

Enel Grids Flexibility Lab: one year in action!

“Stakeholders collaboration on the pathway to flexible power system” Interim Report

The transformation of the global energy system away from fossil fuels to renewables and the strong increase of global electricity demand to reach the net zero-ambition require an overall and joint commitment by all the stakeholders.

International Energy Agency ¹, in its Net Zero Emission scenario, estimates that global electricity demand increases close to 40% by 2030 and more than doubles by 2050 compared to 2021, also as an effect of electric mobility expansion, and the share of renewables in the global electricity generation grows from 28% in 2021 to over 60% in 2030 and close to 90% in 2050.

With reference to EU ambition set in the FitFor55² legislative package by the European Commission, reinforced by Repower EU plan, almost 800 GW of solar and wind capacity will need to be added to the system by 2030, more than three times the 2020 installed capacity.

Moreover, according to Bloomberg NEF³, in 2050 the average size of power plants in Europe will be 17 times smaller than today. Consequently, the share of generation capacity directly connected to distribution grids is expected to grow from current 24% to 67% in 2050, turning distribution electricity grids into the real backbone of the energy transition.

The progress through this new energy paradigm is increasingly requiring use of smart grids, combining the use of conventional equipment with the upcoming digital solutions, that makes the electricity network more effective in remote control and near real-time exchange of information with connected Distributed Energy Resources (DERs).

DSOs (Distribution System Operators) are going to act as neutral facilitator in order to optimize the use of new flexibility solutions aimed at supporting congestion management, outage prevention or voltage control.

From this perspective, DERs (e.g., storage, EV, demand response...) could become a FSP (Flexibility Service Provider) directly or through an aggregator, as players in the envisaged flexibility markets. The evolution of flexible power system lays down innumerable opportunities at all levels and where each stakeholder, including aggregators, Flexible Service Providers, academics, research centre, TSOs and DSOs, technological providers, has a significant role to play.

The Flexibility Lab initiative represents a corner to discuss and collaborate with all the stakeholders involved about any innovation and technology challenges related to the implementation of the new flexibility framework.

The initiative, promoted by Enel Grids and launched in June 2021, currently counts more than fifty members covering the whole value chain and making possible to gain a comprehensive view and to deliver relevant outcomes.

Flexibility Lab Members has carrying out activities in a participatory way within Working Groups dedicated to three streams with identified first goals: DERs Observability and Controllability, DERMS and Market Platforms, E-Mobility.

This interim report presents the preliminary results achieved by each Working Group.

¹ World Energy Outlook 2022 by IEA

² https://energy.ec.europa.eu/implementing-repowereu-plan-swd_en

³ Bnef New Energy Outlook 2020



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DERs Observability and Controllability

Flexibility Lab first goal: understand the value of observed data and compare different models of controllability.

The increasing number of DERs connected to the grid implies that operators must be able to monitor and manage the behaviour of DERs, to activate flexibility and to measure their performances.

Observability and controllability capabilities are essential to adapt grid infrastructures in this changing scenario, upgrading traditional grids into smart grids leveraging on digitalization.

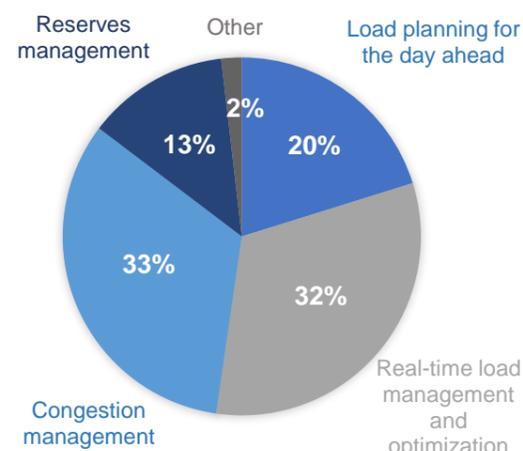
Observability perspective will require to tackle several aspects, such as devices communication requirements and data usage while controllability should focus on the identification of the most suitable operative model without forgetting cybersecurity aspects.

Flexibility Lab Members considered that the observation of edge data plays a crucial role in the implementation of innovative services. As matter of facts, services such as congestion management or real-time load management and optimization followed up by load planning of the day-ahead or reserves management services stand out for the use of observed data.

Another relevant outcome is the importance of behind-the-meter data thanks to devices such as smart meters to let customers manage their consumption.

Cybersecurity concerns joint together with privacy issues or lack of trust in participating by customers, should be well addressed in order to do not jeopardize potential of data observation.

In this sense, among the urgent actions to be taken, there are the adoption of defence technologies and the implementation of cybersecurity regulations properly considering grid observability and controllability needs.



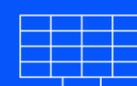
*Flexibility Lab members view
Services provided by the availability of edge data relevance*

DERMS and Market Platforms

Flexibility Lab first goal: Identify key functionalities and interfaces for DERMS, and guidelines to assure transparency within flexibility markets.

Platforms are one of the key enablers for flexibility services implementation. Two types of platforms can be considered.

On one hand, there are DER Management System (DERMS) that can be designed both for grid operators (DSO DERMS) and aggregators. In particular, DSO DERMS support the operation and planning activities taking into consideration availability of flexibility services. One of the greatest challenges in this sense is to design and deploy platforms that enable the integration of variable energy while reliable and continuous supply of electricity is guaranteed.



