Advanced functionalities for the future Smart Secondary Substation

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under Marie Sklodowska-Curie grant agreement No 675318

Agenda

- Introductory plane
  - The shift paradigm
  - Motivation
- Overview of the Conceptual Technical Architecture
  - Conceptual architecture preview
  - Use Cases : Analysis (Anticipated addressed challenges)
- Current Work
  - Base case scenarios & Case networks
- Final remarks – Work Ahead

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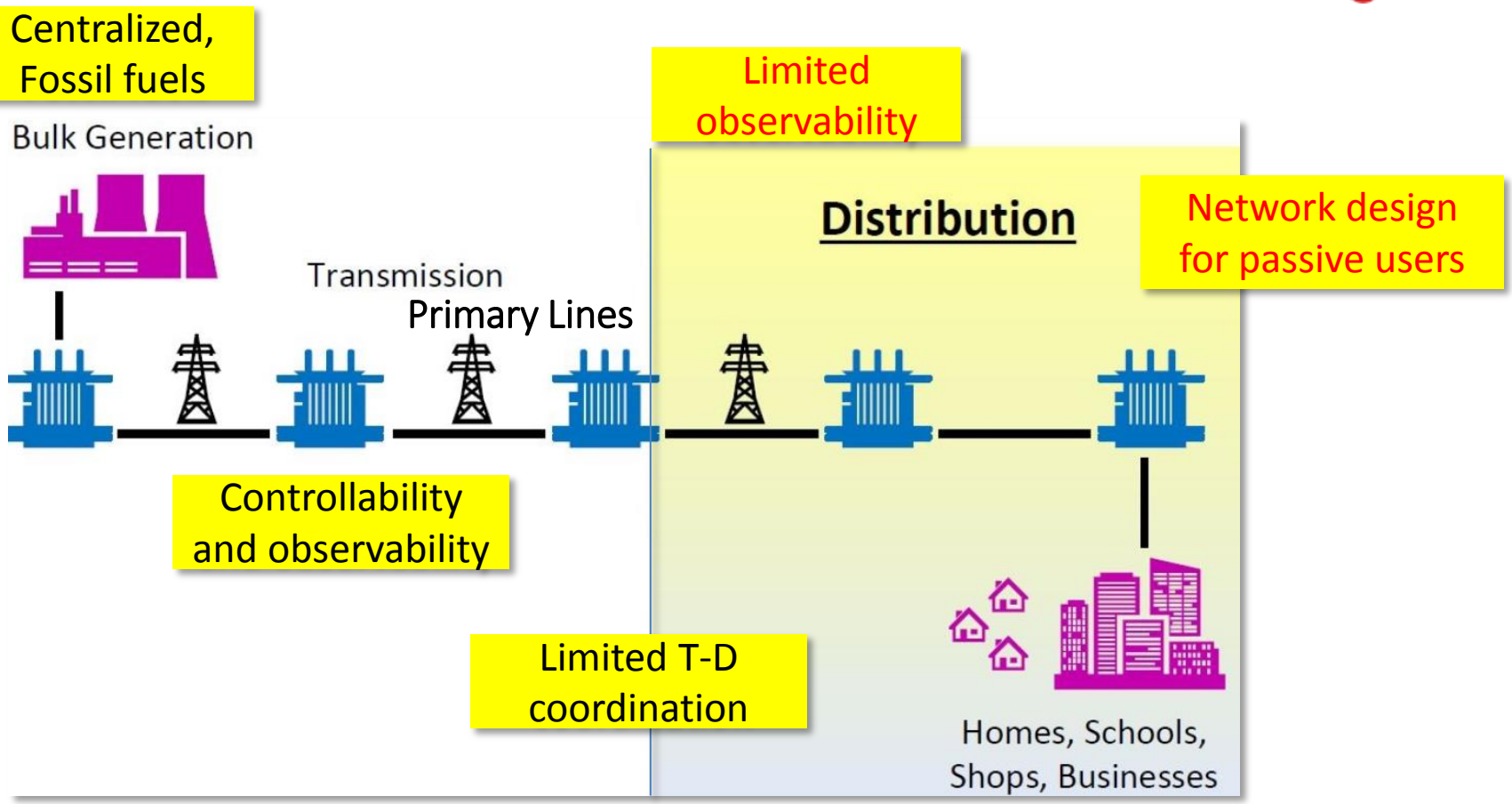

