DOMINOES – DELIVERABLE

D6.10 Standardization Proposals – Year 2

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Executive Summary

The key themes in the DOMINOES local energy market concept include utilization of demand response and flexibility for the benefit of distribution system operators (DSOs) and other stakeholders in the power system, peer to peer (P2P) trading and sharing of energy, and aggregation services. The regulatory framework related to these themes was reviewed in the year 1 report (D6.9) of DOMINOES Task 6.2 Standardization and regulatory issues. This year 2 report of Task 6.2 discusses the regulatory development concerning the following key challenges identified by the DOMINOES partners:

- Missing clear definition of the possible ownership of storage by the DSOs
- Incentives lacking in regulation for the use of demand response in the ancillary service markets
- Existing markets are not available for small prosumers (i.e. small energy production and small flexible load) and in some cases aggregation is not permitted
- National legislation about the energy communities is yet to be formed

The 'Clean energy for all Europeans' legislative package was finalized during 2019, and some of the identified challenges should be mitigated once the changes are implemented into national laws.

This report also summarizes partners' activities related to standardization and regulation. The activities included, for example, studies and pilots made for or in cooperation with regulators and legislators, and participation in standardization committees. In addition, cyber security standards have been addressed in D2.6 of the DOMINOES project.

List of Acronyms

BM	Business model
BRP	Balance responsible party
DSO	Distribution system operator
ECSP	Energy community service provider
ESS	Energy storage system
EV	Electric vehicle
ISR	Imbalance settlement responsible
P2P	Peer to peer
SABSA	Sherwood Applied Business Security Architecture Framework
TSO	Transmission system operator
UC	Use case

1 Introduction

1.1 Purpose and scope of the deliverable

This deliverable, D6.10, is a part of the WP6 Dissemination, standardization, regulation and exploitation and the Task 6.2 Standardization and regulatory issues (T6.2). The aim of T6.2 is to produce recommendations for changes in existing local market related standards and regulatory rules. Furthermore, the deliverables of T6.2 list standardization activities of all project partners with updates every 13 months. This is the second deliverable of T6.2, focusing on M15-M27 (December 2018 – December 2019) of the DOMINOES project.

This deliverable is organized in the following way: section 2 discusses the regulatory development concerning the DOMINOES concept, section 3 summarizes the work concerning cyber security standards done in the project during year 2, and section 4 summarizes partners' activities related to regulation and standardization. Finally, section 5 concludes this report.

First, however, subsection 1.2 summarizes the development of the DOMINOES local energy market concept and section 1.3 the issues discussed in the first year report (D6.9).

1.2 DOMINOES concept

The development of the DOMINOES local market concept defines which issues in the regulation and standardization are relevant for the project. During year 1 of the project, five DOMINOES use cases and six business models were presented in deliverables D1.3 and D5.1, respectively. Based on them, the following key themes of the DOMINOES concept were identified:

- Utilization of demand response and flexibility for the benefit of DSOs and other stakeholders in the power system
- Peer to peer (P2P) trading and sharing of energy
- Aggregation

During the second year of the project D2.3 Scalable local energy market architecture (second release) elaborated further on issues such as stakeholders and their roles, balance responsibility, operation sequence and products. Especially balance responsibility is related to regulation and market rules and is, therefore, briefly discussed also in this deliverable.

1.3 Issues discussed in the year 1 report

Year 1 report (D6.9) identified challenges in the current regulatory environment related to demand response, aggregators, peer to peer trading and sharing, and DSOs' opportunities to utilise flexible resources. Potential changes in regulation were reviewed, with main focus on the 'Clean energy for all Europeans' legislative package. D6.9 concluded that if the proposals in the package will come into effect, some of the identified gaps will be clarified. One of the main issues concerning DOMINOES concept was whether DSOs are remunerated for use of demand response, and DOMINOES project supported the proposal that regulatory framework would enable DSOs to procure services. The related European legislation was finalised in summer 2019, and final versions of the new electricity directive (2019/944) and regulation (2019/943) have been published.

Furthermore, standards related to key technological issues were reviewed and analysed. Recommended standards and solutions in order to address security requirements were presented. The analysis of standards on energy storage systems (ESS) and inverter driven technologies will be utilized in the design and implementation of the energy harvester which will be used as a validation tool in the project.

