Interoperable solutions for implementing holistic **FLEXI**bility services in the distribution **GRID**

Recommendations on current European regulations

Deliverable 7.3

WP7

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ABBREVIATONS

CA: Consortium Agreement
CC: Communication Committee
DMP: Data Management Plan
DoA: Description of Action
EC: European Commission
GA: General Assembly
H2020: Horizon 2020
IPR: Intellectual Property Right
KPI: Key Performance Indicator
M: Month
PC: Project Coordinator
PH: Project Handbook
R&D: Research and Development
SC: Steering Committee
SME: Small and Medium Enterprise
TP: Technical Partner
WP: Work Package

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EXECUTIVE SUMMARY

This deliverable offers a deep dive into the European regulatory framework that affects the implementation of FLEXIGRID's technology, with a focus on advancing the Energy Transition in Europe. The analysis begins with a comprehensive overview of the current European regulations, ensuring that subsequent recommendations are based on the understanding of the existing legislative environment.

The legislative barriers identified by the demo partners limit the full potential of innovative projects and business models, necessitating a critical review and potential revision.

Drawing from the insights of the Smart Grid Task Force's roadmaps, the issues faced on the demos, and the Policy conclusions outlined in the Communication on the State of the Energy Union 2015, targeted recommendations are presented. These suggestions aim to refine and enhance the current regulations, aligning them more closely with the evolving needs of the energy sector.

Building on this foundation, the report then proposes fresh legislative measures tailored to bolster the Energy Transition in Europe. These new regulations and legislations are informed by the Clean Energy for All Europeans initiative and are crafted to maximize the impact of solutions such as FLEXIGRID's and other BRIDGE initiatives. The overarching goal is to close the gap between the present regulatory framework and the future needs of the energy transition, positioning Europe as a leader in sustainable energy innovation.

TABLE OF CONTENTS

1. INTRODUCTION

The following report constitutes Deliverable 7.3 **Recommendations on current European regulations** and is part of Task 7.3 Regulatory framework and policy recommendations to legislators (M37-M48) in WP7 "Guarantees of replication".

The general objective of the deliverable is to identify the regulatory framework to give recommendations with the intention of promoting amendments in European regulations or new regulations for the Energy Transition in Europe. These recommendations are related to the needs identified during the development of the project, looking forward to maximising the impact of the FLEXIGRID solutions.

The deliverable main objectives are:

- Identify the most relevant regulations that may affect the development of project solutions.
- Bring recommendations to promote amendments in regulations.
- Compare regulations in Europe and identifying amendments or improvements.
- Implement cost-benefit solutions that now have legislative barriers.
- Propose new regulations and legislations for the Energy Transition in Europe.

The idea of the deliverable is to achieve a collaborative work in which demo partners contribute with the actual regulations that affect them during the implementation of the pilots and how did they interfere. Suggestions on new regulations or improvements to the actual ones will be made to facilitate the replication of FLEXIGRID's solutions around European countries.

2. REGULATORY FRAMEWORK

This section describes the European main standards and directives at European level and per country, considering the demos carried out in the project and the impact that these regulations had in the development of FLEXIGRID's technologies in each demo.

2.1 SPANISH DEMO

In Spain the main regulations related to technologies and solutions developed in the project, and considering the implementation of the demo in Viesgo's facilities, are the following.

European level

- EU Directive: **Regulation no. 548/2014** (eco-design): This regulation establishes the requirements, in terms of eco-design, for placing on the market or putting into service power transformers with a minimum power rating of 1 kVA used in 50 Hz electricity transmission and distribution networks or for industrial applications.

Moreover, there are some directives that apply specifically to energy meters for the CE marking and therefore their commercialization in Europe:

- **Directive 2014/32/EU** of the European parliament and of the council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of measuring instruments (MID).
- **Directive 2014/53/EU**. Radio equipment directive (RED).

National level

The following Spanish law adds some requirements for the installation and commercialization of meters.

- **Order ITC.155.2020** metrological control from the State of measuring instruments.

Furthermore, in Spain there are some standards that were considered for carrying out the demo in Santander and should be considered in the future for implementing FELXIGRID's solutions. Taking into account the technologies developed and evaluated, the corresponding standards are detailed.