[1] N. Ochoa "OpenDSS Tutorial", 2015 Univeristy of Manchester

Secondary Substation (S/S) or MV/LV S/S

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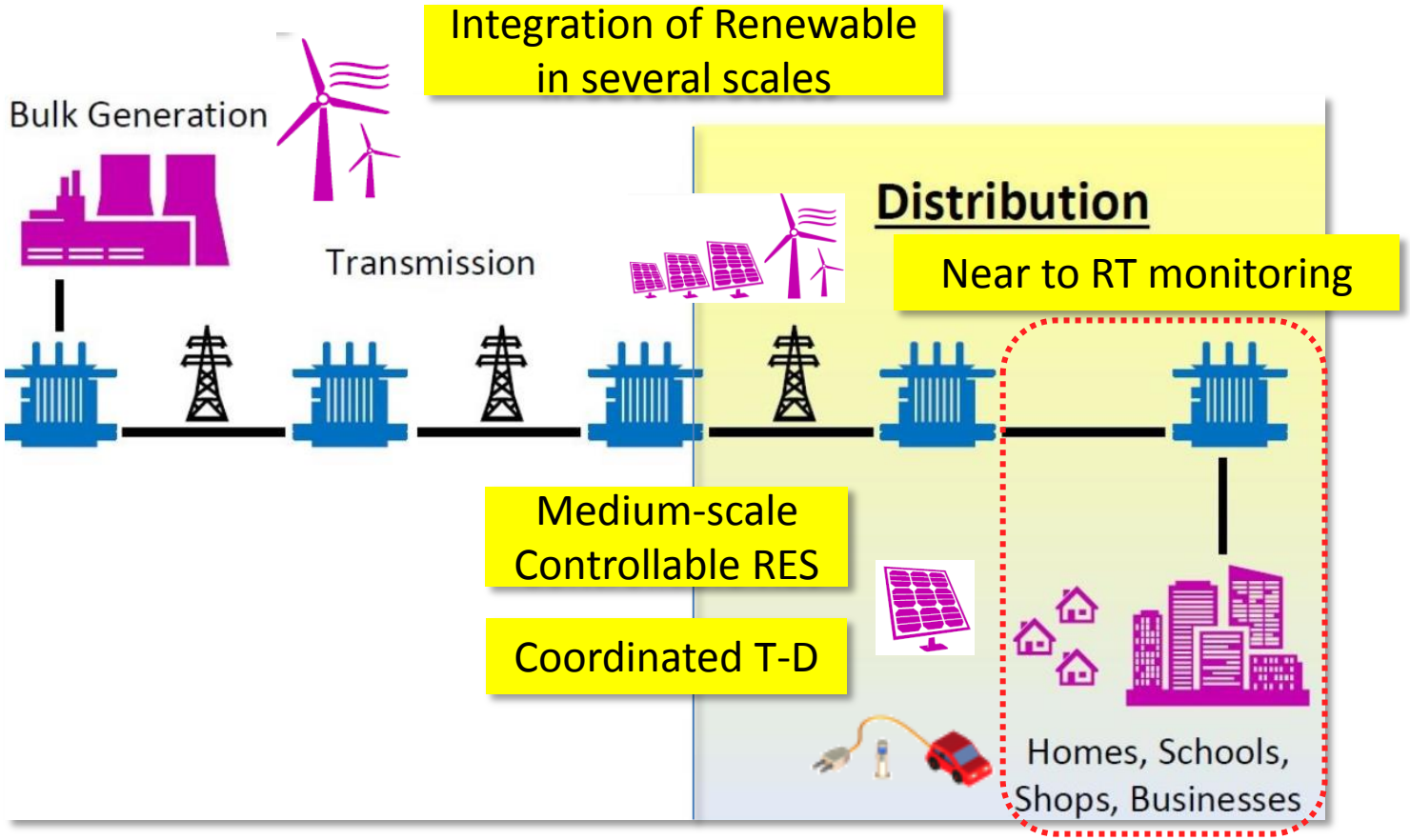

Secondary Substation (S/S) or MV/LV S/S

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Classic view of Power System

"fit 'n forget"

Integration of DG

Induced Technical Challenges

- Voltage rise effect
- Power Quality
- Protection
- Stability

LV case?

Responding these challenges…

- A1: Grid Reinforcement
- A2: Impart Intelligence to Grid- transit to Active Network Management

Advanced forecasting tools

Advanced coordinated operation

Advanced local distribution grid monitoring

→ Advanced functionalities

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Portraying the Smart Secondary Substation

Inputs

Com Link with ADMS

Sensors (IED, Smart Meters)

Distribution Transformer Controller

- **Monitoring** (Advanced RTU features, I-V sensors)
- **Tele-control** (Communication with control breakers & switches)
- **Power Flow Control** (Power Control Algorithms through tracking m-DGs and responsive-Loads)

Substation

Com Link with downstream Grid connected Smart Devices (i.e. smart meters, smart inverters etc.)

