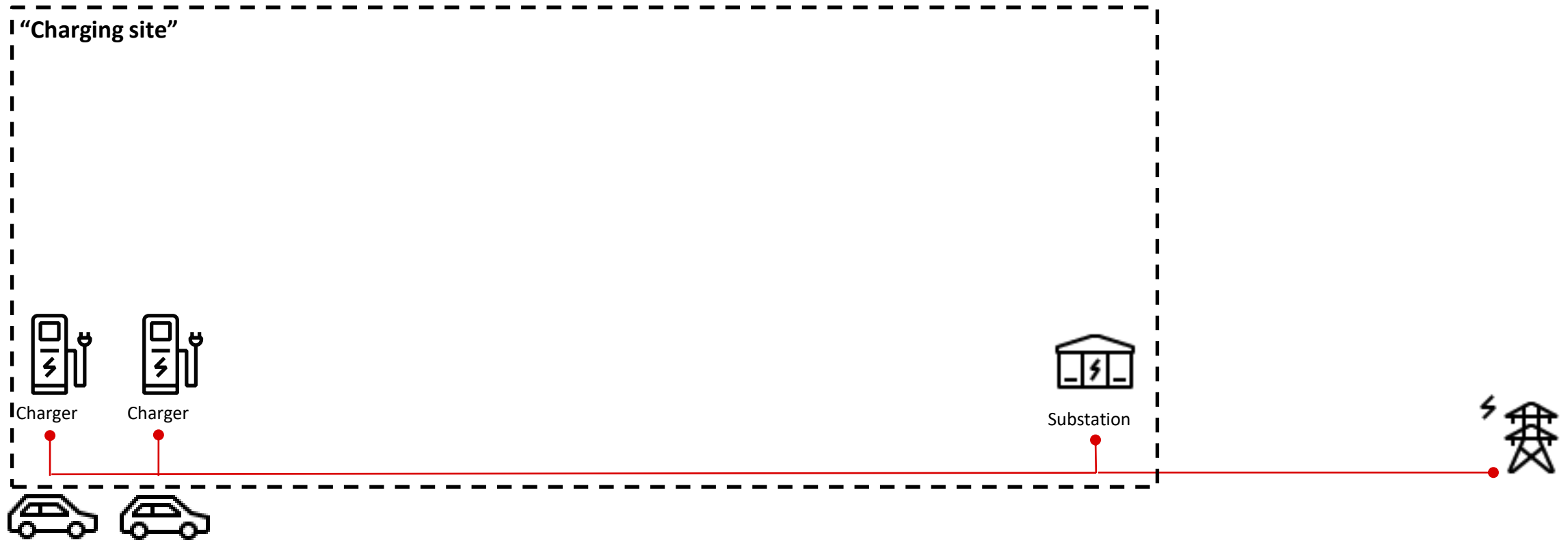
LOST SPACE



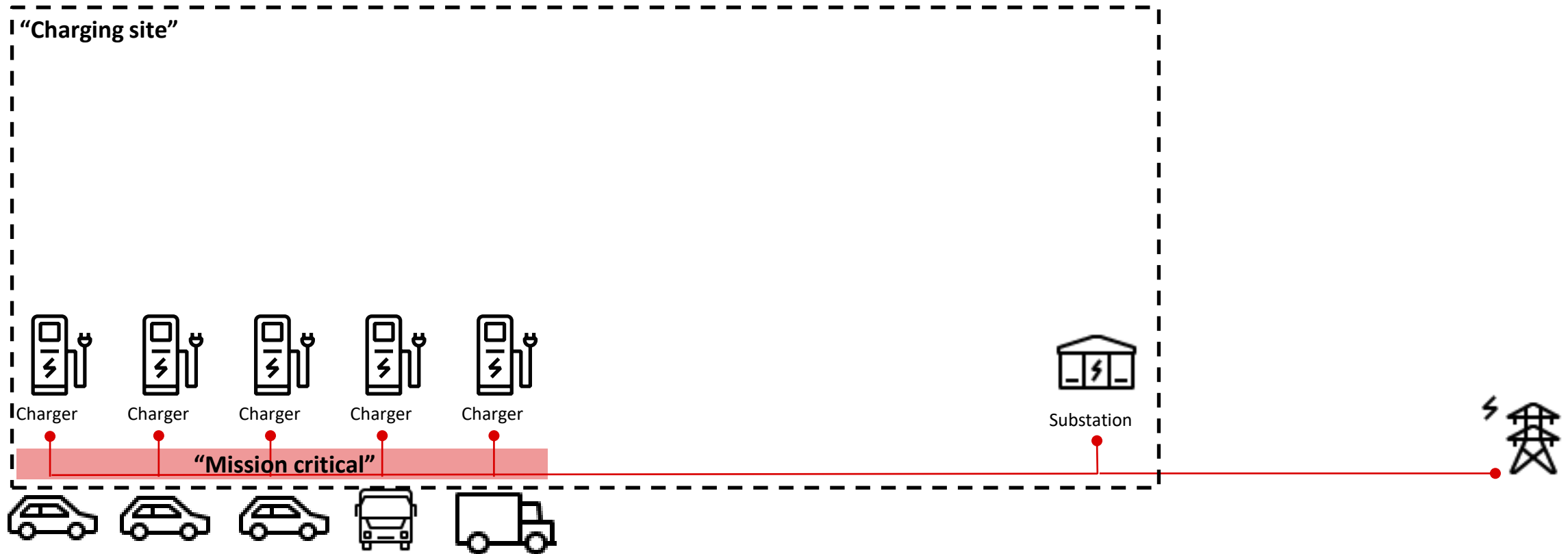
[Link to online story](#)



