Electric Vehicle CPMS and Secondary Substation Management

E-Mobility Power System – Stockholm, Sweden

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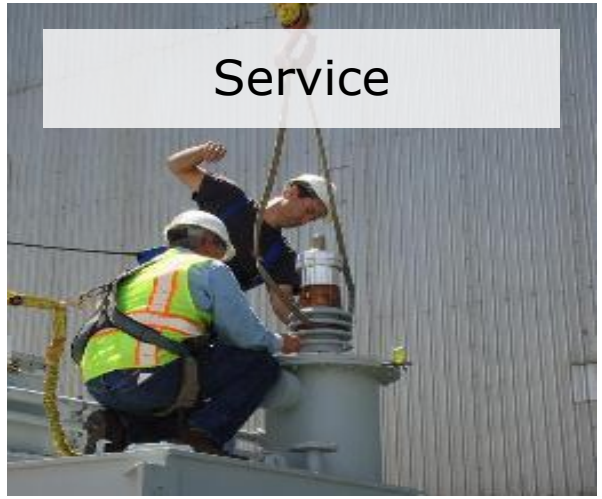
Efacec has activity in three business segments

Our power products' portfolio includes …

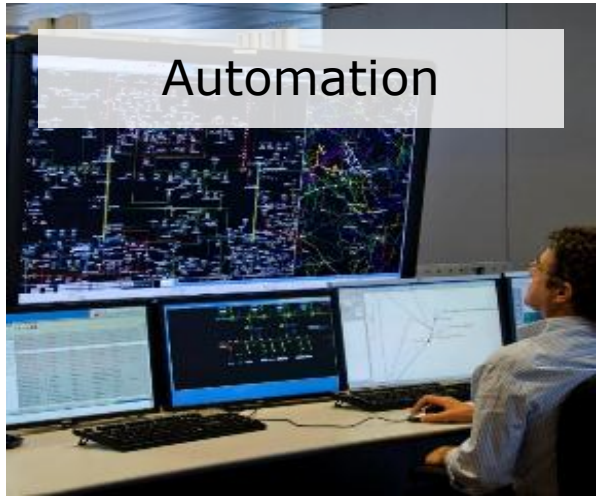
- **Power** Transformers:
  - Shell
  - Core
- Mobile **Substations**
- **Distribution** Transformers

- **Primary** Distribution
- **Secondary** Distribution
- Compact **Substations**
- **High and Medium Voltage** Switchgear

- Application:
  - Electric power grids
  - Electric distribution systems
  - Industry
  - Infrastructure systems



- **Vertically integrated services** to:
  - Industrial facilities
  - Hydroelectric power plants
  - Thermoelectric power plants
  - Small hydro power plants
  - Cogeneration
  - Wind farms
  - Substations
  - Transformer stations



- Energy Management Systems
- Advanced Distribution Management Systems
- Protection, Automation and Control Systems
- Smart Grid Solutions
- Power Electronics
- Energy Storage
- Space Project

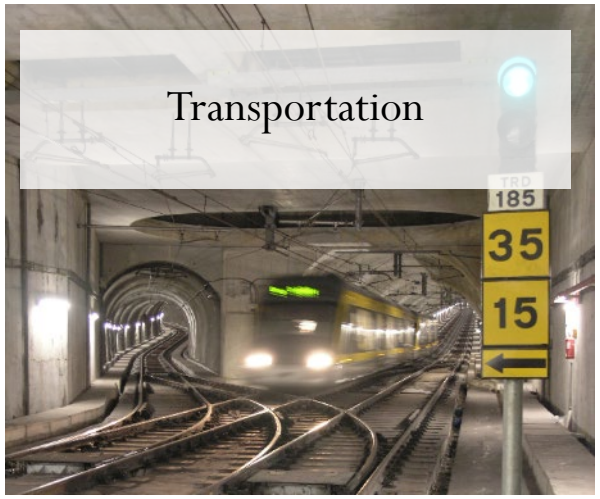
- Application:
  - Electrical power grids
  - Utilities
  - Transportation
  - Cities
  - Industry

We develop turnkey contracting solutions for …

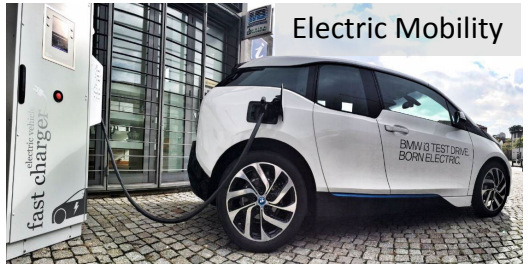
- Production, Transportation & Distribution
- Integrated offer of Maintenance and Technical Assistance

- Effluent treatment stations
- Water treatment plants
- Pumping for irrigation and supply stations
- Mechanical treatment (Sorting and Biological Treatment of Solid Waste
- Refuse Derived Fuel Systems
- Biogas and Valorization Systems
- Systems operation

- Cogeneration/Combined Cycle/Conventional Thermal Plants (Coal/Oil)
- Distributed control systems (DCS)
- Control & instrumentation
- Energy efficiency retrofit



