

R&D
NESTER

ETIP-SNET
Regional Workshop - Lisbon

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AN OVERVIEW ON SOME OF OUR RESEARCH, DEVELOPMENT & INNOVATION PROJECTS



RENEWABLE ENERGY
MANAGEMENT TOOLS



POWER SYSTEMS SIMULATION &
LABORATORY



SUBSTATION OF THE FUTURE

RESEARCH, DEVELOPMENT & INNOVATION PROJECTS

RENEWABLE ENERGY MANAGEMENT TOOLS

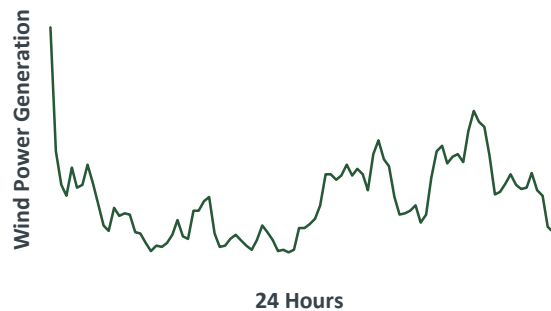


- WIND POWER FORECASTING TOOLS
- SOLAR POWER FORECASTING TOOLS
- RESERVE DIMENSIONING TOOLS
- ANCILLARY SERVICES WITH VRE
- ...

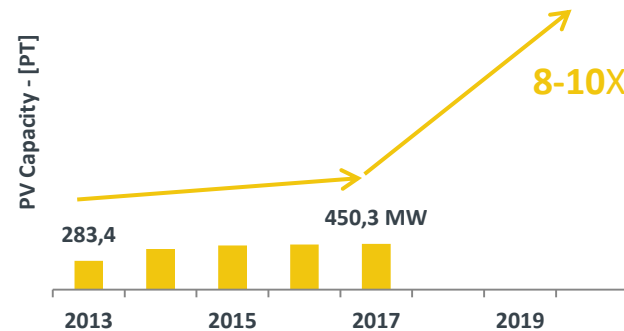
RENEWABLE ENERGY MANAGEMENT TOOLS

MOTIVATIONS

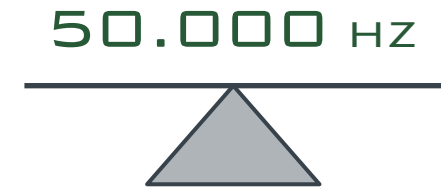
WIND POWER UNCERTAINTY



BOOST IN PV CAPACITY

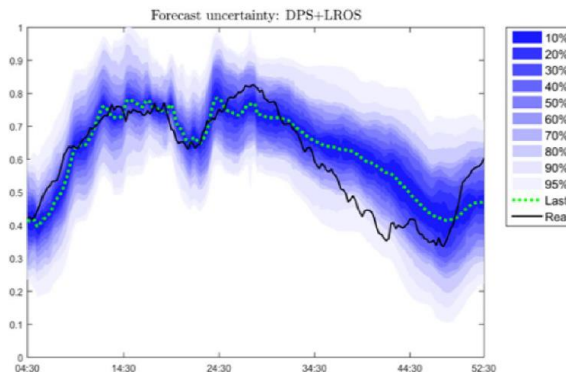


SYSTEM BALANCING WITH RENEWABLES



SOLUTIONS / ACHIEVEMENTS

WIND POWER FORECASTING TOOLS



SOLAR POWER FORECASTING TOOLS



OTHER

- Quantify additional reserves accounting with Wind and Solar forecasting errors
- Demonstration of P(f) control with Wind and PV technologies
- Demonstration of Q(V) control with Wind and PV technologies
- Online assessment of inertia with high VRE

RESEARCH, DEVELOPMENT & INNOVATION PROJECTS

POWER SYSTEMS SIMULATION & LABORATORY

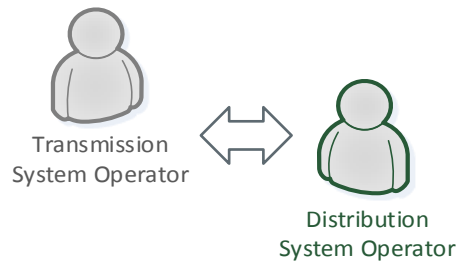


- IMPROVING TSO-DSO DATA EXCHANGE
- TSO-DSO COORDINATION TOOLS
- SIMULATION & TESTING INFRASTRUCTURE
- ...

