eMobility Infrastructure Design guide for building applications

IEC Design Guide

01/2023

se.com/emobility

Life Is On | Schneider Electric

Legal and safety information

Important Instructions

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it.

The following special messages may appear throughout this guide or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a "Danger" or "Warning" safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER
DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury. **Failure to follow these instructions will result in death, serious injury, equipment damage, or permanent loss of data.**

⚠ WARNING
WARNING indicates a hazardous situation which, if not avoided, **can result in** death or serious injury. **Failure to follow these instructions can result in death, serious injury, equipment damage, or permanent loss of data.**

⚠ CAUTION
CAUTION indicates a hazardous situation which, if not avoided, **can result in** minor or moderate injury. **Failure to follow these instructions can result in injury or equipment damage.**

NOTICE
NOTICE is used to address practices not related to physical injury. The safety alert symbol shall not be used with this signal word.

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When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

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NOTICE

POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY

- Change default passwords at first use to help prevent unauthorized access to device settings, controls, and information.
- Use cybersecurity best practices to help prevent unauthorized exposure, loss, modification of data and logs, or interruption of services.

Failure to follow these instructions can result in a non-operational system where the Wireless Panel Server is installed.

Purpose of this Document

Target Audience

This design guide is intended for certified EcoXpert partners, System Integrators, Specifiers, Electrical distribution designers, Installers, Electricians and other qualified personnel who are responsible for the design and definition of eMobility infrastructures.

Objective

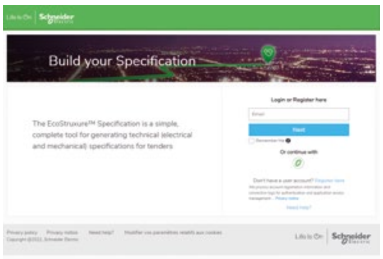
The objective of this document is to offer support and guidelines to fulfill the needs of customers in charge of eMobility infrastructures deployed in building and fleet applications.

This document details the system design considerations for the electrical installation that must be taken into account when designing an eMobility infrastructure with electrical distribution and digital architecture.

It also helps to select the most appropriate architecture according to the building owners and charge point operators' needs, and provides guidelines on implementation to meet the system design considerations.

This technical guide provides a special focus on all the necessary building blocks required at each level, for each application.

Build your specifications



To evaluate the systems, connect to Schneider Electric on-line specification tool.

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MiEV
ELECTRIC VEHICLE

INTRODUCTION

EcoStruxure for eMobility

Introduction

Part of EcoStruxure™, our IoT-enabled architecture end-to-end platform, EcoStruxure™ for eMobility is a holistic solution, beyond the charging infrastructure, where the whole electric mobility ecosystem is connected to provide an optimized and cleaner energy management strategy for multifamily homes, commercial and industrial buildings and fleets of vehicles.

This involves building the mobility of the future.

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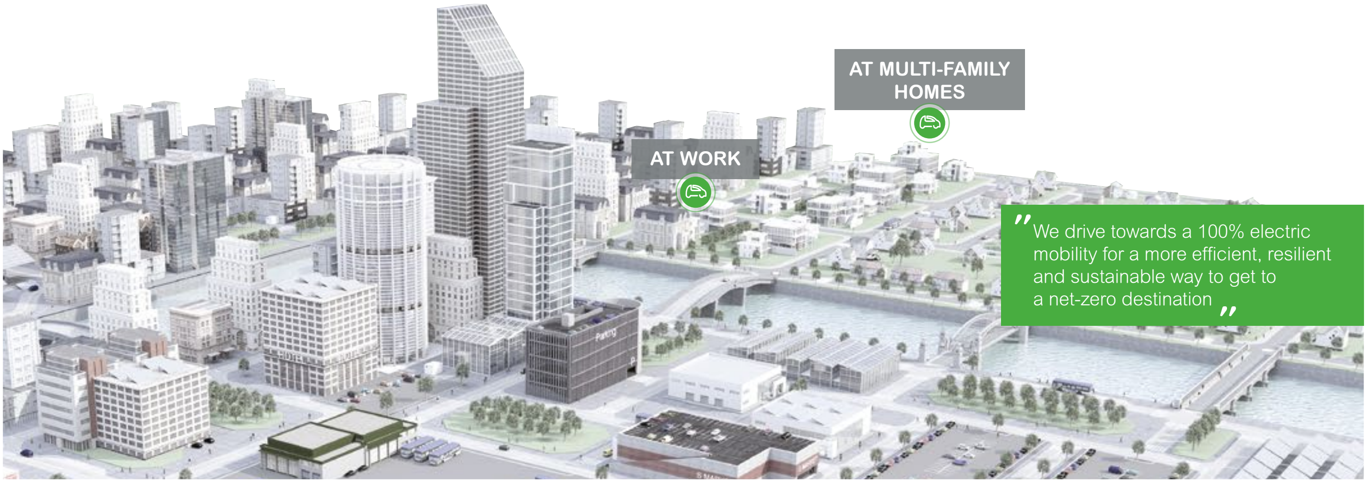

EcoStruxure for eMobility | Schneider Electric

Open architecture for customer flexibility	Vendor agnostic solution that connects EV chargers, power distribution and software to enable services.
EcoStruxure ready	Open to EcoStruxure digital architectures.
Building upgrade solutions	Deep expertise in electrical distribution enables end-to-end customer solutions, managing electrical upgrades easily

EcoStruxure for eMobility




Charging Station Management System (CSMS)

APPS, ANALYTICS AND SERVICES

EcoStruxure™ EV Advisor

Cloud-based supervision for installers, fleet operators, and charge point operators, to easily commission, monitor, and control the EV charging infrastructure.

Schneider Electric for eMobility solution is open to third party*

Supervision

EDGE CONTROL

EcoStruxure™ EV Charging Expert

A charging load management system that helps efficiently control EV infrastructure and smartly distribute available power to the charging stations.

Load management system

CONNECTED PRODUCT

EVlink Charging Stations

EVlink Pro AC Metal | EVlink Pro AC | EVlink Smart Wallbox | EVlink DC fast charge

Equipment

EV Supply Equipment (EVSE)

*to be confirmed with third party vendors

Electrical distribution for eMobility
From grid to EV

PrismaSeT Switchboard | Canalis EVlink terminal distriution kit | iMnx Undervoltage release tripping unit | iEM Energy Meters | Acti9 A-Si type Earth leakage protection | or | Acti9 B type Earth leakage protection

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A

General Methodology

Designing eMobility Infrastructure for residential and commercial buildings

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An electrical installation for charging station infrastructure is much easier to define if you consider 4 main inputs before designing the architecture:

Understanding EV drivers charging usages

SECTION 1

- > EV drivers' profiles and needs
- > Charging capacity and parking configuration
- > Customer case illustration

Defining electrical distribution, and installation characteristics

SECTION 2

- > Main criteria that can influence design
- > Electrical Infrastructure integration
- > Installing Electrical Vehicle Supply Equipment (EVSE)
- > Customer case illustration

Setting the appropriate power management strategy

SECTION 3

- > Load Management System overview
- > Dynamic versus Static loads management
- > Smart charging and local energy generation
- > Customer case illustration

Considering the operational requirements

SECTION 4

- > Communication network definition and cybersecurity recommendations
- > Cloud-based Supervision Systems
- > Cloud-based Supervision of the EV charging infrastructure through Facility Management Systems
- > Service plan and infrastructure extension
- > Customer case illustration

Reference Architectures

SECTION 5

SECTION 1

Understanding EV drivers charging usages

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Who has charging needs?

- ☐ Dwelling owners or tenants in residential buildings
- ☐ Employees or/and visitors at tertiary buildings
- ☐ Customers, subscribers

What are EV drivers charging needs?

- ☐ Number of EV drivers, number of charging sessions
- ☐ Average charging time and average number of sessions
- ☐ Extra range expected per charging session

What is the parking configuration and where are the charge points going to be installed?

- ☐ Number of parking zones
- ☐ Number of parking spaces
- ☐ Outdoor and/or underground
- ☐ Individual and/or shared parking

How many chargers are going to be installed?

- ☐ Less than 10
- ☐ From 10 to 100
- ☐ More than 100

What is the expected capacity per charge point?

- ☐ AC from 3.7 to 22 kW
- ☐ DC ... kW

Is there any plan to extend the EV charging infrastructure in the future?

- ☐ ....

Understanding EV drivers charging usages

1 / EV drivers' profiles and needs

How long will the EV drivers stay?
What distance has been traveled before reaching the stopping area or what distance will be traveled afterwards?
When did they arrive?
When will they leave?

Each EV driver has got their own mobility profile and at this stage it's only possible to define or estimate the typical usage based on the place where they will charge.

The turnover of vehicles can be different considering the targeted usage of each charger.

As an example, for residential markets, the vehicles will mainly be charged overnight, while fast charging will be requested for supermarkets and top-up loads, and very fast charging will be required to recover a full carload on highways.

Authentication modes, tariff rules, and reservation methods are also significant levers influencing the EV driver behavior and the level of frequentation.

Correspondence between charging station location and Electrical Vehicle Supply Equipment (EVSE) power:

Total power output of the charging system

Requirements for charging site: quantity of charging points and durations				
Site typology	Residential buildings	Work places	Shopping malls	Stores
Charge time	8-12 h	8 h	1-2 h	30-60 min
Extra range	50-300 km	50-150 km	20-100 km	20-60 km

Average charging time of a typical electric passenger car for a 40 km trip

22 kW charging station	7 kW charging station	Domestic socket
20 min	1 h	+4 h

> Learn more

Wiki guide for Electrical Vehicle charging

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Focus on technology

As an example, with Mode 2, the charging capacity is limited to 2.3 kW, while Mode 3 provides faster and more efficient 7.4 kW capacity for battery charging.

The effective charging capacity is defined by the weakest link.

Vehicle charger	Cable/charging mode	Charging point	Effective charging capacity
7 kW	2.3 kW (Mode 2)	Domestic power socket 2.3 kW (Mode 2)	2.3 kW
7 kW	7.4 kW (Mode 3)	Charging station 22 kW	7.4 kW

M A

Understanding EV drivers charging usages

2/ Charging capacity and parking configuration

How many and what type of charging points should I install?
What minimum power would be necessary?

Today there is no real standard rule to define or to give a straightforward answer to these questions but there are more and more local regulations that accompany eMobility market growth and fast-growing sales of BEV and PHEV vehicles.

The first stage will be to check the local regulations and guidelines.

Without considering any local rules, here are some guidelines and recommendations for estimations.

Number of EVSE to be pre-set in any installation

$$N * A = \frac{P_{ev}}{P_{evse} * C\,fn}$$

N: total number of parking spaces at the location
A: percentage of parking spaces to be equipped with EVSE
P_{ev}: minimum power to be reserved for EV infrastructure at the location

Minimum power reservation for EVSE infrastructure design

$$P_{ev} = A * N * P_{evse} * C\,fn$$

P_{evse}: power of EVSE to consider as a reference for the location
C fn: demand factor

Defining charging station specifications

Charging capacity per charging point				
Power	3.7 kW	7.4 kW	11 kW	22 kW
Extra range / h	19 km	37 km	55 km	110 km

Charged range per hour calculated as 20 kWh / 100 km

Average charging time to charge 50 kWh (250 km) batteries to full

Power	Charging time	
22 kW	< 3 h	EVlink charging station
11 kW	< 6 h	
7.4 kW	< 8 h	
3.7 kW	< 15 h	
Domestic socket	< 27 h	

Focus on technology

The power of the source determines the charging speed*

Example: for a vehicle with a 40 kWh battery:

Source used	Domestic power socket	Dedicated AC power socket		Dedicated DC power socket
Power	Single-phase: 2.3 kW	Single-phase: 7.4 kW	Three-phase: 22 kW	Three-phase: 24 kW
Time for a full charge	18 h	7 h	2h30 min	2h
% of charge reached in 30 min	3%	7%	20%	25%

(*) Subject to the use of a suitable cable.

Learn more

Wiki guide for Electrical Vehicle charging

Understanding EV drivers charging usages

Defining minimum power reservation

Number of places to pre-equipped, based on the parking configuration

Parking places	N < 40				N > 40			
	A	P_{evse}	C fn	Minimum Power reservation	A	P_{evse}	C fn	Minimum Power reservation
Residential buildings	50 %	7.4	0.4	20 %	75 %	7.4	0.4	20 %
At work: offices or industrial buildings	10 %	11	0.4	10 %	20 %	11	0.4	20 %
Public parking	10 %	22	0.4	10 %	20 %	22	0.4	20 %
At destination	5 %	11	0.4	5 %	10 %	11	0.4	10 %

With :
N: total number of parking spaces at the location
A: percentage of parking places to be equipped with EVSE
P_{ev}: minimum power to be reserved for EV infrastructure at the location
P_{evse}: power of EVSE to consider as a reference for the location
C fn: demand factor

C fn should be adapted to car park usage and expected charging station availability.
C fn = 1 if you expect all your charging stations to be used at full power at the same time.

Understanding EV drivers charging usages

Charge Point Operator

Building owner

An office building with multiple areas and type of usages

CUSTOMER CASE
illustration #1

CUSTOMER CASE illustration #2

CUSTOMER CASE illustration #3

CUSTOMER CASE illustration #4

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The following usages have been defined:

Employees

Service vehicles / fleet vehicles:

It is considered that this category of vehicles can be charged over the night.

- a charge capacity of 11 kW could be enough to cover current needs.
- 22 kW chargers could be used to anticipate the increase in EV battery capacity and EV on-board charger

Private employee vehicles:

These are charged during the day.

- Three-phase 11 kW chargers can cover the need.

Visitor / Customer

Customer and visitor vehicles:

These are charged during the day.

- 22 kW chargers are appropriate for this use case.

Application	Chaging kW AC				Demand factor (Cfn)	Charging period	kW max	kW min	Total kW
	3.7	7.4	11	22			Day	Night	
Sales area									
Demo / Company cars				1	0.8	day	17.6	0	17.6
New car delivery		4			0.5	night	0	14.8	14.8
Cars for tests drives				1	0.5	day	11	0	11
After sales area									
Service loan cars		4			1	night	0	29.6	29.6
Repaired customer cars				2	0.5	night	0	22	22
Customer parking area				4	0.6	day	52.8	0	52.8
Employee parking area		8			0.4	day	23.68	0	23.68
Total							105.08	66.4	171.48

In this example, the power has been calculated with some demand factor (Cfn) below 1, assuming that a Load Management System such as EVlink Charging Expert is regulating the EVSE power demand.

Without a load management system, the demand factor would have been 1, as defined in IEC 60364-7-722 "Requirements for special installations or locations – Supplies for Electric Vehicles".

SECTION 2

SECTION 2

Defining electrical distribution and installation characteristics

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What is the power capacity dedicated to the charging infrastructure?

- ☐ ....
- ☐ ....

How is the charging infrastructure going to be supplied?

- ☐ Individual utility meter for each parking spaces (residential buildings)
- ☐ Dedicated supply for the EV charging infrastructure
- ☐ Supplied from the building
- ☐ Single phase / Three phases

Are there any existing chargers to be considered - Schneider Electric or other manufacturers?

Where are the chargers going to be installed?

- ☐ Outdoor / underground
- ☐ Wall mounted / floor mounted

How is the electrical / power distribution going to be managed?

- ☐ Centralized (switchboard) versus distributed (CANALIS)
- ☐ New switchboard to be created versus existing switchboard upgrade
- ☐ Protection / metering in the charger versus protection in the switchboard / tap-off unit

Are there any power meters already installed?

- ☐ ....
- ☐ ....

Power requirements and installation characteristics

1 Main criteria influencing design

What is the required electrical protection?
How is the charging infrastructure going to be supplied?
Does it impact my Infrastructure's electrical distribution?

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Electrical Vehicle standards

Charging an electric vehicle means connection to a powerful electricity supply.

All electrical installations should be properly designed, constructed, and treated according to the IEC standards for EV installations.

The International Electrotechnical Committee (IEC) has defined a set of standards, covering devices, protection and electrical installation.

The user or integrator should always perform an appropriate complete risk analysis, and test the system with respect to the relevant specific application or use thereof.

Learn more:

IEC 61851 standard for EV supply equipment (EVSE)

This standard defines the fundamental aspects of EV charging and contains all the requirements covering the EVSE, as equipment. Therefore, the EVSE must comply with the IEC 61851 series and shall be supplied according to IEC 60364-7-722 Requirements.

Electric Vehicle Supply Equipment complying with IEC 61851-1 edition 3

IEC 60364 -part 7-722 for Low Voltage installations

The international series of standards for Low Voltage Electrical Installations (IEC 60364 series) contains a new part dedicated to supplies for electric vehicle.

IEC 60364 part 7-722 requires electrical protective measures:

- **Protection against short-circuits and overloads with circuit breakers**
- **Protection against electric shocks and risks of electrocution with a 30 mA RCD.**
- **Protection against overvoltage with a surge protection device (SPD).**

Acti9 iC60 circuit breaker

Acti9 B type Earth leakage protection

Acti9 Surge Protection Device

Power requirements and installation characteristics

EV Supply Equipment electrical protection and metering

The EV READY Mark is a certification mark that provides an answer to the questions of **Interoperability, Security and Performance for Electrical and Hybrid Rechargeable Vehicle (EV) Charging Stations**.

Launched on the initiative of automobile manufacturers Renault-Nissan, the EV READY mark is the result of technical quality work undertaken at numerous workshops with representatives of all the players in this industry (vehicle manufacturers, charging station manufacturers, installers, operators, utilities, networks, standardization organizations, third party laboratories, etc.).

The EV READY mark results in a Third-Party Certification process that takes into account both the product and its installation. In this context, ASEFA is the certification body for this mark and delivers the following certificates:

- ASEFA Certificate type 5 for Products
- ASEFA Qualification Certificate for Installers
- EV READY Certificate for Installed Products

Learn more

Wiki Guide
for electric vehicle charging

White Paper
Safety measures for electric vehicle charging

Technical reference document
"E.V. READY" Certification

Guide
Earth Fault Protection

Focus on technology

Schneider Electric Power distribution

Electrical Protections

Energy Efficiency

Scalability

Metering solutions display the active energy consumed to:

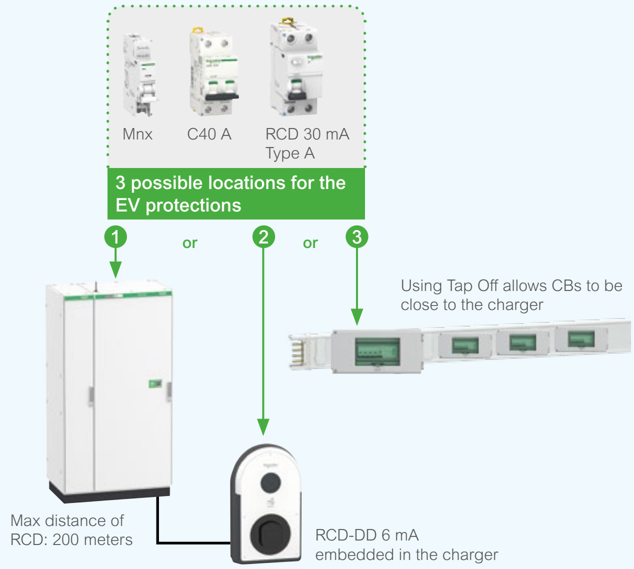
- Maximize the power allocated to the EV infrastructure in residential, commercial and industrial buildings.
- Provide a MID certified meter so that payment and billing is linked to the amount of energy consumed.
- Send active energy consumed information in OCPP to a supervision system with communicating meters.

Power requirements and installation characteristics

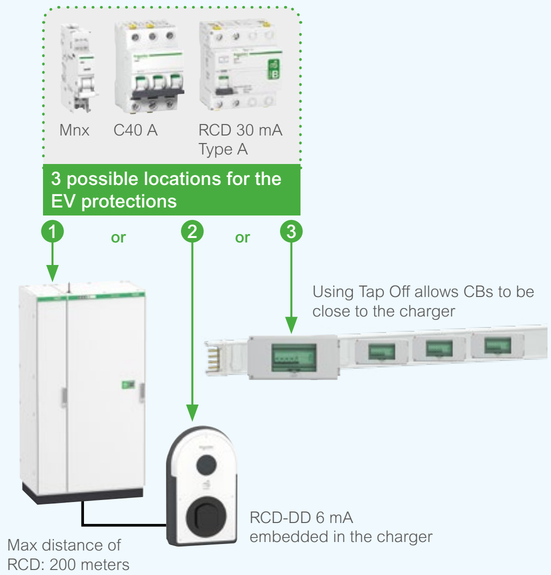
Designing electrical distribution

Charging infrastructure for indoor parking

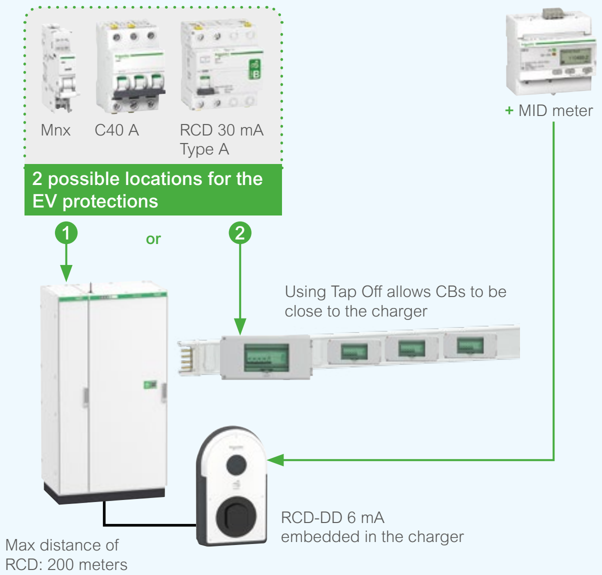
Single phase without MID meter



Three phase without MID meter



Three phase with MID meter



Note: infrastructure set-up is always related to needs and must comply with local regulations.