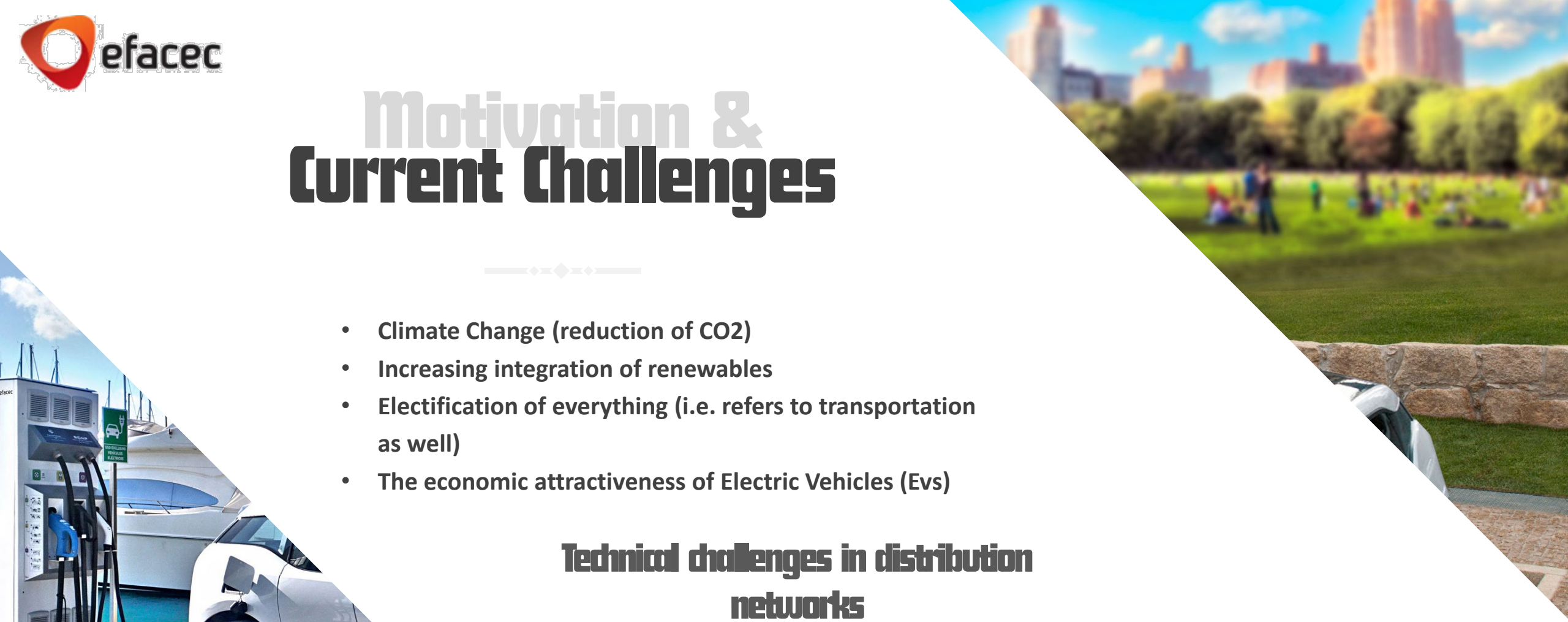
- Integrated electrical and automation solutions for Railways, Light rails and Roadways segments
- Core capabilities also able to be used in Telecom



Efacec offer includes a full range of Solutions for Electrical Vehicles

- Full range of charging solutions to Electric Vehicles
  - Private Charging | Public Charging
  - Quick Charging |Buses Charging
- Integration of cars, motorcycles and buses in management systems for efficient use of electric grid infrastructure

Motivation & Current Challenges



- Climate Change (reduction of CO2)
- Increasing integration of renewables
- Electification of everything (i.e. refers to transportation as well)
- The economic attractiveness of Electric Vehicles (Evs)

Technical challenges in distribution networks

- Roll-out of EV? (overloads on secondary S/S)
- Notable voltage drops
- Possible increased losses (i.e. up to 10%)

