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One Network for Europe – Scalability and Replicability in View of Harmonised Electricity Markets

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Abstract. Renewable energy production is mentioned by many as one of the key factors in mitigating the effects of climate change. However, there may be several downsides to the spread of renewables, such as their impact on the balance of the electricity system and on receiving networks. The project OneNet (One Network for Europe) is funded through the EU's eighth Framework Programme Horizon 2020. It is titled "TSO – DSO (Transmission-Distribution System Operator) Consumer: Large-scale demonstrations of innovative grid services through demand response, storage and small-scale (Renewable Energy Source) generation" and responds to the call "Building a low-carbon, climate resilient future". While the electrical grid is moving from being a fully centralized to a highly decentralized system, grid operators must adapt to this changing environment and adjust their current business model to accommodate faster reactions and adaptive flexibility. This is an unprecedented challenge requiring an unprecedented solution. Thus, the two major associations of grid operators in Europe, the European Network of Transmission System Operators for Electricity (ENTSO-E) and European Distribution System Operators (EDSO), have activated their members to establish a unique consortium.

Key words. customer-centric network operation, cluster, market participants, demonstration area, system operator.

1. Introduction

OneNet will provide a seamless integration of all the actors in the electricity network across Europe to create the conditions for a synergistic operation that optimizes the overall energy system while creating an open and fair market structure. The project aims to provide a new generation of network services in a single country that can take full advantage of demand-side responses, storage and distributed generation, while at the same time creating fair, transparent and open conditions for consumers. As a result, it creates a customer-centric approach in network operation.

This ambitious vision is pursued by offering new markets, products and services, as well as specific IT solutions to support innovative mechanisms for platform federation. The project also aims to build a broad consensus on a solution by launching various initiatives, including a broad discussion forum within the international energy community. OneNet will see the participation of a consortium of over 70 partners. Key partners in the consortium include: the already mentioned ENTSO-E and EDSO, Elering, E-REDES, RWTH Aachen University, University of Comillas, VITO, European Dynamics, Ubitech, Engineering, and the EUI's Florence School of Regulation (Energy).

The key elements of the project are:

1. Definition of a common market design for Europe: this means standardized products and key parameters for grid services which aim at

the coordination of all actors, from grid operators to customers;

2. Definition of a Common IT Architecture and Common IT Interfaces: this means not trying to create a single IT platform for all the products but enabling an open architecture of interactions among several platforms so that anybody can join any market across Europe; and
3. Large-scale demonstrations to implement and showcase the scalable solutions developed throughout the project. These demonstrations are organized in four clusters including countries in every region of Europe and testing innovative use cases never validated before.

Basic information about the project:

- There are 72 consortium members.
- 23 countries in 4 clusters are participating in the project.
- The project started on 1st October 2020 and will end in October 2023 (duration: 36 months).
- Total budget: EUR 28 million, out of which 70% is for partners from industry and 100% for partners from public institutions.

The project follows a seven-step process:

1. Identifying new and standardised products and services based on project experience.
2. Creating appropriate market structures to support the defined specific products and services.
3. Developing an open IT architecture that enables market structures, supported by scalable data management.
4. Implementation of the architecture in a reference version that can serve as a basis for European deployment.
5. Validating the concepts and solutions proposed by OneNet in large-scale field tests (demonstration sites).
6. Building consensus at European level on GRIFO (the OneNet launched the GRId Forum, an innovative platform that brings together and facilitates the dialogue between the stakeholders) with the participation of all key stakeholders.
7. Taking the results of OneNet forward in a standardisation process for significant market uptake.

