



20-23 SEPTEMBER 2021

# **SPECIAL REPORT - SESSION 6**

## **DSO CUSTOMERS, REGULATION AND BUSINESS MODELS**

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## Introduction

The business environment and the role of the DSO is substantially changing in the ongoing energy transition.

Session 6 focuses on the evolving business environment and regulation of the DSO to support active customer's and society's energy transition.

This includes a wide variety of topics: digitalization, circular economy, customer flexibility incentives and services, microgrids, integration of storage, e-mobility issues and more – all necessary to ensure a sustainable and efficient electricity distribution infrastructure.

It is important to share experiences and perspectives to better understand the impacts of various strategic choices. Important sources for knowledge are results from demonstration projects and case studies.

Within this changing frame, Session 6 has chosen four blocks of papers:

- Block 1 Regulation enabling flexibility and new business models
- Block 2 DSO risk management in a disruptive environment
- Block 3 Electrification, active customers and local energy communities
- Block 4 Information and digitalization driving the future DSO business

The blocks address each important issues related to the DSO business – both today and in the future.

In the review process, Session 6 has accounted for several different stakeholders all the way from governments/regulators, through competitive market players to academia. This variety of stakeholders makes Session 6 unique in the CIRED context – covering a very broad span of stakeholders and interests.

In total Session 6 has accepted 86 papers. In the following each of the blocks of papers are presented, with briefs comments related to the contents of each paper.

## **Block 1: Regulation enabling flexibility and new business models**

The transformation of the energy system has put the spotlight on the need for flexibility and related business models. The topic in itself can be regarded as a revolution under which there is a evolution happening from year to year.

In Europe the implementation of the Clean Energy Package is the main driver and definition for flexibility, however much remains to innovate and develop to find the rules, regulations and business models that will be viable for the energy transformation.

Below is a short summary of the papers attached to this block;

Paper 34: Analyze of reducing losses, improving efficiency and increasing network utilization in low voltage utility networks in Argentina when distributed plug-in EV are randomly connected.

Paper 222: Introduces a quota-based local market between residential and semi-commercial consumers, prosumers and producers to show how this allows forecasted congestion to be prevented by intra-low voltage grid trading.

Paper 311: Explains how the Covid-19 pandemic the challenged DSOs to rethink the operation both in terms of the provision of the service, reorganizing it, as well as the relationship with users.

Paper 377: The paper provides a needed classification of innovation and shows a range of options to tackle hurdles in the German regulatory framework.

Paper 437: Developed a methodology to analyse and estimate the long-term day-ahead electricity market. The methodology used data of Finnish electricity market to show the performance.

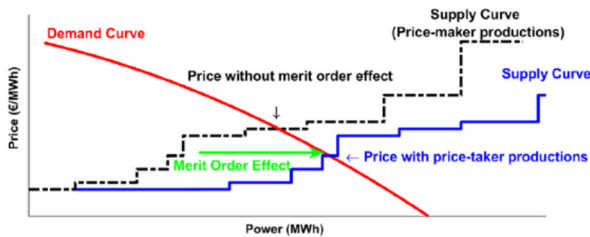


Figure 1: Paper 437, The supply curve and merit order effect.

Paper 448: The paper presents an evaluation method as well as the associated results of the energy renovation in 2016 - 2017 of the low-rent housing units of the city of Longjumeau.

Paper 456: The paper visualizes the impact of Covid-19 on society by using smart meter data, and the result confirms the restrictions.

Paper 486: Discusses several classic examples of network effects that are especially useful for clarifying how and when network effects benefit customers.

Paper 489: Provides a comparison of an energy community energy trading under different regulations and trading structures.

Paper 529: Blockchain-based approach to improve the communication between transmission system operators (TSOs), distribution system operators (DSOs), and control reserve providers (CRPs).