Dispatch set-points, Auto-regulation of OLTC

Outputs

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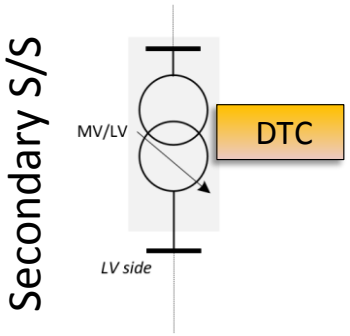
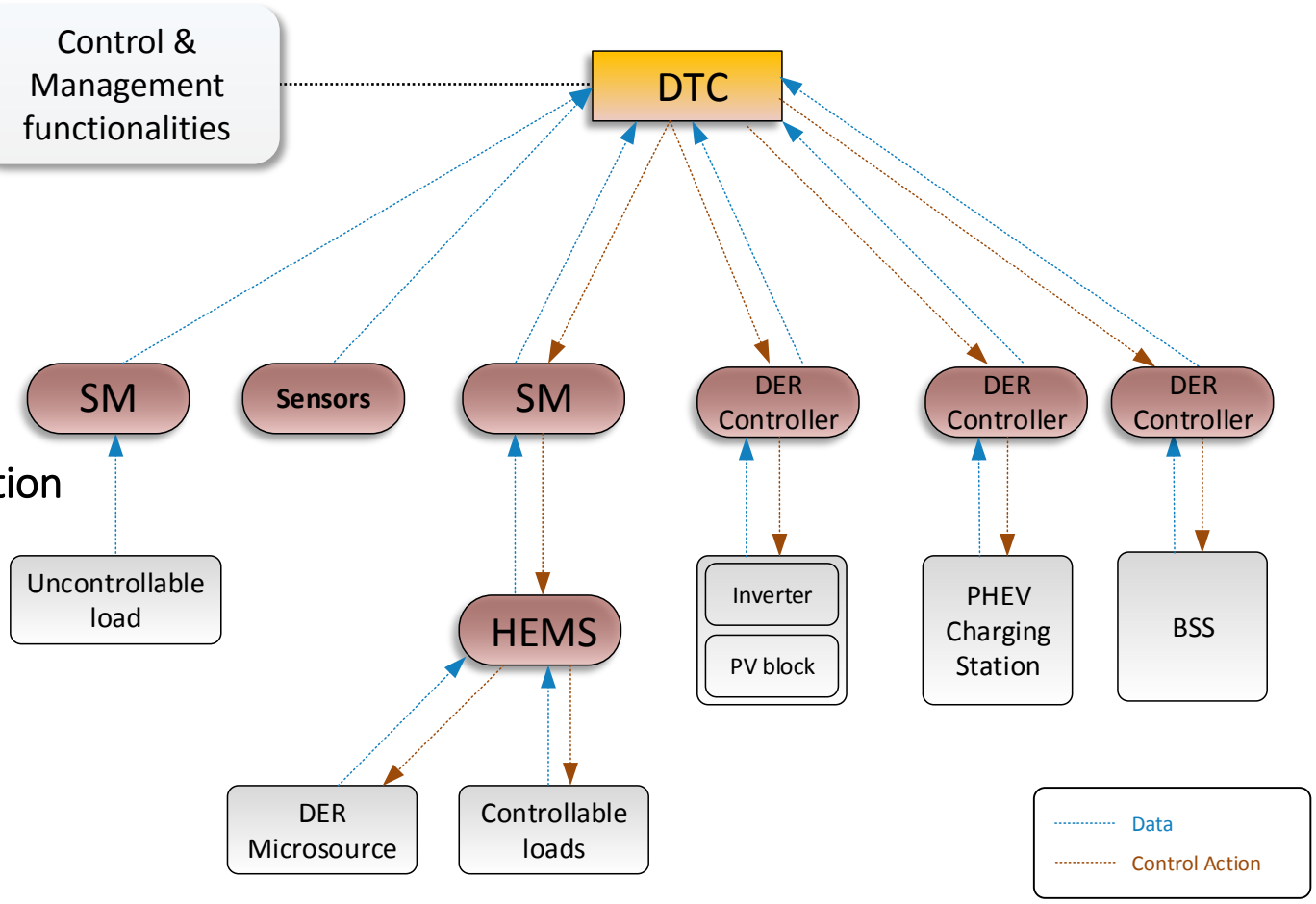
Pivotal element of the proposed architecture



- Top-level centralized scheme based on DTC
- Provide a control operation scheme involving DER integration