Finally, D6.9 summarized partners' activities related to standardization organizations and regulatory bodies. Partners have representatives in national standardization organisation committees working among systems aspects for electrical energy supply and electric vehicle charging. Furthermore, background work for a national regulator on flexibility as part of balance settlement and network ancillary service value was done. On European level, the project was active in the IEEE Power and Energy Society and DG CONNECT discussions on facilitation of flexibility information exchange.

2 Regulatory environment

Since the delivery of the year 1 report (D6.9), the 'Clean energy for all Europeans' legislative package was completed and the final versions of Directive (EU) 2019/944 on common rules for the internal market for electricity, and Regulation (EU) 2019/943 on the internal market for electricity have been published with some changes compared to the proposal texts. For example, regarding communities the proposed directive used the term 'local energy community' whereas the final version of the Directive 2019/943 uses the term 'citizen energy community'.

A web-based survey was conducted in June 2019 to gather DOMINOES partners' views on problems in the current regulation. The identified problems included:

- Missing clear definition of the possible ownership of storage by the DSOs
- Incentives lacking in regulation for the use of demand response in the ancillary service markets
- Existing markets are not available for small prosumers (i.e. small energy production and small flexible load) and in some cases aggregation is not permitted
- National legislation about the energy communities is yet to be formed

The legislative framework around the identified issues is discussed in the following subsections. Furthermore, the DOMINOES local market concept was developed further in D2.3 Scalable local energy market architecture (second release). This included analysis of the implications of flexibility and energy trading of distributed resources on the balance responsibility process. Therefore, also the regulatory framework related to balance settlement and balance responsibility is discussed.

2.1 Utilization of storage by DSOs

Directive (EU) 2019/944 on common rules for the internal market for electricity introduced a framework for DSOs' storage use.

Article 36 of Directive 2019/944 states that:

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*** *…* ***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 … 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 fully integrated components that DSOs may be allowed to own and operate are defined in the directive (Article 2) as "*network components that are integrated in the transmission or distribution system, including storage facilities, and that are used for the sole purpose of ensuring a secure and reliable operation of the transmission or distribution system, and not for balancing or congestion management*."

Thus, principally the DSOs are not allowed to acquire storage facilities to be utilized in balancing and congestion management. This is likely to increase the need for services provided by local energy markets and prosumers which is at the core of the DOMINOES concept as two of the business models developed in D5.1 were specifically focused on providing services for the DSO, and DSO was among the potential customers also in other business models.

2.2 Utilization of flexibility by DSOs

One challenge discussed in the year one report was DSOs' opportunity to utilize flexibility services. This issue is addressed in Article 32 of Directive 2019/944, Incentives for the use of flexibility in distribution networks:

1.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. In particular, the* ***regulatory framework shall ensure that distribution system operators are able to procure such services from providers of distributed generation, demand response or energy storage and shall promote the uptake of energy efficiency measures****, where such services cost-effectively alleviate the need to upgrade or replace electricity capacity and support the efficient and secure operation of the distribution system. ...*

2.Distribution system operators … or the regulatory authority itself, shall … establish the specifications for the flexibility services procured and, where appropriate,

> *standardised market products for such services at least at national level.* ***The specifications shall ensure the effective and non-discriminatory participation of all market participants, including market participants offering energy from renewable sources, market participants engaged in demand response****, operators of energy storage facilities and market participants engaged in aggregation. ….* ***Distribution system operators shall be adequately remunerated for the procurement of such services*** *to allow them to recover at least their reasonable corresponding costs, including the necessary information and communication technology expenses and infrastructure costs.*

The problem of regulatory frameworks favouring infrastructure investments over service procurement (discussed in D6.9) should be mitigated once the requirements are implemented in the member states. However, this will take time as the regulatory framework is typically fixed for several years at a time. It is also likely that the remuneration mechanisms will differ between countries as the current regulatory frameworks differ widely in other aspects also. Another important point for the DOMINOES concept is the requirement for non-discriminatory participation demand response providers and aggregators.

2.3 Ancillary services

The access of prosumers (i.e. end-users that both consume and produce electricity, or provide flexibility services) to organized electricity market is a challenge to the DOMINOES concept.

In some of the current flexibility markets, the eligibility is limited only to generators and even large loads are not accepted as resources. This applies for example to frequency containment reserve and frequency restoration reserve in many European countries (see ENTSO-E, 2019).

