Platone

PLATFORM FOR OPERATION
OF DISTRIBUTION NETWORKS

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PLATform for Operation of distribution NEtworks

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Report on the Analysis of the Regulatory and Legislative Framework

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Abstract

Distribution networks play a key role in the supply chain among power systems and consumers. The modern transformation in electric power systems must fulfill a number of objectives leading to a reliable and secure operation. This continuous development of electrical equipment is changing the way we approach smart grids and energy systems, seeking for energy independence and flexibility while at the same time respecting and fulfilling the existing regulatory and legislative framework and amending or expanding it when necessary. This report presents the main characteristics of the distribution grids in Europe and introduces the national and European legislative and regulatory framework concerning the innovative solutions developed in Platone and the three demonstration examples placed in Germany, Greece and Italy. This analysis will result in the understanding of the permissible and necessary limits according to which the project and three demonstration networks will be developed. Thus, possible obstacles can be surpassed and possible gaps in the European legislation can be defined to further clarify the current needs of the optimal operation of the distribution networks.

Keyword list

Distributed system operators, prosumer, legislation, clean energy package, blockchain

Executive Summary

Objective of the Report

This report provides an analysis in the European legislation for electricity networks according to the three demonstrations examples that will be developed in the framework of Platone project (PLATform for Operation of distribution Networks). Platone, thanks to a multilayer platform architecture collecting data and delivering secure information both to Distribution Management Systems and to an open Marketplace, will provide a seamless integration of operation and market, simplifying the life of customers, Distribution System Operators (DSOs), aggregators and other energy related players. This project targets the identification of new approaches to ameliorate the observability of renewable energy sources (RES) and to mitigate the load predictability in order to succeed in having a reliable and cost-effective power system. To achieve this, the main goal is to develop advanced management platforms which will combine the two aforementioned actions giving priority to the DSOs' policies and putting the consumers' involvement in the centre.

Background of the Project

DSOs together with the Transmission System Operators (TSOs) are nowadays responsible for the reliable operation of the electrical system and the continuous power supply of the consumers. However, in the most recent years, this task has become more challenging due to the integration and constant expansion of renewable energy sources linked to the distribution grids. At the same time, consumers are looking for greater energy flexibility, either by installing additive renewable sources in their houses or by exploring new market services. This evolution is having a significant influence on the power systems and especially on the DSOs, who are the operating managers of the energy distribution networks. To meet the consumers' demands, the DSOs are led to the use of innovative tools that will adapt to the new technology and requirements and will enhance their technology and their efficiency of operation.

Nevertheless, the DSOs are not independent, but they operate in accordance with specific laws and rules formed in European Union (EU) and in each country separately. They must adhere to the national and international regulatory framework which encourages consumers to install renewable energy resources and other distributed generators, while at the same time narrowing the operating margins of the DSOs, and deal with aspects such as adjustable costs or regulatory mechanisms concerning their operational behaviour towards the consumers. Consequently, with the cooperation, on the one hand, of the DSOs and, on the other hand, of the consumers, smart management platforms can be built which will increase the energy flexibility and will exploit the renewable energy generation capacity.

Overview of the Conclusions

The vital participation of DSOs and consumers towards the implementation of this platform proposed by Platone project requires not only the enforcement of the legislation concerning the system operators' side but also consumer protection (e.g. protection of personal data). The following report concentrates on the analysis of the laws which should be followed towards the development of the Platone's platforms and architecture that will be implemented at the three demo sites of the project (Italy, Greece, and Germany) and will enable the new solutions to be introduced. The description of the European legislation will give the principles and basis on which the implementation of the three demos should be structured. This analysis can be very fruitful, since obstacles, which concern mainly the active factors of a distribution network (protection of the consumers and interests of the distribution operators), can be addressed and possible gaps, which should be further improved and developed, can be identified. In general, the legislative framework sets the right balance between making decisions at EU, national, and local level. They will bring considerable benefits from a consumer, an environmental and an economic perspective. They will lead to more reliable and functional network that will be in favour of the customer, if all the energy stakeholders comply with the necessary measures concerning the purchase, energy, consumption and protection.

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Table of Contents

1 Introduction

The Platone project aims to develop an architecture for testing and implementing a data acquisitions system based on a two-layer approach (an access layer for customers and distribution system operator (DSO) observability layer) that will allow greater stakeholder involvement and will enable an efficient and smart network management. The tools used for this purpose will be based on platforms able to receive data from different sources, such as weather forecasting systems or distributed smart devices spread all over the urban area. These platforms, by talking to each other and exchanging data, will allow collecting and elaborating information useful for DSOs, transmission system operators (TSOs), customers and aggregators. In particular, the DSO will invest in a standard, open, non-discriminating, economic dispute settlement blockchain-based infrastructure, to give to both the customers and to the aggregator the possibility to more easily become flexibility market players. This solution will see the DSO evolve into a new form: a market enabler for end users and a smarter observer of the distribution network. By defining this innovative two-layer architecture, Platone removes technical barriers to the achievement of a carbon-free society by 2050, creating the ecosystem for new market mechanisms for a rapid roll out among DSOs and for a large involvement of customers in the active management of grids and in the flexibility markets. The Platone platform will be tested in 3 European trials (Greek, Germany and Italy) and the consortium aims to go for a commercial exploitation of the results after the project is finished.

Platone's targets and vision align with the energy goals of the European Union, which recently completed a comprehensive update of its energy policy framework to facilitate the transition away from fossil fuels towards cleaner energy. To deal with climate change and to protect the EU's energy competitors, the European Commission (EC) proposed a regulatory package which determines the new European energy policies. This package aims to establish new legislation and measures to reduce pollution caused by greenhouse gas emissions and to increase the use of renewable energy. Furthermore, the development of an internal energy market by changing and strengthening its regulation is one of the main priorities. Adapting the already existing electric regulatory framework, the EC developed new legislation, taking into account simultaneously the energy, financial and environmental factors, targeting a sustainable and reliable power supply. From that perspective, each European country has developed or ameliorated their legislation policies in order to be able to supervise the energy planning, the power quality and the electricity costs. To achieve this, the electrical power companies were obliged to accurately inform about their electrical infrastructures, their systems' performance and the quality of their services.

The **Clean energy for all Europeans package**, published in May 2019, is the most recent energy-related legislative framework of the EU and will help accelerate the clean energy transition [1]. The package includes eight legislative files. The new rules include the **Directive on common rules for the internal market for electricity (EU) 2019/944 (e-Directive)**, which replaces Electricity Directive (2009/72/EC), **the new Regulation on the internal market for electricity (EU) 2019/943 (e-Regulation)**, which replaced the Electricity Regulation (EC/714/2009) on January 1 2020, **the Directive (EU) 2018/2001 (RED II) and an enhanced role for the Agency for the cooperation of energy regulators (ACER)** which coordinates the work among national energy regulators. The Clean Energy Package cements the EU's energy objectives to transform and decarbonize its energy supply, reduce Europe's dependency on energy imports and ensure its security of supply.

1.1 Task 6.4 - Analysis of the Legislative and Regulatory Framework

This analysis is necessary to identify risks, gaps and uncertainties coming from the side of legislation that could possibly affect the project. In such cases, suitable recommendations will be produced. Because this technology is relatively new, it is necessary to identify how blockchain's potential can be deployed as much as possible.

1.2 Objectives of the Work Reported in this Deliverable

In the following, European legislation and regulations which concern the Platone project and the three demonstration examples which will be installed in three different countries, will be presented. Through this analysis, the allowed limits will be identified according to which these three demonstration examples

can be developed. Through this investigation, possible obstacles or gaps which could be later appear can be outlined.

1.3 Outline of the Deliverable

In the Ch. 2, the three demonstration examples are introduced giving a primary description of their structure and objectives. The third, fourth and fifth chapters introduce to the reader the EU's electricity market framework. The latest EU and National (of the three countries with the demo sites) legislation about energy balance, flexibility, DSOs, TSO/DSO cooperation, demand response and energy storage among others are presented. Chapter 6 highlights the role of the consumer. The entity of aggregator together with its recent regulatory framework are analyzed. Afterwards, in the seventh, eighth and ninth chapters, cybersecurity, data protection and data management regulations are introduced respectively, which are very significant factors because citizens are the core of the new legislations. The new rules introduce a comprehensive framework for consumer protection, information and empowerment in the EU electricity sector. Lastly, in Ch. 10, the blockchain and smart contracts regulatory framework is presented because blockchain technology plays a fundamental role in the Platone project. Finally, the conclusions of the analysis are presented pointing the main ideas and obstacles which could appear during the project's implementation.

1.4 How to Read this Document

In this report, the latest European and National legislations are presented thoroughly. Because the European legislation is renewed constantly according to the current technology and consumers' and DSOs' needs, increasingly putting the consumer in a dominant position, the reader should be continuously informed about them due to their future impact on the energy sector. The main focus is on the laws that concern Platone project, and where necessary, definitions are given for specific terms. There is no need for the reader to have previous specific prior knowledge on the subject, since the current legislation matters and previous decisions have been already officially published and are available to the general public.

Platone's "Data Management Plan" (initial release D9.1; final D9.2) provides detailed information on how the data will be processed in Platone and shared to support Open Research Data during the project's development and after the project's conclusion.

2 Description of the Three Demonstrations of Platone

Platone consists of three demonstration sites deployed in Italy, Greece and Germany. The three "demos" will not be identical - instead, each country has different Use Cases (UCs) that will be developed. However, a common platform is being developed by Engineering in WP2. The common Platform will be based on the Italian demo but both Greece and Germany will use specific parts of the Platform depending on their specific needs.

The demonstrations sites are summarized below:

- A field trial in Rome, Italy, which will demonstrate the complete structure of the platform.

The aim of the Italian demo is to define a fully functional system that enables distributed resources connected to medium and low voltage grid to provide services in different flexibility market models which include all the stakeholders (TSO, DSO, aggregators and end-users). The grid is completely underground because the field trial area has a high artistic value. The electric users in the area are very heterogeneous: (a) headquarters of important companies and institutions, (b) a shopping centre, (c) about 4,000 users connected in low voltage, (d) about 30 prosumers that use rooftop photovoltaic power plant, (e) about three big companies with a relevant Electric Vehicles fleet for testing V2G energy services.

- A field trial in Mesogeia, Greece, with specific focus on customer flexibility with indirect control methods.

The aim of the Mesogeia demo is to demonstrate the ability of DERs to provide ancillary services to the system, participate in the Day-Ahead (DA) and Balancing markets and contribute to the secure operation of the distribution network. The pilot site is located in the area of Mesogeia at the south-eastern part of Attica, near Athens and is considered as ideal for demonstration purposes since: a) it combines parts of mainland and interconnected islands, which gives an interesting mixture of locations, systems and infrastructure to be studied; b) provides a mix of rural, urban and suburban areas; c) consists of a customer mix including households, small, medium and large industries; d) has high RES penetration of various types and e) is close to the capital.

- A field trial in Germany, which will focus on the flexibility implementation.

The German demo site will focus on a low voltage network in a rural area with a high penetration of DER. It is these regions where a high potential for DER meets a low residential and commercial load where the challenges of the energy transition surface first. This demonstration aims at the supervision between local balancing mechanisms and centralized grid operation. Furthermore, the flexibility arrangement between the local network and the higher-level networks will be addressed. An effective informational and temporal uncoupling of low and medium voltage networks is another goal which will be treated by handling energy supply and export in bulk packages instead of a real-time exchange.

3 Flexibility and Demand Response

Platone aims at creating unique synergies between market and operations, developing a multi-layer platform for customer integration in network operation. This project plans to create a mechanism to link the edge structure with the DSO operation, both for market perspective and grid management and to develop a new concept of market platform that is able to collect and manage bids both for local grid management and for DSO-TSO interaction. Platone will address the growing needs of DSOs to have real-time insight into the operation of their networks while unlocking new flexibility markets in a fair and open way. Moreover, the Italian pilot will test the implementation of a "local flexibility market": The DSO will place on the market its own request for flexibility dedicated to its own connected customers. Considering the above mentioned aspects, it is important to examine the relevant regulatory framework.

3.1 Flexibility – Analysis of the Legislation and Regulation

Flexibility services include modification in consumption and generation patterns, in response to an external signal, to provide a service within the energy system. The provision of flexibility services at the distribution level can deliver value to the electricity system through, e.g., congestion management, voltage control, and the mitigation of power quality problems. At the same time, resources connected at the distribution level can benefit from the provision of flexibility services by means of cost savings, the improved quality of distribution activities, and the remuneration of the services provided [2].

Flexibility services may provide multiple services that can be divided from an economic perspective into:

- Energy services, both short-term (e.g. day-ahead markets) and long-term (e.g. commodity trading between two market players);
- Adjustment services (e.g. intraday markets) – trading of services to deal with imbalances; this also consists of trading among market players;
- Ancillary services (e.g. re-dispatching) – trading between System Operators (SOs) and market players in order to guarantee system integrity.

3.1.1 Involvement of DSOs and TSOs in Flexibility

Flexibility is of increasing interest and importance across the entire energy value chain [35]. In the **"Flexibility Use at Distribution Level"** report (July 2018) concerning the role of DSOs in facilitating greater flexibility on the energy system, the **Council of European Energy Regulators (CEER)** and **European Network of Transmission System Operators for Electricity (ENTSO-E)** together with **E.DSO for Smart Grids, CEDEC, Eurelectric and GEODE** described several approaches to enable DSOs and TSOs to access flexibility [3]:

- a rule-based approached – imposing flexibility requirements through codes and rules;
- network tariffs – designing cost-reflective network tariffs to better align the charges grid users face with the network costs they cause;
- connection agreements – DSOs could reach arrangements with customers for the provision of flexibility in return for a cheaper connection;
- market-based procurement – DSOs and TSOs can explicitly procure flexibility that benefits the grid services from the market(s);
- technical solutions using grid assets: a reconfiguration of the grid topology to alter power flows, including reactive power flows, and achieve a more desirable system state.