Power requirements and installation characteristics

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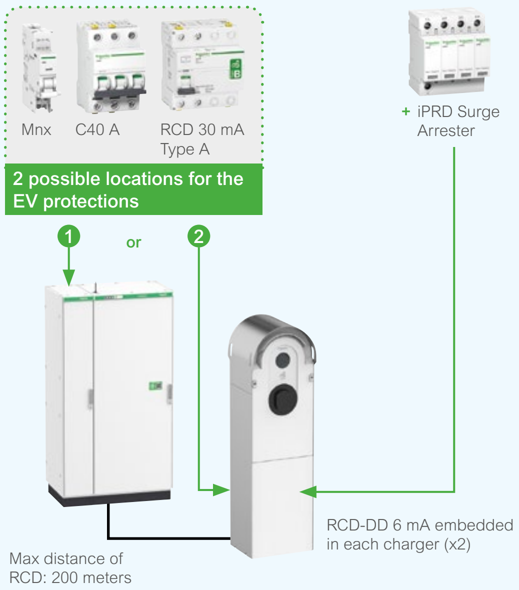
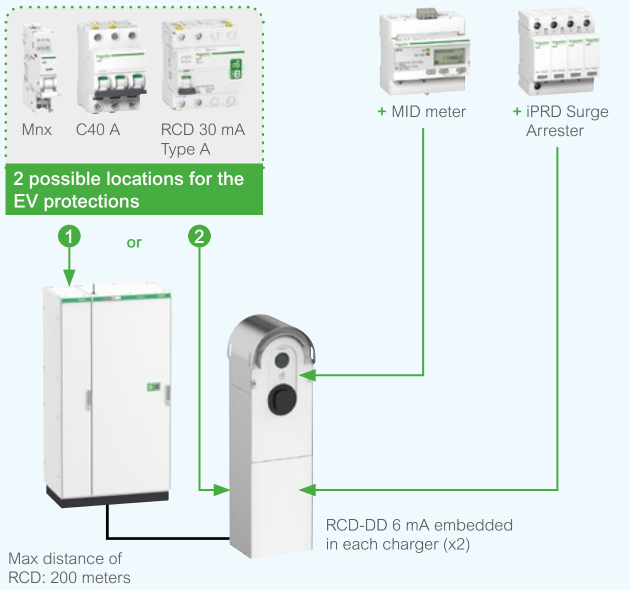
Charging infrastructure for outdoor parking

Three phase with surge arrester



Three phase with surge arrester and MID meter



Power requirements and installation characteristics

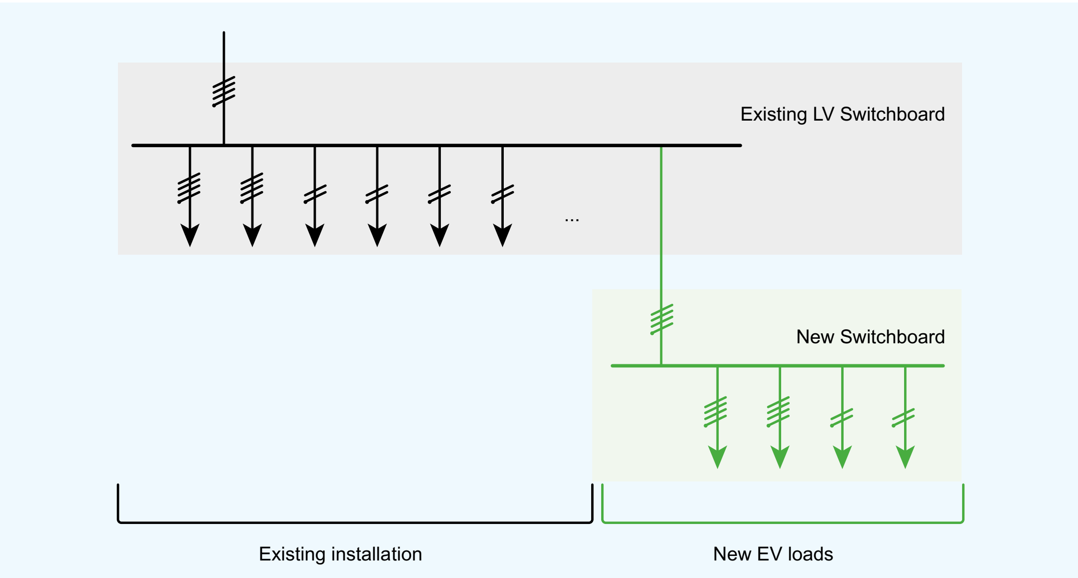
2 Electrical Infrastructure integration

The integration of EV charging supply equipment requires an integration of several high-power loads and an adaptation to the existing electrical infrastructure.

This section presents basic principles for designing the EV charging infrastructure and its integration into the existing electrical installation.

EV charging power demand lower than the installed power demand

If the amount of charging points and their capacity is significantly lower than the installed power, an option to investigate could be to integrate the EV chargers into the existing electrical installation.



EV loads integrated into the existing electrical infrastructure

A preliminary audit is required to assess the capacity of the existing installation to absorb the power demand of the new loads. It should be checked that:

- the utility can provide the new power demand.
- the existing busbar is adequately sized to absorb the new power demand.
- the existing LV panel is adequately sized to absorb the new power demand, and to integrate the additional protection equipment for the EV circuits.
- overcurrent protection selectivity can be achieved between the main circuit breaker and the circuit breakers at the EV circuits.
- selectivity can be achieved for the residual current protections between the main Residual Current Device (RCD) and the RCDs in the EV circuits.
- the RCDs in the existing installation can operate in the presence of DC leakage currents induced by the EV supply equipment.
- overvoltage protection including the new EV charging stations is achieved, with the addition of SPDs if necessary

The integration of EV chargers into the existing electrical infrastructure is an interesting option if it does not require significant changes or replacement of equipment.

Power requirements and installation characteristics

At this stage of the project, an audit is highly recommended to identify the power load that can be added without changing the existing electrical infrastructure. Energy efficiency measures could be proposed to reduce the existing consumption and therefore increase the power demand that can be added.

Local power supplies and storage could be proposed to compensate for the impact of integrating the EV charging equipment.

If the existing LV switchboard cannot accommodate the additional power and/or devices required, the option described in next paragraph is recommended.

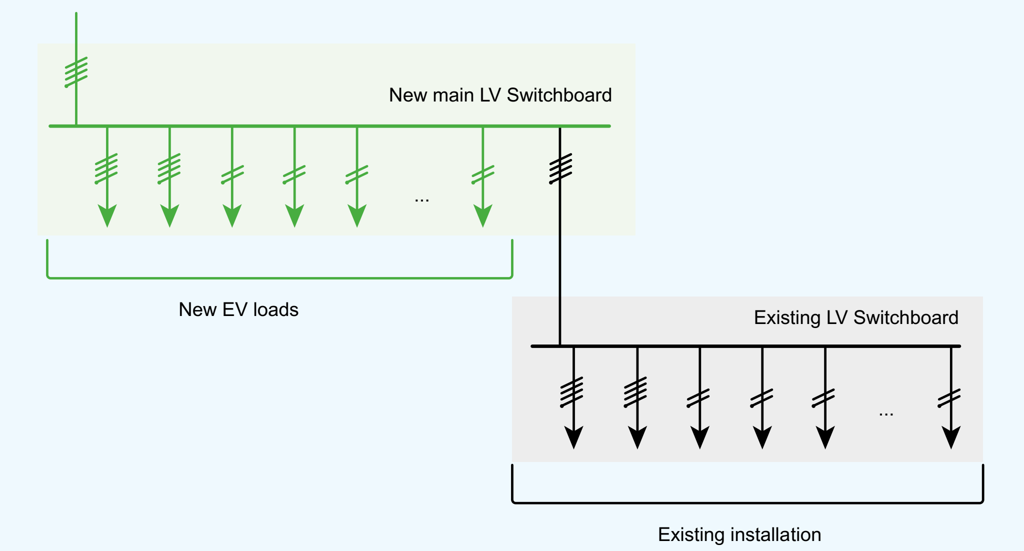
EV charging power demand equivalent to or higher than the existing power demand

If the power demand of the new EV loads is equivalent to or higher than that of the existing electrical installation, it could be preferable to install a new main LV switchboard to integrate all EV loads.

The existing electrical infrastructure will be connected to this new main LV switchboard. An overcurrent and residual current protection selectivity need to be achieved between the existing installation feeder and the new main incomer.

If there are several EV chargers located in the same area, secondary LV switchboards could be installed close to the EV charging area in order to optimize the cable length.

The creation of a new main LV switchboard presents the advantage of minimizing the changes to the existing electrical installation. In addition, it offers the opportunity to coordinate protection devices, and thus optimize the power availability.



EV loads integrated into a new main low voltage switchboard

Power requirements and installation characteristics

Use of local energy supplies to compensate for the EV charging power demand

The integration of EV loads increases the power demand of the electrical installation significantly.

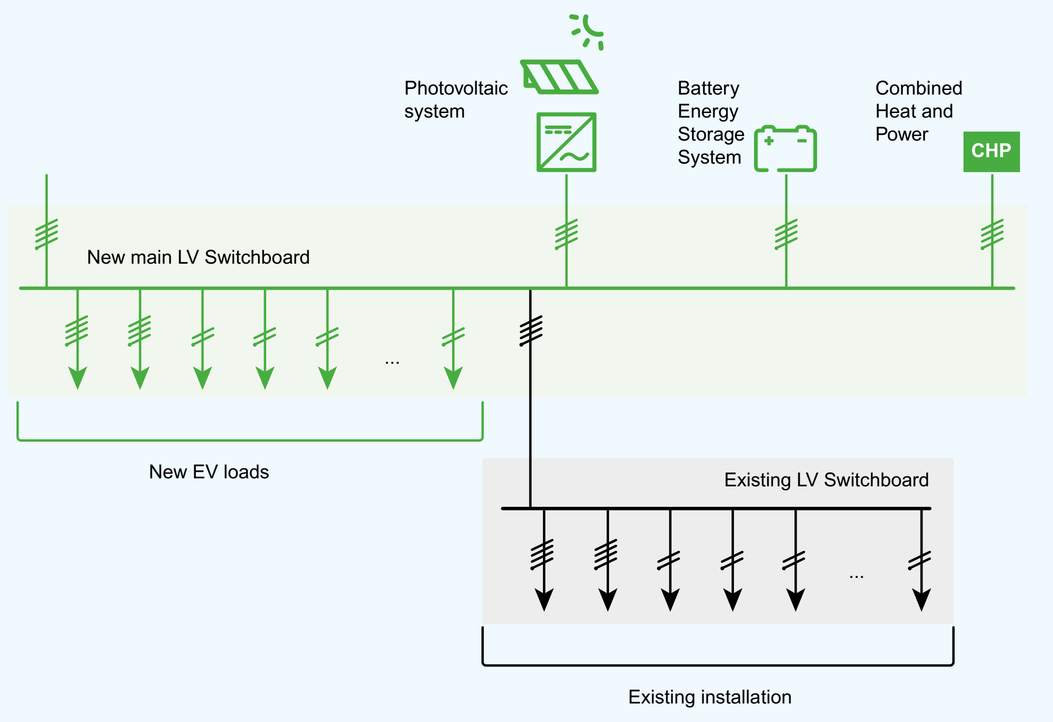
An extension of the local energy infrastructure is often required. A switch from a LV grid connection to a MV grid connection could be necessary in certain cases.

In addition to the electrical infrastructure, the electricity contract with the energy provider needs to be reviewed.

To limit or avoid these types of significant modifications to the existing local installation, local energy power supplies can be added, such as:

- Photovoltaic system: for local energy production and a commitment to sustainability.
- Energy storage system: to avoid power demand peaks and optimize solar production use.
- Combined heat and power (CHP): combined heat and power production if relevant.

Local power supplies can be connected to the new main LV switchboard. Their integration into an existing electrical infrastructure requires a preliminary audit.



EV loads and local power supplies integrated into a new main low voltage switchboard

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Power requirements and installation characteristics

3

Installing Electrical Vehicle Supply Equipment (EVSE)

Should EVSE be installed on the floor or wall mounted?
How can you scale up your needs?

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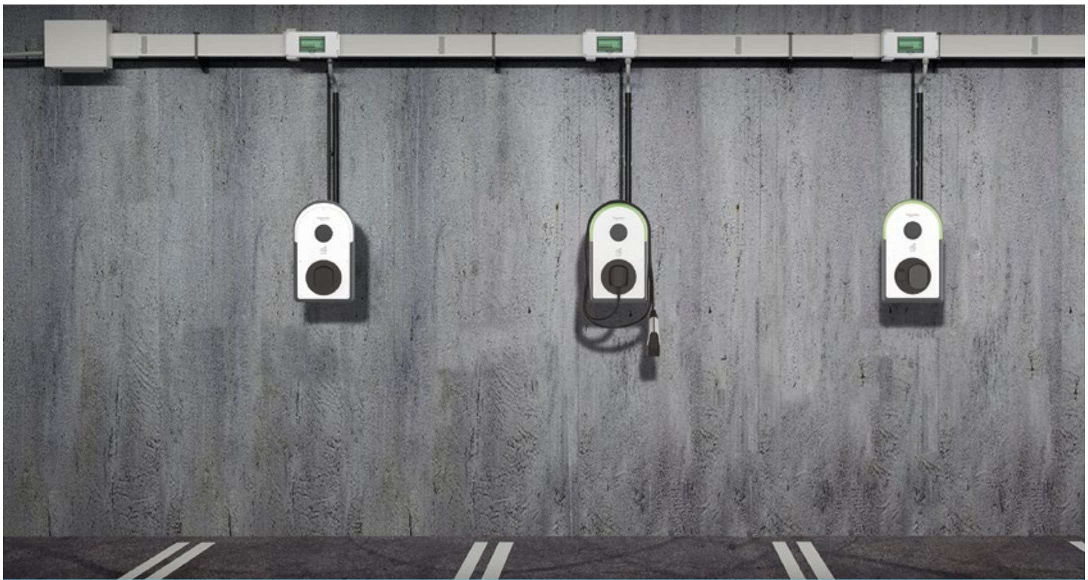
Floor or wall mounted EVSE are easy-to-install, flexible and cost effective solutions for indoor or outdoor areas.

After having followed local design rules or guidelines for power reservation, you can start by installing a reduced amount of EVSE and then to scale it up progressively as per the need.

With centralized distribution, the LV switchboard will handle reservation.



Wall mounted

Floor standing

Power requirements and installation characteristics

How should it be installed?

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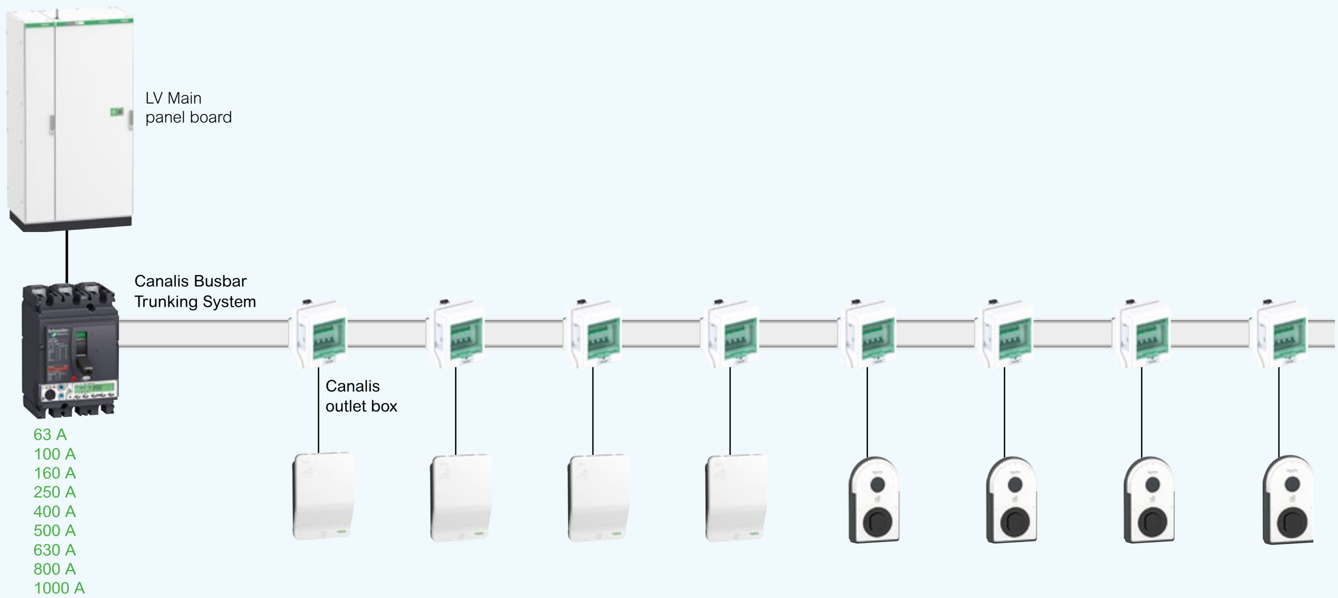
To minimize installation costs, and also to facilitate identification of EV charging areas, it is better to group charging points at the same location and then design the appropriate electrical distribution.

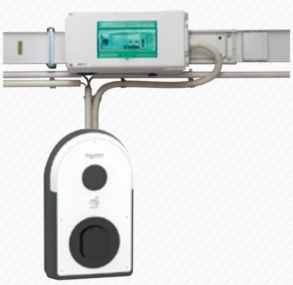
The charging station space should be identified with vertical signage (panel) as well as with a floor marking (horizontal signage).



EV infrastructure based on Canalis distribution system

Focus on technology

EVlink™ terminal distribution kit



Electrical distribution with Canalis™ busbar trunking system allows you to save time and costs during installation, and to be ready for future extensions.

- From 100 A to 1000 A
- Can cover the entire parking area
- Scalable without power switch-off
- Reassemble charging stations without power switch-off
- Easy access to circuit breaker and RCD Type B
- Optimized installation time
- Space saving

Power requirements and installation characteristics

Charge Point Operator

Building owner

An office building with multiple areas and type of usage

CUSTOMER CASE
illustration #2

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CUSTOMER CASE illustration #1

CUSTOMER CASE illustration #3

CUSTOMER CASE illustration #4

Power demand calculation:

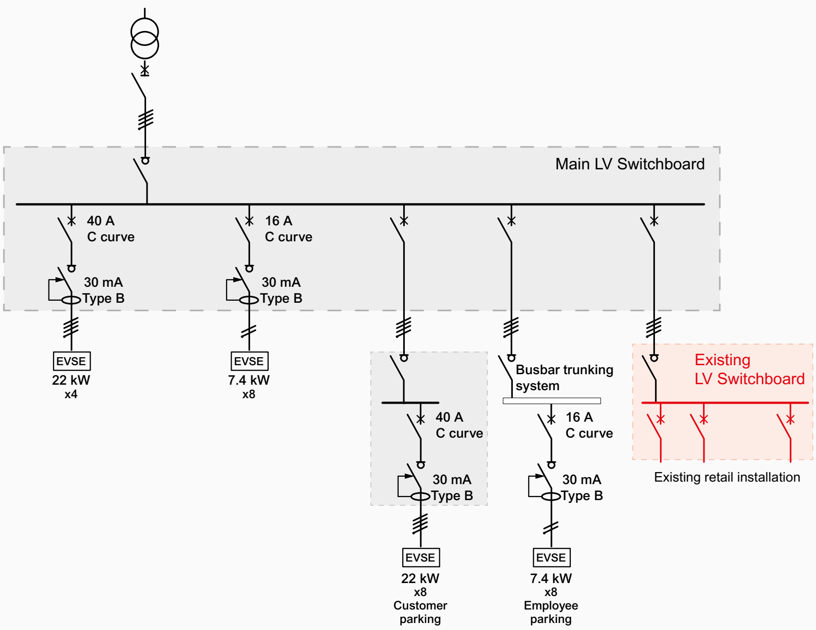
The power demand is calculated for the day-period and the night-period, assuming that the EV charging in the different areas takes place either during the day or during the night.

The maximum (day or night) power demand is used to size the electrical installation busbar, main incomer protection and switchboard, if a Load Management System pilots the EVSE.

Otherwise, the total power demand should be used for the sizing.

In this case, the overall EV power need is ~170 kW and this is higher than the 150 kW power installed in this office building (~2000 m²). Without any additional power generation, the choice is to add a new LV switchboard and to connect EV loads and the current building switchboard to the new LV switchboard (as per the fig. below).

The figure below gives an example of an EV charging infrastructure corresponding to the above assumptions.



All EV loads are connected to a new main Low Voltage Switchboard.

- Each EV circuit is protected by a circuit breaker and 30 mA type B residual current device as required by IEC 60364-7-722.
- As there are several single phase EVSE of 7.4 kW, it is recommended to connect them equally among the 3 phases to avoid unbalance
- As there are several EVSE located in the same area (outdoor customer parking), it could be worth while to install nearby a LV panel in order to optimize the number of cables and cabling length.
- As there are several EVSE located in the same area (indoor employee parking), a busbar trucking system can be used to provide upgradeable and flexible solution.
- As the existing dealership installation is connected to the new main LV Switchboard, overcurrent and residual current protection selectivity need to be considered.
- The additional new EV loads increase the power demand significantly. An MV connection is required.

SECTION 3

SECTION 3

Setting the appropriate power management strategy

What is the power capacity dedicated to the charging infrastructure?

- ☐ ....
- ☐ ....

Is there any risk that EV charging infrastructure power demand exceeds its power capacity?

- ☐ ....
- ☐ ....

Is there a need for dynamic optimization of power availability among the EV charging infrastructure and the building?

- ☐ ....
- ☐ ....

Is there any local energy generation to consider: PV, battery storage…?

- ☐ ....
- ☐ ....

EV charging power management strategy

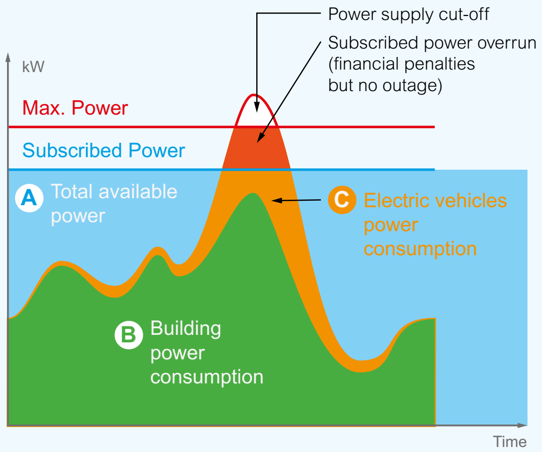
1 Load Management System overview

Why is a Load Management System recommended for controlling EVSE?