Directive 2019/944 addresses the position of aggregated loads (demand response) in these markets as Article 17 (2) states:

> *Member States shall ensure that transmission system operators and distribution system operators,* ***when procuring ancillary services, treat market participants engaged in the aggregation of demand response in a non-discriminatory manner*** *alongside producers on the basis of their technical capabilities.*

Furthermore, Article 17 (3) sets e.g. the following requirements for the regulatory framework in member states:

> *(a) the right for each market participant engaged in aggregation, including independent aggregators, to enter electricity markets without the consent of other market participants;*

> *(b) non-discriminatory and transparent rules that clearly assign roles and responsibilities to all electricity undertakings and customers;*
>
> *(c) non-discriminatory and transparent rules and procedures for the exchange of data between market participants engaged in aggregation and other electricity undertakings …*
>
> *(d) an obligation on market participants engaged in aggregation to be financially responsible for the imbalances that they cause in the electricity system; to that extent they shall be balance responsible parties or shall delegate their balancing responsibility in accordance with Article 5 of Regulation (EU) 2019/943;*
>
> *…*

Thus, these changes should open the ancillary service markets in all member states for (aggregated) loads and equalize the market position of demand response between European countries. This is an important prerequisite for the DOMINOES concept as selling flexibility to TSOs is considered as a revenue stream in the business models developed in D5.1.

2.4 Energy communities and prosumers

The proposal for the electricity directive (European Commission, 2017) included in the 'Clean Energy for all Europeans' package used the term 'local energy community'. In the finalized Directive 2019/944, the term had switched to 'citizen energy community' defined in Article 2 (11) as a legal entity that

> *(a) is based on **voluntary and open participation** and is effectively **controlled by members or shareholders that are natural persons, local authorities, including municipalities, or small enterprises**;*
>
> *(b) has for its **primary purpose** to provide **environmental, economic or social community benefits to its members or shareholders or to the local areas** where it operates rather than to generate financial profits; and*
>
> *(c) may engage in generation, including from renewable sources, distribution, supply, consumption, aggregation, energy storage, energy efficiency services or charging services for electric vehicles or provide other energy services to its members or shareholders;*

Furthermore, requirements for regulatory framework concerning these communities is defined in Article 16 (1).

> *1. Member States shall provide an enabling regulatory framework for citizen energy communities ensuring that:*
>
> *(a) **participation** in a citizen energy community is **open and voluntary**;*
>
> *(b) members or shareholders of a citizen energy community are **entitled to leave the community**, in which case Article 12 applies;*

> *(c) members or shareholders of a citizen energy community* ***do not lose their rights and obligations as household customers or active customers****;*
>
> *(d) subject to fair compensation as assessed by the regulatory authority,* ***relevant distribution system operators cooperate with citizen energy communities*** *to facilitate electricity transfers within citizen energy communities;*
>
> *(e) citizen energy communities are subject to non-discriminatory, fair, proportionate and transparent procedures and charges…*

Rights of citizen energy communities are also addressed in Article 16 (3):

> *3. Member States shall ensure that citizen energy communities:*
>
> *(a) are able to* ***access all electricity markets****, either directly or through aggregation, in a non-discriminatory manner;*
>
> *(b) are treated in a non-discriminatory and proportionate manner with regard to their activities, rights and obligations as final customers, producers, suppliers, distribution system operators or market participants engaged in aggregation;*
>
> *(c)* ***are financially responsible for the imbalances they cause in the electricity system****; to that extent they shall be balance responsible parties or shall delegate their balancing responsibility in accordance with Article 5 of Regulation (EU) 2019/943;*
>
> *(d) with regard to consumption of self-generated electricity, citizen energy communities are treated like active customers in accordance with point (e) of Article 15(2);*
>
> *(e) are entitled to arrange within the citizen energy community the sharing of electricity that is produced by the production units owned by the community, subject to other requirements laid down in this Article and subject to the community members retaining their rights and obligations as final customers.*

Present regulatory framework varies between the Member States, and legislative changes will take place during the year 2020, as the above mentioned Directive requires transposition to laws and regulations by 31 December 2020.