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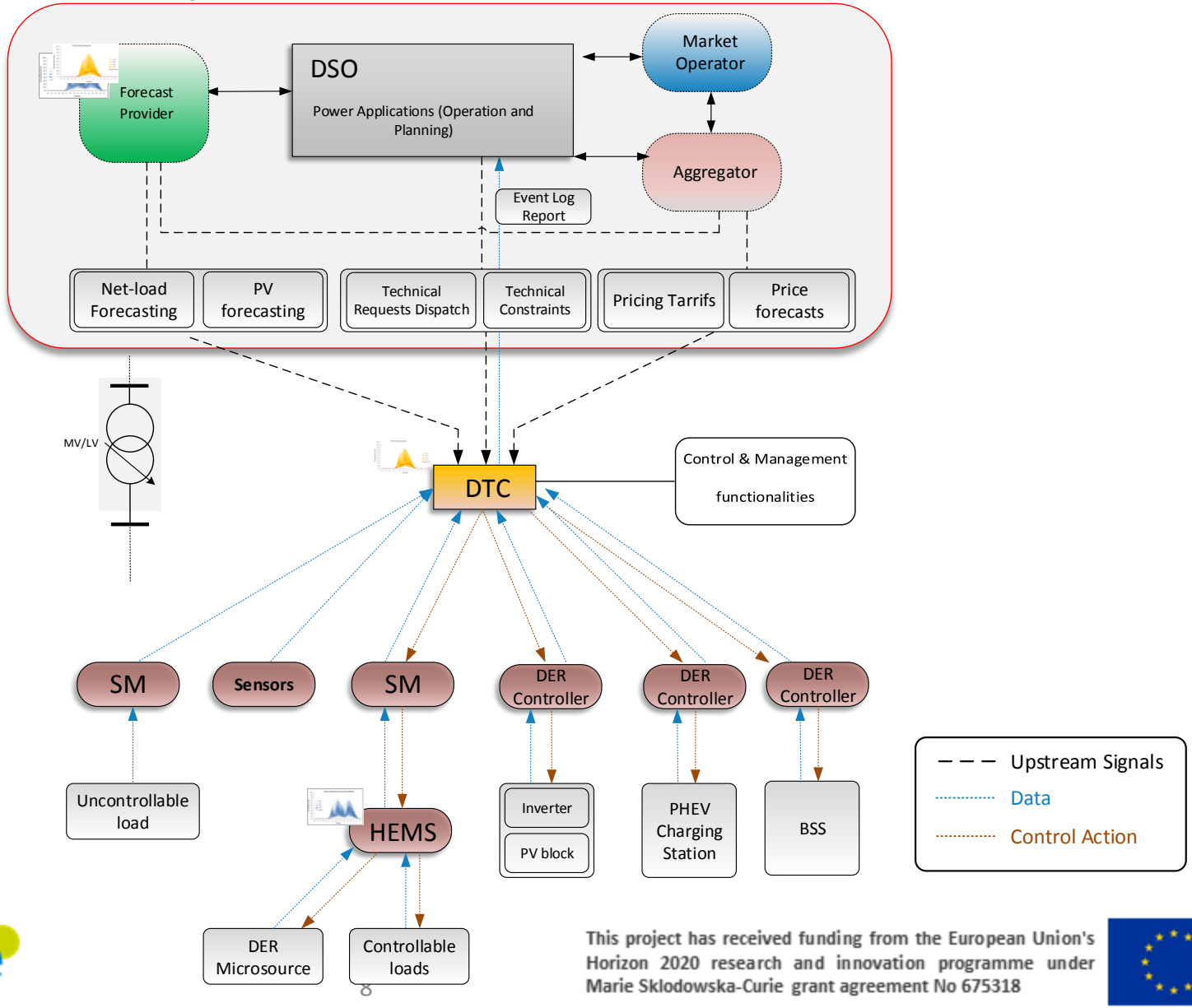
Overview of the conceptual architecture

