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Project acronym:

INTERPLAN

INTEgrated opeRation PLAnning tool towards the Pan-European Network

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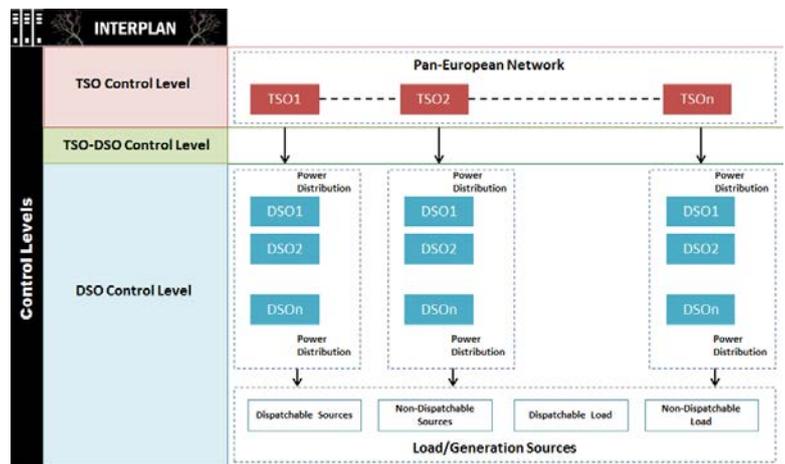
1. SUMMARY

The European Union (EU) energy security policy faces significant challenges, as we move towards a pan-European network based on the wide diversity of energy systems among EU members. In such a context, novel solutions are needed to support the future operation of the EU electricity system in order to increase security of supply also accounting for the increasing contribution of renewable energy sources (RES). The goal of INTERPLAN project is to provide an **INTE**grated **oper**ation **PLANN**ing tool towards the pan-European network, to support the EU in reaching the expected low-carbon targets, while maintaining the network security. The project involves 6 partners from 5 European

countries. It is currently at Month 3 under the Grant Management phase.

2. PROJECT SCOPE

The main goal of INTERPLAN Project is to provide an integrated operation planning tool for the pan-European electricity network, with a focus also on the TSO-DSO interfaces, to support the EU in reaching the expected low-carbon targets. A methodology for proper representation of a “clustered” model of the pan-European network is provided, with the aim to generate grid equivalents as a growing library able to cover all relevant system connectivity possibilities occurring in the real grid, by addressing operation planning issues at all network levels (transmission, distribution and TSO-DSO interfaces). In this perspective, the chosen top-down approach will actually lead to an “integrated” tool, both in terms of voltage levels, going from high voltage down to low voltage up to end consumer, and in terms of building a bridge between static, long-term planning and considering operational issues by introducing controllers in the operation planning. In addition, novel control strategies and operation planning approaches will be investigated in order to ensure the security of supply and flexibility of the interconnected EU electricity grids, based on a close cooperation between TSOs and DSOs.



3. PROJECT TECHNICAL DESCRIPTION & IMPLEMENTATION

The basic INTERPLAN idea of covering the greater number of possible system connectivity and solving interconnectivity issues requires a thorough assessment by country in terms of: generation, load, transmission and balancing data, TSO/DSO interaction overview, and existing grid codes. Therefore, the first phase of the work focuses on an in-depth analysis of existing projects and studies connected to the themes above. The exploitation, in particular, is oriented to identify more significant scenarios for the later definition of use cases and clustering methodology (“grid equivalenting”). This latter, which is conceptually the successive phase of the work, is the process to generate a grid equivalent model encompassing a large part of network substituted by a smaller counterpart having the same relevant properties. To this aim, the network models of previous use cases will be designed in numerical power system simulation environment. Then, a clustering methodology for transmission and distribution systems up to the end user level will be identified, and a detailed approach for generating grid equivalents will be developed for different use cases.

To assess operational planning aspects, key decisions regarding planning criteria/functionalities (e.g., maximizing RES share in generation portfolio in secure manner) will be taken for each use case. The application of selected

criteria to previous use cases will allow to construct significant showcases. Semi-dynamic simulations of grid equivalents for each showcase will provide the network behavior and eventual operational problems (e.g. line congestion). The post-processing or parallel-processing of the results will allow to identify operational problems to be solved by developing new control system strategies. These latter will be designed in order to apply adequate intervention measures through appropriate control parameters such as storage, demand response and aggregation through cluster and interface controllers. Finally, a validation process will be applied through numerical simulation environment to prove the validity of the proposed concept. In detail, static and dynamic analysis will be led in lab environment in order to show the effectiveness of the tool (e.g., ability to avoid congestion problems at interface TSO-DSO level or to apply adequate intervention measures).

The project consists of 7 Work Packages, and it is in line with the Work Programme, in ensuring more flexibility and active involvement of all stakeholders, and a close coordination of TSOs and DSOs. The innovation products of INTERPLAN will be delivered at the TRL 5: The TRL at the beginning of the project is 2 (technology concept formulated).

WP Title	Lead partner
1. Coordination and project management	ENEA
2. Technical assessment and regulatory status of the European electricity grid	UCY
3. Requirements, scenarios and use cases definition	DERlab
4. Grid equivalenting	AIT
5. Operation planning and semi-dynamic simulation	ENEA
6. INTERPLAN model validation and testing	FRAUNHOFER IEE
7. Dissemination, communication and exploitation	DERlab

4. RESULTS ACHIEVED AT KICK-OFF

On 18 December 2017 the kick-off meeting of the INTERPLAN project took place at the ENEA Research Centre in Naples (IT). The main outcomes are in the following:

- Presentation of the general aspects and technical ones of INTERPLAN Project by the Project Coordinator and Technical Project Coordinator, respectively (objectives, innovation, methodology, implementation, etc.).
- Presentation of the Work Packages by the Work Package Leaders, and Partners presentation by representatives of each partner (description of work, planned resources, time schedule, deliverables, milestones, risks, etc.).
- Presentation by the Project Officer (general overview on EC / INEA / Horizon 2020, guidelines for the Grant management, periodic reporting, payments, dissemination & communication, communication with the Project Officer, etc.).

