Market RES

Methodology implemented by Market4RES to quantify and compare the impacts of different market design options

Expert Workshop on short-term electricity market design options in the 2020 framework

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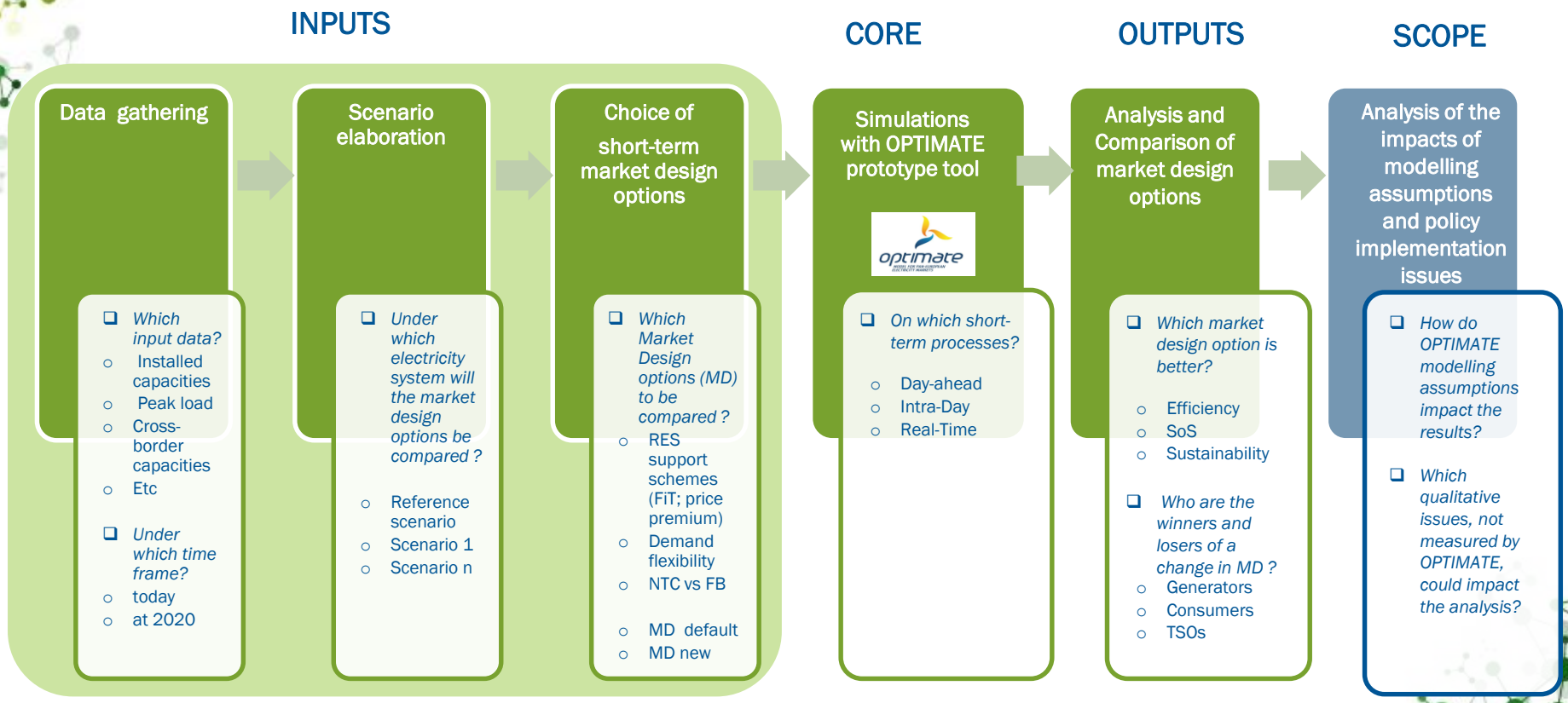
Outline

- Overview of the methodology implemented by Market4RES
- Inputs :
  - Data gathering
  - Scenario elaboration
  - Choice of short-term electricity market design options
- Core : Simulations with the OPTIMATE tool
- Outputs : Analysis and comparison of market design options
- Scope : Analysis of the impacts of OPTIMATE modelling assumptions and policy implementation analysis
- Towards policy recommendations