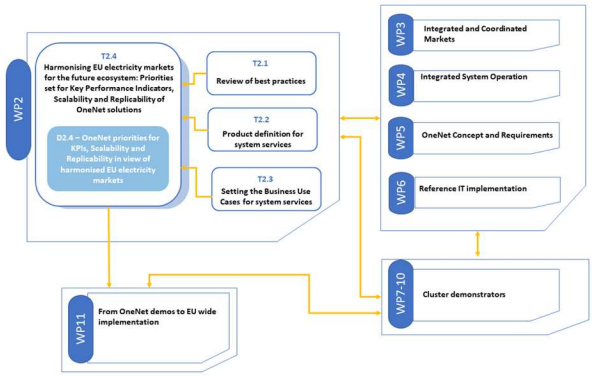

Fig. 1. Interconnection between the different work packages in the OneNet project

2. Clusters in the project

The OneNet project aims at contributing to the integration of all the actors in the electricity network across the countries creating the conditions for a synergistic operation that optimizes the overall energy management while creating an open and fair market structure. OneNet activities are based on three main pillars:

- Definition of a common market design for Europe,
- Definition of a common IT Architecture and common IT Interfaces,
- Verification of the proposed solutions in large field tests.

The first pillar encompasses the definition of standardised products and key parameters for grid services, the definition of procedures to coordinate the actors creating a market environment, and the promotion of the procurement of services by TSOs and DSOs from the resources connected in the TSO and DSO networks. The second pillar regards the creation of an architecture defined as an interoperable network of platforms that fits the market requirements, the provision of universal access for market participants in EU regardless of their geographical point of connection. The third pillar concerns the development of the demonstration activities by the field tests addressed by the demonstrators that implement the solutions developed with respect to the first and second pillars.
The three pillars of the OneNet project activities lead to the achievement of the OneNet strategic objective of developing an open and flexible architecture to transform the actual European electricity system, which is often managed in a fragmented country- or area-level way, into a pan-European smarter and more efficient network, in which market and network technical operations are reciprocally coordinated closer to real time i) among them, ii) across different countries iii) while maximizing the consumer capabilities to participate in an open market structure. Correspondingly, the OneNet project has the operational objectives of:

1) Developing innovative market structure;
2) Upscaling, adapting, validating and testing the OneNet architecture;
3) Removing barriers for the commercial use of the innovative market structure.

The project involves different market participants, and different service-product combinations are tested, both transmission system operator and distribution system operator products are involved. The overall concept is tested in 4 clusters at several pilot sites (Figure 2).

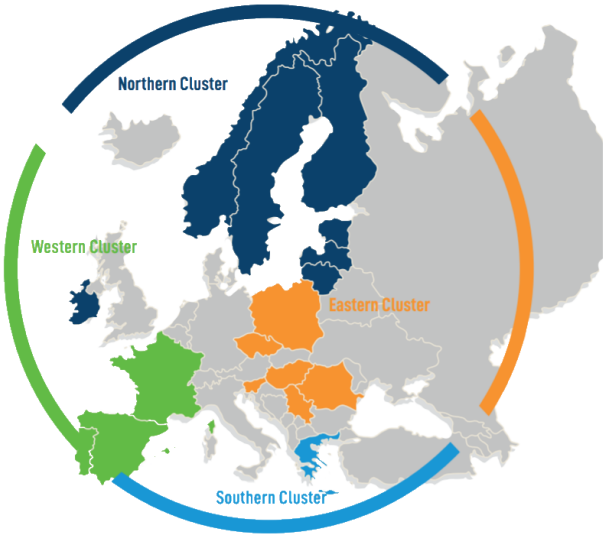

Fig. 2. OneNet cluster and participating countries

2.1. Northern Cluster (NOCL)

The OneNet Northern Cluster is formed by the demonstrators in four countries: Finland, Estonia, Latvia, and Lithuania. The Northern Demonstrator is an integrated effort by multiple TSOs and DSOs to enable market-driven flexibility uptake by these networks in a coordinated way through multiple markets where liquidity can be reached due to scope or existing trading volumes. Through this demonstration, the project will show mapping and management of network needs in multiple use cases over multiple networks. This cluster focuses on joint and shared mechanisms to be used by multiple networks and, therefore, on demonstrating the scalability and contribution towards a pan-European solution. Cross-border joint use cases are defined; therefore, country-specific market models coincide.

The key developments in the Northern Cluster relate to new mechanisms for flexibility procurement, namely flexibility register (FR) and TSO & DSO coordination platform (T&D CP). A FR is needed for the qualification and management of market parties and assets. This register is also used for settlement and verification, data sharing and access management as well as forecasting and visualization and enabling secondary market.

