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Giorgio Graditi. He received the doctoral degree and the Laurea degree (cum laude) in electrical engineering from the University of Palermo (Italy). Since 2000, he has been a Researcher at ENEA, Italian National agency for new technologies, Energy and sustainable economic development. From October 2011 until August 2018, he was the head of Photovoltaic Systems and Smart Grid Unit of ENEA; since September 2018, he has been leading the Solar Thermal and Smart Network Division of ENEA, and since June 2019, he has been the Vice Director of Energy Technologies Department of ENEA. He is also the president of MEDENER.

In 2017, he received the Italian National Scientific Qualification as Full Professor in the sector of electrical energy engineering. His main research interests are in power systems design and control; power system conversion; PV, CSP electrical and thermal design, characterization and testing; microgrids and smart grids modelling and analysis; design, management and control of multi-energy hub systems by multi-objective optimization approach.

He is responsible of National and European (FP7, H2020) projects within renewable energy and smart grid topics. He is the vice-coordinator of Joint Programme on Smart Grid (JP SG) within European energy Research Alliance (EERA). He is operating as Italian member for Mission Innovation Challenge 1 "Smart Grids" and Challenge 2 "Off-grid access to electricity", and as a member of the national board of directors of H2020 for "Secure, Clean and Efficient Energy".

Interview with Giorgio Graditi

What is the main contribution of INTERPLAN to the power system operation and who are the main stakeholders?

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 grid operators for the future operation, resilience and reliability of the EU electricity system in order to increase the security of supply by also accounting for the increasing share of renewable energy sources (RES). INTERPLAN's tool will support TSOs and DSOs in the operation planning of the pan-European network, while also fostering the achievement of the low-carbon objectives targeted by the European Commission for 2030 and 2050. **In this sense, the main stakeholders for the project are TSOs and DSOs, since the main goal of the tool is to achieve the operation planning of an integrated grid from the perspective of these grid operators through handling efficiently and effectively intermittent RES as well as the emerging technologies such as storage, demand response and electric vehicles.**

The project will also provide a methodology for a proper representation of a "clustered" model of the pan-European network, with the aim to generate grid equivalents as a growing library able to cover a number of relevant system connectivity possibilities occurring in the real grid, by addressing a number of operation planning issues at all network levels (transmission, distribution and TSO-DSO interfaces).

Does the INTERPLAN consortium interact and consult with experts from system operators or similar projects? How can this affect the developments in the projects?

Since the beginning, the involvement of external stakeholders in the project's activities has represented a crucial aspect for the INTERPLAN Consortium. Indeed, informing and involving additional stakeholders such as grid operators, public authorities, industry representatives, energy utilities and research organisations other than those already involved in INTERPLAN, with the aim to increase the project impact, enables the fostering of a culture of cooperation between research infrastructure providers, grid operators and scientific communities. Moreover, it increases the visibility and impact of the project and allows to receive valuable feedback about the project developments and results.

In accordance with this objective, INTERPLAN established the novel approach of actively involving external stakeholders since the beginning of the project through organizing a series of targeted workshops as well as surveys for validating and complementing the intermediary results achieved. So far, three workshops have been organized and about 90 stakeholders are involved in the project.

Getting in touch with the relevant stakeholders to receive feedback and recommendations, especially about the use cases, the showcases and the tool itself, is of major importance for the project.

Why is INTERPLAN looking at the potential operation challenges specifically in the future pan-European grid?

INTERPLAN looks at the potential operation challenges which TSOs and DSOs are called to address in the 2030+ power system. In fact, the ongoing deployment of the pan-European Network strongly depends on different potential scenarios related to the RES share in generation and installed capacity, as well as the penetration of emerging technologies, such as storage and Demand Response (DR). Although these factors represent the preferential patterns to meet the EU decarbonized energy targets for 2030 and 2050, they bring new challenges for the energy system, which will outline the key operational needs of the European grid operators in the near future.

In such a context, TSOs will need to evolve progressively from a “business as usual approach” to a proactive approach in order to avoid a bottleneck effect in the future European grid, and this could be addressed through a proper system operation planning. As for the distribution networks, they have been traditionally designed and treated to transport electrical energy in one direction, i.e., from the generation units connected to the transmission system to the end-users. However, with the growing share of non-dispatchable distributed generation, customers are increasingly generating electricity themselves, and, by becoming “prosumers”, they are shifting from the end point to the centre of the power system. As a result, Distribution System Operators (DSOs) will need to actively manage and operate a smarter grid through appropriate system control logics, by utilizing the flexibility potential in the grid, with the aim to optimize the distribution network performance.

Furthermore, an additional critical issue is the interface between transmission and distribution systems, which is expected to evolve in the near future through a mutual cooperation between TSOs and DSOs, with the aim to address operational challenges as congestion of transmission and distribution lines and at the interface among them, voltage support between TSOs and DSOs, and power balancing concerns. The increasing complexity of the grids requires control and operation planning tools even more advanced and homogenous among European countries. **With these premises, the INTERPLAN idea was born. The project aims to develop control system logics which suit the complexity of the integrated grid, while managing all relevant flexibility resources as “local active elements” in the best manner. Moreover, by looking at the 2030+ power system, the project also addresses policy and regulation aspects, aiming to identify a set of possible amendments to the existing grid codes, reflecting the developments achieved in INTERPLAN through its tool, use cases and showcases. The aim of this analysis is to break down the current barriers to the integration of emerging technologies and to foster TSO-DSO cooperation in managing grid operation challenges.**

Will INTERPLAN open source their tools? And how to access those tools?

The developed network planning and operation tools are based on established commercially available products like Python and PowerFactory, that are widely used by the industry, aiming to be readily available for immediate adoption and implementation. The INTERPLAN consortium is making a common effort to create open source tools and models, with the aim to offer the possibility for researchers from academia, industry as well as grid operators to further develop, validate and integrate these tools.

In practice, a detailed user manual for the INTERPLAN tool will be made available for open and wide use by all interested stakeholders and / or software developers. Additionally, the consortium intends to provide an integrated tool to the prospective users with the following features and advantages:

- It will include an exhaustive library of grid equivalents in CIM-Format responding to all known needs of operators and system analysts and covering all voltage levels and their active components.
- It will provide easy-to-use grid clustering techniques that are adaptive and responsive to the dynamic growth of the evolving grid, thus refreshing and valid as new technologies emerge and adapted in the grid.
- The integrated clustering algorithms can, due to its open source character, be applied to other grid areas and voltage levels. Hence, it can be the basis for further development.
- The integrated control system logics can be applied to other grid areas and different voltage levels, thereby representing a source for further development and integration.

In conclusion, the consortium will ensure to make the achievements of the project available for further research, in order to widen the scope and functionality of the developed tools. To make a practical example, in developing the integrated network operation planning tool, the consortium identified the need for further research and advancement in order to cover aspects such as ICT, cybersecurity, and user friendly GUI (graphical user interface) of the tool.