CEER proposed that the market-based approach is the preferred option because the procurement of flexibility on a competitive basis would be efficient as long as markets for the provision of flexibility that benefit the network are liquid and comply with unbundling rules. CEER does not consider that this would exclude the simultaneous use of other coordination mechanisms, e.g. incentivizing network tariffs. Codes and rules, which impose detailed flexibility requirements, network tariffs, connection agreements details and rules for market-based procurement should not be defined at EU-level but should be defined

by the Member States (MS) or the National Regulatory Authority (NRA) and be consistent with national provisions and national practices.

In the **e-Directive**, the market-based approach is adopted [4]. More precisely, in Art. 32, it is described that DSOs shall procure flexibility services in accordance with transparent, non-discriminatory and market-based procedures unless the regulatory authorities have established that the procurement of such services is not economically efficient or would lead to severe market distortions or to higher congestion.

In addition, to ensure cost-efficient, secure and reliable network planning and operation, **the e-Regulation** (Art. 57) foresees the exchange of all necessary data and information between TSOs and DSOs as well as the coordinated use of demand-side flexibility [5]. In that respect, the EU DSO entity will play an important role as a mouthpiece for the interests of all DSOs (Art. 51). The EU DSO entity is a cooperation of DSO's at EU level, "in order to promote the completion and functioning of the internal market in electricity, and to promote optimal management and a coordinated operation of distribution and transmission systems." (Art. 49)

In the following paragraphs the basic provisions of the regulatory framework are presented. The different key topics are based on the **"Assessment and roadmap for digital transformation of the energy sector towards an innovative internal energy market",** a European Commission research [2].

Cooperation among TSOs and DSOs

At present, provisions concerning the issue of the cooperation between DSOs and TSOs can be found in three different EU Regulations: **Regulation (EU) 2017/2195 ('Electricity Balancing Guideline'), e-Regulation and Regulation (EU) 2017/1485 ('SO GL') on Electricity Transmission System Operation Guideline**. The most important points relevant to Platone project of each legislation are presented below.

Electricity Balancing Guideline [5]

- **The obligation to consult the implementation of the Balancing Guideline.** The Balancing Guideline affirms the obligation for MS, NRAs and SOs to "consult with relevant DSOs and take account of potential impacts on their system when applying the Regulation" (Art. 3.2).
- **The cooperation in the provision of flexibility services.** The Regulation assigns a specific article (Art. 15) to the issue of the "Cooperation [of TSOs] with DSOs" in order to ensure "efficient and effective balancing service" (Art. 15.1).
- **A joint methodology for the allocation of costs resulting from the provision of active power reserves.** TSOs and DSOs shall elaborate a joint methodology for the allocation of costs resulting from the provision of active power reserves by reserve providing groups or units located in the distribution system (Art. 15.3).

e-Regulation [6]

- **The EU DSO Entity and the monitoring of implementation of the network codes and guidelines.** The Electricity Regulation institutes the so-called EU DSO entity (Art. 55.2). The EU DSO entity shall cooperate with ENTSO-E with respect to several subjects such as "the monitoring of implementation of the network codes and guidelines adopted [pursuant to the Regulation] with respect to the operation and planning of distribution grids and the coordinated operation of the transmission and distribution networks" (Art. 55.2).
- **The cooperation in the network planning and operation.** The Regulation obliges TSOs and DSOs to cooperate with respect to the planning and operation of networks (Art. 57.1) through the exchange of all the necessary information and data concerning a wide range of activities, such as: the performance of generation assets and demand side response; the daily operation of the networks and the long-term planning of network investments, with the view to ensure the cost-efficient, secure and reliable development and operation of their networks.
- **The coordinated access to resources connected at the distribution level.** The Regulation also highlights the issue of a coordinated "access to resources such as distributed generation,

energy storage or demand response that may support particular needs of both DSOs and TSOs" (Art. 57.2).

Regulation (EU) 2017/1485 (SO GL) [7]

- **The coordination between DSOs, TSOs (and Significant Grid Users) in the definition of the applicability and scope of data exchange concerning distribution-connected power generating facilities.** The Regulation affirms the obligation for DSOs and TSOs to "determine the applicability and scope of […]: (a) structural data […]; (b) scheduling and forecast data […]; (c) real-time data […]" with respect to distribution-connected power generating facilities" (Art. 40):
- structural data including information as: general data of the power generating module, including installed capacity and primary energy source or fuel type; Frequency Containment Reserve (FCR) data; Frequency Restoration Reserve (FRR) data; Replacement Reserve (RR) data; protection data; reactive power control capability; capability of remote access to the circuit breaker; data necessary for performing dynamic simulation according to the provisions in Regulation (EU) 2016/631; and voltage level and location of each power generating module (Art. 48);
- scheduling and forecast data concerns data related to scheduled unavailability, scheduled active power restriction and its forecasted scheduled active power output at the connection point; any forecasted restriction in the reactive power control capability (Art. 49);
- real-time data include evidence on: the status of the switching devices and circuit breakers at the connection point; and the active and reactive power flows, current, and voltage at the connection point (Art. 50).
- **The coordination between DSOs and TSOs with respect to the delivery of active power reserves**. The Regulation affirms the obligation for DSOs and TSOs to "cooperate in order to facilitate and enable the delivery of active power reserves by reserve providing groups or reserve providing units located in the distribution systems" (Art. 182). In particular, the prequalification process for the FCR, FRR and RR services shall specify the following information: voltage levels and connection points of the reserve providing units or groups; the type of active power reserves; the maximum reserve capacity provided by the reserve providing units or groups at each connection point; and the maximum rate of change of active power for the reserve providing units or groups.

Active role of DSOs in flexibility services

DSOs can enforce the flexibility services acting as an energy supplement which ensures an efficient and secure operation of the distribution system. In the following, parts of the e-Directive and e-Regulation will be introduced which highlight and define the role of the DSOs in flexibility services.

e-Directive

- **An incentive-based regulatory framework.** According to the e-Directive, "Member States shall provide the necessary regulatory framework to allow and provide incentives to distribution system operators to procure flexibility services, including congestion management in their areas, in order to improve efficiencies in the operation and development of the distribution system" (Art. 32.1).
- **The remuneration of reasonable costs.** The regulatory framework shall be designed to ensure the procurement of flexibility services from "all the existing resources" – "distributed generation, demand response or energy storage" – in a "cost-effective" way and to "adequately" remunerate DSOs for the procurement of such services (Art. 32.1). In particular, DSOs shall be able to recover their "reasonable corresponding costs, including the necessary information and communication technology expenses and infrastructure costs" (Art. 32.2).
- **Adoption of a long-term network development plan.** The establishment of the obligation to define a network development plan illustrating the needed investments "for the next five- to- ten years" (Art. 32.3) also requires setting a length of the regulatory period consistent with the required time-horizon established for the planning network investments. The plan shall provide

particular emphasis on “the main distribution infrastructure which is required in order to connect new generation capacity and new loads, including recharging points for electric vehicles” and the “the use of demand response, energy efficiency, energy storage facilities or other resources that the distribution system operator is to use as an alternative to system expansion” (Art. 32.3).

- **The coordination in the procurement of products and services.** The e-Directive affirms the obligation of coordination between DSOs and TSOs and other relevant market participants for “the procurement of products and services necessary for the efficient, reliable and secure operation of the distribution system” (Art. 31.6 and 32.2).

e- Regulation

- **An incentive-based regulatory framework.** Consistent with the e-Directive, the e-Regulation establishes that “tariff methodologies shall reflect the fixed costs […] and shall provide appropriate incentives to transmission system operators and distribution system operators, over both the short and long run, in order to […] facilitate innovation […] in areas such as digitalization, flexibility services and interconnection” (Art. 18.2). To this aim, regulatory methodologies may “introduce performance targets in order to provide incentives to distribution system operators to increase efficiencies in their networks, including through energy efficiency, flexibility and the development of smart grids and intelligent metering systems” (Art. 18.8).

3.1.2 Products Connected to the Flexibility Services

The specifications of the products for flexibility services, outlined in the Electricity Balancing Guideline, e-Regulation and e-Directive, allow identification of the rights and obligations of resources connected at the distribution level with respect to their participation in electricity markets.

Electricity Balancing Guideline

- **The settlement of imbalances.** The Electricity Balancing Guideline affirms the general principle that “all market participants should be financially responsible for the imbalances they cause in the system” (Art. 17). To this end, an efficient pricing methodology for the imbalance settlement “should create positive incentives for market participants in keeping their own balance or helping to restore the system balance in their imbalance price area, thereby reducing system imbalances and costs to society. Such pricing approaches should strive for the economically efficient use of demand response and other flexibility resources, subject to operational security limits” (Art.18, 30 and 32) In particular, the Balancing Guideline establishes that “imbalance prices should reflect the real-time value of energy” to make balancing markets and the overall energy system fit for the integration of the increasing share of variable renewable energy. In particular, the Balancing Guideline suggests the “single price” methodology as the pricing methodology for imbalance settlement (Art. 55). According Art. 55, each TSO shall set up rules to calculate the imbalance price, which can be positive, zero or negative for each imbalance price area within an imbalance settlement period.
- **Characteristics of Flexibility Service Products.** With respect to balancing markets, standard products for balancing energy and balancing capacity shall, in particular, […] “facilitate the participation of demand facility owners, third parties and owners of power generating facilities from renewable energy sources as well as owners of energy storage units as balancing service providers” (Art. 25). In general, with respect to balancing services markets, TSOs and DSOs shall set terms and conditions relative to balancing services that allow “the aggregation of demand facilities, energy storage facilities and power generating facilities” (Art. 18.4).

e-Regulation

- **The settlement of imbalances.** The e-Regulation establishes the principle that “all market participants shall be responsible for the imbalances they cause in the system and that each balance responsible party shall be financially responsible for its imbalances and shall strive to be balanced or shall help the electricity system to be balanced” (Art. 5). The imbalances shall be settled at a price that reflects the real-time value of energy (Art. 6).
- **Efficient congestion management.** The e-Regulation provides indirect incentives to DSOs and TSOs in mitigating congestion management activity. In particular, both DSOs and TSOs

are subject to a reporting activity towards the competent regulatory authority with respect to the level of development and effectiveness of market-based re-dispatching mechanisms for power generating, energy storage and demand response facilities; the reasons, volumes in MWh and type of generation source subject to re-dispatching (Art. 13.2).

e-Directive

- **Characteristics of flexibility service products.** The e-Directive establishes that DSOs shall procure, in particular, "non-frequency balancing services needed for its system in accordance with transparent, non-discriminatory and market-based procedures" (Art. 31.7). To this end, DSOs shall establish the "specifications for the flexibility services procured" and standardized market products for such services" (Art. 32.2) and procedures ensuring the participation of all market participants including "producers from renewable sources, demand response, operators of energy storage facilities and aggregators" (Art. 32.2). These specifications shall ensure the effective and non-discriminatory participation of all market participants (Art. 32.2). The provision of flexibility services shall be allowed, indeed, in each electricity market and according to a non-discriminatory treatment with respect to the access to such markets, the stipulation of contracts with aggregators, tariffs and network charges.
- **Prequalification criteria for the provision of flexibility services.** With respect to the entitlement of providing balancing services, neither the e-Directive nor the e-Regulation provides indications with respect to particular pre-qualification measures with reference to single resources or aggregators. The participation of market operators selling energy from renewable sources, engaged in demand response, operating energy storage facilities or engaged in aggregation is subject, to the definition of technical requirements for the participation established by the DSOs or the TSOs (for balancing services markets) in close cooperation with other market participants (Art. 31 and art. 40).

3.2 Demand Response – Analysis of the Legislation and Regulation

Under **Directive 2009/72/EC** of the European Parliament and of the Council, EU Member States are required to ensure the implementation of smart metering systems that assist the active participation of consumers in the electricity markets [8]. The Directive 2009/72/EC, which is part of the Third Energy Package - a legislative package proposed by the European Commission, that entered into force in 2009 and is being replaced by Clean Energy Package - defines the concept of "energy efficiency/demand-side management", acknowledging the positive impact on the environment, the security of supply, the decrease of primary energy consumption and the peak loads. The Art. 25.7 requires network operators to consider demand response and energy efficiency measures when planning system upgrades. Art. 3.2 also states "In relation to security of supply, energy efficiency/demand-side management and for the fulfilment of environmental goals and goals for energy from renewable sources, [...] Member States may introduce the implementation of long-term planning, taking into account the possibility of third parties seeking access to the system".

Moreover, the **2012 Energy Efficiency Directive** was a major step towards the development of demand response in Europe [9]. The Directive requires EU Member States to promote participation in and access to demand response. It also requires them to define technical modalities for participation in these markets.