One challenge here is that Directive regulates that energy communities shall be able to access electricity markets (either directly or aggregated), and at the same time, members of energy community do not lose their rights and obligations as household customers or active customers. This means that the members of the energy community should be able to make an electricity supply contract with any supplier they want, and simultaneously they should be able to get the benefits of energy community's energy resources, such as own generation. Hence, energy community cannot be a single customer as a whole, but its members have to have market access also as individual customers. One technical solution to fulfil this requirement is to share the own generation in energy community to

its members by netting the share of own generation and measured consumption within the same hour (if balancing period is one hour). For instance; let us assume that the own generation within the energy community is 10 kWh/h during the hour *x*, consumption of the customer *y* of the community is 8 kWh/h during the same hour *x*, and the share of the that customer from the generation of the energy community is 10 %. In that case, the customer y would be supplied by 1 kWh/h from the own generation, and purchase from markets would be 7 kWh/h. Measurements can be done by using existing measurement infrastructure (if the smart meter roll-out has been completed), and the calculated information about the net consumption (i.e. 7 kWh/h in this case) can be used for electricity procurement and billing, as well as in balance settlement process. Using of existing metering infrastructure promotes cost efficiency.

However, a regulatory barrier for such solution is Chapter 10.5 in Annex I of the Directive 2014/32 on the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments, which states:

> *Whether or not a measuring instrument intended for utility measurement purposes can be remotely read it shall in any case be fitted with a metrologically controlled display accessible without tools to the consumer.* ***The reading of this display is the measurement result that serves as the basis for the price to pay****.*

In above described method of sharing the own generation within energy community, the net value of the customer consumption, applied in billing, is based on the netting two measured values, and hence, billing would not be based on the value that can be read from the display. Meter reading in display is typically showing the cumulative value of the energy consumption. Hence, also real-time priced supply contracts would be similarly against the directive, if customer is unable to read hourly measurement values from the display.

Although the directive is written with good intentions to protect the customers, this part seems to be technically outdated. Typically, customers can access energy consumption information via on-line services, and display in the meter is not a primary source of information.

This challenge has been actively communicated for several authorities, and there seems to be consensus about the fact that services provided with the present smart meters, for instance dynamic pricing, are not in-line with the above mentioned part of the directive. Furthermore, it would be costly to renew the smart meters just because of this requirement. Hence, there seems to be genuine will to somehow solve this regulatory barrier.

The 'Clean energy for all Europeans' package included also another type of community, i.e. the renewable energy community defined in the recast renewable energy directive 2018/2001. In addition, directive introduced the definitions for 'renewables self-consumers' and 'jointly acting renewables self-consumers'. Thus, the directive sets requirements for the rights of prosumers with renewable generation.

This directive was published in its final form in the end of 2018 and was discussed in D6.9. Thus, some of the member states have already transposed some of the requirements of this directive into the national laws. For example, the Portuguese legislation related to self-consumption was updated in October 2019. The previous framework regarding self-consumption allowed only individual self-consumption but Decree Law No. 162/2019 allows also collective self-consumption which means that consumers can group together and use the same energy production unit. In addition, the Decree Law allows self-consumers to trade their excess generation in spot markets or through bilateral trading. Furthermore, it transposes the requirements of the renewable energy directive (2018/2001) concerning renewable energy communities into the Portuguese legislation.

2.5 Balance settlement and balance responsibility

One issue discussed in the DOMINOES local market architecture (D2.3) is the balance responsibility and balance settlement. Local trading (e.g. peer to peer) and flexibility controls increase the imbalance risks of retailers if the balancing mechanism is not changed. Thus, D2.3 analysed the benefits and drawbacks of alternative approaches (smaller balance responsible party units, independent aggregators, multiple retailers) and identified two solutions for implementing balance responsibility locally.

In the *BRP (full model)*, the balance responsibility is extended to e.g. the level of individual houses and trades from local market are forwarded directly to the imbalance settlement responsible. In the *sub-BRP (light model)*, the traditional balance responsibility is maintained and a separate local balance is created. The local market coordinates changes to the balances on the system level.

Table 2.1 compares the requirements in the current Nordic model and the two proposed alternatives.