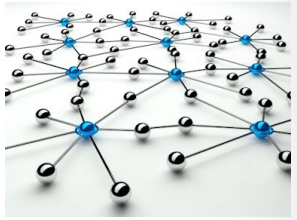
ACTORS

For the framework

Distribution system operator

DSO

Charge Point Operator

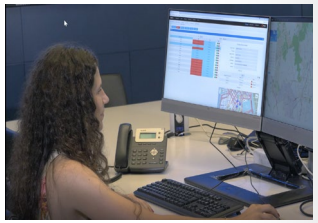


EV CPO

Electric mobility service provider

eMSP

Charge point management point



CPMS

Electric Vehicles Drivers

EV DRIVER

Electric Vehicle supply equipment of EV battery charger

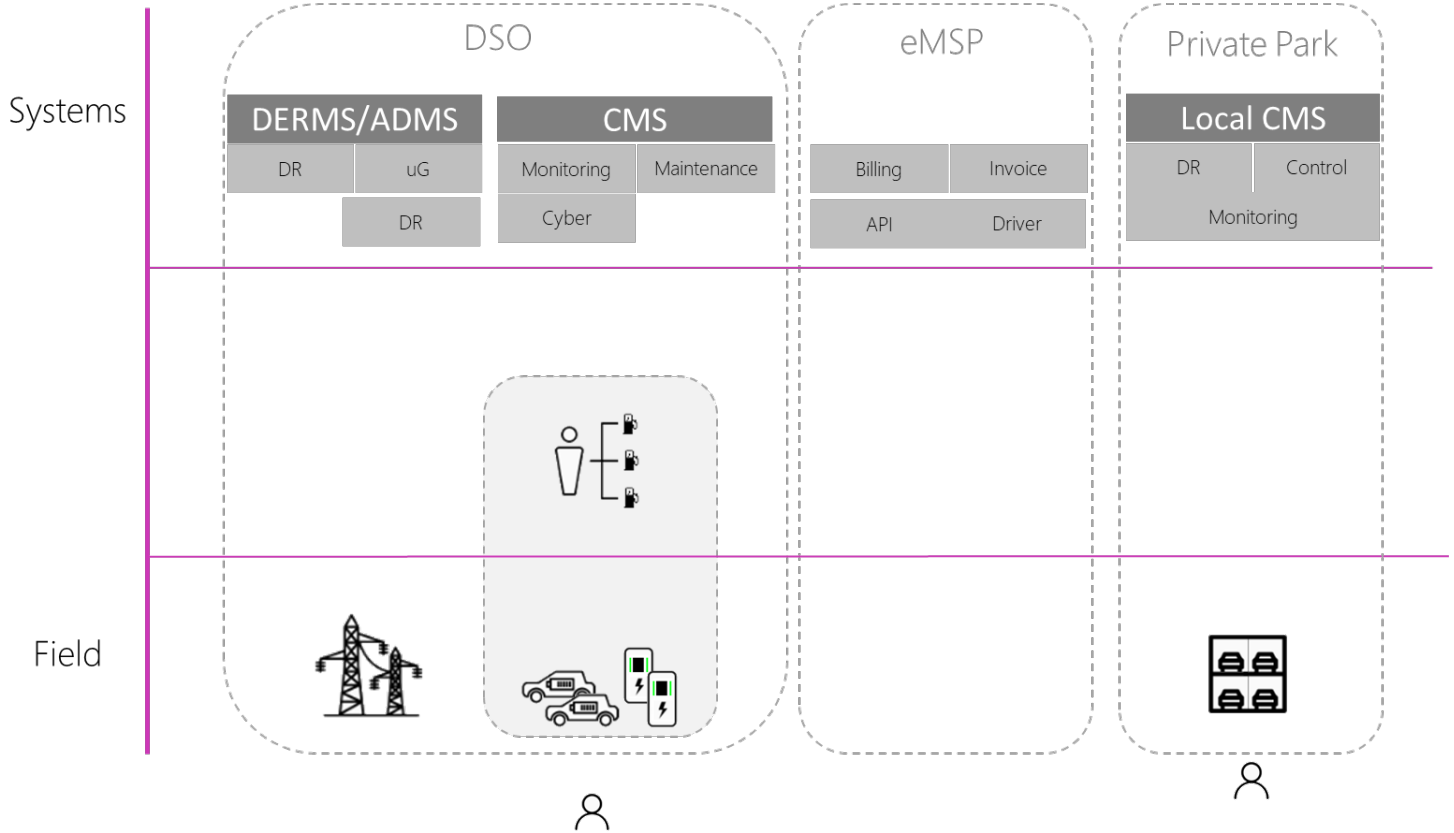
EVSE

Private parking

P.PARKING

Operation Models

- DSO MODEL
- OPERATOR MODEL



DSO Model

On the DSO model, the DSO owns the EV infraestructure and can explore commercially the infrastructure or not (similar to regulated / non – regulated energy market).

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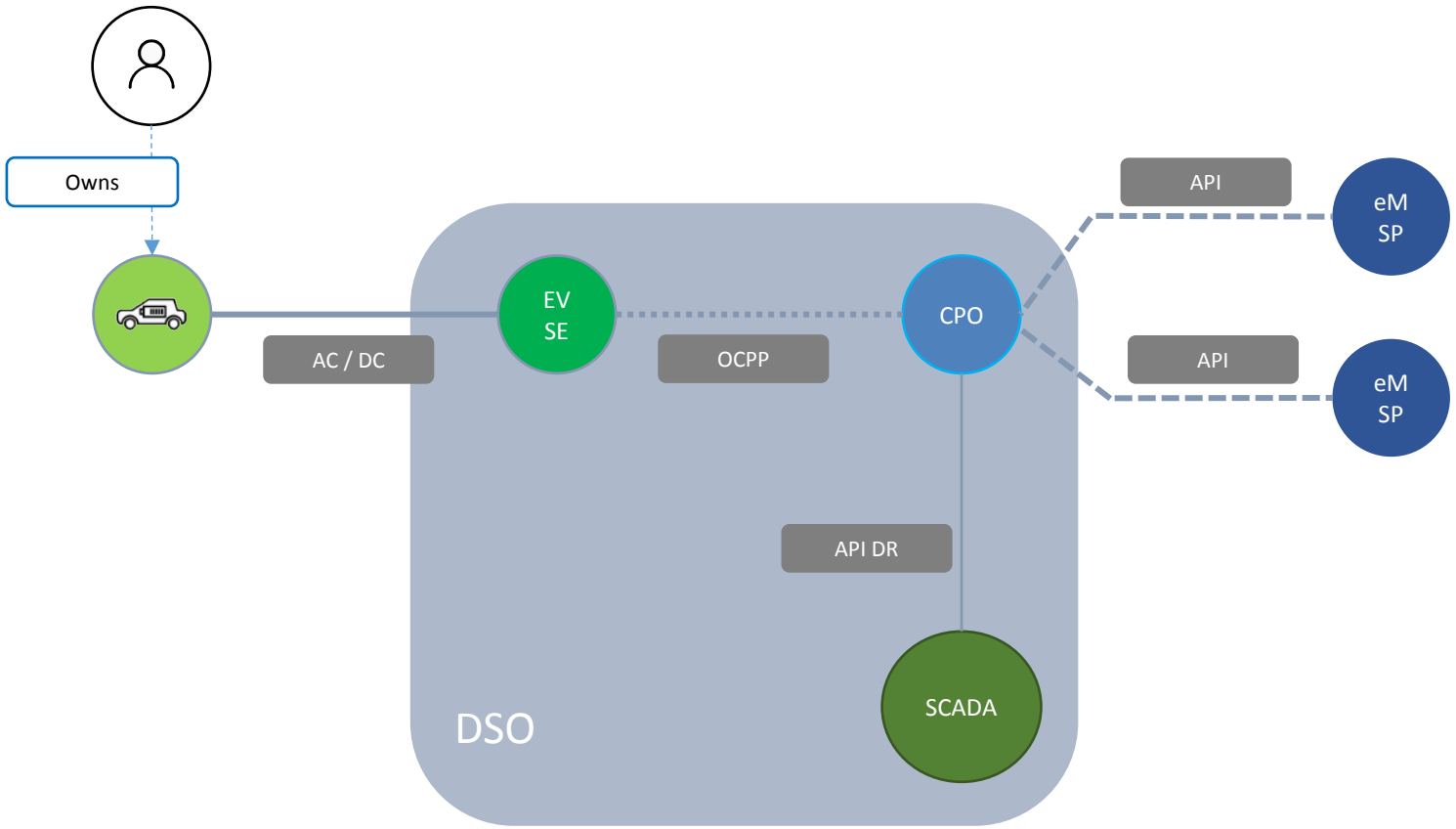