The T&D CP has three main tasks: first to ensure that flexibility activations do not cause congestions in any network level, i.e. setting continuously (from prequalification to activation) constraints on the flexibility bids to complete grid prequalification (considering thermal limits, voltage requirements). Second, to prioritize flexibility bids/activations that are not only economical but also technically cost-effective. Finally, the third task is to maximize the use of flexibility by doing value stacking, i.e. to find the most optimal mix of available flexibilities to be activated by running an optimisation algorithm based on socio-economic value.

The OneNet Northern cluster demonstrator envisions the definition of a market architecture that applies to all the demonstrators in the participating countries. Therefore, all the countries involved in the Northern demonstrator are to implement the same market architecture. The market architecture of the Northern demonstration includes the design of new markets for flexibility procurement.

The Northern Cluster is procuring flexibility for congestion management, balancing and voltage control services. The relevant products that have been defined for the Northern Cluster are NRT-P-E (Near Real Time Active Energy), ST-P-E (Short Term Active Energy), LT-P-C/E (Long Term Active Capacity/Energy), ST-P-C (Short Term Active Capacity), LT-Q-C (Long Term Reactive Capacity), NRT-Q-E (Near Real Time Reactive Energy).

2.2. Southern Cluster (SOCL)

The Southern Cluster is formed by the Cypriot and Greek demonstrators. The objective of the Southern Cluster is to devise, develop, implement and evaluate two pilot projects in Greece and Cyprus dealing with balancing and congestion management challenges facing system operators in the clean energy era, in compliance with the OneNet overall architecture. The results will be evaluated to provide recommendations for future market reforms in the region and harmonise a pan-EU electricity market. The primary activity of the Greek demonstrator is the improvement of the procedures for congestion management resolution. The Greek demonstrator focuses on the technical-based TSO–DSO coordination based on the existing market architecture. On the other hand, the Cypriot demonstrator aims to provide an effective collaboration framework for the TSO–DSO–Consumer value chain and the energy market by developing an active balancing and congestion management platform. The Cypriot demonstrator includes the definition of a market-based TSO–DSO coordination.

The Southern Regional Business Use Case (BUC) aims to enhance the regional cooperation through the provision of early warnings regarding potentially hazardous weather conditions and cyber threats. This will be achieved by exchanging information about cyber security and severe weather condition forecasts between the Greek and Cypriot demonstrations. Predictive maintenance algorithms together with enhanced storm predictions will be developed under Greek BUC to preserve the system running into dangerous topological or operational states. In addition, information exchange

and an early warning system for potentially hazardous weather conditions and cyber threats with TSO and DSO from Cyprus will be introduced to avoid dangerous power system regimes which could lead to damage to the critical infrastructure.
The main foreseen functionalities related to this particular business case are as follows:

- Regional storm predictive operations and maintenance process in TSO and DSO grid.
- Cyber security and protection of the vital infrastructure.

Table I. Southern Cluster Regional BUC overview

BUC ID	SOCL-BUC-01
BUC Name	Regional critical infrastructure security awareness information exchange
Scope	Regional cooperation and information exchange about cyber security and severe weather condition forecasts.
Objectives	o Cyber Security; o Critical infrastructure protection and avoidance of damages caused by severe weather conditions and cyber-attacks; o Predictive maintenance and outage management; o Enhanced severe weather condition management; and o Early warning on a potentially hazardous power system topology and regimes.
Countries	Cyprus, Greece

2.3. Western Cluster (WECL)

The Western Cluster includes 3 countries: Portugal, Spain, and France; and it has the overall objective of implementing a wide range of flexibility mechanisms, namely addressing DSO and TSO needs, including coordination between market mechanisms and the planning and real-time operation of the grids. Among the main goals to be achieved, increasing the share of renewables in energy generation and anticipating operating scenarios are relevant priorities.
The Portuguese demonstrator focuses on defining the principles and the information exchange needed to the procurement of flexibility, and on addressing operational planning activities, particularly focusing on congestion management.
The Spanish demonstrator develops and tests a local market model to unlock the flexibility of the resources connected to the distribution system to contribute to congestion management at the distribution level.
The French demonstrator focuses on the interactions between the TSO and the DSO established due to the already existing market architecture. One of the activities of the OneNet French demonstrator, the System for Traceability of Renewable Activations (STAR), aims to track the activation of power generation curtailments. Meanwhile, Tunnel of Warranty aims to ensure that the resource activation in one system operator's network does not negatively affect other system operator's network.

