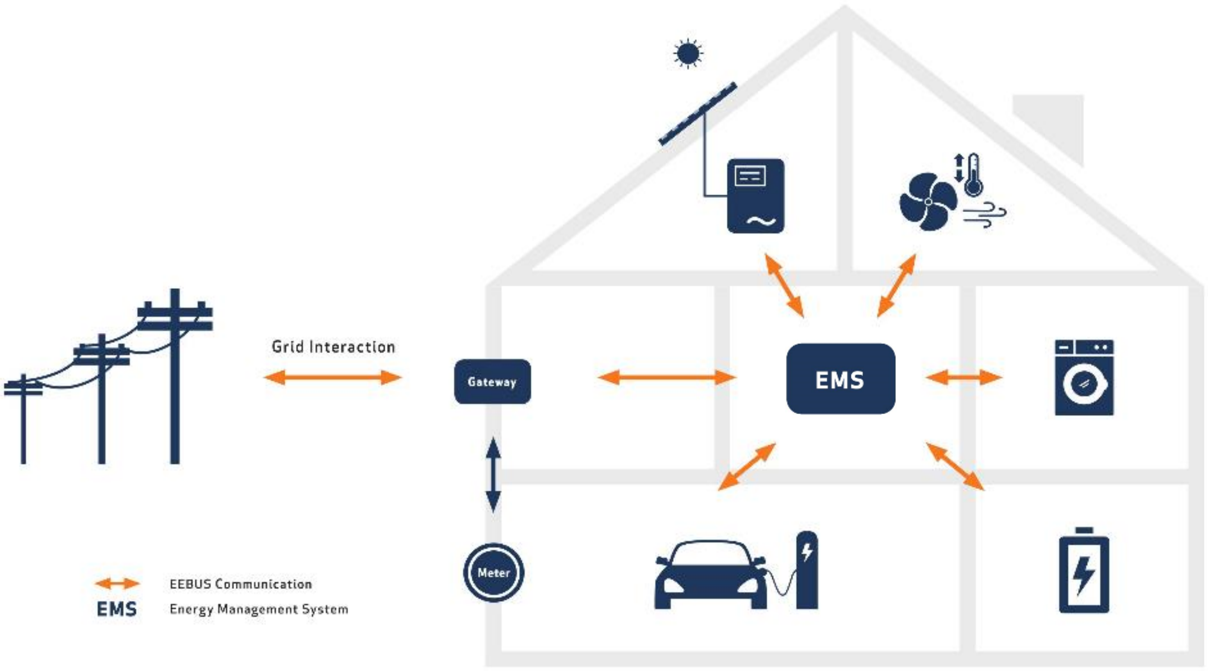
EEBUS
OVERVIEW USES CASES

V1.7 / 22.12.2022

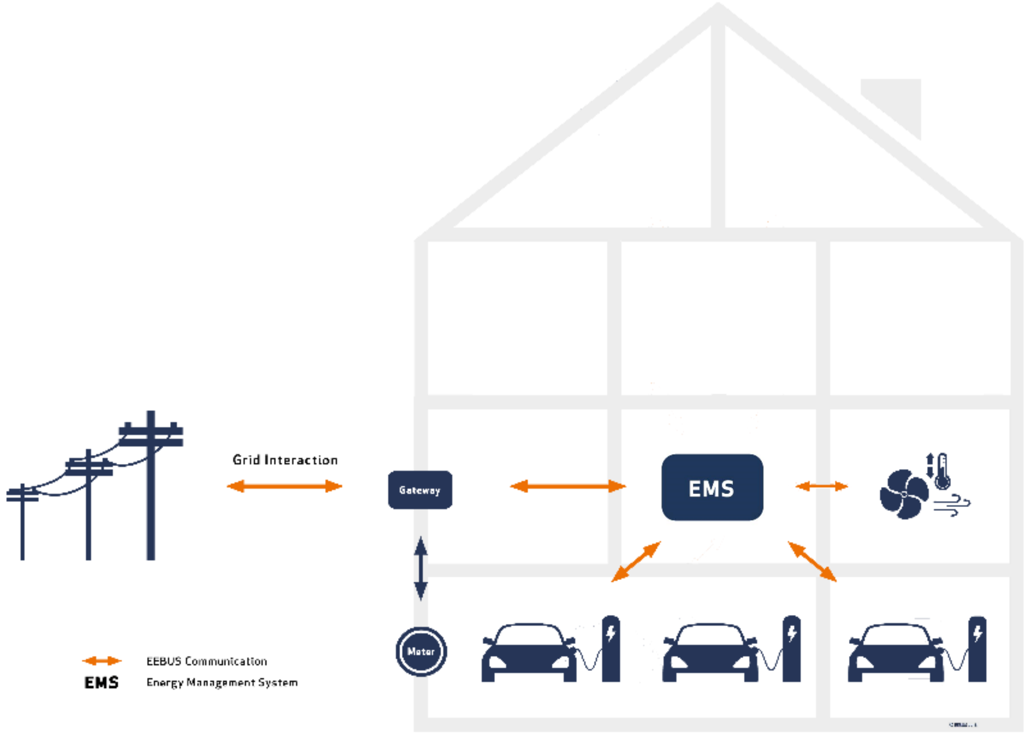
FROM RESIDENTIAL



Building Connectivity

Grid / ESP Connectivity

TO COMMERCIAL



Building Connectivity

Grid / ESP Connectivity

WHAT USE CASES DOES EEBUS PROVIDE?

