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Smart TSO-DSO interaction schemes, market architectures and ICT Solutions for the integration of ancillary services from demand side management and distributed generation

3rd Advisory Board meeting | 2018/02/01

Present status of the three project pilots

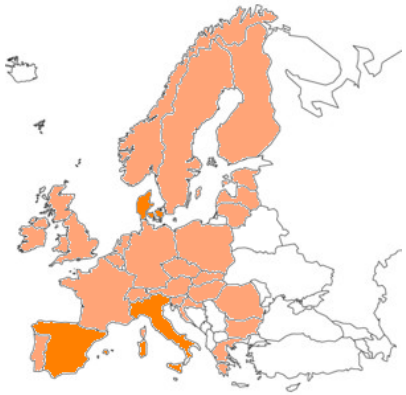
Carlos Madina (Tecnalia)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691405

Aims and goals of WP5

Realisation of three complementary pilots to evaluate the performance of different TSO-DSO interactions under different market structures.

Coordination with laboratory simulations to bridge the gap between present real-world implementation and the opportunities envisaged for the future.



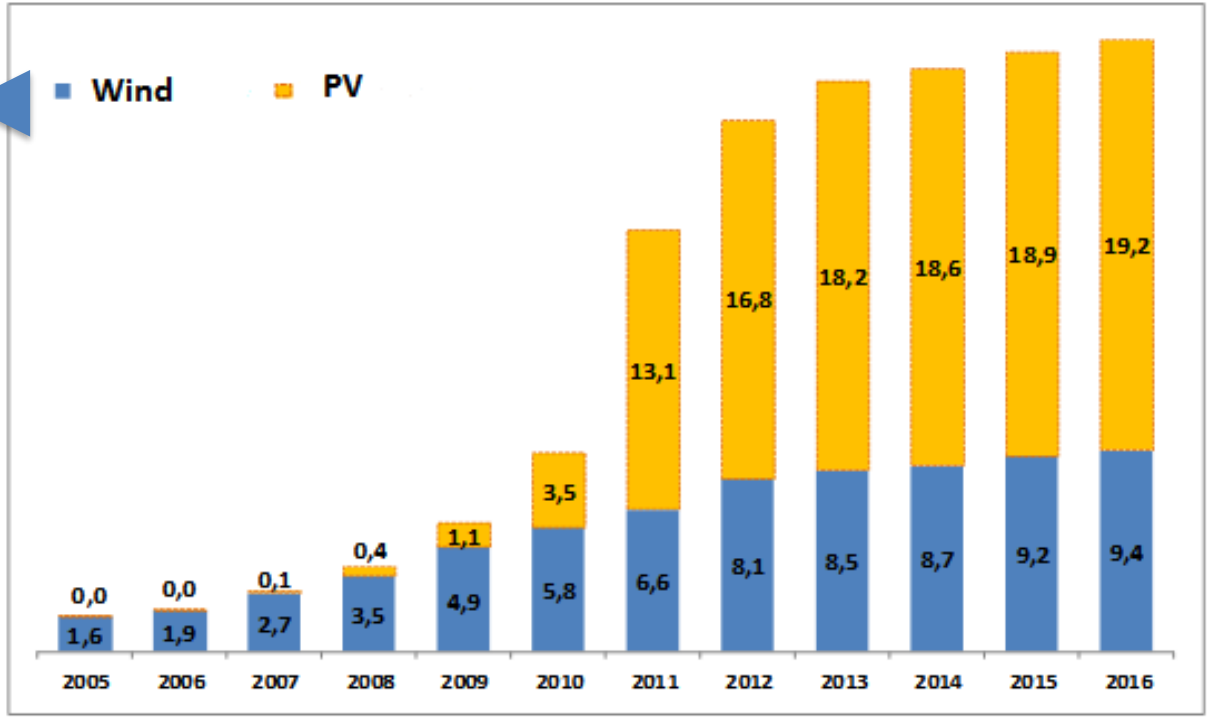
Identify & remove barriers to facilitate the way to the pan-European market for ancillary services.