5. IMPACT

Overall expected impact #1: Relevance and compatibility with the broad EU energy policy context such as Climate-Energy packages, Energy Union.

INTERPLAN addresses planning, development and operational issues of the integrated grid capable of handling efficiently and effectively intermittent RES technologies, storage in its broader context, flexible aggregated demand capable of offering demand response services complementing other system flexibilities as a positive response to the needs of intermittent sources of energy. In this respect, INTERPLAN responds to the strategic objectives of EU for reducing emissions by 40% by 2030 and be No 1 in RES technologies achieving a 27% RES target in final energy use over the same period, as well as to the paradigm change from “generation is following load” to “load following the generation” by building the grid with the end-user in the centre of all activities. All these tie in well with the objectives set out in the Energy Union for No 1 in RES and smart EU energy system with consumers at the centre and related issues in the 10 key actions of the SET Plan and the 13 themes of the SET Plan Integrated Roadmap.

Overall expected impact #2: Contribution to ongoing policy developments in the field of the design of the internal electricity market, of the retail market, ongoing discussions on self-consumption.

INTERPLAN moves away from the radial design of the grid and approaches its planning, development and operation from a technology neutral view, allowing active contributions throughout the network hence in support of the ongoing policy developments. The end-user is transformed to an active contributor to the grid functioning optimising self-consumption, improving market operation by building aggregated services throughout the grid that complement the diversified services of operators, thus building a more dynamic internal electricity market capable of optimising resources and leading the way towards the planned sustainable economy.

Overall expected impact #3: Contribution to enhanced interconnections between Member States and/or between energy networks.

INTERPLAN approaches the grid as being interconnected allowing seamless extension from country to country



by offering tools to improve its synthesis and analysis. With this approach, INTERPLAN via effective cluster and interface controllers contributes to the objectives for building one single energy network within the interconnected Europe allowing the contributing benefits of complementary energy networks to the electricity network.

Specific expected impact #1: Optimized grid planning and design at European level, maximizing the capacity of the grid to host variable renewables, take full advantages of a pan-European grid for stability and security.

INTERPLAN is addressing the planning, development and operation of the integrated grid from the European perspective without losing the myriad benefits of distributed resources and smart controllers spread throughout the grid. The equivalent architecture of INTERPLAN with the cluster and interface controllers, effective models for storage, aggregated demand response suits the complexity of the integrated grid as it will evolve through the adaptation of the most competitive technologies in the sustainability trajectory. Stability and security will be addressed at area, regional and pan-European level offering ease in the synthesis and analysis but fully responsive to the requirements of the pan-European dimension.

Specific expected impact #2: Safe, secure, efficient and coherent data handling, enabling more cross border trading and real time balancing.

INTERPLAN will use system and user data through the logical interfaces to be handled by national data operators that will provide the required security that will safeguard the provider. For INTERPLAN to be effective and responsive requires reliable data at the prescribed latency. This is anticipated to be available hence contributing to the smooth functioning of the electricity market in Europe and achieving optimal use of resources at all times.

Specific expected impact #3: Enabling new flexibility services to the grid associated with new business opportunities, offering the access to cheaper energy for the consumers and maximising the social welfare.

INTERPLAN is going to develop a platform for analysis, development and operation of the interconnected grid of tomorrow with the seamless integration of the intermittent sustainable technologies, supporting technologies such as storage and aggregated flexibilities through the active participation of the end users through demand response activities. These possibilities will facilitate the evolution of the electricity grid in a direction that will optimise resource availability in line with the sustainable policies of Europe and create diverse opportunities for new market participants to emerge, that will exploit the emerging business opportunities such as new emerging technologies, aggregated solutions, energy communities as outlined in the Winter Package, etc.

Specific expected impact #4: Increasing the potential of exchanges between energy networks, enhanced security of supply, create business opportunities, avoidance of curtailment, offering new services to the grid.

As outlined in *specific expected impact #3*, INTERPLAN will facilitate the evolution of the electricity grid in an optimal way from the end user with the aggregated services to the grid to the most sophisticated centrally managed generating station including large offshore wind farms harnessed through dedicated DC grids. This development will safeguard the local element with the hierarchical central needs of the system. This approach will offer the detailed benefit of socialising infrastructure where needed and only through justifiable techno-economic benefit.

Specific expected impact #5: Account for human behavior in the design of infrastructure and demand-response to avoid blockages due to social acceptance, placing the consumer at the center of the energy system.

INTERPLAN addresses the development, planning and operation of the electrical grid through a synthesis of clusters of homogeneous nature that are technology neutral building on the strengths of aggregated end users and the benefit they offer to the system at large. In this respect, INTERPLAN by its own nature and structure will support the energy transition process and nurture the build-up of a participatory culture which is so desirable for the success of this venture.

6. ADDITIONAL INFORMATION

As a key aspect to achieve the main goal of INTERPLAN Project, it is important to involve external stakeholders, such as grid operators, public authorities, industry representatives and energy utilities, with the aim to increase the project impact, by fostering a culture of cooperation between research infrastructure providers, grid operators and scientific communities. Moreover, the novel approach of actively involving external stakeholders in a series of targeted workshops for validating and complementing the identified recommendations for improved regulations and grid rules is the key to actual adoption and further exploitation. An initial stakeholder group has already been formed during the proposal preparation phase by the parties who agreed in taking part in the Advisory Board.