FlexPlan

Newsletter M36 – 31th October 2022

Letter of the Project Coordinator

The final months of activity are difficult for all research projects and FlexPlan is no exception.

The two tools that are part of the innovative grid planning suite by FlexPlan (pre-processor and grid-expansion engine) are both completely debugged and finalized. A demo version of the grid-expansion engine will soon be available, ready to be distributed upon request by Eurpean stakeholders.

On top of FlexPlan grid planning suite, two comprehensive open access libraries, created on top of the contractual obligations, can already be freely downloaded from GitHub (an feedback after using these packages is welcome!):

- OptimalTransmissionRouting.jl, a Julia/JuMP package to determine the **optimal transmission system route** considering spatial information. Such package has been published as an open access license toolbox and can be found on: https://github.com/Electa-Git/OptimalTransmissionRouting.jl
- FlexPlan.jl, a Julia/JuMP **package to carry out transmission and distribution network planning** considering AC and DC technology, storage and demand flexibility as possible expansion candidates. A mixed-integer linear problem is constructed to be solved with any commercial or open-source MILP solver. Installation instructions, information regarding problem types and network formulations are provided in the package documentation (https://electa-git.github.io/FlexPlan.jl/dev/).

The 6 Regional Cases are now in the running phase. This phase is very time-consuming and for this reason, 6 Amazon Web Servers have been booked for two months in order to give a virtual meachine available to each Regonal Case. The investments for the three decades of interest (2030, 2040 and 2050) are being assessed in sequence and the final results should be available by end of November 2022.

Meanwhile, the activities of the “regulatory” work package (WP6) have been resumed. They feature three important goals to be achieved during the last 6 months of project activities:

- Analyze the results of the 6 Regional Cases in order to understand what can be genralized, what depends on the input assumptions and what highlights an evident trend for the mid-long term. The important question to be answered is: “To what extent the deployment of flexibility (storage and DSM) can support grid planning?”
- Analyze the prospects of scalability and replicability of the FlexPlan grid-planning suite in order to understand possible barriers to the adoption by TSOs and DSOs across Europe.

- Analyze the evolution during the last years of the EU regulation on storage and demand-side management as well as the provisions adopted by the national governments in the different European regions covered by the 6 Regional Cases. The final goal is to single out regulatory barriers to storage and DSM deployment and efficient ways to remove them. All this activity will be finally distilled into synthetic regulatory guidelines, which will constitute the final result of the FlexPlan project.

Final activities will be those analysing the prospects for exploitaton of the main project results and the impact assessment of the regulatory provisions individuated by FlexPlan.

A “booklet” featuring a summary of all project results will be published as deliverable D8.2. Additionally, a similar booklet will be published as an ISGAN WG6 report, this latter adding the result of a questionnaire that should add the extra-EU wiepoint on the topics of analysis of FlexPlan.

Last but not least, the last months of the FlexPlan poject will see important dissemination events: a final workshop to be physically held in Brussels on 14th February 2023 and 6 national events to disseminate the results of the 6 Regional Cases to the relvant national stakeholders.

Stay tuned!

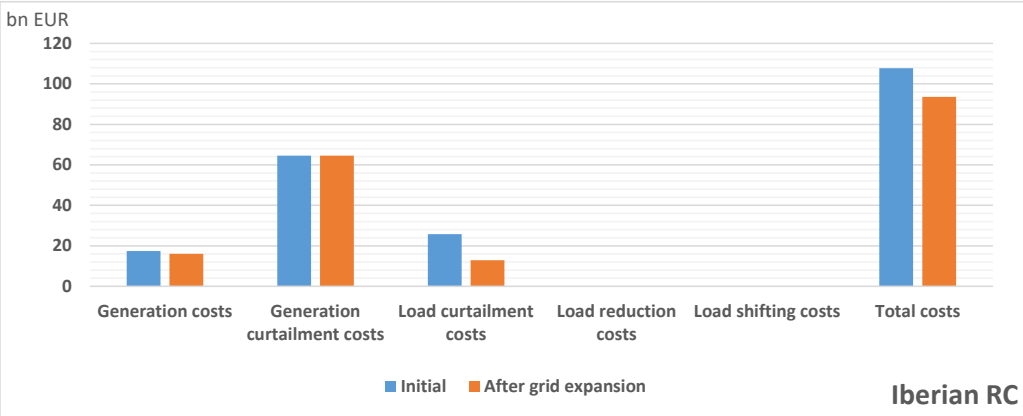
Gianluigi Migliavacca (RSE)