Centralised TSO control in high-DER area

Italian context: Energy situation

Large increasing of RES in the last 10 years

New issues in terms of power management of the electrical grid



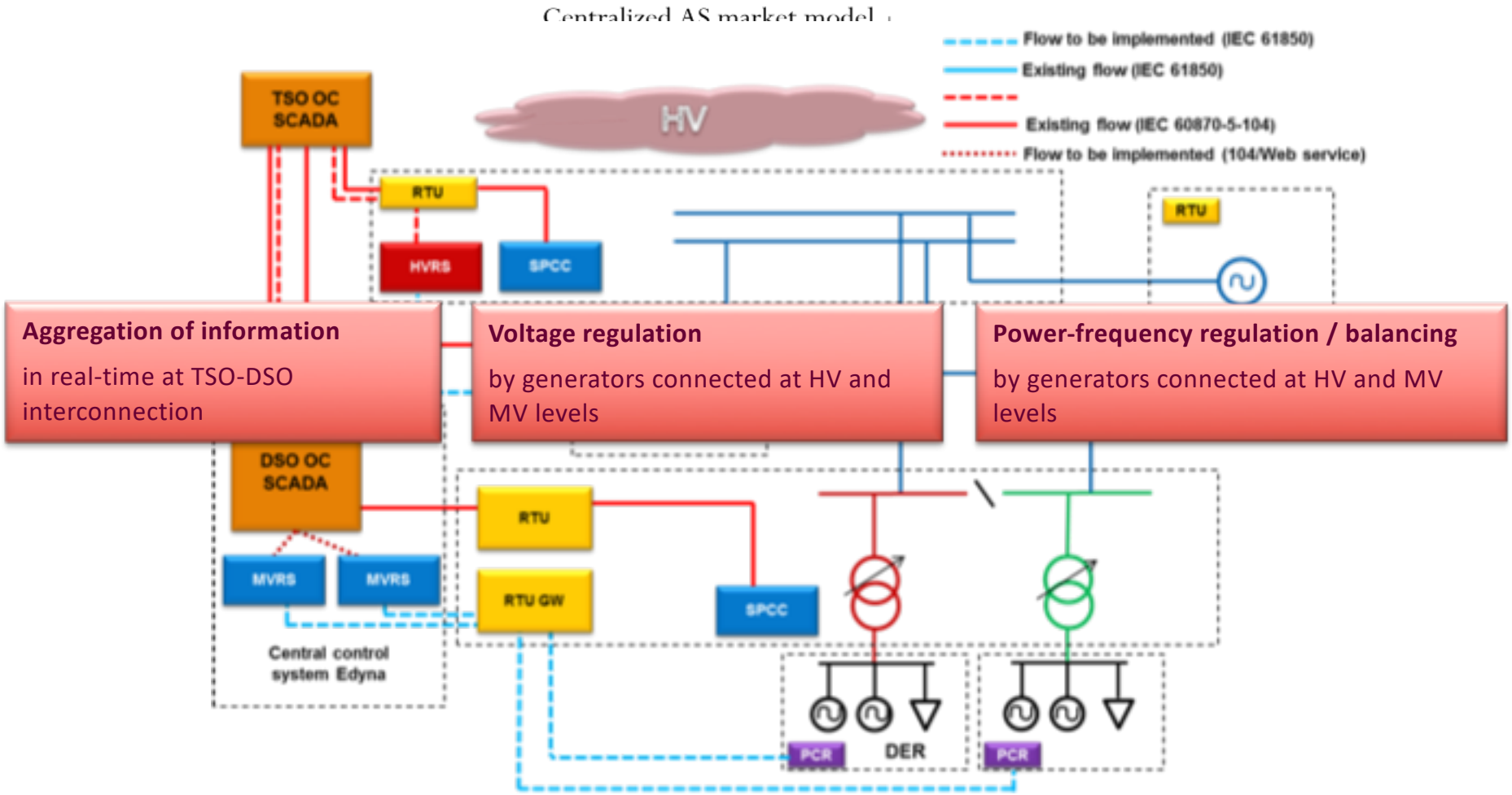
Active power rise from MV up to HV grid

Difficulty to predict RES production

Italian NRA is opening the market to DG and DR through *aggregators* and requiring the DSO to improve *observability* for the TSO