A Load Management System to control EVSE power demand is highly recommended as it optimizes the impact of a charging solution's consumption on an electrical installation.

The problem

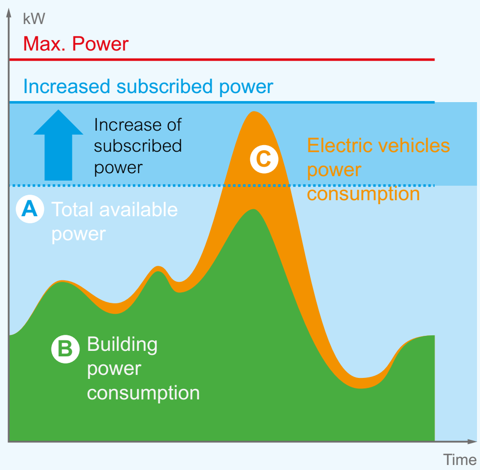
Initial situation



The installation of charging stations in an existing electrical installation can have a significant impact due to the power level required by electric vehicles to charge.

Solution without energy management

Increase of subscribed power



This solution consists of increasing the power subscribed from the energy supplier to maintain the same consumption model. It implies an increase in the cost of the subscription and that the trigger threshold can be exceeded. Thus the continuity of service of the building could be impacted.

If such a solution is not installed, the installation should be sized for the maximum power demand without considering the charging period and usage coefficient. As a result, the installation will be oversized compared to the real need, and the costs of the EV charging infrastructure will be higher.

Principle of load balancing between vehicles

When the load shedding is triggered, the algorithm allows the available energy to be distributed according to two strategies (depending on the settings):

- Based on the energy already consumed: the system interrupts the charging of the vehicles that have obtained the highest amount of kWh since the start of their charging, favoring new vehicles.
- Based on the connection time: the system interrupts the charging of the vehicles with the longest charging time favoring those last arrived.

In both cases, the system rechecks and updates the situation every 15 minutes.

In this case, with the existing loads, the new EV chargers and the photovoltaic production, we recommend a dynamic energy allocation via a general DYNAMIC setpoint.

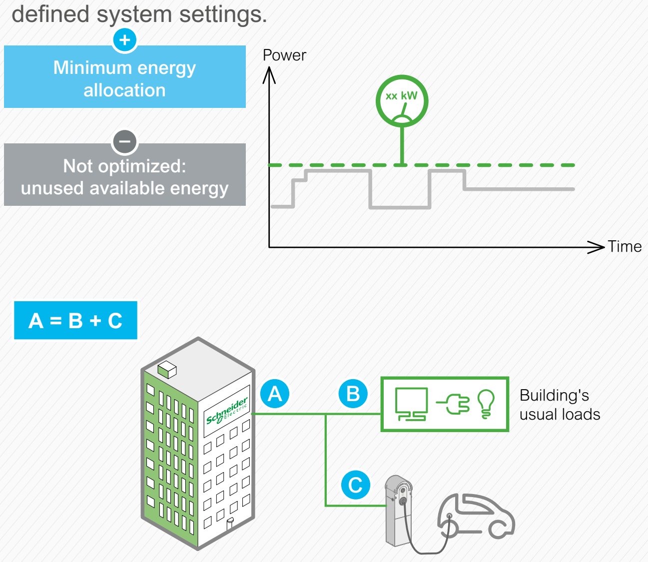
EV charging power management strategy

2/ Dynamic versus Static loads management

The Load Management System allocates the available energy on the site in real time to the electric vehicle charging network. In doing so, it would also temporarily limit the charging power to meet the energy constraints imposed by the rest of the electrical installation. Conversely, the power allocated may be higher at times when the energy consumption of the rest of the electrical installation is low.

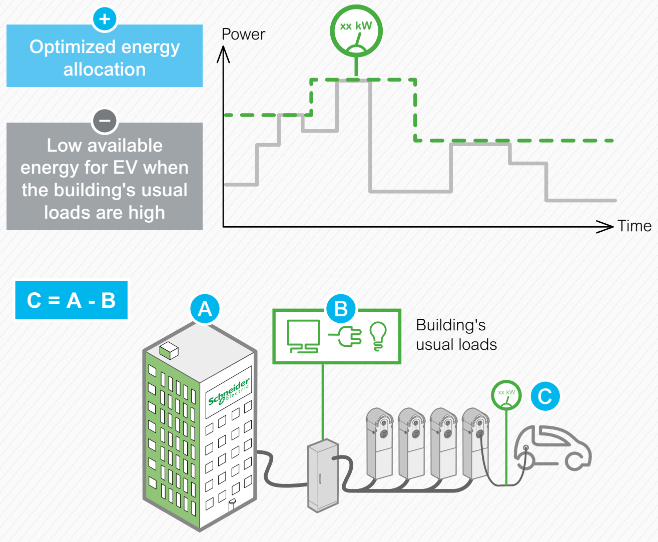
STATIC loads management

The maximum power value is equal to the subscribed demand or any fixed value. EV Charging Expert dynamically distributes the energy below that fixed value among the chargers based on the energy demand and defined system settings.



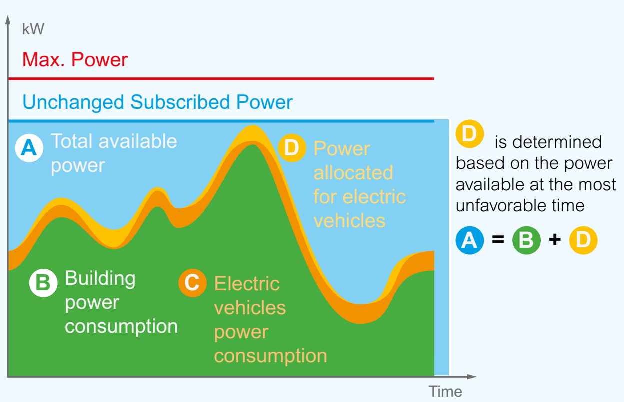
DYNAMIC loads management

The remaining energy at the building is allocated to the EV infrastructure in real time based on the energy demand and defined system settings.



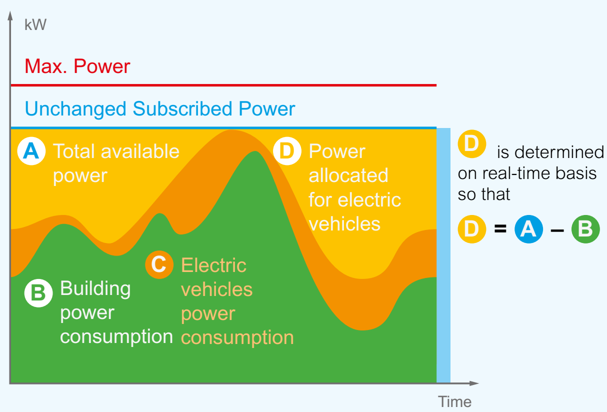
Determination of the dynamic setpoint

STATIC loads management



Setpoint "D" is fixed. The power is distributed between all connected vehicles.

DYNAMIC loads management



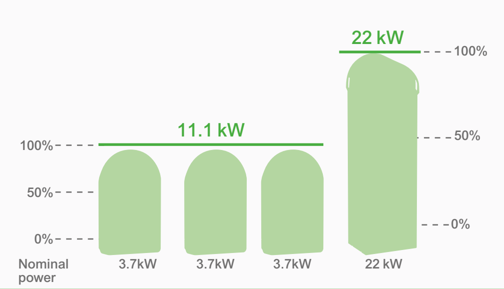
Setpoint "D" is adjusted in real time according to the consumption of the rest of loads in the building, to maximize the power allocated to charging electric vehicles.

EV charging power management strategy

Illustration of load reduction and load shedding operation

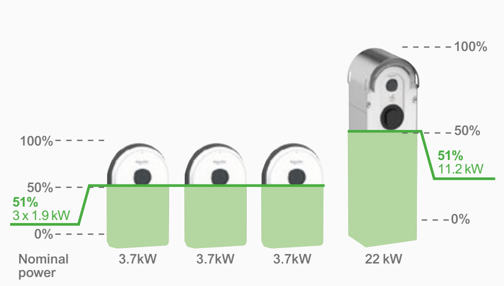
Available power in the building allocated to EV charging	Delivered charging power	Description

33.1 kW



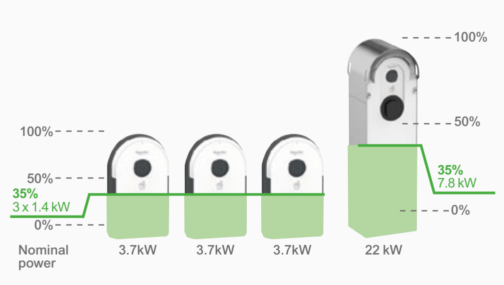
The full available energy is delivered.

17 kW



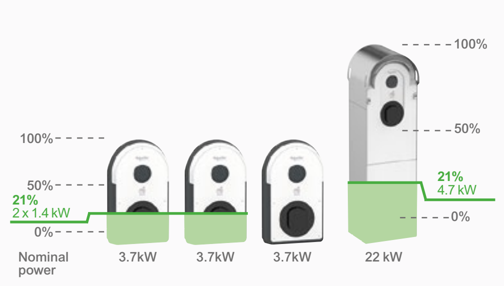
The energy will be delivered according to an equal percentage, in this example: 51%.
Details
17 kW / 33.1 kW = 51%.

12 kW



When reaching the minimum current setpoint of a charge point, its current level will be maintained so that the EV keeps charging.
Details
Min. current for an EV to charge (according to IEC 61851) = 6 A, representing 1.4 kW of a 3.7 kW charging station.
12 - (3 x 1.4 kW) = 7.8 kW, that are provided by the 22 kW charging station.

7.5 kW



If there is not enough power to feed all the charging stations, charge point load shedding will be triggered, following the load shedding rules.
Details
With 6 A (1.4 kW) per active charging station (IEC 61851 minimum current), the 7.5 kW of charging power are respected by switching off 1 charging station.
7.5 - (2 x 1.4 kW) = 4.7 kW, that are provided by the 22 kW charging station.

EV charging power management strategy

3/ Smart charging and local energy generation

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- **What is smart charging?**
- **Why do buildings need smart charging for EVs?**

How is smart charging different to traditional load management?

Smart charging

Smart charging refers to a system that is able to monitor, manage, and eventually regulate the use of EV charging devices with the aim of optimizing energy consumption.

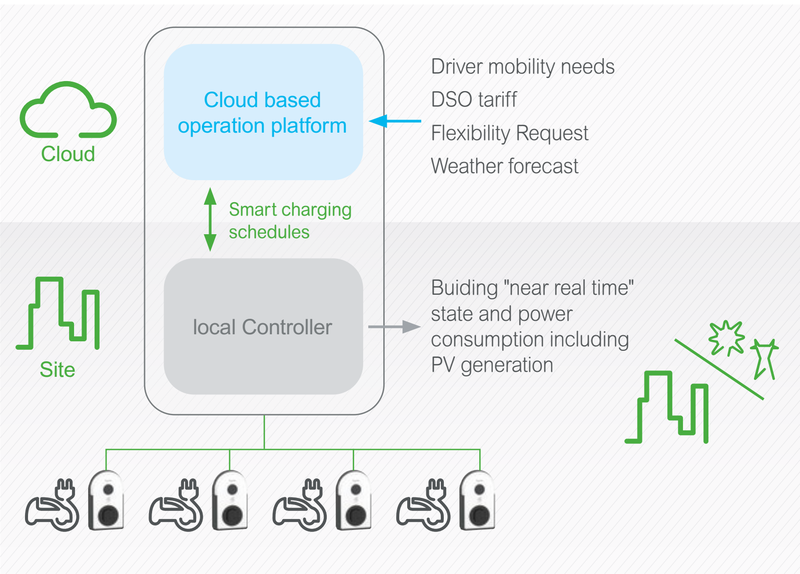
The adjective "smart" underlines how this solution is able to intelligently and flexibly adapt the charging strategy to meet both the needs of EV users and the power grid.

A smart charging system will allow flexibility, optimized energy consumption, infrastructure scalability, and cost efficiency.

Smart charging for EVs in buildings

A smart charging infrastructure ensures buildings have power availability by minimizing the EV charging infrastructure's impact on the existing power distribution system. Smart charging and digitization technologies are used to create a better, more efficient charging experience that makes it easier to integrate renewable energy and provide resilient power.

A smart charging system will reliably meet the increasing power demand from EVs in buildings.

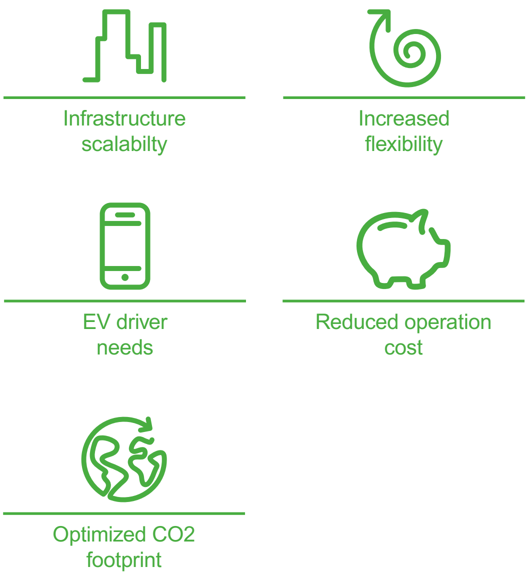


> Discover an architecture exemple that integrates microgrid values

Difference between smart charging and traditional load management

The term "smart charging" is frequently used synonymously with the terms "classic load management" and "dynamic load management". However, these are not the same.

Smart Charging goes further than a standard load management setup. It is an intelligent system with proactive logic to schedule and forecast, and therefore provides an optimal charging solution. In a nutshell, each EV plugged into the charging station charges with a specific charging profile. It not only takes into the account the needs of the EV driver (eg. Departure time etc.) but also respects the power limits of the entire installation. On top of this, a smart charging system gives significant OPEX savings to the infrastructure owner by optimizing the locally generated renewable energy (eg. PV installation on the building) and using the dynamic electricity tariffs for cost efficient charging.



EV charging power management strategy

Charge Point Operator

Building owner

An office building with multiple areas and type of usage

CUSTOMER CASE
illustration #3

CUSTOMER CASE illustration #1
CUSTOMER CASE illustration #2
CUSTOMER CASE illustration #4
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Load management system criteria:

- Total power of the building: 150 kVA
- Charging stations power demand: 170 kVA
- Total consumption limit: 250 kVA

Whatever the load of the building and the number of charging stations used at the same time, total consumption should never exceed 250 kVA by asking the chargers to adapt in real time to the building's other loads.

The current setpoint for each of the charging stations will be transmitted in real time to the vehicle which has 5 seconds to apply it.

Load Management System allocation method allows you to:

- Distribute the available energy evenly between all the vehicles being charged
- Sequence the loads between the connected vehicles simultaneously
- Control energy costs by subscribing the optimal energy contract from the energy supplier (might not be the case in countries where the energy contract has no limit)

To determine the dynamic setpoint dedicated to the charging infrastructure, the system shall be connected via:

- TCP / IP Modbus to a PM5320 / PM5370 / PM5365 (panel mounted) or PM5563 (DIN rail),
- or Acti9 iEM3x5x with Link 150 gateway,
- or PowerTag with Acti9 SmartLink SI D gateway,
- or MasterPact MTZ breaker and Micrologic control unit with embedded metering,
- or Compact NSX breaker and Micrologic control unit with embedded Schneider Electric metering..

EcoStruxure EV Charging Expert

This stands as a local controller located on the premises with several Charge Points connected, and is acting as proxy OCPP between the Charge Points and CSMS.

Its main role is to deliver an Energy Management system, optimizing the energy delivered to the Charge Points with the available production capacity, in a cost-effective solution.

Furthermore, it brings resilience of energy management in case of loss of connection in the EV infrastructure or with Cloud based CSMS, avoiding the Charge Points having to be run abruptly in degraded mode (6 A) in case of communication issues.

Lastly, it allows the Charge Points to be operated with CSMS while providing connectivity openness with an on-premises third party system for energy management monitoring and control.

SECTION 4

SECTION 4

Considering the operational requirements

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How are the eMobility services expected to be managed?

- ☐ Operated internally or delegated to a charge point operator
- ☐ On premise or cloud -based supervision

What are the eMobility services expected?

- ☐ User access management
- ☐ Cost allocation or charging evidence for free charging
- ☐ Automatic billing and payment / Ad-hoc payment means
- ☐ Public charging
- ☐ Reimbursement for company cars
- ☐ Troubleshooting and preventive/corrective maintenance

What is the communication network architecture?

- ☐ Connectivity to internet (IT service or 4G)
- ☐ Connectivity with chargers (Star or daisy chain topology)

Is there any building operation software that the EV charging infrastructure needs to be integrated with?

- ☐ Microgrid management system
- ☐ Building and energy management system

If yes...

- ☐ Schneider Electric Building Management System (EcoStruxure Power Monitoring Expert, EcoStruxure Building Operation, EcoStruxure Microgrid Advisor)
- ☐ 3rd party BMS

EV charging operations

1 Communication network definition

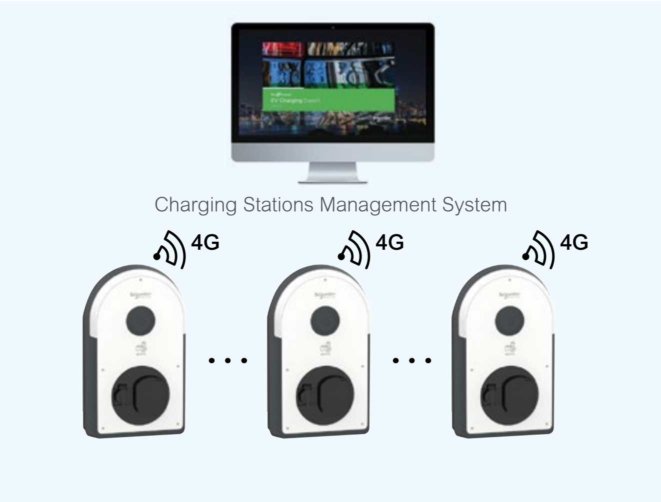
This section details the guidelines for the WAN (Wide Area Network: Internet network) and the LAN (Local Area Network for EV chargers based on IPV4 addressing) communication networks. The eMobility digital infrastructure relies on the Ethernet communication network wired for the LAN and wired or wireless for the WAN.

The choice of ethernet communication topology and addressing policy is driven by:
- Customer environment: interconnexion with existing IT infrastructure or isolated EV system
- Existing local edge controller in the EV infrastructure
- Maintainability - scalability of the communication network
- Level of openness of the EV LAN to third party system
- Cloud connectivity WAN and targeted level.

Key recommendations:
- Use Ethernet cables CAT6 as a minimum cable size, and check the cables during the commissioning with the appropriate verification tool
- Check the quality of Ethernet network thanks to manageable switch interface that provides diagnosis features
- Schneider Electric Ethernet switches are recommended. Avoid using Ethernet switches from different vendors
- For EVlink Pro AC charging stations, Ethernet ports parameters are by default set as follow:
  - Speed: automatic detection
  - Duplex mode: automatic detection
  - The recommended settings are: 100Mb/s and full duplex mode.

Wireless WAN connectivity without local Load management system

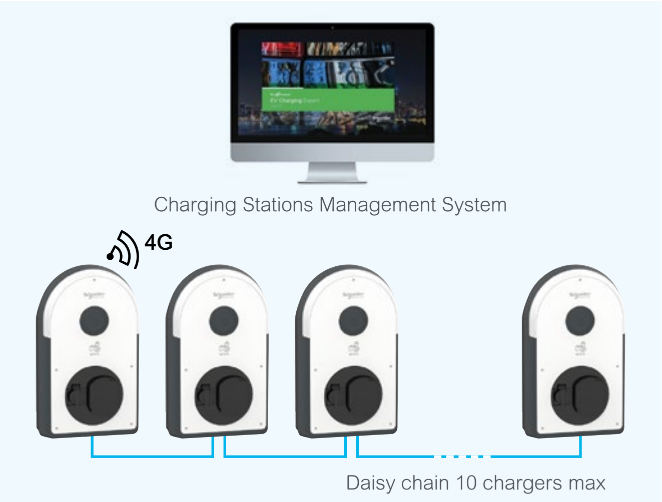
The choice of the wireless communication architecture depends on charging stations number and cost targets. The following illustrations details different possibilities:



Individual 4G modem* integrated in each EVlink Pro AC

This architecture provides an independent connection to CSMS for each charger and avoids any Ethernet cabling.

The antenna is embedded in the charger. It cannot be extended outside of the charger so the 4G signal shall only be available where the charger is located.



4G modem* integrated in one EVlink Pro AC

The antenna is embedded in the charger. It cannot be extended outside of the charger so the 4G signal shall only be available where the charger is located.

The wired Ethernet connection is represented as a daisy chain, but a star topology can also be used with an unmanaged switch.

