

# EV Charging infrastructure integration in energy and building management

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## 1 Objectif

The aim of this document is to provide guidance to system integrator, EcoXpert who wants to integrate charging infrastructure in Building Energy Management System with the REST API server of EV Charging Expert.

## 2 Introduction

Electromobility growth has major impact on building operations, presenting new challenges to facility managers and charge point operators. While integrating EV charging setup into existing infrastructure, many questions are naturally raised such as:

- What charging infrastructure makes sense?
- How to operate charging infrastructure in a flexible way?
- How to integrate the EV charging operations as smoothly as possible as part of an existing process?
- How to mitigate the impact of the rising demand and manage smartly power sources?

To tackle these new challenges for building operators, EV charging infrastructure needs to be integrated into existing operation platforms to simplify buildings management.

Operating an EV infrastructure mostly means to monitor EV loads, status and alarms as they are most of the time part of the building infrastructure and are electrically connected to the same power distribution. Moreover, when building microgrid is managed through specific software, the power dedicated to EV charging needs to be adapted as per a centralized software strategy.

EV Charging Expert, as EV load balancing device, opens its REST API to such Building Energy Management Systems in order to monitor and get better control over EV charging infrastructure without having to implement charging stations communication protocol and load balancing algorithms.

### 3 Glossary and reference documents

|                  |  |
|------------------|--|
| BEMS             | Building Energy Management System  |
| Charging Station | Physical equipment to charge EV (may have multiple Connectors)   |
| Connector        | Outlet on a Charging Station to connect an EV  |
| CPO              | Charge Point Operator  |
| CSMS             | Charging Station Management System   |
| EV               | Electrical Vehicle   |
| EVCE             | EV Charging Expert (Edge Gateway that manage EVs, EV loads balancing, OCPP Proxy and server REST API connectivity)                           |
| OCPP             | Open Charge Point Protocol (EV protocol based on web sockets)  |
| REST API         | Representational State Transfer Application Programming Interface: Simple webservice interface based on HTTPS and JSON                       |
| EBO              | EcoStruxure Building Operation (Schneider-Electric Building Management System)   |
| PME              | Power Monitoring Expert (Schneider-Electric Energy Management System)  |
| Static zone      | Group of EV chargers managed by EVCE with a static limitation  |
| Dynamic zone     | Group of EV chargers managed by EVCE with a dynamic limitation that varies depending on other loads connected to the same power distribution |

User Guide EV Charging Expert: [EcoStruxure EV Charging Expert User guide](#)

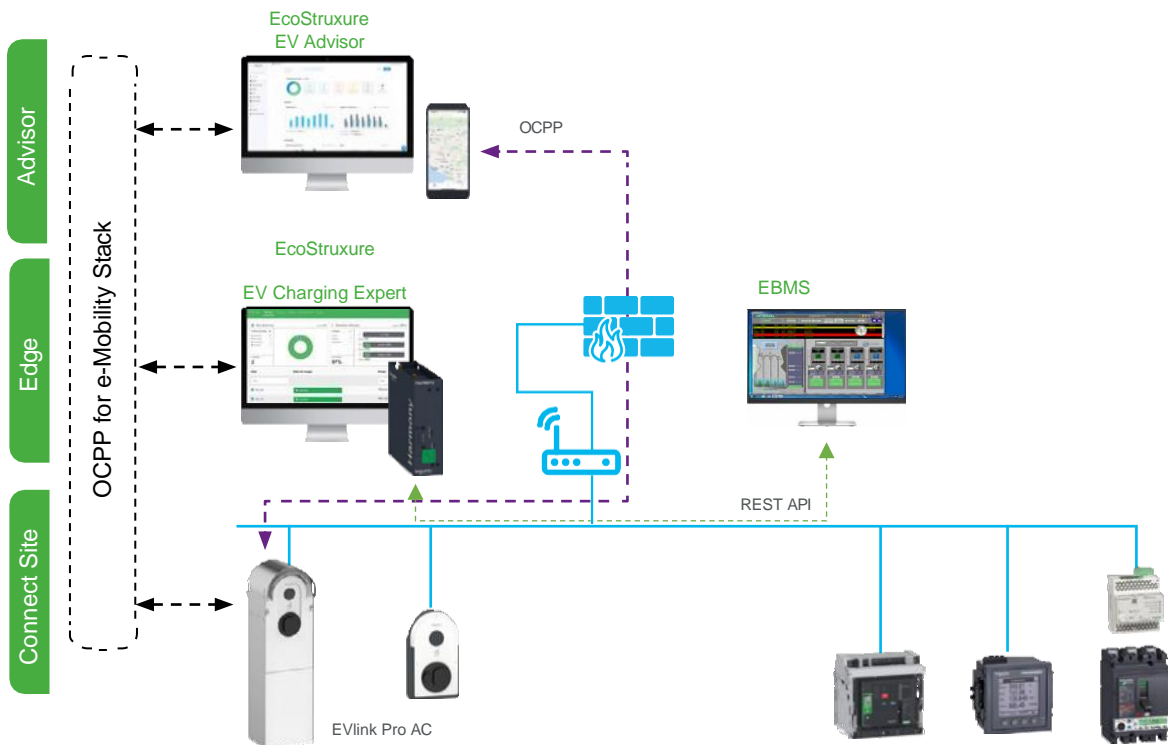
Wiki: [EV charging - energy and asset management - Electrical Installation Guide](#)