Art. 15. 4 requires Member States to:

- "Ensure the removal of those incentives in transmission and distribution tariffs that are detrimental to the overall efficiency (including energy efficiency) of the generation, transmission, distribution and supply of electricity or those that might hamper participation of Demand Response, in balancing markets and ancillary services procurement".
- "Ensure that network operators are incentivized to improve efficiency in infrastructure design and operation, and, within the framework of Directive 2009/72/EC, that tariffs allow suppliers to improve consumer participation in system efficiency, including Demand Response, depending on national circumstances"

Art. 15. 8 states:

- "Member States shall ensure that national regulatory authorities encourage demand side resources, such as Demand Response, to participate alongside supply in wholesale and retail markets."
- "Subject to technical constraints inherent in managing networks, Member States shall ensure that transmission system operators and distribution system operators, in meeting requirements for balancing and ancillary services, treat demand response providers, including aggregators, in a non-discriminatory manner, on the basis of their technical capabilities."
- "Member States shall promote access to and participation of Demand Response in balancing, reserves and other system services markets, inter alia by requiring national regulatory authorities [...] in close cooperation with demand service providers and consumers, to define technical modalities for participation in these markets on the basis of the technical requirements of these markets and the capabilities of Demand Response. Such specifications shall include the participation of aggregators."

According to Art.2.20 of the new **e-Directive**, demand response means "the change of electricity load by final customers from their normal or current consumption patterns in response to market signals, including in response to time-variable electricity prices or incentive payments, or in response to the acceptance of the final customer's bid to sell demand reduction or increase at a price in an organized markets as defined in point (4) of Art. 2 of Commission Implementing Regulation (EU) No 1348/2014, whether alone or through aggregation".

In general, demand participation in electricity markets requires that consumers have:

- the equipment (e.g. smart meters);
- the real-time information;
- the contracts that allow them to react to price increases and to adapt their electricity consumption accordingly.

The e-Directive ensures that the Member States and the system operators have to provide consumers with all the necessary data and equipment in indiscriminately (Art. 19, Art. 20, Art.21).

3.3 The Three Demos - Discussions

The **Energy Industry Act (*Energiewirtschaftsgesetz, EnWG*)** sets out the main regulatory framework in the electricity sector in **Germany** [10]. The **Electricity Market Act (Strommarktgesetz**), which passed into law at the end of July 2016, further modernizes the electricity market [11]. The Electricity Market Act is an umbrella act. It amends various acts and ordinances, including the Energy Industry Act, the Renewable Energy Sources Act and the Reserve Power Plant Ordinance.

The main pieces of legislation regulating the electricity sector in **Greece** are: a) the Law no. 4001/2011, OJ 179 A/22.08.2011 (the Energy Framework Law); b) the law no. 4425/2016, OJ A'185/30.09.2016, as amended by the law 4512/2018, OJ A'5/17.01.2018 regulating the establishment and operations of the Energy Exchange, (the Energy Exchange law); and c) the Law 4389/2016, OJ A' 94/27.05.2016, regulating the quarterly electricity forward products' auctions (the NOME law) [12].

In **Italy,** the electricity market is governed by Legislative Decree No. 79 of 16 March 1999 (Decree 79/99), which transposed Directive 96/92/EC concerning common rules for the internal market in electricity into national legislation [13], [14]. The electricity market is undergoing a significant transformation both in terms of structure and regulation. In 2017, the Italian government approved the National Energy Strategy setting out future policy goals for the electricity sector. The objective is to make the national energy system more competitive, sustainable and secure [15].

3.4 Brief Chapter Summary

The e-Regulation and e-Directive are two of the eight new legislative acts that consist the Clean Energy Package, which is the new policy framework of EU to facilitate the European energy transition. They are the cornerstone of developing forward-looking European electricity markets, adapting to the increasing contribution of renewables, and integrating new sources of flexibility. Important aspects of these new

legislations concern the role of DSOs in energy flexibility and demand response. The EU adopts a market-based approach to enable DSOs to use and procure flexibility services, especially to solve local constraints in their networks and to defer reinforcements of the grid when the use of flexibility is the most efficient means. However, it is important for the DSOs to be neutral market facilitators. That means that the DSOs shall procure flexibility services in accordance with transparent, non-discriminatory and market-based procedures, unless, as it is highlighted, the regulatory authorities have established that the procurement of such services is not economically efficient or that such procurement would lead to severe market distortions or to higher congestion. Moreover, cooperation with TSOs in network operation and development is important.

However, the rules, which impose detailed flexibility requirements, network tariffs, connection agreements details and the rules for market-based procurement should not be defined at EU-level but should be defined by the MS or the NRA and be consistent with national provisions and national practices. This can lead to a possible inconsistency among the MS on achieving EU energy targets because of the different priorities of each country. Action by the EC is limited by Article 194 of the Lisbon Treaty, agreed in 2017 [72]. It states that measures established by the European Parliament and Council to achieve energy market objectives and security of supply “shall not affect a Member State's right to determine the conditions for exploiting its energy resources, its choice between different energy sources and the general structure of its energy supply”. It is an important issue that the EU should analyze, maybe by taking into account to its policy framework the differences between its Member States [73].

4 Consumer – Prosumer

The blockchain technology, that will be one of the main axes of Platone, will increase the direct consumer participation in the energy and flexibility marketplaces. Platone aims to empower the consumers to become active and informed stakeholders in the energy sector, being in accordance with the EU's recent targets about citizens. The EU's newest relevant directives of the Clean Energy Package - RED II and e-Directive – are presented in chapter 4.1 below. Platone's solution will focus on offering to the final customers connected to the DSOs' grids a full range of solutions both on the Hardware/Software (HW/SW) access layer to the flexibility market and to all the financial/economic opportunities coming from supply-demand of energy services. The Italian pilot will implement a complete end to end flexible environment, i.e. a real integrated market where, applying highly innovative distribution network technologies like blockchain and new grid equipment, retail and business customers interact with both aggregators (to access new flexibility market options) and the DSO to become active players of the network optimized management in an effective and efficient Active Distribution Network.

4.1 Putting the Consumer in the Active Position - Analysis of the Legislation and Regulation

The European Commission explicitly acknowledged in its **Energy Union strategy (COM/2015/080)** that "citizens should be at its core, where they take ownership of the energy transition, benefit from new technologies to reduce their bills, participate actively in the market, and where vulnerable consumers are protected." [16]

On 15 July 2015, the European Commission adopted a Communication on **Delivering a New Deal for energy consumers ('New Deal')**, as part of the **Summer Energy Package** [17]. The New Deal emphasizes on the importance of three key points: consumer empowerment, smart homes and networks and data management and protection [18]. In this document, the EC has summarized ten main European Energy Consumers' Rights established under EU law [19]:

1. Right to have your home connected to the local electricity network;
2. Choice of supplier from full range of EU suppliers offering their service in your area;
3. Easy and fast switch of supplier (changes to take place within three weeks of request);
4. Clear contract information and right of withdrawal;
5. Accurate information on consumption (including competitively priced individual meters for electricity and gas in all new, or extensively renovated, buildings);
6. Information on how to use energy more efficiently (including the EU energy label) as well as the benefits of renewables to be provided by all energy suppliers;
7. Vulnerable consumers to be identified and measures put in place to protect them;
8. Easy resolution of complaints or disputes (including an independent out-of-court dispute settlement body and not only through legal channels);
9. Energy performance certificate for every home to buy or rent;
10. Single national contact point for energy, consumer rights set out in national laws.

The **EU Clean Energy Package** was adopted in May 2019, comprising of a series of policy documents and legislative proposals that included provisions on prosumers [47]. The new rules outline a comprehensive framework for consumer protection, information and empowerment in the EU electricity sector. The most relevant of the directives are the **RED II** and the **e-Directive**. For the first time ever, the EU has established a right for energy consumers to both produce and consume (prosume) their own electricity, and obliges its Member States to adopt a legislative framework to enable prosumers to exercise this right. Prosumer is a new term that, in the energy field, most often denotes consumers who both produce and consume electricity. They self-consume some of the electricity they produce, and sell the excess to the grid. But when their production falls short, they also buy power from the grid, which makes them both producers and consumers. Examples of prosumers include residential, commercial and public prosumers and citizen-led energy cooperatives [55], [56].

The **RED II** [20] defines “Renewable self-consumers” as “a final customer operating within its premises located within confined boundaries or where allowed by Member States, on other premises, who generates renewable electricity for its own consumption, and may store and sell self-generated renewable electricity, provided that, for non-household renewable self-consumers, those activities do not constitute their primary commercial or professional activity” (Art.2.14). Moreover, it defines “Renewable Energy Communities” (RECs) (Art.2.16) as legal entities which are optional, member-controlled organisations, proximate to renewable energy projects they own or operate. Their primary purpose should be to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits. RECs’ shareholders must be natural persons, SMEs or local authorities, including municipalities.

In Art. 21, it is highlighted that “Member States shall ensure that consumers are entitled to become renewables self-consumers” and a series of consumer rights are mentioned.

According to the RED II, Art. 22.1, RECs are entitled to self-arrange sharing of renewable energy within the community and to access all suitable energy markets directly or through aggregation in a non-discriminatory manner. RECs are limited to renewable energy technologies and may be active in all energy sectors (CEER, 2019). Participation in a REC should be accessible also to low-income and vulnerable households (Art. 22.4(f)).

Additionally, the **e-Directive** presents the definition of ‘Citizen Energy Community’ (CEC) (Art. 2.11), which is similar to Renewable Energy Community. The difference is that CECs may also engage in operating grid infrastructure, as well as in aggregation, storage, energy efficiency services or other energy services. Unlike RECs, CECs’ activities are restricted to the electricity sector only. Also, the e-Directive does not specify that the activities of CECs cannot constitute a primary commercial or professional activity and there is no geographic limitation, so this type of community can be a virtual network. CECs provide a potentially more inclusive model than RECs, since participation is not restricted to a specific location.

The e-Directive, in Art. 2, provides a series of definitions for the different types of customers. Moreover, it ensures rights of the consumers to participate in the electricity market (Art.3, Art.13), as well as their access to consumption data (Art.21).

4.2 The Three Demos - Discussions

The **German Renewable Energy Act (EEG)** sets out a framework for consumers, prosumers and energy communities [21]. The framework came into force on 1st January 2017 without including the RED II and e-Directive. In 2017, the **Tenant Supply Act (Mieterstrom)** has been introduced (BMWI 2017), which allows the plant operator in a multi-family house to sell locally produced electricity to the tenants in direct proximity [24]. Also, with the **“Act on the Digitisation of the Energy Transition” (Gesetz zur Digitalisierung der Energiewende)**, the government focuses on the installation of smart meters in Germany. The goal is to develop a digital infrastructure capable of connecting more than 1.5 million electricity producers and large-scale consumers. The law has been in force since September 2nd, 2016 [22], [23].

Until now, **Italy** had not any specific regulatory framework [49], but new measures were introduced in March 2020 [25]. The Italian government has amended its near-annual **Milleproroghe decree** of bundled new legislation to include a provision enabling homes, businesses and public entities to invest in, generate, sell and distribute renewable energy. The new framework is open to power projects with a generation capacity no larger than 200 kW. The new provisions anticipate the transposition of regulations brought into force under the new Renewable Energy Directive (RED II) adopted by the EU in December 2018.

In January 2018, a new law on energy communities was voted in the **Greek** Parliament [26], which defines the role of citizens in the energy sector, and gives wide scope for energy communities (**OJ A 9/23.01.2018**). The law encourages citizens, local authorities and private and public agencies to participate in the production, distribution and supply of energy; essentially, it gives electricity consumers a possibility to become electricity producers [27], [28].

4.3 Brief Chapter Summary

EU's clean energy package wants the consumers to become active and informed stakeholders in the energy sector, which is also one of the main goals of Platone. The new EU legislations, that have been mentioned in this chapter, outline a comprehensive framework for consumer protection, information and empowerment in the EU electricity sector. The most relevant of the directives are the RED II and the e-Directive. Consumers can have more than one electricity supply contract at the same time, provided that the required connections and metering points are established - the smart metering expansion however is at different stages in the EU countries. Moreover, if a customer wishes to change supplier, he is entitled to such change but only within three weeks.

Consumers will be free to buy and trade electricity services independently from their electricity supply contractors. The right for consumers to generate and sell their electricity is not only ensured individually but also collectively (energy communities). EU Member States are expected to enable power producers to supply customers within their territories through direct lines, without being subject to disproportionate administrative procedures or costs. It has asked MS not to introduce or maintain requirements, administrative fees, procedures and charges for active clients that participate to the energy market through their own distributed power generators or through the aggregation market [71].

5 Energy Storage

Energy storage has a key role to play in the transition towards a carbon-neutral economy, and it addresses several of the central principles in the Clean Energy for all Europeans Package. By balancing power grids and saving surplus energy, it represents a concrete means of improving energy efficiency and integrating more renewable energy sources into electricity systems, but it will also help enhance European energy security and create a well-functioning internal market with lower prices for consumers.

Energy storage is also a subject that will be examined in Platone project. Concerning the German demonstration, the goal is to utilize the energy storage in order to minimize the exchange between the local network and the supplying medium voltage feeder. Moreover, in the Italian demo, one of the activities is the installation and the management of the battery energy storages at the end-users.

5.1 Development of the Energy Storing Devices – Analysis of the Legislation and Regulation

A variety of technologies to store electricity are developing at a fast pace and are increasingly becoming more market competitive, but there are significant challenges in terms of limited access to grids and excessive fees. To address these issues and identify how to further develop energy storage technologies, the European Commission published **guiding documents on proposed definition and principles in June 2016** [29] **and the role of electricity in energy storage in February 2017** [30].