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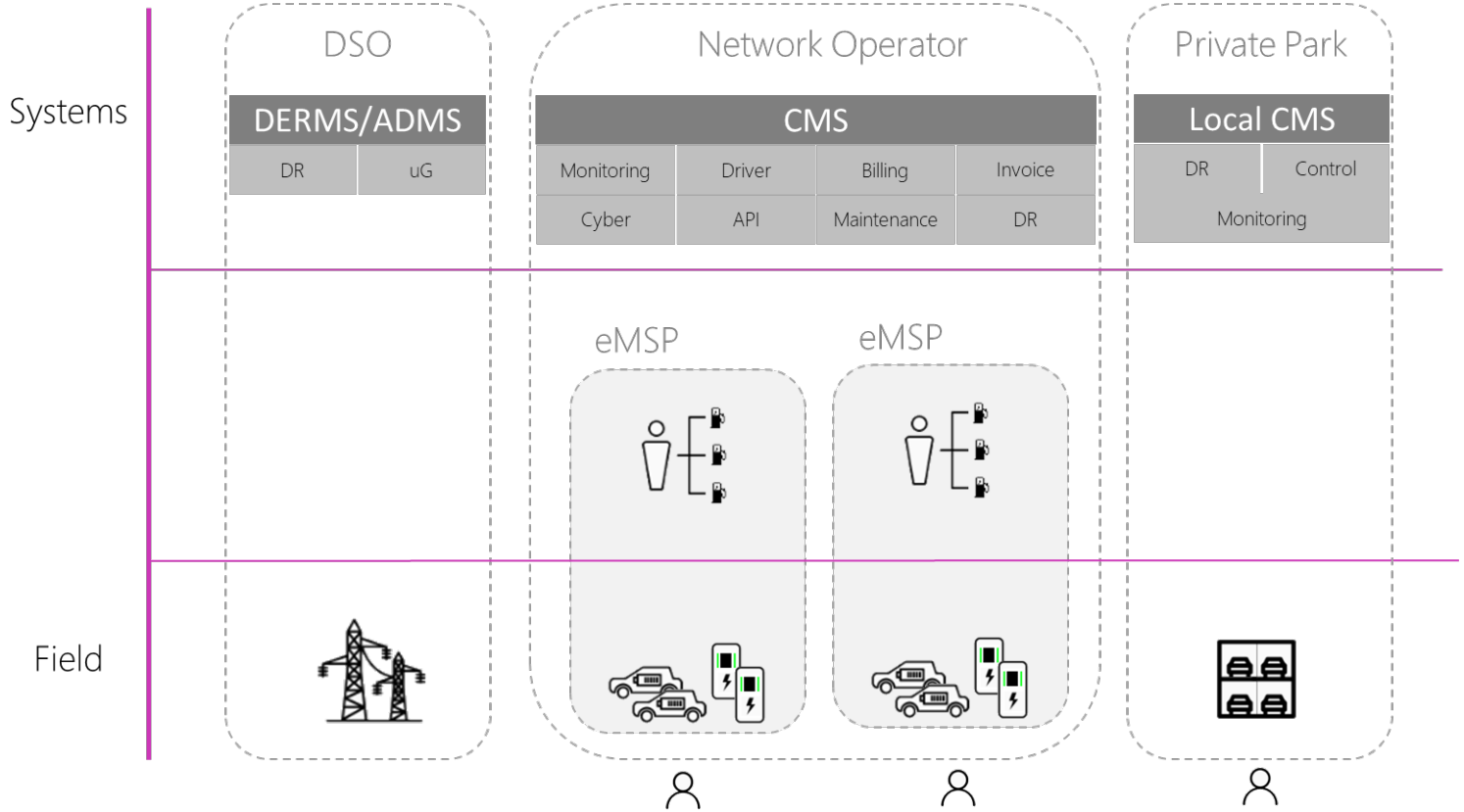
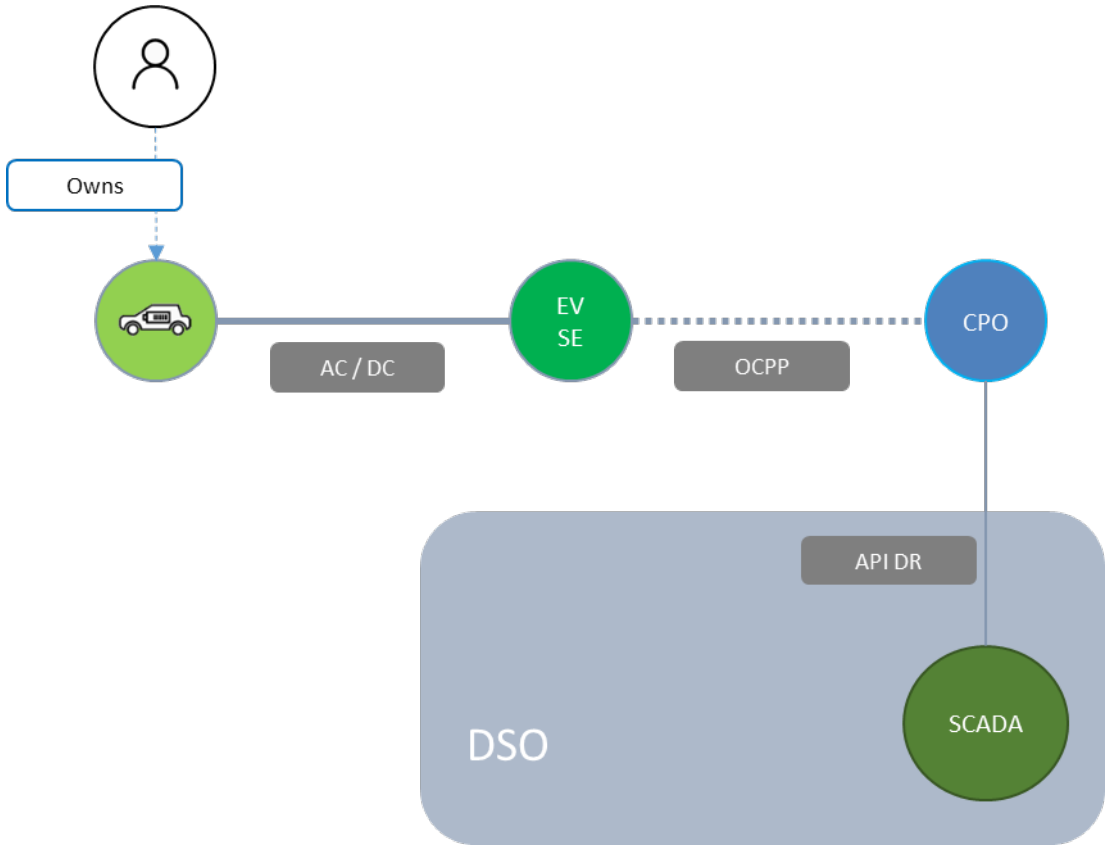