	DSO/ESP at Grid Connection Point	E-MOBILITY	HVAC	Inverter	White Goods
	VDE 2829-6 FNN Requirement Profile	VDE 2122-1000 IEC63380	EN50631		EN50631
Blackout Prevention	Limitation of Power Consumption (LPC)[1,2]	Limitation of Power Consumption (LPC)[1,2]	Limitation of Power Consumption (LPC)[1,2]		
	Limitation of Power Production (LPP)[1,2]			Limitation of Power Production (LPP)[1,2]	
	Monitoring of Grid Connection Point (MGCP)[1,2]				
	Monitoring of Power Consumption (MPC)[1,2]	Monitoring of Power Consumption (MPC)[1,2]	Monitoring of Power Consumption (MPC)[1,2]		
Tariff Management	Time of Use Tariff (TOUT)[4]	Coordinated EV Charging (CEVC)[1,2]	Incentive Table based Power Consumption Management (ITPCM)[1,3]	Control of Battery (COB)[3]	Flexible Start of White Good IOT (FSWG_IOT)[1,3]
		Scheduled Bidirectional EV Charging (SBEVC)[4]			
Preventive Capacity Allocation	Power Demand Forecast (PODF)[4]				
	Power Envelope (POEN)[4]	Scheduled Bidirectional EV Charging (SBEVC)[4]	Incentive Table based Power Consumption Management (ITPCM)[1,3]		
	Extra Power Request (EPRQ)[4]	Coordinated EV Charging (CEVC)[1,2]			
Self Consumption Optimisation		Optimisation of Self Consumption EV (OSCEV)[1,2]	Optimization of Self Consumption by Heat Pump Compressor Flexibility (OHPCF)[1,2]	Control of Battery (COB)[3]	Flexible Start of White Good IOT (FSWG_IOT) (Example for DSO)[1,3]
		Dynamic Bidirectional EV Charging (DBEVC)[4]	Flexible Load/Heating Rod (FLOA)[4]		
				Monitoring of Inverter/Battery (MOI/MOB)[3]	
Further Use Cases for Monitoring & Control for EMS		Overload Protection by EV Charging Current Curtailment (OPEV)[1,2]			
		Power Consumption Monitoring (EVCEM)[1,2]	Monitoring and Control of Smart Grid Ready Conditions (MCSGRC)[1,3]	Monitoring of Inverter/Battery (MOI/MOB)[3]	
		EV Charging Summary (EVCS)[1,3]	HVAC Temperature Package [2]	Monitoring of PV String (MPS)[3]	
		EV State of Charge (EVSOC)[1,3]	HVAC System Function Package[2]	Visualisation of aggregated PV/Battery System (VAPD/VABD) [3]	
Setup		EV Commissionig and Configuration (EVCC)[1,2]			
		EVSE Commissionig and Configuration (EVSECC)[1,2]			
		Node Identification (NID) [4]	Node Identification (NID) [4]	Node Identification (NID) [4]	Node Identification (NID) [4]

Status of Use Cases
1 Standardised
2 Released (download)
3 Release candidate in evaluation
4 In progress

SPEAK ENERGY

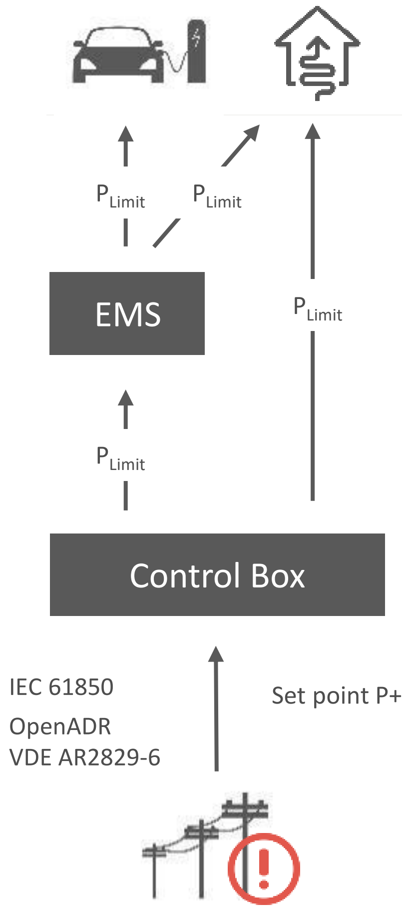
GRID INTERACTION USE CASES

Limitation of Power Consumption (LPC)

Enables the system to limit the power consumption (e.g. building or device). The definition of a duration is optional.

Added value: Avoids overload scenarios in the low-voltage distribution network by reducing the power consumption of the connected devices directly or through a local energy manager according to the received limits.