In these documents, the EC identified the lack of a proper and concrete regulatory framework and proposed a number of more general guidelines that would be beneficial for energy storage. Development and financing of energy storage could therefore rely on a number of principles:

- “Energy storage should be developed to the extent the overall costs of the new energy system are lower with storage than without storage;”
- “In relation to the electricity grid energy storage should be rewarded for the services provided on a peer basis with the alternative suppliers for those services, being demand response or flexible generation;”
- “Energy storage as a supporting mean for integrating variable renewable energy (vRE) should be rewarded for the contribution to improving energy security and decarbonisation of the electricity grid or other economic sectors; the avoided costs of vRE curtailment and the carbon reductions of the backup capacities could support the business case of large-scale energy storage;”
- “When a generator or a consumer chose to integrate a storage facility at its location, this should not lead to less favourable treatment, neither in terms of obligations nor in terms of eventual support that it receives in the energy system;”

The **Electricity Market Design Directive**, part of the Clean Energy Package, aims to reduce barriers to energy storage, and mandates non-discriminatory and competitive procurement of balancing services and fair rules in relation to network access and charging. The directive has adopted the proposals and sets a clear definition for energy storage:

“**Energy storage** in the electricity system would be defined as the act of deferring an amount of the energy that was generated to the moment of use, either as final energy or converted into another energy carrier”.

With a series of articles, the e-Directive sets new guidelines for the energy storage, including provisions about ownership of energy storage facilities by customers and DSOs and the role of TSOs. The most important of them are presented below:

“Article 15. Active customers

Member States shall ensure that active customers that own an energy storage facility:

1. have the right to a grid connection within a reasonable time after the request, provided that all necessary conditions, such as balancing responsibility and adequate metering, are fulfilled;

2. are not subject to any double charges, including network charges, for stored electricity remaining within their premises or when providing flexibility services to system operators;
3. are not subject to disproportionate licensing requirements or fees;
4. are allowed to provide several services simultaneously, if technically feasible."

"Article 36. Ownership of energy storage facilities by distribution system operators

1. Distribution system operators shall not own, develop, manage or operate energy storage facilities.
2. By way of derogation from paragraph 1, Member States may allow distribution system operators to own, develop, manage or operate energy storage facilities, where they are fully integrated network components and the regulatory authority has granted its approval, or where all of the following conditions are fulfilled:
   a) other parties, following an open, transparent and non-discriminatory tendering procedure that is subject to review and approval by the regulatory authority, have not been awarded a right to own, develop, manage or operate such facilities, or could not deliver those services at a reasonable cost and in a timely manner;
   b) such facilities are necessary for the distribution system operators to fulfil their obligations under this Directive for the efficient, reliable and secure operation of the distribution system and the facilities are not used to buy or sell electricity in the electricity markets; and
   c) the regulatory authority has assessed the necessity of such a derogation and has carried out an assessment of the tendering procedure, including the conditions of the tendering procedure, and has granted its approval.

   The regulatory authority may draw up guidelines or procurement clauses to help distribution system operators ensure a fair tendering procedure.
3. The regulatory authorities shall perform, at regular intervals or at least every five years, a public consultation on the existing energy storage facilities in order to assess the potential availability and interest in investing in such facilities. Where the public consultation, as assessed by the regulatory authority, indicates that third parties are able to own, develop, operate or manage such facilities in a cost-effective manner, the regulatory authority shall ensure that the distribution system operators' activities in this regard are phased out within 18 months. As part of the conditions of that procedure, regulatory authorities may allow the distribution system operators to receive reasonable compensation, in particular to recover the residual value of their investment in the energy storage facilities.
4. Paragraph 3 shall not apply to fully integrated network components or for the usual depreciation period of new battery storage facilities with a final investment decision until 4 July 2019, provided that such battery storage facilities are:
   a) connected to the grid at the latest two years thereafter;
   b) integrated into the distribution system;
   c) used only for the reactive instantaneous restoration of network security in the case of network contingencies where such restoration measure starts immediately and ends when regular re-dispatch can solve the issue; and
   d) not used to buy or sell electricity in the electricity markets, including balancing."

"Article 40. Tasks of transmission system operators

Each transmission system operator shall be responsible for managing electricity flows on the system, taking into account exchanges with other interconnected systems. To that end, the transmission system operator shall be responsible for ensuring a secure, reliable and efficient electricity system and, in that

context, for ensuring the availability of all necessary ancillary services, including those provided by demand response and energy storage facilities, insofar as such availability is independent from any other transmission systems with which its system is interconnected;"

"Article 42. Decision-making powers regarding the connection of new generating installations and energy storage facilities to the transmission system

1. The transmission system operator shall establish and publish transparent and efficient procedures for non-discriminatory connection of new generating installations and energy storage facilities to the transmission system. Those procedures shall be subject to approval by the regulatory authorities.
2. The transmission system operator shall not be entitled to refuse the connection of a new generating installation or energy storage facility on the grounds of possible future limitations to available network capacities, such as congestion in distant parts of the transmission system. The transmission system operator shall supply necessary information."

Moreover, the "**Electricity Balancing Guideline**" allows owners of energy storage units to become balancing service providers and highlights the importance of facilitating their participation at the balancing market (Art. 18.4).

5.2 Brief Chapter Summary

Energy storage will play a key role in enabling the EU to develop a low-carbon electricity system. Energy storage can supply more flexibility and balancing to the grid, providing a back-up to intermittent renewable energy. The Clean Energy Package sets a foundation for the network integration of energy storage and the further growth of a market for energy storage that is open to all relevant technologies and introduces a definition of energy storage valid for all EU Member States. To date, there exists no precise and appropriate definition for energy storage in the three countries of the project and this legal gap must finally be filled by 2021 at the latest, when the Clean Energy Package legislation needs to be implemented by all Member States.

The support for prosumers or energy communities in e-Directive and RED II are two further good examples with potential to better harness and utilise the capabilities of energy storage for the continent's transition towards carbon-neutrality. Moreover, final customers are entitled to store and sell self-generated electricity in all organised markets either individually or through aggregators. However, the barrier of double-charging, which is levying energy storage systems with fees when both consuming or transferring power from and to the grid, still exists. The Commission is currently carrying out an evaluation of the Energy Taxation Directive of 2003. Another issue that should be mentioned is that e-Directive states that customers owning a storage facility are allowed to provide several services simultaneously, if technically feasible. However, that applies to customers who store electricity generated within their premises, sell self-generated electricity or participate in flexibility schemes, provided that these activities do not constitute their primary commercial or professional activity. The e-Directive does not address the case of companies who provide such services as their main activity.

The e-Directive mentions also that DSOs would not be allowed to own, develop, manage or operate energy storage facilities, except in certain cases mentioned in Chapter 5.1, in order to maintain their neutrality in this regulated market.

6 Aggregator

The Aggregator is a new type of actor in the electricity systems that can influence a number of grid-connected units via a communication interface [31]. The units are coordinated, usually by a centralized optimization. Aggregators may operate in different geographical parts of the grid and use the units in their portfolio for interchange with the electricity and auxiliary service markets. Aggregators' business models typically assume a "transactional" relationship with the consumer, whereby price or volume signals, reflecting market signals, are sent to the consumer by the Aggregator, with the consumer assuming responsibility for reacting to these signals [32].

The blockchain-based infrastructure of Platone will give Aggregators the possibility to more easily become flexibility market players and to exchange customers between them in a simple and reliable/certificated way. The Platone framework aims to create a fully replicable and scalable system that enables distribution grid flexibility/congestion management mechanisms through Peer 2 Peer (P2P) market models involving all the possible actors including Aggregators. Aggregators will be active players in the DSO Technical Platform of Platone, exchanging data with DSOs and customers. In Greek demo site, the concept of Aggregator will be employed as an intermediate between DERs and the DSO and for the Italian demo an Aggregator platform will be created.

6.1 Demand Side Response Aggregators – Analysis of the Legislation and Regulation

There are multiple references to demand side response (DSR) Aggregators in the European energy market legislation.

The **Energy Efficiency Directive 2012/27/EU** was an important step forward for the DSR in Europe. Article 15.8 introduces the term of aggregator for the first time in EU:

"Member States shall ensure that national energy regulatory authorities encourage demand side resources, such as demand response, to participate alongside supply in wholesale and retail markets. Subject to technical constraints inherent in managing networks, Member States shall ensure that transmission system operators (TSO) and distribution system operators (DSO), in meeting requirements for balancing and ancillary services, treat demand response providers, including aggregators, in a non-discriminatory manner, on the basis of their technical capabilities. Subject to technical constraints inherent in managing networks, Member States shall promote access to and participation of demand response in balancing, reserve and other system services markets, inter alia by requiring, [...] in close cooperation with demand service providers and consumers, to define technical modalities for participation in these markets on the basis of the technical requirements of these markets and the capabilities of demand response. Such specifications shall include the participation of aggregators."

The **Electricity Balancing Guideline (2017/2195),** in follow up of the **Regulation (EC) No 714/2009**, allows the aggregation of demand facilities, energy storage facilities and power generating facilities in a scheduling area to offer balancing services (Art. 18.4).

According to Art. 2.19 of the **Demand Connection Code (DCC)** [33]**,** demand aggregation represents a set of demand facilities (*demand facility: a facility which consumes electrical energy and is connected at one or more connection points to the transmission or distribution system*) or closed distribution systems which can operate as a single facility or closed distribution system for the purposes of offering one or more demand response services (*demand response: the change of electricity load by final customers from their normal or current consumption patterns in response to market signals* – e-Directive Art. 2.20).

6.2 Electricity Market and Renewable Sources – Analysis of the Legislation and Regulation

Analyzing the **Clean Energy Package** shows that many provisions in the relevant regulatory acts (the Regulation on the Internal Market for Electricity, the Directive for the Internal Market in Electricity and the Renewable Energy-Directive) mention aggregators or aggregation in different contexts [2], [34].

The **Directive for the Internal Market in Electricity (e-Directive)**, which will be applied in 2021, outlines rules for the generation, transmission, distribution, supply and storage of electricity, together with consumer protection aspects, aiming to create integrated competitive, consumer-centred, flexible, fair and transparent electricity markets in the EU. In Art. 2, the concept of Aggregator is defined as "a market participant that combines multiple customer loads or generated electricity for sale, for purchase or auction in any organized energy market". "Independent Aggregator" is defined as a market participant that performs aggregation which is not affiliated to its customer's supplier. The key topics related to aggregators in this directive are presented below.

Aggregators as enablers:

- "Customers should be allowed to make full use of the advantages of aggregation of production and supply over larger regions and benefit from cross-border competition. Market participants engaged in aggregation are likely to play an important role as intermediaries between customer groups and the market. Member States should be free to choose the appropriate implementation model and approach to governance, for independent aggregation while respecting the general principles as laid out in this Directive. This could include market-based or regulatory principles which provide solutions which achieve the provisions set out in this Directive, including models where imbalances are settled or where perimeter corrections are introduced. The chosen model should contain transparent and fair rules to allow independent aggregators to fulfill this role and to ensure, that the final customer adequately benefits from their activity. Products should be defined on all energy markets, including ancillary services and capacity markets so as to encourage the participation of demand response." (Art. 26)
- "Member States shall ensure that all customers are free to purchase and sell electricity services, other than electricity supply, including aggregation, independently from their supply contract and from an electricity undertaking of their choice." (Art.13)
- "Member States shall ensure that, where a final customer wishes to conclude an aggregation contract, this shall not require the consent of the final customer's electricity undertaking." (Art.13)

Concerning Demand Response (Art. 17):

- "Member States shall ensure that national regulatory authorities encourage final customers, including those offering demand response through aggregators, to participate alongside generators in a non-discriminatory manner in all organized markets."
- "Member States shall ensure that transmission system operators and distribution system operators when procuring ancillary services, treat demand response providers, including independent aggregators, in a non-discriminatory manner, on the basis of their technical capabilities."
- "Member States shall ensure that their regulatory framework encourages the participation of aggregators in the retail market and that it contains at least the following elements:

  (a) the right for each aggregator to enter the market without consent from other market participants;

  (b) transparent rules clearly assigning roles and responsibilities to all market participants;

  (c) transparent rules and procedures for data exchange between market participants that ensure easy access to data on equal and non-discriminatory terms while fully protecting commercial data;

  (d) aggregators shall not be required to pay compensation to suppliers or generators;

  (e) a conflict resolution mechanism between market participants."
- "Member States shall ensure access to and foster participation of demand response, including through independent aggregators in all organized markets. Member States shall ensure that national regulatory authorities or, where their national legal system so requires, transmission system operators and distribution system operators in close cooperation with demand service providers and final customers define technical modalities for participation of demand response

in these markets on the basis of the technical requirements of these markets and the capabilities of demand response. Such specifications shall include the participation of aggregators."

Regulation on the Internal Market for Electricity (e-Regulation) states that market participation of consumers and small businesses shall be enabled by aggregation of generation from multiple generation facilities or load from multiple demand facilities to provide joint offers on the electricity market and be jointly operated in the electricity system, subject to compliance with EU treaty rules on competition (Art. 3). The key points related to are presented below:

Aggregation and market participation

- "All market participants shall be responsible for the imbalances they cause in the system" (Art. 4)
- "Balancing markets, including prequalification processes shall be organized in such a way as to ensure non-discriminatory access to all market participants, including electricity generated from variable renewable sources, demand response and energy storage, be it individual or through aggregation and also mentions the possibility of the participation in the procurement of balancing capacity through aggregation." (Art. 5)
- "Day-ahead and intraday markets are organized in such a way as to ensure that all markets participants are able to access the market individually or through aggregation." (Art. 6 para. 2)

Regarding a framework for local settlement of generation, energy communities and self-consumption several provisions are to consider Art.21 and Art.22 of **Renewable Energy Directive (RED II)** related to the renewable self-consumer and the renewable energy community and their connection with the concept of aggregator.