# Evolution of the EV Charging value chain

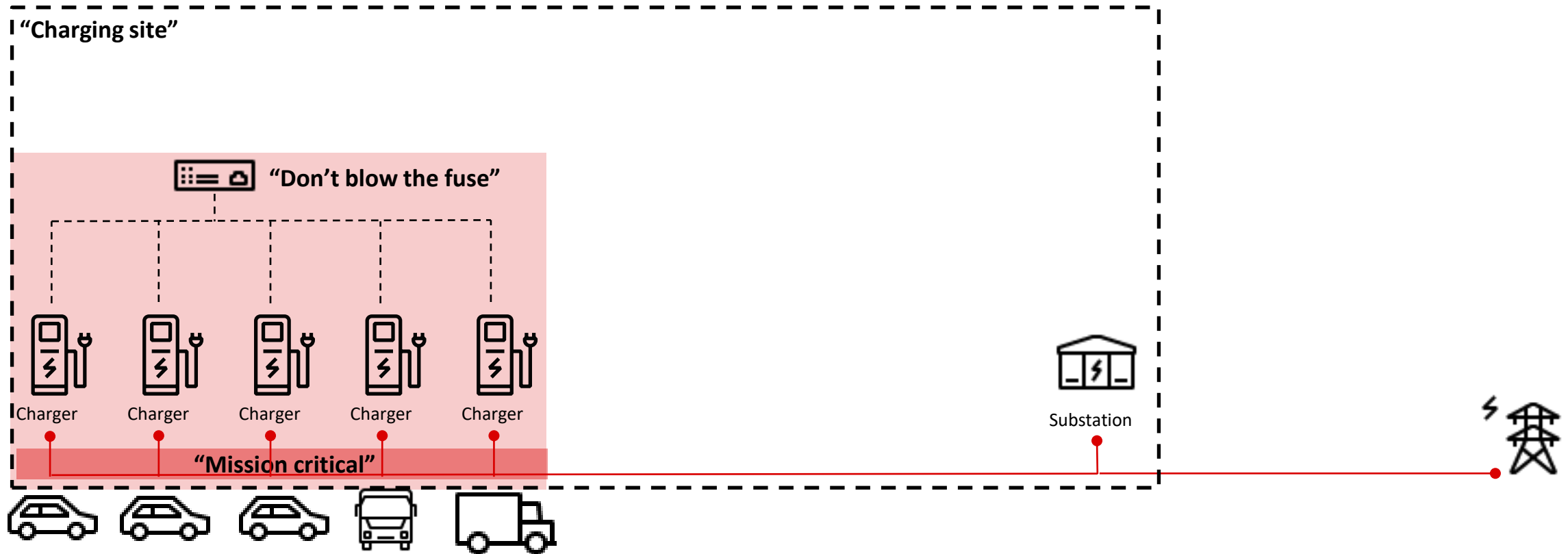


# Evolution of the EV