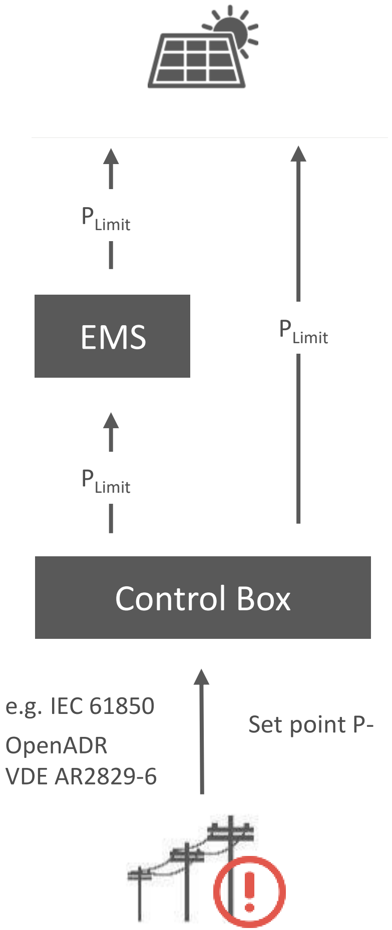
- >> EMS available → limit refers to total power consumption of the building
- >> No EMS available → limit refers to single device



Limitation of Power Production (LPP)

Enables the system to limit the power production. The definition of a duration is optional.

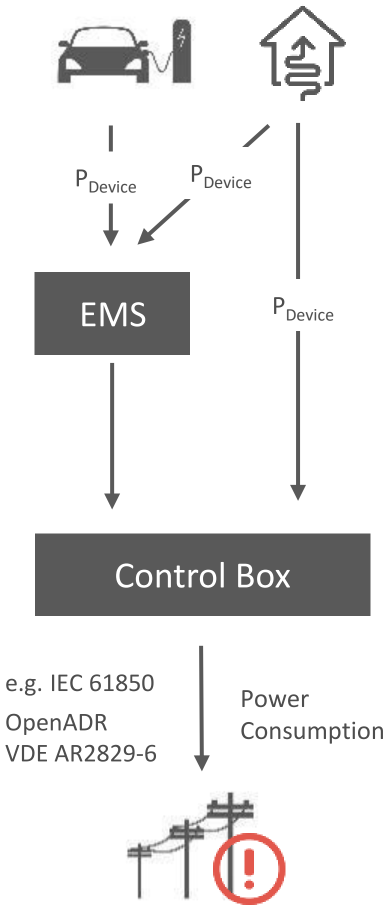
Added value: Avoids underload scenarios in the low-voltage distribution network by reducing the power production of connected power generation devices directly or through a local energy manager according to the received limits.



Monitoring of Power Consumption (MPC)

Enables the system to measure the power consumption or production of devices.

Added value: The energy manager may use the devices' power consumption within its control algorithm or use it for power consumption calculations or visualization. If the energy manager is connected to a DSO control box the energy manager may provide the current power consumption of flexible loads to the DSO. If the device is connected to the control box directly the DSO may read the devices' power consumption to identify hot spots.

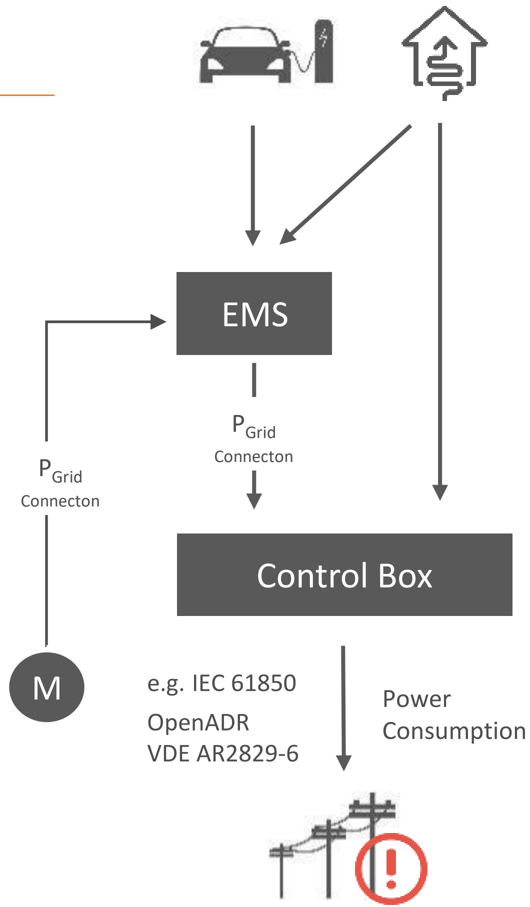


Monitoring of Grid Connection Point (MGCP) (Submeter or Smart Meter)

Enables the system to communicate

- Power, energy or current which is fed into or taken from the grid
- Voltage and frequency as grid stability information

Added value: The energy manager may use the total power consumption within its control algorithm or use it for total power consumption calculations or visualization. The DSO may read the total power consumption from the control unit to identify hot spots or even check the quality of the grid through voltage or frequency data.