*Optional accessory

EV charging operations

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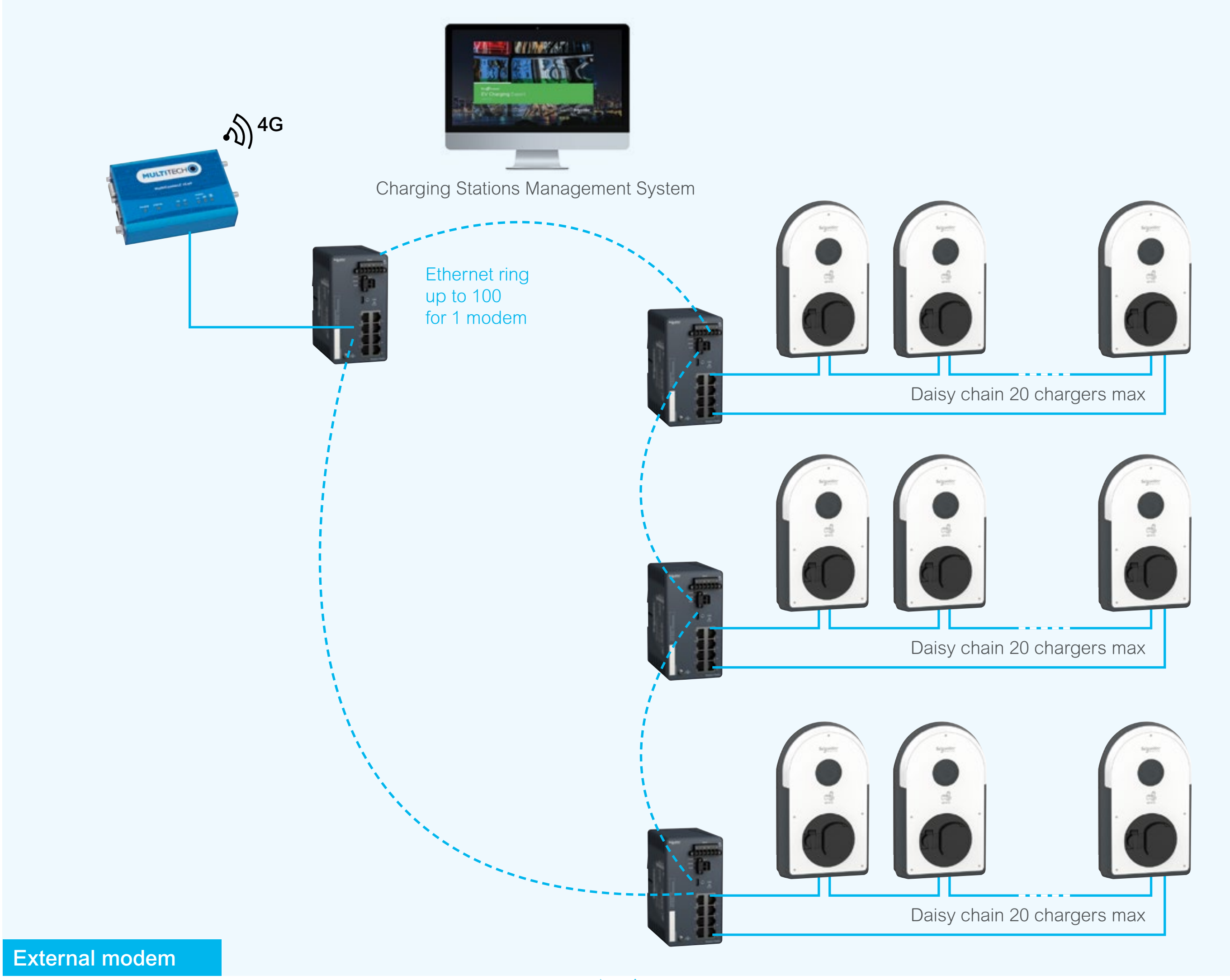


This IT design is recommended for a wireless internet 4G connection for more than 10 chargers, or in case 4G connectivity is located outside of the EV infrastructure.

This illustration shows a daisy chain loop on the LAN side, but a star topology can be used too.

See the next section.

Focus on technology

The Modicon Networking range offers you a smart and flexible way to integrate Ethernet solutions into your operation, from the device level to the control network and to your corporate network.

Unmanaged switch for star topology

4 ports for copper
MCSESU053FN0

8 ports for copper
MCSESU083FN0

Managed switch for ring and daisy chain topologies

4 ports for copper
MCSESM043F23F0

8 ports for copper
MCSESM083F23F0

These managed switches come with the Ethernet TCP/IP protocol.

They come with 4 or 8 copper cable transmission ports.

They provide simple and complex connectivity for multiple Ethernet devices, network management, enhanced cybersecurity and more advanced switching features.

EV charging operations

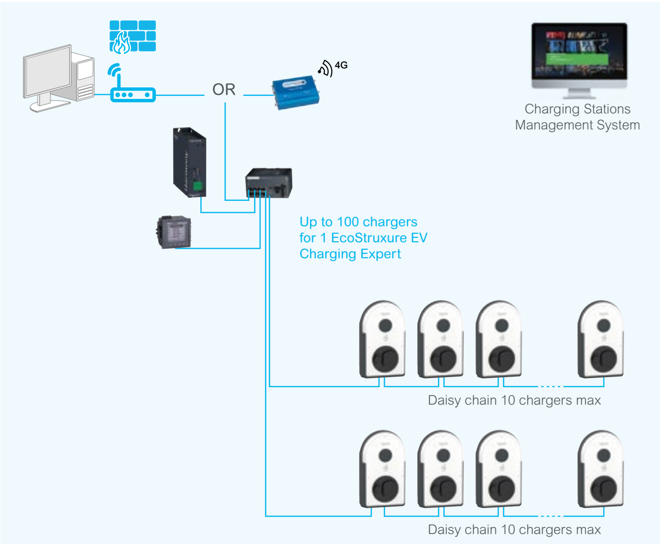
Communication network with EcoStruxure EV Charging Expert

In this section, the different communication architectures are presented.

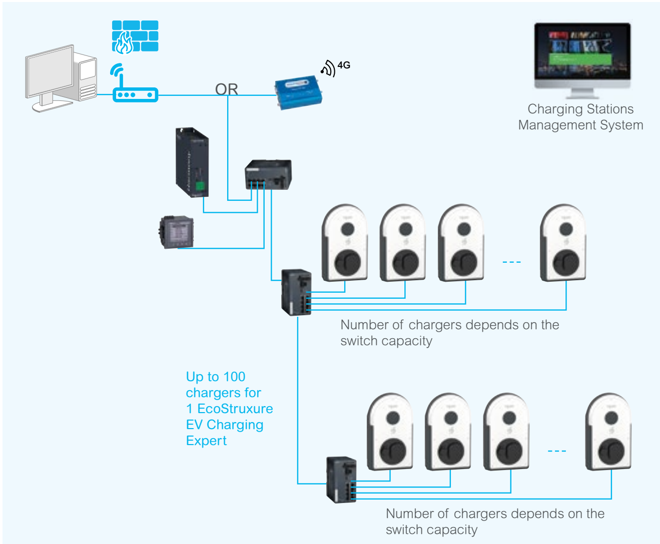
There are different network topologies: star and daisy chain. To decrease dependency between a group of chargers it is highly recommended to prefer star topology than daisy chain.

In case of daisy chain topology, it is recommended to build a daisy chain loop topology using manageable switches.

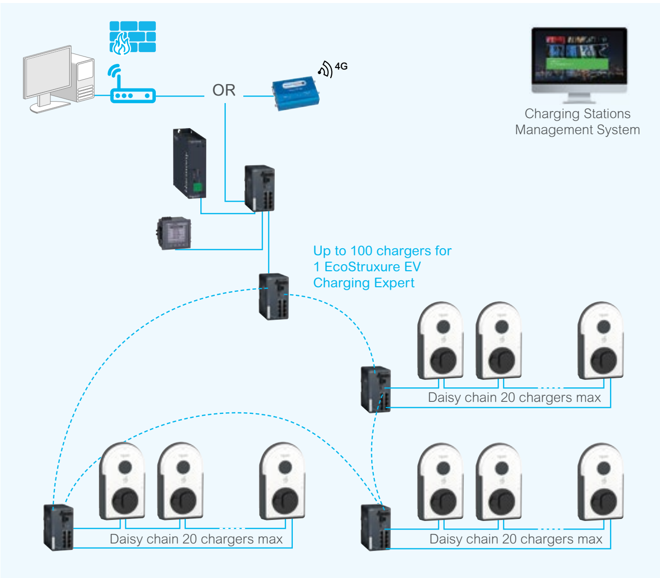
The communication network devices and EcoStruxure EV Charging Expert can be located inside an electrical switchboard (specific area) or in a dedicated IT bay (preferred setup for complex infrastructure). Charging stations' IP adresses and Power meter information are required. EcoStruxure EV Charging Expert can be set in Static mode or in Automatic mode from the dashboard.



Simple Ethernet daisy chain



Star topology



Ethernet daisy chain loop

IT information to be consolidated before the Ethernet network installation:

- **IP addresses**
- **Subnet mask**
- **Default gateway**
- **DNS server**
- **Proxy**
- **IT diagram**

For a complex project with a high number of chargers or specific IT architectures (ie, different subnet mask, DMZ…) Schneider Electric recommend collaborating with Schneider Electric EcoXpert partners or IT designer and system integrators skilled in communication networks.

EV charging operations

Cybersecurity - General rules

Cybersecurity's importance in eMobility is continuously increasing with a fast-growing eco-system involving lots of interconnection and stakeholders, each bringing cyber risks that need mitigation. On top of this, new laws and regulations on cybersecurity are constantly shaping the products and applications.

To support the development and maintenance of products, Schneider Electric follows a Secure Development Lifecycle (SDL) compliant with the IEC 62443-4-1 Security Standard for Industrial Automation and Control systems.

To learn more about how to secure the environment and infrastructure in which the eMobility building application is deployed, Schneider Electric publishes guidelines, white papers, and best practices that can be consulted in the Cybersecurity Solutions page of the Schneider Electric global website:

Cybersecurity Solutions

Discover our Cybersecurity Solutions

In addition, other resources can be found in the Schneider Electric Cybersecurity Support Portal, including:

- Schneider Electric vulnerability management policy
- Security Notifications about vulnerabilities in products and systems

Cybersecurity Support Portal

Vulnerability policy

Security notifications

Schneider Electric's vulnerability management policy addresses cybersecurity vulnerabilities affecting Schneider Electric products in order to support the security of our customers. Schneider Electric works collaboratively with researchers, Cyber Emergency Response Teams (CERTs), and asset owners to ensure that accurate information is provided in a timely fashion to adequately protect customer installations. Schneider Electric's Corporate Product CERT (CPCERT) is responsible for managing vulnerabilities and mitigations affecting products and issuing alerts.

In Schneider Electric eMobility architecture, OCPP communication links are secured, based on TLS 1.2 which provide confidentiality and integrity of communication data.

Focus on technology

To keep your system up-to-date download the newest firmware version:

The communication network of the eMobility building application shall consider the security requirement and network communication constraints coming from the global IT network of the building, like network IP addressing, segmentation (VLAN), firewall, external commutation link (VPN, IPSEC).

The following page illustrates the design of communication network security principle.

1 2 3 4 5

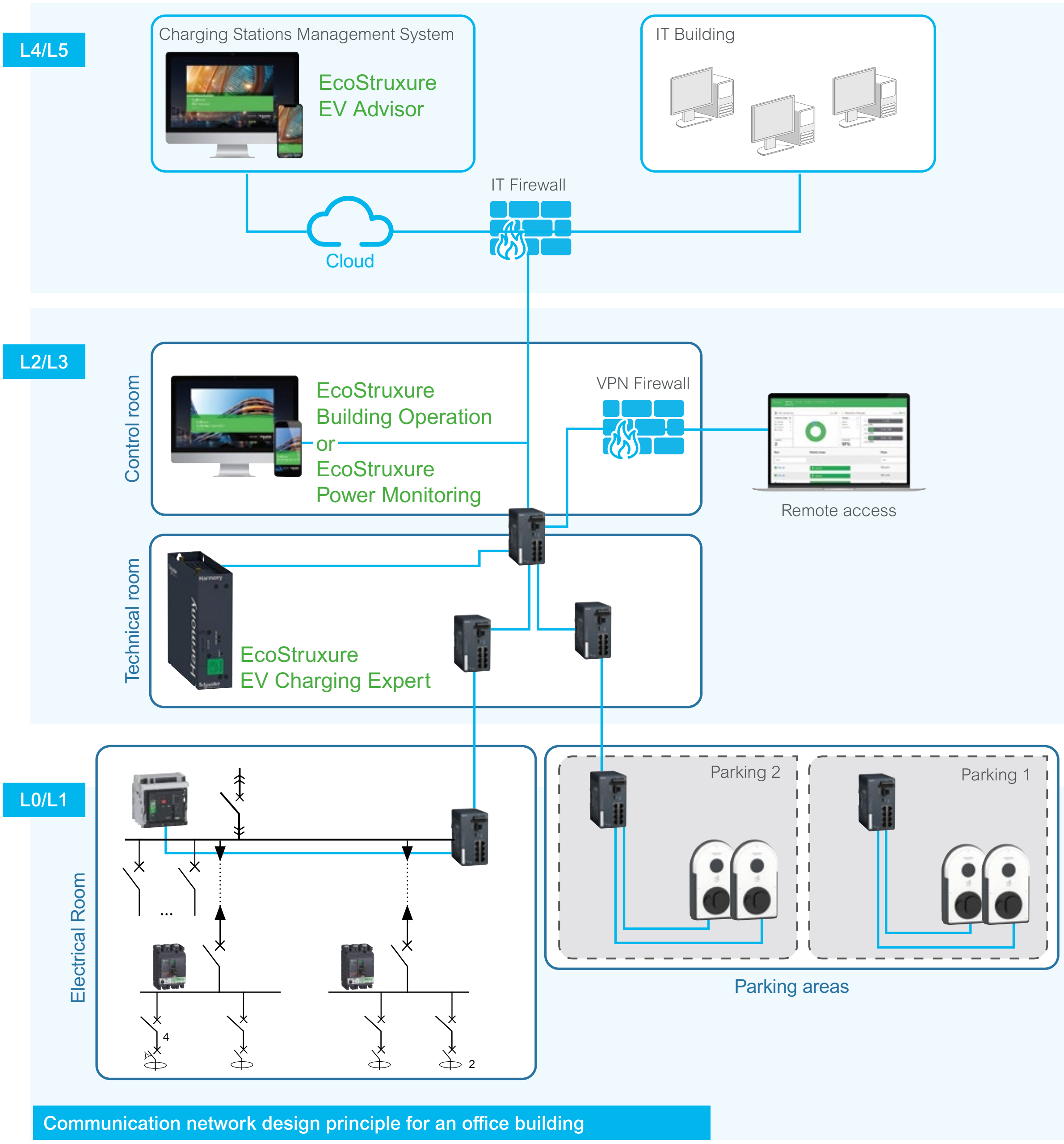
M A

EV charging operations

Cybersecurity recommendations - Example

IT infrastructure should be managed globally and considered from the design phase to the operation and maintain activities, leveraging cybersecurity good practices throughout that help to prevent potential compromise of system availability, integrity and confidentiality.

- Change default passwords at first use to avoid unauthorized access to device settings, controls, and information
- Control physical access to cabinets
- Consider functional segregation that allows network separation (VLAN) by using switches instead of unmanaged systems
- Anticipate remote access needs for troubleshooting and maintenance



Communication network design principle for an office building

Functional segregation (L0...L5)
Physical access controls
Ethernet network

1 2 3 4 5

EV charging operations

2/ Cloud-based Supervision Systems

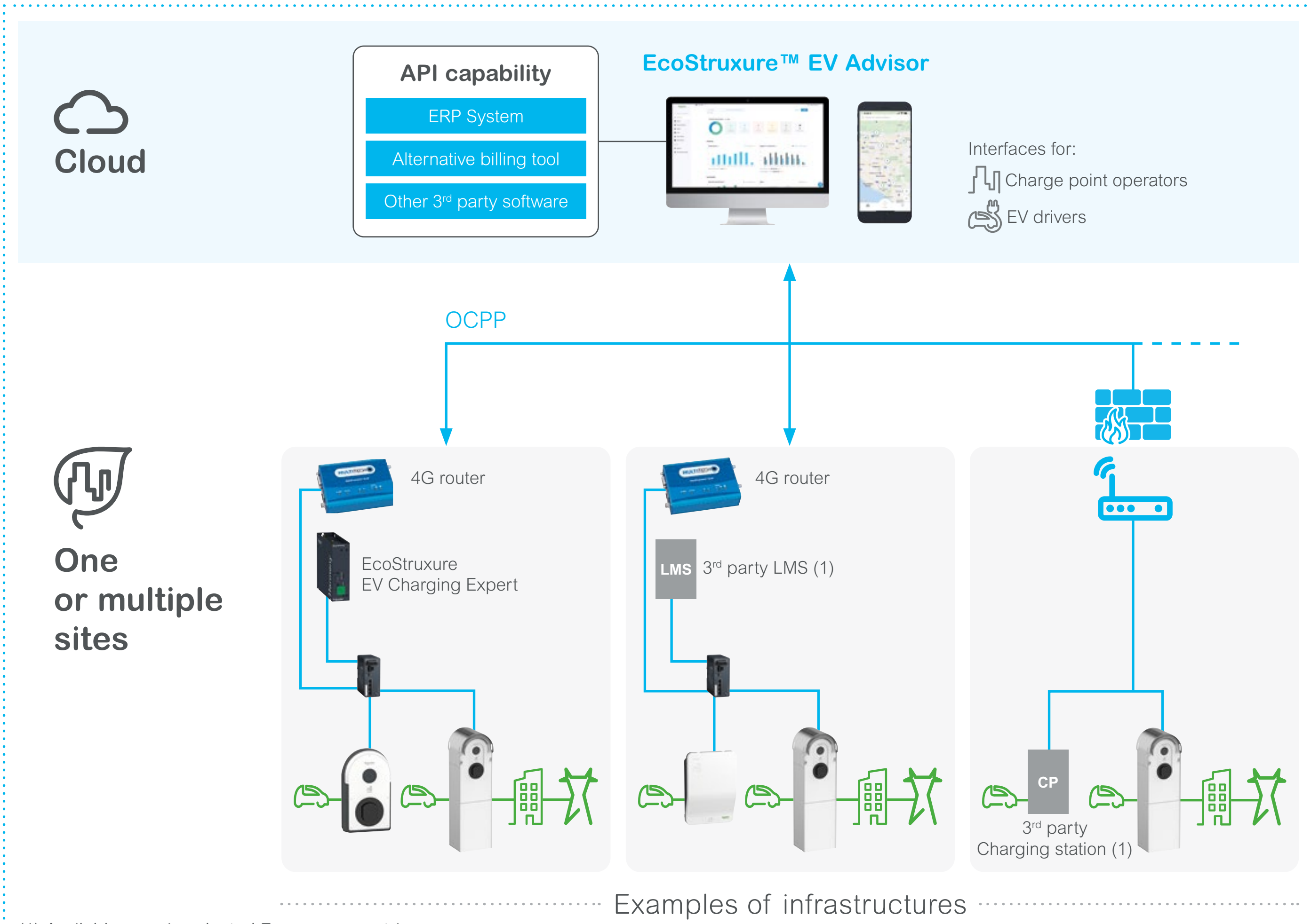
What opportunities are offered by supervision connected to the EV infrastructure?
What are the technical and communication prerequisites for deploying such a solution?
Is it an open or locked solution?

With a supervision system, you can remotely monitor and manage all your chargers on your sites from one single platform. You will get a global overview and the capability to deep dive on a site to manage chargers, Load Management Systems, or EV drivers' usages.

Charging infrastructure can be connected either via a local network or with a 4G modem connection. It can enable access to the platform to be allocated according to roles or responsibilities and provides separate or combinable logins to commission, maintain and operate the EV charging infrastructure.

In addition, some systems provide an EV Driver app with features designed to improve the EV drivers' charging experience.

Supervision illustration



(1) Available soon in selected European countries.
(2) Consult us to get the list of approved 3rd party charging station manufacturers.

1 2 3 4 5

EV charging operations

Supervision features

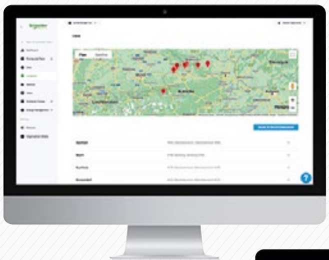
Managing EV charging infrastructure	• Remote monitoring of the charging infrastructure and carrying out for maintenance and troubleshooting activities. • Simultaneous and remote monitoring of multiple organizations and locations. • Access and permissions management by specifying the rights of individuals or groups of EV Drivers.
Managing tariffs and billing	• Setting up tariff for charging events based on location, day of the week, time of day, parking time, consumption and number of charging events. • Cost allocation, billing and payment.
Optimizing cost and grid usage	• Static cloud energy management feature to optimize EV infrastructure energy consumption. • Dashboards and stats monitoring of the EV infrastructure, enable sizing and anticipation of future needs.
Taking advantage of an Open Platform	• Integration of third party OCPP compliant hardware. • Library of APIs to create a seamless customer experience.
Considering EV drivers' user experience	• EV drivers App to locate and unlock charging stations, monitor their usage and review invoices. • Brand white-labelling of the EV Driver application.
Considering customization capabilities	• Specific business case as per business activity, from a small number of locations to a complete network. • User rights: view-only or editor rights for different users • Brand white-labelling of the platform dashboard. • Customized APIs supporting app development and other use cases including identity management, payment and CRM system integration.

1 2 3 4 5

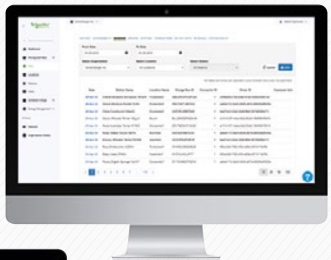
Focus on technology

EcoStruxure™ EV Advisor

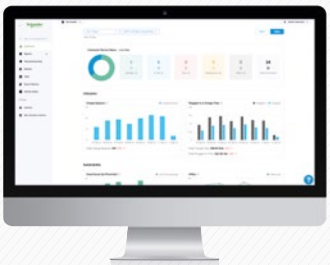
Charge point operator, Facility manager, Fleet manager user interface



Site Map



Detailed reports



Performance dashboard

User-friendly charging experience

"My Charger" application helps EV drivers to start a charging session from their phones and to see what chargers are available.

They can control their usage in real-time, receive detailed reports and access their EV charging history.

EV charging operations

3 Cloud-based Supervision through Facility Management Systems

What information does the Facility Manager look for?
Is it an open or locked solution?

The digital age is rapidly transforming how we manage the places where people spend up to 90 percent of their time: buildings. As the Internet of Things connects more devices within buildings, the amount of building management data is increasing exponentially.

How that data is used to create smart buildings is improving what matters most – increasing operational efficiency and improving the occupant experience.

