Technological and ICT requirements for the use of EV batteries in small to medium scale storage applications

Mid-Term Conference

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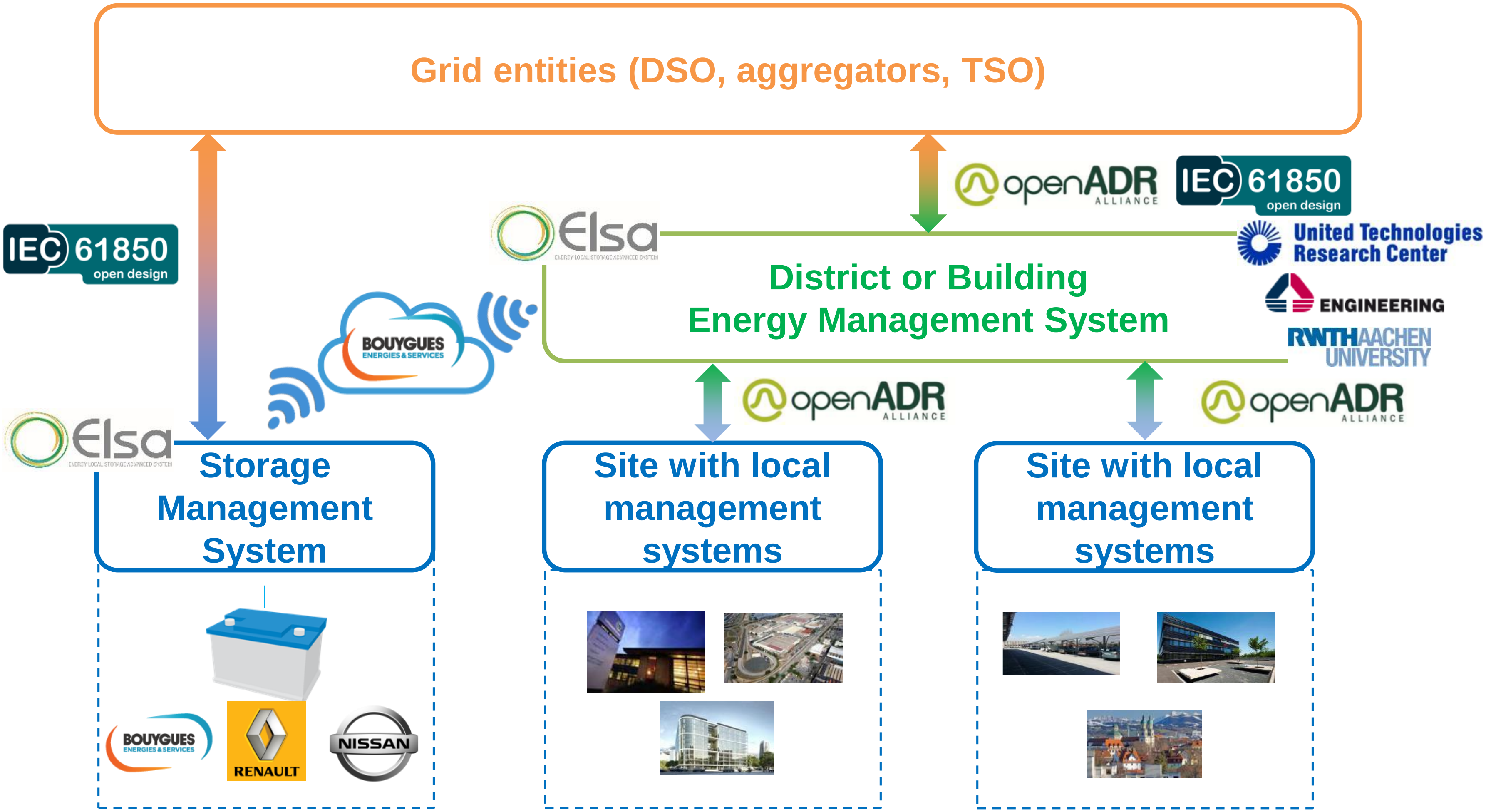
Agenda

