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FlexPlan

Advisory Board Meeting| 29th October 2020

FlexPlan project overview

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Agenda

- This meeting
- Motivations of the FlexPlan project
- What will FlexPlan achieve?
- The FlexPlan consortium
- The new planning tool
- The pre-processor
- Pan-European and regional scenarios
- The FlexPlan web

This meeting

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- **Introduction (15 minutes)**
  - Project overview (10 minutes - Gianluigi Migliavacca, RSE)
  - Q&A (5 minutes)
- **Planning tool modelling framework (55 minutes)**
  - Presentation of project results (15 minutes - Hakan Ergun, Katholike Universiteit Leuven)
  - Debate with stakeholders (40 minutes)
- **Pre-processor and planning candidates formulation (55 minutes)**
  - Presentation of project results (15 minutes - Raul Rodriguez, TECNALIA)
  - Debate with stakeholders (40 minutes)
- **Pan-European and regional scenarios (55 minutes)**
  - Presentation of project results (15 minutes – Jawana Gabrielski TU Dortmund and Nuno Amaro, R&D NESTER)
  - Debate with stakeholders (40 minutes)

Motivation of the FlexPlan project

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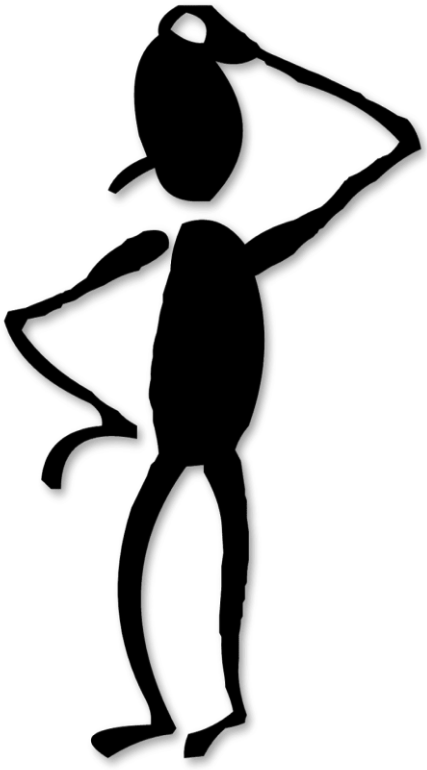
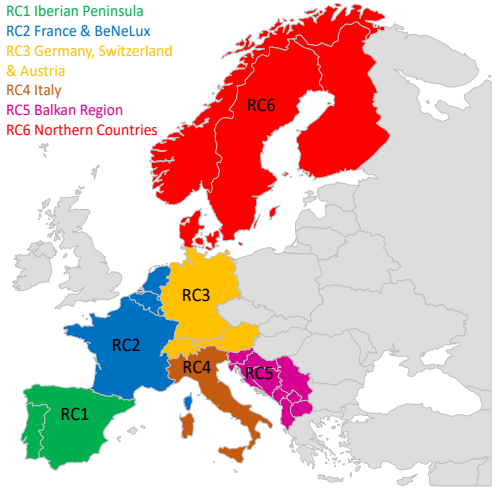
- High-speed deployment of RES (challenging European target: 32% at 2030) is making T&D planning more and more complex and affected by a high level of uncertainty
- Grid investments are capital intensive and the lifetime of transmission infrastructure spans several decades: when a new line is commissioned it might be already partially regarded as a stranded cost
- Building new lines meets more and more hostility from the public opinion, which makes planning activities even longer and affected by uncertainties
- Variable flows from RES are generating a new type of intermittent congestion which can sometimes be well compensated with system flexibility: investments in a new line would not be justified.
- There is an on-going debate on the employment of storage technologies and system flexibility to make the RES grid injection more predictable ("virtual power plant")
- **Hence the idea of establishing a new grid planning methodology considering the opportunity to introduce new storage and flexibility resources in electricity transmission and distribution grids as an alternative to building new grid elements**



What will FlexPlan achieve?

1 – New planning methodology - Creation of a **new tool for optimizing T&D grid planning**, considering the **placement of flexibility elements** located both in transmission and distribution networks **as an alternative to traditional grid planning**: in particular, storage, PEV, demand response)



2 – Scenario analysis 2030-40-50 - New methodology applied to analyse **six regional grid planning scenarios at 2030-2040-2050.** A **pan-European scenario** will deliver border conditions to initialize in a coherent way the 6 regional cases.

