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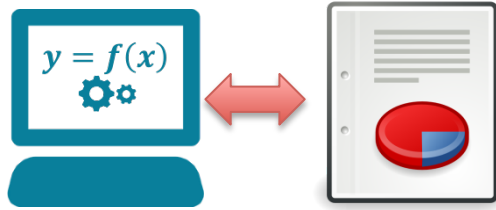
# Comparison of the national cases in a simulation environment and laboratory testing

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# Development of the national cases in lab test environment



***Development and validation of a future scenario (2030) and simulation environment in order to reproduce the TSO-DSO interactions in the three national cases***

***Elaboration of ad-hoc Cost Benefit Analysis methodology and selection of the TSO-DSO interactions with the highest potential***

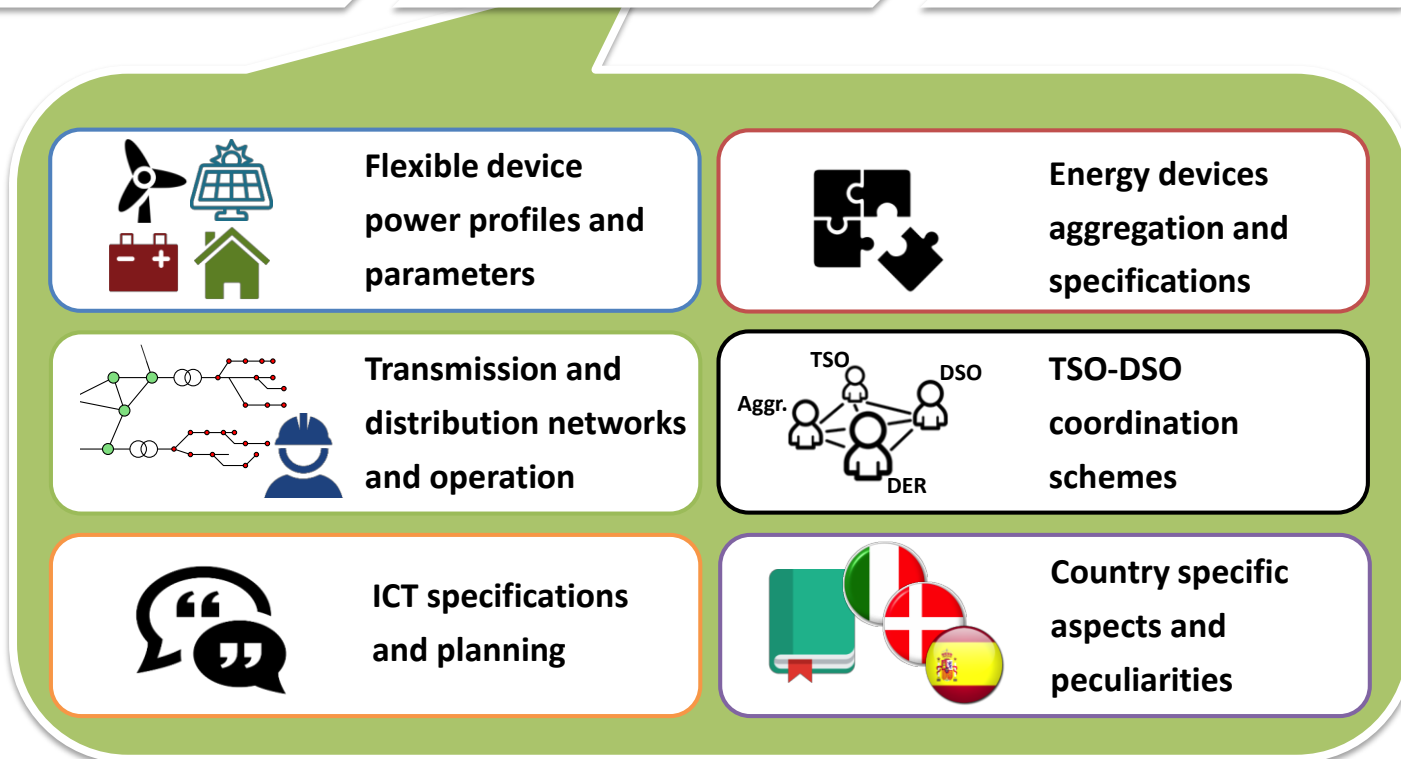
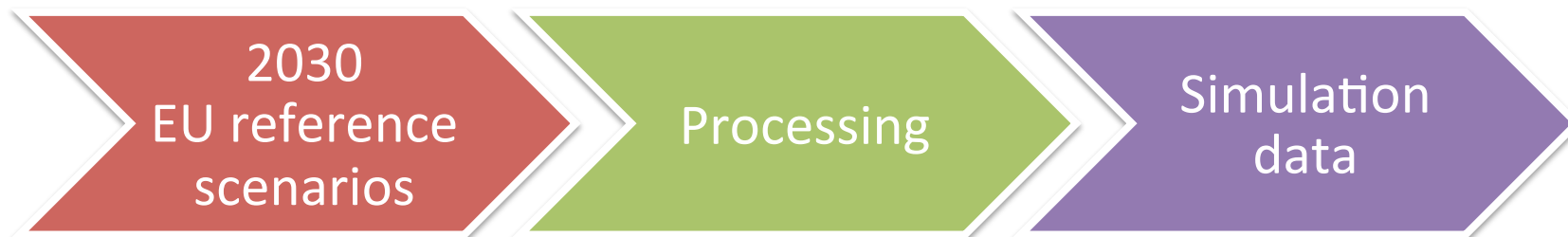