In Art. 21 of RED II, renewable self-consumers, individually or through aggregators, are entitled to generate renewable energy, including for their own consumption, store and sell their excess production of renewable electricity. This includes power purchase agreements, electricity suppliers and peer-to-peer trading arrangements.

Art. 22 outlines benefits renewable energy communities. They are entitled to generate, consume, store and sell renewable energy, including through power purchase agreements; to arrange sharing of renewable energy within the community that is produced by the production units owned by the community; to access all suitable energy markets directly or through aggregation in a non-discriminatory manner. It also states that Member States shall provide an enabling framework to promote and facilitate the development of renewable energy communities.

6.3 Brief Chapter Summary

In European markets, Aggregators deal mainly with large scale industrial and commercial entities, with limited examples of Aggregators engaging with smaller non-domestic and domestic customers. However, with the introduction of smart metering alongside advances in digital technologies, it is perceived that flexibility aggregation will become more accessible to smaller non-domestic and domestic customers within the next few years and the Aggregator will take the role of the intermediary among decentralized actors and the market and help small actors like renewable self-consumers, active customers, or small businesses to participate in the electricity market.

The e-Directive from Clean Energy Package determines with several articles the role of Aggregator and highlights the obligation of the member states to ensure that their regulatory framework encourages their participation in the retail market. Moreover, the Electricity Balancing Guideline allows the aggregation of demand facilities, energy storage facilities and power generating facilities in a scheduling area to offer balancing services and e-Regulation provides some guidelines about Aggregators' market participation. The Renewable Energy Directive connects renewable self-consumer and the renewable energy community with the services that an Aggregator can provide.

7 Cybersecurity

Cybersecurity is one of the most important issues is cybersecurity in Platone project. Digitalization and technologies such as blockchain, will play a key role in Platone project with the development of platforms able to receive data from different sources, such as weather forecasting systems or distributed smart devices spread all over the urban or semi-rural areas of the demo sites.

7.1 Cybersecurity in European Union – Analysis of the Legislation and Regulation

The digitalization of industry, including energy, is at the core of all major EC initiatives such as the Digital Single Market, the Energy Union package and the Single Market strategy. These initiatives aim to create the right framework conditions to accompany the transformation of our markets, processes, actors and to provide consumer benefits in this digitalization trend.

One of the major challenges accompanying this trend is the need to ensure appropriate cybersecurity for operators, market participants and consumers [36]. The more devices are getting digitally connected to the power system, the more they expose a very critical infrastructure to the risk of cyberattacks. As a result, cybersecurity is becoming a notable challenge for many stakeholders of the energy sector. As energy systems develop ubiquitous intelligence and communication capabilities throughout their operations, the security of critical infrastructure is now a core issue in national, international, and corporate security dialogue and policies.

Cybersecurity is now considered among the highest priorities for the European Union [37]. At EU level, a cybersecurity framework is set by the **Network and Information Systems Directive** (NISD), adopted in July 2016, which is the cornerstone for strategic cooperation among Member States. The Directive specifies measures to achieve a high common level of security of networks and information systems within the EU to improve the functioning of the internal real and digital market. The basic points of the directive concerning cybersecurity are:

- **Supervisory role of national competent authorities.** (Art. 8) Each Member State shall designate one or more national competent authorities on the security of network and information systems. The competent authorities shall monitor the application of this Directive at national level.
- **Incidents management.** (Art. 9) Member States should be adequately equipped, in terms of both technical and organizational capabilities, to prevent, detect, respond to and mitigate network and information system incidents and risks. They should therefore ensure that they have well-functioning Computer Security Incident Response Teams (CSIRTs) complying with essential requirements to guarantee effective and compatible capabilities to deal with incidents and risks and ensure efficient cooperation at EU level.

In addition to the NISD, the recently adopted **Clean Energy Package** includes provisions for the adoption of future technical rules for electricity such as a Network Code on Cyber Security. In September 2017, the Commission presented the "**Cybersecurity Package**" under the demand side management (DSM) strategy, which builds upon existing instruments and presents new initiatives to further improve EU cyber resilience and response [38]. As part of the package, the Commission presented a legislative proposal, the "**Cybersecurity Act**" [39], including:

- **The reinforcement of European Union Agency's for Network and Information Security (ENISA) role.** With the Regulation (EU) No 526/2013 ENISA was tasked to assist the EU and the MS in enhancing and strengthening their capability and preparedness to prevent, detect and respond to network and information security problems and incidents. The new (EU) Regulation (The Cybersecurity Act) approved in March 2019 repeals the Regulation (EU) 526/2013 on ENISA and aims to reinforce its role as the EU's centre of advice and expertise with regard to cybersecurity matters.
- **EU cybersecurity certification.** (Art. 46) The lack of EU-wide mechanisms of certification is one of the main issues affecting the single market in the field of cybersecurity that reduces the choice of viable and usable cybersecurity technologies. For this reason, the Cybersecurity Act

has proposed the creation of an EU certification with a view to creating a digital single market for Information and Communication Technology (ICT) products, ICT services and ICT processes.

The reformed ENISA will provide support to Member States, EU institutions and businesses in key areas, including the implementation of the NISD and the proposed cybersecurity certification framework. The proposed ICT certification framework creates a comprehensive set of rules, technical requirements, standards and procedures to agree on each scheme. A certificate will attest that ICT products and services that have been certified in accordance with such a scheme comply with specified cybersecurity requirements. The resulting certificate will be recognized in all member states, making it easier for businesses to trade across borders. The schemes would be voluntary and would not create any immediate regulatory obligations on vendors or service providers.

The **Clean Energy Package** also sets obligations for electricity operators to contribute to the development of resilience in the energy sector in respect to the risk of malicious cybersecurity attacks, or incidents related to the information and operational technologies widely used in the electricity sector. The final target of all the legislative proposals is to monitor and operate the grid effectively and efficiently, while taking into account the cybersecurity risks resulting from the use of new technologies and from the adaptation of old technologies to a new digitalized and complex environment.

7.2 The Three Demos - Discussions

The **German IT Security Act (IT-SiG, 2015)** and the current draft version of the **German IT Security Act 2.0 (IT-SiG 2.0)** are the legal acts concerning cybersecurity in German legislation [40]. The IT-SiG came into force on 25 July 2015 with the aim of "significantly improving the security of information technology systems (IT security) in Germany" (Bundestagsdrucksache 18/4096). It is not an independent law that directly contains obligations for citizens and companies, but modifies and supplements various existing individual laws, including: the primary statute governing cyber-security issues—the Act on the German Federal Office for Information Security (*Gesetz über das Bundesamt für Sicherheit in der Informationstechnik*) (**BSIG**); the primary statute governing telecommunications providers and their services—the German Telecommunications Act (*Telekommunikationsgesetz*) (**TKG**); the primary statute governing online media, e-commerce and hosting provider liability—the German Telemedia Act (*Telemediengesetz*) (**TMG**); and the German Criminal Code (*Strafgesetzbuch*) (**GCC**). In 2017, that law was slightly amended to bring it in line with the Directive (EU) 2016/1148 concerning the security of network and information systems ("**NIS Directive**"). The German IT Security Law 2.0 is part of the German Cybersecurity Strategy of 2016 [41]. A ministerial draft of the IT-SiG 2.0 was published on 27th March 2019.

In March 2017, the Presidency of the Council of Ministers in **Italy** adopted the National Plan for cyberspace protection and ICT security [42], which identified the operational guidelines, the goals to pursue and the lines of action to be carried out. The Italian Government has recently taken a further step towards the implementation of a comprehensive national cyber-security framework through the adoption of **the Law Decree n.105 of September 21st, 2019 (Decreto-Legge 21 settembre 2019, n. 105**). The Decree has brought along significant innovations in relation to the creation of a perimeter of national cyber security that will have a great impact on public administrations and both public and private national operators [43], [44].

The **Greek National Cyber Security Strategy** was implemented on 21 September 2017. The National Strategy reflects its relativeness not only to the existing institutional framework, but also to other Strategies at national or international level and it is also harmonized with the requirements of relevant EU regulations and directives (in particular with Directive (EU) 2016/1148) [45]. The National Cyber Security Authority was established and operates at the General Secretariat for Digital Policy of the Ministry of Digital Policy Telecommunications and Media, according to Presidential Decree 82/2017 (A117) [46].

7.3 Brief Chapter Summary

Cybersecurity contains all the safeguards and measures adopted to defend information systems and their users against unauthorized access, attack and damage to ensure the confidentiality, integrity and

availability of data. In the energy sector cybersecurity is of crucial significance as Information Technology (IT) and Operational Technology (OT) systems are connected through cyberspace delivering/transmitting data and executing controls to energy systems. As mentioned above, the need to ensure appropriate cybersecurity for operators, market participants and consumers is very important because the more devices are getting digitally connected to the power system, the more they expose such a very critical infrastructure to the risk of cyberattacks. At EU level, a cybersecurity framework is set by the **Network and Information Systems Directive** (NISD), which was adopted in 2016. European countries have prioritized cybersecurity at the national level and are in the process of developing support measures. However, this is often being done at the horizontal level without focused activities in the energy sector [69].

The lack of EU-wide mechanisms of certification is one of the main issues affecting the single market in the field of cybersecurity that reduces the choice of viable and usable cybersecurity technologies. The problem is being addressed partially with the NISD, because under the proposed certification scheme in the Cybersecurity Act, the application of certification for ICT products and services will be voluntary. A lack that has been identified by ENISA is also that the term "high level of security" in NISD is undefinable and the level of security has not been defined clearly enough [70].

8 Data Protection

The blockchain based platform of Platone will allow the DSOs to perform a data aggregation process that does not violate the privacy and security of the customers. The Platone project will use technical data (such as topology and asset description data, measurements, market, prediction and planning data) which is not considered as personal data. Moreover, customers' personal data will be confidential, and it will be treated in a restricted way and not as open data. Further information on the way data is handled in Platone is provided in the Platone Data Management Plan.

8.1 Protection of Consumers in the European Union – Analysis of Legislation and Regulation

Consumer data and privacy protection is of high importance. Since the mid-1990's, data protection legislation in the European Union (EU) has been primarily based on **EU Directive 95/46/E (Data Protection Directive)**.

The EU has recently reviewed and updated its data protection laws, in the form of the **General Data Protection Regulation (GDPR)**, which came into force on 25 May 2018 [48]. According to the GDPR, end users must sign an agreement to give access to their private data (ambient and consumption monitoring). To limit the number of stakeholders who get in touch with the sensitive data, third parties that may have access to energy management platforms should operate with anonymized data.

Concerning smart metering systems in particular, specific provisions on final customer data protection and security are given by the **Directive for the Internal Market in Electricity (e-Directive)**. The e-Directive embeds relevant GDPR provisions in the new text and transforms those to the needs and specificities of smart meters' implementation and functioning. According to the Directive, member states should take into account the best available techniques for ensuring smart metering systems and data communication at the highest level of cybersecurity protection while bearing in mind the costs and the principle of proportionality (Art. 20.b and Annex II), when performing the economic assessment of smart metering roll-out. Moreover, the Directive provides explicit references to the recently (May 2018) adopted Regulation (EU) 2016/679, the General Data Protection Regulation (GDPR) where in Art. 20 (1)point (c) states that "the privacy of final customers and the protection of their data shall comply with relevant Union data protection and privacy rules".

The e-Directive recalls and reflects some of the rights of the data subject listed in the GDPR.

- Art. 20 f) reflects Art. 14 of the GDPR on the **right to be informed**, requiring Member States to ensure that, prior or at the time of installation of smart meters, final customers are duly informed about their energy consumption and "the collection and processing of personal data in accordance with the applicable Union data protection rules".
- Art. 20 e) reflects Art. 15 of the GDPR on the **right of access**, stipulating that, under their explicit request, final customers are entitled to access their metering and consumption data in an easily understandable format.
- Art. 20 expressly refers to the **right to data portability** introduced for the first time by Art. 20 (1) of the GDPR. It states that for the purposes of Art 20 point (e) "it shall be possible for final customers to retrieve their metering data or transmit them to another party at no additional cost and in accordance with their right to data portability under EU data protection rules".

Regarding customer privacy, with the aim of guaranteeing a high level of privacy rules for all electronic communications, the Commission's proposal (COM (2017) 10) for an **e-Privacy Regulation** (Regulation on Privacy and Electronic Communications) is currently in the legislative process in the European Parliament and the Council [50]. The e-Privacy Regulation is a proposal for greater regulation of electronic communications within the European Union, in order to increase privacy for individuals and entities. It will repeal the Privacy and Electronic Communications Directive 2002 (e-Privacy Directive). The scope of the e-Privacy Regulation would apply to any business that provides any form of online communication service, uses online tracking technologies, or engages in electronic direct marketing. When entering in force, it will protect confidentiality of electronic communications and the devices. In particular, when communications include personal data, the general rules of the GDPR apply, unless

the e-Privacy Regulation will lay down more specific rules. The e-Privacy Regulation will ensure the protection of fundamental rights and freedoms, in particular the respect for private life, confidentiality of communications and the protection of personal data in the electronic communications sector. It also guarantees the free movement of electronic communications data, equipment and services in the European Union.