The **transforma.smart** must comply, as a minimum, with the standards and specific customer technical specifications indicated below.

- IEC 60076: Power Transformers.
- IEC 60214: Tap changer.
- IEC 61000: Electromagnetic compatibility (EMC).

The **supervised LVB** must comply, as a minimum, with the standards and specific customer technical specifications indicated below.

- Electrical low voltage regulation.
- UNE EN 61439-1: "Low voltage facing sets. Part 1 general rules".
- UNE EN 61339-5: "Low voltage facing sets. Part 5: Switchgear assemblies for public distribution networks".
- UNE EN 60947-1: "Low voltage switchgear. Part 1: General Rules.

- UNE EN 60947-2: "Automatic Switches".
- UNE EN 60947-3: "Switches, disconnectors, switch-disconnectors and combination fuses".
- UNE EN 60947-5: “Low voltage switchgear. Part 5-1: Devices and switching elements for control circuits. Electromechanical devices for control circuits”.

For **Smart meters**:

- EN 50470-3 Electricity metering equipment (a.c) – Particular requirements - Static meters for active energy, class indexes A, B and C).
- EN 50470-1 or IEC 62052-11. Electricity metering equipment (a.c.) – Electricity metering equipment (AC) – General requirements, tests and test conditions.
- EN 62052-31: Electricity metering equipment (AC) - General requirements, tests and test conditions – Safety.
- IEC 62056 series (DLMS).
- EN 50065-1: Signalling on low-voltage electrical installations in the frequency range 3 kHz to 148,5 kHz - Part 1: General requirements, frequency bands and electromagnetic disturbances.

General Standards applying to all demo solutions:

- Norm NT-TRMT.01 from Viesgo: HV/LV transformers.
- NT-CBTI.01 from Viesgo: Low-voltage switchboard for outdoor transformer substation for Remote Management.
- NT-ERTU.01 de Viesgo: Remote Telecontrol Stations (RTU).

2.2 CROATIAN DEMO

As regards the Croatian demo in Zagreb and the technologies and solutions evaluated in it, the following regulations should be considered.

European level

- **EU Green Deal and EU Clean Planet for all** define the steps needed for transformation towards the system without net emissions of greenhouse gases, economic growth, increase in the share of renewable energy sources, etc. The solutions developed in the FLEXIGRID project share the goals with those presented in the mentioned politics.

- **Trans-European Networks for Energy** focused on linking the energy infrastructure of European countries.

National level

- **National grid code for distribution networks** regulates the values of technical quantities such as voltage magnitude.

- **National electricity market law**. This law defines some of the basic standards that need to be followed by entities participating in the exchange of electricity. One of the solutions in the Croatian demo site has the goal of improving voltage profiles with the activation of flexibility services. This may affect the project solutions as flexibility services can be traded on developed electricity markets, so it is of utmost importance that entities follow regulations defined in the market in terms of exchanging electricity.

- **Croatian renewable energy sources law.** Further integration of renewable energy sources will create new planning and operational challenges for system operators who will need to use solutions like the one proposed in the FLEXIGRID project. Therefore, it is important for entities to be familiar with these regulations.

As regards standards, since some of the solutions proposed during the demos in FLEXIGRID are oriented towards the improvement of technical quantities, most of the limitations and thresholds for different values are defined in the standard **EN 50160** and the group of standards **IEC 61000-3-x**. Another important standard is **IEC 61000-4-30** which specifies the technical documentation that the manufacturer compiles to declare compliance with the applicable substance restrictions. As the demos in the project are characterized by a high number of newly installed devices, it is important to ensure their compliance with the mentioned standard.

Since one of the goals of the Croatian demo is the improvement of the infrastructure of the Distribution Control Areas (DCA) of HEP ODS, the Croatian DSO, conclusions of the tests are going to be used in the further transition towards a smart system.

2.3 GREEK DEMO

In Greece the main regulations related to technologies and solutions developed in the project, and that affected the demonstration in Thasos are the following.

