FlexPlan

Letter of the Project Coordinator

Six months have elapsed since the kick-off of the FlexPlan project. In these six months, the activities, always very tight and exciting, covered different key aspects.

There is an important on-going research activity to find the best representation for the equations of the new planning tool. Here, significant modelling efforts are requested because of the dimensionality challenges this model is subject to:

- nodal representation of very wide systems (each regional case encompasses one or several EU countries),
- hourly detail for three grid years (2030, 2040 and 2050), solved together in order to co-optimize mid- and long-term grid planning,
- large number of grid expansion candidates (each of them attached to a binary decision variable saying whether that investment is carried out or not): new lines or cables, refurbishment of existing ones, new storage units, flexible exercise of big industrial and tertiary loads,
- internalization of environmental externalities (landscape impact, air quality, CO2 lifecycle)
- holistic view of the planning procedure (transmission and distribution together): in modelling distribution grids it is important to capture the most relevant aspects while avoiding bogging into details on the huge number of lines making up the distribution system. For this reason, synthetic networks are created, so as to summarize those aspects of the real grid that are relevant for planning.

Another important subject of current investigation is the pre-processor tool, which is aimed at elaborating a nodal list of investment candidates to be proposed to the planning tool. Here the research is acting on two fronts:

- characterization of technologies and operating modalities for storage and flexibility candidates,
- creation of a robust algorithm using the results of a non-expanded minimum cost optimization to formulate lists of nodal candidates.

During the first six project months, there has also been a big effort to start elaborating data to feed both the pan-European model (ENTSO-E TYNDP scenarios and data have been taken as the basis) and the grid models of the six regional cases (based on the ENTSO-E grid model for the transmission part).

Finally, it was important also to assess the current *status quo* of EU regulation and TSO/DSO planning practice in order to build a picture of the context in which the new grid planning methodology proposed by FlexPlan is located. This analysis, produced the first technical deliverable (D6.1) which can now be downloaded from the project web site (https://flexplan-project.eu/).

The project web site is an important communication tool for FlexPlan: on it, all new achievements and all information on on-going dissemination activities is regularly posted. Everyone who is interested in grid planning issues is invited to surf it on a regular base! Presently, we have three open web consultations (https://flexplan-project.eu/consultations/): here, feedback is welcome from all EU stakeholders!

Gianluigi Migliavacca (RSE)

Why T&D grid planning needs to account for flexibility

In the light of the Covid-19 pandemic, we are observing an exceptionally low demand period due to the deceleration of economic activity. All across Europe, the average demand has decreased by approximately 20% in the period of March and April. Combined with high power generation form renewable energy sources due to favourable weather conditions, this has resulted in an increased number of negative price incidents on the day-ahead electricity market, which is a typically a sign of lacking downwards flexibility. Today's situation can be seen as scaled-down experiment of a renewable energy dominated future where the share of renewable generation is expected to be much higher than what we are observing even in this current situation. To guarantee electricity supply, the future power system needs to rely upon various sources of demand flexibility and storage on one hand, and a strong, well interconnected and flexible transmission system on the other.

Within the FlexPlan project we are in the final steps of formulating a planning model which includes flexible demand, storage and flexible transmission system models, and achieves the best trade-off between classic line and flexibility investments, tailored to the needs of the future power system. An important feature is that the model combines both transmission and distribution grid planning in order to avoid inefficiency and bottlenecks in much needed flexibility provision from and to lower voltage levels. Another important feature is that three important environmental externality factors are internalized into the model (landscape impact, air quality and CO2 lifecycle assessment). In the next coming months, we will start with the implementation of the planning model as a software tool (WP3) and demonstrate its added value in a number of regional cases (WP5). What also matters is that we are searching for planning solutions over a very long time period, encompassing the three grid years 2030, 2040 and 2050. This will allow, once applied to the European system to cast a view on the system development from the medium term till a long term where RES generation will be prevalent in the system.

Hakan Ergun (K.U. Leuven) - WP1 Leader

Flexibility resources characterization as input for network planning

The increasing participation of variable wind and solar energy production plants in the power system requires flexibility from other resources, such as fast reacting generation assets, storage and demand response. Storage, other than pumped-storage hydropower, and demand response have not been considered in traditional network planning procedures and it is the aim of FlexPlan project to revert this situation.