Table II. Western Cluster Regional BUC overview

BUC ID	WECL-BUC-01
BUC Name	Cluster Preparatory Phase: Cross-SO grid pre-qualification
Scope	Regional Use Case, enabling coordination among market and system operators of the Western Cluster through OneNet System for the harmonization of the preparatory phase based on the experience of the system and market operators from the three countries in the cluster.
Objectives	o Design the Pre-qualification process phase of ASM report among the Cluster so that it can serve as a basis for future developments; o Design the Flexibility Resource Register requirements among the Western Cluster; o Exchange information for the Grid Pre-qualification through OneNet System; and o Facilitate the entry of FSPs into the various flexibility markets within the Western Cluster.
Countries	Portugal, Spain, France

2.4. Eastern Cluster (EACL)

The Eastern Cluster comprises four demonstrator countries: Slovenia, Czech Republic, Poland, and Hungary. The Eastern Cluster develops and extends capabilities of existing flexibility market platforms for TSO and DSO system services.
The Polish demonstrator focuses on the market-based TSO–DSO coordination while the Slovenian, Hungarian, and Czech demonstrators focus mainly on DSO coordination.
The Slovenian demonstrator addresses several use-cases regarding the application of resources connected at the distribution level to defer and avoid grid reinforcements; hence, an interoperable marketplace for flexibility enablement is aimed at, and the optimisation of ancillary services procurement, and TSO–DSO coordination is developed.
Similarly, the demonstrator in the Czech Republic focuses on creating a new market platform for non-frequency services and defining those services as standard products.
The Hungarian demonstrator investigates P and Q control for DSO congestion management, voltage control, and TSO–DSO coordination through information exchange.
The Polish demonstrator has as the primary objective to enable the resources connected to the distribution level to support the system operation of both DSO and TSO. According to market-based coordination, a digital platform to procure the services for balancing, congestion management, and voltage control is developed and tested.

Table III. Eastern Cluster Regional BUC overview

BUC ID	EACL-BUC-01
BUC Name	Flexibility market data aggregation
Scope	Sharing aggregated data on individual national flexibility platforms via the ONENET system
Objectives	Defining and preparing key data on the results of national flexibility markets. Rules for sharing data through the ONENET system, by registered users of the ONENET system
Countries	Czech Republic, Hungary, Poland, Slovenia

3. Hungarian demonstration

It is expected that significant new capacity will be connected to the medium-voltage distribution network in Hungary, which will cause a burden on the voltage management of distribution networks. Hungarian medium-voltage overhead line networks are characterized by long feeders and relatively small line ampacities, making them also prone to contingencies. To increase the level of seamless integration of large-scale

and small-scale flexibilities, it is important to reduce the constraints introduced by the grid itself.

The main primary assets in the demonstration are medium voltage distribution lines (mainly 20 kV overhead lines), high voltage to medium voltage transformers (120 kV/20 kV), high voltage lines (120 kV overhead lines) and high voltage to high voltage (220 kV/120 kV and 400 kV/120 kV) transformers. The availability and loadability of these assets determine the availability of the offered services across the grid.

To tackle these challenges, two solutions are proposed: (1) the functional extension of a national flexibility platform and (2) the development of an expert system to maximise value offered by assets providing flexibility. The solution includes the definition of new products with related use cases, product and grid prequalification processes and the optimization of operation. The solutions will be demonstrated in the service area of MVM and E. ON DSOs to test their scalability.