Upstream Inputs to the DTC and interrelation



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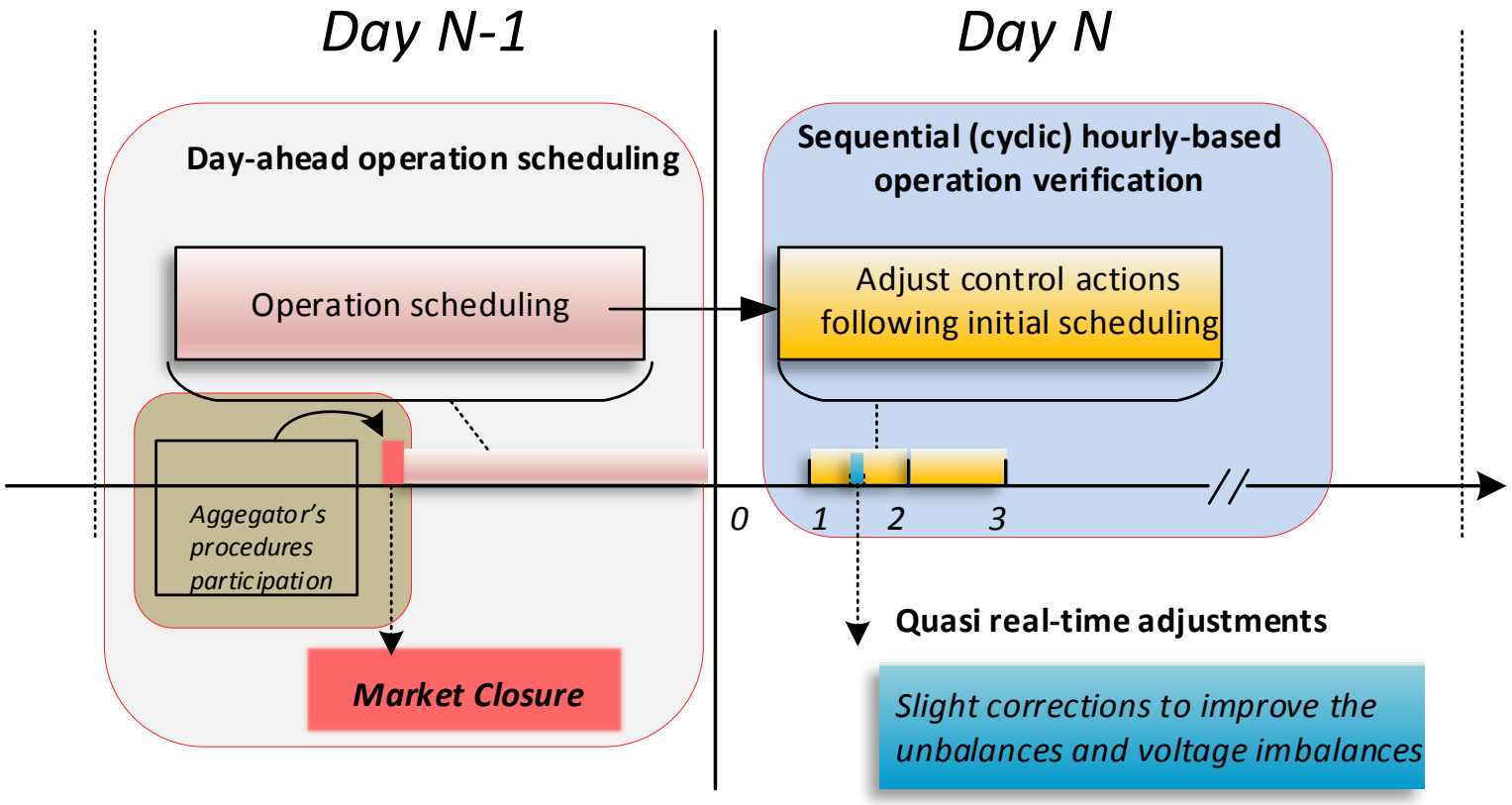
A time-frame analysis of the control scheme



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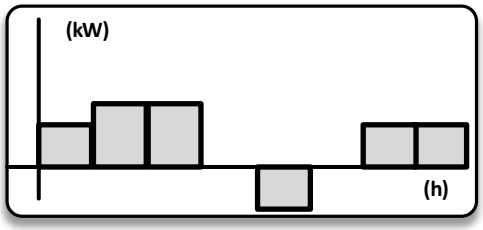
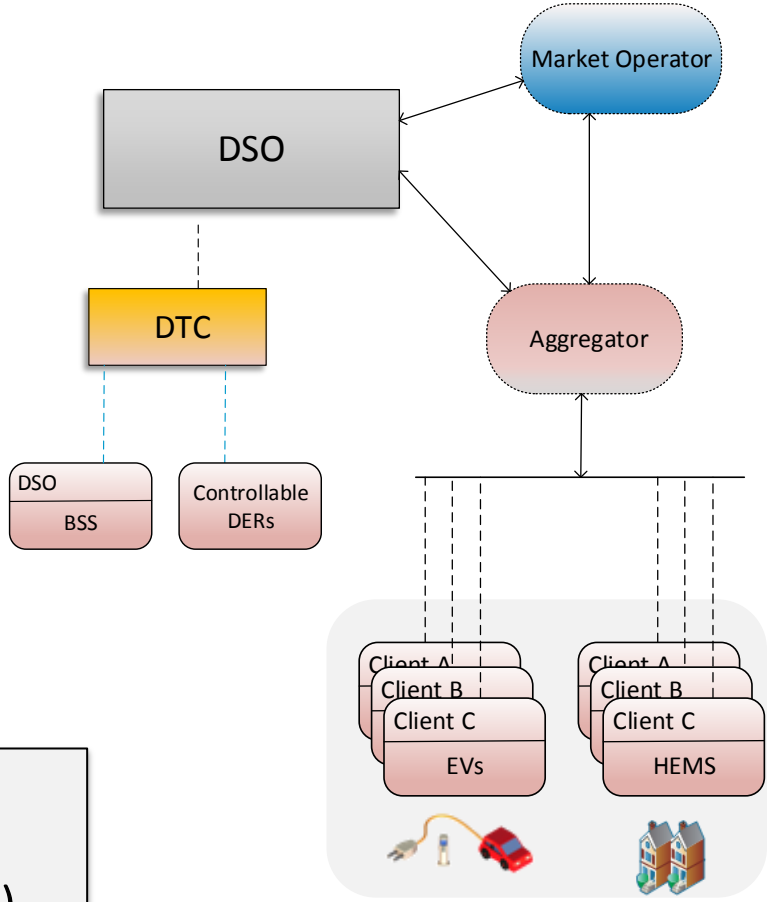
Managing the flexibilities provided by DERs