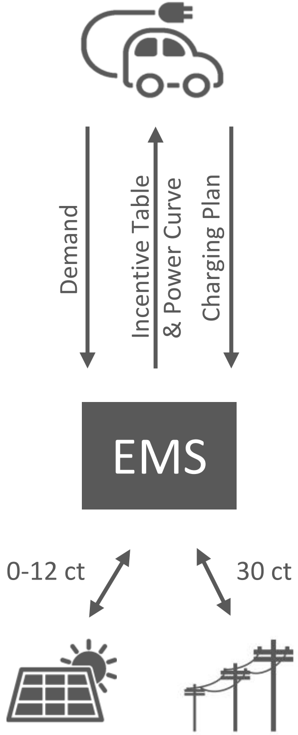


(B)EV USE CASES

Coordinated EV Charging

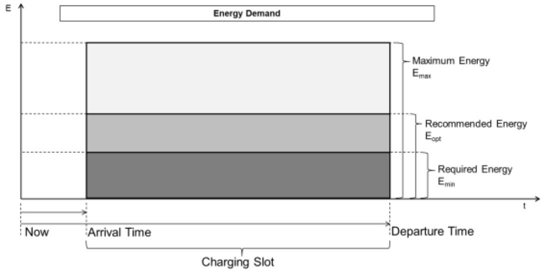
Enables communication of EV's departure time, minimum energy required and optimal energy (or maximum capacity) to the energy manager. The energy manager responds with an incentive table and the available energy (maximum power curve). The EV creates the charging plan at low monetary or ecological costs and sends it to the energy manager. A renegotiation may be triggered by all devices, e.g. if energy demands of the EV or the energy cost through more available PV energy has changed.

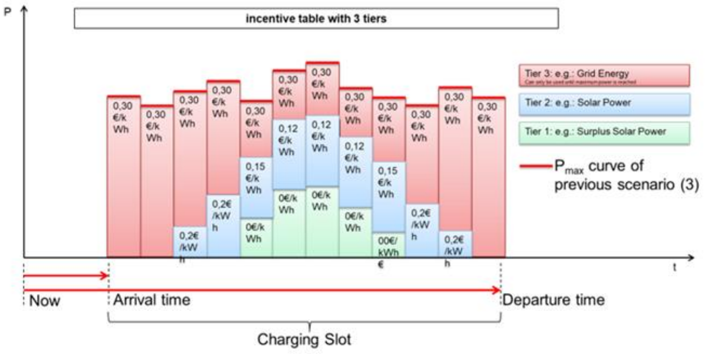
Added value: Through different energy resources at very different costs (e.g. cheap PV energy, PV energy at no costs during PV power curtailing, cheap grid energy during over production period) the costs of operation of an EV may be decreased significantly. In case of PV power curtailing charging the EV at no costs and zero carbon dioxide emission becomes true. Future option: The energy manager could send the energy demand forecast to the grid.



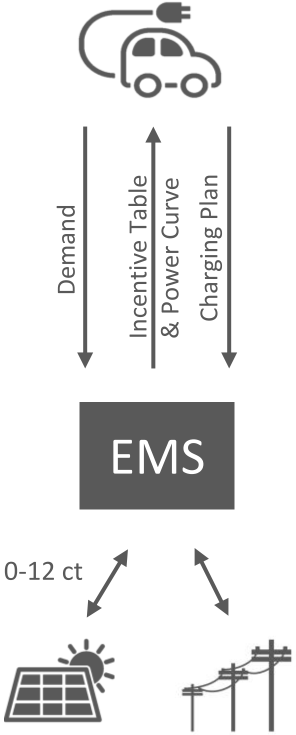
Details Coordinated EV Charging

EV sends departure time, minimum/ target/maximum energy demand

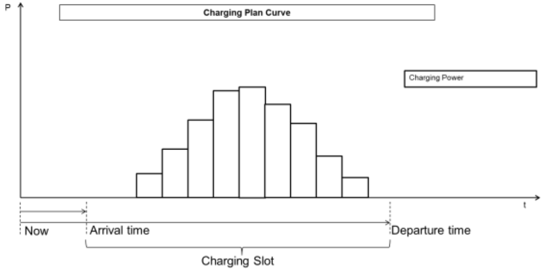




EMS sends incentive table / maximum power curve



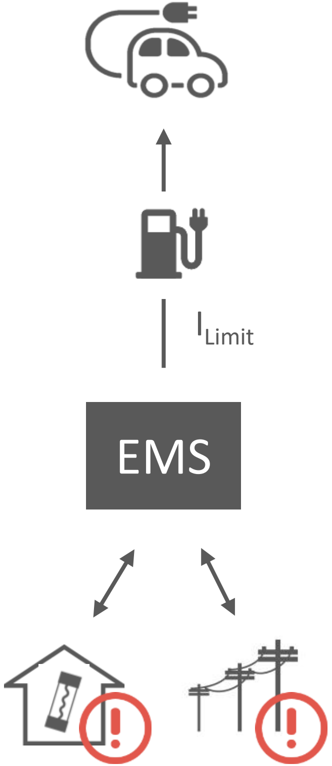
EV provides charging plan



Overload Protection by EV Charging Power Curtailment

Enables the system to limit the maximum charging current of the EV on each phase depending on the electrical connection.
As well the connection itself is monitored. In case there is no connectivity the EV will only operate within defined safety parameters typically set by the charging station (EVSE).