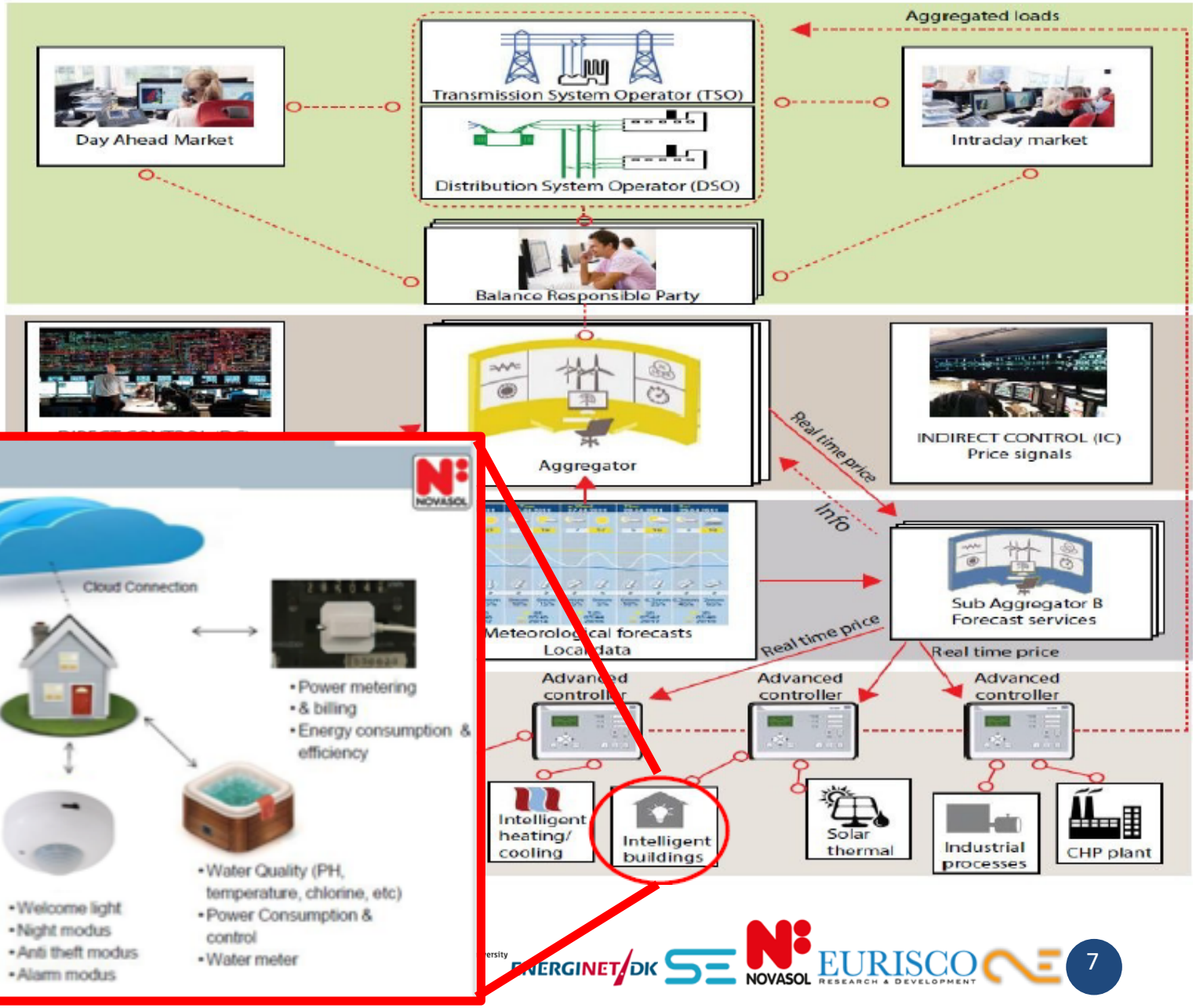
Needs to improve the infrastructure for monitoring and control of MV and LV levels