The 6 Regional Cases: results for 2030

Aleksandr Egorov (WP5 Leader) – R&D NESTER

The six Regional Cases are simulated using realistic geo-referenced models of the corresponding transmission and sub-transmission systems. In order to ensure a coherent approach for all cases, it was decided to use a common base dataset for the networks. An important activity to complement the existing grid models was dedicated to the collection of data related to generation units and distributed load time-series on higher voltage levels of transmission substations. Based on this input data and to account for the variability of RES generation and load conditions, a probabilistic cost minimization Optimal Power Flow is performed to identify existing congestion and other relevant results (e.g., costs related to system operation including load and generation curtailment costs) and to replace the traditional N-1 criterion. Congestion is identified through the existence of non-zero Lagrange Multipliers (LM) associated with branch flow constraints, which leads to proposing a list of grid expansion candidates to solve the grid expansion problem. In order to demonstrate the robustness and applicability of the proposed methodology, two out of the six Regional Cases results for solving the grid expansion problem in 2030 are herein shortly described.

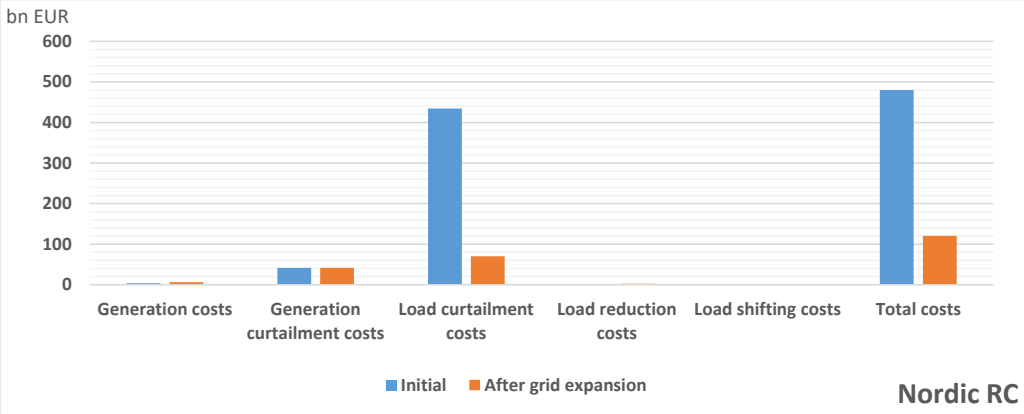
For Iberian Regional Case, 4 candidates were proposed in transmission network, 54 in distribution network, 8 storages and 34 flexibility loads. A small number of candidates in the transmission network is due to a strong mashed transmission network in Iberian Peninsula, which led to not very big number of congestions (291 congestion, 120 of which are in transmission network). From 100 candidates in total 47 were approved, which includes 3 AC branches in transmission network, 31 AC branches and 2 transformers in distribution network, 2 hydrogen storages and 9 flexibility loads. These grid expansion decisions decreased the total costs by 13% of the initial costs.



It can be seen, that even though there is a small increase in generation curtailment costs, the significant reduction of the total costs is due to the reduction of the load curtailment costs (almost 50% reduction) and generation costs (8%).

For Nordic Regional Case, in addition to 100 automatically generated candidates, 14 more manually added were considered. 13 candidates were proposed in transmission network, 95 in distribution network, 3 storages and 3 flexibility loads. The network in Nordic Regional Case is more elongated, comparing to Iberian

Regional Case, which leads to significantly higher number of congestions (approx. 56 000 of congestions, approx. 7 000 of which are in transmission network) and also includes two of the three transmission corridors into the area of interest in Norway. From 114 candidates in total 73 were approved, which includes 7 AC branches in transmission network, 63 AC branches and in distribution network and all 3 flexibility loads. These grid expansion decisions decreased the total costs by 75% of the initial costs.



Such a significant reduction in initial costs was made possible by a very significant reduction in the load curtailment costs (reduction of almost 84%).

By end of November 2022 results will be obtained for all remaining Regional Cases.

