Overview of the project

IDEAL
ideal grid for all

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COOPERATION

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IDE4L

ideal grid for all

Basic facts

- Duration: September 2013 – August 2016
- Budget: 8 M€
- IDE4L-project is co-funded by European Commission

- A2A Reti Elettriche SpA (Italy)
- Unión Fenosa Distribución (Spain)
- Østkraft Holding A/S (Denmark)
- Telvent (Spain)
- Danish Energy Association (Denmark)
- Tampere University of Technology (Finland)
- Technical University of Denmark (Denmark)
- RWTH Aachen University (Germany)
- University Carlos III de Madrid (Spain)
- Kungliga Tekniska Högskola (Sweden)
- Catalonia Institute for Energy Research (Spain)

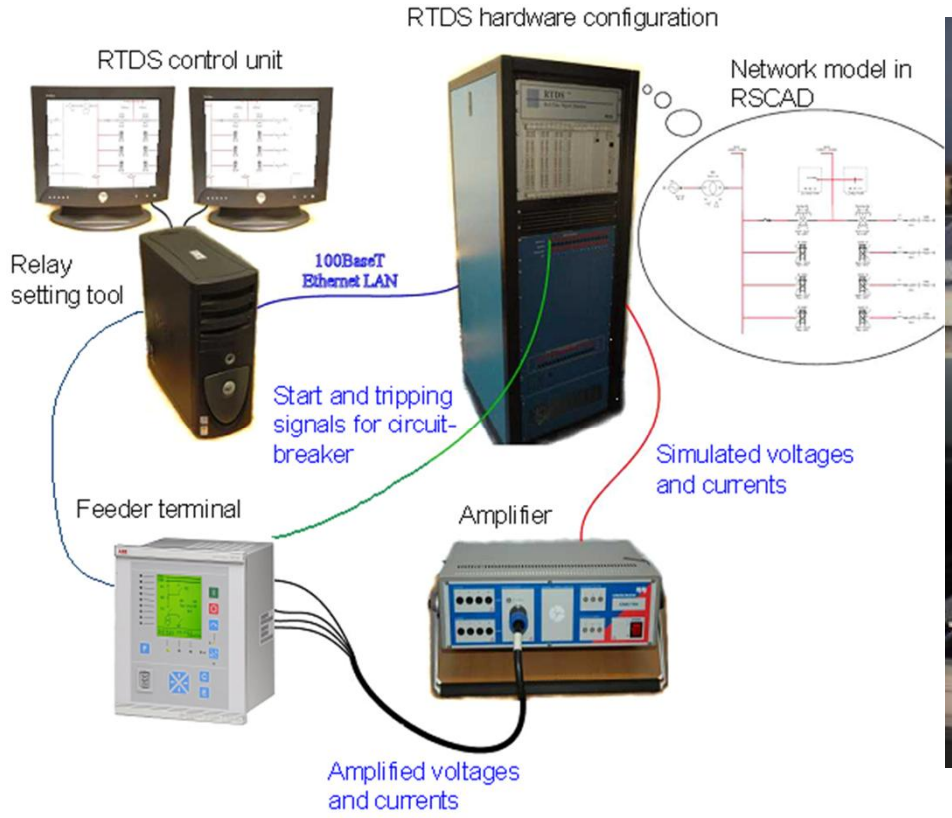
Introduction

- Motivation
  - RES and energy efficiency actions increase the complexity of network planning and operation
  - Existing and new networks and resources should be utilized more efficiently
  - Continuity of the electricity supply is important for the modern society
- Scope
  - Planning of active network
  - Distribution automation in MV and LV networks
  - Active network management utilizing DERs
  - Interactions of DSO/TSO and DSO/market actors

From concept to demonstrations

1. Defining the concepts
   - Active network (D2.1)
   - Automation for active network management (D3.1)
   - Aggregator system (D6.1)
2. Developing planning methods and automation functionality
3. Building the demonstrations in:
   - Denmark (Østkraft Holding A/S)
   - Italy (A2A Reti Electtriche SpA)
   - Spain (Unión Fenosa Distribución, S.A.)

From laboratory to field trials



Laboratory tested ideas, software and devices are further tested in real networks.