- ELSA Vision
- Storage System Architecture
- Technical Requirements
  - Mechanical
  - Environmental
  - Safety
  - Performances – Power & Energy
- ICT Architecture for the storage system
- ICT Requirements
  - Safety / BMS & Control means
  - Interfaces / internal
  - Interfaces with EMS, aggregators & grid operators

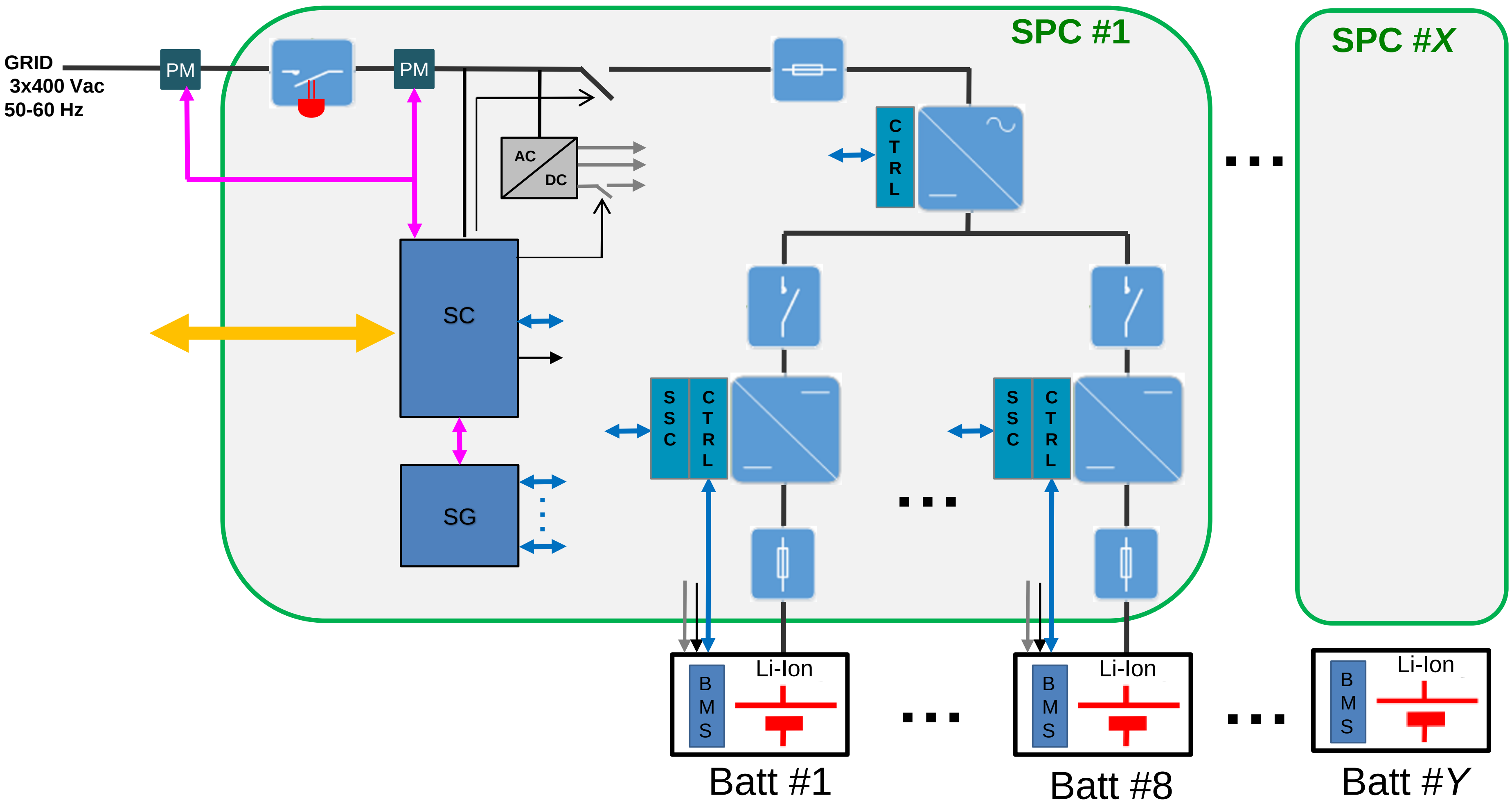
ELSA Vision

TSO: Transmission System Operator
DSO: Distribution System Operator
SMS: Storage Management System
BEMS: Building Energy Management System
DEMS: District Energy Management System