Table 2.1 BRP requirements in the current Nordic and the proposed models (D2.3)

Requirement	Current Nordic	BRP (full model)	sub-BRP (light model)
Imbalance settlement agreement	with ISR (imbalance settlement responsible)	with ISR for energy and flexibility	either with a local ISR or alternatively with retailer for energy and flexibility and with DSO for flexibility
Planning balanced schedules	✓	✓	✓
Submitting plans	per Regulation Object (group of production limited to one type of pro-duction within market balance area)	for production	
Submitting bilateral trades	✓	(if direct P2P trading is implemented)	
Acting as a financial counterpart to settlement of imbalances	priced according to im-balance prices (from balancing market)	could be priced according to system imbalance prices, somewhat lower or using separate pricing mechanism based on e.g. quantity of local imbalances	
Verifying data reported by ISR	✓	✓	✓
Keeping imbalance settlement structure information up to date	w.r.t. retailers and Regulation Objects within metering grid areas	metering grid area information to ISR as well as structure of aggregated groups (metering points per VPP)	Structure of aggregated groups (metering points per VPP)

In the European legislation, balancing issues are addressed mainly in the Commission Regulation (EU) 2017/2195.

Article 52 (1) of the Regulation addresses the arrangement of the imbalance settlement:

> *1.**Each TSO** or, where relevant, third party **shall settle within its scheduling area or scheduling areas** when appropriate **with each balance responsible party for each imbalance settlement period** pursuant to Article 53 **all calculated imbalances** pursuant to Article 49 and Article 54 against the appropriate imbalance price calculated pursuant to Article 55.*

In addition, Article 52(2) obligated all TSOs to develop a proposal to further specify and harmonize at least (a) the calculation of imbalance adjustment[2], a position[3], an imbalance[4] and an allocated volume[5], (b) the main components used for the calculation of the imbalance price for all imbalances, (c) the use of single imbalance pricing for all imbalances, and (d) the definition of conditions and methodology for applying dual imbalance pricing for all imbalances. ENTSO-E published this proposal (ENTSO-E, 2018) in December 2018.

Neither Regulation 2017/2195 nor the TSOs' proposal (ENTSO-E 2018) formulated based on it take a stand on the size or level of the balance responsible party. The terms and conditions for BRPs may vary between countries as Article 18(1) of the regulation required national TSOs to develop proposal regarding the terms and conditions for (a) balancing service providers and (b) balance responsible parties. Nevertheless, the approaches proposed in the DOMINOES local market architecture do not contradict with the European legislative framework.

[2] 'imbalance adjustment' means an energy volume representing the balancing energy from a balancing service provider and applied by the connecting TSO for an imbalance settlement period to the concerned balance responsible parties, used for the calculation of the imbalance of these balance responsible parties;

[3] 'position' means the declared energy volume of a balance responsible party used for the calculation of its imbalance;

[4] 'imbalance' means an energy volume calculated for a balance responsible party and representing the difference between the allocated volume attributed to that balance responsible party and the final position of that balance responsible party, including any imbalance adjustment applied to that balance responsible party, within a given imbalance settlement period;

[5] 'allocated volume' means an energy volume physically injected or withdrawn from the system and attributed to a balance responsible party, for the calculation of the imbalance of that balance responsible party;

3 Cyber security standards

The year 1 report (D6.9) of this task discussed standardization issues concerning cyber security, energy storage systems and inverter driven technologies. The cyber security issues have been addressed also in a dedicated task, T2.5 Architecture and design of a data security framework.

The deliverable related to T2.5 (D2.6), which was finished during year 2, provides beneficial insights for implementing a secure and trusted P2P energy trading platform. It includes a detailed description of the current data protection regulations, and the existing smart grid cybersecurity guidelines and standards. The effective smart grid cybersecurity measures have been reviewed, and the DOMINOES cybersecurity challenges have been discussed. Furthermore, the following high-level data security and privacy objectives for the DOMINOES context were defined:

- Maintaining confidentiality of measurements, users' data and system parameters used in each operator.
- Protecting and segregating, appropriately, information from all stakeholders involved.
- Protecting the DOMINOES platform from current and future threats.
- Ensuring the good and consistent operation of the whole system.
- Maintaining the integrity of communication information between operators in the network.
- Preventing tampering and data manipulation.
- Ensuring the availability of data.

The datasets that will be exchanged, stored, or shared by DOMINOES have been identified and classified as public (information that can be made available freely to the public), operational (information that is generally available to any registered user or platform manager), restricted (information that is sensitive for any stakeholder) or confidential (information that is highly sensitive for any stakeholder). Cybersecurity threat types and threat agents have been discussed. Finally, the DOMINOES cybersecurity architecture is presented and a set of recommendations are mapped to the security architecture layers. Techniques that should be used to mitigate major identified security risks have been discussed.