POWER SYSTEMS SIMULATION & LABORATORY

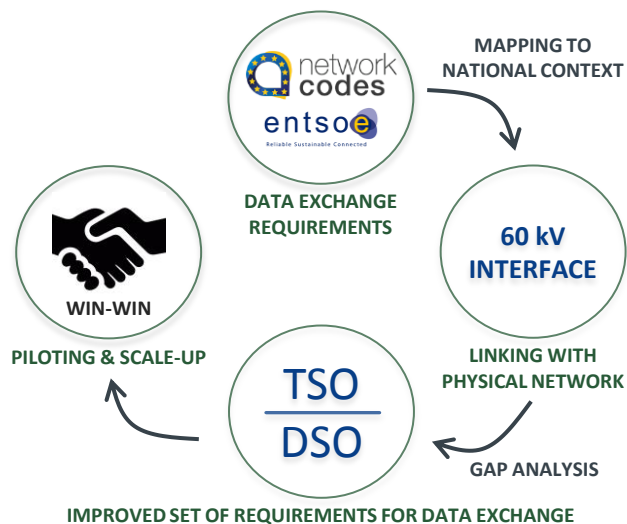
MOTIVATIONS

FOSTERING TSO-DSO COLLABORATION



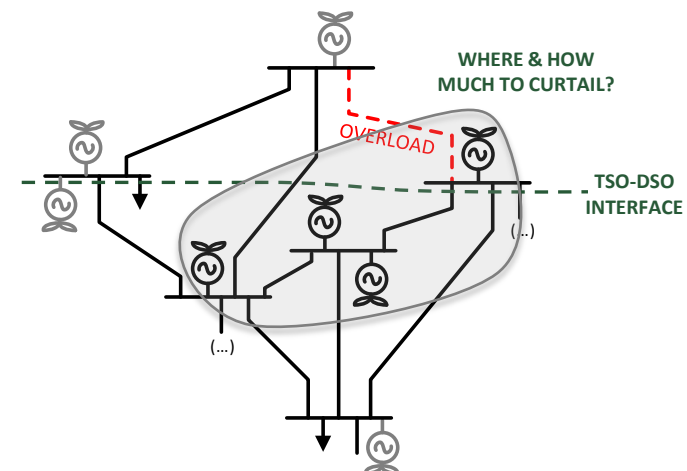
SOLUTIONS/ ACHIEVEMENTS

ENHANCING TSO-DSO DATA EXCHANGE



TSO-DSO COORDINATION TOOLS

e.g. WIND POWER CURTAILMENT OPTIMIZATION TOOL



POWER SYSTEMS SIMULATION & LABORATORY

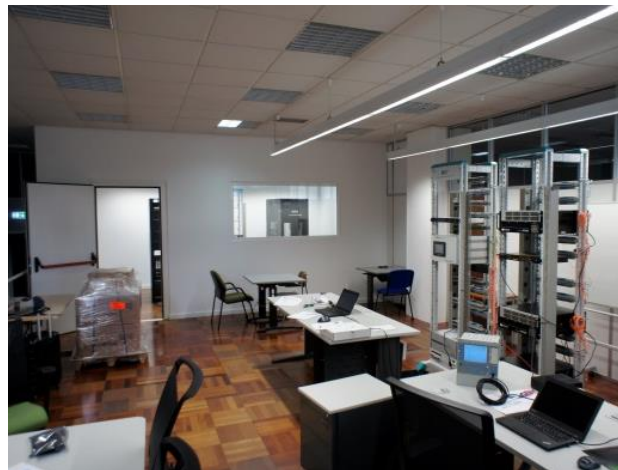
MOTIVATIONS

INCREASINGLY COMPLEX POWER GRIDS



SOLUTIONS / ACHIEVEMENTS

REAL-TIME POWER SYSTEMS SIMULATION LABORATORY



POWER SYSTEMS SIMULATION & LABORATORY

MOTIVATIONS

INCREASINGLY COMPLEX POWER GRIDS



SOLUTIONS / ACHIEVEMENTS

REAL-TIME POWER SYSTEMS SIMULATION LABORATORY

CAPABILITIES

- POWER SYSTEMS SIMULATION
- TESTING OF POWER SYSTEMS DEVICES (e.g. IEDs or PMUs)
- COMMUNICATION NETWORKS SIMULATION
- TESTING OF ICT DEVICES (e.g. Switches or Routers)
- STANDARDS AND PROTOCOLS TESTING (e.g. IEC 61850, PTP)



RESEARCH, DEVELOPMENT & INNOVATION PROJECTS

SUBSTATION OF THE FUTURE



- A NEW VISION
- EVOLVE SYSTEM DESIGN
- IN-LAB TESTING OF NEW CONCEPTS
- TOWARDS IMPLEMENTATION
- ...