European level

- **Regulation on the Governance of the Energy Union.**[1]

This regulation establishes a political process outlining, how EU countries and the Commission work together, and how individual countries should cooperate, to ensure that the objectives of the Energy Union, especially the EU's 2030 energy and climate targets (such as reduction of 40% of greenhouse gas emissions, a minimum of 32 % renewables in the EU energy mix etc.) will be achieved.

- **General Data Protection Regulation (GDPR).** [2]

This is the toughest law in the world as regards privacy and security of data. It imposes obligations to organisations all around the world, if they target or collet data from people in the EU.

Smart metering and all data gathered from electricity data value chain participants that are deemed confidential or private (paying particular attention to data gathered from prosumers and are of a personal nature) may be processed for various reasons, including enhancing energy efficiency, metering accuracy, customer information, grid stability, timely billing, etc. As a result, the information gathered from smart meters and other sources along the integrated electricity data value chain may be lawfully processed for various purposes and may be subject to various processing and transmission restrictions.

[1] Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, 21.12.2018, p. 1–77
[2] Intellectual property rights infringements, 04.05.2016, pp.1-99.

- **Smart Meters' Legislation**[3]

One of the most significant enablers of the energy transformation on a European and global scale may be the smart metering legislation (and supporting infrastructure). Its growth is connected to the liberation and realization of several cutting-edge services. Discussions about recording measurement data at 15-minute intervals are currently taking place at the European level and in many Member States since it is simple to create accurate graphs of the actual consumption from such detailed metering data.

- **Renewable Energy Directive**[4]

In order to increase the use of renewable energy in Europe, the EU has established a comprehensive policy for the production and promotion of energy from renewable sources. The following is the target set in the original version of this document: *By 2020, renewable energy sources will supply at least 20% of the EU's overall energy needs. Additionally, by 2020, all EU nations must guarantee that at least 10% of their transportation fuels come from renewable sources. As part of the "Clean Energy for all Europeans" initiative, the revised renewable energy directive 2018/2001/EU went into effect in December 2018. As a result, it establishes a new, 32% binding renewable energy target for the EU for 2030, along with a review provision that allows for an upward revision by 2023.*

National level

- **Net metering**

Consumers of energy in Greece have the option to install renewable energy systems for their own use. This effectively means that the user will consume energy produced in real-time from the installed renewable energy source(s) (such as PVs, biomass, wind, etc.), and at times when this is not sufficient to cover the building's energy needs, the additional energy is provided from the grid, without the need to use batteries to store energy. Similarly, when the renewable energy systems produce excess energy, this is fed back into the grid. The billing of the customer is performed every 4 months, where the “net” positive amount of energy that has been consumed over this period is charged to the customer, while if the “net” consumption is negative (higher generation than demand), the consumer is not reimbursed for the excess energy, rather it is being transferred to the next billing period. The operation of the "net-metering" scheme, has been launched in December 2014 by the Ministry of Environment, Energy and Climate Change, and has defined the operational framework and technical details of the program, such us installed power limitations etc.

- **Regulation on Smart Meters**

The foundations for the rollout of smart meters were laid in the adoption of **Law 3855/2010**, which implemented **Directive 2006/32/EC** in national law. The large-scale expansion of smart meters is provided for in **Article 59 of Law 4001/2011** ‘On the operation of Energy Markets for Electricity and Natural Gas for Research, Production and Hydrocarbon transport networks and other provisions’ (Official Government Gazette-A 179/2011). The replacement is regulated by a decision of the Minister of Environment, Energy and Climate Change (Minister) following an

[3] Trieb, Volume 1, Issue 2, May 2011, Pages 121–128.
[4] Directive (EU) 2018/2001 of the European Parliament and of the Council on the promotion of the use of energy from renewable, 21.12.2018, p. 82–209, 2018.

opinion of RAE and a relevant recommendation of the Hellenic Electricity Distribution Network Operator (HEDNO). Finally, in February 2013, by virtue of Ministerial Decision D5/EL/A/F33/2067/2013 'Replacement of final electricity consumption metering systems' (OG B 297/13.02.2013) (Decision) the large-scale replacement of conventional meters with smart metering systems was approved.