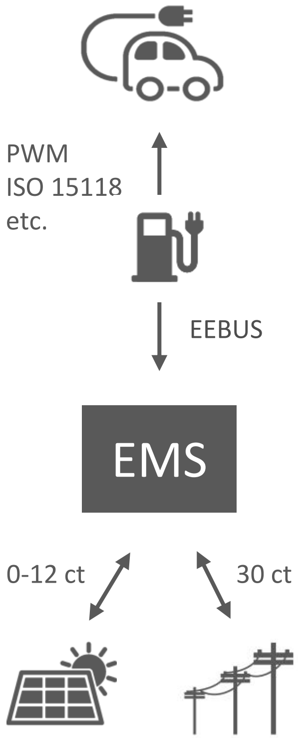
Added value: The power consumption of the EV may be reduced to prevent grid issues or even fuse brake through limiting the maximum current. The strong requirement to react within 4s will be fulfilled.



Optimization of Self-Consumption during EV Charging

Enables communication of optimal power level to indicate how much self produced power is available on each phase depending on the electrical connection. In addition, the connection itself is monitored.

Added value: EV can adjust its consumption to the actual self-produced PV energy to benefit from more cheap PV energy and less carbon dioxide emission to realize much better or even zero carbon dioxide emission footprint.



E-MOBILITY USE CASES (5)

EV Charging Electricity Measurement (Current, Power or Energy)

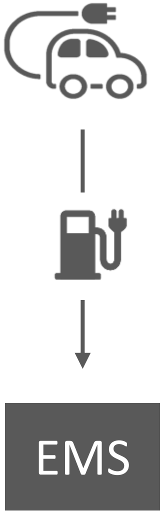
Enables communication of charging current, power or energy of the EV

Added value: Energy manager or corresponding device may consider actual energy demand of the EV

EV State of Charge

Enables the EV to communicate the percentage of charge and the battery capacity to the energy manager to calculate how much battery capacity is already charged and how much capacity is left to charge.

Added value: To increase self consumption it is important to the energy manager to know how much capacity is available, e.g. when PV forecast indicates that the PV power will exceed the grid feed-in limits, the costless energy can be stored into the battery and zero carbon dioxide emission becomes true.



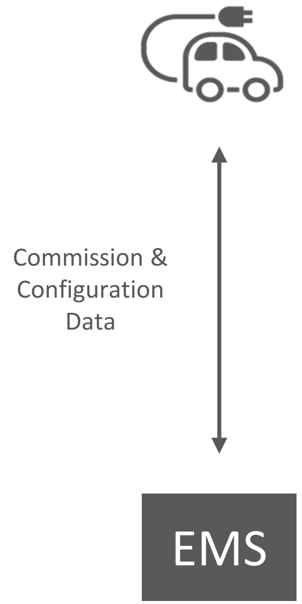
E-MOBILITY USE CASES (6)

EV Commissioning and Configuration

Enables communication of the EV’s:

- Identification
- Communication standard (between EV and charging station)
- Asymmetric charging support (different currents on each phases)
- Manufacturer data (e.g. serial number, device and vendor name)
- Charging power limits

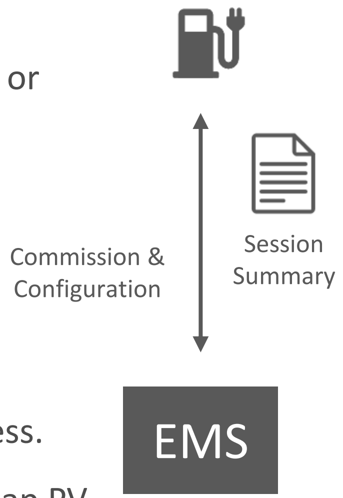
Added value: Exchange of relevant data to integrate EVs into the smart home



EVSE Commissioning and Configuration

Enables the system to communicate EVSE type specific values, e.g. manufacturer, device type or serial number of the EVSE to the energy manager.

Added value: Provide relevant data to integrate charging stations into the smart home



EV Charging Summary

During and after the charging process a summary may be requested by the EV. The summary provides information about the power consumption as well as the costs of the charging process.

Added value: 100% transparency on costs of operation and efficiency of EVs recharged by cheap PV energy or through cheap grid power (future option: flexible tariffs)

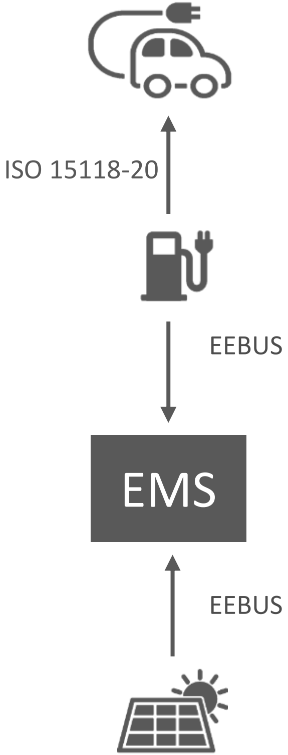
Bi-directional EV Charging (V2H/V2G)

Enables the system to use the battery of the EV for V2H or V2G applications like

- Increase of self-consumption: Charge PV energy into the EVs battery to make PV energy available after sunset
- Peak shaving
- Participate in Intraday or primary control reserve trading

The EV's constraints (departure time, energy demand) will be fulfilled at any time.

