FlexPlan

Second project advisory board | 24th November 2021

Overview on progress of the FlexPlan project

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Agenda

- Recap of FlexPlan goals and modelling hypotheses

- Present progress of the project

- The six-months extension of the project duration

- Programme of the present Advisory Board meeting

What FlexPlan will 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)

RC1 Iberian Peninsula
RC2 France & BeNeLux
RC3 Germany, Switzerland & Austria
RC4 Italy
RC5 Balkan Region
RC6 Northern Countries
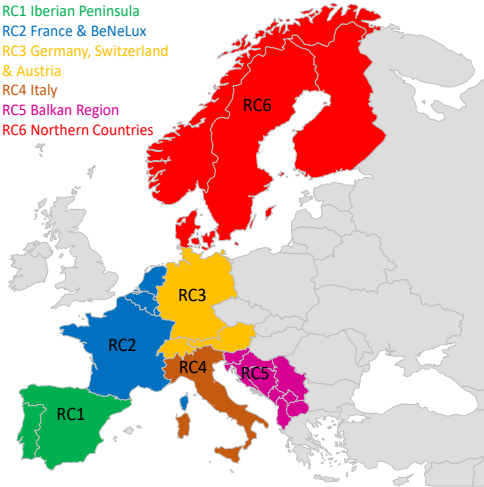
2 – Scenario analysis 2030-40-50 - New methodology applied to analyse **six regional grid planning scenarios at 2030-2040-2050.** A **pan-European scenario** will deliver border conditions to initialize in a coherent way the 6 regional cases.
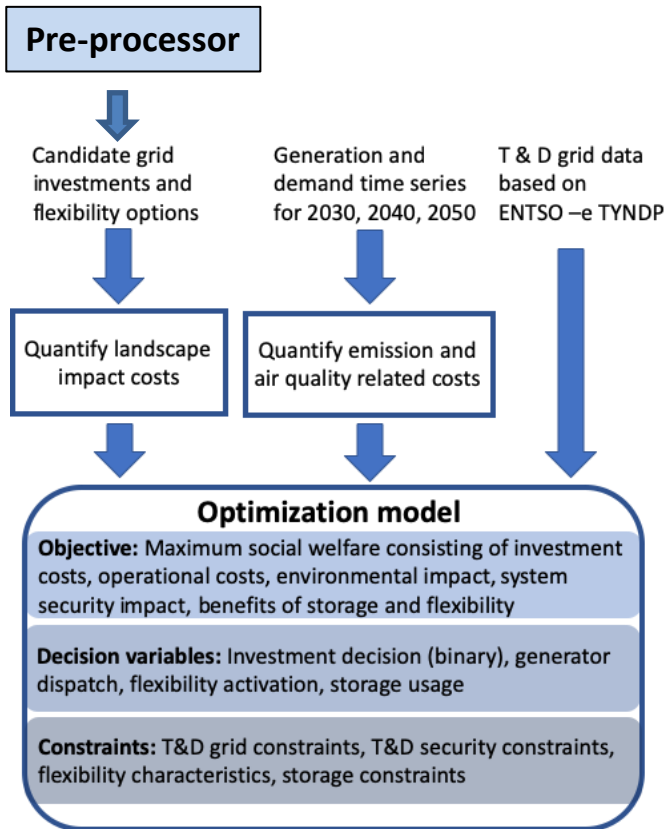
3 – Regulatory guidelines – FlexPlan goal is to provide:

* 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
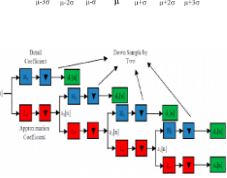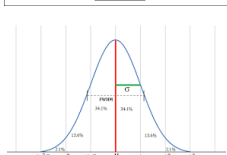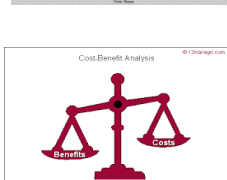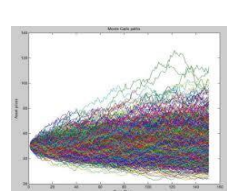* guidelines for NRA for the adoption of opportune regulation.

3

The new planning tool

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Pre-processor

Candidate grid investments and flexibility options

Generation and demand time series for 2030, 2040, 2050

T & D grid data based on ENTSO –e TYNDP

Quantify landscape impact costs

Quantify emission and air quality related costs

Optimization model

Objective: Maximum social welfare consisting of investment costs, operational costs, environmental impact, system security impact, benefits of storage and flexibility

Decision variables: Investment decision (binary), generator dispatch, flexibility activation, storage usage

Constraints: T&D grid constraints, T&D security constraints, flexibility characteristics, storage constraints