Pilot A: Centralised TSO control in high-DER area

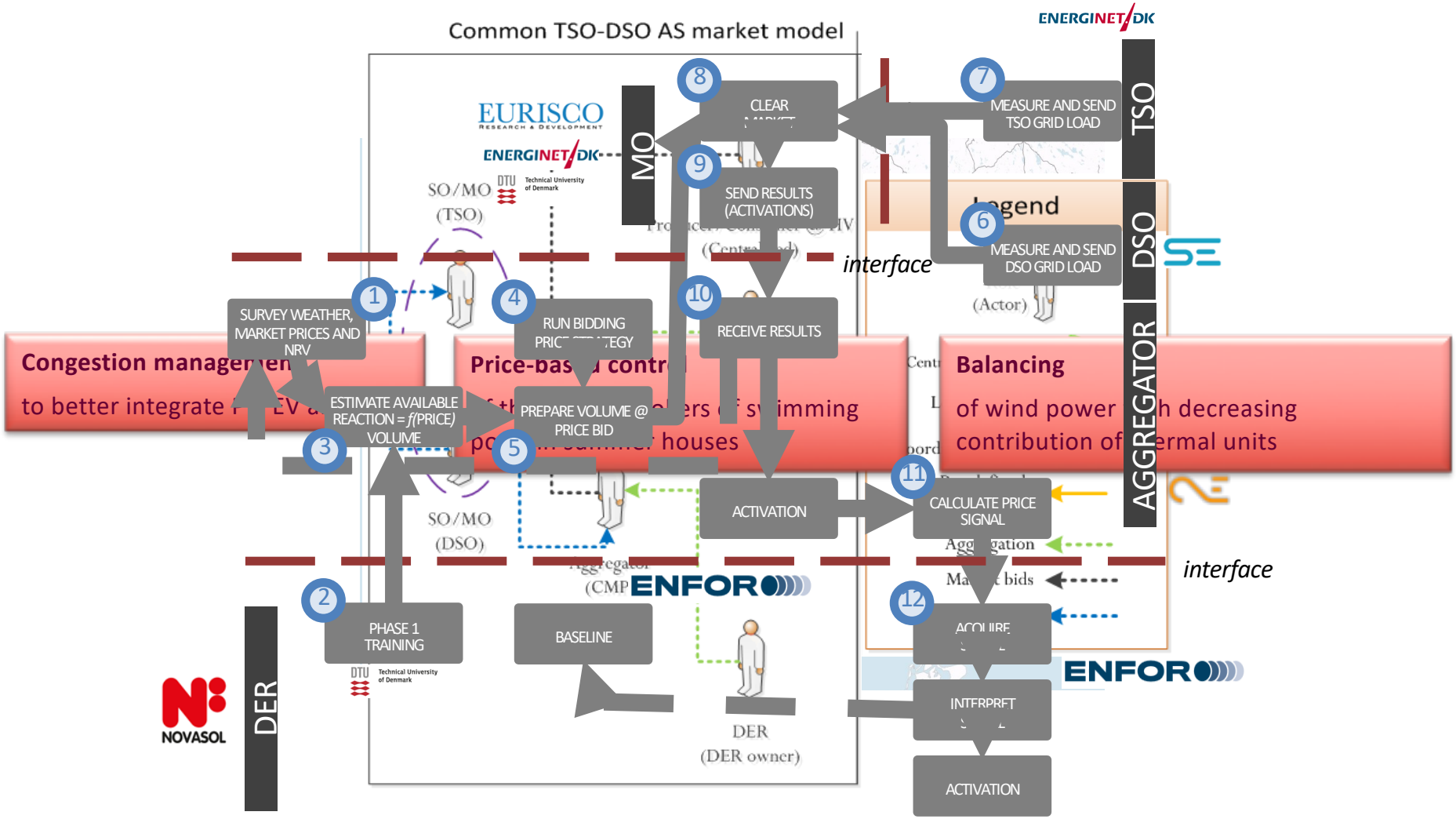


Common TSO-DSO market with pool flexibility

Smart Energy Operating System (SE-OS)