Main objectives

- Demonstrate the automation system and selected use cases for active distribution network
- Develop advanced distribution network automation system including utilization of flexibility services of DERs and their aggregators
- Develop advanced applications that enable monitoring and control of whole network
  - Fault location, isolation and supply restoration (FLISR)
  - Congestion management and voltage control
  - Interactions between distribution and transmission operators

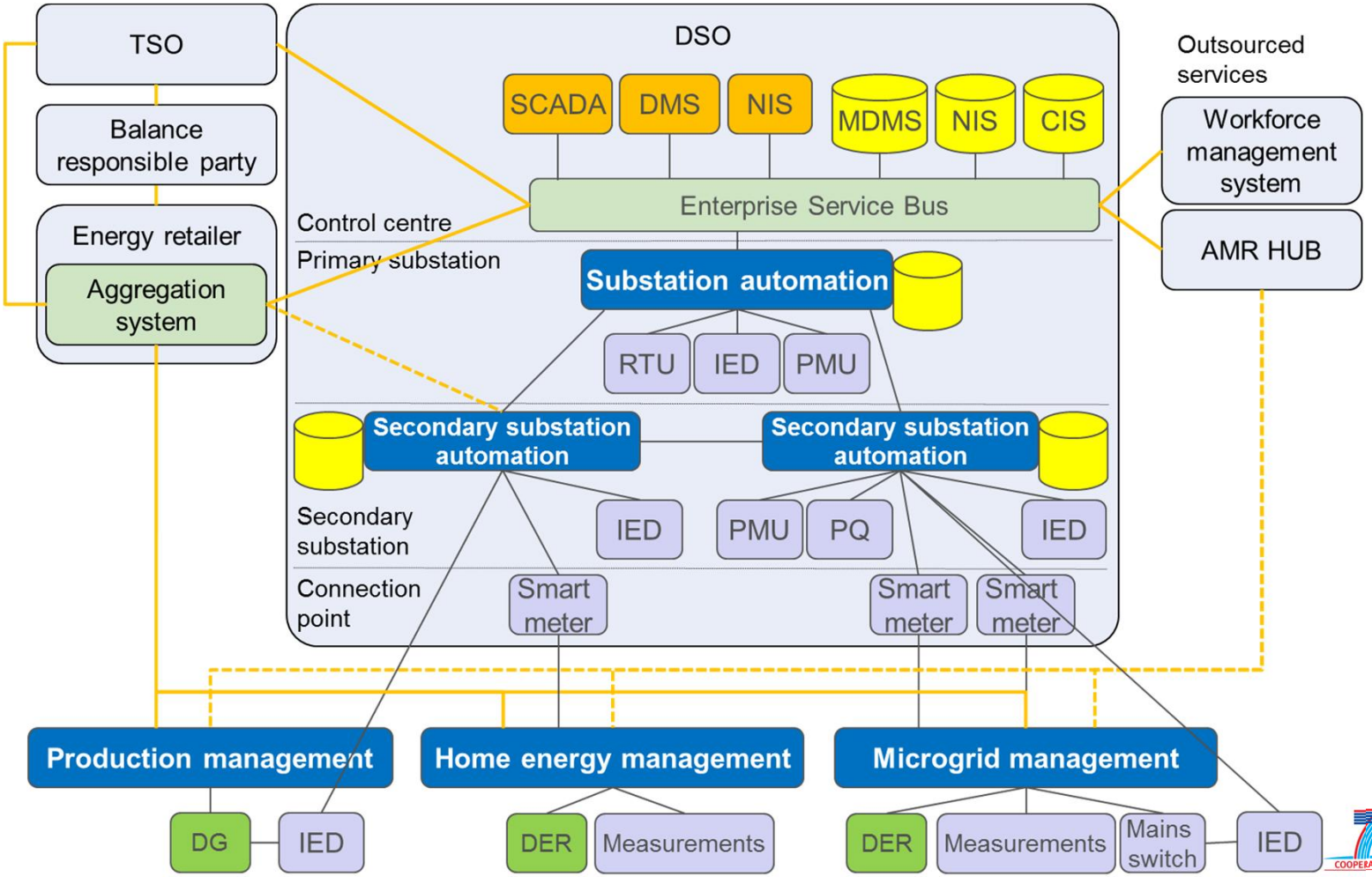
Expected outcomes

- Planning tools to design active distribution network and to evaluate costs and benefits of developed concept and technical solutions.
- Advanced automation system will extend monitoring and control functions deep in the distribution network.
  - Increment of network hosting capacity for DG
  - Management of fast changing conditions and integration of large number of DG and DR
  - Knowledge to apply standard protocols like IEC 61850 for data exchange
  - Aggregation of information from small-scale DERs and flexibility services for distribution network management