3 – Regulatory guidelines – FlexPlan goal is to provide:

- an optimized planning methodology for the future usage of TSOs and DSOs
- indications on the potential role of flexibility and storage as a support of T&D planning
- guidelines for NRA for the adoption of opportune regulation.

FlexPlan: partnership

- **Research Partners:**
  - **RSE**, Italy (Project Coordinator, WP7 and WP8 leader)
  - **EKC**, Serbia
  - **KU-Leuven**, Belgium (WP1 leader)
  - **N-SIDE**, Belgium (WP3 leader)
  - **R&D NESTER** Portugal (WP5 leader)
  - **SINTEF**, Norway (WP6 leader)
  - **TECNALIA**, Spain (WP2 leader)
  - **TU-Dortmund**, Germany (WP4 leader)
  - **VITO**, Belgium
- **Transmission System Operators:**
  - **TERNA**, Italy
    - **Terna Rete Italia** as Linked third Party
  - **REN**, Portugal
  - **ELES**, Slovenia
- **Distribution System Operators**
  - **ENEL** Global Infrastructure and Networks
    - **e-distribuzione** as Linked third Party

The new planning tool

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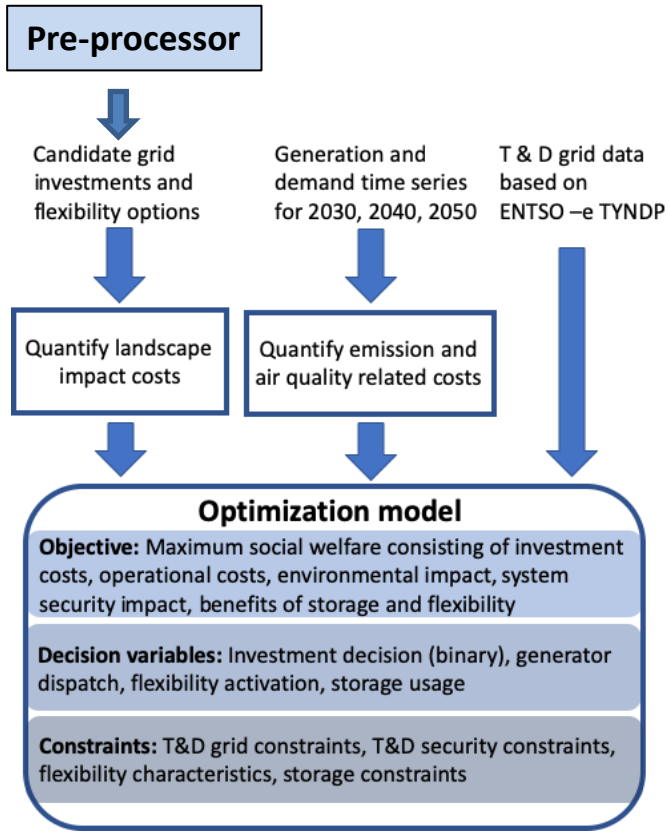


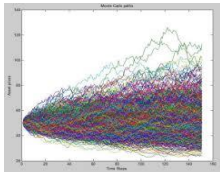
- Best planning strategy with a limited number of expansion options (mixed-integer, sequential OPF)

- T&D integrated planning

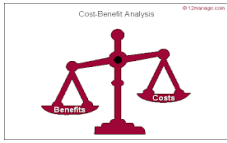
- Embedded environmental analysis (air quality, carbon footprint, landscape constraints)

- Simultaneous mid- and long-term planning calculation over three grid years: 2030-2040-2050

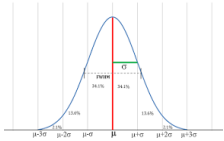
- Yearly climate variants (variability of RES time series and load time series) taken into account in by a Monte Carlo process; the number of combinations reduced by using clustering-based scenario reduction techniques.