- 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

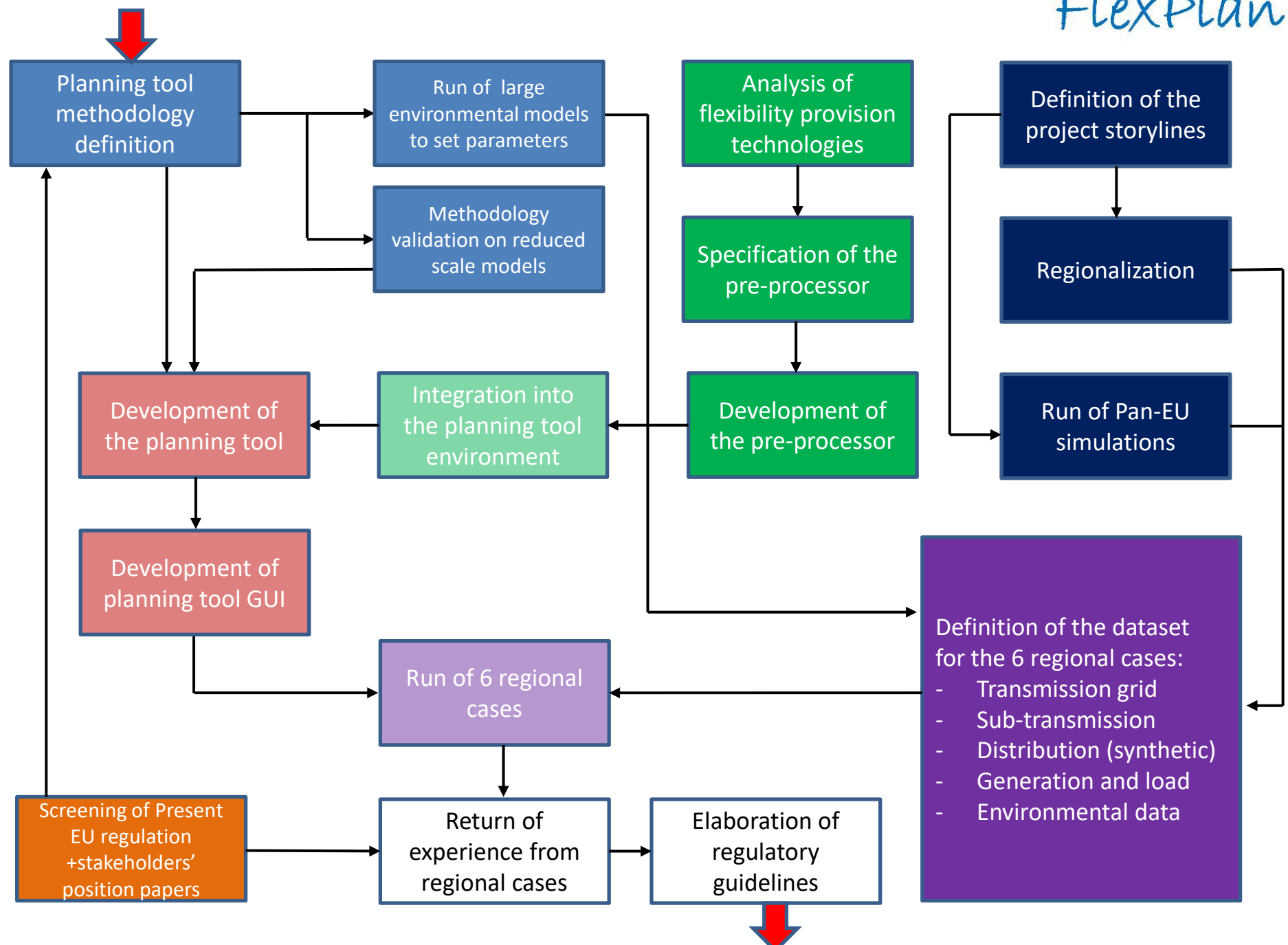| Non-expanded OPF	→ Lagrange multipliers →	Pre-processor	→ Planning candidates →	Planning tool

- 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 Lagrange 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).

Present progress of the FlexPlan project

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- **The first 18 months of the project (P1) brough to achieve the following goals**:
  - detailed specifications were issued for both the planning tool and the pre-processor
  - run of pan-EU simulations
  - small-scale tests proved very successful
  - the first versions of the environment (non-expanded OPF) were put in services.

- **Subsequent months (from July 2020 till now) have brought to:**
  - the definition of the full dataset for the regional cases
  - first partial runs for the 2030 non-expanded OPF

- **Very recently, the experience of the 6 regional cases showed that the 6 non-expanded 2030 OPF cases can be run for a maximum of 1 month of simulation**, whereas the complete yearly case exceeds the available calculation resources. So, it was decided to decouple the management of the seasonality of hydro power stations from the dynamic storage management that is carried out within each month. That brough to solve a non-expanded OPF separately for each month.