The Hungarian regulator intended to finalise the framework of flexibility markets early in 2020. These markets will introduce a new player in the form of flexibility providers; these entities are similar to aggregators but are able to activate services based on their locations and are expected to involve smaller customers into the cooperation. Flexibility providers will be able to offer their services to the TSO (mostly balancing and frequency services) and DSOs (mostly non-frequency, like congestion management, voltage control), which necessitates a certain level of cooperation. The flexibility providers are expected to bring flexibility, provided by various resources (e.g., ~300 MW control range of existing aggregators, demand-side, storage and solar photovoltaic plants), to the market. Hungary intended to start the operation of its flexibility platform in 2021 with base level functionalities. In the project, capabilities of this platform will be compared to European benchmarks, to identify the most valuable functionalities that could drive the development of the extensions.

The extensions will focus on four areas: definition of new potential standardized flexibility services, elaboration of related product and grid prequalification processes, the conceptualisation of location-based service activation and the coordination of access to local and system-level services. The extensions are planned to be gradually introduced and demonstrated.

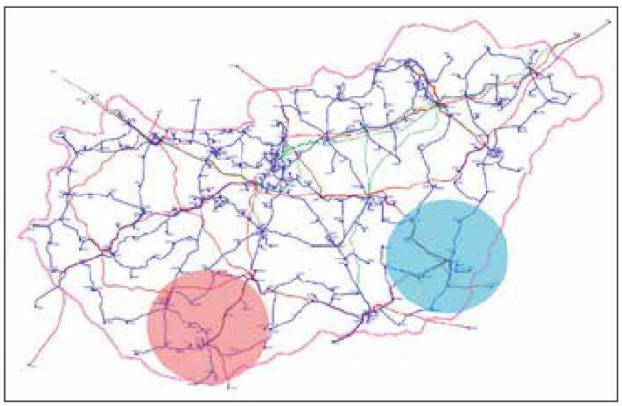

Fig. 3. Demonstration areas in Hungary

As it is typical for research projects, the technical content of the project has been modified several times since the proposal was submitted. The theoretical background of extended functionalities has been completed as an R&D task within the planned schedule. For the simulation of the platform, a market simulation tool was created to simulate the operation of the different scenarios and extensive sensitivity tests. The simulator comes with standardised inputs and outputs and will be available to all market participants through the OneNet platform.

The automated simulation environment is developed jointly by the BME and MEI, using the experience of Hungarian system operators, based on the data (medium voltage topology, load data, resilience operators service provider data) provided by them. The main parts of this tool are:

- Calculation of sensitivity factors,
- Generation of both voltage and load congestions,
- Generation of offers of flexibility providers,
- Procession of bids, optimization of a market based on an algorithm,
- Evaluation of results.

The simulator is used to run simulations on demonstration sites previously selected by DSOs, where they have sufficient information on real-world operation. The simulation environment is created based on predefined scenarios which includes extensive sensitivity testing.

Furthermore, an important element of the work is to examine the use of new services through the validation of service providers, assessing their technical and business potential to define several use cases. A complex use case matrix will be created, and an optimisation exercise will be carried out, in which the objective function will be defined for each flexibility provider, in particular for energy storage.

Tables IV and V present the BUCs defined for the Hungarian demonstration, namely, the MV feeder voltage control and the HV/MV transformer overload.

Table IV. EACL-HU_BUC-01 BUC overview

BUC ID	EACL-HU-BUC-01
BUC Name	MV feeder voltage control
Scope	Increasing renewable penetration causes violation of standard voltage bands on MV lines. The main scope of EACL-HU-BUC-01 is to mitigate voltage variations of MV feeders by activating flexibility services.
Objectives	o Keep actual voltage values of MV feeders within the standard bands.
Services	Predictive active and reactive power management for VC
Type of coordination	Market-based DSO coordination

Table V. EACL-HU-BUC-02 overview

BUC ID	EACL-HU-BUC-02
BUC Name	HV/MV transformer overload
Scope	Increasing renewable penetration causes overloading of HV/MV transformers. The main scope of EACL-HU-BUC-02 is to mitigate overloading of HV/MV transformers by activating flexibility services.
Objectives	o Avoid overloading of HV/MV transformers in all operational states of the power system.
Services	Predictive active and reactive power management for VC
Type of coordination	Market-based DSO coordination