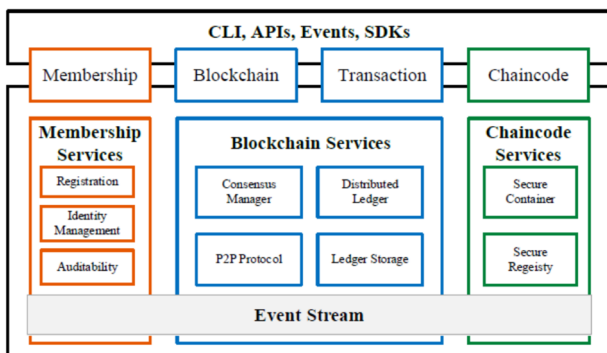


Figure 2: Paper 529, Modular architecture of Hyperledger fabric

Paper 534: Proposes a new approach for the regulatory evaluation of non-technical losses in power distribution networks and uses inspections' datasets and Kriging method to geographically estimate the location of the non-technical losses in network of the utility.

Paper 561: Presents an analysis of the potential profits yielded from the operation of a large-scale battery in the Finnish Frequency Containment Reserves for Normal Operations market and an overview of dimensioning the power and energy capacity of the battery is presented.

Paper 580: Introduces the Portuguese case for self-consumption and shows how the implementation relies on a deep involvement of DSO in the whole process for the collection and validation of the data required by the different stakeholders.

Paper 582: Based on 31 interviews from a broad range of the stakeholders in the energy business four business models are presented and discussed from the perspective of different stakeholders or actors in the ecosystem, either because they are involved in their implementation or affected by them.

Paper 619: Instead of studying individual indexes or average indexes to recognize performance the paper presents a machine-based clustering approach for recognizing frontiers from large datasets and demonstrates the method with an example on pricing.

Paper 658: The paper analyzes and tries to formulate which electrification business models are the most appropriate for the off-grid rural areas in Colombia.

Paper 762: Assess policy and regulatory environment concerning implementation of local multi-energy systems (MES) in several European countries.

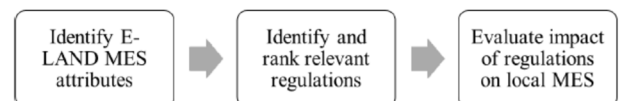


Figure 3: Paper 762, A three-step approach to assess regulatory impact.

Paper 805: Suggest topology for developing energy communities based on regulatory, contractual and commercial aspects. The main classification elements used: use of the public grid, geographical proximity, property boundary crossing, individual/collective contracts and customer type (industrial/residential or commercial).

Paper 808: Analyzes distribution network pricing in the presence of energy communities as new emerging user types.

Paper 809: Defines the flexibility value chain and the required roles. It also brings forward the importance of sub-aggregators as key enablers for harnessing flexibility in a cost-efficient manner.

Paper 831: Review of recent national approaches to build regulatory sandboxes in the electricity sector and documentation of best practices.

Paper 856: Results of H2020 project PANTERA uncovering the main barriers limiting R&I activities in the domain of Smart Grids, storage and distributed energy with focusing on the countries that show low R&I activity into the related fields.

Paper 858: Describes four scenarios for the future electricity distribution grid in Norway, which are made up in a foresight process.

Paper 911: Insights from the ongoing European H2020 MERLON project covering the potential of local energy systems, business models and identifies barriers to the development of local energy systems.

Paper 1001: Present technical challenges that DSO's will encounter in the near future while integrating DERs into LV grids and possible solutions that would make this integration feasible in the Netherlands.

Paper 1010: Present a study by Enedis which, with the implementation of data visualization, enables French territories to better understand their consumption and production.



Figure 4: Paper 1010, First dashboard: data of the whole town.

Paper 1044: An formalization and resolution for a bi-level optimization approach that solves for a set of non-linear tariffs, from which each customer can freely choose the more advantageous for one's demand profile.

Paper 1088: Proposal to improve the Brazilian regulatory framework about the incentive/penalty mechanism, in order to encourage the improvement of service quality in technical and commercial aspects.

Paper 1098: Analyze of the Brazilian Regulatory Agency proposed novel methodology to determine the Reference Price Bank to be considered for asset valuation recognition in upcoming tariff revision.