- **Energy Markets**

The Greek energy market is regulated by the Ministry of Environment and Energy (MEE) and the Regulatory Authority for Energy (RAE). The MEE sets the country's energy policy and issuing secondary legislation, whereas RAE is an independent administrative authority, established based on the provisions of **Law 2773/1999**, transposing **Directive 96/92/EC** on the liberalization of the electricity market. RAE's role was enhanced notably following the implementation of the third EU Energy Package by **Law 4001/2011** and **Law 4425/2016**. Following this reform, RAE is designated as the competent authority responsible for the security of energy supply and the granting, modification and revocation of all producer certificates and licenses (although the authority to issue producer certificates will eventually be transferred to another administrative body pursuant to Law **4685/2020**) required for the undertaking of energy activities, including the production, transmission, distribution, supply and trading of electricity and natural gas. RAE's other areas of competence include the approval of tariffs for non-competitive activities, the granting of exemptions to the third-party access regime, the certification of transmission system operators for both electricity and gas and the certification of distribution system operators for gas.

A significant milestone was reached on 1 November 2020, following Greece's transition to the European Target Model for the operation of its wholesale electricity market (with the financial energy market already launched in March 2020), replacing the pre-existing mandatory pool system.

Pursuant to **Article 19 of Law 4425/2016**, as in force, HEnEx is also responsible for organizing and operating the natural gas markets. The natural gas trading platform, launched on 21 March 2022, operates in accordance with the EU BAL Network Code, the REMIT Regulation, and the Rulebook for the Natural Gas Trading Platform, and aims to determine the price on the basis of the demand and supply of wholesale natural gas in Greece.

- **Regulation on demand response and flexibility markets**

Currently, there is no established flexibility market in Greece operated by the network operators apart from load shedding which is the current flexibility management between the two Network Operators. Load shedding in the Greek distribution network is determined according to standard operating procedures. After offline communication between IPTO and HEDNO, the latter isolates load in coordination with IPTO. This rudimentary, non-data-system based mechanism is rather out of date and necessitates the implementation of a fully automated flexibility management system.

The domestic system's flexibility is expected to be enhanced following the new proposed legislation[5] which sets the overall framework for the respective partners' rights and obligations

[5] Article 21, L.4986/2022, Official Gazette A 204 – 28.10.2022

as well as certain incentives to promote Demand Response participation of the various Greek electricity market actors.

2.4 ITALIAN DEMO

The Italian demo was held by EDYNA, the main DSO in South-Tyrol region, in the North of Italy. The main regulations related to technologies and solutions developed in the project are the following.

European level

As far as European standards are concerned, to carry out the Italian demo, partners based themselves in the **RfG Regulation** (Requirements for generators). The problem with RfGs, however, is that they define so many aspects of network and facility management, but precisely by defining so many aspects the clarity of the rules gets a bit lost.

National level

With regards to island operation, current regulations give the possibility of doing this through bilateral agreements, but there are no rules for this. Recently, an update of **CEI 0-16 (CEI 0-16_2022-V1)** has come out, which describes how to use generators, including emergency generators, in island mode.

In 2021, ARERA issued **Resolution 352/2021/R/EEL PILOT PROJECTS FOR THE APPROVING OF LOCAL ANCILLARY SERVICES** in order to encourage a number of projects to understand how the market for ancillary services could physically work. The **CEI 0-16** and **CEI 0-21** standards already describe many technical prescriptions to enable static and rotating generators to provide grid services. However, ARERA has not issued any resolution on the use of these services.

Currently in Italy, MV and LV users connected to the grid are free to withdraw or inject as much energy as they want within the contractual limits. There are no remunerated grid services. Only producers have the possibility of having their input power reduced or reduced to zero in relation to grid requirements. With **del. 540/21** ARERA established the obligation to install the Central Plant Controller (CCI) for all production plants > 1 MW. For now, this equipment only has a monitoring function (reading measurements) towards the DSO and TSO, in the future it will also serve for the management of ancillary services and market participation. The characteristic of CCI and its communication protocols are descripted in the annexes O and T of CEI 0-16 standard.