Storage System Modular & scalable Architecture

GOAL: TRL8 « ***Actual system completed and mission qualified through test and demonstration in an operational environment*** **»**



Technical requirements

- Mechanical
  - Facts : 2nd life EV batteries are heavier and more bulky than optimized new system; each battery has a different size & shape
  - Consequence: less optimized system footprint, non-standard structure to install the batteries & specific lifting equipment required.

Technical requirements

- Environmental
  - Fact: EV batteries are designed and qualified to work in a wide range of outdoor conditions (very low to very high ambient temperature)
  - Consequences: room temperature control is less critical for 2nd life EV batteries applications, allowing a lower cost and a better overall system efficiency

Technical requirements

- Safety
  - Fact: all Lithium batteries cells are individually sealed and air-tight. They do not create ATEX (explosive) areas such as open lead batteries
  - Fact: furthermore, EV batteries are designed, tested and qualified for rough outdoor life, car crash test... EV batteries do not explode and do not propagate fire
  - Consequence: Using second life EV batteries help creating a safer storage system.
  - NB: it is nevertheless recommended to install a fire detection system, as for any technical room with power conversion equipment.

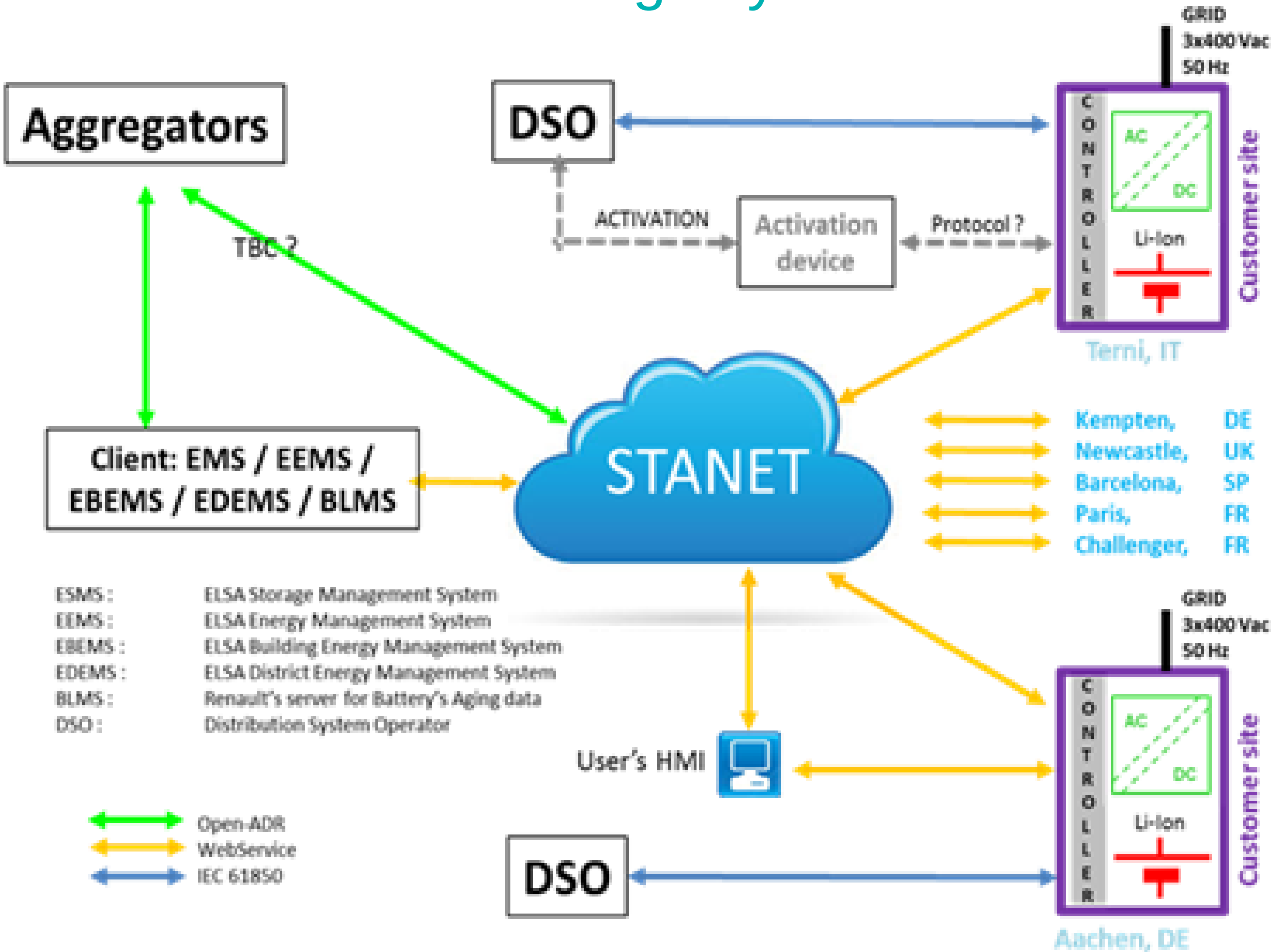
Technical requirements

- Performances : power and energy
  - Fact: as of today and for the full range of identified services, power/energy ratio goes from 0,5C to 2C
  - Fact: EV batteries are used in the vehicle up to 4C or higher
  - Consequence: 2nd life EV batteries are well suited for energy flexibility services
  - Furthermore, ELSA modular design allows to propose solutions tailored to the need.

Technical requirements

- Performances : long time commitment
  - Fact: as of today, call for tender for large storage systems (islands grids, frequency regulation…) rely on cascaded commitment from the EPC contractor to the battery supplier in order to deliver to full scope of services over the expected life of the system.
  - Consequence: ELSA has a service oriented approach, which means that the system capabilities is continuously monitored so that we will be able to undertake strong commitments on a service level agreement.

ICT Erchitecture for the storage system