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On the other hand, there are Market Platforms designed according to different needs and models where DSOs can procure flexibility services.

Flexibility Lab members agreed on the relevant role of DSO DERMS in increasing the hosting capacity, in solving grid criticalities and deferring infrastructure reinforcement, being able to optimize economic resources allocation.

In relation to the key functionalities of DERMS, the following ones have been selected as focus by members:

- DER monitoring: continuous observation of DER status and provision of this information to other relevant systems.
- DER registering: standardized information into DERMS
- Flexibility Services planning: to identify the most suitable available flexibility services to address specific grid criticalities at a given area and time.
- Flexibility Services dispatcher: once the best Flexibility Service is identified, DERMS also serves as the engine to execute the plan interacting with Flexibility Service Providers, through Market Platforms, to procure flexibility services and then activate them. Moreover, Flexibility Lab Members consider that DERMS must be compliant with high level of cybersecurity.

Finally, regarding technology, Flexibility Lab Members consider Battery Energy Storage Systems, EV (electric vehicles) and demand response loads as the most promising technologies to contribute to flexibility of the system. Nevertheless, all technologies are included and evaluated alongside working groups' activities.

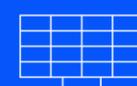
In particular, Battery Energy Storage Systems are perceived as preferred FSP (Flexibility Service Provider) because they guarantee flexibility without curtailing or losing renewable thanks to their inherent ability to both charge and discharge.

E-Mobility

Flexibility Lab first goal: identify the barriers for Smart Charging and V2G to become Flexibility Service Providers.

Policies are encouraging Electric Vehicle (EV) adoption. As a consequence, the mobility sector is going towards a huge revolution, where the share of EVs is expected to follow a steep increase in the next decades. An un-managed transition would challenge the power system operation and control, generating risks for grid stability and costs for its reinforcement. However, if properly addressed, the presence of millions of EVs connected to the grid could result in a huge opportunity to improve power system flexibility and take advantage of the increasing amount of DERs.

Innovative charging schemes such as "smart charging" and "vehicle-to-grid" can be key enablers for the flexibility provision, this is one of the main topics that has been discussed in this Working Group where stakeholders of the whole EV value chain are addressing the most relevant technical R&I topics related to the EV massive integration in power systems.



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In particular, an analysis of the following key aspects is important: how to exploit EV flexibility potentials, which is the needed infrastructure (also covering ICT aspects), and which are the most promising business models to foster smart charging and vehicle to grid (V2G) schemes.

EV user engagement and how to foster his availability in taking part in flexibility schemes is part of the analysis.

Main concerns for the development of technologies and innovative solutions for EVs to provide flexibility services are high EVs capital costs, long charging times, lack of suitable standards and the delay in charging infrastructure deployment.

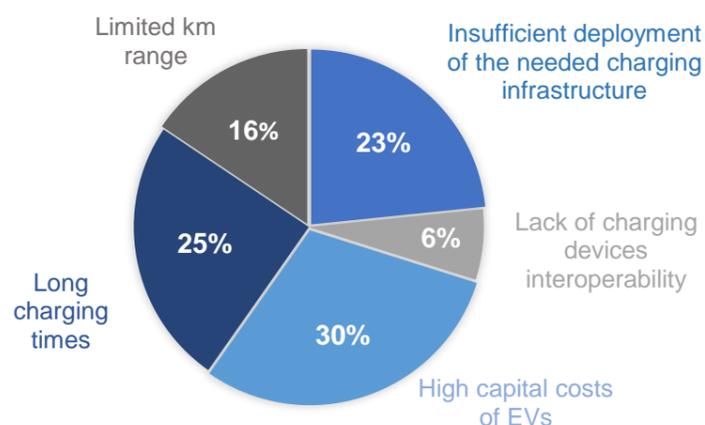
Flexibility Lab members indicate that a clear picture of the market structure and adequate price signals (with meaningful remuneration) are the best ways to foster user participation into flexibility markets. As far as the EV user's perception on participating into smart charging/V2G schemes is concerned, the maturity level of smart charging has been claimed by the members to be on an early stage (but with good perspective about future improvements), whereas the V2G charging scheme appears not to be a mature technology.

V2G schemes implementation shall be accelerated by improving the standardization of communication rules among the interfaces of the whole system (grid asset, electric vehicle supply equipment, EV battery, charging point etc.). System management and rules are indeed an open issue to be addressed.

Aggregators have been identified as the best actor suitable for offering flexibility services to the grid by e-Mobility, overseeing managing the EV fleet, and with insights about charging points, smart charging and V2G.

Next steps of Flexibility Lab in 2023

The upcoming aim of the Flexibility Lab for 2023 is the drawing up of a White Paper highlighting the role of innovation and technology to pave the way of the implementation of flexible power systems.



*Flexibility Lab Members view
Primary technological barriers that are blocking EV to provide flexibility services*

Flexibility Lab is always looking to enrich the contribution adding new members.

If you want to join, please write to flexibility-lab@enel.com and we will be pleased to contact you.



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ACKNOWLEDGEMENT

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