Analysis of Regional Cases results and elaboration of regulatory guidelines: a delicate activity for the last 6 months of project activities

Andrei Morch (SINTEF ENERGI – WP6 Leader) and Dario Siface (RSE – Leader of tasks T6.2-T6.3)

The opening activity of the workpackage dedicated to "Regulatory Analysis" was conducted in 2019, during the first six months of FlexPlan project, and consisted in creating a comprehansive overview of the regulatory landscape to feed the main activities of the project. This activity brought to the conclusion that there were strong regulatory signals prompting European system operators to consider flexible resources as a new important active subject in the grid expansion planning process. The activity also highlighted the main limitations and shortcomings, which were presented in a dedicated public report: "Guideline for the compliance of network planning tool with EU overall strategies and regulatory conditions".

After two and a half challenging FlexPlan years the projects has recently resumed the activities for the workpackage "Regulatory Analysis". The plan is to derive the main lessons learned from the six regional cases, where the network planning tool was deployed and tested. Already in November 2021 the Consortium made the first steps towards these goals at a dedicated internal workshop in Trondheim (NO), when the project groups carried out a brainstorming to single out the main priorities and points of attention for the concluding activities.

Considering the importance to consider flexibility in grid planning practices, an assessment will be carried out to analyse the scalability and replicability potential of the FlexPlan methodology and tools, to identify the possible barriers and consider possible ways to overcome these in order to ensure the future exploitation of the project's outcomes.

Another parallel activity focuses on the regulatory challenges and policy lessons learned analysis of the gep between the planning methodology and tools proposed by FlexPlan and the present network planning practice and regulation. The activity has already initiated an online survey among the stakeholders to get the latest status for the planning practices.

Finally, following the intentions of EU Directive 2019/944 on Internal Elerctricity Market, the European Regulators (ACER) have recently issued the "Framework Guideline" for the forthcoming Network Code for Demand Response. FlexPlan project recognises the significance of this document for the succesfull delpoyment of outcomes from FlexPlan and thus intends to follow closely its development and align its conclusions to the main highlighted topics.

The Project Final Workshop and many other dissemination events for the last project months

Gianluigi Migliavacca (RSE)

The FlexPlan **final workshop** will take place in **Brussels on 14th February 2023** to disseminate the most important achievements of the FlexPlan project. The event will be held at the L42 business center (https://www.l42.be/portfolio-item/live/) with the following programme:

- Draft event programme (from 9.00 till 16.30 / lunch break 12.00 - 13.30):
  - Overview of FlexPlan aim and methodology (45 minutes including Q&A)
  - Showcase of FlexPlan pre-processor and planning tool (45 minutes including Q&A)
  - Results of the pan-European model and of the 6 regional cases (2 hours 45 minutes including Q&A)
  - Preview of the final regulatory reflections and guidelines (45 minutes including Q&A)
  - General debate on possible up-scalability of the FlexPlan methodologies and tools and about real takeaway for the European stakeholders (1 hour)

For registering to the event, please provide your request through the web page: https://flexplan-project.eu/contacts/. Possibly, it will also be possible to follow the event in remote, even if, the physical participation will allow a better participation in the discussions.

In addition to the Final Workshop, 6 regional events will be held to inform about the project FlexPlan achievements with highlight to the results of the local Regional Case. Each of these events will be held preferably by using the local language.
The Italian event will take place in Milan as a physical event on 25th January 2023.
In parallel, the other 5 regional cases will all organize an on-line event between January and February 2023.

Regional Case	Date	Language	Mail for registration
Italy	25/01/2023	Italian	Please provide your request through: https://flexplan-project.eu/contacts/
Germany, Austria and Switzerland	28/02/2023	German	flexplan.ie3@gmail.com
Iberian Peninsula	17/02/2023	English	Registration will be done at TECNALIA's web site. Please, check https://www.tecnalia.com/en/agenda from the 15th of January on.
Nordic Countries	20 February, 2023 13:00-15:00	Norwegian	flexplan.ie6@gmail.com

Balkan region		Serbian	Date still to be finalized within first week of February 2023
France and BeNeLux	01/02/2023	English	flexplan.ie2@gmail.com

Finally, two webinars will be organized too, one in the framework of the BRIDGE initiative and another organized by the alliance of the European Energy Research Alliance (EERA). Information will be timely published on the FlexPlan web site.

I take the opportunity to signal two recent paper publications presented at the CIGRE Session 2022 and at the SEST Conference in Eindhoven. They can be downloaded from the project web site: https://flexplan-project.eu/

Last but not least: end November 2022, you can find the FlexPlan project in the EU Zone of the ENLIT conference in Frankfurt am Main (https://www.enlit-europe.com/).

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