Added value: EV may be used to increase self-consumption and autarky rate (V2H) of a building by making cheap PV energy available after sunset. The BEV owner may participate in Intraday or primary control reserve trading to get payments for grid support.

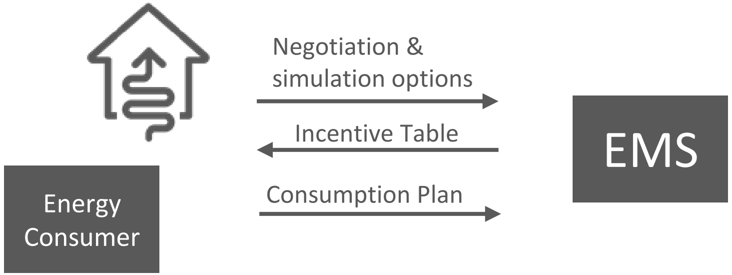


HVAC USE CASES

Incentive Table based Power Consumption Management

Enables the energy manager to influence the power consumption of a device (e.g. heat pump) through the price of energy (incentive table).

Added value: The energy manager may negotiate consumption plans without touching the devices' internal process. The devices know about when green, cheap or costless energy is available and can change the operation mode accordingly. The device can operate without loss of comfort by accepting the energy price valid at that time.

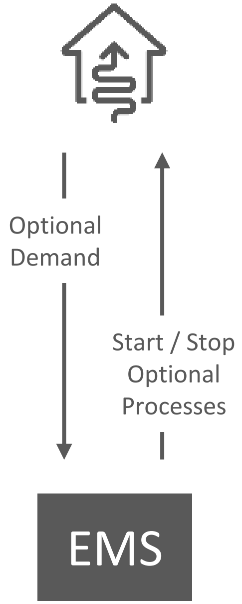


HVAC USE CASES (2)

Optimization of Self Consumption by Heat Pump Flexibility

This Use Case explicitly describes the combination of a PV system and an electrical heat pump system with the goal of optimizing the electrical power consumption of the heating system according to the available PV power in order to reach economic or ecological goals.

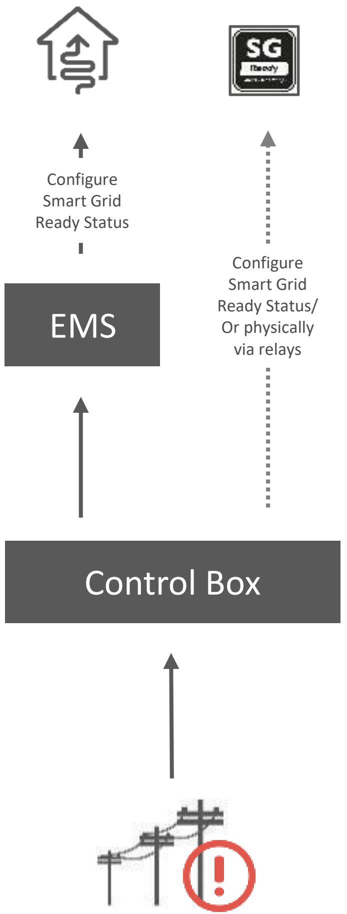
Added value: To make sure the heat pump is running at the lowest costs it should be integrated into the energy management. This feature enables the coordination of cross domain processes.



Monitoring and Control of Smart Grid Ready Conditions

Enables system to read/write “SmartGrid-Ready Status” from/to the heat pump

Added value: Digitalization of relay contact. Set 1 of 4 different states, e.g. “SmartGrid-Ready Status” to “SG Ready Condition 3” digitally by an EMS. This use case is especially designed to support retro fit of heat pumps

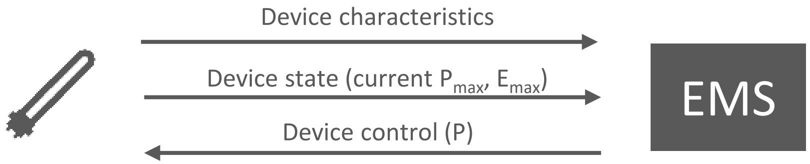


HVAC USE CASES (4)

Flexible Load /Smart Heater DHW

Simple use case for closed-loop-control of a device's optional power consumption. This use case is applicable for devices that can be controlled with no or minimum delay. An example is a hot water storage with smart heater which may heat up the domestic hot water (DHW) to the maximum allowed temperature.

Added value: Especially useful for short-term use of PV power that otherwise would need to be power curtailed. The use case complements other use cases that enable early scheduling of energy consumption.