Details data are accessible:

- from The EVCE embedded web pages or
- by opening the YAML file: "BEMS EVCE 5\_3\_0 API.yaml" with a [Swagger Editor](#).

## 4 Architecture

### 4.1 Architecture description



### 4.2 Architecture limitations

One single EVCE + up to 100 charging stations (as per EVCE licence)

|                               | Availability in API | Supported in EBO              | Supported in PME |
|-------------------------------|---------------------|-------------------------------|------------------|
| EVlink Pro AC                 | Yes                 | Yes                           | Yes              |
| EVlink Wallbox, City, Parking | Yes                 | Yes (except cumulated energy) | No               |
| EVlink Pro DC60, 120-180      | No                  | No                            | No               |
| EVlink DC24                   | No                  | No                            | No               |

Recommended infrastructure limits:

- 4 zones max
- 25 chargers max per zone for PME
- One single BEMS connected to EVCE REST API at a time.

In case accurate energy measurement is required (such as precise billing for example), it is recommended to add dedicated Power meters directly connected to BEMS

## 5 Baseline

This feature is available from the following versions:

| Product                            | From Version |
|------------------------------------|--------------|
| EcoStruxure EV Charging Expert     | 5.3.0        |
| EVCE Smart Connector extension (*) | v1.1.0.1783  |

\* *Middleware for Schneider Electric offers (EBO/PME)*

These architectures have been validated with up to 100 EV Charging stations and 4 zones in EV Charging Expert.

## 6 Configuration:

### 6.1 User creation

#### REST API Login process

Create a user for REST API browsing through EVCE Admin / User Management web page:

- Add user with 'Webservices' role:

The screenshot shows the 'EV Charging Expert' web interface. The 'ADMIN' menu is selected, leading to the 'User Management' page. An 'Add User' dialog box is open, containing the following fields and options:

