Electric Vehicle CPMS and Secondary Substation Management

E-Mobility Power System – Stockholm, Sweden

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Efacec has activity in three business segments

Products
- Transformers
- Switchgear
- Service
- Automation

Systems
- Energy
- Environment
- Transportation

EPS

Efacec Power Solutions

Electric Mobility
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
- Energy
  - 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

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

- Transportation
  - 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
• Electrification 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
On the DSO model, the DSO owns the EV infrastructure and can explore commercially the infrastructure or not (similar to regulated / non-regulated energy market).
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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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Upgrade Needs

DSO

• DSO Model
• Operator Model
• For DSO and Operator Models
Secondary Substation Sensing

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

- MV panels controller
- Transformer Controller
- LV Feeders Sensors
CPMS

Charging point Management System

- CPMS ARCHITECTURE
- SMART CHARGING
A typical EV CPMS with integration with EVSE, eMSP and SCADA
- Integration with EVSE
- Tariff management
- API and integration with eMSP
- Smart Charging management
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- Integration with EVSE
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The Smart Charging architecture is composed by the following modules:

- Interface to SCADA
- Load forecast
- Interface to EVSE
- Smart charging modules
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 an optimized charging solution and non-optimized.

The first graph indicates that the not optimized schedule has a peak charging need of 12kWh, while 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