4. Conclusion

The simulations of the presented project are based on real topology, consumption and production data are planned to be published later. In parallel with the OneNet project, flexibility platform developments are running at the Hungarian system operators as external projects. These flexibility platforms will have the four extended functionalities committed in the OneNet project. The results provide important input for the development and fine-tuning of resilience platforms in Hungary. The conceptualisation and service-product approach of the OneNet project itself has contributed greatly to the specification of the domestic resilience platforms. Thanks to this, market operators can use their experience with the simulator, as well as their information on the market participants before the platforms are live and are able to use the OneNet project services developed in the context of the OneNet project. The project will also contribute significantly to the more efficient management of the increasing number of renewable energy producers connected to the grid.

Table VI. OneNet demonstrators BUCs re-clustered according to the BUC objective and activities addressed

Country's demonstrator	BUC	Market platform development	Congestion management	Voltage control	Balancing	Forecasting, data processing and exchange	Prequalification
North	NOCL-BUC-01	■	■				
Cyprus	SOCL-CY-BUC-01	■	■	■	■		
	SOCL-CY-BUC-02	■		■			
Greece	SOCL GR-BUC-01		■	■		■	
	SOCL GR-BUC-02						
France	WECL-FR-BUC-01		■			■	
	WECL-FR-BUC-02					■	
Portugal	WECL-PT-BUC-01		■			■	
	WECL-PT-BUC-02					■	
	WECL-PT-BUC-03					■	
Spain	WECL-ES-BUC-01	■	■			■	
	WECL-ES-BUC-02	■	■			■	
Czech Republic	EACL-CZ-BUC-01	■	■			■	
	EACL-CZ-BUC-02	■		■		■	
Hungary	EACL-HU-BUC-01	■		■			
	EACL-HU-BUC-02	■	■				
Poland	EACL-PL-BUC-01						■
	EACL-PL-BUC-02	■			■		
	EACL-PL-BUC-03	■	■	■			
	EACL-PL-BUC-04	■			■		
Slovenia	EACL-SL-BUC-01	■	■				
	EACL-SL-BUC-02	■		■			