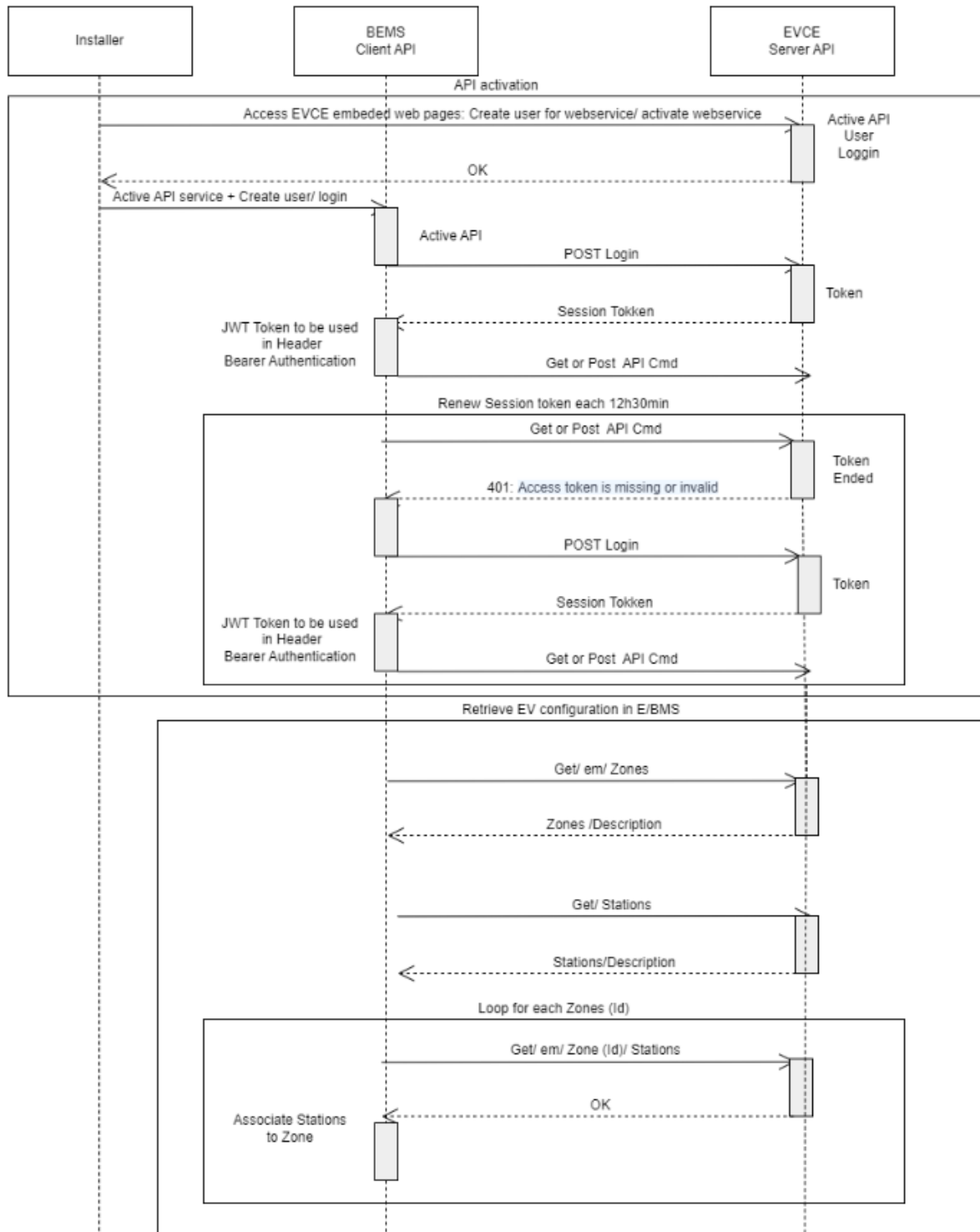
- Confirm you have right to add user:**
  - Administrator Username: Admin
  - Administrator Password: [masked]
- Provide new user information:**
  - New User Role: Webservices (dropdown menu)
  - New Username: MyClientName
  - New User Password: [masked]
  - Confirm Password: [masked]