The presented DOMINOES cybersecurity architecture is based on the open-source security architecture development and management method called Sherwood Applied Business Security Architecture Framework (SABSA) (Sherwood et al. 2005). The SABSA architecture is divided to six layers which are 1) contextual, i.e. business point of view, 2) conceptual, i.e. architect point of view, 3) logical, i.e. designer point of view, 4) physical, i.e. constructor point of view, 5) component, i.e. technician point of view, and 6) management (operational), i.e. manager point of view. DOMINOES cybersecurity recommendations were mapped to these layers as shown in Table 3.1.

Table 3.1 DOMINOES cybersecurity recommendations in SABSA layers (D2.6)

Security Architecture Layer	Recommendations
Contextual	• To have clear business opportunities, strategy, requirements, and capability, for the overall DOMINOES platform. • To create a technology strategy, capability, and technology architecture for the overall platform and each component in the DOMINOES environment.
Conceptual	Cyber Threats, Education and Awareness, Policies, Standards, Guidelines, and DPIA)
Logical	• Network Security: o Application Control o Content Security (Email Inspection and Control, Web Inspection and Control) o Data Centre Segregation (Firewall, IDS/ Intrusion Protection Systems (IPS), UTM/Next Gen, Deep Packet Inspection) o Network Access Control o Geolocation o Network Time (NTP) o Wireless (Application Control (App FW), Pre- Authentication (802.1x), Guest Network, Encryption) o Monitoring (Network Behaviour Analysis/Network Anomaly Detection, Network Forensics, Logging and Monitoring) o Network Encryption (Layer 2 Encryption, Transport Layer Security, Virtual Private Networking VPN) • Endpoint Security: o Endpoint Defense (Anti Malware, Host Firewall, and HIPS) o Disk Encryption o Remote Access/VPN o Secure Config Baselines o Sandboxing • Physical Security: o Physical Access Control o Physical Asset Control o Security Passes – Identity o CCTV/Monitoring • Web Services Security: o Direct Authentication o Brokered Authentication o Data Confidentiality o Data Origin Authentication o Logging and Monitoring • Data Security: o Databases Security (Database Encryption, Database Assessment, Database Activity Monitoring) o Data Loss Prevention (Storage, Database, Network, Endpoint, Email, and Web Gateway DLP, Physical Media Control, and Content Discovery) o Encryptions (Files, Emails, SAN, and Applications) o Access Management (Entitlement and File Activity Management) o Logging and Monitoring • Identity and Access Management: o Authentication (Web, Enterprise, Certificates, Remote Access Authentication, Biometrics, Mobile Device, and Network Authentications (802.1x, PPAP, CHAP etc.)) o Authorisation o Privileged User Management o Provisioning (Joiners, Leavers and Movers, Device Identities, Managing Generic Accounts) • Security Management: o Security Operations (SIEM, Log Management, Security Operations Center, Response and Investigation, Dashboard and Compliance reporting, Cyber Intelligence) o Vulnerability Management (Penetration Testing, Vulnerability Assessment) o Crypto Management o System Management (Patching and Configuration Management) o Security Incident Management

	o Forensics Management (Digital and Malware Forensics) o Business Continuity (Disaster Recovery, Business Continuity and Service Continuity plans) • Cloud Security: o Cloud-based hardware security module (HSM) o VPN Gateway o API Gateway o DDoS Protection o Cloud Firewall Appliances o Threat Detection o Disk Encryption o Just in Time Access o Logging and Monitoring o Cloud Security Access Broker (Authentication, Data Tokenisation, Encryption, DLP, Logging, Single Sign-On, Access Control etc.) • Application Security Controls: o Auditing (Business, Operational, and Components Activity Logging) o Access Control – Authorisation (File system, Database, and client ACL. Role Based Access Control, and Least Privilege Controls) o User and Application Authentication (Browser-based Federation (SAML, ADFS), Bespoke Authentication, Directory (LDAP), Single Sign-On, Unsuccessful Login Controls, and Previous Logon Notification) o Encryption within the Application o Session Management o Integrity Controls (Tamper Resistance and Detection, Memory Protection, and Code Control) • Security Testing and Code Validation: o Secure Development (Code Repository Tooling, Code Control Tooling, Automated Code Packaging and Deployment Tooling) o Web Application Assessment (Web Vulnerability Scanning, and Web Application Testing)
Physical	• Cloud Monitoring • Data Loss Prevention • Build Compliance • Vulnerability Scanning • Incident Management • Privileged User Management • Patch Management • Remote Access Management • Anti-Malware Management • Business Continuity Management • Key Management • Cloud Security Insight • Certificate Management • Security Testing
Component	• Secure by Design • Operational Risk Management • Security Risk Management • Education and Awareness • Security Requirements for Devices and Systems • Security Policy, Standards, and Guidelines Governance and Compliance Management (ISO 27000, GDPR, NIST, COBIT, PCI, TLS, IEC, and others)
Management	• Software Version Management • Asset and Configuration Management • Backup and Recovery • Network Management • Licence Management • Change and Release Management • Problem Management • Service Level Management • Service Continuity Management • Deployment Compliance • Release and Deployment Management • Cloud Monitoring and Management • Testing • Release Management