EV loads integrated into a Facility Management System

All-in-one monitoring of the electrical distribution	• A single interface to supervise and monitor the EV charging infrastructure integrated into the building electrical distribution network. • Detailed alarms to make quick and informed decisions if something happens. • Detailed view of circuit capacity to optimize the electrical distribution and to forecast EV infrastructure evolution.
Power demand and Power quality monitoring	• EV charging station status and usage continuous monitoring. • Monitoring of the EV charging stations' power output to control the peak demand. • Power quality view to analyze the impact of DC charging on the ED network and anticipate adverse effects.
Energy consumption trends and KPIs	• Identification of the charging stations with the highest consumption. • Consumption comparison per zone, time period, parking usage…

1 2 3 4 5

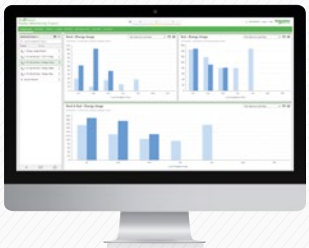
Focus
on technology

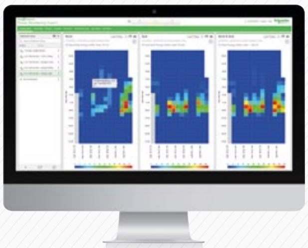
EcoStruxure Power Monitoring Expert

Facility Manager single and remote user interface

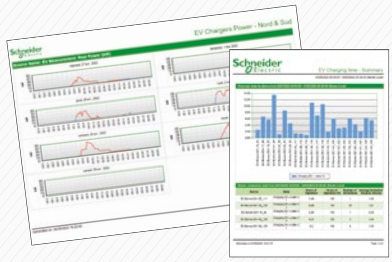

Energy consumption dashboard


Charging stations monitoring


Energy consumption comparison


Heatmaps for deep analyses


Trends


Reports

EcoStruxure Building Operation


EVSE view

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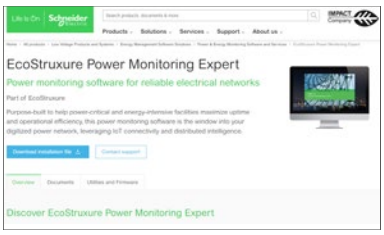
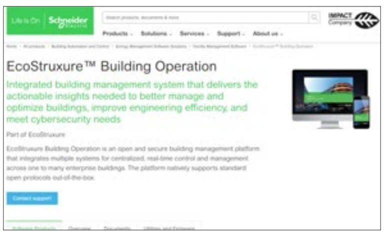
Learn more



EcoStruxure Power Monitoring Expert



EcoStruxure Building Operation

EV charging operations

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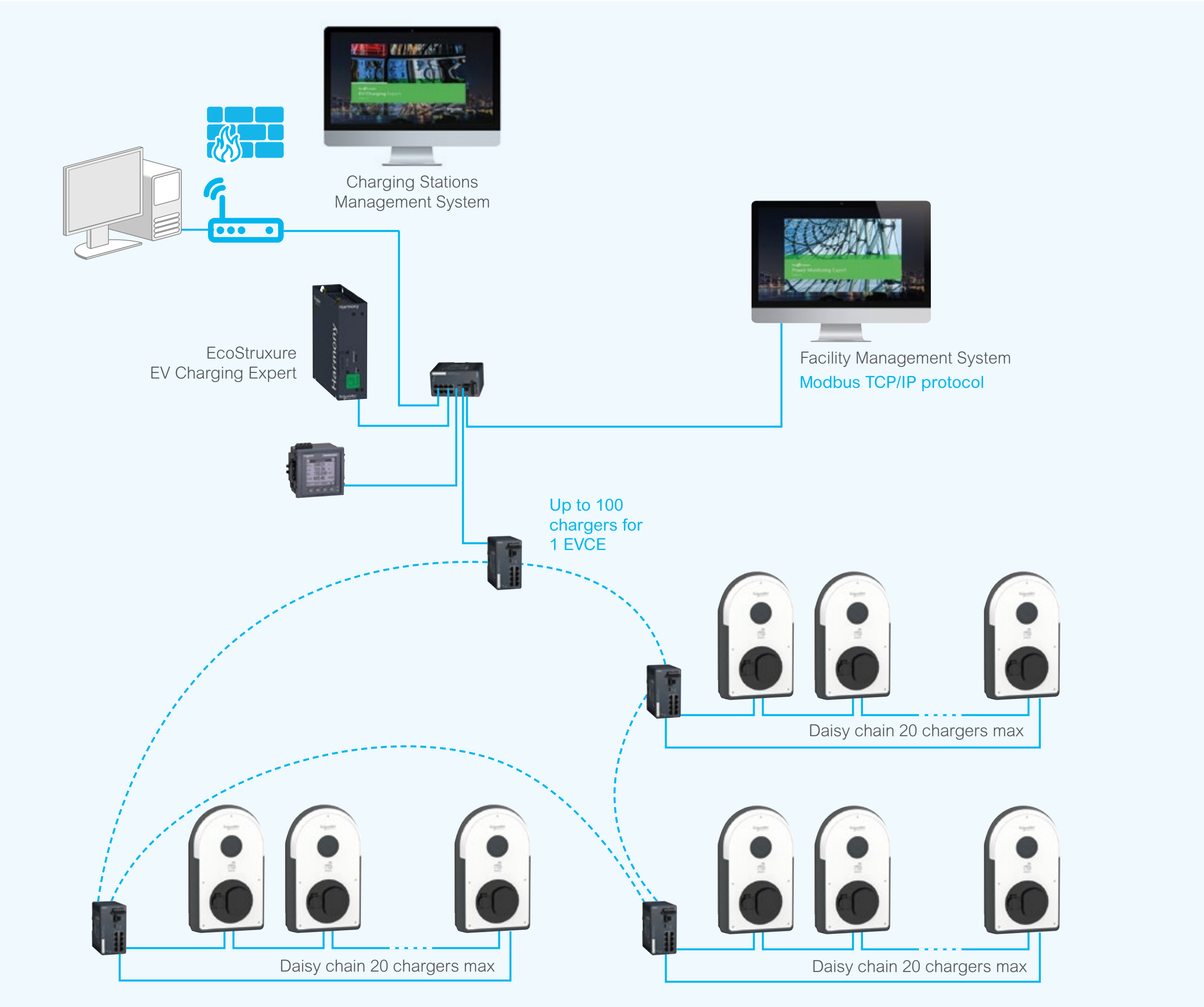
Communication network with Facility Management Systems

The following illustration details the communication architecture between the EV infrastructure that enables the Charging Point Operator to manage the drivers' access and billing while the Building Management System or the Energy and Power Management System are focused on energy or on operations.



Integration with Building/ Energy management system

Facility Management Systems request energy and asset management data in the Modbus TCP/IP protocol with the chargers using the same IP Network that the OCPP protocol between EcoStruxure EV Charging Expert and the chargers.

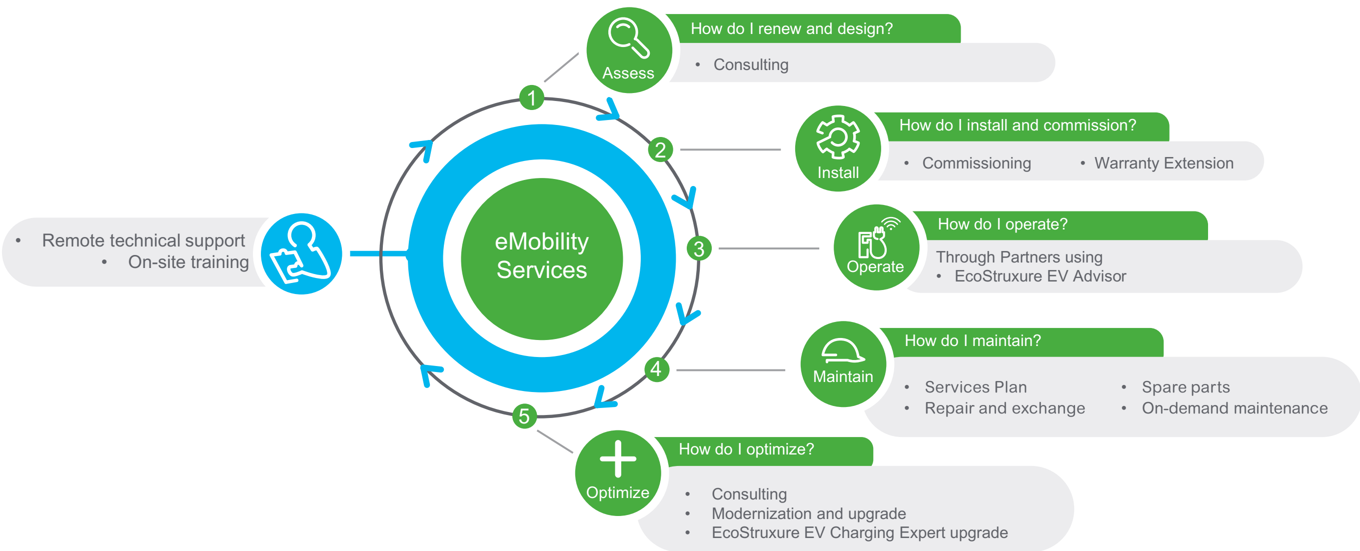
For complex projects with a high number of chargers or specific IT architectures (i.e, different subnet mask, DMZ…) Schneider Electric recommends collaborating with Schneider Electric EcoXpert partners or IT designer and system integrators skilled in communication networks.

Large EV infrastructure for large buildings
IEC Electrical and Digital Reference Architecture Guide (EVSOL2DG001)

EV charging operations

4 Service along the infrastructure lifecycle

Services are key to optimizing the performance and uptime of the EV infrastructure and to keep the assets running in optimum conditions throughout the whole lifecycle, from installation and commissioning, to maintenance and modernization.



Increase uptime	• Optimized business continuity thanks to remote technical support and regular preventive maintenance
Optimize investment	• Budget control thanks to a fixed yearly plan for all the maintenance needs and warranty extension
Operate in optimum conditions	• Up-to-date features and firmware, and expert advice on the infrastructure optimization

Focus on technology

eMobility Services Plan from Schneider Electric

With a fixed yearly plan, you can expect top-of-the-line services from Schneider Electric for your eMobility infrastructure. All that in addition to priority access to on-site and remote support and preferential prices on our spare parts ecosystem.

EV charging operations

Charge Point Operator Building owner

An office building with multiple areas and type of usage

CUSTOMER CASE
illustration #4

CUSTOMER CASE illustration #1
CUSTOMER CASE illustration #2
CUSTOMER CASE illustration #3
1 2 3 4 5

Operation needs:

The operation of the charging infrastructure has been delegated to a charge point operator to maximize uptime of the entire installation while delivering a convenient charging experience for the EV drivers. The building owner and CPO are looking to:

Building owner

Deliver a smooth charging experience for EV drivers:

- Locate charge points and access its real time status
- Start and stop the charging session using an RFID card. For visitors, it will be provided by reception

Maximize uptime of the charger for Private employee vehicles:

- Inform the CPO in case of issues
- Get visibility on the repair and maintenance activities

Access to the charging session history, the ability of making money from the EV charging solution:

- Access the charging session history for each employee
- Define a tariff for chargers open to visitors, and get paid for it

Charge Point Operator

Monitor and manage charge points remotely:

- Monitor all the charging points remotely and be notified in case of issues
- Get remote troubleshooting capability and go on site only if necessary
- Upgrade firmware for chargers remotely

Get an automatic billing and payment process

To enable all the eMobility services required, the EV charging infrastructure is connected to a cloud-based Supervision system.

EcoStruxure EV Advisor

EcoStruxure EV Advisor is an eMobility management platform that enables seamless EV charging for fleets, buildings and destinations.

This SaaS offer is built to supply charge point operators, installers, building operators and fleet operators with everything they need to make their operation a successful venture.

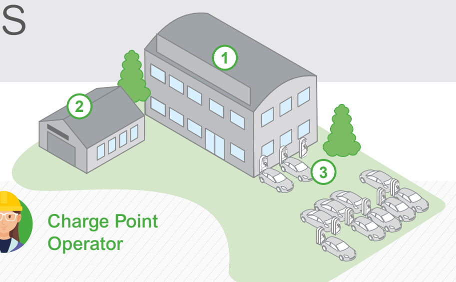
Users benefit from supervision and operation functions including features such as asset monitoring and asset control, cloud based static load levelling, EV driver access management and pricing.

SECTION 5

How to implement the infrastructure

Reference architecture for office buildings

Design inputs



Building owner

Charge Point Operator

1.Usages

- New Office building, 5000 m²
- Indoor and outdoor parking
- 25 chargers, 22 kW in total
- Authentication modes:
  - Badges for employees
  - Free charging for visitors

2.Electrical Distribution

- EV dedicated switchboards
- Canalis distribution in indoor parking
- Outdoor parking:
  - CBs for electrical protection installed in the switchboards
  - RCDs installed in the charging station

3.Power managment strategy

- Optimizing charging capabilities (LMS):
  - Load balancing between building loads and charging stations (dynamic – main switchboard)
  - Capex optimization by under sizing EV switchboard (static –p1 and p2)

4.Operational needs

- EV charging infrastructure operated by Charge Point Operator

1 Office Building
2 Parking 1 (indoor)
3 Parking 2 (Outdoor)

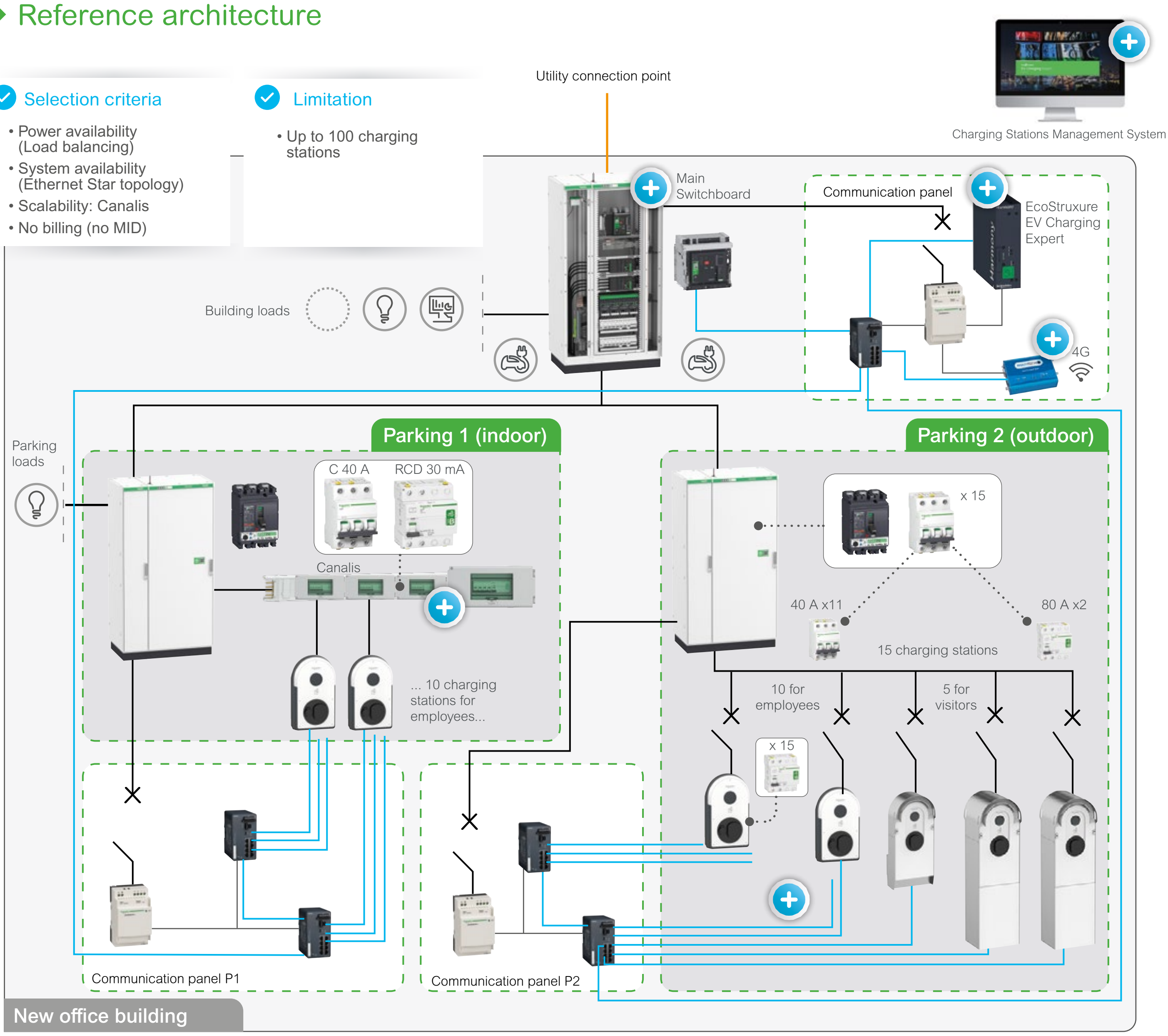
Reference architecture

Selection criteria

- Power availability (Load balancing)
- System availability (Ethernet Star topology)
- Scalability: Canalis
- No billing (no MID)

Limitation

- Up to 100 charging stations



Utility network
Power network
24 VDC
Ethernet network

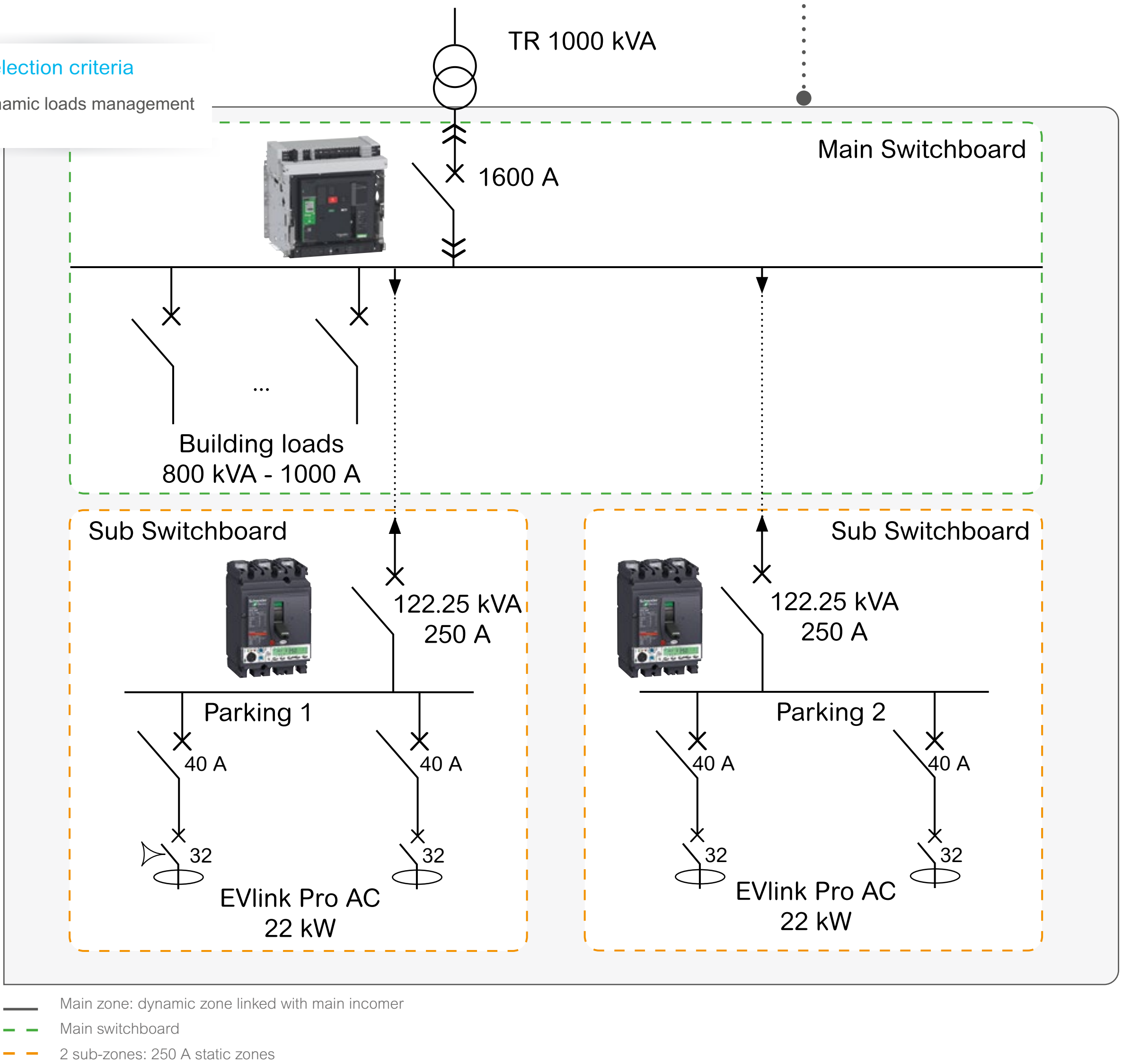
Reference architecture for office buildings

Zoom-in Electrical distribution based on options for electrical zones

> Implementation for 1 dynamic zone, with 2 static sub-zones.

Selection criteria

- Dynamic loads management



Reference architecture for office buildings

Zoom-in Electrical distribution based on options for electrical zones

> Complex electrical distribution with multiple incomers and busties.