OPERATOR Model

the Operator model, has as a main idea a totally deregulated market where the EV infrastructure installation, maintenance, CMS management and so on are just managed by entity's that are not the DSO, and that are Indifferent to possible technical issues



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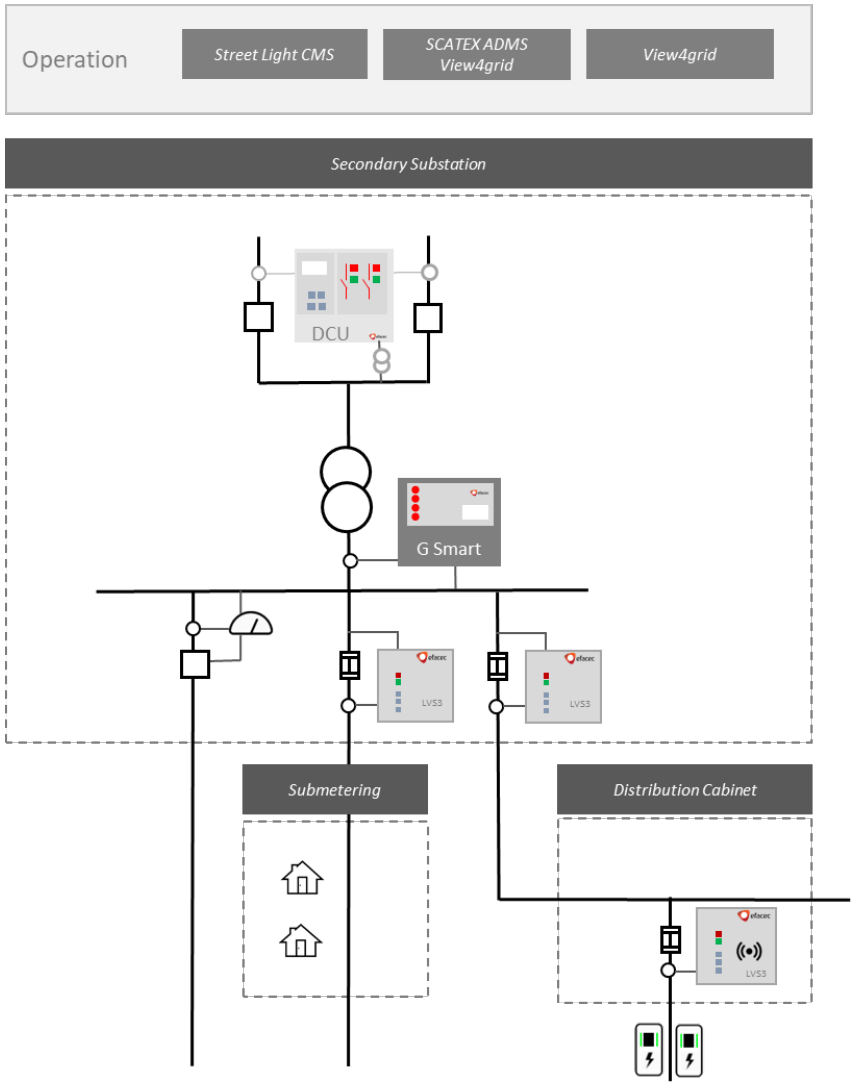
DSO
UPGRADE NEEDS

- DSO MODEL
- OPERATOR MODEL
- FOR DSO AND OPERATOR MODELS



Secondary Substation Sensoring

The secondary substation, will have a big impact on future of MV/LV distribution grids