Pilot B: Common TSO-DSO market with pool flexibility



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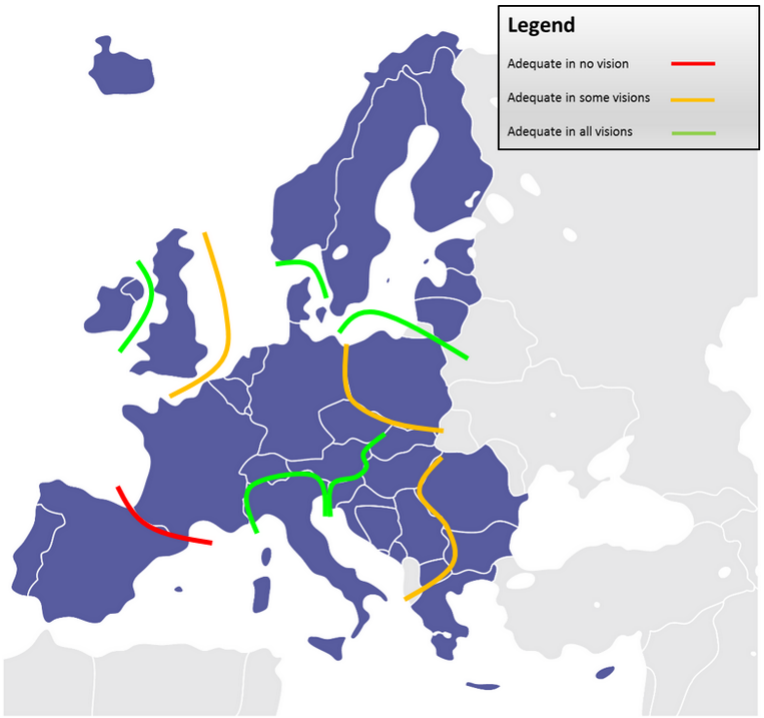
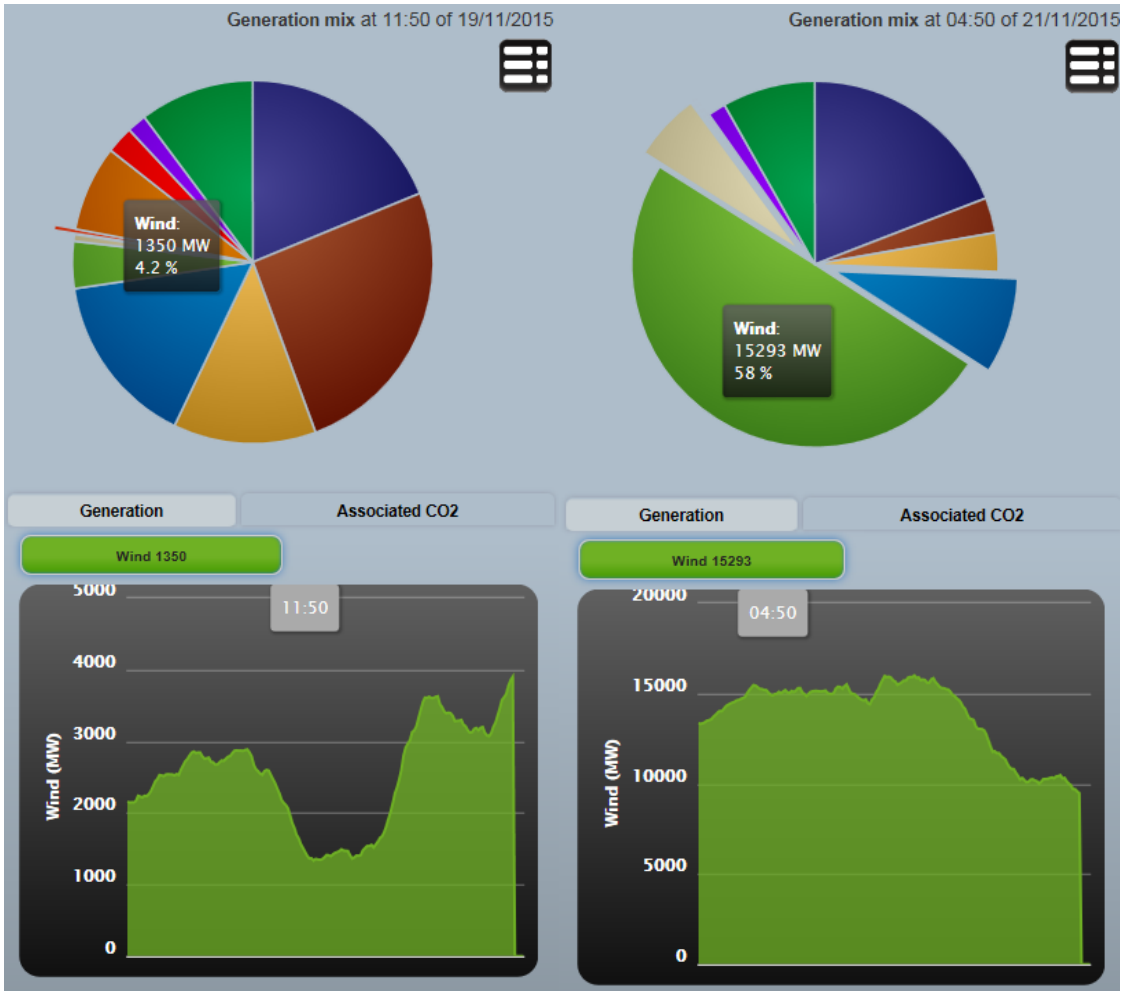
Shared responsibility with base station flexibility