Overview of the methodology



Credits : OPTIMATE FP7 EC funded project

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Towards policy recommendations

Outline

INPUTS

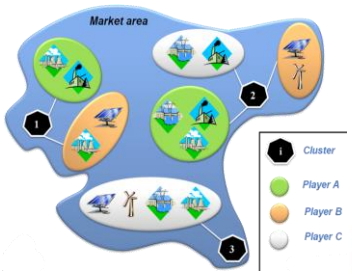
DATA GATHERING | SCENARIOS | SHORT-TERM MARKET DESIGNS

Data gathering

Inputs

Data on the state of the European electricity system (today and 2020)

- **Characteristics of the underlying power network :**
  - Aggregate network configuration: clusters, critical branches
  - Cross-border capacities
- **Market players and assets :**
  - **Thermal generation mix** : technologies (e.g. nuclear, coal, gas, oil) and their techno-economic characteristics (nominal capacity, start-up duration, start-up costs, variable costs, etc.), installed capacities
  - **RES penetration level** : technologies (e.g. wind, solar, hydro dams, must-run), installed capacities, generation profiles
  - **Demand features:** Peak load, load profiles
  - **Forecast data:** load and RES forecasts
  - **Market operators' portfolio** composition
- **Geographical scope :** number of countries to be considered
- **Time of the year :** full year/half year, number of seasons



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Scenario elaboration

Inputs

- A scenario :
  - gathers assumptions on the **state of the European electricity system**, where market designs will be tested, and
  - is consistent with a **reference equilibrium of the market**

- Scenarios are key for the analysis since **market performances are closely related to the characteristics of the system tested**

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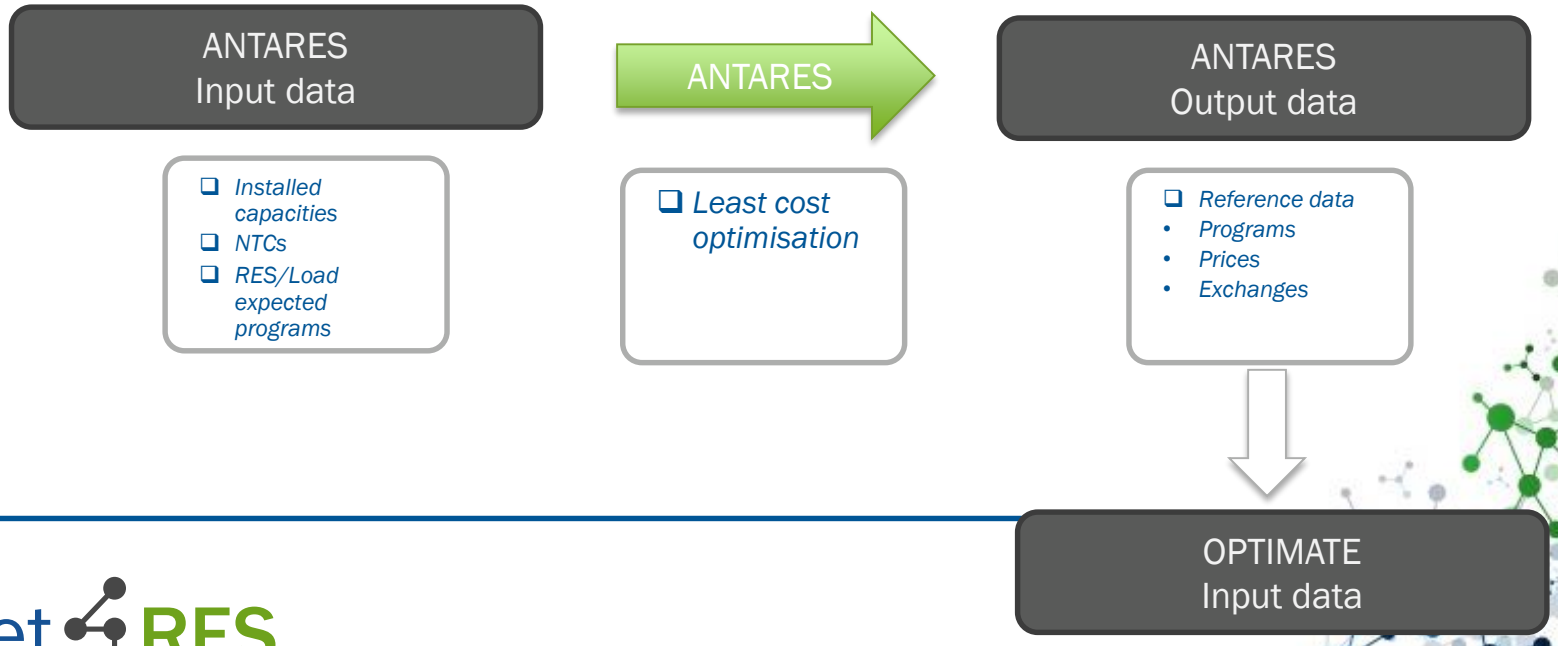
Scenario elaboration