- MV panels controller
- Transformer Controller
- LV Feeders Sensors

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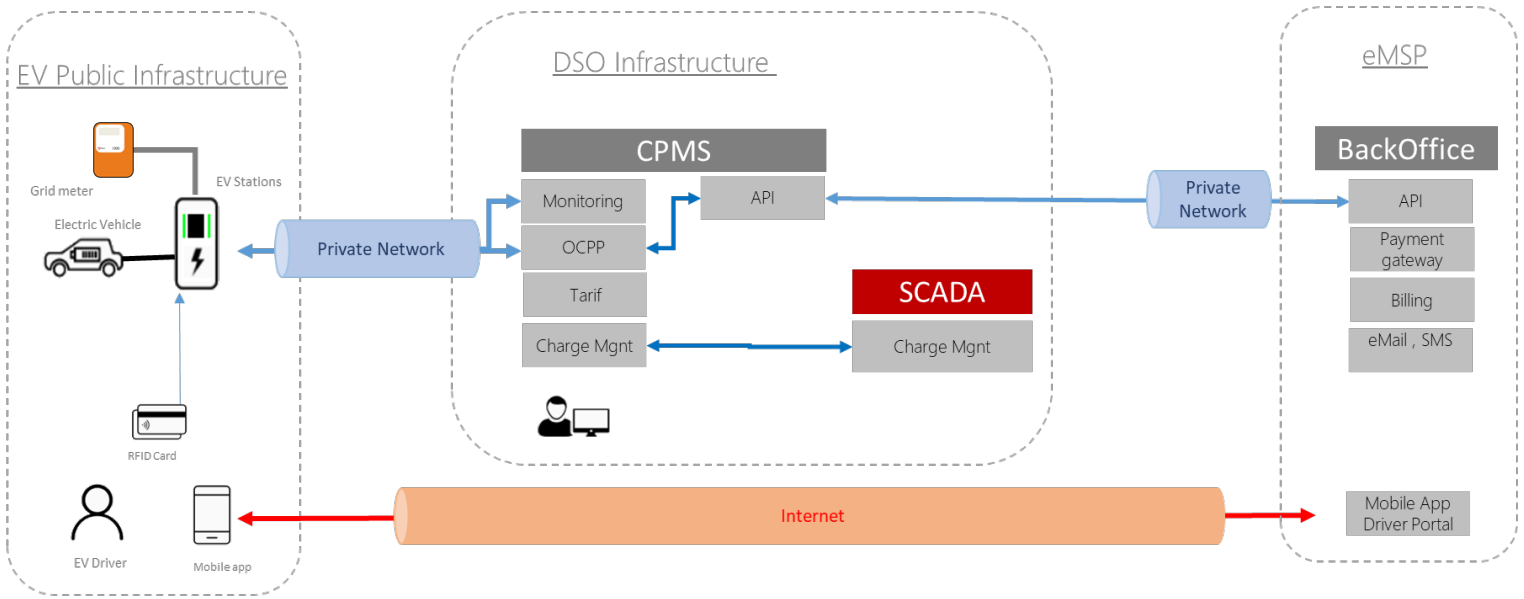
CPMS
Charging point Management System

- CPMS ARCHITECTURE
- SMART CHARGING

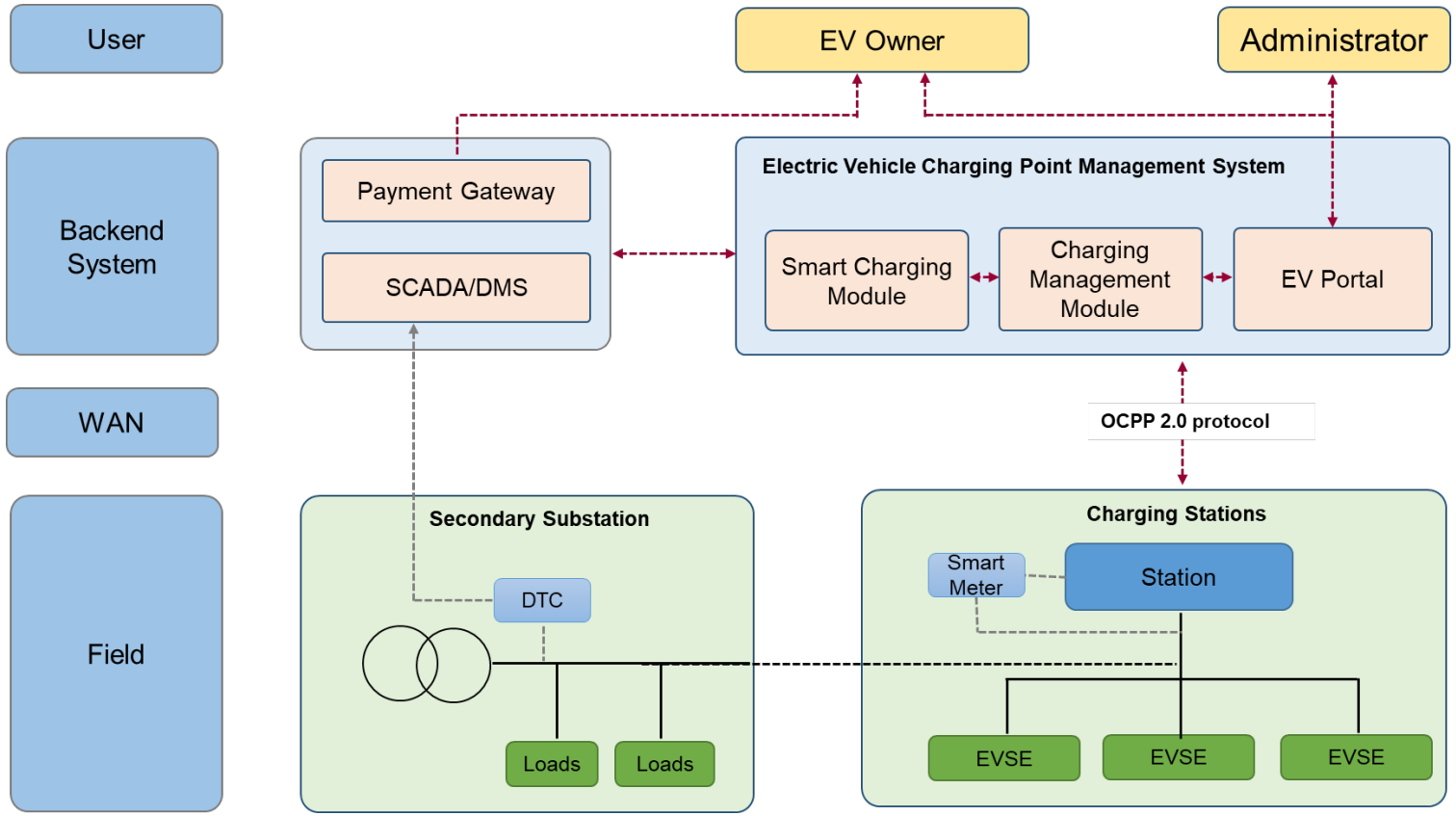
CPMS Architecture



A typical EV CPMS with integration with EVSE, eMSP and SCADA

- Integration with EVSE
- Tarif management
- API and integration with eMSP
- Smart Charging management