Spanish context



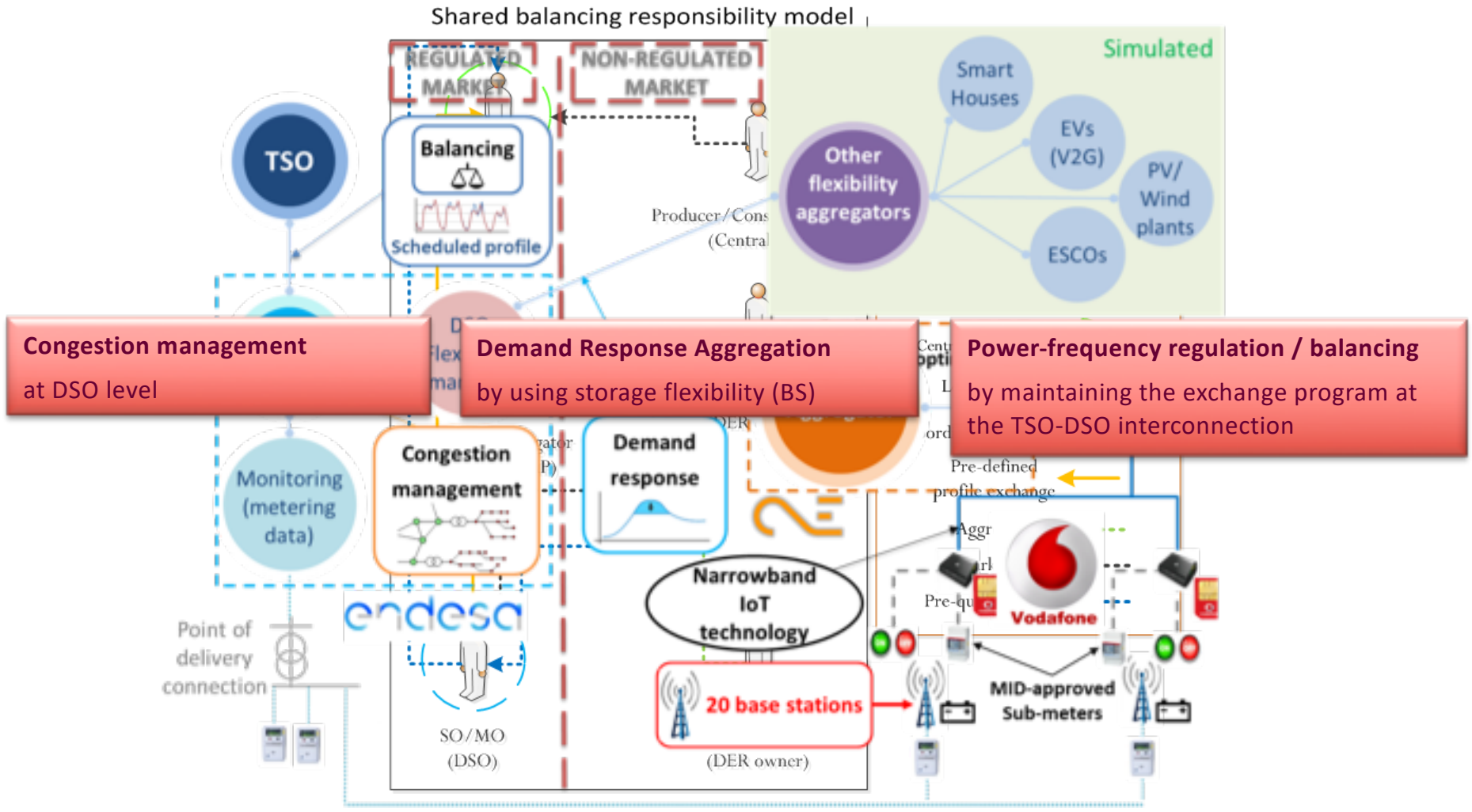
2030 Transmission adequacy (TYNDP'16)
http://tyndp.entsoe.eu/exec-report/