**Discussion**

Based on the activities in the business and the papers submitted it is clear that business models around flexibility is a large area where there still is uncertainties when digging below the conceptual level. Regulations or the interpretation of the regulation is still a grey zone with a significant need for further innovation, development and especially real life demonstrations.

**Table 1: Papers of Block 1 assigned to the Session**

Paper No. Title	MS a.m.	MS p.m.	RIF	PS
34: Regulatory incentives for reducing losses and increasing network utilization when plug-in electric vehicles are connected in Argentinian distribution systems				X
222: Matching Quota-Based Power Markets in Low Voltage Grids				X
311: Electric energy distribution in the context of economic recession, the				X

COVID 19 pandemic and the quarantine				
377: Evaluation of innovation approaches as additional regulatory instruments for the incentive regulation of grid operators in Germany	X			
437: Day-ahead electricity market estimation of Finland in 2030				X
448: Evaluation of energy savings using customer meter data				X
456: Impact assessment of COVID-19 on electricity demand by utilizing smart meter data				X
486: Network effects from electricity grid connections: from traditional grids to smart grids				X
489: Comparison of optimized operation of energy community's flexibility considering different regulations and trading structures				X
529: Platform for vertical coordination of secondary control reserve using blockchain technology				X
534: An alternative approach for regulatory evaluation of non-technical losses in Brazil				X
561: A cost-benefit analysis of large-scale battery energy storage systems for frequency markets				X
580: DSO as a key facilitator of the energy sharing and self-consumption revolution				X
582: New business models at distribution grids: a stakeholder consultation				X
619: Data-based method for analysing steering mechanisms of the distribution network business regulation	X			
658: Electrification business models in rural off-grid communities, International and Colombian scope				X
762: The implementation of multi-energy systems - policy and regulatory implications				X
805: Towards practical typology of energy communities: main differentiating elements and examples of promising implementations				X
808: Aspects of development needs for distribution network tariffs in the case of energy communities as new emerging user types				X
809: Sub-aggregator business models in demand response				X
831: Regulatory sandboxes in the energy sector – review and learnings for the case of Switzerland	X			X
856: Implementing the clean energy package: best practices in overcoming barriers	X			X
858: Scenarios for the future electricity distribution grid anno 2030-2040				X
911: Business models and barriers towards the development of local energy systems in Europe: Insights from the MERLON project				X
1001: Challenges, barriers & possible solutions for future distribution grids-an insight for the Netherlands	X			
1010: Illustration of a territory's energy footprint using electric consumption data	X			
1044: Optimal distribution network tariffs computation with a bi-level optimisation approach				X
1088: Alternative procedure for incentive regulations of electricity supply continuity in Brazil				X
1098: Adequate statistical approach for outliers removal in tariff revision related datasets, given its non-normal and asymmetric characteristics				X

**Block 2: DSO risk management in a disruptive environment**

The changing business environment are challenging for the DSO's in terms of a robust risk management that matches business needs and the society expectations. Changes are happening much faster than the traditional risk management is covering today risking short term risk minimization at the cost of long term optimization and risk minimization. Key is to align on long-term expectations on the DSO services provided without reducing flexibility to adapt to disruptive changes.

Below is a short summary of the papers attached to this block;

Paper 119: The paper presents a strategic asset management framework for the sub-transmission and distribution level including a suggestion for integration of the framework into the existing process landscape of the utility.

Paper 187: Describes a pilot project for a sophisticated asset simulation model to support long-term asset decisions. The results are used to prioritize measures as well as to identify the most efficient investments.

Paper 283: The paper proposes a method for effectively detect non-technical losses of meter manipulating/malfunctioning and adapting the honesty coefficient attribution method.

Paper 337: This paper describes the implemented information system for advanced business analysis and reporting in business processes at DSO JP Elektroprivreda B&H and its application in improving the efficiency of these processes.