4 Activities related to standardization organizations and regulatory bodies

Partners' activities related to standardization, regulation and legislation were mapped with two web-based surveys. The first survey was done in June 2019 and it covered the activities between December 2018 and June 2019 (M15-M21). The second survey was done in December 2019 and it covered the activities between July 2019 and December 2019 (M22-M27) and any unreported activities from M15-M21. The activities reported in these surveys are summarized in this section. Furthermore, partners' views on the recent development in the regulatory environment are discussed.

Standardization organisations

Empower and LUT have representatives in SESKO's (Finnish National Electrotechnical Standardization Organization) committee SK8 Systems aspects for electrical energy supply and are involved in discussions on flexibility management technology implementation. SK8 participates in activities of the committees IEC TC 8 Systems aspects for electrical energy supply, IEC SC 8A Grid Integration of Renewable Energy Generation, IEC SC 8B Decentralized Electrical Energy Systems, IEC TC 123 Management of network assets in power systems, IEC SyC Smart Energy, and SyC LVDC Low Voltage Direct Current and Low Voltage Direct Current for Electricity Access. Furthermore, SK8 participates in CENELEC committee CLC/TC 8X System aspects of electrical energy supply.

LUT has a representative in SESKO's committee SK69 Electrical road vehicles and industrial trucks. The national committee participates standardization work of the committees IEC/TC 69 (Electric road vehicles and electric industrial trucks) and CENELEC/TC 69X (Electrical systems for electric road vehicles) and also observes committees IEC/TC 21 (Secondary cells and batteries), IEC/SC 23H (Plugs, Socket-outlets and Couplers for industrial and similar applications, and for Electric Vehicles), IEC/SC 121B (Low-voltage switchgear and control gear assemblies) and ISO/TC22/SC21 (Electric Road Vehicles). The national committee SK69 prepares national standardisation in the field of EV charging for Finland and provides national guidelines to follow.

The different committees related to systems aspects are relevant for DOMINOES project as they work among topics such as design and management of decentralized electricity supply systems, cybersecurity in power systems, and virtual power plants. EV charging on the other hand represents a potential controllable load i.e. demand response resource.

CIRED working groups

DOMINOES partners had representatives in the following CIRED (i.e. an international association active in the technical field of Electricity Distribution Systems, including dispersed and embedded generation issues) working groups:

- Microgrids in interconnected and islanded modes - WG 2018-3 (CNET)
- Microgrids business models and regulatory issues - WG2019-2 (LUT)
- Blockchain, Transactive Energy and P2P Trading - WG 2018-6 (LUT)
- Flexibility in active distribution systems - WG 2019-3 (LUT)

These working groups are investigating issues such as frequency control and voltage regulation (WG 2018-3), challenges presented by transactive energy, role of DSOs in the implementation of such marketplaces, market models and business models of transactive energy and associated opportunities and challenges for DSOs (WG 2018-6) (CIRED 2020), microgrids value, taking into consideration ability to optimize DSO's investments and provision of services to power system (WG2019-2), possible structure of markets relevant to flexibilities provided by distributed generation, storage systems and active demand to DSOs and TSOs (WG 2019-3) (CIRED 2020). These issues are considered also in the DOMINOES project and thus, DOMINOES can provide relevant information for the working groups and vice versa.

Regulatory and legislative bodies

LUT has been participating in a study on electricity self-production and energy communities for the Finnish prime minister office. Final report (Gaia Consulting and LUT University 2019) was published in December 2019, and it includes proposals for promoting energy communities and self-production in Finland, including proposals for regulatory changes.