Monitoring/Configuration of Temperatures

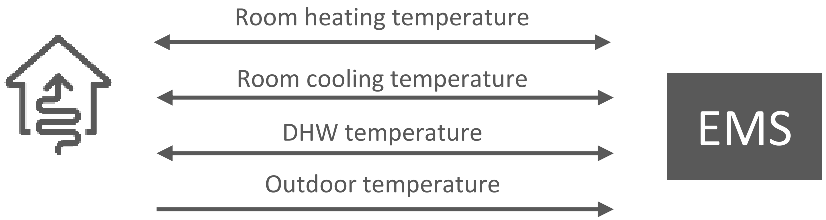
This Use Case collection enables the energy manager to monitor / configure temperatures of an HVAC system.

Monitoring: Energy costs may be saved by reducing the temperatures during non-use of rooms. The energy demand of the HVAC system may be estimated by comparing the actual temperatures to the setpoints.

Configuration: The energy manager may adjust the setpoints according to a user input or based upon algorithms that consider energy optimization tasks as well as consumption profiles.

Depending on the capabilities of the HVAC system one or more of the following temperatures may be monitored/configured:

- Room heating temperature
- Room cooling temperature
- Domestic hot water (DHW) temperature
- Outdoor temperature (monitoring only)



Monitoring/Configuration of System Functions

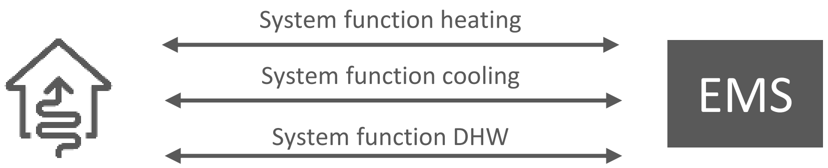
An HVAC system function (heating, cooling, ventilation or domestic hot water) may be monitored/ configured by an external appliance or display unit such as HMI (human-machine-interface) or tablet/smartphone.

Monitoring: The status of the HVAC system may be visualized

Configuration: The HVAC system may support overrun operations that override the current operation mode temporary

Depending on the capabilities of the HVAC system one or more of the following system functions may be monitored/configured:

- System function heating
- System function cooling
- System function DHW (domestic hot water)



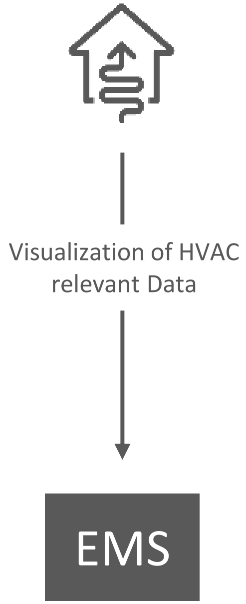
Visualization of Heating Area Name

Enables the HVAC system to communicate the

- Heating circuit name
- Heating zone name
- Heating room name

of a HVAC room.

Added value: The names can help identify the heating circuit, heating zone or heating room during installation or maintenance.

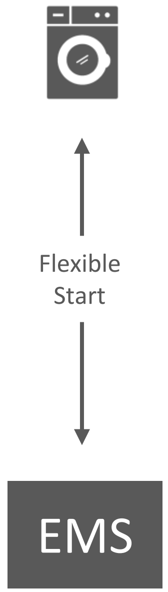


WHITE GOOD USE CASES

Flexible Start

Enables the system to start a pre-selected program of a device. The user will select the end time of a program right at the device which communicates end time, selected program and its power profile to the energy manager. The energy manager determines the timeslot of the program at the lowest energy costs between now and the pre-defined end time.

Added value: The energy manager may run the devices at the lowest energy costs or even for free during PV power curtailing with zero carbon dioxide emission footprint.



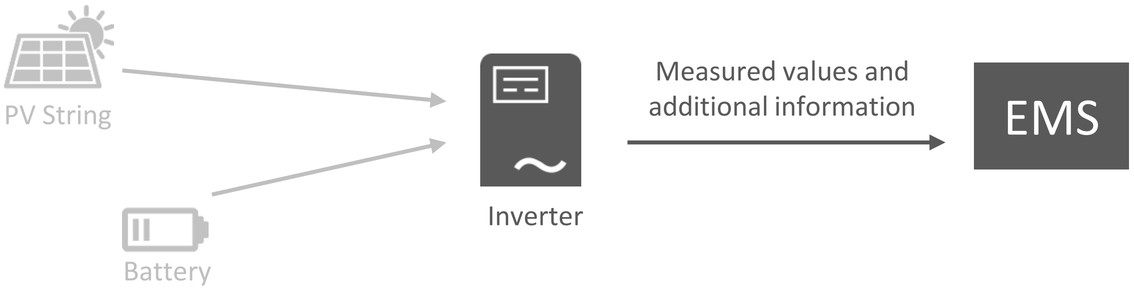
SPEAK ENERGY

PV AND BATTERY SYSTEM USE CASES

Monitoring of Inverter

Enables the energy manager to monitor data provided by any type of inverter, such as PV, battery, hybrid, etc. The inverter provides information like identification, state, power production or data points needed for diagnosis or efficiency calculation.

Added value: An energy manager may read all energy relevant values from the inverter to consider those in energy management or to show detailed status information.