Paper 368: Developed a multivariate linear regression model for the monthly electricity demand of customers supplied at 400 V that includes a number of weather conditions as explanatory variables.

Paper 375: The paper presents a methodology for determining the usage pattern of the relevant consumers considering type of the building, minimum yearly consumption, as well as the potential of available roof area for PVs installation.

Paper 572: The paper uses a geographic multi

agent system to simulate restoration processes after a storm. This approach allows to combine multiple domains (organization process, electro-technical system, geographic system and road network) in a combined model.

Paper 620: The paper presents the experiences from E-REDES using their developed Equipment and Materials Specification and Qualification Process (EMSQP).

Paper 629: Presents a comprehensive revenue optimization model is presented which links several optimization models by modelling their interdependencies to enable a coherent overall simulation of the distribution system operation.

Paper 680: The paper examines the principles that define how future grid upgrades will impact flexible connection customers and provides advantages and disadvantages of cost allocation and financial risk management strategies relevant to flexible connection solutions.

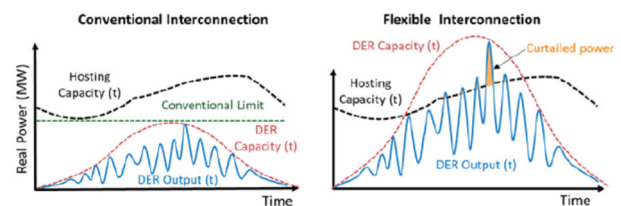


Figure 5: Paper 680, conventional (fixed capacity) vs. flexible interconnection.

Paper 730: This paper investigates whether intentional islanding of certain sections of the network could yield significant benefits for customers and assist Distribution Network Operators (DNOs) with the transition to Distribution System Operator (DSO).

Paper 779: The paper presents the impact of COVID-19 pandemic on daily load profile patterns in the distribution grid of Slovenian DSO Elektro Celje.

Paper 828: The paper estimates the effect of post-outage consumption peaks and shows that approximately 0.3–2.5% of customers whose distribution bill would be affected by post-outage consumption peak if power-based tariff was introduced.

Paper 1004: This work provides a discussion on

the European regulatory framework regarding the reactive power procurement and on new means for system operators to respond to the new regulatory requirements.

Paper 1095: The paper shows the experience of E-REDES climate resilience in the context of the energy transition.

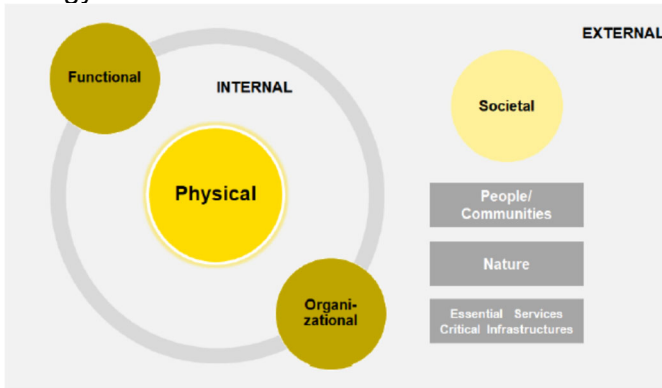


Figure 6: Paper 1095, E-REDES' climate

adaptation dimensions

Paper 1123: The paper develops the conceptualizations and results related to the successful implementation of a training program and training of human resources of an electric power distribution company through virtual platforms in a restrictive environment due to the COVID-19 pandemic.

### Discussion

The variety of the papers in this block shows the many aspects of risk management in the DSOs. Significant work to adapt and improve the risk management processes are ongoing to match the disruptive changes happening. Experience exchange and alignment is probably an important success factor to match the energy transition with DSO's risk minimization and society need and expectations.