***Implementation of the simulation environment in the laboratory in order to test real equipment aimed at contributing in TSO-DSO interactions***



# 2030 Scenario Data

European reference scenarios are processed in order to generate the system configurations and data to be used in simulation and laboratory studies

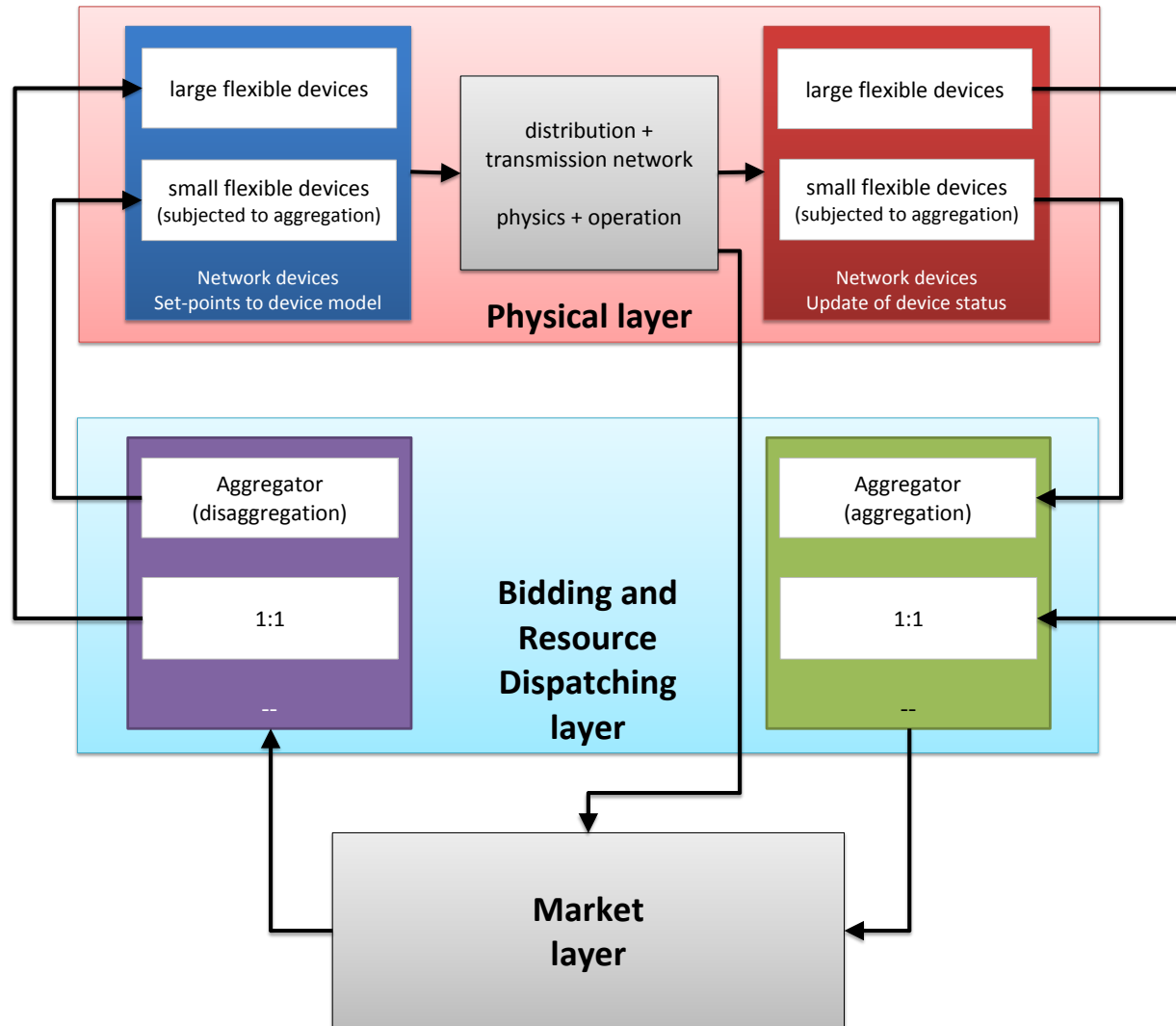




# Simulation blocks

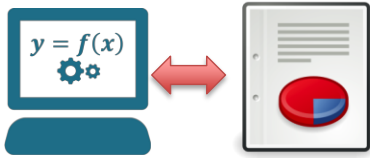
## Physical layer

Simulates the physical transmission and distribution networks, operation and connected devices