Building a vision for smarter transmission substations, materializing it through a whole new set of system specifications



SUBSTATION OF THE FUTURE

MOTIVATIONS

FULL DIGITALIZATION



STANDARDIZATION



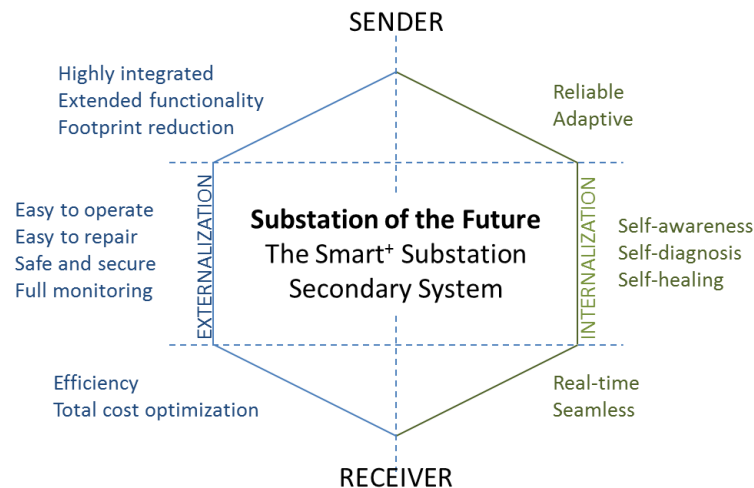
IEEE 1588

ICT IMPACTING POWER SYSTEMS



SOLUTIONS / ACHIEVEMENTS

VISION



SYSTEM DESIGN

- Substation Topologies
- Secondary System Description
 - General Architecture
 - Functional Integration
 - Redundancy
 - Physical Layout
- Communication Network
- Test Protocols



Testing a proof-of-concept of the substitution of the future in a close to real environment towards implementation in a transmission substation

SUBSTATION OF THE FUTURE

MOTIVATIONS

FULL DIGITALIZATION



STANDARDIZATION



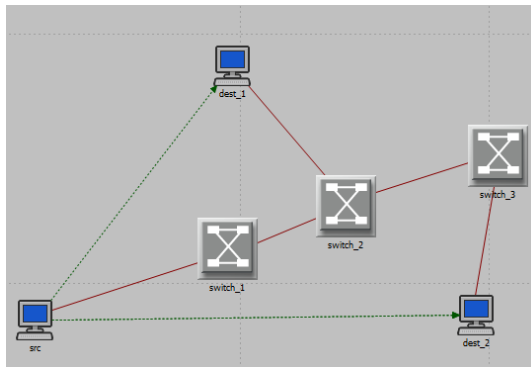
IEEE 1588

ICT IMPACTING POWER SYSTEMS



SOLUTIONS / ACHIEVEMENTS

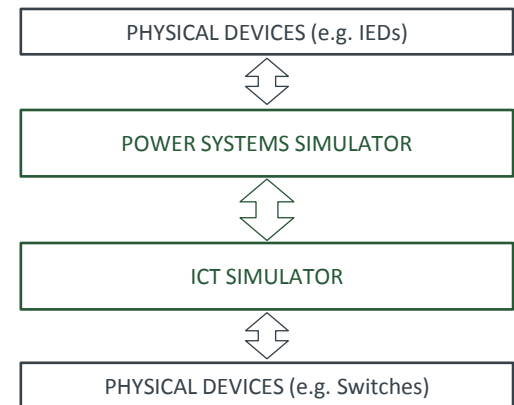
IN-LAB TESTING & PROOFING



COMMUNICATION NETWORK TOPOLOGY & TRAFFIC CHARACTERIZATION



INTEROPERABILITY



CO-SIMULATION PLATFORM

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SUBSTATION OF THE FUTURE



Thanks for your
attention!