Inputs

- **Reference equilibrium of the market**
  - As OPTIMATE models **short-term processes,** market players have access to forecasts, derived from a **reference market equilibrium,** used **to initialize generation, exchange and load**
  - The **reference equilibrium** of the whole electric system is built based on **ANTARES**, optimal dispatch software program
- **Main steps**



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Scenario elaboration

Inputs

- **Definition of reference scenario** (common reference for all studies)
  - a scenario mimicking the current situation of the power system
  - a scenario mimicking the situation of the power system which can be reasonably expected for the next years (e.g. at 2020)
- **Definition of alternative scenarios**
  - Scenarios mimicking a situation in which one or more parameter is altered compared to the reference
- **Several scenarios should be considered for a comprehensive sensitivity analysis**

Choice of short-term market design options

Inputs

- Market design options available in the OPTIMATE simulator for Day-Ahead processes (the focus of Market4RES studies) :

  - **RES support schemes** :
    - **Feed-in-Tariffs (FiT)** : fixed regulated price per MWh fed into the grid (whatever the electricity market price); with priority dispatch
    - **Price premium** : RES producers receive the spot electricity market price plus a premium; no priority dispatch

  - **Demand flexibility levels** :
    - As a default option, demand is considered inelastic
    - Demand can be set to have a flexible part which can be voluntarily shed when market prices reach a certain level

  - **Cross-broder Capacity model :** NTC vs FlowBased

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Choice of short-term market design parameters

Inputs

- Market design parameters available in the OPTIMATE simulator for Day-Ahead processes

  - **Bidding type :** unit bidding or portfolio bidding
    - For e.g., this parameter can be used to model a Balancing Responsible Party dedicated to RES management

  - **Gate Closure Time** : 12h00 or 19h00

  - **Market price floor/cap :** min/max price authorized on Day-ahead market

Outline

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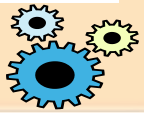
CORE