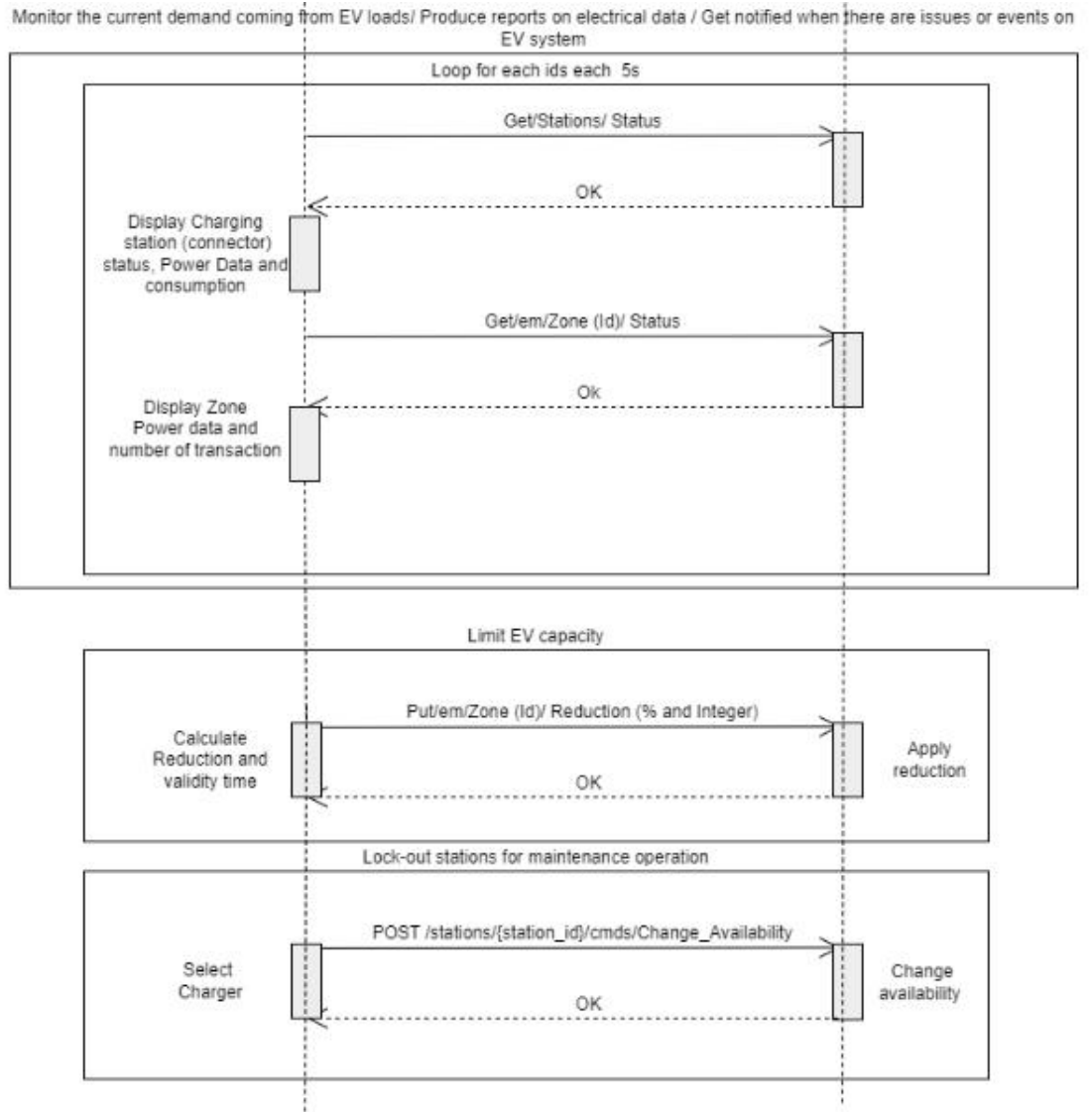
Below the password fields, there is a note: "Your password must satisfy the following conditions: at least 8 characters long, lowercase characters, uppercase characters, numbers, special characters". At the bottom right of the dialog are 'Save' and 'Cancel' buttons.

- **Log using Post / login / login** request with new created user credentials to get the bearer token that shall be used for all requests described below.

## 6.2 Sequence diagram

Refer to below description on how to use the REST API commands to get the relevant data from EVCE to BEMS.







## 7 List of API commands

Below are the main use cases which will be enabled while integrating the EVCE REST API.

### 7.1 Retrieve EV configuration in BEMS

#### 7.1.1 Description

The system integrator shall be able to retrieve the EV configuration that was previously carried out in EVCE and get the phase wiring of the chargers in BEMS.

#### 7.1.2 Data

- Zones (Name, type: static / dynamic / Max setpoint in Amps and Power kW)
- Charging Station (Model, ID)
- Connector (DC/ AC, Max current Power)
- Link of Station and zone
- Per connector: Phase connection: Tri123, Tri 231, Tri321, Mono1, Mono2, Mono3

#### 7.1.3 Limitations and recommendations

##### 7.1.3.1 EVCE reconfiguration

The system integrator shall first configure EVCE and discover all EV chargers managed by the EVCE and assign them to a zone.

Then he shall **back-up and save the configuration of EVCE**: refer to the user manual of EVCE. This backup configuration shall be restored in case of EVCE replacement.

The configuration in BEMS shall be done, only when 2 first steps are completed at EVCE level. In case of EVCE configuration change, configuration shall be done again at BEMS with potential loss of data history.

##### 7.1.3.2 EV Charging station replacement

EVCE will provide a **New ID** in case of EV charger physical replacement, so historical data may be lost.