CPMS Architecture



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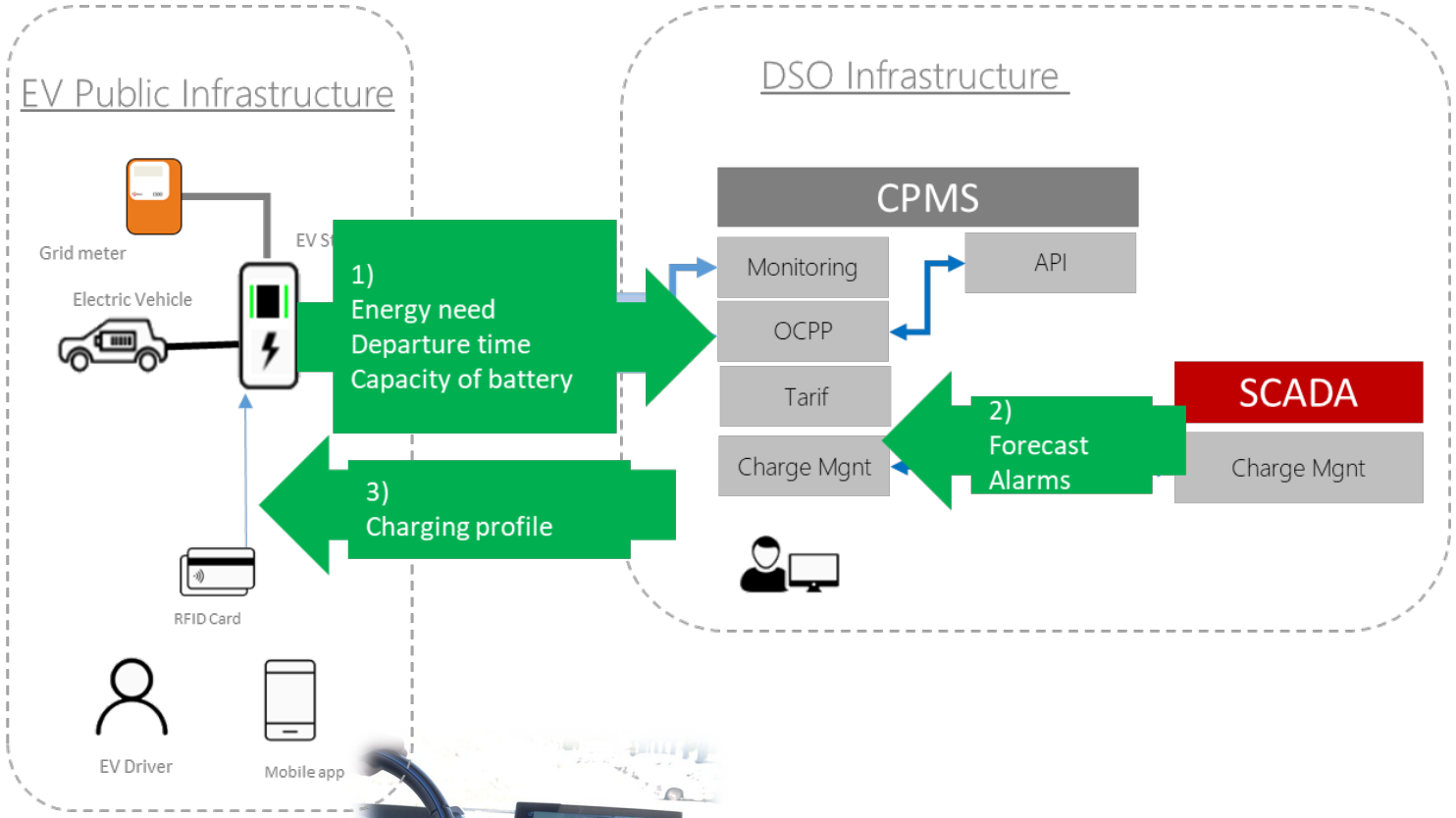
SMART CHARGING



The Smart Charging architecture is composed by the following modules:

- Interface to SCADA
- Load forecast
- Interface to EVSE
- Smart charging modules