Charging value chain

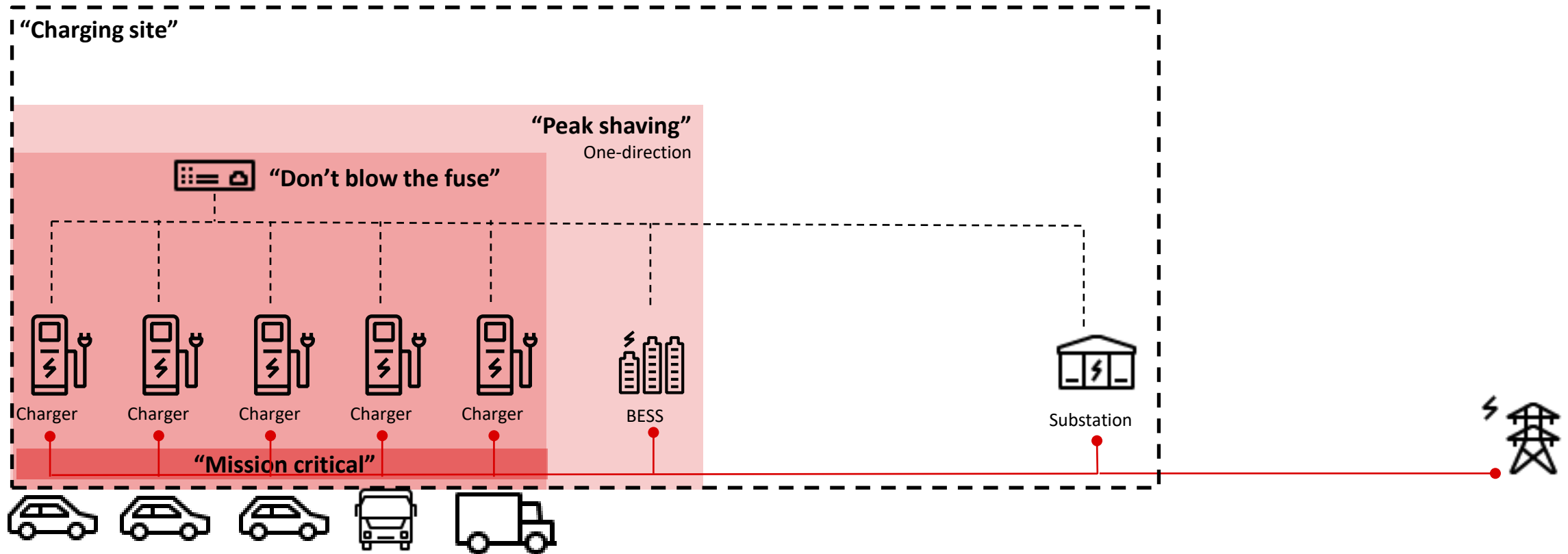




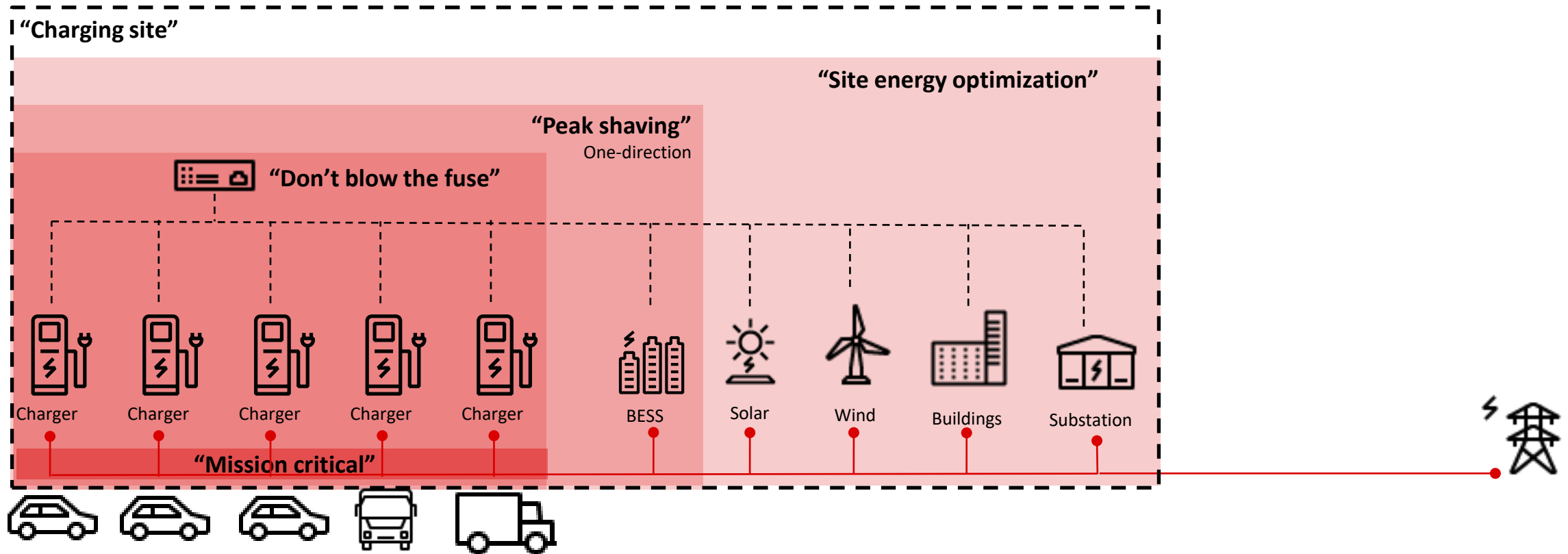