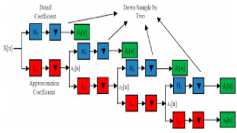
- Full incorporation of CBA criteria into the target function



- Probabilistic elements (instead of N-1 security criterion)



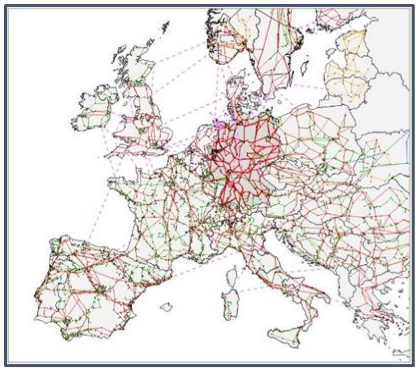
- Numerical *ad hoc* decomposition techniques to reduce calculation efforts



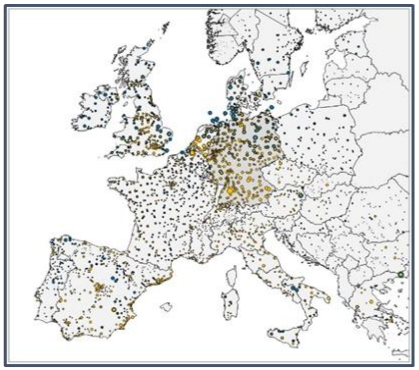
The pre-processor

- The planning tool needs to receive as an input the planning candidates for the three years (2030, 2040, 2050) and for each node.
- This input is provided by a software tool (pre-processor) that ranks for each node the suitability of different kinds of investments (new lines/cables, storage elements, flexible management of big loads
- To do so, the pre-processor exploit the information provided by Lagrangian multipliers of line transit constraints and nodal power balance of a non-expanded minimum cost OPF (they provide information on how much the target function would improve as a consequence of a unit relaxation of the constraint).

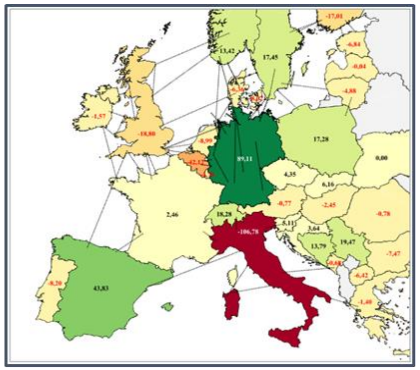
Pan-European and regional scenarios



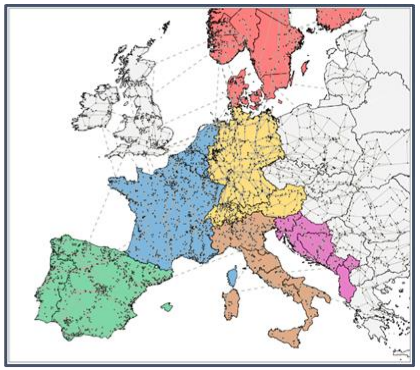
Prepare
pan-EU grid model



Regionalization of
RES capacities and loads



Market Simulation
for cross-border exchanges



Grid simulations for
detailed Regional Cases

The main source for the scenarios considered in FlexPlan project is the Ten Year Network Development Plan (TYNDP) 2020, developed by ENTSO-E, which describes possible trends up to 2050. ENTSO-E's TYNDP describes three scenarios:

- National trends
- Distributed Energy
- Global Ambition

that added up over three grid years (2030, 2040, 2050) makes up 9 scenarios to be considered by FlexPlan. For 2050, the document "A Clean Planet for all" by the EC was also considered.

ENTSO-E's TYNDP 2018 pan-European **transmission grid model** (extra-high voltage) is also utilized as a basis for the FlexPlan simulations. For sub-transmission, public data from Open Street Map sources is used alongside with information available to the consortium partners.
Synthetic distribution networks are created in order to have a reduced scale model of the real networks. They are created on the basis of network statistics and with the help of the DiNeMo tool.

The FlexPlan web

- The official web site of the FlexPlan project is: https://flexplan-project.eu/
  All project news and other information are posted there
- Project brochure can be downloaded from: https://flexplan-project.eu/wp-content/uploads/2020/02/FlexPlan_brochure.pdf
- All project publications (deliverables, papers, important presentations) are publicly downloadable from: https://flexplan-project.eu/publications/

Thank you…

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