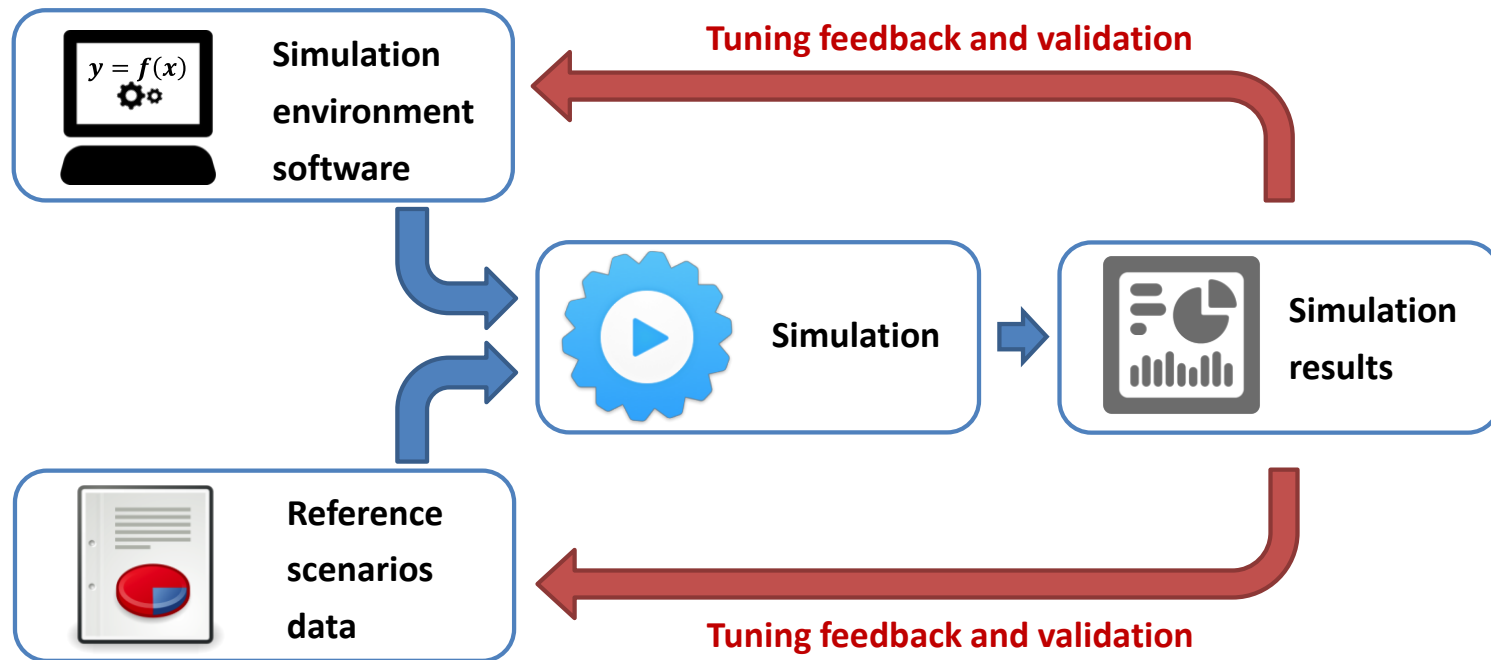
## Market layer

Runs the market clearing algorithms on the basis of the received bids and network constraints