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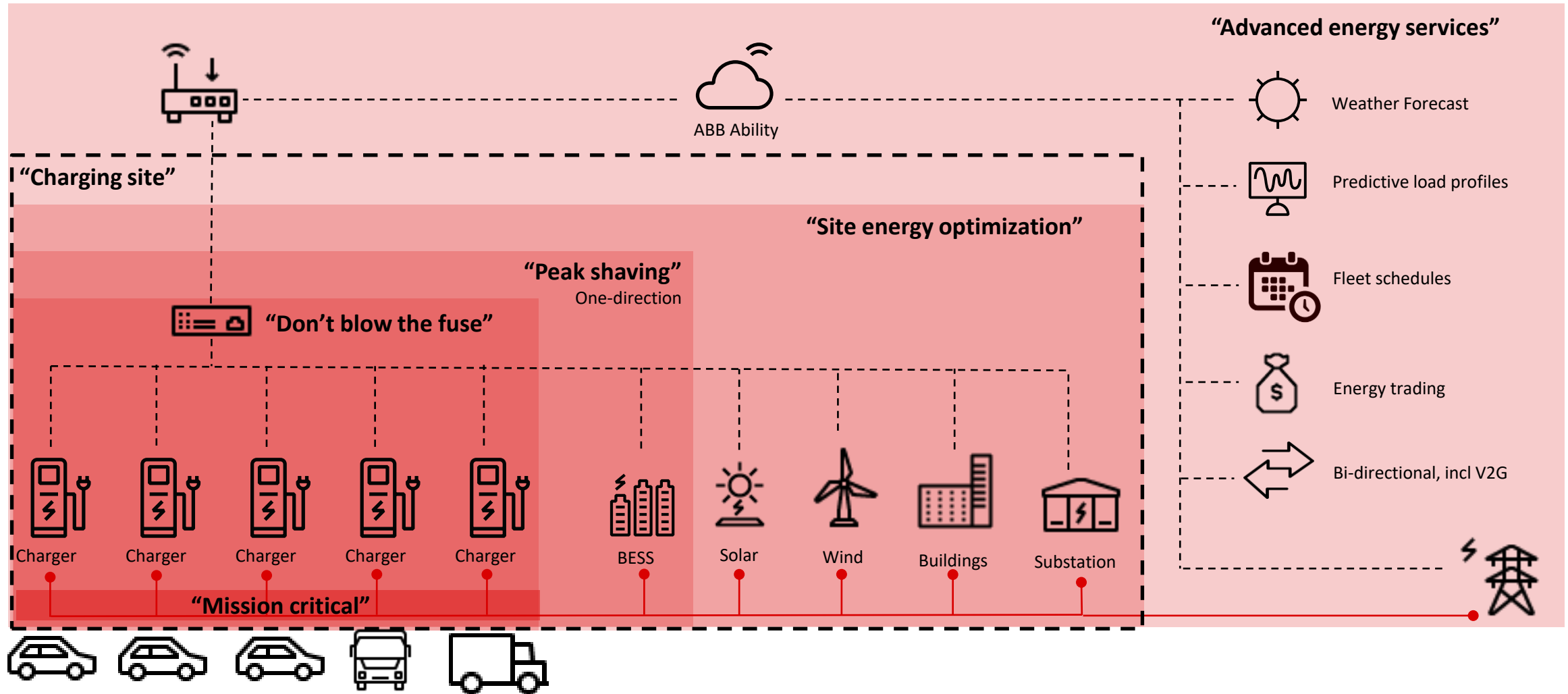
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