FlexPlan

The project

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 863819

Why FlexPlan?

- 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
- There is an on-going debate on the selection of storage technologies and system flexibility, able to make the overall generation-set behaviour more predictable and schedulable

Hence the idea of a grid expansion tool for analysing storage and flexibility as alternative to new T&D lines; incentivization procedures could be put in place by the regulators wherever consistent advantages are seen.

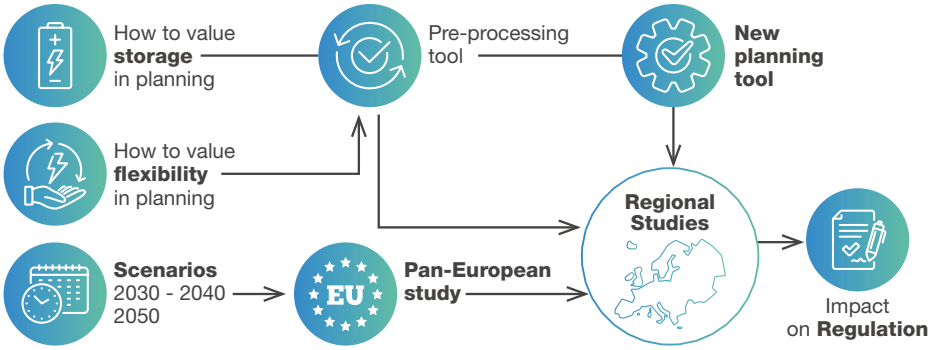
The project in brief

Partners	13 partners from academia, research organizations and industry + 2 linked third parties
Countries	8 European Countries involved
Duration	3 years (2019-2022)

What is FlexPlan

The **FlexPlan project** aims at 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. This is in line with the goals and principles of the new EC package *Clean Energy for all Europeans*, which emphasizes the potential usage of flexibility sources in the phases of grid planning and operation as alternative to grid expansion. In sight of this, FlexPlan creates a new innovative grid planning tool whose ambition is to go beyond the state of the art of planning methodologies, by including the following innovative features: integrated T&D planning, full inclusion of environmental analysis, probabilistic contingency methodologies replacing the N-1 criterion as well as optimal planning decision over several decades. However, FlexPlan is not limited to building a new tool but it also uses it to analyse six regional cases covering nearly the whole European continent, aimed at demonstrating the application of the tool on real scenarios as well as at casting a view on grid planning in Europe till 2050. In this way, the FlexPlan project tries to answer the question of which role flexibility could play and how its usage can contribute to reduce planning investments yet maintaining (at least) the current system security levels. The project ends up formulating guidelines for regulators and for the planning offices of TSOs and DSOs.

Overall project layout



Main stakeholders' vision

"[...] Reinforcement should always be compared with getting flexibility from the resources in the system and the optimal solution should be determined. Typically, non-frequent congestion could be more efficiently treated with the activation of flexibility whereas prolonged or high levels of congestion could call for a system reinforcement."

From the document: «An integrated approach to Active System Management with the focus on TSO-DSO coordination in congestion management and balancing» (CEDEC, EDSO, ENTSO-E, Eurelectric, GEODE)

"[...] Energy storage or relocation of consumers and production units can help to remedy temporary congestions in the transmission network. [...] When performing a cost-benefit analysis, it is therefore important to also compare increased transmission capacity with alternatives that have the potential to be a more economically efficient way of achieving the same objective."

From the document: "Cost-benefit analysis of investments in the transmission network for electricity" – document Energimarknadinspektionen R2018:12 - April 2018

"[...] The network development plan shall also demonstrate the use of demand response, energy efficiency, energy storage facilities or other resources that distribution system operator is using as an alternative to system expansion"

From the Directive of the European Parliament and of the Council on common rules for the internal market in electricity (recast)

"Article 54 - Ownership of energy storage facilities by transmission system operators

1. Transmission system operators shall not be allowed to own, develop, manage or operate energy storage facilities
2. In derogation of paragraph 1, Member States may allow transmission system operators to own, develop, manage or operate energy storage facilities which are fully integrated network components and the regulatory authority has granted its approval or, if all of the following conditions are fulfilled:
   - other parties [...] could not deliver these services at a reasonable cost and in a timely manner
   - such facilities or non-frequency ancillary services are necessary for the transmission system operators to fulfil their obligations under this Directive for the efficient, reliable and secure operation of the transmission system and they are not used to buy or sell electricity in the electricity markets
   - the regulatory authority has assessed the necessity of such derogation"

From proposal for a Directive of the European Parliament and of the Council on common rules for the internal market in electricity (recast)

FlexPlan: aims and features

Creating next generation of flexible system planning models

Led by **KU LEUVEN**, Belgium.