## Simulation approach

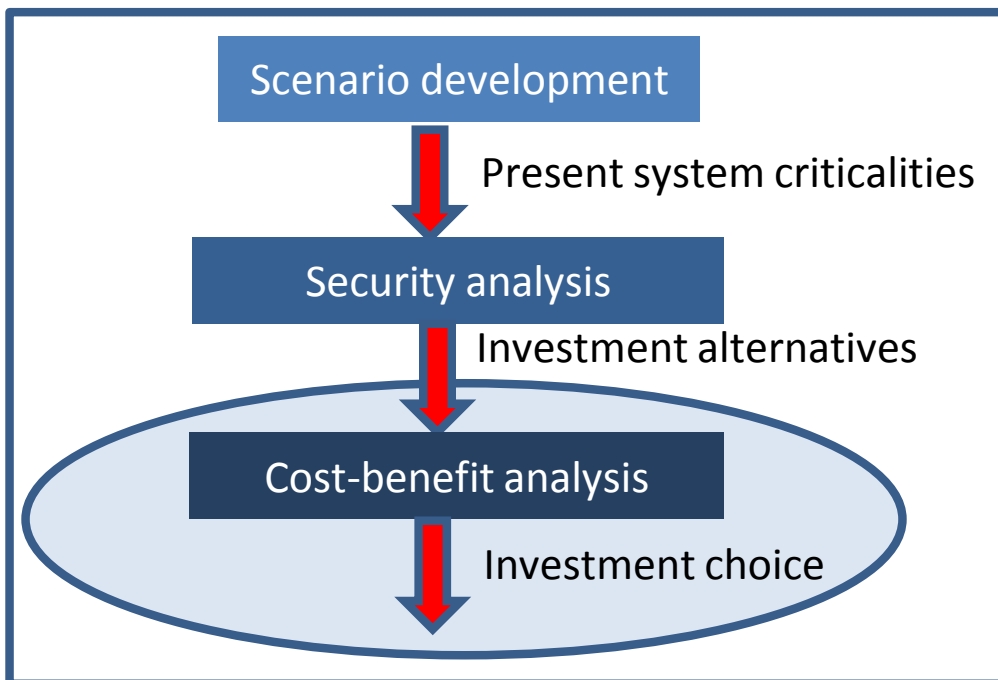
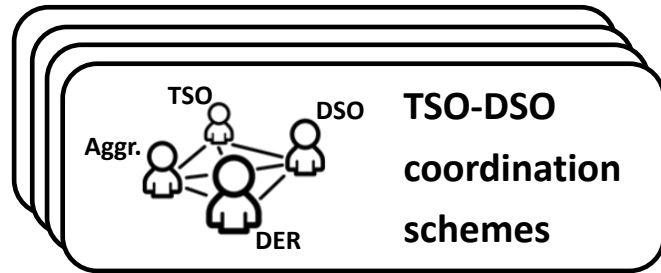
The simulation will be performed by considering the selected scenario (how Italy, Denmark and Spain will evolve in 2030).



Variations to the average scenarios will be introduced in order to evaluate the sensitivity of simulation results to scenario variations



# Calculating the costs and the benefits at system level



- Lifecycle costs
- Overall system social welfare
- CO<sub>2</sub> emissions
- System reliability
- Extra costs due to distribution investments
- Extra costs due to market power
- Socio-environmental costs of new lines
- Social welfare split (winner/loser zones and stakeholders with weighing)
- RES curtailment costs
- CO<sub>2</sub> prices interval up to change merit order
- Risk driven vs. “social” rates for the ROI

**Core elements** (typical)

**Experimental items** (innovative)

**Sensitivity factors** (enriching)





# Laboratory tests



The **SmartEST laboratory** features:

- 1 MW lab for Smart Grid component tests and system integration
  - Inverter tests
  - Tests with multiple components
  - Environmental tests
  - Simulation and validation
- Research, design and validation environment for Smart Grid
  - Component development
  - Automation and communication
  - Design and validation

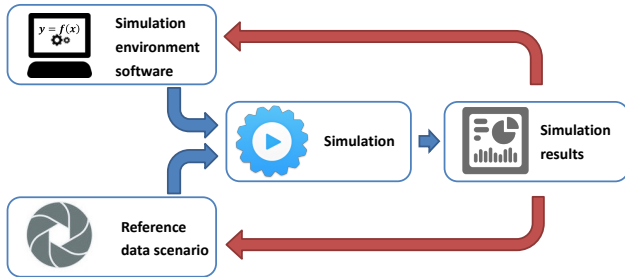
## ***Tests on physical equipment for TSO-DSO interactions***

- *SCADA*
- *Power plant controllers*
- *ICT*



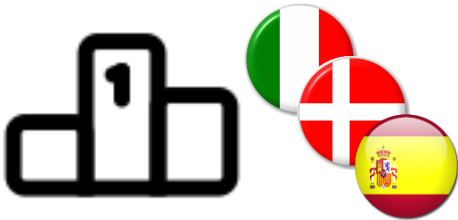


## Key products



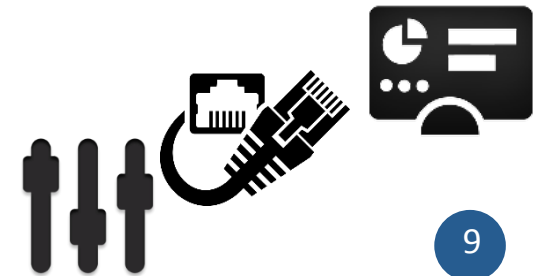
**Validated simulation environment  
(software modules + scenarios)**

**Dedicated Cost Benefit Analysis approach**



**Best TSO-DSO interaction patterns for each  
considered national case**

**Guidelines on hardware utilization within  
the considered TSO-DSO schemes**





Thank You

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