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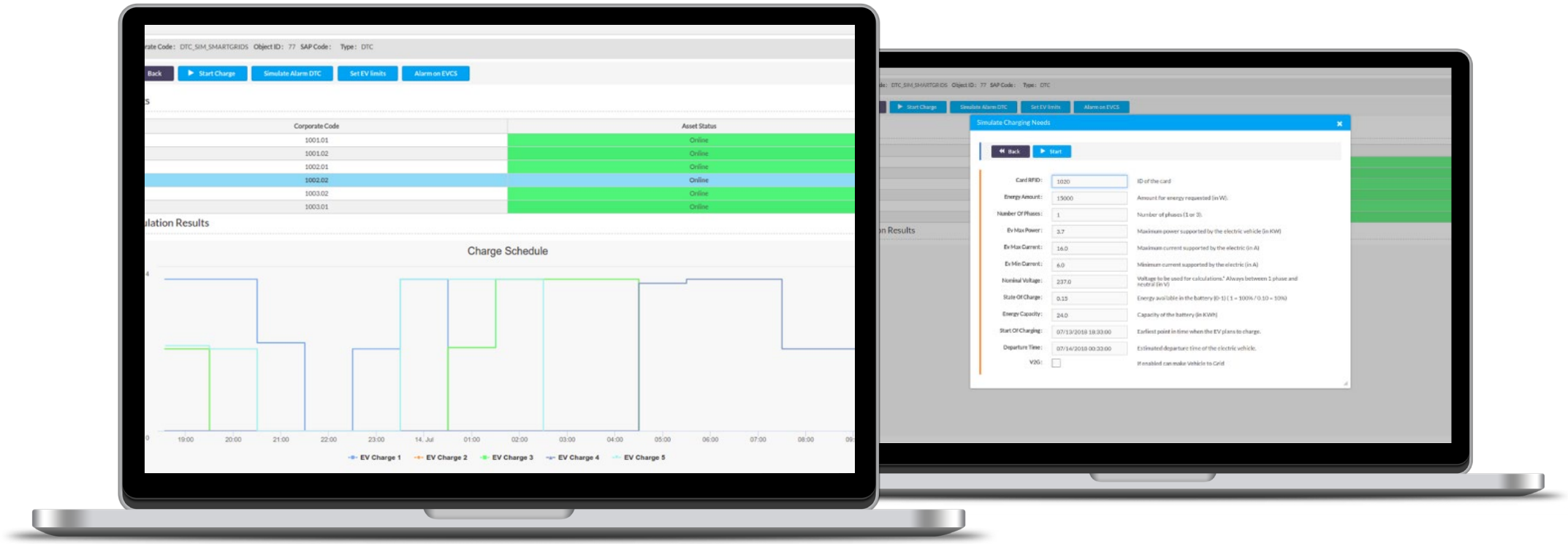
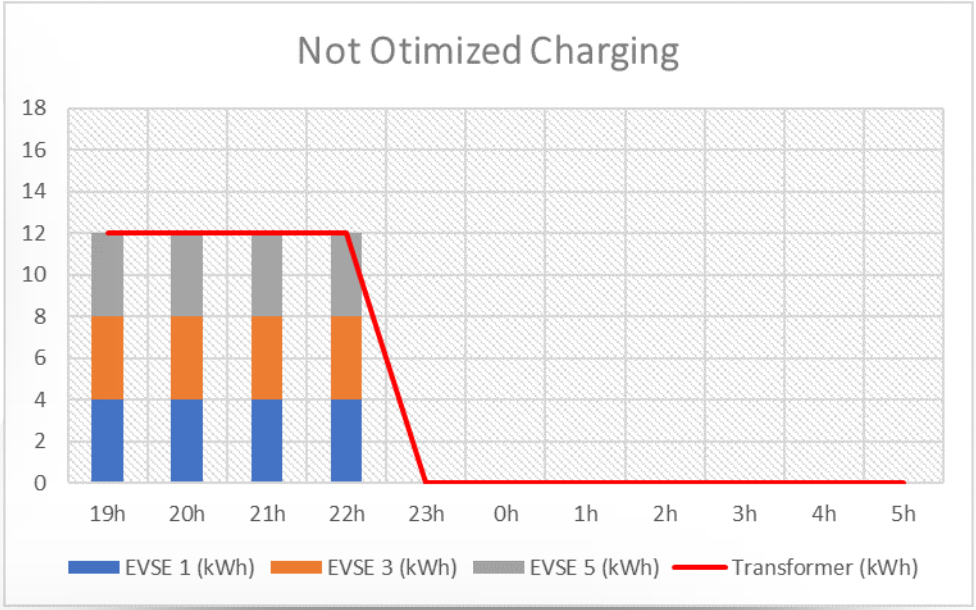
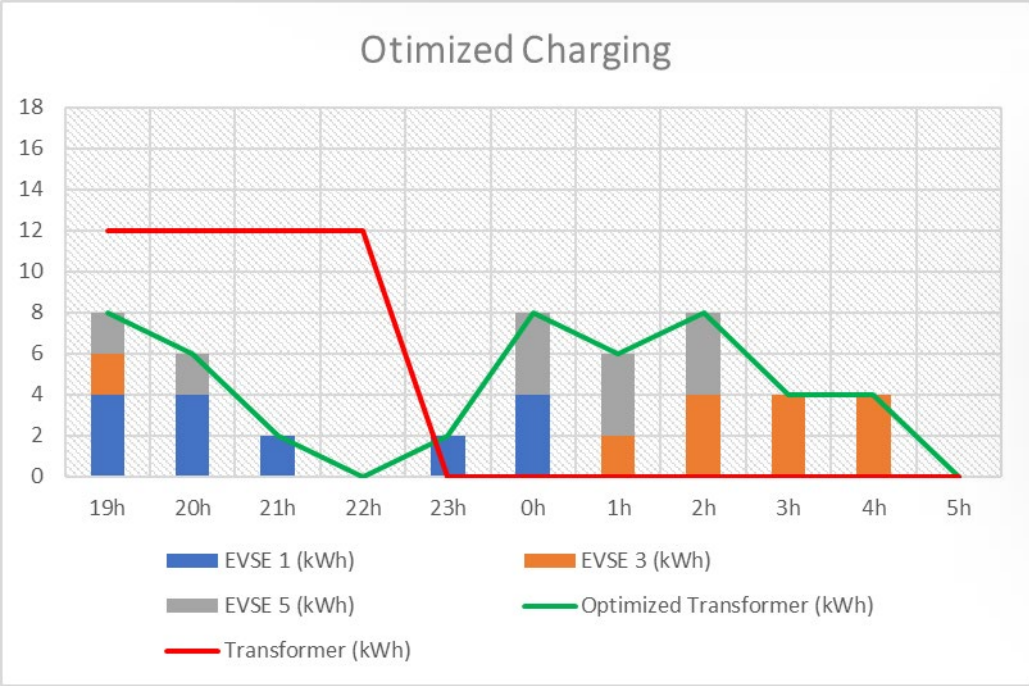


EFACEC CPMS (view4grid)

The modules are implemented on EFACEC CPMS (view4grid) and an example result can be verified on the next images. The 1st image simulates the EV Driver request, like departure hour. The 2nd image displays the existent EVSE allocated to the secondary substation transformer, and the line chart displays the different EV charging profile to send to different EVSE´s.

Difference in peak loads in the secondary transformer, between a optimized charging solution and non-optimized





The first grapht indicates that the not optimized schedule has a peak charging need of 12kWh, white on the optimized scheduled charging process, the maximum peak is of 8 kWh

Remarks & Conclusions

- Modular architecture based on the business model
- Minimize peak load
- Mitigate overloads on the Secondary Transformer
- Deployment of Smart Charging
- Manage commercial aspects

2nd E-Mobility Power System Integration Symposium

preceding the 8th Solar & 17th Wind Integration Workshops

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THANK YOU STOCKHOLM