Poor interconnections

Big contribution by highly-variable RES production

Pilot C: Shared responsibility with BS &EV flexibility



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Thank You

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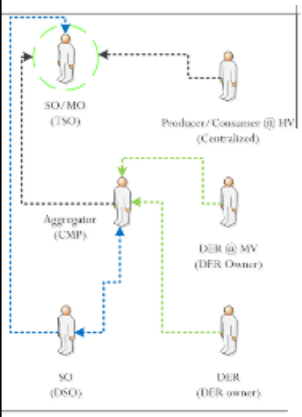
Pilot A: Back-up slide



Flow to be implemented (IEC 61850)

Existing flow (IEC 61850)

Existing flow (IEC 60870-5-104)

Flow to be implemented (104/Web service)

TSO OC SCADA

HV

RTU

HVRS

SPCC

RTU

DCS

RTU

DSO OC SCADA

RTU

MVRS

MVRS

RTU GW

SPCC

Central control system Edyna

PCR

DER

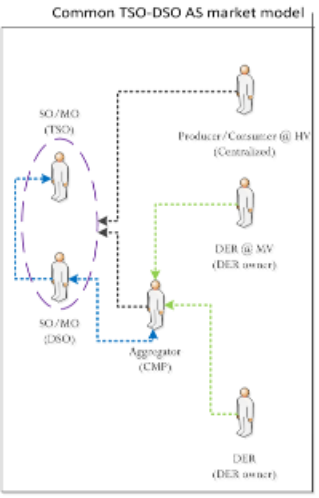
PCR

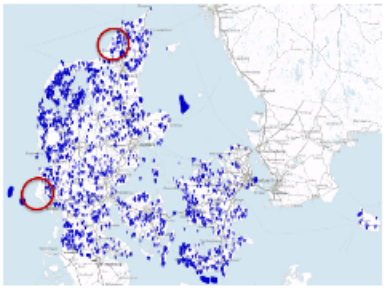
Aggregation of information
in real-time at TSO-DSO interconnection

Voltage regulation
by generators connected at HV and MV levels

Power-frequency regulation / balancing
by generators connected at HV and MV levels

Pilot B: Back-up slide





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EURISCO RESEARCH & DEVELOPMENT

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DTU Technical University of Denmark

MO

TSO

DSO

AGGREGATOR

DER

NOVASOL

ENFOR

DTU Technical University of Denmark

ENFOR

1 SURVEY WEATHER, MARKET PRICES AND NRV

2 PHASE 1 TRAINING

3 ESTIMATE AVAILABLE REACTION = *f*(PRICE) VOLUME

4 RUN BIDDING PRICE STRATEGY

5 PREPARE VOLUME @ PRICE BID

6 MEASURE AND SEND DSO GRID LOAD

7 MEASURE AND SEND TSO GRID LOAD

8 CLEAR MARKET

9 SEND RESULTS (ACTIVATIONS)

10 RECEIVE RESULTS

11 CALCULATE PRICE SIGNAL

12 ACQUIRE SIGNAL

BASELINE

INTERPRET SIGNAL

ACTIVATION

ACTIVATION

interface

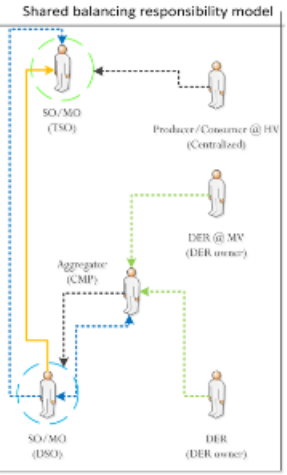
interface

Congestion management
to better integrate PV, EV and HP

Price-based control
of thermal controllers of swimming pools in summer houses

Balancing
of wind power with decreasing contribution of thermal units

Pilot C: Back-up slide



REGULATED MARKET

NON-REGULATED MARKET

Simulated

TSO

Balancing

Scheduled profile

Other flexibility aggregators

Smart Houses

EVs (V2G)

PV/ Wind plants

ESCOs

DSO

DSO Flexibility manager

Monitoring (metering data)

Congestion management

Demand response

Aggregator

DR optimisation

Vodafone Network

endesa

Point of delivery connection

Narrowband IoT technology

Vodafone

20 base stations

MID-approved Sub-meters

Congestion management at DSO level

Demand Response Aggregation by using storage flexibility (BS)

Power-frequency regulation / balancing by maintaining the exchange program at the TSO-DSO interconnection