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MINT Tender spec

VERSION 1.0

EN

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Table of Revisions

Date	Version	Description of Changes	Status	Author
06-12-2024	0.1	Concept	Draft	Frederik Leempoels
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1 Energy management

1.1 General

This chapter deals with the implementation of an energy management system that focuses on optimising energy flows (e.g., the charging process of individual charging stations), including hard- and software. The approach shifts from energy demand to supply, with the system distributing available energy over time, based on users' needs. The system considers both controllable (such as electric vehicle fleets) and non-controllable consumers (such as production processes), aiming for an efficient use of energy resources.

- Analysing production and consumption based on historical data to understand energy flows per installation.
- Real-time measurement of energy data that provides real-time insight into production of renewable energy and serves as a basis to control consumers.
- Providing a "control layer" (through physical controllers) that allows control between energy production on the one hand, possible storage (battery), and potential consumers (heat pumps, boiler vessels, freezers, vehicle charging infrastructure, etc.) on the other hand.
- Considering weather forecasts during the decision-making process.
- Being able to consider dynamic prices in the decision process.
- Making the platform available to users that allows them to start optimising policies through insightful reports.

1.2 Included in the solution

- Software.
- Licenses.
- EMS controller.
- 1 Measuring device type "cabinets".
- Communication to the cloud environment (e.g. modem + SIM card).
- Low voltage power supply.
- Required network switches (number tailored to charging points and communicating components).

In case of control based on multiple points in the electrical network, additional measuring devices can be installed (see section 1.4).

- Measuring device type "charging points".

1.3 Type of solutions

1.3.1 Single charge point - Type "Advanced"

For individual charge points, an energy management system with capacity control is installed, linked to the digital meter of the grid connection point. This system, combined with charging points of the "Advanced" type, regulates capacity based on the maximum peak setting by users.

1.3.2 Multiple charging points

At locations with multiple charging stations, a dynamic energy management system is used. This system collects real-time information about the demand for charging power and available energy resources, calculates the optimal energy consumption through algorithms, and sends instructions to charging stations to avoid overloading the network. The software collects and analyses real-time information about the power consumption and energy demand of each charging station.

1.3.3 Basic requirements

Basic requirements are included in the price and customised for each project. Additional needs require an annual license fee per charging point, including necessary hardware (e.g. modem, switches).

1.4 Components energy management

1.4.1 Measuring device: “Electricity”

Technical characteristics:

- Communication via RS-485 Modbus and or MODBUS TC/IP.
- Compatible with power control system.

The power meter displays real-time values including current, voltage, active power, reactive power, apparent power, power factor, frequency and consumption values.

1.4.2 Energy controller

The controller must be able to remotely read and monitor electricity meters and other metering devices, collect and analyse data, with sufficient internal memory and necessary software.

1.4.3 Network switch

All network cables from the charging points converge on a separate network switch with DIN-rail mounting, power supply of 24V DC and RJ45 ports according to the number of charging points.

According to cybersecurity requirements, one should have the possibility to switch to a managed switch.

1.4.4 Modem

The modem must provide a stable connection to the 4G network, be capable of sending and receiving data, with associated software for configuration and monitoring.

1.4.5 Low voltage power supply

The power supply must provide a stable power supply for connected equipment with DIN-rail mounting, supply in 230V AC, supply out 24V DC, minimum efficiency of 90%, and CE certified.

1.4.6 Cybersecurity

Due to security reasons, direct connection of the charging infrastructure to the building's internal network is not allowed. Linking is done via the Internet, with a modem, or via a managed switch to separate the networks. The energy management system must be certified to prevent access to confidential information on the customer's internal network.

1.5 Feature list EMS

- Grid connection protection by dynamically controlling EV charging infrastructure up to 5 levels.
- Dynamically control different brands and types of EV charging infrastructure at one location.
- Set charging priorities based on parking location and/or user profiles.
- Maximise car consumption of its own PV or wind energy by deferring non-priority charging sessions and by controlling a stationary battery.
- Visualise energy flows through a cloud-based dashboard.
- Set optimised EV charging regimes per user based on Model Predictive Control (MPC) and through any of the following inputs:
    - User's charging profile read via RFID code.
    - Depending on the departure time and desired autonomy entered via the energy management system app.
    - By linking with scheduling software.
- Predict and optimise the EV charging demand, the energy demand of the building and the PV production with Artificial Intelligence (AI).
- If the customer has a dynamic power tariff based on EPEX SPOT: charge at the lowest tariff blocks of the day.
- Dynamically control “controllable loads”.
- Execute control commands from the DSO[1].
- Read a fire control system and be able to respond to it.

1.6 EMS hardware / software setup

For each hardware type, the following links should be made.

1.6.1 AC charging points

- Measurement of each charge point/connector, power and current drawn per phase.
- Writing the maximum charging current of each charging point/connector.
- Temporarily deactivate the charge point (= interrupt charging session) by writing 0A or writing a deactivation command.
- Display the status of the charging session (A1, B1, B2, C1, C2, F).
- A communication gateway may be used, provided it operates transparently and does not apply its own logic.
- Reading out the RFID badge is possible.

[1] Distribution System Operator.

1.6.2 DC charging points

- Measurement of each charge point/connector, power and current drawn per phase.
- Writing the maximum charging current of each charging point/connector.
- Temporarily deactivating the charge point (= interrupting charging session) by writing 0A or writing a deactivation command.
- Display the status of the charging session (A1, B1, B2, C1, C2, F).
- A communication gateway may be used, provided it operates transparently and does not apply its own logic.
- Readout of the RFID badge is possible.

1.6.3 Stationary batteries

- Measurement of electrical values.
- Adjusting operating mode if available.
- Control of charging or discharging of the battery.

1.6.4 Solar installations

- Measurement of electrical values.

1.6.5 Energy meters

- Measurement of electrical values.

1.6.6 DSO / TSO specific hardware for RFG[2] compliance

- Transmission of measured values.
- Follow-up of control commands.

For making the link with the various energy assets on-site, Modbus TCP is preferred.

Depending on the number of devices to be linked, one or more PLCs can be used on-site. These controllers work together and can operate standalone in case of emergencies. Each PLC contains one central control program that reads and controls all hardware interfaces as needed. Optimised load schedules are calculated using Model Predictive Control (MPC) and transmitted from the central cloud environment. The PLC uses a secure and standardised MQTT interface to the cloud. Each PLC handles this independently, so there is no communication bottleneck. If communication with the cloud environment is temporarily unavailable, the PLC automatically switches to a fallback scenario running locally on the PLC. Once the Cloud Optimiser transmits optimised control commands, the PLC seamlessly switches to these settings. This structure makes it flexible to deal with different hardware while maintaining control logic.

[2] Requirements for Generators.