Parallel Session 5

INNOVATION AND APPLICATION OF DIRECT CURRENT TECHNOLOGIES

HYPERRIDE

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Intro DC – AC/DC hybrid grid for a modular, resilient and high RES share grid development

- Pilar 3 “Secure, clean and efficient energy” – Programme “A single, smart European electricity grid”
- Innovation Action (IA), 4 years (10/2020 - 09/2024)
- 7 Mio Euro funding, 10 partners from 6 European countries
- Provision of 3 (virtually linked) demonstration sites in 3 different countries at EPFL campus (Switzerland), RWTH Aachen Campus (Germany) and DSO grid ASM TERNI (Italy)

Objectives

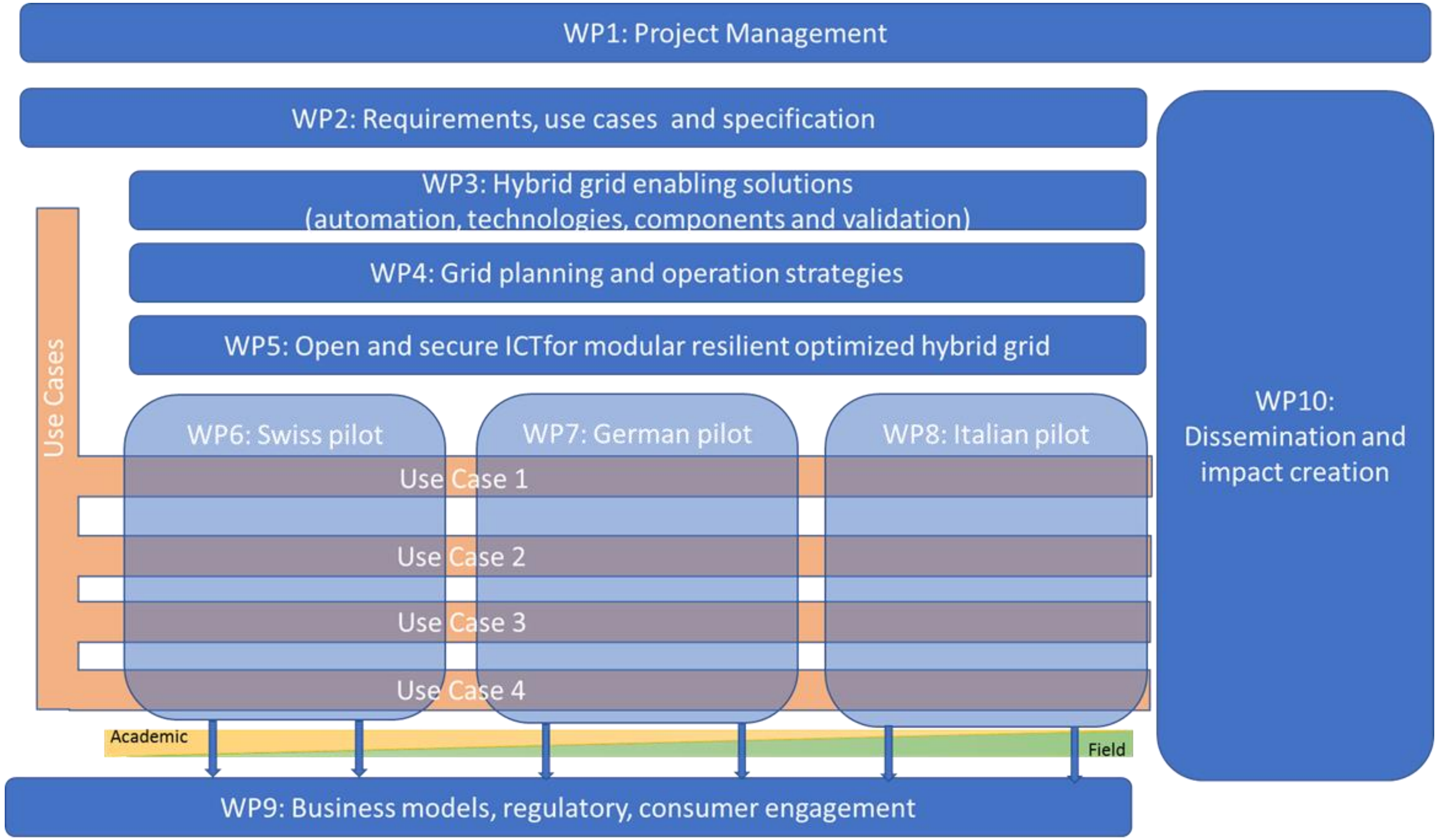
- Planning, operation and automation solutions (incl. operation on and separated from main AC grid)
- Development of enabling technologies (MVDC circuit breakers and sensors, DC measurement unit, open interoperable ICT platform, test and validation services)
- Fault management and cybersecurity solutions (protection coordination, stability assessment, automatic grid reconfiguration)
- Technology demonstration (target TRL 5-8)
- Effective business models & knowledge transfer, recommendations for standardization/regulation bodies