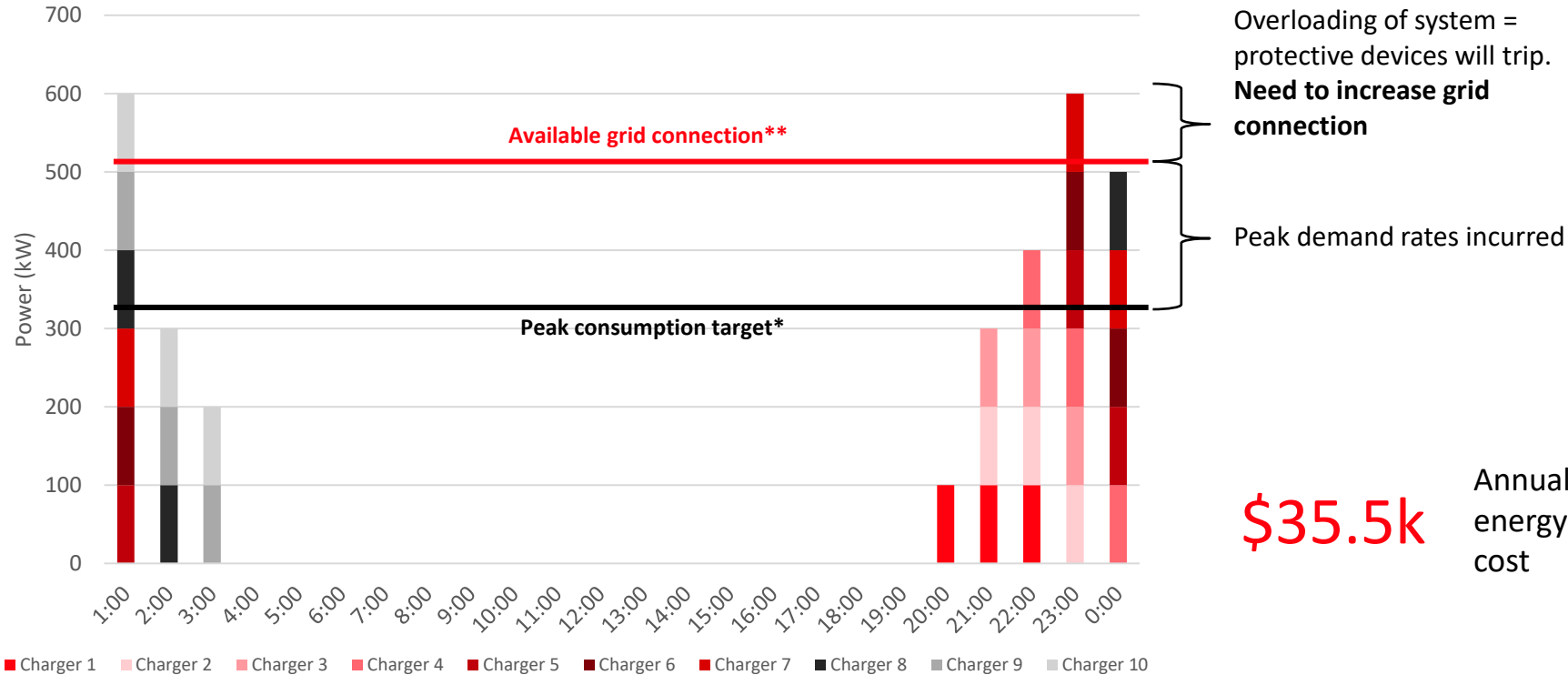
# Evolution of the EV Charging value chain