Empower has been active in the IEEE Power and Energy Society through collaboration with research partners and DG CONNECT discussions on facilitation of flexibility information exchange (e.g. implementation of datahubs). DG CONNECT facilitated an interactive session between development projects where DOMINOES was showcased as part of Utility Week in Paris. Empower has also continued discussion with authority and ministry resources based on completed work on flexibility as part of balance settlement and network ancillary service value for the Finnish Energy Authority.

CNET has been participating in European projects promoting the aggregation of flexibility or use of storage and has promoted recommendations for changes in EU regulations and policies. In addition, CNET has participated in a flexibility pilot test (led by the Portuguese Regulator), for load flexibility participating in the ancillary services provision. EDPD has regular interactions with the Portuguese Regulator, ERSE. Furthermore, their regulation department participated in some public consultations promoted by the Council

of European Regulators. EDPD is involved in European projects regarding regulatory issues.

VPS maintains informal contacts with the Portuguese energy services regulatory authority to better understand the medium to long term legislator viewpoint and position. For example, the need of having a legal framework that allows a more active role of the energy consumer/prosumer in the energy systems of the future, namely, having the possibility of implementing the Local Energy Markets being developed in DOMINOES project has been discussed with the director of pricing and tariffs of ERSE. VPS has also had a meeting with DGEG (Directorate-General for Energy and Geology) a public administration body working on the design, promotion and evaluation of public policies related to energy resources, focusing on the discussion and clarification about the future legal framework to implement renewable energy communities. VPS has discussed with a market manager of the Portuguese TSO regarding a pilot project for demand-side participation in the regulatory reserve market. In addition, VPS has also participated in some workshops and in the public consultation phase of some regulatory documents by offering comments or asking for clarifications. USE has disseminated results and asked for regulator viewpoints on topics such as prosumer legislation, types of self-consumption and their regulatory, legislation about selling your energy to grid.

The formal cooperation and informal discussions with the regulators promote information exchange between the project and the regulator. It enables taking the regulatory viewpoints into consideration when the work is in progress and also bringing new viewpoints to developers of regulation and market rules.

Views on the development of regulatory framework

Portugal already approved some regulation regarding energy communities, but they will only be fully enforced by 2021. Other changes needed would be the authorisation of the use of aggregated load flexibility to provide ancillary services to the TSO; and a change in the balancing areas (to reduce them or completely abolish them), in order to allow the provision of flexibility without geographical (or balancing areas) constraints.

On the other hand, ERSE has recently promoted a flexibility provision pilot project for large consumers. However, and although the Portuguese government and the Regulator have taken many steps towards a more decentralized and renewable energy sector, there are no established rules for any type of local energy market yet. A clear government policy that defines local markets, regulation and standardization is missing also in other countries.

In Finland, aggregated flexibility can already participate in the ancillary service markets and some of the markets are open also to independent aggregators. However, legislation concerning energy communities and local energy markets is still pending.

5 Conclusions

This deliverable has followed the regulatory development related to the DOMINOES local energy market concept. In addition, DOMINOES partners' activities related standardization, regulation and legislation during year 2 of the project have been reported.

When the year 1 report was finalized, some of the legislative proposals included in the 'Clean energy for all Europeans' package had not been adopted yet. Also the last proposals in the package have now been approved with some changes to the initial proposals. Once implemented in Member States, they should improve the conditions for the DOMINOES concept and mitigate some of the problems identified by the partners, especially the access on flexible loads and small prosumers to the markets. More uniform situation regarding the eligibility of resources will facilitate the introduction of local markets in different countries. However, although the definition of 'citizen energy communities' and their rights and responsibilities offers some clarifications to the position of energy communities in the power systems, open questions still remain for example regarding arrangement of metering in communities and local energy markets. Thus, changes in the regulatory framework concerning measurement instruments would promote development of communities and services for them.

During year 2, partners have had activities related to standardization, regulation and legislation with both national and European organizations. These have included, for example, studies and pilots made for or in cooperation with regulators and legislators and participation in standardization committees' work. In addition, during year 2, cyber security issues including standards have been addressed in a dedicated task (T2.5 Architecture and design of a data security framework) and deliverable (D2.6) which defined the cybersecurity architecture for the DOMINOES project.

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