Further Step to define flexibility

Correspond to the availability of an asset to offer a particular active power deviation for a specific time frame.





Flexibility might be considered as two-factors :

- Part of DSM schemes
- Multi-temporal flexibility (set of feasible trajectories)

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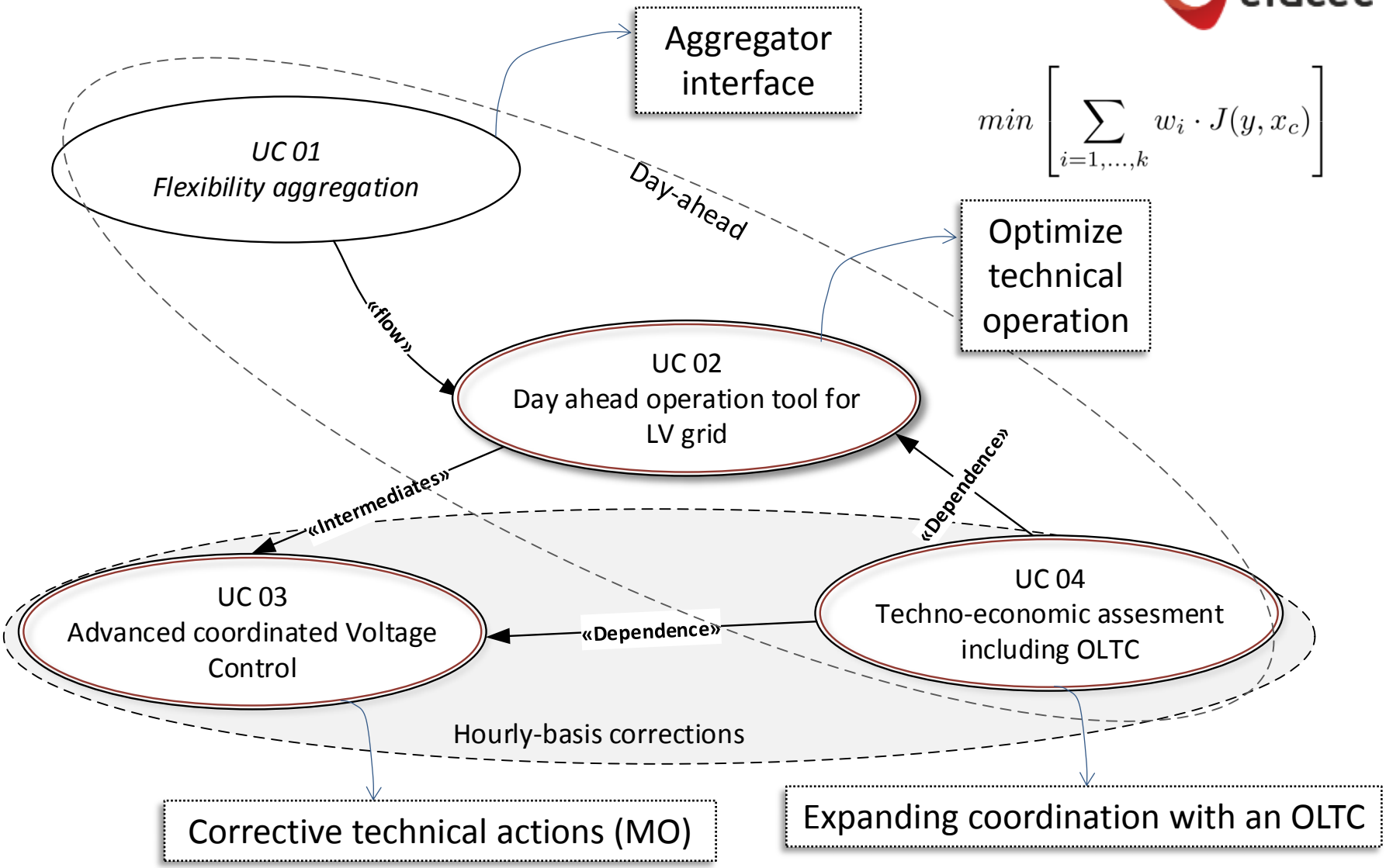
Use Cases: Analysis