SIMULATIONS

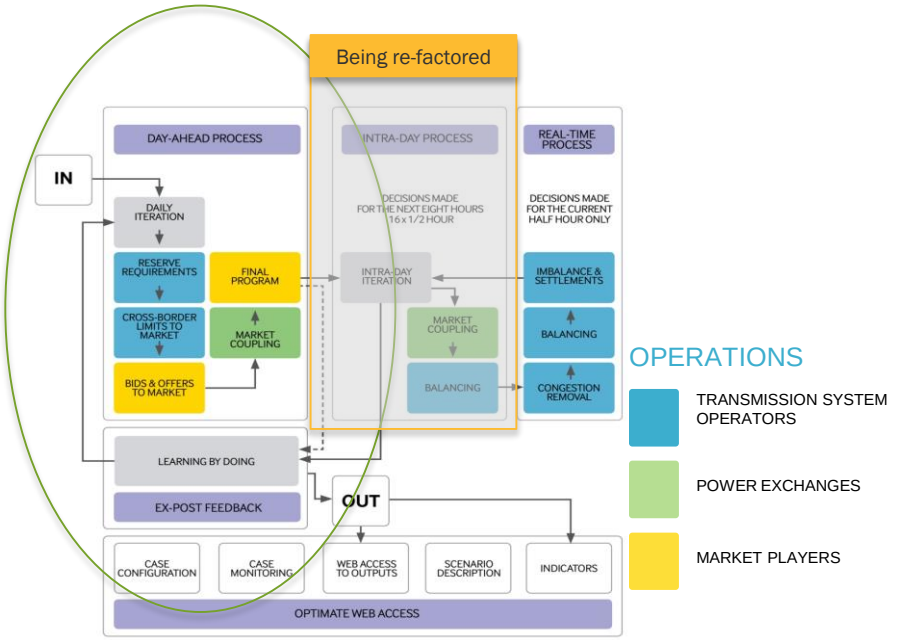
Markets — optimate — Network



Core

Simulations with the OPTIMATE tool

- On which short–term electricity markets and systems to focus the analysis ?
  - Day-Ahead : processes taking place the day before electricity delivery
  - Intra-Day : tasks conducted between 8 hours and half-hour before electricity delivery
  - Real-Time : TSOs processes taking place less than half an hour before delivery



OPTIMATE simulator modular structure

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Outline

INPUTS

DATA GATHERING | SCENARIOS | SHORT-TERM MARKET DESIGNS

CORE

SIMULATIONS

Markets — optimate — Network

OUTPUTS

ECONOMIC EFFICIENCY

SECURITY OF SUPPLY

SUSTAINABILITY

REDISTRIBUTIVE EFFECTS

Analysis and comparison of market design options

- OPTIMATE three groups of pre-defined quantitative indicators covering the three pillars of the EU energy policy :
  - **Economic Efficiency :** Day-Ahead electricity market clearing prices, generation costs, social welfare, etc
  - **Security of Supply :** Amount of tertiary reserve power, load curtailment duration, etc
  - **Sustainability :** RES-E share, CO_2 emissions, etc

Analysis and comparison of market design options

Outputs

- Redistributive effects to identify ***winners and losers :***
  - *Which stakeholders would lose the most in the studied design change?*
  - *Which market design change has to be prioritized in order to minimize the number of losers?*

- Related issues :
  - *How to compensate the losers in order to make the market design change more acceptable?*

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Analysis and comparison of market design options

- Redistributive effects can be assessed by :
  - **Type of stakeholders** (generators, consumers, TSOs):
    - ✓ Producer surplus
    - ✓ Consumer surplus
    - ✓ TSO congestion revenue
  - **Geographic position** (market areas, control blocks, countries), e.g.:
    - ✓ country A total welfare
    - ✓ country A producer surplus
  - **Technology type** (RES, thermal), e.g.:
    - ✓ RES generator surplus
    - ✓ conventional generator surplus

Outline

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CORE

SIMULATIONS

Markets — optimate — Network

OUTPUTS

ECONOMIC EFFICIENCY

SECURITY OF SUPPLY

SUSTAINABILITY

SCOPE

REDISTRIBUTIVE EFFECTS

IMPACT OF MODELLING ASSUMPTIONS

POLICY IMPLEMENTATION ISSUES

Impact of OPTIMATE modelling assumptions

Scope

- Modelling assumptions are made in the OPTIMATE platform in order to keep modelling manageable and computation time limited

- Example :
  - Price taker behavior of market operators
  - Fully harmonised market designs in all market areas (except for RES support schemes and demand flexibility levels)
  - Forward contracts are not considered

Policy implementation analysis

Scope

- Aspects not captured by the OPTIMATE prototype simulator, e.g.:
  - Interactions among different markets (e.g., gas and electricity markets)
  - Strategic behavior of market players

- Technological, organizational, regulatory and political barriers to the implementation of a market design, e.g. :
  - Maturity of available technologies
  - Political unacceptability of a market design producing too many price peaks

Toward policy recommendations

INPUTS

DATA GATHERING | SCENARIOS | SHORT-TERM MARKET DESIGNS

CORE

SIMULATIONS

Markets — optimate — Network

OUTPUTS

ECONOMIC EFFICIENCY | SECURITY OF SUPPLY | SUSTAINABILITY

SCOPE

REDISTRIBUTIVE EFFECTS

IMPACT OF MODELLING ASSUMPTIONS | POLICY IMPLEMENTATION ISSUES

= quantitative results enabling the comparison of different options to stimulate a rational dialogue on short-term electricity market designs in the 2020 framework

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Towards policy recommendations

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Thank you very much for your attention

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