Expected outcomes

- The same automation infrastructure will be utilized to enhance the distribution network reliability
  - Automatic fault location, isolation and supply restoration algorithm will be developed and demonstrated to improve the reliability of distribution network.
  - Design of a universal controller to enable flexible operations of micro-grids, smoothly transitioning from grid-supporting mode, grid-connected mode and islanded mode, while guaranteeing quality of service.

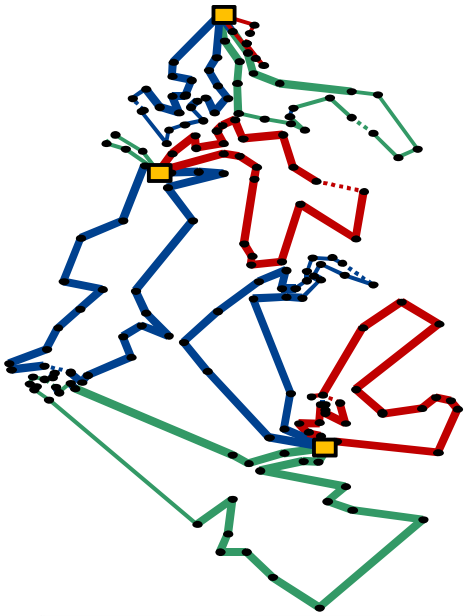
Automation architecture

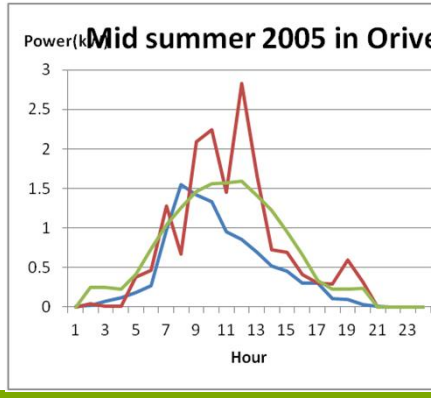


Targets of each WP

WP2 – Planning tools for distribution network management

- Main objectives
  - Define a distribution network concept including large-scale DER participation in network management
  - Develop network planning tools to evaluate the costs and the benefits of active distribution concept and proposed applications
    - Horizons: target network planning, expansion planning and day-ahead planning
    - Uncertainty of consumption, production and availability of resources
- Main outcomes
  - Studies of demonstration networks
    - Existing networks and scenarios of 2020 and 2050
    - Understanding which circumstances active control may replace passive network reinforcement





WP3 - Distribution Network Automation Architecture

- Define the distribution automation concept for architecture design, *i.e. what should the distribution network be able to do? How? What does it take to enable it?*
  - Use cases, functions, services, actors, high level data and information in/out
- Develop the distribution network monitoring and control architecture, *i. e. what semantics, function allocation, integration based on standards and off-the-shelf technologies?*
  - Detailed architecture
- Test of developed architecture, *i.e. prove in simulation, HIL and demos that the architecture enables the automation concept*
  - Validated portions of the architecture based on demo results

WP4 - Fault location, isolation and supply restoration

- Main Objectives
  - Research on decentralized FLISR strategies including means to reduce the impact of DER on the performing of self-healing functions and to adapt them to active network operation trends.
  - Reduce the impact on the system power stability of DER operational mode transitions.
- Main Outcomes
  - Modular and flexible solutions where FLIRS will be modeled on a way that they can be adapted to operate on different distribution grid scenarios and responding to the latest industrial trends.
  - Decentralized FLISR solution for power complete recovering in 1min time.
  - Microgrid control system for smooth states transitions and FLISR coordination.