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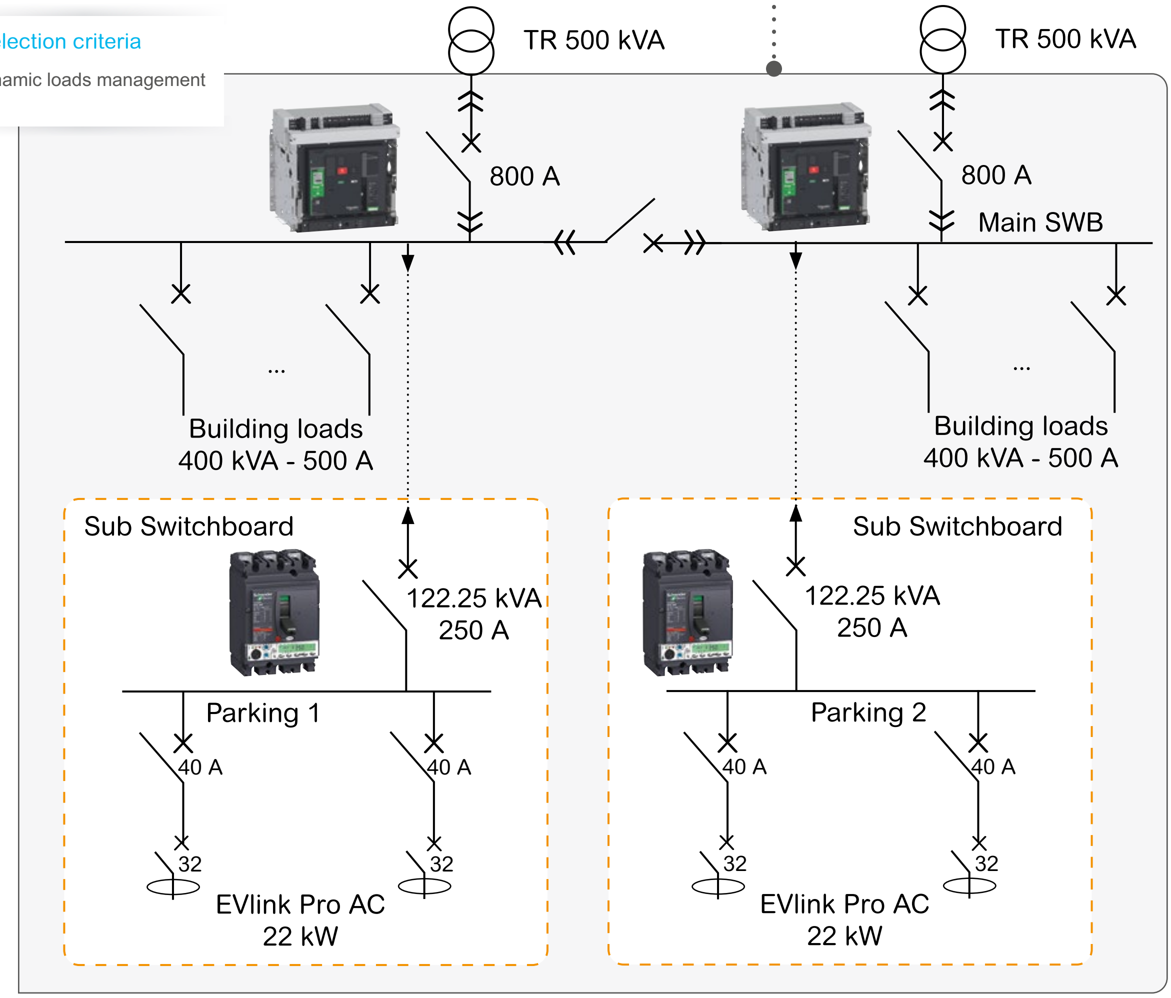
Selection criteria
- Dynamic loads management

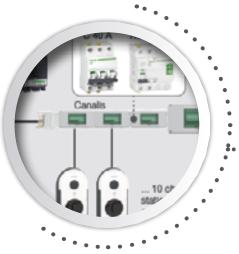


2 zones: 250 A static zones

Note: for complex electrical distribution, contact your Schneider Electric Solution Center.

Reference architecture for office buildings

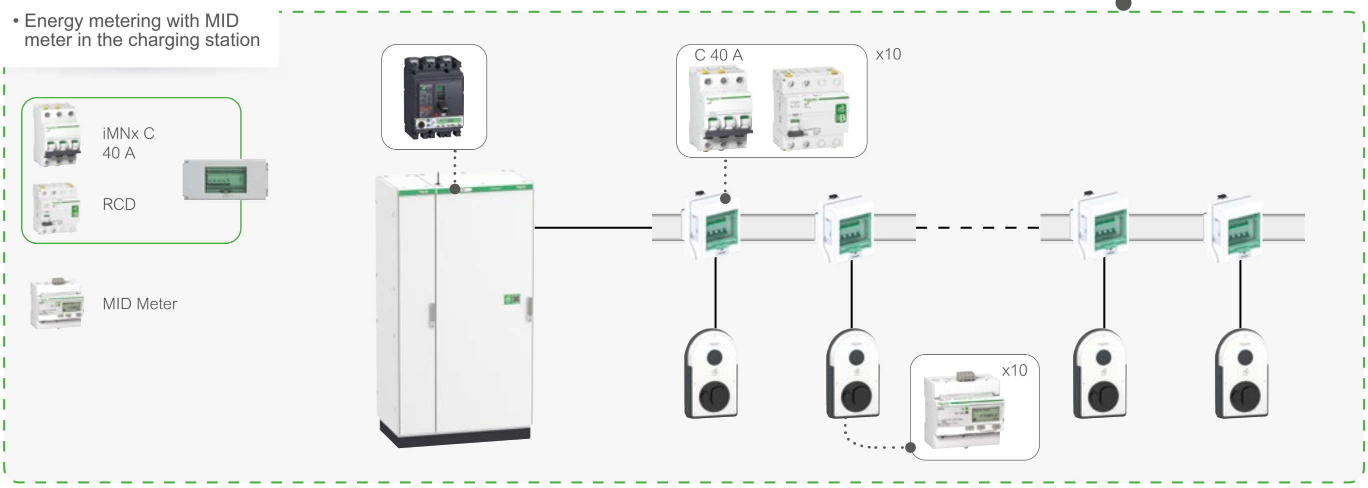
Zoom-in Electrical distribution with Canalis distribution system



Possible implementations for indoor parking with Canalis busbar trunking system enabling metering: not connected to ethernet or management systems (EV or Loads).

Selection criteria

- Energy metering with MID meter in the charging station



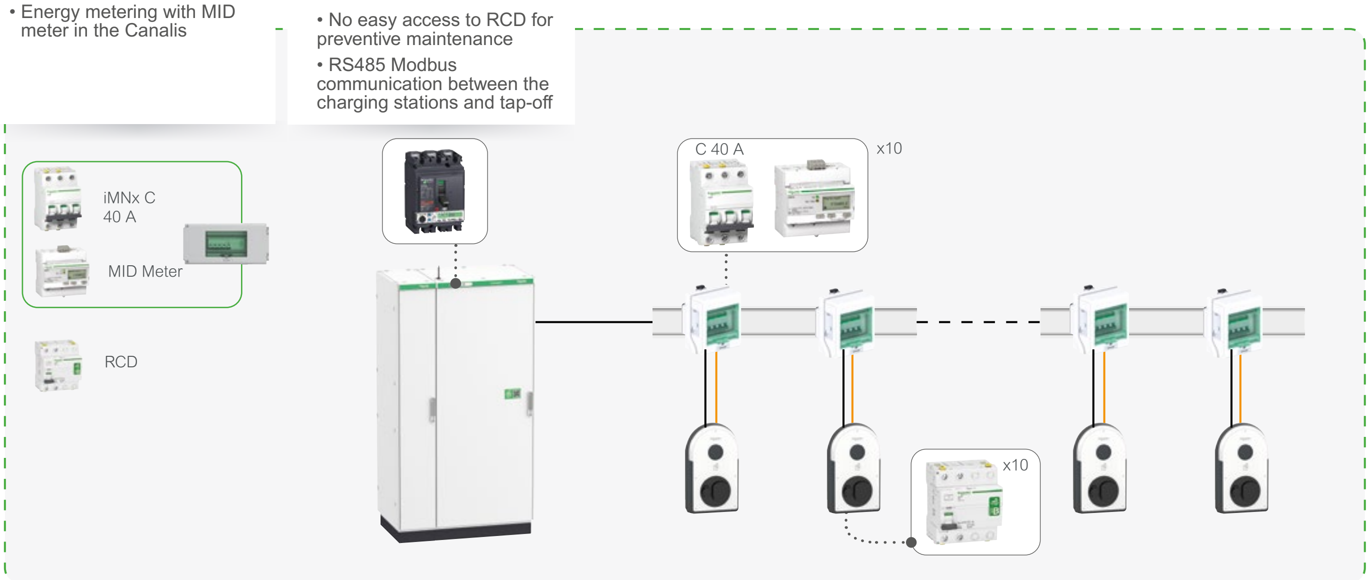
Power network

Selection criteria

- Energy metering with MID meter in the Canalis

Limitation

- No easy access to RCD for preventive maintenance
- RS485 Modbus communication between the charging stations and tap-off

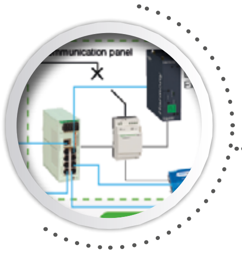


Power network

RS485

Reference architecture for office buildings

Zoom-in Power management optimizing availability of key loads



Implementation of dynamic load management in EcoStructure EV Charging Expert.

Selection criteria

- Optimizing the power delivered to the EV infrastructure while preserving the building key loads

Limitation

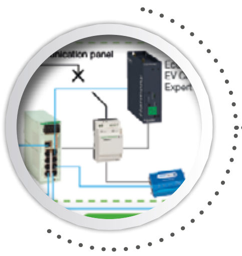
- Dynamic load management requires consumption data from the main switchboard

The power delivered to EV chargers can be managed (Load Management algorithm):

- In Dynamic mode: EcoStruxure EV Charging Expert shall receive the Main Power consumption from the whole building
- In static mode: no need of communication between EcoStruxure EV Charging Expert and the main switchboard

Dynamic load management with local Power Monitoring in EcoStruxure EV Charging Expert brings:

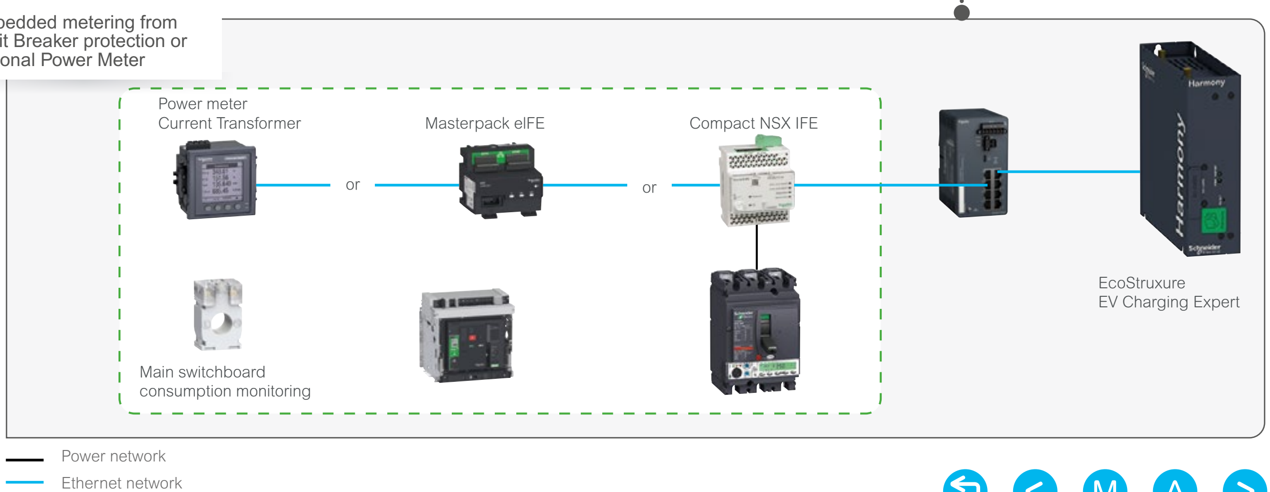
- **More resilience** in isolated mode (cloud disconnection): EVCE as local controller balances the maximum charge capacity among the EVs and avoids the charging points switching to default mode (Maximum power calculated in static mode)
- **Better performance** in case of a large loads (large motor, compressor…)



Digital implementation of various power meters that can be used to monitor the main switchboard consumption.

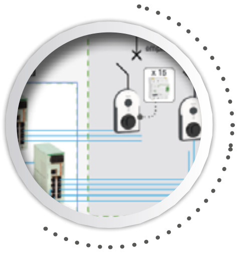
SELECTION CRITERIA

- Embedded metering from Circuit Breaker protection or additional Power Meter



Reference architecture for office buildings

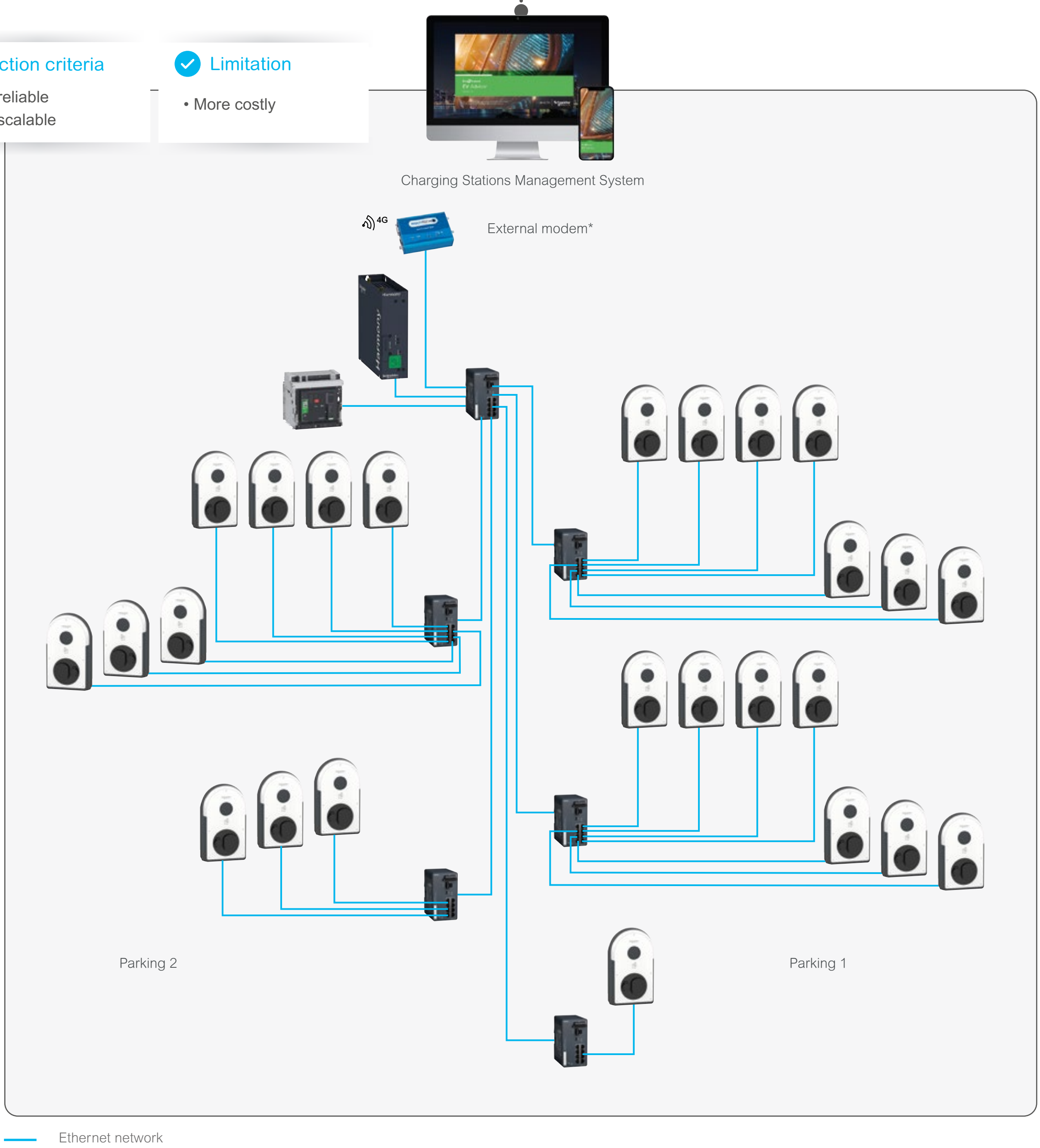
Zoom-in EV Charging operations enabling one-to-one connection



LAN Ethernet star connection option.

Selection criteria
- More reliable
- More scalable

Limitation
- More costly

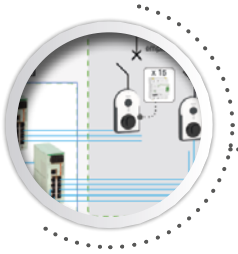


*Up to 100 charging stations for 1 external modem.

Reference architecture for office buildings

Zoom-in

EV Charging operations optimizing Ethernet network infrastructure



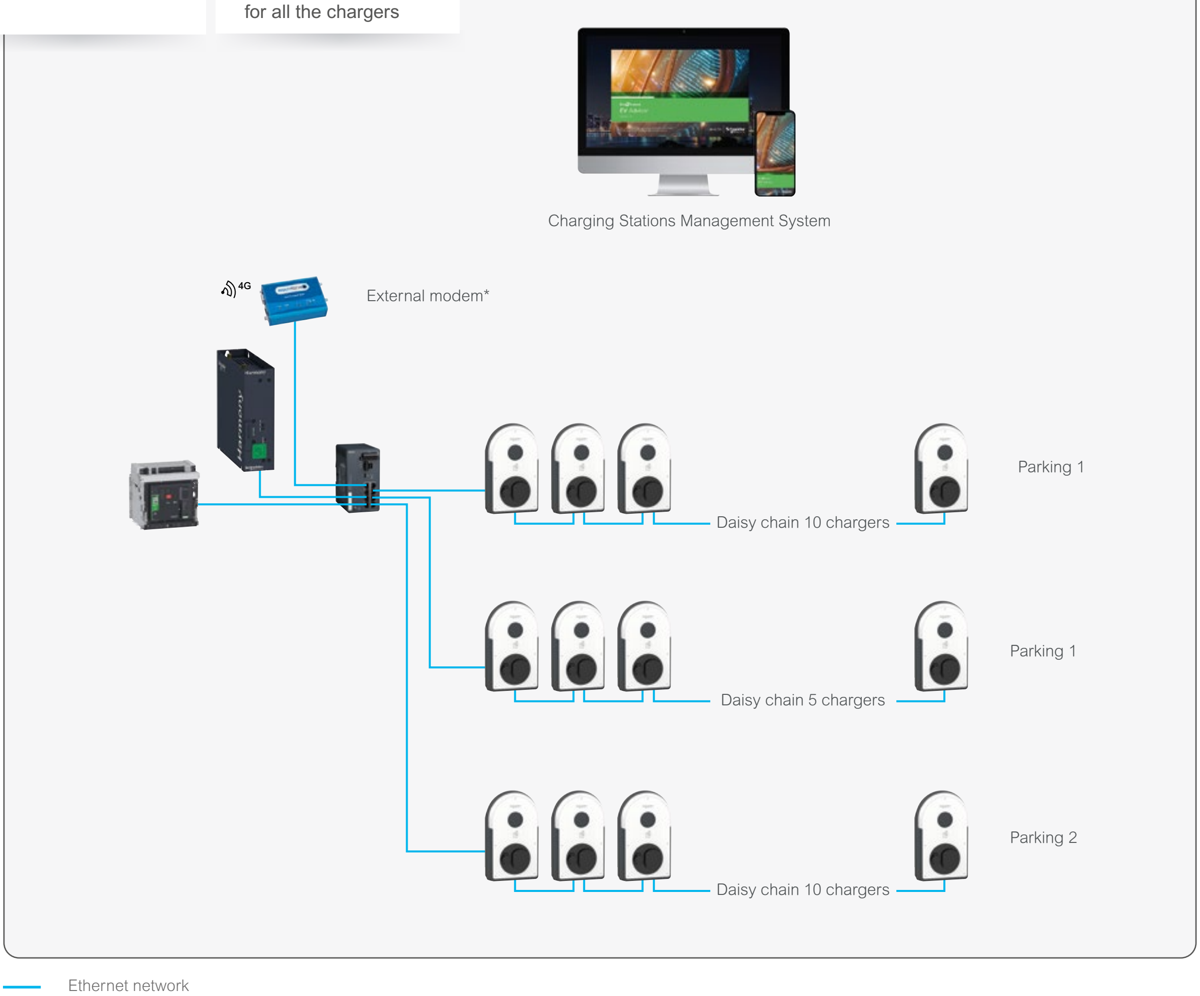
> LAN Ethernet Daisy chain connection (WAN 4G external modem to Charging Station Management System).

Selection criteria

- Cost effective

Limitation

- Common communication network for all the chargers

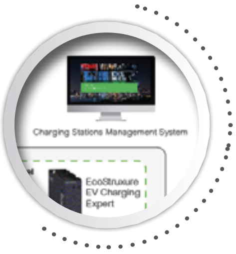


*Up to 100 charging stations for 1 external modem.