**Table 2: Papers of Block 2 assigned to the Session**

Paper No. Title	MS a.m.	MS p.m.	RIF	PS
119: Adopting state-of-the-art asset management theory to create added value in a utility setting	X			
187: Integrated approach to handling risks in critical infrastructures – pilot for transformers	X			X
283: Detection of Frauds and Other Non-Technical Losses in Medium and Low Voltage Distribution Systems: Improvement of the Honesty Coefficient Attribution Method				X
337: Application of business intelligence tools for efficient managing business processes and data in distributed system operator Elektroprivreda B&H				X
368: Forecasting electricity demand at low voltage using a multivariate model				X
375: Estimated impact of self-generation and prosumers to DSO and TSO in Croatia				X
572: Use of multi agents systems in a crisis management context				X
620: Innovative tools accomplished with NP EN ISO 9001 to retain technical specification and qualification knowledge				X
629: A comprehensive revenue optimization model for DSOs				X
680: Cost allocation mechanisms and financial risk management for flexible connection solutions	X			X
730: Investigation of technical, legal, regulatory and commercial considerations of intentional network islanding	X			X
779: Simple and effective analyses of COVID-19 impact on load profile patterns in DSO Elektro Celje				X
828: Estimating the effect of post-outage consumption peaks on customers' peak power-based tariff costs	X			
1004: Regulatory, technical, and market developments of reactive power procurement				X

1095: Hands-on for E-REDES climate resilience in the context of energy transition	X			X
1123: Training of human resources in electric energy distribution under the restrictions of the COVID-19 pandemic				X

### **Block 3: “Electrification, active customers and local energy communities”**

The evolution of the distribution networks through increased electrification and new load and generation technologies and patterns, calls for an increased overall need for flexibility in the operation and planning of distribution networks.

In addition to technological solutions, there is also a clear need for new ways of thinking and innovative solutions regarding how to solve increased electrification and involvement of active customers.

Below is a short summary of the papers attached to this block;

Paper 129: This paper presents a study of two different EV charging concepts were evaluated, addressing the challenges related to profitability for the charging concepts within the existing framework conditions.

Paper 142: The paper reports from the H2020 project *Flexigrid*, aiming to facilitate energy sector stakeholders to create and utilize advanced Energy Services (ESs). The paper presents the flexibility market architectures that FLEXGRID develops, discussing requirements, advantages, disadvantages and their compatibility with today’s smart grids.

Paper 182: This paper from Germany reports on revenue potential of prosumers types in local flexibility markets, where flexible grid users can offer their flexibility and thereby avoid critical grid states. The price of the offered flexibility decides whether the local flexibility market is an economical solution for the congestion management of the distribution system operator.

Paper 213: This paper reviews recent studies investigating the benefits and challenges of utilizing different demand response programs in the planning and operation of renewable-based microgrids. It shows that mechanisms such as incentives and penalties, curtailment requests, market structure for energy balancing, and

power trading should be developed further to make the utilization of demand response programs more affordable. The paper presents a framework to help system operators consider these demand response programs in the planning and operation stage of a renewable-based microgrid.

Paper 264: This paper from Brazil reports on the perspectives of how distributed energy resources will the boundaries of the distribution utilities companies. Observing how technology improvements changes other monopolies, it is possible to conclude that some activities now typically executed by distribution companies will be done by the DER owners, unbundling the actual concept of electricity distribution.

Paper 275: The work presented in this paper addresses the participation of the distributed renewable energy resources (DRES) in the provision of ancillary services at distribution grid level. Since the DRES have an intermittent nature, auxiliary storage systems should also be added, which cost may differentiate according to nominal capacity and voltage level.

Paper 332: This paper from the H2020 project *DOMINONES* reports on demand response modes designed for the local energy and flexibility markets, stating that the sustainability of the investment deeply depends on a comprehensive assessment over the fundamental revenue sources and relevant costs to consider, being influenced by a number of key parameters.

Paper 352: This paper presents how the H2020 project *InterConnect* is enhancing the relationship between smart buildings, energy communities and grids, enabling the potential of interoperable flexibility mechanisms and new energy and non-energy services, presenting a technical definition of the DSO Interface that will ensure interoperable integration of flexibility services between DSOs and the different market



parties.