ICT requirements

- Safety / BMS
  - Fact: Each EV battery has its own redundant BMS system with the highest ASIL level (ASIL = Automotive Safety Integrity Level) : ASIL D.
  - Fact: ELSA storage system is designed to maintain this level of safety, with redundant controllers for the battery supervision
  - Consequence: Using second life EV batteries help creating a safer storage system.

ICT requirements

- Safety / control means
  - Fact: a given battery can be electrically isolated thanks to a DC breaker between the inverter and the batteries, to the battery internal power relays, and (especially in case of emergency) to the dedicated fire-brigade pull-out “safety plug”
  - Consequence: Using second life EV batteries help creating a safer storage system.

ICT requirements

- Interfaces / inside the system
  - Fact : each EV battery type (Zoe, Kangoo, Leaf, eNV200…) has its own CAN messages
  - Consequence : for each battery type, there is some specific software development
- Interfaces / inside the system
  - Fact: the CAN bus is highly reliable and enables high speed communication
  - Consequence: Using second life EV batteries help creating storage system suited to the most demanding applications

ICT requirements

- Interfaces / between the storage system and the energy management systems
  - Fact: our storage system provide both local and cloud based monitoring and control using the standard protocols for storage or Demand Response application
  - Consequence: No proprietary interface or protocol + proper implementation of the industry standards is the best way to ensure interoperability

ICT requirements

- Interfaces / with aggregators
  - Fact: commercial aggregators look for Demand Response capacity over 500kWh
  - Fact : STANET, our cloud based monitoring & supervision system, is a technical aggregator
  - Consequence: ELSA storage system is ready to offer both local services (peak shaving, tariff optimization, power quality…) and Demand Response services

ICT requirements

- Interfaces / with grid operators
  - Fact: Grid operators rely on the IEC 61850 communication standard or on a specific remote “activation device” for frequency regulation services
- Consequence: ELSA storage system is able to handle either direct communication with the DSO over IEC61850 or can be tuned to communicate with a specific local activation device.

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