1 2 3 4 5

Reference architecture for office buildings

Zoom-in EV Charging operations enabling operational management on Energy and Power Management Systems



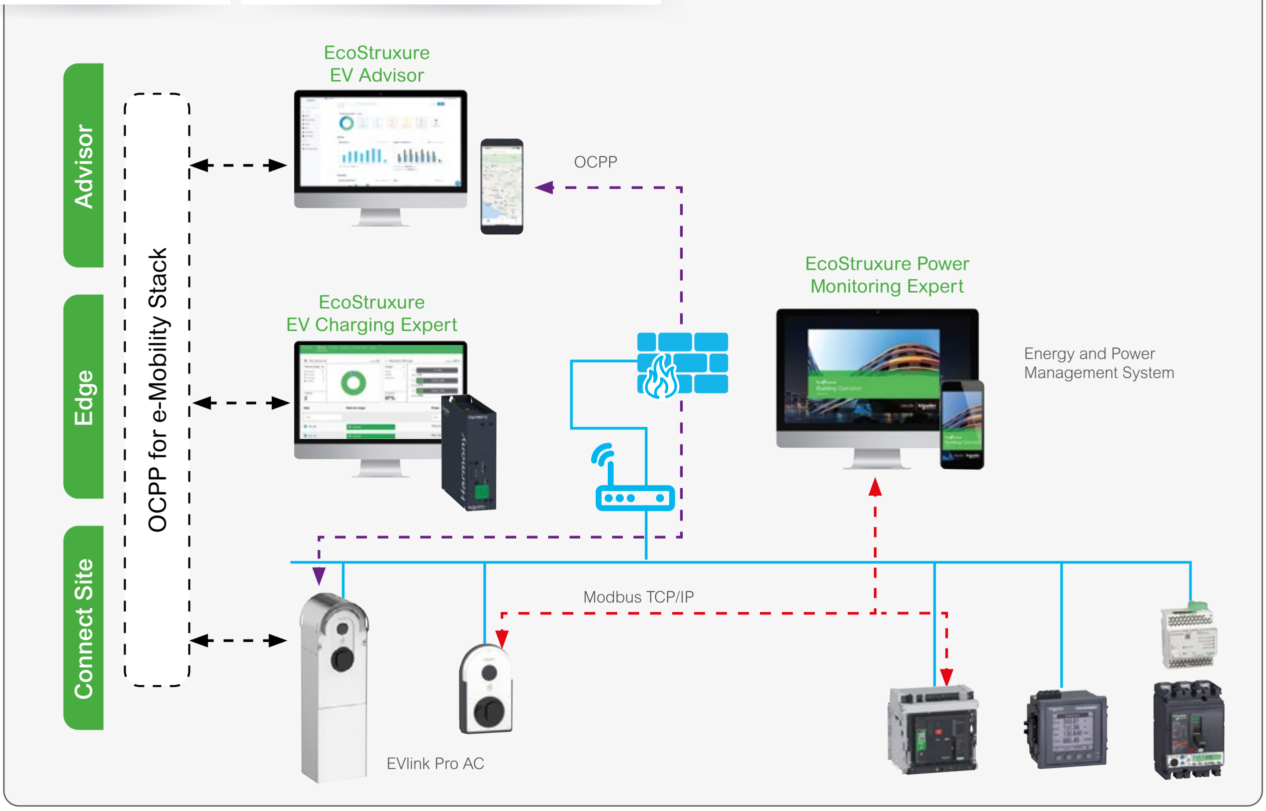
> Charging stations: operations managed by Charge Point Operator.
> EV Energy and assets managed thanks to EcoStruxure Power Monitoring Expert.

Selection criteria

- Monitor each charger in the EcoStruxure Power Monitoring Expert
- EVlink Pro AC Chargers integrated using Modbus TCP/IP device profile/widget in EcoStruxure Power Monitoring Expert

Limitation

- Interconnection of EcoStruxure EV Charging Expert and EcoStruxure Power Monitoring Expert Ethernet network
- Needs IT management with firewall to isolate the building network from the EV Network
- Engineering and commissioning time for EcoStruxure Power Monitoring Expert to integrate devices
- Individual chargers will be integrated– engineering needed in EcoStruxure Power Monitoring Expert to create EV zones



Ethernet network
Modbus TCP/IP
OCPP

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Reference architecture for office buildings

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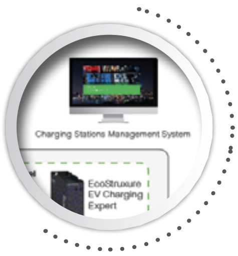
Zoom-in

EV Charging operations enabling operational management on Building Management Systems



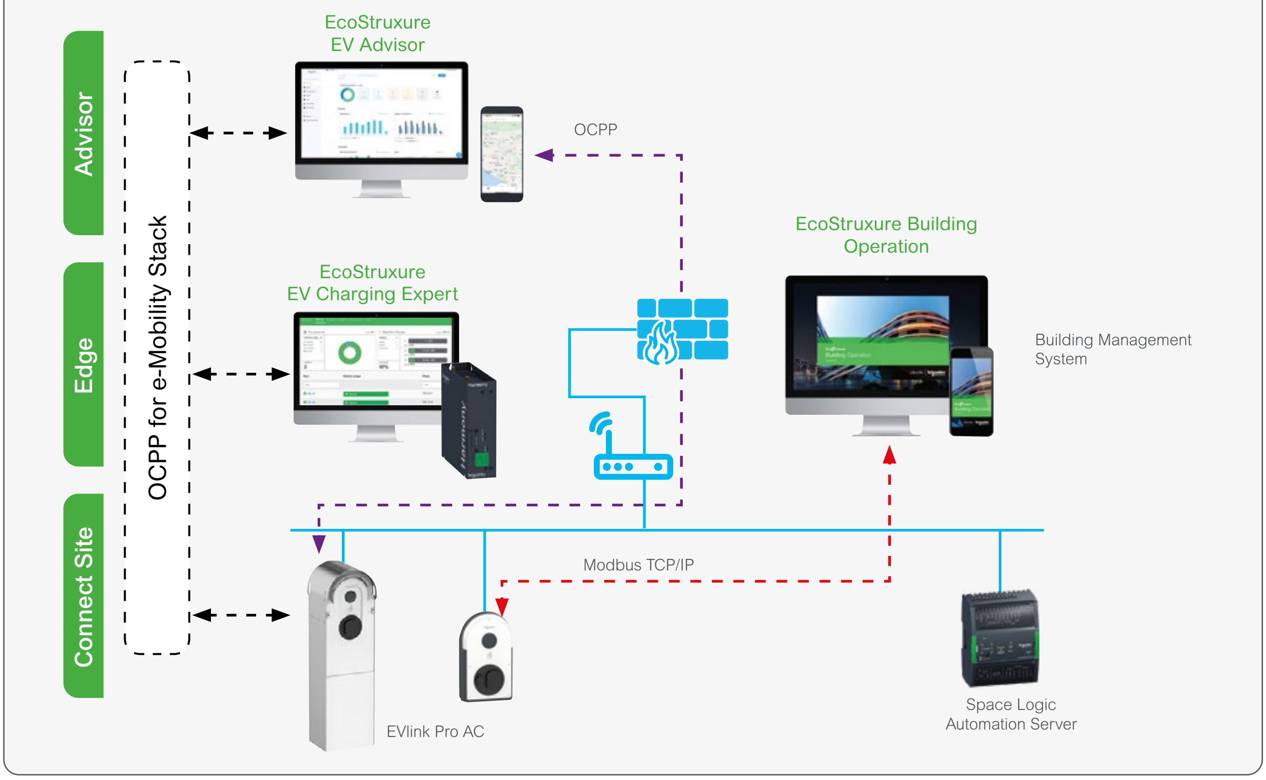
› Charging stations: operations managed by Charge Point Operator.
EV Energy and assets managed thanks to EcoStruxure Building Operation.

Selection criteria

- Monitor each charger in the EcoStruxure Building Operation
- EVlink Pro AC Chargers integrated using Modbus TCP/IP device profile/widget in EcoStruxure Building Operation

Limitation

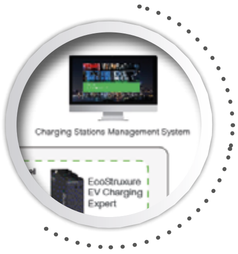
- Interconnection of EcoStruxure EV Charging Expert and EcoStruxure Building Operation Ethernet network
- Needs IT management with firewall to isolate the building network from the EV Network
- Engineering and commissioning time for EcoStruxure Building Operation to integrate devices
- Individual chargers will be integrated– engineering needed in EcoStruxure Building Operation to create EV zones



Ethernet network
Modbus TCP/IP
OCPP

Reference architecture for office buildings

Zoom-in EV Charging operations enabling energy management



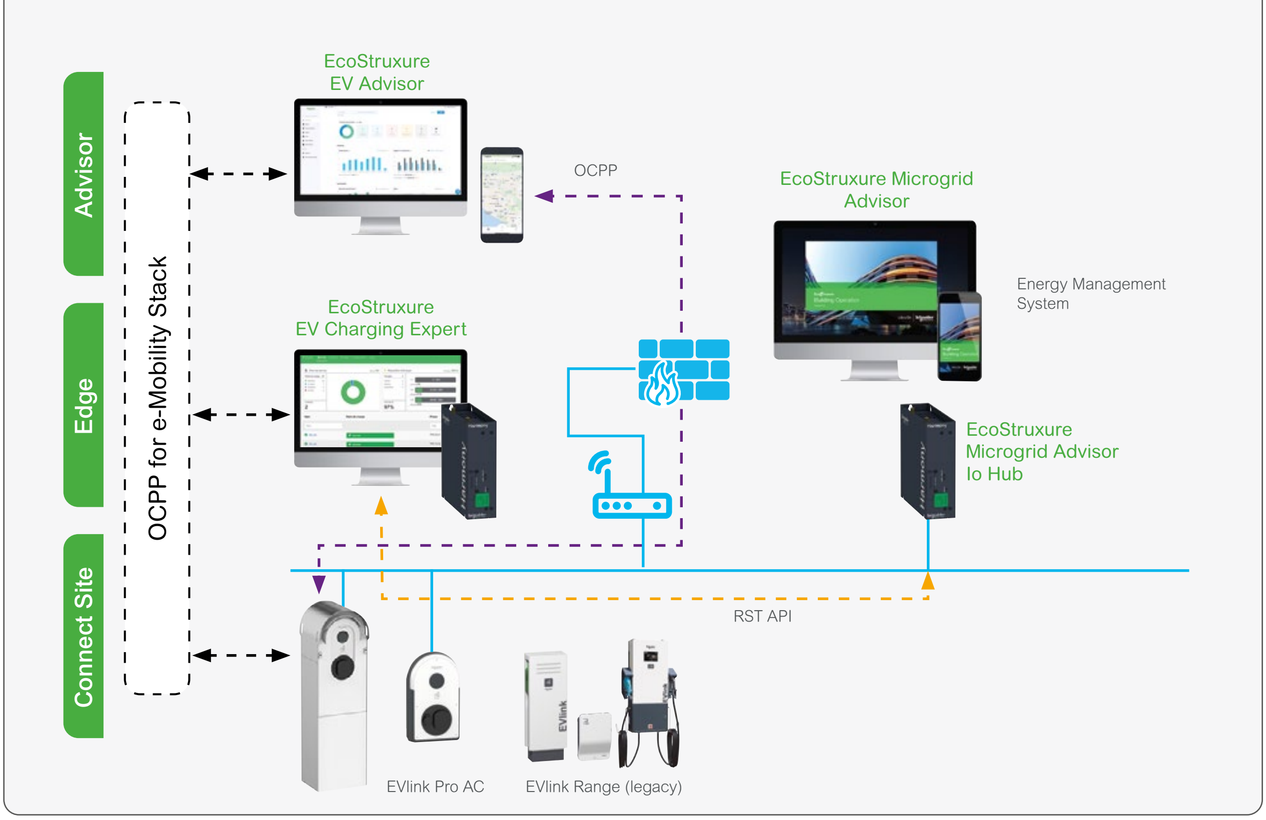
Charging stations: operations managed by Charge Point Operator.
Energy setpoints of the EV infrastructure managed by EcoStruxure Microgrid Advisor.

Selection criteria

- EcoStruxure EV Charging Expert integrated with EcoStruxure Microgrid Advisor via REST API
- Zones Setpoint monitoring and control from EcoStruxure Microgrid Advisor

Limitation

- Interconnection of EcoStruxure EV Charging Expert and EcoStruxure Microgrid Advisor Ethernet network



Ethernet network
RST API
OCPP

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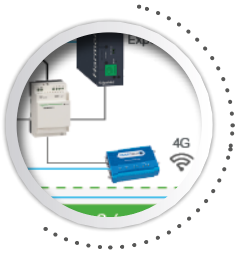
Reference architecture for office buildings

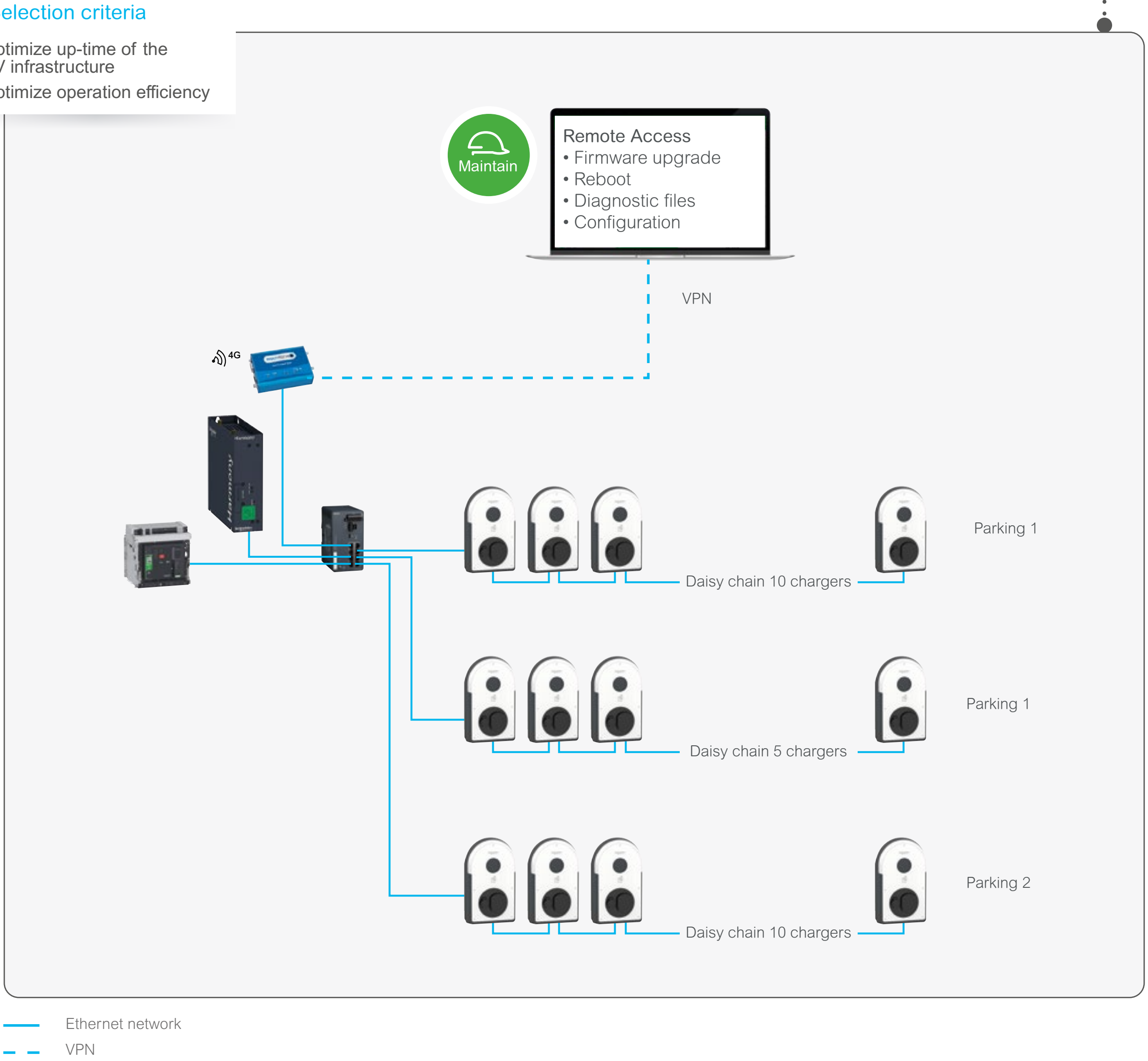
Zoom-in Alternative enabling remote services



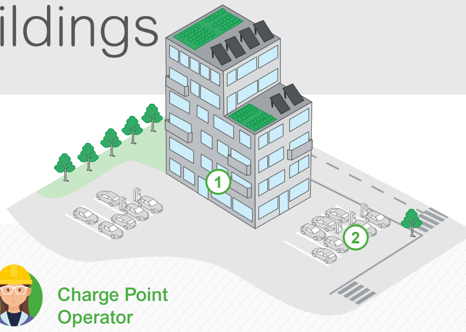
› Provide cybersecured access to a service provider, that allows remote and on-demand access for EV charging infrastructure troubleshooting, maintenance and firmware upgrade.

Selection criteria

- Optimize up-time of the EV infrastructure
- Optimize operation efficiency



Reference architecture for residential buildings



Design inputs

Building owner

Charge Point Operator

1.Usages
- Multi family Home, 40 Flats
- Outdoor parking with EV charging zone
- 10 chargers, 4.4 kW
- Authentication modes: badges for residents

2.Electrical Distribution
- EV dedicated switchboard
- EV charging zone:
  - CBs for electrical protection installed in the switchboard
  - MID meters and RCDs installed in the charging stations

3.Power managment strategy
- Optimizing charging capabilities (LMS): load balancing between building loads and charging stations

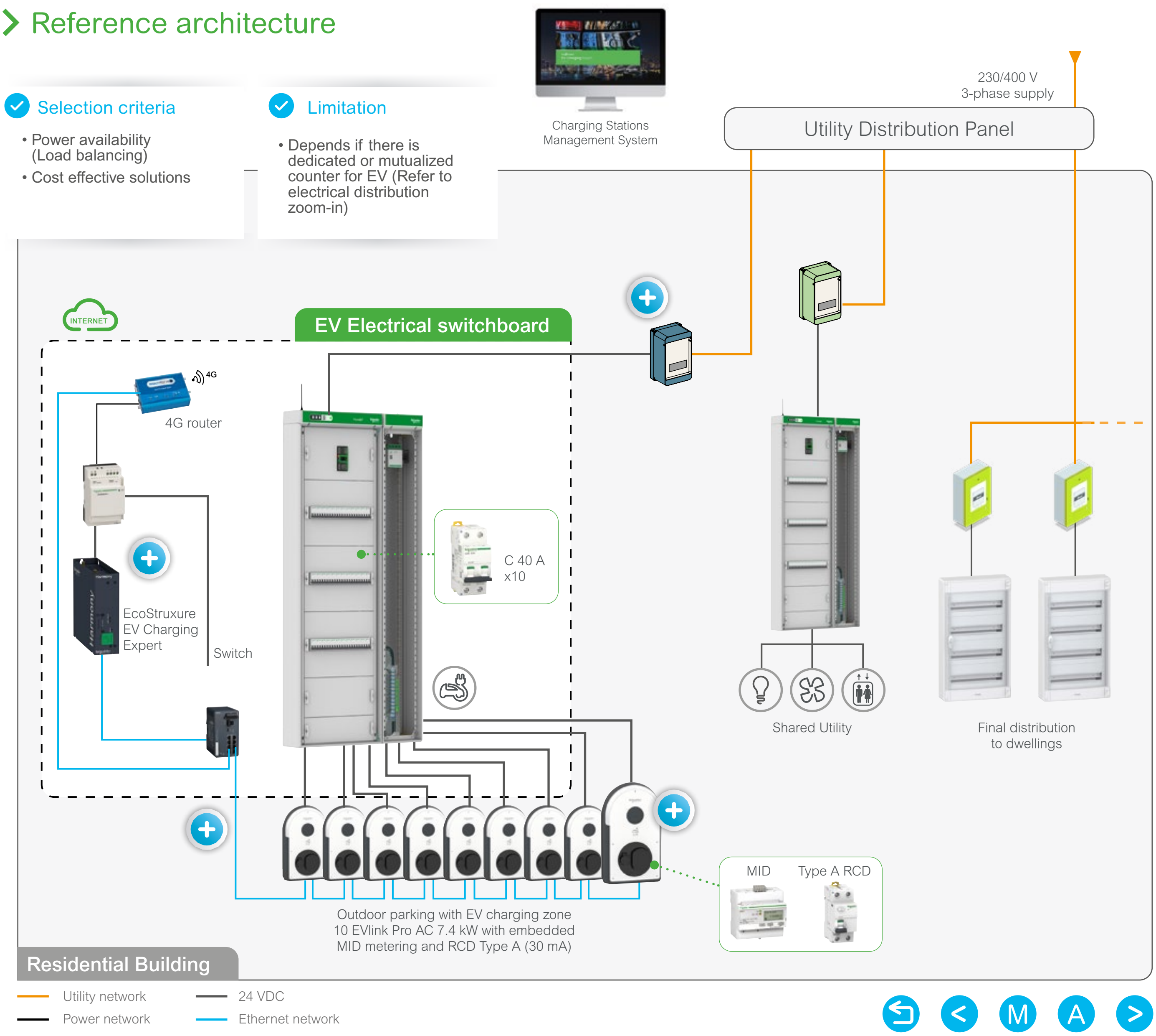
4.Operational needs
- EV infrastructure operated by the Charge Point Operator

(1) Residential Building
(2) Parking with EV charging stations

Reference architecture

Selection criteria
- Power availability (Load balancing)
- Cost effective solutions

Limitation
- Depends if there is dedicated or mutualized counter for EV (Refer to electrical distribution zoom-in)



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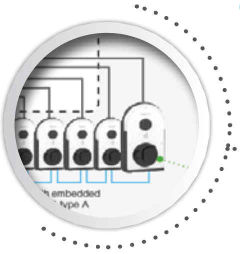
Reference architecture for residential buildings

Zoom-in Alternative usages for faster charge with two possible cost allocations



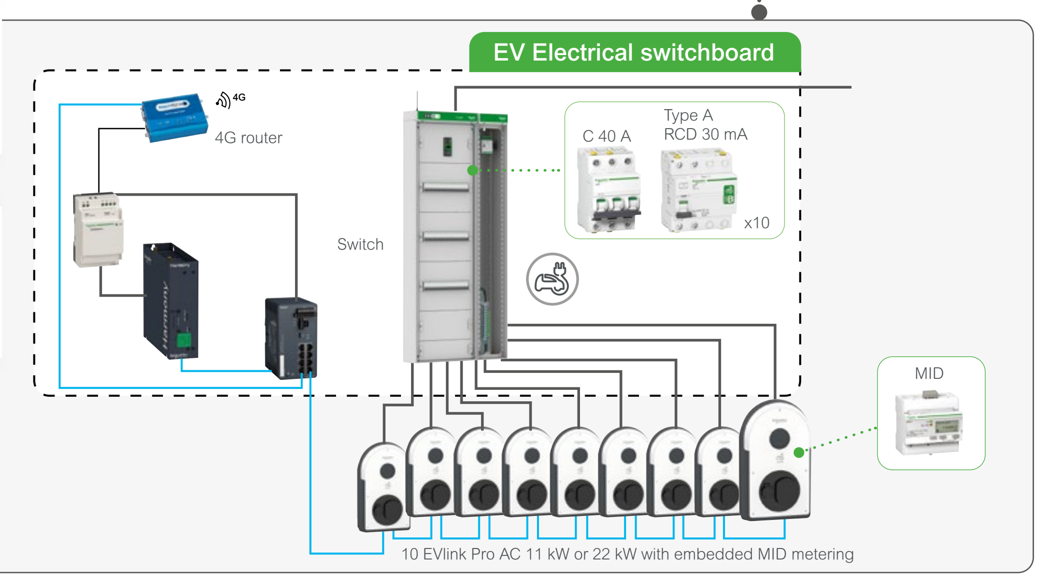
Implementation of 11 kW or 22 kW charging stations with embedded MID meters.