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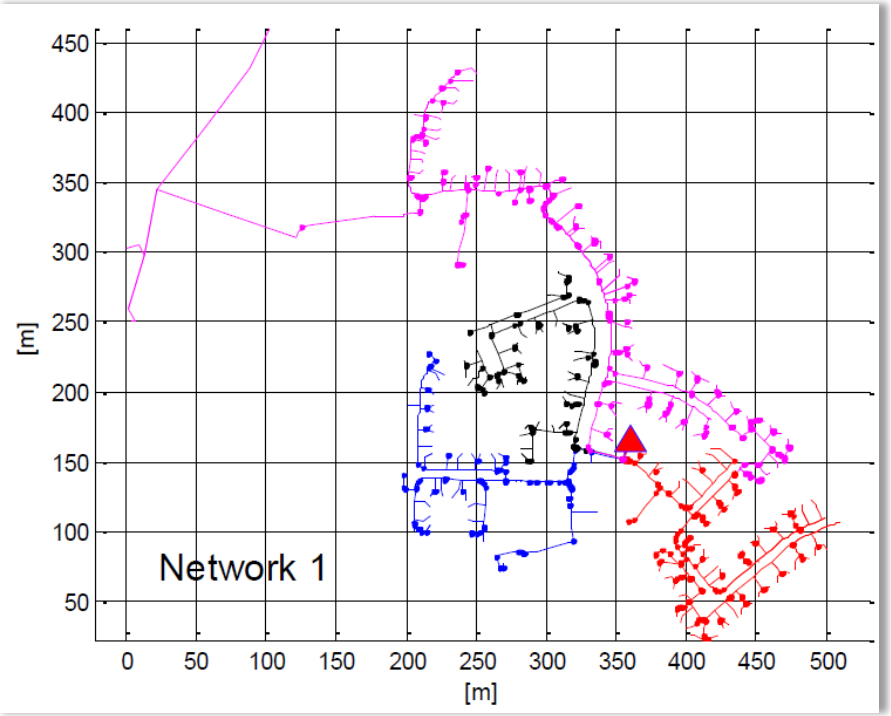
Software used to simulate network

- GridLab-D (first approach)
- Simulink
- OpenDSS Interfaced with MATLAB (GUI framework for other ESRs)
- Pool case networks in WP4 (?) or Repository with Data

Starting from a benchmark IEEE case

- Based on European model
- Feeder of a Real Case network



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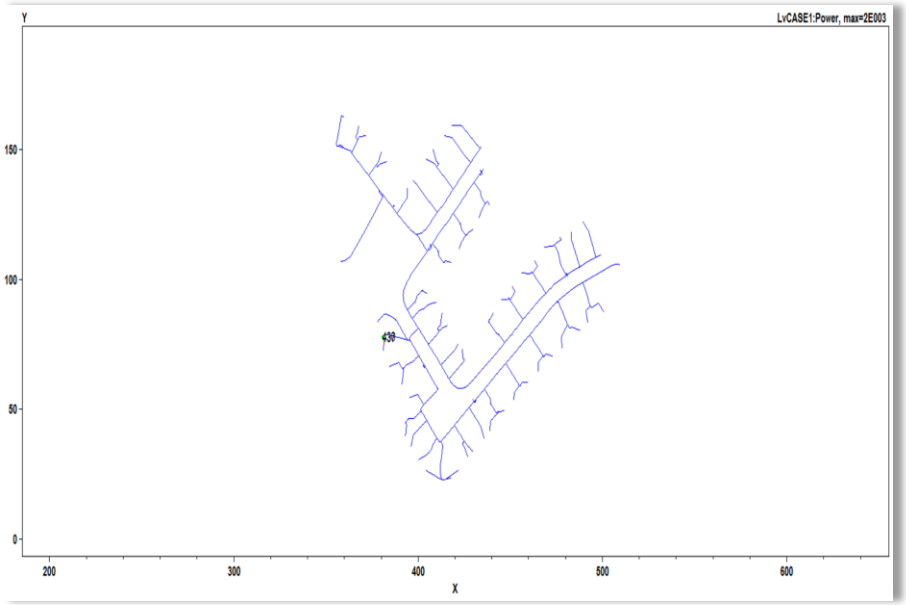
Examined metrics

- Voltages for Overvoltages and Undervoltages
- $\mathrm{VUF}[\%] = \frac{V_2}{V1} * 100\%$