The system integrator could re-assign the new EV Charging Station ID manually, if possible, in BEMS

Example with EBO:



Server 1 ▸ EcoStruxure Web Service - EVCE API ▸ EVCE Ews Server ▸ EVCE Zones ▸ Zone 1 ▸ P93 ▸ StationId ▸

System Tree

- Server 1
  - System
  - Servers
  - ADT Dashboards
  - EcoStruxure Web Service - EVCE API
    - EVCE Ews Server
      - EVCE Zones
        - Zone 1
          - HistoryItems
          - P92
          - P93
            - EVSE-1
              - Connector-1
                - HistoryItems
                - IsAcceptedByCpo
                - StationActiveEnergy
                - StationCpoUri
                - StationFriendlyName
                - StationId
                - StationIPAddress
                - StationIsAvailable
                - StationIsConnected
                - StationModel
                - StationNumberOfConnectors
                - StationOCPPIdentifier
                - StationOverallActivePowerPhase1
                - StationOverallActivePowerPhase2

StationId ×

Basic References

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General Information

|                 |                     |
|-----------------|---------------------|
| Name            | StationId           |
| Description     | StationId           |
| Type            | Long Value          |
| Foreign address | Null                |
| Modified        | 23/05/2024 10:09:24 |
| Note 1          |                     |
| Note 2          |                     |
| Validation      | None                |

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Status Information

|               |                                   |
|---------------|-----------------------------------|
| EWS Id        | Zones/Zone-1/Station-26/StationId |
| EWS Type      | integer                           |
| Value         | 26                                |
| EWS Writeable | ReadOnly                          |
| EWS State     | Good                              |

## 7.2 Produce reports on electrical data

### 7.2.1 Description

The facility manager shall be able to produce reports that detail total consumption per zone and individual consumption per connector per day, week, month in BEMS.

### 7.2.2 Data

- Per station:
  - o Total active energy (non-resettable counter)
- Per Zone
  - o Total active energy (non-resettable counter)

### 7.2.3 Limitations

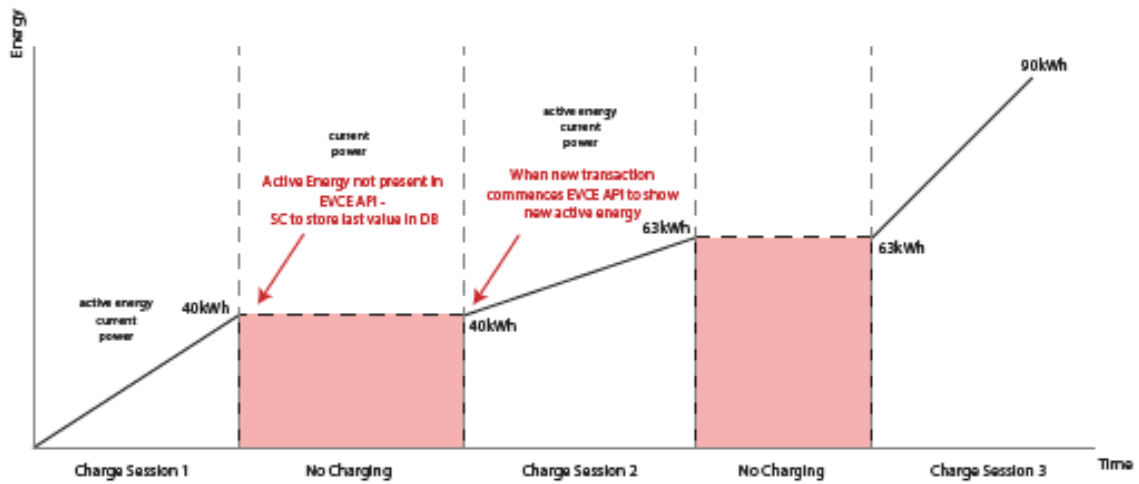
Total energy reporting process :

- Reported per connector in kWh thru active\_energy parameter value.
- Active\_energy parameter not reported when no transaction is ongoing.
- For disconnected charging station, connector total energy shall be the last active\_energy parameter value reported before connection loss.

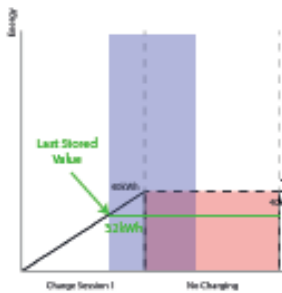
After a re-connection or an EVCE restart:

- Active\_energy is reported only when transaction is ongoing. Wait of a new transaction may be required to get it refreshed.