Within the FlexPlan proposed methodology, flexibility resources are presented as candidates for network planning, competing with the conventional network capacity increase approach, e.g., through new line construction. In the past months, the flexible

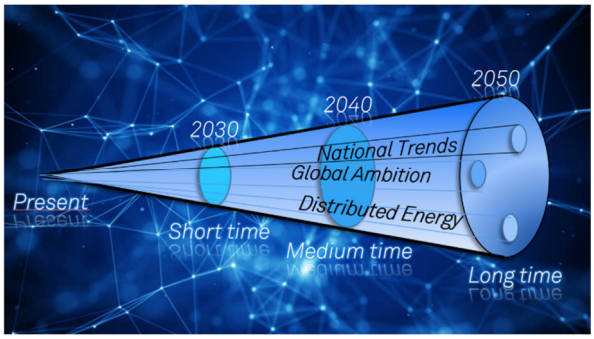
technologies have been characterized, as a first step to consider them as input for the innovative planning tool. Two main aspects have been considered for this characterization, on the one hand techno-economical characteristics and, on the other, operational strategies in the frame of power system applications.

A list of eligible flexible resources and their main characteristics have been identified. The list includes batteries, hydrogen, electric vehicles, pumped hydro, thermal loads, compressed and liquid air, demand response… From their characteristics, attributes are being identified and two common flexibility resources models will be proposed, one for storage and another for demand response.

In addition, operation modalities for flexibility resources have been identified through the analysis of the applications of both storage and demand response strategies in the power system. Congestion support has been defined as main objective for flexibility resources and, in the next months, the research focus will be set on the development of strategies to locate and size flexibility within the network to generate candidates for the planning tool.

Raúl Rodriguez (TECNALIA) – WP2 Leader

Creating an ambitious set of pan-European scenarios



The European energy system is a highly meshed interconnected system. As FlexPlan aims at establishing a new grid planning methodology considering storage and flexibility resources for the pan-European power system, it is of great importance to extend the analysis to an area as wide as possible of the European territory. This will allow to examine a very high number of cases, which is important for the creation of the regulatory guidelines elaborated in the last phase of the project. For this reason 6 detailed regional scenarios are set up, covering each a significant portion of the European grid. However, in order to provide homogeneous border conditions to all regional cases, a pan-European scenario has to be created as well.

For each target year (2030, 2040 and 2050) we examine three different scenarios to model divergent political and regulatory policies, resulting in a total set of nine variants. The scenario set used in FlexPlan is in line with the latest ENTSO-E Ten Year Network Development Plan (TYNDP). While the *National Trends* scenario considers the national energy and climate targets of the member states, the other two are completely energy-based and take into account all kind of energy (not only gas and electricity). The *Global Ambition* scenario implements centralized generation reflecting the Paris Agreement target. The *Distributed Energy* scenario is in line with the target to reduce emissions to zero by 2050 by integrating the consumer into the system. Currently we are working on a methodology to finalize the detailed scenario data for 2050. In the next steps we will execute a pan-European market simulation to calculate the trans regional power exchanges. This will allow us to feed the 6 regional cases with the right border conditions. Furthermore, we will apply a regionalization methodology in order to calculate spatially-distributed time series for load and feed-in of renewable energy sources.

Jawana Gabrielski (T.U. Dortmund) – WP4 Leader

Preliminary screening of planning practices and EU regulation

Within the activities of the FlexPlan project, a preliminary screening of current planning practices and EU regulation has recently been completed. It brought to the finalization of the deliverable "**Guideline for the compliance of network planning tool with EU overall strategies and regulatory conditions**", which is now freely downloadable from the FlexPlan project web site (https://flexplan-project.eu). This deliverable is the first in a series of three reports that are looking into regulatory aspects concerning the methodologies developed within the project. The document presents an assessment of the present pan-European regulatory framework, complemented by a reference to the existing practices at both TSO and DSO levels. The activity applied qualitative evaluation methods, based on data collected through literature screening and survey-based research. The results are structured around 17 specific thematic topics. The deliverable put forward several important remarks related to the use of flexible resources, cost-benefit analysis at both TSO and DSO levels and TSO-DSO interactions. The document concludes that there are strong regulatory signals prompting the European system operators to consider flexible resources as a new important active subject in the grid expansion planning process for system operators. Despite strong efforts from ENTSO-E to develop common methodologic principles, there are still several missing elements in the puzzle. This strengthens once again the importance and proper timing of FlexPlan project for developing and testing new innovative grid planning methodologies coping with the present and future challenges.

Andrei Morch (SINTEF) – WP6 Leader

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