According to EN-50160

Creating discrete base case scenarios

- no DERs



- Involving DERs (% PV+ % EVs+ %Controllable loads)
- Scope to create discrete Case scenarios indicating technical bottlenecks induced by DERs

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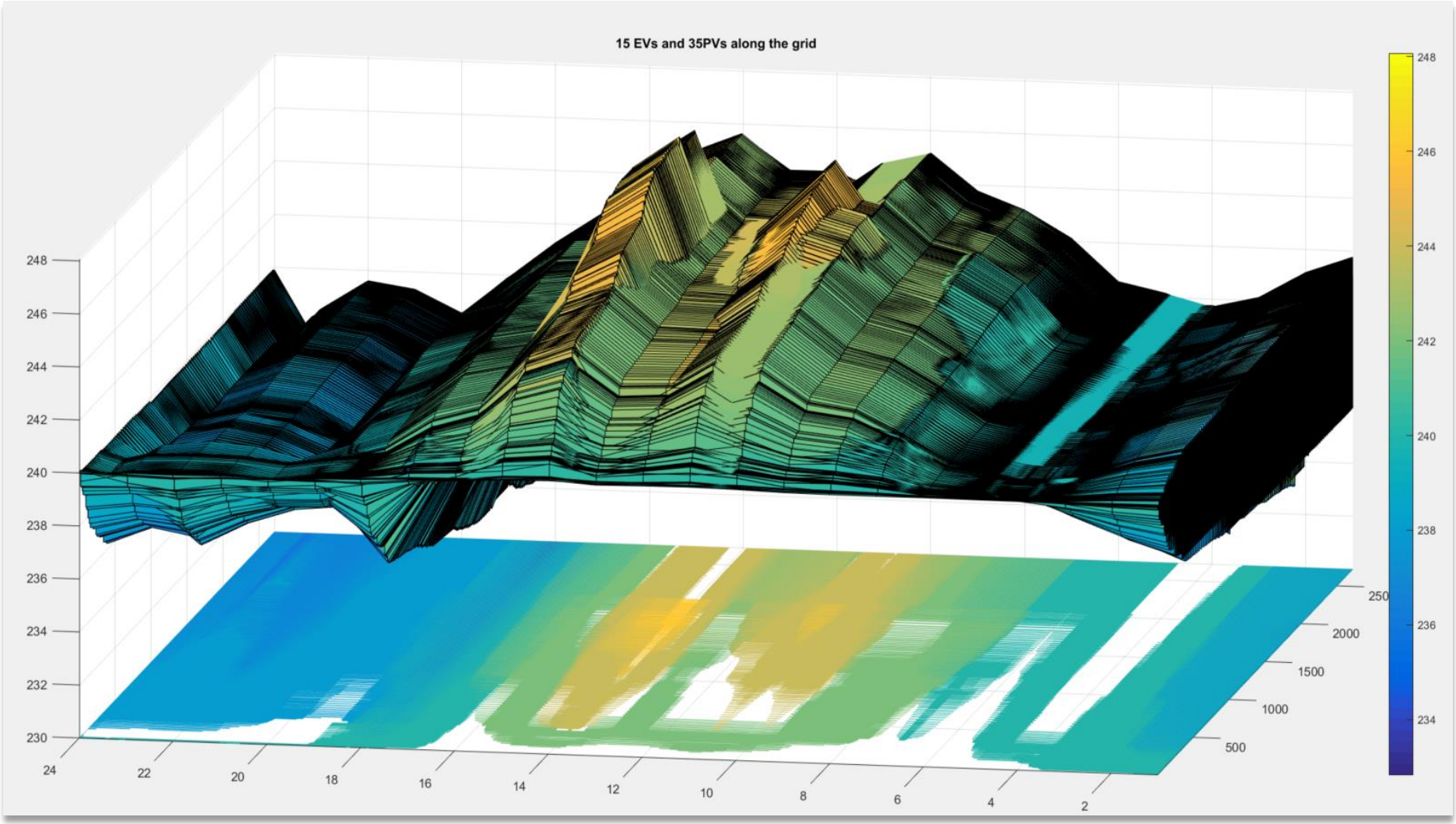

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Final Remarks

- Developments will be encompassed on LV network performing Multi-temporal Control strategy
- Uncertainties and impact on the control actions.
- Operation and control management
  - Making use of DER flexibility under DSM schemes
  - enabling the coordination controllable assets

Current Work & Work Ahead

- Identification of base case scenarios on benchmark networks
- Establish use case networks within WP4
- Finalizing the simulation platform
- Methodology Approach and focus on UC1-2
- Flexibility model (implicit or explicit model)

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Advanced functionalities for the future Smart Secondary Substation

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

2nd Workshop and Summer school Meeting

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