Regarding non-personal data, the **Free-flow of Non-personal Data Regulation 2018/1807**, entered into force in May 2019, ensures that transparency principles are adopted, while data economy opportunities are unleashed. Companies and public administrations across Europe will be allowed to store and process non-personal data everywhere in the EU and competent authorities will have access to data with no geographical limitations and will be entitled to carry out regulatory control purposes [51].

8.2 The Three Demos- Discussions

The EU General Data Protection Regulation, applies directly in each EU member state and replaces the EU Data Protection Directive (Directive 95/46/EC) (EU Directive) and its local implementing laws. The GDPR introduces a single legal framework across the EU. However, several GDPR provisions allow EU member states to enact national legislation specifying, restricting, or expanding the scope of the GDPR's requirements. **Germany** enacted the new Federal Data Protection Act (Bundesdatenschutzgesetz) (BDSG) on July 5 2017 and it took effect on May 25, 2018. It aligns German data protection law with the GDPR [52].

Greece has implemented the GDPR in its national legislation under Law 4624/2019. The law entered into force on 29 August 2019 [53].

The Legislative Decree no. 196 of 30 June 2003 (the "Data Protection Code"), as amended by the Legislative Decree no. 101 of 10 August 2018, adapts **Italian** data protection laws to the new provisions of the GDPR. The Legislative Decree no. 101 entered into force on 19 September 2018 [54].

8.3 Brief Chapter Summary

The EU has recently reviewed and updated its data protection laws, in the form of the General Data Protection Regulation (GDPR), which is in force since May 2018. The GDPR applies directly in each EU member state. To limit the number of stakeholders who get in touch with the sensitive data, third parties that may have access to energy management platforms should operate with anonymized data. This limitation affects Platone and therefore, the data that will be used is only technical data which is not considered as personal data.

Besides GDPR, there is also the e-Privacy Regulation which is a proposal for the regulation of the use of electronic communications services within the European Union. The e-Privacy Regulation is primarily aimed at companies operating in the digital economy and ensures the protection of fundamental rights and freedoms, in particular the respect for private life, confidentiality of communications and the protection of personal data in the electronic communications sector. It also guarantees the free movement of electronic communications data, equipment and services in the European Union. Unlike with the GDPR, the EU states have not yet been able to agree on the draft legislation. When the proposed e-Privacy Regulation became effective, the national laws that currently are in force would be superseded and will likely be repealed.

9 Data Management

One of Platone's targets is to maximize grid observability thanks to a data driven approach. The multi-layer platform that Platone will develop, will be based in a concept of data management that, while unlocking flexibility for DSOs, will also improve the grid operation through an advanced observability approach, facilitate the fair participation of customers in the market and efficiently support also the cooperation with the TSO. The introduction of the blockchain technology at this level guarantees transparent unmodifiable data management and sharing. In the case of the Italian demo, in addition to responsibility for metering data, collection and sharing, the DSO will also develop a "Shared Customer Database" that will transparently provide to all the authorized players (aggregators, customers, TSOs…) involved in the flexibility market, all the blockchain certified requests and measures logs to calculate the flexibility action results. The platform architecture that will be created, will develop a concept of data management with multiple benefits, such as the improvement of grid operation, the facilitation of fair participation of customers in the market, and the efficient cooperation between DSOs and TSOs among others. As a result, it is recommended to examine the relevant regulatory framework.

9.1 Data Availability and Collection – Analysis of the Legislation and Regulation

Consumers have been given the right to access and share their own energy data by recent EU legislation from the Third Energy Package and the General Data Protection Regulation (GDPR) to the Clean Energy Package (CEP) [57].

Annex 1 of the **Third Energy Package** states that consumers shall "have at their disposal their consumption data, and shall be able to, by explicit agreement and free of charge, give any registered supply undertaking access to its metering data. The party responsible for data management shall be obliged to give those data to the undertaking. Member States shall define a format for the data and a procedure for suppliers and consumers to have access to the data. No additional costs shall be charged to the consumers for that service."

Moreover it underlines that "the Member States, or any competent authority they designate, shall ensure the interoperability of those metering systems to be implemented within their territories and shall have due regard to the use of appropriate standards and best practice and the importance of the development of the internal market in electricity."

Art. 9 of **EU Directive 2012/27/EU** on energy efficiency (the Energy Efficiency Directive) sets out rules in relation to metering. In particular, the Directive establishes the importance of customers, or third parties acting on behalf of customers, being provided with good quality data. It also reinforces the importance of ensuring the security of data provision and protecting the privacy of customers. Article 10 of this Directive also ensures that customers can have easy access to (historical) consumption data, setting rules in relation to the type and amount of consumption information. Furthermore, customers will be able to use new smart technologies to manage their energy consumption and production, or may choose to engage service providers to manage their interface with the energy market.

As part of the CEP, the recast of the **e-Directive** lays down general principles for how Member States should deal with consumer data. Among others, they require Member States to create an adequate regulatory framework to organize the management of consumer data.

Existing Data Management Models (DMMs) present a large variation across Member States, according to the TSO-DSO Data Management Report by ENTSO-E, Eurelectric, EDSO, GEODE and CEDEC [58]. In this report, a data management model is described as "*the framework of roles and responsibilities assigned to any party within the electricity system and market and the subsequent duties related to data collection, processing, delivery, exchanges, publishing and access*." They typically consist of a set of different roles, responsibilities, legal frameworks, technical standards as well as informal rules [59]. Three types of DMMs are identified by CEER:

- A **decentralized model**, where the key aspects of data management are decentralized and within the DSO's responsibility. The means of exchanging data among market parties and the DSO is often a rather simple format, sometimes standardized yet often non-standardized. Customers have to specifically contact the DSO for access to data.

- A **partially centralized model**, where one or few key aspects of data management are centralized, typically distribution and access to data. This model thus enables centralized access (via the *communication hub*) to data stored in several decentralized databases (at DSOs or at metering points).
- A **fully centralized model** comprises the centralization of all key aspects related to data exchange. It typically represents a one-stop shop (*a business office where multiple services are offered* [79]*)* for data, where DSOs, market actors and all consumers have only one actor, the *data hub*, which they relate to.

The **e-Directive** with Art. 19, 20 and 21 provide new regulations about smart metering systems, and with Art. 23 sets some principles about data management.

Art. 23 states that Member States shall organize the management of data to ensure efficient and secure data access and exchange, as well as data protection and data security. It is important to note that the Clean Energy Package expresses no preference of one DMM over the other. Instead, the principles laid down apply independently of the DMM. To ensure compliance with the requirements of the e-Directive, the Member State or a designated competent authority shall authorize and certify, or where applicable, supervise, the parties responsible for the data management. Article 23 is presented below:

- "When laying down the rules regarding the management and exchange of data, Member States or, where a Member State has so provided, the designated competent authorities shall specify the rules on the access to data of the final customer by eligible parties in accordance with this Article and the applicable Union legal framework. For the purpose of this Directive, data shall be understood to include metering and consumption data as well as data required for customer switching, demand response and other services."
- "Member States shall organize the management of data in order to ensure efficient and secure data access and exchange, as well as data protection and data security. Independently of the data management model applied in each Member State, the parties responsible for data management shall provide access to the data of the final customer to any eligible party, in accordance with paragraph 1. Eligible parties shall have the requested data at their disposal in a non-discriminatory manner and simultaneously. Access to data shall be easy and the relevant procedures for obtaining access to data shall be made publicly available."
- "The rules on access to data and data storage for the purpose of this Directive shall comply with the relevant Union law. The processing of personal data within the framework of this Directive shall be carried out in accordance with Regulation (EU) 2016/679."
- "Member States or, where a Member State has so provided, the designated competent authorities, shall authorize and certify or, where applicable, supervise the parties responsible for the data management, in order to ensure that they comply with the requirements of this Directive. Without prejudice to the tasks of the data protection officers under Regulation (EU) 2016/679, Member States may decide to require that parties responsible for the data management appoint compliance officers who are to be responsible for monitoring the implementation of measures taken by those parties to ensure non-discriminatory access to data and compliance with the requirements of this Directive. "
- "No additional costs shall be charged to final customers for access to their data or for a request to make their data available. Member States shall be responsible for setting the relevant charges for access to data by eligible parties. Member States or, where a Member State has so provided, the designated competent authorities shall ensure that any charges imposed by regulated entities that provide data services are reasonable and duly justified."

Therefore, no common specific data management model is recommended at EU level, and each Member State, independently of the adopted data management model, have to authorize, certify or, where applicable, supervise the parties responsible for data management.

Furthermore, Art. 24 of the e-Directive addresses the need for Member States to facilitate the full interoperability of energy services within the Union to promote competition in the retail market and to avoid excessive administrative costs.

When it comes to the tasks of the DSO, Art.31.3 states that the DSO has to provide system users with the information they need for efficient access to, including use of, the system. Further, DSOs and TSOs shall exchange all necessary data (Art.53.1).

The tasks of the EU DSO entity according to **e-Regulation** (Art.55.1) are, inter alia:

- Facilitating the integration of renewable energy resources, distributed generation and other resources embedded in the distribution network such as energy storage;
- Facilitating demand side flexibility and response and distribution grid users' access to markets;
- Contributing to the digitalization of distribution systems including deployment of smart grids and intelligent metering systems;
- Supporting the development of data management, cybersecurity and data protection in cooperation with relevant authorities and regulated entities.

Art. 57 of e-Regulation mentions that DSOs and TSOs shall cooperate with each other in planning and operating their networks. In particular:

- "Distribution system operators and transmission system operators shall exchange all necessary information and data regarding, the performance of generation assets and demand side response, the daily operation of their networks and the long-term planning of network investments, with the view to ensure the cost-efficient, secure and reliable development and operation of their networks."
- "Distribution system operators and transmission system operators shall cooperate with each other in order to achieve coordinated access to resources such as distributed generation, energy storage or demand response that may support particular needs of both the distribution system operators and the transmission system operators."

Moreover, regarding individual rights on data management and protection, the provisions of the Clean Energy Package are linked to the general principles and rules about individuals of the **General Data Protection Regulation (GDPR)** objects, which can be applied for the energy consumers/providers. Those rules state that customers have a right:

- To be informed that their data are being collected and processed, with at least the following information:

  a. The identity of the controller and of his representative, if any;

  b. The purposes of the processing for which the data are intended;

  c. Any further information such as the recipients or categories of recipients of the data, the existence of the right of access to and the right to rectify the data concerning him/her, etc.
- To access such data, so that, at any event, once asked, smart grid data controllers must establish a mechanism to access personal data, without constraint at reasonable intervals and without excessive delay or expense. Information on its particular details should be provided by means of the relevant services contract, once entered with subscribers. Energy consumers need to be able to establish where their data is found and obtain copies thereof. Special data retention rules might also apply. It is additionally required that individuals be informed of (and be able to object to) the logic in automated decision-making systems. Whether smart grid systems are to be characterized as such is currently in discussion.
- To object in the event when they consider that data processing is unlawful, for example in the case of incorrect personal data stored in the data controllers' systems.

9.2 Data Governance - Discussions

Another important issue that concern the data management within distribution networks when DSOs and TSOs are getting involved is the Data Governance (DG). Who will be in charge of managing the availability, usability, integrity and security of the data [75] is an important factor meaning that any party or parties responsible for the data management ought to guarantee neutrality, be confidential with data

protection and respect the different market actors [76]. In the literature, many definitions of DG exist some of them are mentioned below [77, 80]:

- according to Global Data Management Community, “Data Governance is the exercise of authority and control (planning, monitoring, and enforcement) over the management of data assets.”
- according to Data Governance Institute, “Data Governance is a system of decision rights and accountabilities for information-related processes, executed according to agreed-upon models which describe who can take what actions with what information, and when, under what circumstances, using what methods.”
- according to Wikipedia, “Data governance is a term used on both a macro and a micro level. The former is a political concept and forms part of international relations and Internet governance; the latter is a management concept and forms part of corporate governance.”

However, in general, DG is a collection of practices and processes which help to ensure the formal management of data assets within a network [77], in accordance with standards and policies which supervise the proper data usage as aforementioned in the previous subsection. Speaking for effective data governance signifies that data must be consistent and trustworthy and doesn't get misused [69]. The DG responsibility is becoming increasingly necessary and critical, since the laws and regulations concerning private data change constantly and the technology is continuously developing, with increasing interest in the machine learning and artificial intelligence areas. The optimal operation and control of distribution networks are based more and more on the data collection and analysis which impose the concept of DG and someone must take the responsibility.

The European Union through GDPR formed recently, as previously cited, rules which protect the collection and exchange of data. Whoever is in charge of DG can further define and develop data strategies, policies, standards and procedures to follow and enforce the already existing legislation and regulation. The DG objectives focus on providing solutions on the correct and reliable supply of data management services, on managing and tackling data related problems and on understanding and protecting the value of data assets.

From the preceding information, it is obvious that an effective DG is significant and, regarding [77], a distribution network operating under a DG concept can have several advantages some of them are enlisted below:

- lower costs as a result of the optimal operation;
- more accurate procedures around regulation and compliance activities;
- greater transparency within any data-related activities;
- reliability and protection around the management of data assets;
- better resolution of past and current data-related problems;
- improvement of monitoring and tracking tools for data quality and other data-related activities.