Develop a novel, dynamic optimization model to find the best balance between flexibility, storage and grid expansion investments for transmission and distribution.

High performance, mixed-integer, dynamic optimization model considering environmental impact of grid expansion and accurate modelling of flexibility and storage.

First large-scale model to combine flexibility modelling, storage investments, reliability constraints and environmental impact assessment applied at European scale.

Characterizing storage and flexibility resources

Led by **Tecnalia**, Spain.

The technical performance and associated costs of storage and demand response (DR) are assessed in the frame of scenarios and specific strategies designed to support the operation of the network.

A simulation software is developed to pre-process flexibility options and provide a reduced number of candidates per node to the planning tool, in response to scenario-based network contingencies.

The pre-processor permits the inclusion of Distributed Energy Resource (DER) technologies within the network planning process. The analysis of DR strategies and simulating the storage as consumable resource helps the planning tool go a step beyond the traditional procedures.

Managing the realization of the innovative planning tool

Led by **N - SIDE**, Belgium.

Design, implement and test the new T&D planning tool, including a GUI, and supporting the large-scale tests performed on 6 regional cases.

Starting from the planning tool requirements, an agile methodology will be used to quickly develop an MVP and then improve it (e.g. algorithms efficiency, GUI).

The new T&D planning model is a huge mixed-integer optimization problem not tackled by current tools, for which innovative algorithms will need to be developed.

FlexPlan: aims and features

Setting up a pan-European model for 2030-2040-2050

Led by **TU DORTMUND**, Germany.

Simulating electricity markets in Europe considering trans-regional effects to derive border conditions for detailed regional case studies.

A regionalization model calculates feed-in of renewable energy sources and load time series. A unit commitment model determines power plant schedules and exchanges in Europe.

Holistic pan-EU scenarios are broken down to smaller consistent individual cases considering market based flexibilities and distributed components on a pan-EU level.

Creating six detailed scenarios to analyse grid expansion needs in Europe at 2030-2040-2050”

Led by **R&D NESTER**, Portugal.

The activity aims at demonstrating the FlexPlan planning tool through six regional cases, covering the different European energy landscapes and different time horizons.

For each case, the planning tool will be applied in the time horizons of 2030, 2040 and 2050, evaluating different technologies for planning purposes (e.g. storage).

The FlexPlan planning tool will produce results coming from six large-scale detailed models that involve a thorough data collection and consider 2050 projections.

Reading planning results in a regulatory perspective

Led by **SINTEF**, Norway.

Ensuring that the project’s outcomes are aligned with the main European regulatory acts and practices and minimising potential obstacles for implementation of the results.

The activity applies qualitative evaluation methods, based on data collected through literature screening, survey direct interaction with the key stakeholders.

FlexPlan is the first project directly addressing the role of flexibility in planning of network expansion and translating this into regulatory actions.

Partners

Poject Coordinator
RSE, Italy (Project Coordinator)

Research Partners:
EKC, Serbia - **KU LEUVEN**, Belgium - **N-SIDE**, Belgium
R&D NESTER, Portugal - **SINTEF**, Norway
TECNALIA, Spain - **TU DORTMUND**, Germany
VITO, Belgium

Transmission System Operators:
TERNA, Italy - **REN**, Portugal
ELES, Slovenia

Distribution System Operators
ENEL Global Infrastructure and Networks

Linked third Parties:
TERNA Rete Italia
E-distribuzione

Stakeholders' board:

Amprion, ARERA, CEER
CINELDI, CYBER-GRID
CLEANTECH, E-CONTROL
EMPOWER, EDSO, EDYNA
EERA Joint Programme Smart Grids
Elering, ELIA, Energinet, ENTSO-E
EURELECTRIC, FEEM
FSR (Florence School of Regulation)
ISGAN Annex VI, JRC
Red Electric de Espana
SmartWires, SwissGrid
T&D Europe, Wind Europe

Project coordinating person

Gianluigi Migliavacca: Gianluigi.Migliavacca@rse-web.it
Project mailbox: info@flexplan-project.eu
Project web site: flexplan-project.eu