WP5 - Congestion management

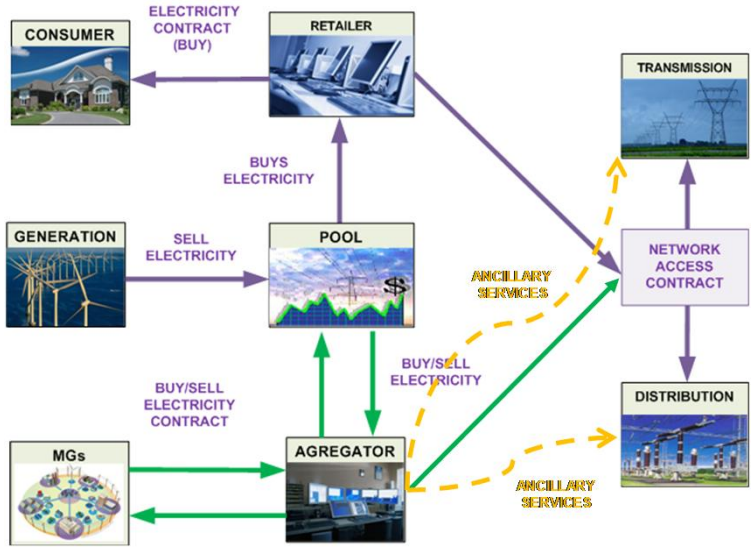
- Main goal: Defining and developing functions for the congestion management of distribution networks

- State estimation and state forecasting: Developing a near real time measurement system that will improve the knowledge about the state of the grid and make it easier to optimize the investment cost.
- Power Control: Development of network overload and voltage management algorithms for MV and LV networks
- Demand Response: Development of methods and algorithms for day ahead energy planning of flexible demands

WP6 - Distribution networks dynamics

This WP deals with two highly interconnected objectives: the optimal management and the technical control.

Main actors: microgrids, aggregators and grid operators (TSO/DSO).



Main objectives of this task:

- To define reference distribution and microgrid networks for the study of distribution network dynamics including intermittent sources.
- To optimize the integration of DER corresponding to dynamic pricing, load balancing and aggregators.
- To define tools for DER participation in ancillary services provision for active/reactive power.
- To develop methods for interfacing TSOs and DSOs via key dynamic information exchange .

WP7 - Demonstrations

- Goals:
  - Validate the IDE4L architecture by running the use cases (WP2-6) in a real-life environment and in lab
  - Assess results through metrics
  - Provide final recommendations
- Demonstrations
  - Denmark (semi-urban area, PV and heat pumps, LV)
  - Italy (urban area and semi-urban area, MV and LV)
  - Spain (Linter test facilities)
  - Lab. Demos (RWTH , TUT, IREC, Telvent)

WP7 – Demonstrations (A2A)

LIST OF ASSETS:

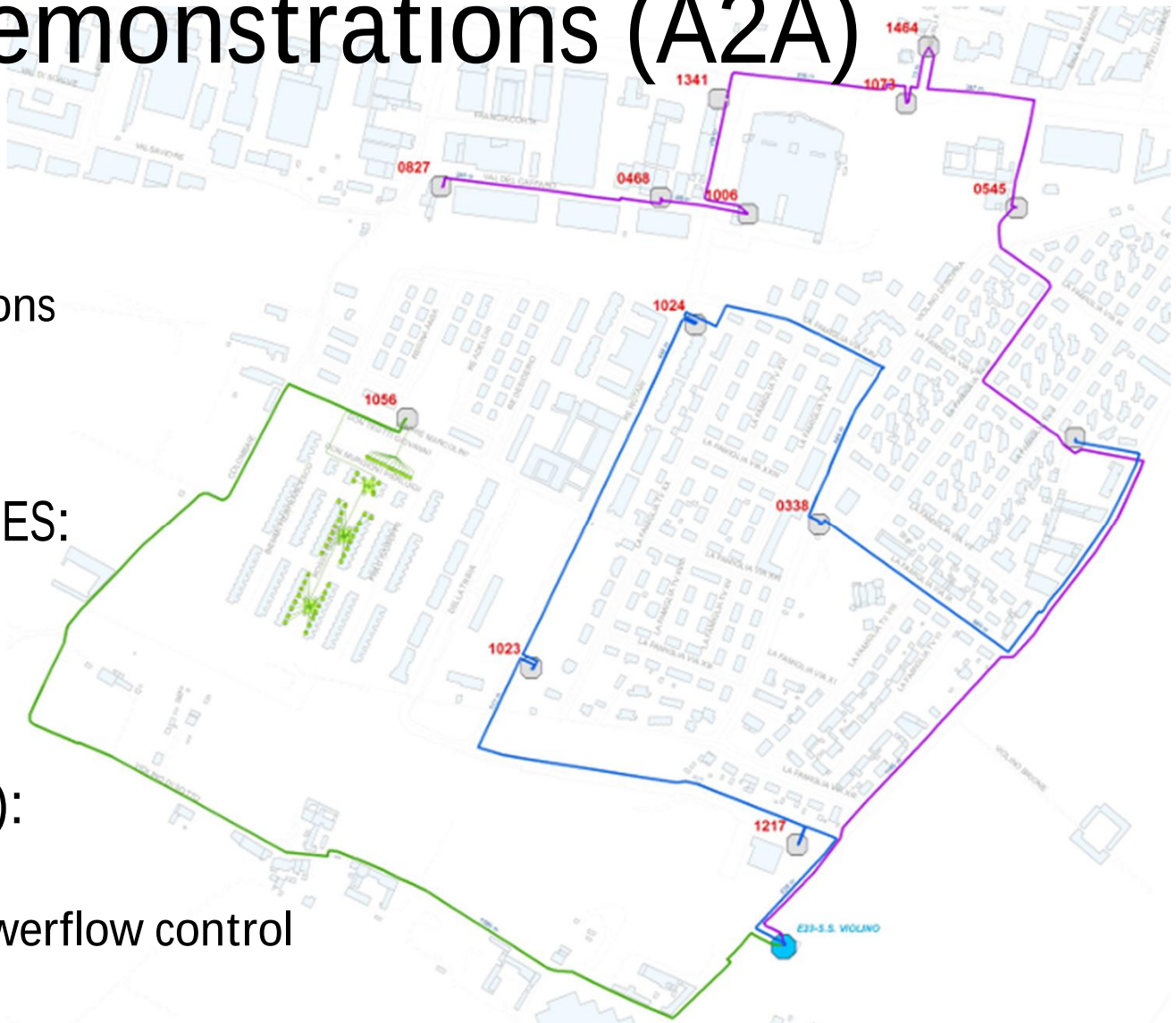
- 1 Primary substation
- 3 MV feeders
- 13 Secondary substations
- 10 LV feeders
- 50 customers with PV

CONTROLLABLE NODES:

- 4x2 MV breakers
- 8 LV breakers
- PQ compensator

USE CASES (MV & LV):

- RT monitoring
- State estimation & Powerflow control
- FLISR



WP7 – Demonstrations (OST)

LIST OF ASSETS:

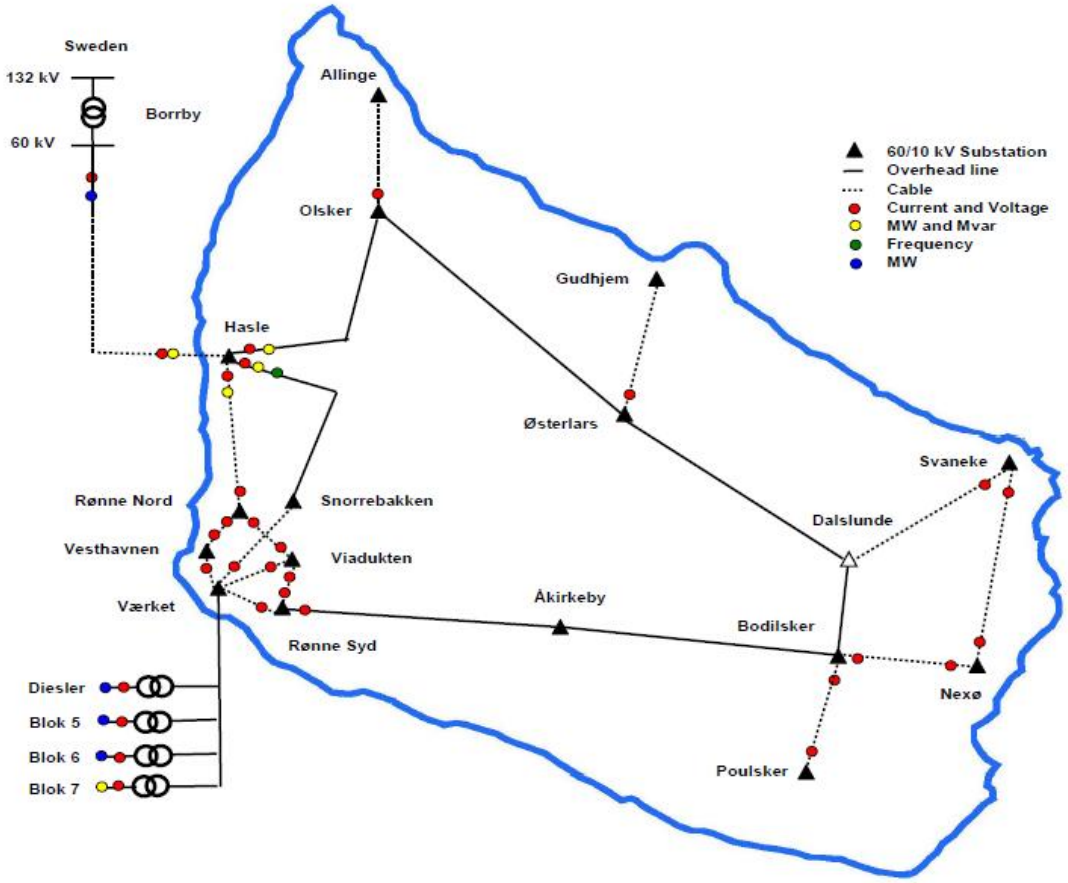
- 1 Secondary substation
- 4 LV feeders
- 120 customers with PV and HP