Up to now, as required by the evolution of data exchange platforms, TSOs have played a more energetic and dominant role in the market [78], while DSOs are in charge of the operations regarding information exchange, such as meter operation, data collection, data storage, data validation and distribution to other market participants. An exception to this is the Platone project that comprises centralized information exchange systems, called data-hubs, in operation, which grants the DSOs a greater responsibility in the data exchange and exploitation. The primary and most significant step in implementing a data governance framework includes the identification of the consumers which possess the data assets within the network under study and their storage in the corresponding governance tool or software. Afterwards, the policies and standards must be developed, along with the rules that will define how data can be used by the authorized members or other consumers and parties. In addition to this, the data origin should always be identified, meaning where it’s stored and how it's protected from failures or security attacks.

9.3 Brief Chapter Summary

The Platone project will develop a concept of data management with multiple benefits such as improved grid operation, the facilitation of fair participation of customers to market and the efficient cooperation between DSOs and TSOs, among others. Consumers have been given the right to access and share their own energy data by recent EU legislation. The Third Energy Package states that consumers shall have at their disposal their consumption data and member states shall define a format for the data and a procedure for suppliers and consumers to have access to the data. The EU Directive 2012/27/EU establishes the importance of customers, or third parties acting on behalf of customers.

The recently adopted e-Directive defines DMMs as “the framework of roles and responsibilities assigned to any party within the electricity system and market and the subsequent duties related to data collection, processing, delivery, exchanges, publishing and access”. Moreover, the DSO has to provide system users with the information needed for the efficient access to and use of the system. Further, DSOs and TSOs shall exchange all necessary data. The e-Regulation of the Clean Energy Package underlines that DSOs and TSOs shall exchange all necessary information and data regarding the performance of generation assets and demand side response, the daily operation of their networks and the long-term planning of network investments, in order to ensure the cost-efficient, secure and reliable development and operation of their networks.

Our analysis showed that no common specific data management model is recommended at EU level, and that each member state, independently of the adopted data management model, has to authorize, certify or, where applicable, supervise the parties responsible for data management.

Another important issue that concerns the data management within distribution networks, when DSOs and TSOs are involved is the Data Governance. DG is a collection of practices and processes which help to ensure the formal management of data assets within a network, in accordance with standards and policies. Often, the early steps in data governance efforts can be the most difficult because every customer would like to protect its personal information. Furthermore, different views of key network data entities can exist, such as customers or products. These differences must be resolved as part of the DG process. An effective DG can lead to data quality improvements which could include the number of data errors ameliorated on a regular basis and the revenue gains or cost savings that result from them. Other common data quality metrics measure accuracy and error rates in data sets. Data governance makes data available to more users. Governance programmes must ensure that data is accurate and accessible for the users, while also guaranteeing that those users don't misuse data or violate the data privacy and security restrictions. The policies and standards must be developed, along with the rules that will define how data can be used by the authorized members or other consumers and parties.

10 Blockchain and Smart Contracts in the Energy Sector

The use of blockchain technology plays a fundamental role in the Platone project. It is therefore necessary to conduct an analysis on what impact the use of blockchain has on the energy domain, in legal and regulatory terms.

In particular, the context of interest of the Platone project is on the use of the blockchain as a legal "registry" and the smart contracts as legal “contracts”, both at European level and in the three different demo countries (Italy, Germany and Greece).

10.1 Analysis of the Legislation and Regulation in the European Union

The European Community has not currently defined a specific legislative framework regulating the application of blockchain technologies in the energy domain but in recent years, it has carried out several initiatives to incentive the adoption of blockchain and Distributed Ledger Technology (DLT), supporting it with the definition of regulatory frameworks and promotion of interoperable standards.

In April 2018, twenty-two European countries signed a declaration for the creation of the **European Blockchain Partnership (EBP),** which will confront the progress among member states in this field and co-operate in the establishment of the European Blockchain Services Infrastructure (EBSI). Since then, eight more Member States have joined the Partnership, bringing the total number of signatories to twenty-nine [60].

The agreement consists of the study on the technology at European scale in the digital single market, giving evidence of benefits for the public and private sectors. As part of this commitment, the Partnership is building a **European Blockchain Services Infrastructure (EBSI)**, which will deliver EU-wide cross-border public services using blockchain technology. In 2020, EBSI will deploy a network of distributed blockchain nodes across Europe, supporting applications focused on selected use cases [61].

In February 2018, the European Commission had already launched the **EU Observatory and Forum on Blockchain**, investing over 80 million Euro in projects, with implications in the technical and social fields that work with this technology.

The Blockchain Observatory and Forum of the European Union has published in September 2019 a new report named “Legal and Regulatory Framework of Blockchains and Smart Contracts” [62]. The first part of the report highlights the main areas of tension between technological properties of the blockchain and the current regulatory framework:

- **legal value of blockchain as registries**: according to electronic IDentification, Authentication and Trust Services regulation (eIDAS) blockchain transactions do not have legal authority by themselves since the digital signatures are not compliant with Trust Service Provider (TSP). Furthermore, as of today very few regulators have addressed the issue of the legal status of blockchain registries. For instance, only France recognized the use of blockchain technology as a registry in support of “minibonds (*a form of debt that allows investors to invest in a company and receive a fixed return over a set period of time, with the initial investment returned at the end of the prescribed duration* [74])” through the publication of an executive order;
- **territoriality**: the decentralized nature of blockchain makes difficult to establish who the network actors are, their location and their actions. In the event of disputes, this decentralization can cause problems, both in ascertaining responsibility and in determining the jurisdiction of the disputes themselves. The report suggests to revise the rules of private international law to take into account the specifications of this technology;
- **enforceability**: according to the report, to promote enforceability, there are different solutions: providing states with identification tools (potentially under the control of courts or through the private sector on a payment basis) as a minimum necessary condition; involve the access points in monitoring and control activities: authorities could require ISPs to block encrypted data or specific transactions or traffic to/from specific apps or even nodes (even if the report does not fail to highlight its legal limits);

- **liability**: the more serious risks related to damages caused by anonymous actors in the permission less blockchain space, or risks borne by consumers, could be covered by the creation of a common insurance system or provision of tools to identify all network actors;
- **data protection**: the document reports three main areas where tensions between blockchain and GDPR are present: it can be difficult to identify data controllers and processors as defined under GDPR, and hence enforce their obligations; blockchains can make it difficult to exercise some data subject rights as defined in the GDPR (e.g. deletion of data); anonymization of personal data (e.g. the hashing of data cannot be considered to be an anonymization technique).

The report also deals with legal issues about smart contracts and makes the difference between smart legal contracts (smart contracts on a blockchain that represent a legal contract) and smart contracts with legal implications (artefacts/constructs based on smart technology that clearly have legal implications).

10.2 The Three Demos - Discussions

In March 2019, **Germany** delivered a national blockchain strategy focusing mainly on legislative measures on financial market [63]. The strategy paper includes also a variety of potential applications for DLT and declares a general intent to further analyze and deepen understanding for the use of the technology especially in the energy sectors and for smart contracts [64]. In particular, for the energy sector, the strategy announces a pilot scheme for a blockchain-based smart meter implementation in the energy grid and envisages the establishment of a database for smart contract templates for use in the energy sector.

Italy is moving rapidly towards the adoption and regulation of blockchain technology. Italy in fact obtained the presidency of the EBP for one year in July 2019, together with Sweden and the Czech Republic [65] and was the first in Europe to have regulated the two instruments of the future i.e. blockchain and smart contract. In February 2019, the law n.12 for the conversion of Simplification Decree (DL no.135) was established and gave blockchain technology a full legal value. Particularly, Art.8 concerning technologies which are based on distributed registers and smart contracts were added to the Decree [66].

"Technologies based on distributed registers" are simplify defined as technologies which use a shared, accessible simultaneously, distributed, replicable register, and architecturally distributed on a cryptographic basis, in order to enable the recording, updating, validating and archiving of information both in clear and further secured by cryptography verifiable by every partaker, not changeable and unmodifiable.

A regulatory framework has not yet been defined in **Greece** nor is there a legislative initiative under discussion that regulates the application of blockchain or DLT technologies in the energy context. However, Greece as well as other European countries are pushing to encourage the use of disruptive technologies such as blockchain in the energy sector and to define a common European regulatory framework. In May 2018, the European Parliament Committee on Industry, Research and Energy passed a resolution outlining the benefits of adopting blockchain/distributed ledger technology (DLT). Greek S&D group member Eva Kaili, author of this resolution and chair of the Science and Technology Options Assessment panel said that “Blockchain and DLT in general have a strong disruptive element that will affect many sectors" including energy sector [67]. She called for "open-minded, progressive, and innovative friendly regulation [68].

10.3 Brief Chapter Summary

There is not a specific European regulatory framework concerning the application of blockchain technologies in the energy domain until now, but in recent years, the European Commission has carried out several initiatives to incentive the adoption of blockchain and DLT technologies. The Blockchain Observatory and Forum of the European Union has published in September 2019 a new report titled “Legal and Regulatory Framework of Blockchains and Smart contracts”, which is a step in that direction.

In this report, the most important gaps of the current EU legislation about the extended adoption of blockchain technology are highlighted: the decentralized nature of blockchain that makes it difficult to establish who the network actors are, their location and their actions, the difficulty to identify data controllers and processors as defined under GDPR and the legal value of blockchain as registries (only recognized by France until now) among others.

More specifically about the demo sites, Italy and Germany have made some progress towards the adoption and regulation of blockchain technology. However, in Greece, a regulatory framework has not yet been defined nor is there a legislative initiative under discussion concerning the connection between energy sector and blockchain or DLT technology.

11 Conclusion

The new EU energy legislative framework is the Clean Energy package - a set of eight legislative proposals, with the goal of providing a framework for the EU energy sector to accelerate the clean energy transition. The most important and relevant to Platone project of them are the revised Renewable Energy Directive and the revised Energy Efficiency Directive, which entered into force in December 2018 and the e-Directive, e-regulation and ACER regulation, which were adopted in May 2019. Along with the GDPR and the NISD, which are the latest data protection and cybersecurity regulations correspondently, they comprise the basis of the legislations we analysed.

Our analysis showed that the new legislations are a step forward to an energy sector that has the consumer in its core, like in Platone's vision. The Clean energy package supports energy communities, consumers and self-consumption and set the basis for more simplified and transparent procedures. Moreover, the intention of creating flexible markets fit for a multitude of decentralized producers and consumers and allowing renewable energies to participate in all market segments are on the positive side. Definitions about energy storage and aggregator are introduced for the first time and their role in the energy market becomes clearer. However, to date, there exists no precise and appropriate definition for energy storage in the national legislations of the three countries of the project.

A few gaps have been identified in the framework concerning the three demonstrations site. Even if these obstacles don't prevent the realization of the project, it is important to be taken into consideration. The new directives that have been adopted in 2019, have not yet been brought into force by the member states, but they should be integrated in national regulations by 2021. Codes and rules, which impose detailed flexibility requirements, network tariffs, connection agreements details and rules for market-based procurement should not be defined at EU-level but should be defined by the member states or the National Regulatory Authority (NRA) and be consistent with national provisions and national practices. This could lead to different national frameworks, based on the benefits of each member state. Moreover, the use of smart meters is at different stages in the different EU countries, a problem that affects the equal opportunities of the European consumers/prosumers/energy communities to take advantage of the new legislation that is in their favour. Another legal gap that should be mentioned is that e-Directive states that customers owning a storage facility are allowed to provide several services simultaneously, if technically feasible. However, that applies to customers who store electricity generated within their premises, sell self-generated electricity or participate in flexibility schemes, provided that these activities do not constitute their primary commercial or professional activity. The e-Directive does not address the case of companies who provide such services as their main activity.

Furthermore, the national cybersecurity strategies are general and without focused activities in the energy sector. The GDPR sets strict rules for the treatment of consumers' data and, therefore, the Platone project will only use technical data which are not considered as personal data. Another issue is that there is not specific European legislation concerning the application of blockchain technologies in the energy domain until now and, while Germany and Italy are making some progress in developing a regulatory framework, there is not such a policy discussion in Greece.

12 List of References

[1] "Clean energy for all Europeans package" [Online]. Available: https://ec.europa.eu/energy/topics/energy-strategy/clean-energy-all-europeans_en.

[2] PWC, Assessment and roadmap for the digital transformation of the energy sector towards an innovative internal energy market, EUROPEAN COMMISSION, 2020.

[3] CEER, Conclusions Paper on Flexibility Use at Distribution Level, Ref:C18-DS-42-04, 17 July 2018.

[4] European Parliament and of the Council, "DIRECTIVE (EU) 2019/944 on common rules for the internal market for electricity and amending Directive 2012/27/EU," June 2019. [Online]. Available: https://eur-lex.europa.eu/eli/dir/2019/944/oj.

[5] "Regulation (EU) 2017/2195 establishing a guideline on electricity balancing", European Commission, November 2017. [Online]. Available: https://eur-lex.europa.eu/eli/reg/2017/2195/oj.

[6] European Parliament and of the Council, "REGULATION (EU) 2019/943 on the internal market for electricity," June 2019. [Online]. Available: https://eur-lex.europa.eu/eli/reg/2019/943/oj.

[7] "Regulation (EU) 2017/1485 establishing a guideline on electricity transmission system operation", European Commission, August 2017. [Online]. Available: https://eur-lex.europa.eu/eli/reg/2017/1485/oj.

[8] European Parliament and the Council, "Directive 2009/72/EC concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC," July 2009. [Online]. Available: European Parliament and of the Council.

[9] European Parliament and the Council, "Directive 2012/27/EU on energy efficiency," October 2012. [Online]. Available: http://data.europa.eu/eli/dir/2012/27/oj.