Some projects have already been done in the past as regards this topic, e.g., SmartNet where EDYNA, together with TERNA, evaluated the use of MV hydroelectric plants for the management of grid services for both the transmission and distribution network. The prototype of CCI used in this project was developed by SELTA, and it was a base for the CCI descripted in CEI 0-16 standard.

Additionally, there are several important European initiatives for smart energy systems, including **BRIDGE, ETIP SNET**, and **EIRIE**. Even though these are no regulations or standards, it is good to take them into consideration. These initiatives discuss relevant topics related to smart grids and smart cities, the integration of advanced technologies, the role of different stakeholders in the energy transition, etc.

3. REGULATORY OBSTACLES

The successful deployment and evolution of FLEXIGRID's technological solutions across Europe is deeply intertwined with the legislative framework of the countries where they were tested and intend to be replicated. As the project unfolded, several legislative barriers came to light, some of which were specific to the technologies developed, while others were more generic, pertaining to the broader realm of Smart Grid implementation.

Even though, in some demos more regulatory obstacles were identified, some of these barriers were common to more than one of the demos developed during the project (Spanish, Croatian, Greek an Italian). This section aims to enunciate these regulatory obstacles, serving as a foundation for subsequent recommendations to enhance European regulations.

Lack of Clear Regulatory Framework

- **Ancillary Services:**

Both Croatia and Italy demos faced challenges due to the absence of clear regulations or methodologies for the provision of ancillary services at the distribution level.

One of the goals of the Croatian pilot is to test the possibility of end-user's participation in providing ancillary services. Although, recent Croatian regulations introduce the concept of ancillary services at a distribution level, a methodology that will enable the provision of such services has not been defined yet. Furthermore, the concept of aggregators, virtual power plants, energy communities, and other entities with the ability to help the system by changing their operation has still not been properly defined. This could represent an obstacle for the implementation of the solution tested in Croatia, as even if the solution is proven to be valid, its implementation will be difficult as there is no policy to regulate it.

The lack of an exact definition of a methodology may affect also in another solution that will be evaluated in Croatia. This solution includes the installation of devices that will enable the change of a distribution network's topology. By activating these devices, a change of topology can also be used as an option for providing flexibility services.

Besides providing ancillary services by rescheduling the operation of devices at the distribution level, the change in their operation can be used in the TSO/DSO coordination, i.e., the provision of ancillary services to a transmission system operator by changing the operation of distribution devices. Recent legislation at the level of the European Union accelerated the implementation of coordination mechanisms and member countries must ensure that problems at the transmission level are possible to solve by using flexibility services provided by flexibility sources at the distribution level. Not having a defined exact methodology within the regulatory framework may create a delay in comparison to other power systems that have already implemented methods that will lead to the complete transition toward smart grids.

In Italy, the absence of this regulation, makes it much more difficult to develop concrete solutions, because distribution networks do not allow long-term planning.

- **Consumer Awareness and Financial Clarity:**

Though this is not directly related to regulations, a significant obstacle for the implementation of the technologies developed during the project is the fact that final consumers are still not aware of the benefits that are introduced by the implementation of advanced solutions.

There is a need for better clarification of the financial benefits that such implementation brings. Final consumers are still unsure if and when the large investment costs will start bringing profit. This is a barrier, not only in the demo countries but also in most European countries. Therefore, decision-makers should organize workshops to inform, but also introduce incentives that will help final consumers in achieving a faster return of the investment.

Technical and Operational Challenges

- **Connection Rules and Responsibilities:**

Both Italy and Spain have highlighted issues related to the rules for connecting active users to grids. In Italy, the responsibility for challenges like overvoltage and grid congestion falls on the grid operator, while Spain faces a broader gap in regulations concerning innovative solutions.

In Italy, the current rules for connecting active users to medium and low voltage grids allow them to feed all their contracted power into the grid whenever they want, as long as they do not exceed the set limits of active power and with PF close to 1 (no technical constraints, only penalties in the bill).The problems arising from this management (overvoltage, grid congestion) are all responsibility of the grid operator.