CONTROLLABLE NODES:

- 1x2 MV disconnectors
- 4 LV breakers
- Demand response (TBC)

USE CASES (LV):

- RT monitoring
- State estimation
- Power flow control



WP7 – Demonstrations (UFD)

LIST OF ASSETS:

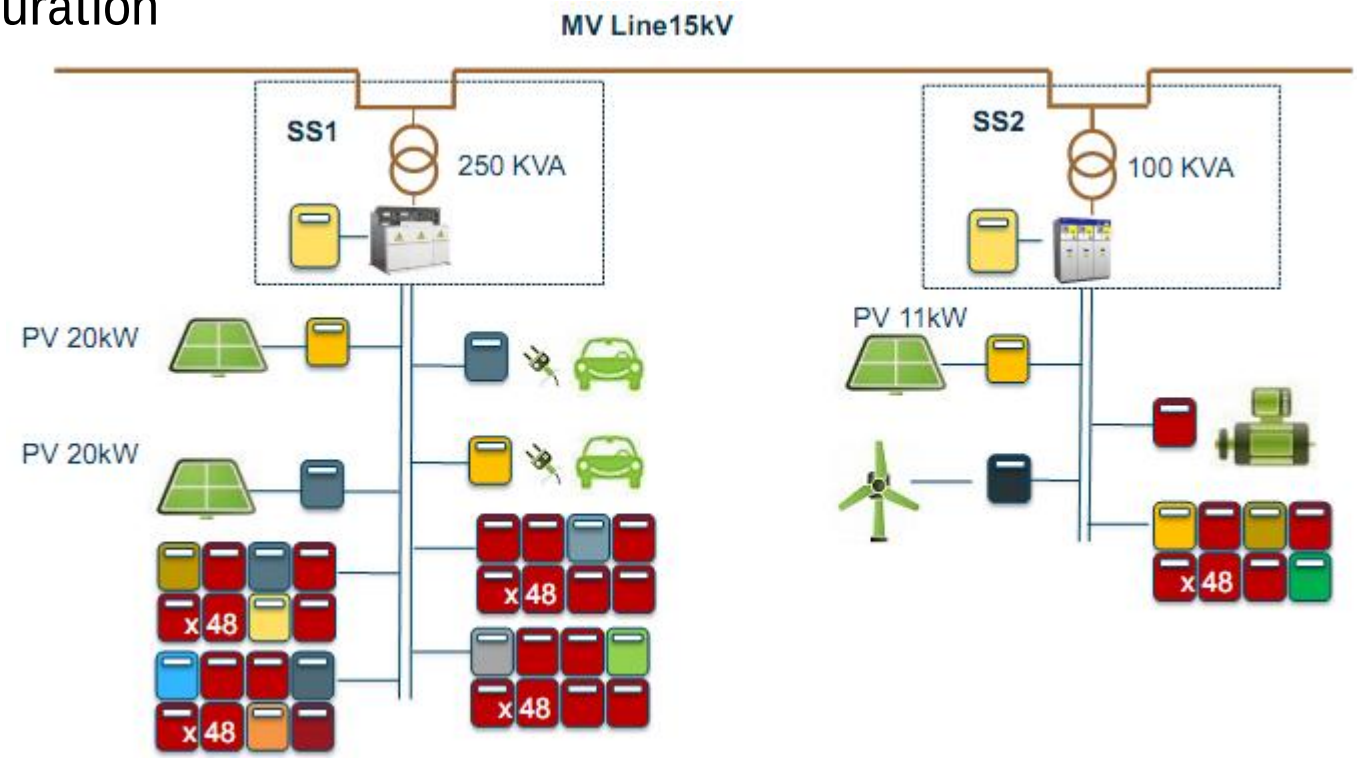
- 2 Secondary substations; 10 LV feeders; 300 loads + DERs