- At the same time, the need to reduce the computational efforts to make it possible to run ambitious study cases with:
  - hourly temporal detail,
  - three grid years solved altogether
  - five variants representing different climate conditions for each year
  - nodal spatial detail including both EHV/HV and MV synthetic networks,

  brough to the need to investigate in detail the application of **decomposition techniques**:
  - between transmission and distribution
  - between the investment problem and the dispatching problems for the three years and the different variants (Benders's approach)

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Planning tool
methodology
definition

Run of large
environmental models
to set parameters

Analysis of
flexibility provision
technologies

Definition of the
project storylines

Methodology
validation on reduced
scale models

Specification of the
pre-processor

Regionalization

Development of
the planning tool

Integration into
the planning tool
environment

Development of
the pre-processor

Run of Pan-EU
simulations

Development of
planning tool GUI

Run of 6 regional
cases

Definition of the dataset
for the 6 regional cases:
-   Transmission grid
-   Sub-transmission
-   Distribution (synthetic)
-   Generation and load
-   Environmental data

Screening of Present
EU regulation
+stakeholders'
position papers

Return of
experience from
regional cases

Elaboration of
regulatory
guidelines
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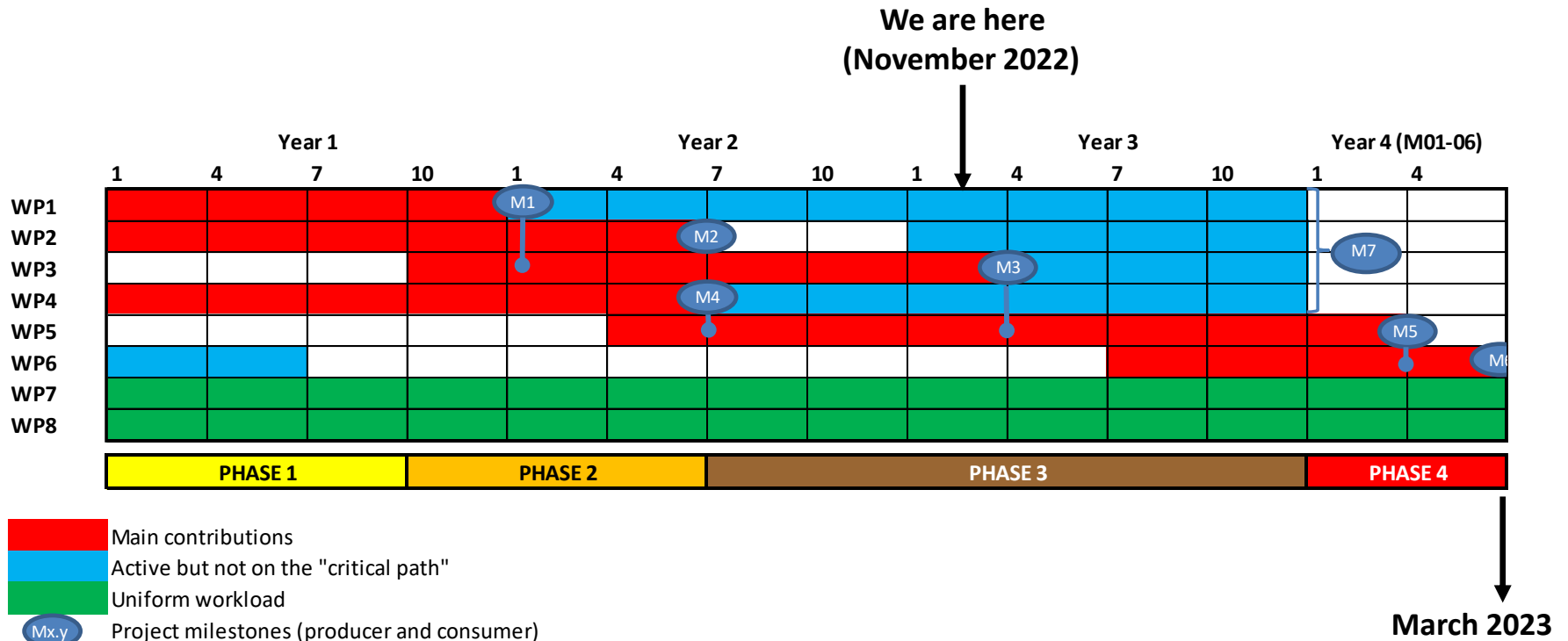
New overall project GANTT with 6 months extension

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- Due to the difficulties encountered, it was unavoidable to request for an extension of **six-month extension** of project duration: the amendment request was launched by the Coordinator on 29th September 2022. On 18° November the EC decided favourably. So, the project will last 42 months and finish in March 2023.

We are here (November 2022)

	Year 1				Year 2				Year 3			Year 4 (M01-06)	
	1	4	7	10	1	4	7	10	1	4	7	10	1	4

Legend:
- Main contributions
- Active but not on the "critical path"
- Uniform workload
- Mx.y Project milestones (producer and consumer)

PHASE 1 PHASE 2 PHASE 3 PHASE 4

March 2023

Programme of today's meeting

FlexPlan

- 14.00-14.15 – Overview on progress of the FlexPlan project
- 14.15-15.10 – Focus on modelling and on implemented decomposition techniques: Benders and T&D
- 15.10-16.05 – Detailed presentation of final pre-processor methodology
- 16.05-17.00 – Goals and first results of regional cases
- 17.00-17.55 – Presentation of the Graphic User Interface of the new FlexPlan planning tool
- 17.55-18.00 – Wrap up and conclusions

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