The existing technical regulations for connection to medium voltage grids (CEI 0-16) already require generators to be suitable for providing numerous grid services, which makes the certification of generators very costly. However, ARERA resolutions' regulating the activation of these services have not yet been issued.

In Spain, innovation meets a technological leap that is not included in any law drafted up to now. This is a challenge that might resonate with other European countries. As technological advancements in the energy sector accelerate, there's a pressing need for legislation to keep pace to ensure that innovations can be effectively integrated and regulated.

- **Demand Response and Network Congestion:**

Greece's demand response trial and Croatia's focus on TSO/DSO coordination both underscore the need for better strategies and regulations to manage network congestion and ensure efficient energy distribution.

Flexibility Services

Greek demo partners identified the absence of a comprehensive framework for the provision, trading, and remuneration of flexibility services to DNOs and TSOs as a huge obstacle for the deployment of the pilot.

In Greece there is currently no holistic regulatory framework (e.g., no mechanisms for trading and remunerating flexibility) for the provision of energy services to DNOs (Distribution Network Operators) and TSOs. This lack of framework fosters innovation that would benefit the whole system since there is no clear mechanism for the customer to get remunerated when providing those services.

More specifically, in the context of the Greek demonstration campaigns they conducted a demand response (DR) trial where services could be provided by the on-field devices to assist with the network congestion management. As described within D6.11, demand response involves shifting or shedding electricity demand to provide flexibility in wholesale and ancillary power markets to help balance the grid. While the trial successfully proved that the implementation of such strategies would be possible using FLEXIGRID's congestion management solution (S7), the lack of regulatory framework in Greece didn't allow them to simulate the benefits of the implementation based on actual requirements but rather based on a generalised framework. If such mechanisms were in place, they could evaluate the financial benefits of providing the services using actual remuneration tariffs, as well as quantify any penalties that could have been applied in the case of deviations from an actual contract with the local DNO.

Cybersecurity Concerns

Spain has explicitly mentioned cybersecurity regulations as a barrier to the implementation of the demo.

Given the increasing importance of cybersecurity in the digital age, it's likely that other European countries also grapple with similar challenges, even if not explicitly stated. The field of electrical distribution plays an essential role in the critical infrastructure of any nation, providing electricity to homes, businesses, hospitals, industries, and other areas. With the increasing digitization of electrical systems and the integration of information and communication technologies (ICT), cybersecurity has emerged as a major challenge in this sector.

In addition, the electricity sector has a unique characteristic that is very different from most other industries: if it is affected, its impact spreads to other areas, making it a clear target.

4. RECOMMENDATIONS FOR IMPROVEMENT

Even though newer legislations mitigate some of the previous problems, the time needed for the start of implementing the proposed solutions is still longer than it is supposed to be. The main obstacles to this problem have been identified and demo-partners have defined a set of recommendations for improvement to the current regulations based on these obstacles. The improvement is expected to bring numerous benefits including faster integration of the technologies developed, not only in the demo countries but also in other European countries.

Based on the contributions from the demo partners, the following recommendations are proposed:

Enhancing Education and Research. User Awareness

Institutions like UNIZG-FER in Croatia play a pivotal role in educating the next generation and conducting research in the energy sector. Incorporating real-world examples from projects like FLEXIGRID into lectures and research can foster a more practical understanding and drive innovation.

Some of the solutions implemented during the development of the FLEXIGRID project, and especially those implemented in the Croatian pilot, have a significant impact on ensuring the safer and easier planning and operation of a distribution network for a system operator. Advanced solutions help in mitigating the newly-created challenges caused by the rapid integration of renewable energy sources and other low carbon technologies. The main role of the UNIZG-FER is to educate a new generation of students and do research in the relevant field.

Parallelly, efforts should be made to educate customers about the benefits of these technologies, ensuring they are well-informed and motivated to participate.

Overcoming Legislative Barriers through Pilot Projects

In Spain, DSOs are proactively addressing legislative barriers by initiating projects like FLEXIGRID, which can serve as blueprints for future regulations. Therefore, increasing this type of initiatives not only in Europe, but also in Spain would help to continue identifying new regulations to ease the implementation of technological solutions that help DSOs.