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References

[1] "Homepage," OneNet Project. https://onenet-project.eu/ (accessed May 13, 2022)
[2] A. Bachoumis et al., "OneNet Concept and Requirements," OneNet, D5.1, 2021. [Online]. Available: https://eui1-my.sharepoint.com/:b:/g/personal/chiara_canestrini_eui_eu/EePq7-Vy-wFHoSsZyTITcnwBOSm7mIQEjG0rn72zp5dukg?e=E7GzxM
[3] J. P. Chaves, M. Troncia, C. D. Silva, and G. Willeghems, "Overview of market designs for the procurement of system services by DSOs and TSOs," D3.1, 2020. [Online]. Available: https://eui1-my.sharepoint.com/:b:/g/personal/chiara_canestrini_eui_eu/EbyaCTdc6TpBjaBbreaJnwwB4wubCm6D1e7FHNkeoV8fFQ?e=W6IFJu
[4] D. Divényi, B. Polgári, Á. Sleisz, P. Sőrés, and D. Raisz, "Investigating minimum income condition orders on European power exchanges: Controversial properties and enhancement proposals," Applied Energy, vol. 281, p. 116070, Jan. 2021, doi: 10.1016/j.apenergy.2020.116070.
[5] B. Hartmann, I. Vokony, and P. Sőrés, "Contextual Evaluation of Electricity Utility Business Models," International Journal of Strategic Energy & Environmental Planning, vol. 2, no. 3, pp. 8–23, 2020
[6] B. Hartmann, I. Vokony, P. Sorés, and I. Táczi, "Service aspect assessment of energy storage under the ownership of distribution system operators," Journal of Energy Storage, vol. 25, p. 100861, Oct. 2019, doi: 10.1016/j.est.2019.100861.
[7] M. A. Sőrés and B. Hartmann, "Analysis of the Relation between State of Health and Self-Discharge of Li-Ion Batteries," ACTA POLYTECH HUNG, vol. 18, no. 10, pp. 225–244, 2021, doi: 10.12700/APH.18.10.2021.10.12.
[8] United Nations Framework Convention on Climate Change (UNFCCC), The Paris Agreement. United Nations, 2015. Accessed: Dec. 30, 2020. [Online]. Available: https://unfccc.int/sites/default/files/english_paris_agreement.pdf
[9] European Commission, 'In-depth analysis in support on the COM (2018) 773: A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy | Knowledge for policy', Nov. 2018. Accessed: Dec. 10, 2020. [Online]. Available: https://knowledge4policy.ec.europa.eu/publication/depth-analysis-support-com2018-773-clean-planet-all-european-strategic-long-term-vision_en
[10] European Commission, 'COM (2018) 773 final, A Clean Planet for all: A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy', Nov. 28, 2018. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52018DC0773 (accessed Dec. 10, 2020).
[11] European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - Energy Roadmap 2050 - COM (2011) 885/2. 2011. Accessed: Jul. 19, 2021. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A52011DC0885
[12] F. Pilo, S. Jupe, F. Silvestro, C. Abbey, A. Baitch, B. Bak-Jensen, C. Carter-Brown, G. Celli, K. ElBakari, M. Fan, P. Georgilakis, T. Hearne, L. N. Ochoa, G. Petretto and J. Taylor, (last), 'Planning and optimization methods for active distribution systems', CIGRE, Paris, 2016. [Online]. Available: https://e-cigre.org/publication/ELT_276_7-planning-and-optimization-methods-for-active-distribution-systems
[13] E. Hillberg et al., 'Flexibility needs in the future power system', International Smart Grid Action Network - ISGAN Annex 6, 2019, doi: 10.13140/RG.2.2.22580.71047.
[14] International Renewable Energy Agency (IRENA), 'Power system flexibility for the energy transition, Part 1: Overview for policy makers', 2018, [Online]. Available: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Nov/IRENA_Power_system_flexibility_1_2018.pdf
[15] International Energy Agency (IEA), 'Status of Power System Transformation 2019 - Power System Flexibility', IEA Webstore, 2019, [Online]. Available: https://webstore.iea.org/status-of-power-system-transformation-2019
[16] CEDEC, ENTSO-E, GEODE, E.DSO, and EURELECTRIC, 'An integrated approach to active system management with the focus on TSO-DSO coordination in congestion management and balancing', 2019.
[17] Dimitris Trakas and Vasilis Kleftakis, 'CoordiNet Deliverable D1.6 - List of KPIs: KPI and process of measures', CoordiNet H2020 project, 2019. [Online]. Available: https://private.coordinet-project.eu//files/documentos/5d724189a008fCoordiNet_Deliverable_1.6.pdf
[18] Elisa Anderson Vazquez et al., 'EUniversal Deliverable D6.2 - Definition KPI for DEMOs', EUniversal H2020 project, 2021. [Online]. Available: https://euniversal.eu/wp-content/uploads/2021/08/EUniversal_D6.2__Definition-KPI-for-DEMOs.pdf
[19] Robert Soler et al., 'EU-SysFlex Deliverable 10.1 Report on the selection of KPIs for the demonstrations', EU-SysFlex H2020 project, 2019. [Online]. Available: http://eu-sysflex.com/wp-content/uploads/2019/02/EU-SysFlex-D10.1-Report-on-the-selection-of-KPIs-for-the-demonstrations.pdf
[20] Jan Kůla et al., 'InterFlex Deliverable 2.2 Minimal set of use case KPIs and measurement methods to perform the technical and economic analysis of the resulting definitions', InterFlex H2020 project, 2017. [Online]. Available: https://interflex-h2020.com/wp-content/uploads/2018/06/D2.2-Minimal-set-of-use-case-KPIs-and-measurement-methods-to-perform-the-technical-and-economic-analysis-of-the-resulting-definitions-.pdf