Monitoring of PV String

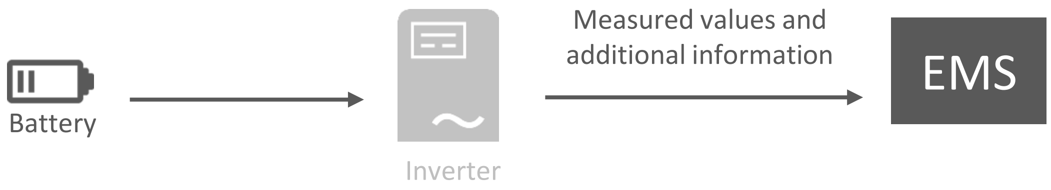
Enables the energy manager or user interface to read PV string specific data like momentary power production, voltages, etc., as well as debugging data like insulation resistance of a PV module through the connected inverter.

Added value: An energy manager may analyze the behavior of the PV system like decrease of power generation or determine the share of the respective DC sources like PV or battery which the AC current is actually generated from. Thus, an energy manager could determine the energy price accordingly or draw conclusions about the type of generation.

Monitoring of Battery

Enables the energy manager or user interface to read battery system specific data such as identification information, the state of the battery, power/current/voltage, or nominal values.

Added value: An energy manager may read all energy relevant values from the battery to consider them in energy management like recharging of an EV independent of the availability of grid energy or to show detailed status information.



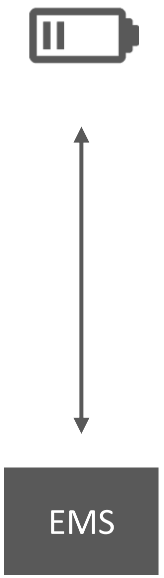
INVERTER USE CASES (4)

Control of Battery

Enables the system to integrate battery systems by controlling its operating behaviour through 2 control modes

- "Power“: The power of the battery is directly controlled (charge/discharge)
- "PCC“: The battery monitors the grid connection point and aims to reach a configured setpoint at the GCP (e.g. "0W")

Added value: The battery may be controlled by the EMS within its operating limits to store PV energy temporary and provide energy to the building over the day and even after sunset.

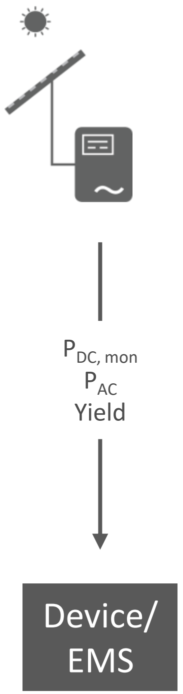


Visualization of aggregated Photovoltaic (PV) Data

Enables the communication of basic PV system information

- Nominal peak power $P_{DC, nom}$
- Current power production P_{AC}
- Cumulated yield [kWh]

Added value: Devices (e.g. heat pump, energy manager) may read the most important energy values of PV systems for visualization or to consider those for basic energy management functions.



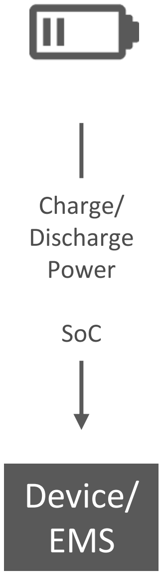
INVERTER USE CASES (6)

Visualization of aggregated Battery Data

Enables communication of the

- Charge or discharge power of a battery
- Charging level of the battery in percent (SoC)

Added value: Energy Manager may read most important energy values of battery systems to consider those in energy management, e.g. to offer fast recharge to the EV.

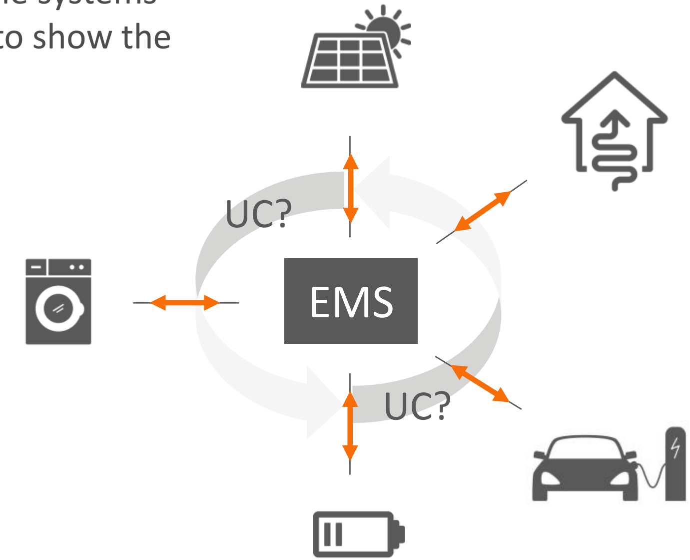


COMMISSIONING

Use Case Discovery

Enables the discovery of supported use cases of the connected devices

Added value: All devices, especially the energy manager, know about the systems possibilities. In addition, a smart phone app may use the functionality to show the interoperability of the connected devices.



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