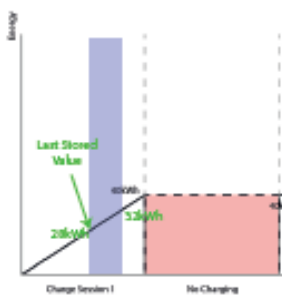
The following diagrams describe the behavior with Schneider electric Smart Connector extension used for PME and EBO



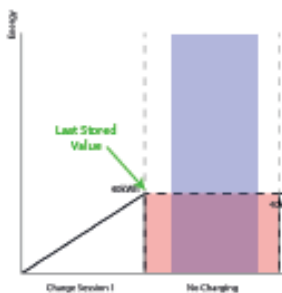
- EVCE API during the period blocked in red will not have active energy available to read from the API
  - Required change in EVCE firmware
- SmartConnector will store the last value in their database and present this during the period in red
  - Required change in SmartConnector



- If there is a loss of connection between SmartConnector and EVCE during the period highlighted in blue there will be a misalignment in data until the next transaction.
- The value that would be stored would be the one highlighted in green - 32kWh
- If the SmartConnector restarts during this period, it will store the last value in the database and reference this when back online - 32kWh



- If there is a loss of connection between SmartConnector and EVCE during the period highlighted in blue, the SmartConnector would start recording the value once the connection is re-established.
- The historical chart would show a straight line between the two data points



- If the SmartConnector restarts during this period, it will store the last value in the database and reference this when back online - 40kWh



## 7.3 Monitor the current demand coming from EV loads

### 7.3.1 Description

The facility manager shall be able to monitor the current demand coming from EV loads, at EVCE level, Zone level, Stations level and for each connector in BEMS.

### 7.3.2 Data

- Per connector
  - o RMS current in Amps and Power value in kW per phase and total active energy (non-resettable counter)
  - o Status (Available, preparing, charging, suspended, finishing, faulty, Not Available...)
- Per Station
  - o RMS current in Amps and Power value in kW per phase and total active energy (non-resettable counter)
  - o Connected (True/ False)
- Per Zone
  - o RMS current in Amps and Power value in kW per phase and total active energy (non-resettable counter)
  - o Number of ongoing transactions.
- Per EVCE
  - o EV demand in kW
  - o EV capacity in kW

## 7.4 Limit EV capacity

### 7.4.1 Description

The facility manager shall be able to limit the power capacity allocated to the EV charging from BEMS.

### 7.4.2 Data

- Zone setpoint reduction (either in absolute value: Amps for current, kW for Power or as a percentage of already configured maximum current in zone)
- Validity timestamp (Absolute time or duration): Base time of API is UTC.

### 7.4.3 Operation

Zone setpoint reduction:

- Reduction is applied to the zone maximum max current as defined in EVCE HMI irrespective of the energy management mode (static or dynamic)
- EVCE applies the minimum setpoint between the one received from BEMS and the calculated one out of internal load balancing algorithms.

### 7.4.4 Limitations

The reduction is not recovered after EVCE restart.

It is recommended to check that command is well applied in BEMS.

For PME the setpoint reduction command is only available in percentage, not in absolute value.

## 7.5 Get notified of EV system issues and events

### 7.5.1 Description

The facility manager shall be notified in BEMS when issues or events within EV infrastructure occur.

### 7.5.2 Data

Event notification:

- Available/Not available connector status change
- Alarm notification
- Faulted connector status
- Station communication fault:
  - o Station is\_connected parameter value = false
  - o Connector status parameter value = unknown
- EVCE communication fault

### 7.5.3 Known issue

User will retrieve communication loss alarm in BEMS when EVCE (version 5.3.0) REST API service is rebooting.



## 7.6 Available- Not Available command for Charging Station for maintenance operation

### 7.6.1 Description

Facility manager shall be able to declare some chargers as available/unavailable from BEMS to plan maintenance operations.

### 7.6.2 Data

- ConnectorId = 0 / evseld=0
  - o Change availability for all connectors of charging station
- ConnectorId = N / / evseld=0
  - o Change availability for connector N

### 7.6.3 Operation

Change availability process:

- Unavailable command sent during a charging session is effective only when the charging session is over.

### 7.6.4 Limitation

No retry automatically performed in case of disconnected charging station.

- It is recommended to check that command is well applied.

## 8 Cybersecurity

Requirements for API Cybersecurity are matching OWASP level 2. Its specification detail is available here: [OWASP ASVS 4.3](#). Regarding session tokens, refer to V3 Session Management and especially V3.3 Session termination. Most notably, if EVCE allows to keep sessions opened, consider req V3.3.2: "If authenticators permit users to remain logged in, verify that re-authentication occurs periodically both when actively used or after an idle period." (for L2: 12 hours or 30 minutes of inactivity)