[10] U. Scholz and J. Ante, *Electricity regulation in Germany: overview,* Thomson Reuters Practical Law, May 2018.

[11] Federal Ministry for Economic Affairs & Energy, *Electricity Market 2.0. An electricity market for Germany's energy transition,* Brochure - Electricity Market of the Future.

[12] M. T. Symeonides, "Electricity," Rokas Law Firm, 2019. [Online]. Available: http://www.greeklawdigest.gr/topics/energy-minerals/item/91-electricity.

[13] A. Sferruzza and G. Biadico, *Electricity Regulation,* Norton Rose Fulbright Studio Legale, October 2019.

[14] A. D. Esposti, The Energy Regulation and Markets Review - Edition 8, 2019.

[15] C. Montella, C. Martorana and A. Tedeschi, *Electricity regulation in Italy: overview,* Orrick, Herrington & Sutcliffe (Europe) LLP, 2018.

[16] "A Framework Strategy for a Resilient Energy Union with a Forward -Looking Climate Change Policy", European Commission, COM (2015) 080 final, 2015.

[17] A. Wilson, *The Commission's Summer Energy Package,* European Parliamentary Research Servic, September 2015.

[18] A. Wilson, *A New Deal for energy consumers,* European Parliamentary Research Service, January 2016.

[19] "Delivering a New Deal for Energy Consumers", European Commission, July 2015. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52015DC0339.

[20] European Parliament and the Council , "Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources," December 2018. [Online]. Available: http://data.europa.eu/eli/dir/2018/2001/oj.

[21] "Self-consumption – the EU Renewable Energy Directive vs. EEG 2017 – how should it be regulated?" [Online]. Available: https://www.roedl.com/insights/renewable-energy/2019-08/self-consumption-the-eu-renewable-energy-directive-vs-eeg-2017.

[22] Agora Energiewende, "Energiewende: What do the new laws mean? Ten questions and answers about EEG 2017", the Electricity Market Act, and the Digitisation Act, 103/07-H-2016/E.

[23] "Energy 2020 / Germany", [Online]. Available: https://www.globallegalinsights.com/practice-areas/energy-laws-and-regulations/germany.

[24] H. Schneidewindt, "Germany: Prosumers (Still) Welcome!", [Online]. Available: https://energy-democracy.org/germany-still-fair/.

[25] E. Bellini, "Energy community provisions for Italy", [Online]. Available: https://www.pv-magazine.com/2020/03/03/energy-community-provisions-for-italy/.

[26] Commission for he Environment, Models of Local Energy Ownershipand the Role of Local Energy Communitiesin Energy Transition in Europe, European Union, 2018.

[27] Greenpeace Greece & REScoop.eu, Energy communities in Greece: new legislation, 2018.

[28] "Energy 2020 / Greece", [Online]. Available: https://www.globallegalinsights.com/practice-areas/energy-laws-and-regulations/greece.

[29] "Energy Storage – Proposed policy principles and definition", [Online]. Available: https://ec.europa.eu/energy/sites/ener/files/documents/Proposed%20definition%20and%20principles%20for%20energy%20storage.pdf.

[30] "Energy storage – the role of electricity", European Commission, [Online]. Available: https://ec.europa.eu/energy/sites/ener/files/documents/swd2017_61_document_travail_service_part1_v6.pdf.

[31] Smart Energy Demand Coalition (SEDC), "Mapping Demand Response in Europe Today", 2015, Belgium.

[32] M. Wimmer and F. Pause, Enabling European legal and regulatory framework for business models for renewable energy aggregation, BestRES, 2019.

[33] "Regulation (EU) 2016/1388 establishing a Network Code on Demand Connection" , European Commission, 2016. [Online]. Available: http://data.europa.eu/eli/reg/2016/1388/oj.

[34] "Demand Side Response Aggregator" [Online]. Available: https://www.emissions-euets.com/internal-electricity-market-glossary/855-demand-side-response-aggregator-dsr-aggregator.

[35] M. D. Castelnuovo and M. Vazquez, *Policy and Regulation for Energy Storage Systems,* Universita Bocconi, June 2018.

[36] CEER, Cybersecurity Report on Europe's Electricity and Gas Sectors, October 2018, C18-CS-44-04, Belgium.

[37] Energy Expert Cyber Security Platform, "Cyber Security in the Energy Sector. Recommendations on a European Strategic Framework and Potential Future Legislative Acts for the Energy Sector", 2017, EECSP Report.

[38] "Cybersecurity: Commission scales up EU's response to cyber-attacks", [Online]. Available: https://ec.europa.eu/commission/presscorner/detail/en/IP_17_3193.

[39] "The EU Cybersecurity Act", [Online]. Available: https://ec.europa.eu/digital-single-market/en/eu-cybersecurity-act.

[40] D.-K. Kipker, Overview: German and European Cybersecurity Regulation, Intrapol, June 2019.

[41] D.-K. Kipker, Presentation of the German IT-Security Law IT-SiG 2.0 draft version 2019, Universität Bremen, June 2019.

[42] Enisa, *The Italian Cybersecurity Action Plan,* Presidency of the Council of Minister, March 2017.

[43] D. Figueroa, Italy: New Provisions on National Cybersecurity Enter into Force, Library of Congress, October 2019.

[44] "Cybersecurity: Italy", [Online]. Available: https://gettingthedealthrough.com/area/72/jurisdiction/15/cybersecurity-italy/.

[45] Enisa, Greek National Cyber Security Strategy V.3, 2017, [Online], Available: https://www.enisa.europa.eu/topics/national-cyber-security-strategies/ncss-map/national-cyber-security-strategies-interactive-map/strategies/national-cyber-security-strategy-greece/view .

[46] F. Kitsios, M. Kamariotou, P. Fouliras and Ioannis Mavridis, *National Cybersecurity Strategy: A Conceptual Framework for Greece,* Doha, Qatar: Proceedings of the 11th

International Conference for Entrepreneurship, Innovation and Regional Development (ICEIRD 2018),, 2018.

[47] CEER, Regulatory Aspects of Self-Consumption and Energy Communities, C18-CRM9_DS7-05-03, June 2019.

[48] "General Data Protection Regulation," [Online]. Available: http://data.europa.eu/eli/reg/2016/679/oj.

[49] C. CARLIN, D. MONETA and V. ANGELUCCI, *ENERGY COMMUNITY: THE ITALIAN SCENARIOWITHIN THE PAN-EUROPEAN FRAMEWORK,* Ljubljana: CIRED Workshop, June 2018.

[50] e. Regulation. [Online]. Available: https://en.wikipedia.org/wiki/EPrivacy_Regulation_(European_Union).

[51] European Parliament and the Council , "Regulation (EU) 2018/1807 on a framework for the free flow of non-personal data in the European Union," [Online]. Available: http://data.europa.eu/eli/reg/2018/1807/oj.

[52] A. Freiherr, *German Implementation of the GDPR,* Thomson Reuter's Practical Law, 2019.

[53] Karageorgiou & Associates Law Firm, "Data Protected - Greece", [Online]. Available: https://www.linklaters.com/en/insights/data-protected/data-protected---greece.

[54] "Data Protected - Italy", [Online]. Available: https://www.linklaters.com/en/insights/data-protected/data-protected---italy.

[55] R. Leal-Arcas, F. Lesniewska and F. Proedrou, *Prosumers: New Actors in EU Energy Security,* Netherlands Yearbook of International Law 2017, Vol. 48.

[56] N. Šajn, *Electricity Prosumers,* EPRS | European Parliamentary Research Service, 2016.

[57] A. Nouicer, V. Reif and T. Schittekatte, *A new deal for energy consumers: consumer data management,* Florence School of Regulation, 2019.

[58] ENTSO-E, CEDEC, GEODE, EURELECTRIC and EDSO, *TSO-DSO Data Management Report,* 2018.

[59] CEER, Review of Current and Future Data Management Models, C16-RMF-89-03, December 2016.

[60] "European countries join Blockchain Partnership", [Online]. Available: https://ec.europa.eu/digital-single-market/en/news/european-countries-join-blockchain-partnership.

[61] "Introducing the European Blockchain Services Infrastructure (EBSI)", [Online]. Available: https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/ebsi.

[62] The European Union Blockchain Observatory & Forum , "Legal and Regulatory Framework of Blockchains and Smart Contracts", [Online]. Available: https://www.eublockchainforum.eu/sites/default/files/reports/report_legal_v1.0.pdf.

[63] "Blockchain - Strategie der Bundesregierung", [Online]. Available: https://www.bundesfinanzministerium.de/Content/DE/Pressemitteilungen/Finanzpolitik/2019/09/2019-09-18-PM-Block-Anlage.pdf;jsessionid=EA5F895307348AE11C6F0D3A403338ED?__blob=publicationFile&v=7.

[64] F. Reul, K. Hafner, "Germany paves the way for DLT securities", [Online]. Available: https://www.linklaters.com/it-it/insights/blogs/fintechlinks/2019/september/germany-paves-the-way-for-dlt-securities.

[65] "EU Blockchain Partnership: l'Italia ottiene la Presidenza per un anno", [Online]. Available: https://www.mise.gov.it/index.php/it/198-notizie-stampa/2039936-eu-blockchain-partnership-l-italia-ottiene-la-presidenza-per-un-anno.

[66] "LEGGE 11 febbraio 2019, n. 12", Gazzetta Ufficiale della republica Italiana [Online]. Available: https://www.gazzettaufficiale.it/atto/serie_generale/caricaDettaglioAtto/originario?atto.dataPubblicazioneGazzetta=2019-02-12&atto.codiceRedazionale=19G00017&elenco30giorni=true.

[67] "Eva KAILI", MEPs European Parliament [Online]. Available: https://www.europarl.europa.eu/meps/en/125109/EVA_KAILI/home.

[68] "Blockchain technology: We aspire to make the EU the leading player", [Online]. Available: https://www.europarl.europa.eu/news/en/headlines/economy/20180514STO03406/blockchain-technology-we-aspire-to-make-eu-leading-player.

[69] European Court of Auditors, "Challenges to effective EU cybersecurity policy", Briefing Paper, 2019.

[70] CONCEPTIVITY, Cybersecurity standard gap analysis: The European landscape and international perspectives on cybersecurity standards today, 2019.

[71] "EU publishes directive, regulations for Clean Energy Package," [Online]. Available: https://www.pv-magazine.com/2019/06/17/eu-publishes-directive-and-regulations-for-clean-energy-package/.

[72] "Treaty of Lisbon," 2007. [Online]. Available: http://data.europa.eu/eli/treaty/lis/sign.

[73] M. Péreza, D. Scholtenb and K. Stegen, "The multi-speed energy transition in Europe: Opportunities and challenges for EU energy security," *Energy Strategy Reviews,* vol. 26, 2019.

[74] "What are mini bonds?", 2019 [Online]. Available: https://www.syndicateroom.com/alternative-investments/mini-bonds

[75] "What is data governance and why does it matter?" [Online]. Available: https://searchdatamanagement.techtarget.com/definition/data-governance

[76] "TSO – DSO Data Management Report", [Online]. Available: https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-

documents/Publications/Position%20papers%20and%20reports/entsoe_TSO-DSO_DMR_web.pdf

[77] "What is Data Governance?", [Online]. Available: https://www.dataversity.net/what-is-data-governance/#

[78] "Market Committee", [Online]. Available: https://www.entsoe.eu/about/market/

[79] "One stop shop", [Online], Available: https://marketbusinessnews.com/financial-glossary/one-stop-shop-definition-and-meaning/

[80] "Data governance", [Online], Available: https://en.wikipedia.org/wiki/Data_governance

13 List of Abbreviations

Abbreviation	Term
ACER	Agency for the Cooperation of Energy Regulators
Art	Article
BDSG	Bundesdatenschutzgesetz, German Federal Data Protection Act
BSIG	Gesetz über das Bundesamt für Sicherheit in der Informationstechnik, German Act to Strengthen the Security of Federal Information Technology
CEC	Citizen Energy Community
CEER	Council of European Energy Regulators
CEP	Clean Energy Package
CSIRT	Computer Security Incident Response Team
DCC	Demand Connection Code
DG	Data Governance
DER	Distributed Energy Resource
DLT	Distributed Ledger Technology
DMM	Data Management Model
DSM	Demand Side Management
DSO	Distribution System Operator
EBP	European Blockchain Partnership
EBSI	European Blockchain Services Infrastructure
EC	European Commission
EDSO	European Distribution System Operators
EEG	German Renewable Energy Act
eIDAS	electronic Identification Authentication and Trust Services regulation
ENISA	European Union Agency for Network and Information Security
ENTSO-E	European Network of Transmission System Operators for Electricity
EnWG	Energiewirtschaftsgesetz, German Energy Industry Act
EU	European Union
FCR	Frequency Containment Reserve
FRR	Frequency Restoration Reserve
GCC	German Criminal Code, in German StGB, Strafgesetzbuch
GDPR	General Data Protection Regulation
ICT	Information and Communication Technology
MS	Member State
NISD	Network and Information Systems Directive
NRA	National Regulatory Authority
REC	Renewable Energy Communities

RED	Renewable Energy Directive
RES	Renewable Energy Systems
RR	Replacement Reserve
SO	System Operator
TKG	Telekommunikationsgesetz
TMG	Telemediengesetz
TSO	Transmission System Operator
TSP	Trust Service Provider
UC	Use Case
V2G	Vehicle to Grid
vRE	variable Renewable Energy