# Why energy management is important?

Bus Depot Example: 10 Buses, 300kWh Battery each, max 100kW Charging, 10 Chargers

## Without EVSS Control 100



**Loss of charging operations**



**CAPEX impact: Requires electrical infrastructure upgrades**

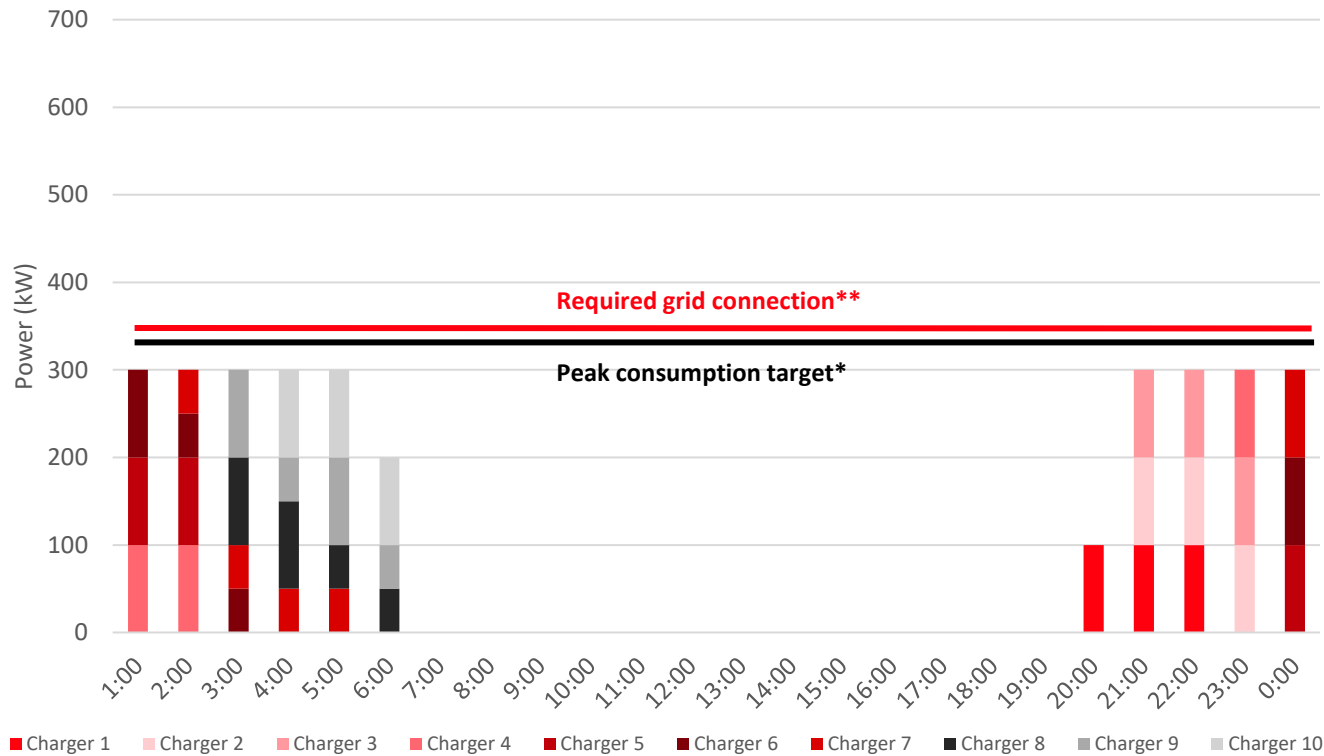


**OPEX impact: higher energy costs**

# Why energy management is important?

Bus Depot Example: 10 Buses, 300kWh Battery each, max 100kW Charging, 10 Chargers

## With EVSS Control 100



No need to increase grid connection = **CapEx savings**

**\$10-150k**  
Dependent on local site conditions

Avoided grid upgrade costs

Peak reduction = **OpEx savings**

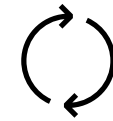
**\$19.9k**

Annual energy cost

**44%**



Cost saving



**Continuous operations, no black-outs**



**Reduced operating costs**



**Faster return on investment**

**ABB**