As regards this, legislation on communications and effective implementation of the demo projects could be interesting for a better execution.

Incentivizing Participation through Ancillary Services Market Creation

Italy's recent ARERA Resolution 352/2021/R/EEL is a commendable step towards testing a market for ancillary services. It's crucial to determine the market model, identify the key players, and establish appropriate tariffs and incentives to encourage participation. This resolution comes in the wake of many projects that have already been initiated and concluded, such as the H2020 SmartNet project in which EDYNA participated.

Economic incentives can motivate producers and consumers to modify their withdrawal and input profiles. A market for ancillary services, where DSOs can also participate, should be created. Making certain services mandatory for new plants can further streamline the process.

Adjusting consumption pricing on an hourly basis, monitored with next-gen smart meters, can optimize energy consumption patterns.

When good results are achieved in experiments, the regulator, ARERA, has always shown interest in what has been achieved, and also takes these results into consideration for future deliberations.

At present, ARERA is working on overcoming the automatic remuneration of DSOs' investments and moving to a cost/benefit remuneration.

Cost/benefit remuneration in investments

Regulators like ARERA in Italy have shown adaptability by considering the results of successful experiments in their future deliberations. Such an approach should be encouraged across Europe.

At present, ARERA is working on overcoming the automatic remuneration of DSOs' investments and moving to a cost/benefit remuneration.

Promoting Energy Communities

Resolutions like the one in Italy promoting the creation of Energy Communities can incentivize onsite self-consumption and foster a community-driven approach to energy management.

Establishing a Regulatory Framework for the provision of flexibility services

Given the absence of a regulatory framework around the provision of flexibility services in European DSOs, the immediate recommendation is to establish such a framework. This would provide customers with regulatory incentives, promoting the adoption of innovative solutions.

Financial Incentives

Across countries, experts emphasize the importance of providing users with funding and financial incentives. This would not only encourage investments in new technologies, but also ensure their sustained interest.

Guarantee the secure access

Improve Cybersecurity regulations making emphasis on secure data access, like password-protected server access and limited information access, can further streamline the implementation of smart grid solutions. Users will feel safer when giving to others or putting their personal information into different platforms.

5. NEW REGULATIONS AND LEGISLATION

The development and implementation of FLEXIGRID's technologies have underscored the need for updated regulations and legislation to facilitate the Energy Transition in Europe. Based on the challenges identified during the demos and the contributions from partners, the following recommendations for new regulations and legislations are proposed:

Streamlining Implementation and Monitoring

- **Accelerated Implementation:**

Address the prolonged time lag between the introduction of new legislations and their implementation. This would facilitate faster integration of renewable energy sources and advanced solutions.

- **Monitoring and Knowledge:**

Emphasize the importance of facility knowledge and monitoring, driving new developments like Remote Management or BT supervision. New laws should provide a framework to cover these advancements, as highlighted by Spain demo partners.

Enhancing Security and Reliability

- **Security of Electricity Supply:**

The Croatian pilot showcased how certain solutions can bolster the security of electricity supply.

Legislation that will introduce penalties for not improving the relevant indicators is going to force system operators and other responsible entities to start acting quicker and make decisions that will ensure avoiding the penalties. Relevant indicators are the ones related to the security of supply, such as SAIDI or CAIDI. Based on their definition indicators' values differ from country to country and there is not a strict limitation for the values of the mentioned indicators.

However, there is the intention from the policy makers to standardize the way of calculating certain indicators, and their allowed values. After the standardization, DSOs will be obliged to follow the rules unless they want to be responsible for paying the predefined amount due to the unavailability of maintaining the observed indicators value within the allowed interval.

- **Power Quality Indicators:**

Regulations should more stringently define and monitor power quality indicators like voltage magnitude or voltage unbalance.

Even though regulations and legislations already define threshold values, it remains uncertain what happens in cases when thresholds are violated. New legislations should be oriented towards defining the penalties that DSOs will need to face. However, implementing FLEXIGIRD technologies will help DSOs to keep the values of all indicators within the wanted interval and they will not be affected by the new legislations if the new technologies are implemented.