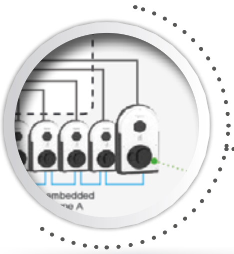
Selection criteria

- Faster charge
- Authentication mode for cost allocation

Limitation

- More incoming power must be requested

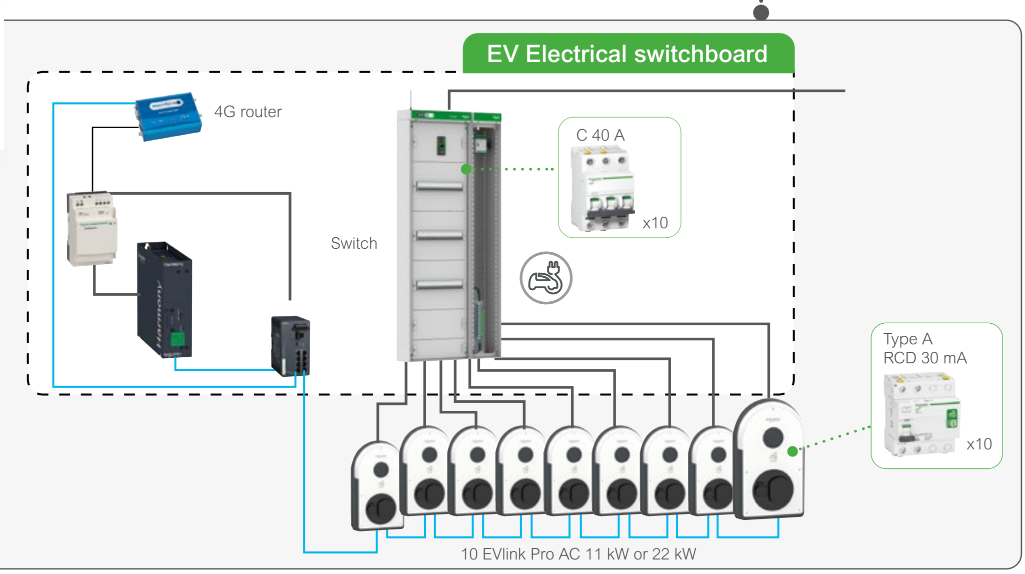




Variant without MID meters

Selection criteria

- Monthly fixed fees received from the Charge Point Operator



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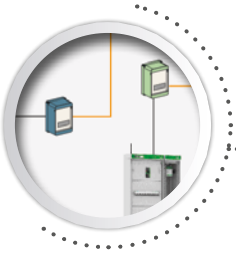
Reference architecture for residential buildings

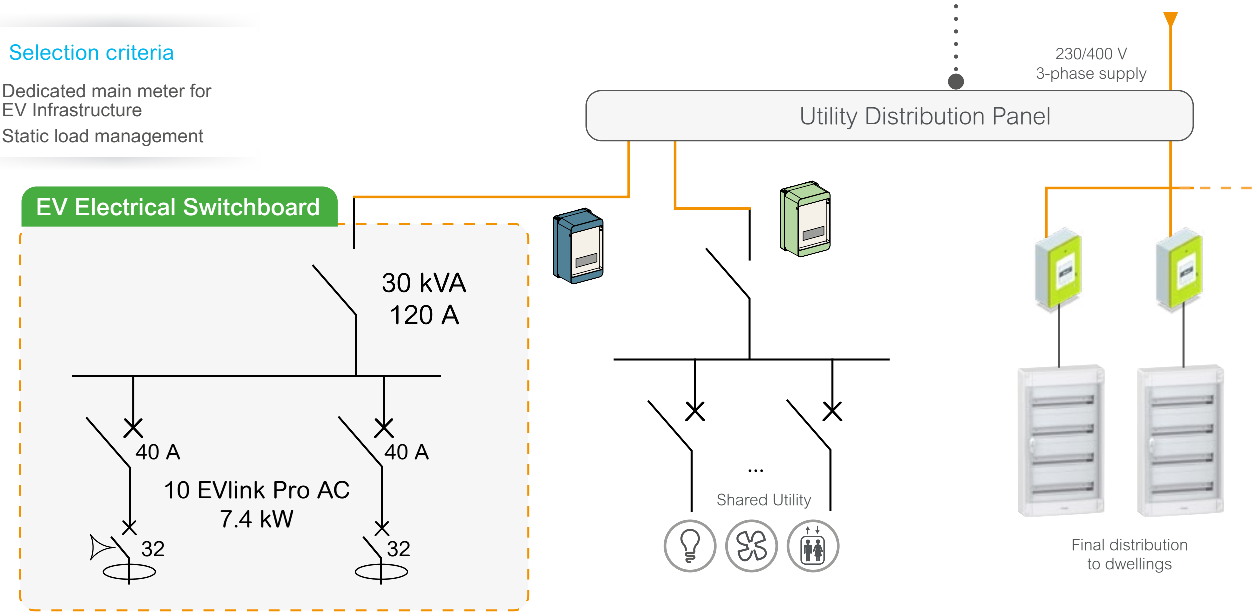
Zoom-in Power requirement based on options for electrical zones



Implementation with 1 dedicated main meter for EV infrastructure.

Selection criteria

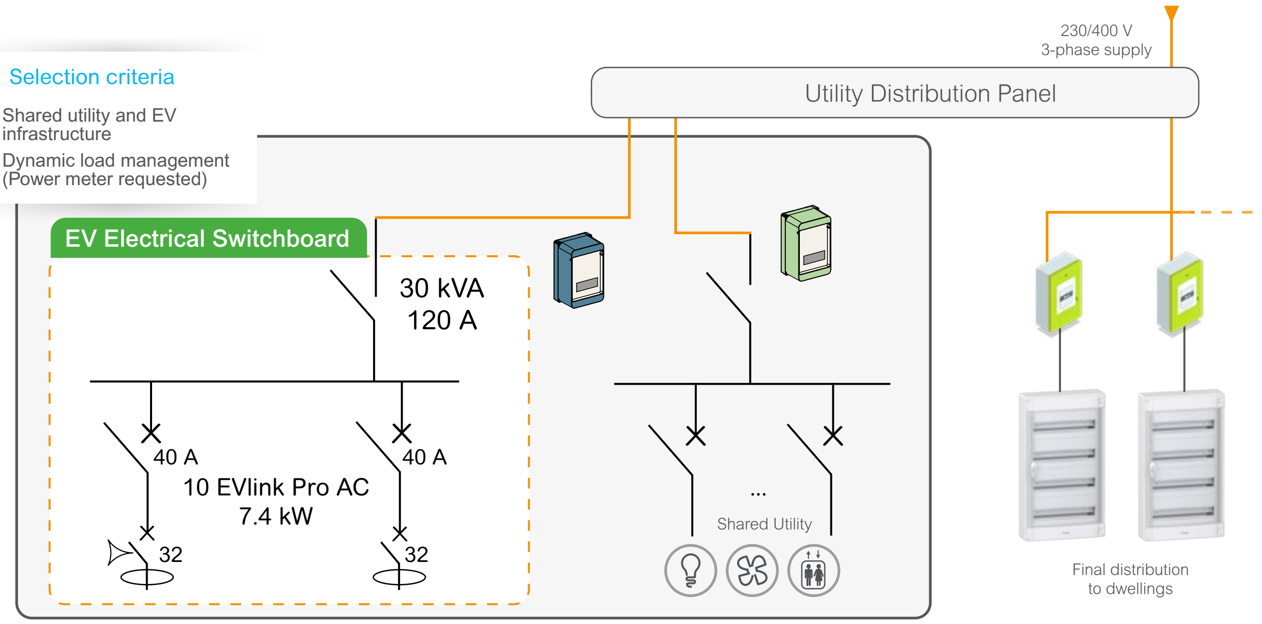
- Dedicated main meter for EV Infrastructure
- Static load management



1 sub-zone: 120 A static zone

Selection criteria

- Shared utility and EV infrastructure
- Dynamic load management (Power meter requested)



1 sub-zone: 120 A static zone
1 dynamic zone

Reference architecture for residential buildings

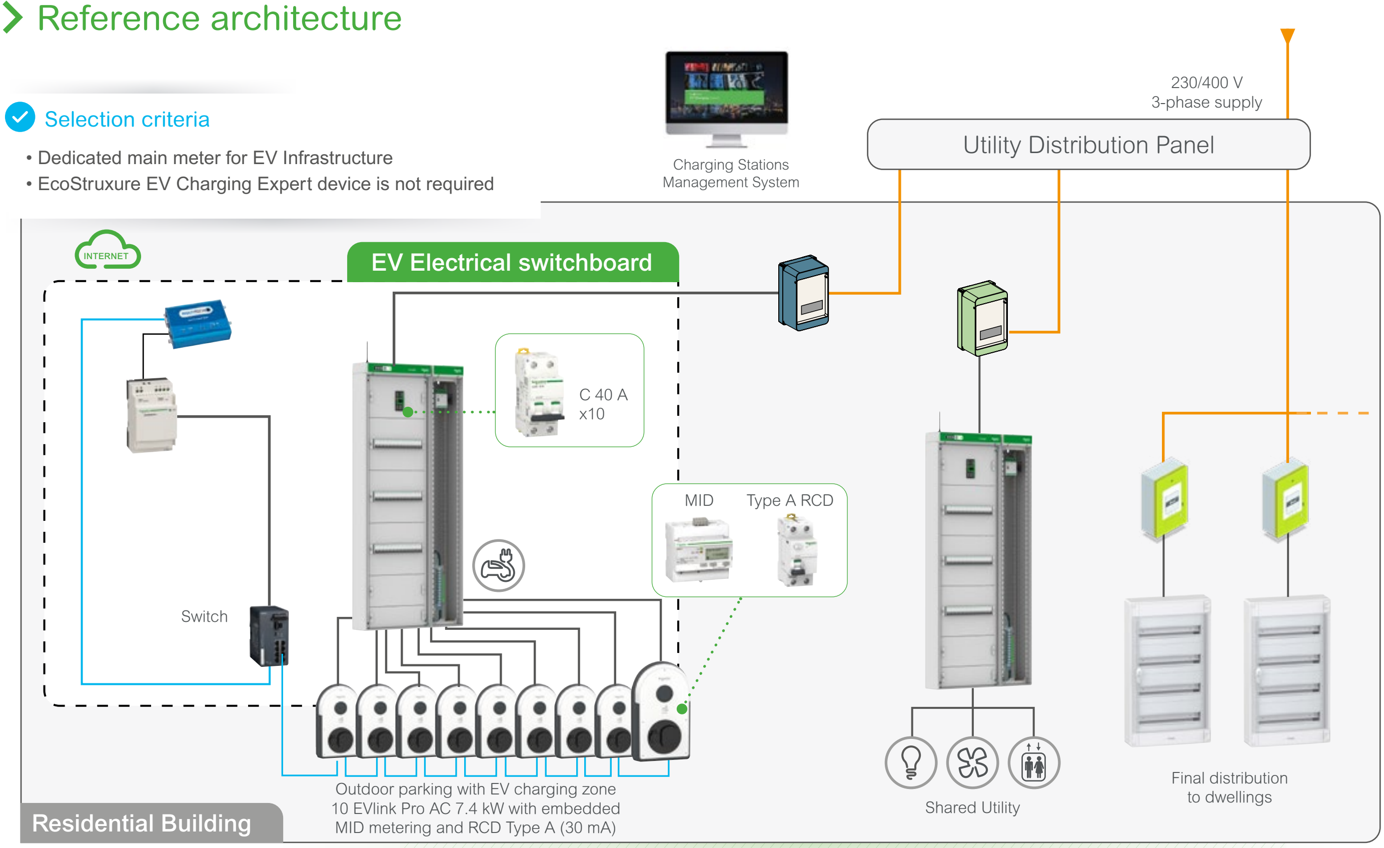
Zoom-in Alternative with cloud-based load management

With this architecture the EV load management is managed from the Charging Station Management System.

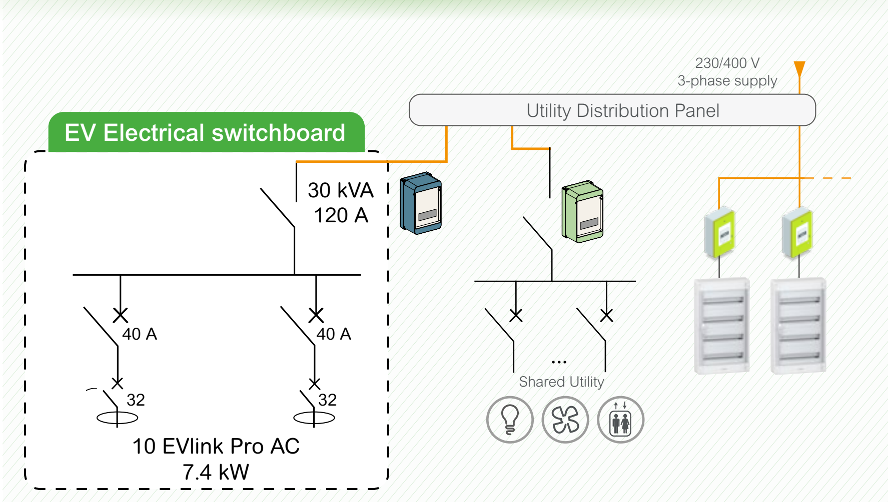
Reference architecture

Selection criteria

- Dedicated main meter for EV Infrastructure
- EcoStruxure EV Charging Expert device is not required



Electrical diagram



Reference architecture for residential buildings

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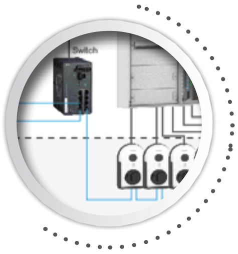
Zoom-in

EV Charging operations optimizing Ethernet network with 4G external modem WAN to Charging Stations Management System



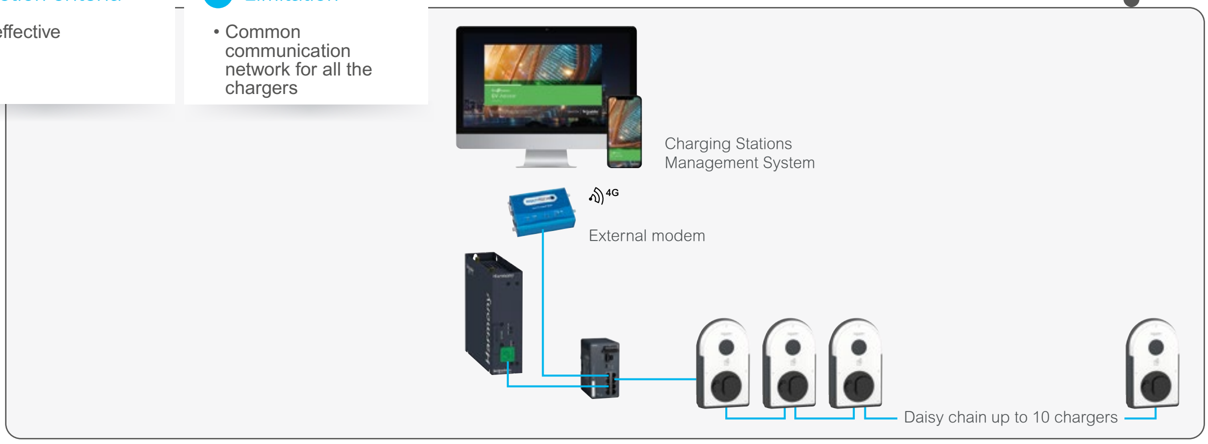
LAN Ethernet daisy chain connection.

Selection criteria

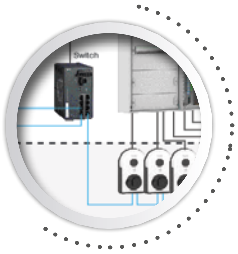
- Cost effective

Limitation

- Common communication network for all the chargers



Ethernet network



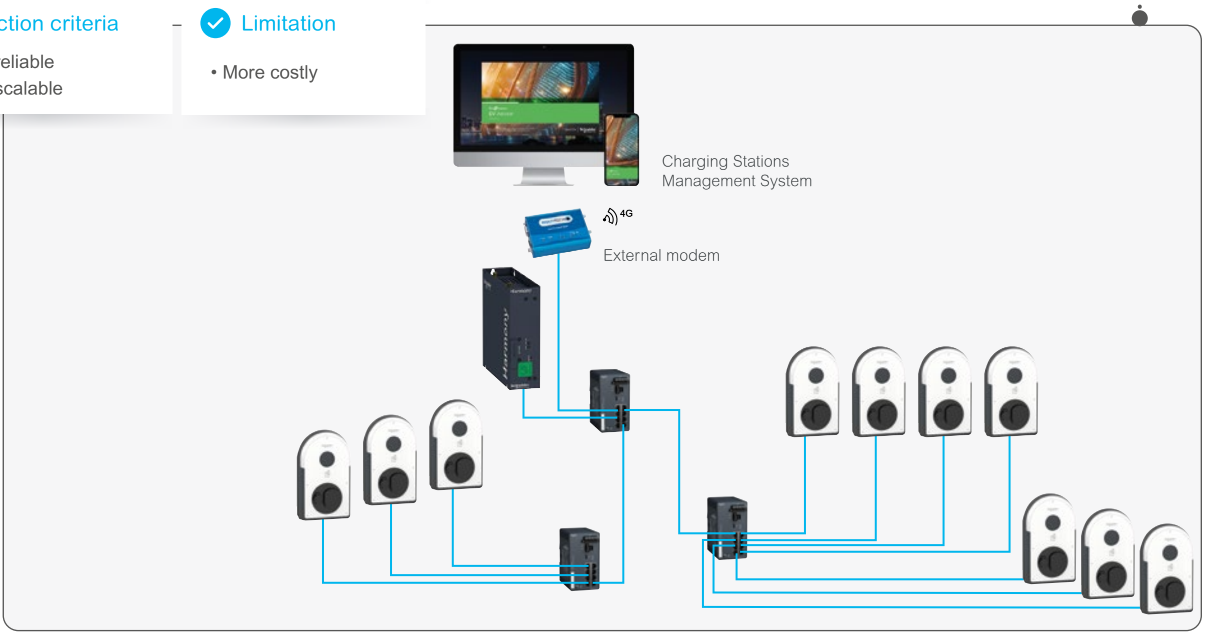
LAN Ethernet star connection option.

Selection criteria

- More reliable
- More scalable

Limitation

- More costly



Ethernet network

Ressources

Technical guides

Earth fault protection - Design Guide
CA908066E

EcoStruxure Power - Digital Application for Large Buildings and Critical Facilities
ESXP2G002EN

EcoStruxure Power for Commercial and Industrial Buildings - Design Guide
ESXP1G001EN

IEC Electrical and Digital Reference architecture Guide
EVSOL2DG001

White Papers

Smart charging solutions

Safety measures for Electric Vehicle charging

On the web

Wiki - EV charging

Schneider Electric specification tool

Schneider Electric eMobility solutions

Schneider Electric Green Premium

Schneider Electric Cybersecurity support portal

Schneider Electric Partner Program

EcoStruxure EV Charging Expert - Solar Impulse Mark

EV Ready certification

Schneider Electric support

Sales support

Customer Care

EVlink Field Services

Green Premium™

An industry leading portfolio of offers delivering sustainable value

More than 75% of our product sales offer superior transparency on the material content, regulatory information and environmental impact of our products:

- RoHS compliance
- REACh substance information
- Industry leading # of PEP's*
- Circularity instructions

The Green Premium program stands for our commitment to deliver customer valued sustainable performance. It has been upgraded with recognized environmental claims and extended to cover all offers including Products, Services and Solutions.

CO_2 and P&L impact through… Resource Performance

Green Premium brings improved resource efficiency throughout an asset's lifecycle. This includes efficient use of energy and natural resources, along with the minimization of CO_2 emissions.

Cost of ownership optimization through… Circular Performance

We're helping our customers optimize the total cost of ownership of their assets. To do this, we provide IoT-enabled solutions, as well as upgrade, repair, retrofit, and remanufacture services.

Peace of mind through… Well-being Performance

Green Premium products are RoHS and REACh compliant. We're going beyond regulatory compliance with step-by-step substitution of certain materials and substances from our products.

Improved sales through… Differentiation

Green Premium delivers strong value propositions through third-party labels and services. By collaborating with third-party organizations we can support our customers in meeting their sustainability goals such as green building certifications.

Discover what we mean by green
Check your products!

*PEP: Product Environmental Profile (i.e. Environmental Product Declaration)

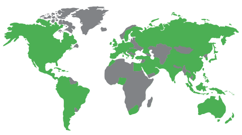
EcoXpert™ Partner Program

The Implementation Arms of EcoStruxure™ all over the World

EcoStruxure™
Innovation At Every Level

Who Are the EcoXperts?

An EcoXpert™ is a Schneider Electric **partner company** that is **trained and certified on EcoStruxure™**, our open, interoperable, IoT-enabled system architecture and platform.



A worldwide certified network delivering local support

More than **4,000** EcoXpert partners in **74** countries

EcoXpert™
Power Services
Certified by Schneider Electric

Cross-expertise knowledge

11 competency certifications (badges) available, distributed in:

- Building and Residential Automation (5 badges)
- Power Distribution and Management (5 badges)
- Services (1 badge)

THE CHANNEL CO. CRN ★★★★★ PARTNER PROGRAM GUIDE WINNER 2020

5-star recognition in CRN's 2020 Partner Program Guide

Why Call On an EcoXpert Partner?

- **Set the optimized solution and minimize costs** thanks to segment specialized partners
- **Receive lifetime support** for your products and projects (design, engineering, installation and maintenance phases)

One Program. One Network. Endless Opportunities.

Discover our EcoXpert program

Find the right partner to support your project

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