CONTROLLABLE NODES:

- LV network reconfiguration
- Control of DERs

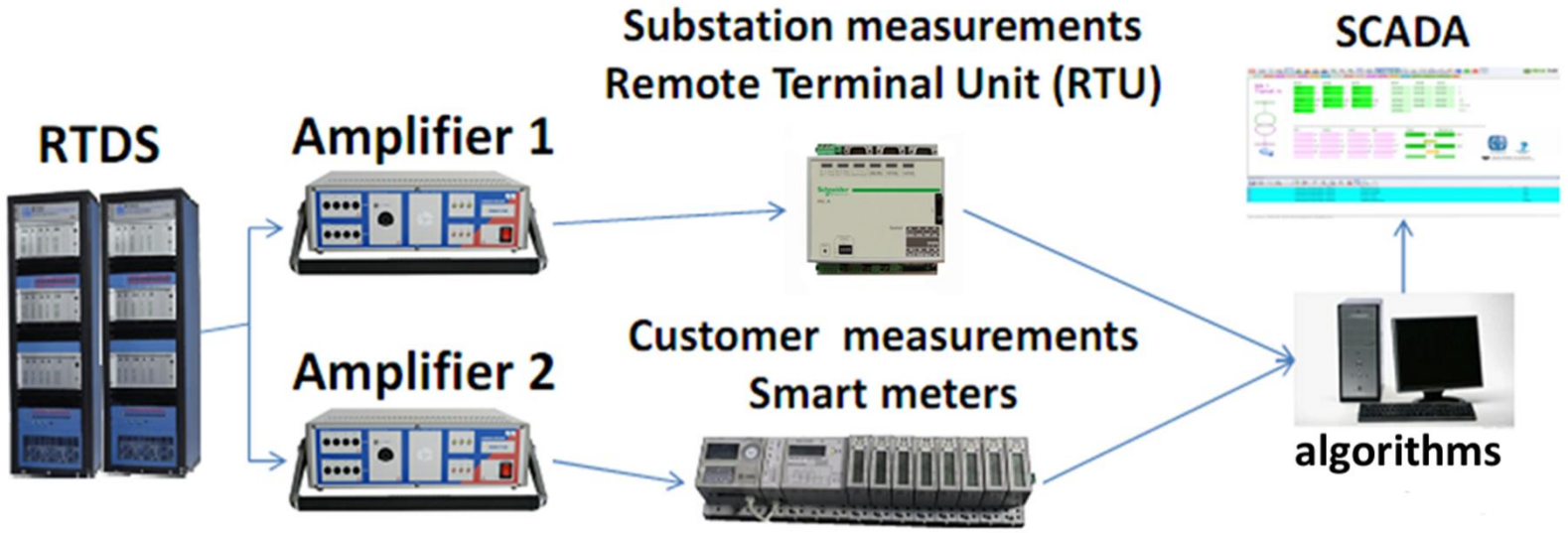
USE CASES (LV):

- RT monitoring
- State estimation
- Power flow control



WP7 – Demonstrations (Labs)

- RTDS to simulate the network
- Connection with other devices e.g. RTUs, PMUs, SMs, …



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IREC

Summary

- Strong focus on DSO viewpoint
- Impacts of DG, DR, aggregators, etc. for distribution network planning and operation
- Benefits of active network management
- Enabler: next generation distribution automation system and its interaction with other systems in electricity system
- Proven solutions by demonstrations

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Thank you

www.ide4l.eu