Creation of Ancillary Services Market

- **Inclusive Ancillary Services Market:**

Both Italy and Spain demo partners emphasize the need for a regulated ancillary services market that involves all players connected to medium and low voltage grids.

This would incentivize producers and consumers to actively participate. Even though only Italian and Croatian partners proposed these new regulations they will be useful in all the European countries where FLEXIGRID's technologies could be applied.

- **Interface Devices and Management Software:**

As tested in the Italian pilot, devices like PCR2 and dispatching platform software are essential for managing flows on the grid. These tools should be standardized and integrated into the regulatory framework.

Incentivizing Producers and Addressing Costs

- **Remuneration for Ancillary Services:**

The pilot developed in Italy under FLEXIGRID project showed the technical possibility to regulate the dispersed energy resources commanded by a central platform.

This is very useful to improve the voltage and loads of the grid, but for the producers the supplying of these services is a cost, because the redaction of their production or the change of PF represents a decrease in profits. For this reason, a specific regulatory framework is necessary, and the creation of a determinate market for the ancillary service is opportune.

- **Islanding Mode Adaptation Costs:**

Regarding the islanding mode, the necessity of a market a remuneration of the service is less important, because the producer has already an advantage in maintaining his generator in function to give this service to the DSO.

In fact, in the normal management of a fault in the grid, the DSO uses its own generator sets and asks to producers connected to the grid stopping they self to not create interferences. But with the islanding mode service the producer can continue to put in the grid his active power, remunerated as usual. Eventually, an aspect to be study in deep, it is the cost recognition for the adaptation of the systems to be able to supply the service of islanding mode. In the Italian pilot the most important MV power plants were involved, but few of these were suitable for the islanding mode. To adapt a power plant to be able to regulate an island the estimated costs were around 10 k€. A similar cost cannot be covered only by the production during an islanding mode, for both the low probability to have the necessity of an islanding mode and the duration of the islanding mode. A regulatory framework should address these costs, ensuring producers are not unduly burdened.

Flexibility Services and Market Development

- **Flexibility Services Regulation:**

The Greek demo partners emphasized the potential of FLEXIGRID's solutions in providing services like peak shaving and demand response. A new regulation allowing energy users to provide such flexibility services would accelerate the adoption of these solutions.

- **Development of a Wider Flexibility Market:**

To foster a comprehensive flexibility market, resources should be allocated for optimum matchmaking between flexibility resources and requirements. This includes accurate forecasting of available flexibility from different assets.

6. CONCLUSIONS

The FLEXIGRID project aims to enhance the operation of the distribution grid, making it more adaptable, dependable, and cost-effective. To achieve this, eight technological solutions were crafted and assessed in particular scenarios across four demonstration sites to gauge various situations and their potential for replication in other European regions or territories.

This deliverable collects the current regulatory framework that governs the implementation of FLEXIGRID's solutions. The regulations that have the potential to influence the development of this solutions in Europe are described, considering European regulations and National Regulations in Spain, Croatia, Greece, and Italy. Through collaborative efforts with the demo partners, we have obtained valuable insights into the challenges they faced during the implementation of the pilots due to existing regulations.

The aforementioned obstacles, identified by demo partners, underscore the need for a more harmonized and forward-looking regulatory framework. Addressing these challenges will not only facilitate the smoother implementation of FLEXIGRID's technologies but will also raid the way for a more integrated and efficient European energy landscape for the implementation of Smart Grids.

The recommendations for improvement, drawn from both the analysis of the current framework and the feedback from the demo partners, offer a roadmap for promoting amendments in existing regulations. Beyond the recommendations for improvements to some specific regulations, one of the improvements that applies across the board to all regulations is the reduction in the implementation time of regulations. It has been observed that lately, advances in technology are occurring very quickly and that regulations are often lagging, which makes it difficult to implement these technologies. Moreover, the recommendations on new regulations presented are also based on the real-world challenges and insights gathered from the demos across various European countries.

These recommendations are not just theoretical suggestions but are grounded in the practical experiences of stakeholders actively involved in the energy transition. By addressing these recommendations, Europe can accelerate its transition to a more integrated, efficient, and green energy landscape.

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