Implementation at 3 virtually linked demonstration sites in 3 different countries

- **EPFL campus (Lausanne, Switzerland)**
  - Connection of CIGRE 15-node 400 Vac grid DES Lab and MV LVDC PE Lab MVDC up to 10 kVdc and 4 LVDC busses up to 1500 Vdc, 1000 A
  - LVAC applications: PV, BESS, EV-charging, fuel cell, supercapacitor, electrolyzer, hydro oxygen storage, heat pump
  - DC measurement units, optimal control, adaptive feeder reconfiguration, protection coordination, stability assessment
- **RWTH Aachen campus (Aachen, Germany)**
  - 5 kV(±2,5 kV) MV LVDC converters in MW range, 5km MVDC cables, wind power test bench (4 MW turbine), Active front end converter
  - Including MVDC circuit breakers and sensors
  - Potentially LV applications: PV, BESS and fast EV-charging stations (380-1000 Vdc)
  - DC measurement units, optimal power flow, fault detection and location
- **DSO grid ASM TERNI (Terni, Italy)**
  - LV DC –AC/DC hybrid grid in a “living” DSO grid (connection via MV LVAC-transformers)
  - 72kW 2nd life Li-ion battery energy storage, 2 PV arrays - 180 kWp and 60 kWp, 3 EVSE charging stations (2 delivering 22kW and 1 delivering 40kW), 1 new V2G EVSE fast charging station, nearby commercial and 17 residential loads

Implementation - Work package structure

- Coordination (WP 1)
- Preparation (WP 2-5)
- Execution pilots (WP 6-8)
- Business models, regulatory consumer engagement (WP 9)
- Accompanying: dissemination and impact creation (WP 10)



INNOVATION AND APPLICATION OF DIRECT CURRENT TECHNOLOGIES

Expected Results & Impact

- Holistic approach unleash full potential of hybrid AC-DC infrastructure (TRLs at demo-sites)
- Provision of guidelines for planning and operation of hybrid structures
  (grid planning and component sizing, tests and validation for DC components & systems)
- Automation solutions of AC-DC infrastructure (open, interoperable ICT platform)
- Data models for interoperability and open reliability information data base
- Component solutions will showcase benefits of hybrid infrastructure
  (e.g. MVDC breakers and sensors, DC measurement unit)
- Safety and security solutions will ensure a resilient energy supply
  (protection coordination, stability assessment, automatic grid reconfiguration in case of faults/cyberattacks)
- Provide feedback to enabling technologies based on demonstration experience
- Enable business models along the value chain to foster market uptake of AC-DC installations

Challenges & Risks for DC – hybrid AC/DC distribution: Power electronic converters based, low-inertia (DC) grids

- *Functional risks:* no consensus on technical interoperability issues
- *Technical risks:* technological results not provided in time, technology does not follow certain standards for DSO grid integration, protection coordination and power quality challenges by DC grid integration in existing AC grid, lack of operational experience
- *Business risks:* missed important business-related points of view, immature or poor business planning, technology is not accepted by industry

HYPERRIDE areas which are in line with BRIDGE activities

- *Data management:* automation and communication architecture, open and interoperable ICT platform, cybersecurity for operating hybrid AC/DC grids
- *Business models:* align activities with other developments and increase the replication potential of the developed solutions for smart grids and energy storage solutions (e.g. local energy communities)
- *Regulations:* comparative analysis of legal and regulatory framework (hybrid AC/DC grids) in the countries of the demo sites including policy recommendations (analysis of barriers for promising use-cases)
- *Customer engagement:* preparation of demos, feedback from demos, engagement of industrial style customers (smart building operators, EVSE operators, PV system/energy storage providers, energy communities, etc.)

Matching/partner projects

- H2020 TIGON project (same call)

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Thank you for your participation!

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bridge