Conclusions from the Call for Use Cases

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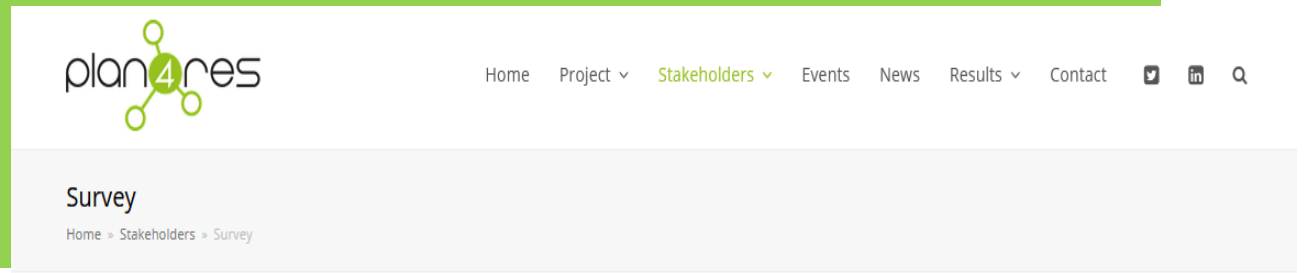
Context

- Adopting the models/tools developed in plan4res will require active engagement with the broader energy community
- A set of questionnaires has been deployed to identify the stakeholders' interests and views on the potential applications of the plan4res tools to support their energy system analysis

https://www.plan4res.eu/stakeholders/survey/



Introduction:

The 2030 and 2050 EU's carbon reduction targets call for significant changes in our energy system: more flexibility, more active involvement of all stakeholders and more collaboration to enable least-cost integration of higher deployment of variable renewable energy sources. Operating the electricity system with the highly targeted shares of RES will only be possible and affordable if both the grid and the generation assets evolve towards a system designed to maximise its capacity to host such amounts of RES. This requires optimising existing assets and new investments, making the best use of all flexibilities (considering the geographical location and services they provide to the system) and developing new services to support the energy system. We believe that an integrated representation of the system is necessary to achieve European climate objectives cost-effectively for all the stakeholders participating in the system operation and development.

However, such an integrated representation will require *overcoming significant technical hurdles in order to allow a set of different but highly interconnected models (strategic investment – operational simulation – multimodal system integration) to work in synergy* while retaining the modularity (possibility of representing only sub-parts of the system, either functionally, geographically or on a specific time horizon, with a specific time resolution, or replacing every model and algorithm by another one). This is necessary for tailoring the tool to the different needs of various stakeholders.

In order to address those challenges, the plan4res project has delivered :

- An end-to-end planning and operation tool, composed of a set of optimisation models based on integrated modelling of the European Energy System, including :
  - Dynamics of energy system development and transformation, in particular with and without perfect foresight;
  - A representation of the interactions of multimodal energy vectors and the impact on available flexibility;
  - A subnational representation of the grid and potential cross-border energy exchange;
  - A realistic dispatch with a precise technical description of all generation assets (including hydro storage);
  - A representation of the new challenges of the grid facing large shares of RES, e.g. frequency stability;
  - A proper representation of flexibility needs and flexibility potential provided by all assets, including multi-energy services.
- An IT platform for providing seamless access to data and high-performance computing resources, catering for flexible models (easily replacing submodels and the corresponding efficient solution algorithms) and workflows;
- Efficient solving algorithms;
- A database of public data used for modelling;
- 3 Case studies showing the tool's functionalities and relevance regarding the uses as mentioned above, especially key advances included in plan4res: multi-energy integration, investment planning under uncertainties, flexibility cost integration within a pan-European approach.

In this context, we would like to ask your view on how such tools, IT platform, solving algorithms, and public data could be used to address the challenges you experience or think will emerge in the near future triggered by the increased penetration of RES.

About respondents

- The respondents are from the academic community, energy suppliers and transmission planners.
- The respondents are experienced, with most of them have more than ten years of experiences.
- The respondents have diverse work areas relevant to the plan4res modelling suites, i.e. expansion planning, system operation, commercial strategy, public policy decisions and strategy, and academic and research and distribution systems.

Insight from the survey

Energy system model

- All respondents already use energy system models.
- All respondents have interests in using the plan4res tools as it captures the functionalities needed by the stakeholders to carry out energy system analysis.
- Since the plan4res models/tools are relatively new, they need to be tested, developed and promoted further to build user confidences.
- The respondents also indicate that they need the model to provide granular data (hourly) and annually aggregated figures. They also would like to have data per technology and on a regional basis.
- There is no strong interest in a more detailed spatial resolution, e.g. local regions or postal code.
- The respondents see that multi-energy system and pan European integration captured in the model as the main added value in addition to the ability of the model to optimise both investment and operation.
- Most of the respondents indicate that the main features of a transmission planning tool they are interested in are the capability to consider multiple investment options, short and long-term uncertainty, detailed modelling of system operation, and the future renewable deployment path, among others.
- Most of the respondents indicate that the main features of the electricity system operation optimisation tool are the ability to deal with RES uncertainty and detailed modelling of system operation. Others features include capacity expansion, seasonal storage valuation, and the ability to optimise flexible demand.
- The respondents suggest that the ability to incorporate a detailed European grid is an important feature of the plan4res model.

Insight from the survey

IT platform

- All respondents use local laptop/desktop and most have remote access to servers for running their tools.
- All respondents use Windows as their operating system for both local and remote system.
- Some respondents express their interest to use a more powerful computation system (e.g. HPC, supercomputer - Cray) to support their work.
- No respondents use virtual machine and software containers.
- All respondents can access external networks like GitLab.

Insight from the survey

Solution algorithm

1. All respondents have used energy optimisation models.
2. Most of the respondents indicate that they sometimes include non-linear and stochastic elements.
3. All respondents experience difficulty in solving complex or very large problems, and therefore, tools like SMS++ and SCIP will be useful to address this challenge.
4. 50% of respondents use sophisticated algorithmic techniques or express their interests in using them, but they experience high implementation cost or lack of sufficient expertise.
5. 50% of respondents develop their own energy models.
6. All respondents use algebraic modelling systems, and the most common use is GAMS.
7. There is a mix of experience in using modelling systems embedded in a programming language, e.g. YALMIP and Pyomo.
8. All respondents use in-memory API of optimisation solvers.
9. CPLEX and GuRoBi are the most common optimisation softwares.
10. C/C++, Java and Matlab are the most common programming languages for implementing optimisation techniques.
11. One respondent indicates that computation robustness and time are the main features for selecting the optimisation tool.

Synergistic Approach of Multi-Energy Models for an European Optimal Energy System Management Tool

Deliverable D 7.4
Conclusions from the "Call for Use Cases"

Deliverable No.	D 7.4	Work Package No.	WP7	Task No.	TASK 7.3
Work Package Title		Dissemination and Exploitation			
Linked Task/s Title		Showcase workshop			
Status		Final	Draft / Draft Final / Final		
Dissemination level		PU	PU-Public / CO-Confidential		
Due date deliverable		2021-04-30	Submission date	2021-04-30	
Deliverable version		D7.4 Conclusions from the Call for Use Case.pdf			

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Survey

https://www.plan4res.eu/stakeholders/survey/

More details can be read in Deliverable D7.4

https://www.plan4res.eu/results/deliverables/