Paper 354: The paper from UK reports on the *IntraFlex* project which is developing a market to test nearer to real time flexibility procurement and the potential for supplier imbalances to be minimised through market mechanisms.

Paper 355: This paper presents an overview of ongoing projects (H2020 projects InterConnect, EUniversal and OneNet) that aim to deliver and demonstrate interoperable solutions across the full value chain of the energy sector.

Paper 378: This paper discusses ICT tools designed to assist network operators, flexibility suppliers and market operators, and make the flexibility markets both efficient and attractive, proposing new market architectures to facilitate the exchange of flexibility services at the distribution level.

Paper 387: This paper from Thailand presents the status of experiences of demand response in Thailand, showing customer daily load profiling analysis by using a K-Means clustering algorithm profile data includes 15-minute.

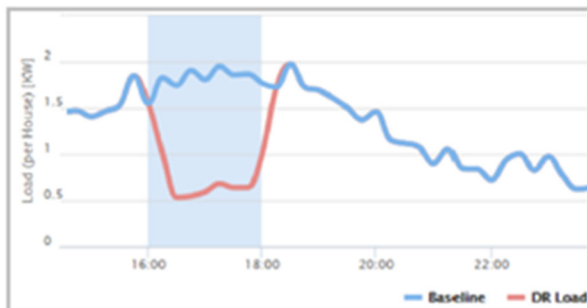


Figure 7: Paper 387, Conceptual diagram of power consumption reduction

Paper 433: This paper from Finland addresses results of a comprehensive demand-side management survey and research of customer's decision-making related to their flexibility potentials, highlighting one major challenge which is to improve the customers' knowledge related to demand-side management.

Paper 467: The paper presents the "flexicurity" potential of energy assets – addressing flexibility and security capabilities of each energy asset, grading their "performance" according to these.

Paper 522: This paper from Belgium addresses

a method for how to minimize the investment risk from an investor perspective in Residential Energy Communities.

Paper 530: The French study presented in this paper compares costs of supplying a grid-connected or off-grid microgrid powered by photovoltaics and a storage system, in order to determine which is more cost-efficient.

Paper 531: This paper presents results from *Mission Innovation IC#1 Smart Grids*, where a global survey has been conducted in order to clarify the current status of demand response as well as to identify common challenges for its integration.

Paper 668: The paper presents a state-of-the-art review about the Local Energy Marketplaces concept and use of Blockchain in energy trading, and a trading mechanism based on blockchain technology and an energy traceability technology for distributed energy systems.

Paper 718: This paper from Sweden describes requirements for a standardised hosting capacity method, outlining the needs and requirements for such a standardised methodology as well as ongoing and upcoming standardisation activities in IEEE and IEC.

Paper 737: The paper addresses performance trade-offs between an introduced linear flexibility market model for congestion management and a benchmark second-order cone programming (SOCP) formulation, providing a structured comparison of the two models.

Paper 814: This paper from Finland presents results from a pilot project that took place in Finland in 2019, where flexibility was activated in real households using a commercial platform.

Paper 834: The paper compares three different value sharing methods in energy communities and what kind of customer proposition they represent: a static model, a dynamic model; and local energy markets.

Paper 857: This paper from Austria addresses ongoing national transpositions, regarding integration in the electricity network structure and related grid tariffs.

Paper 1038: This paper from Saudi Arabia

presents a study performed to give residential and commercial load customers a clear methodology to size their solar PV system based on their yearly load profile to minimize their payback period.

Paper 1067: This Finnish paper summarizes a qualitative analysis of stakeholder interactions and coordination concepts in respect to four major congestion management solutions of distribution system operators, with regards to

benefits and drawbacks of congestion management solution.

Paper 1144: This paper from Norway reports from experiences using a common process for distribution system pilot projects, which has been established in a national research centre CINELDI.

**Table 3: Papers of Block 3 assigned to the Session**

Paper No. Title	MS a.m.	MS p.m.	RIF	PS
129: Economic and technological evaluation of charging concepts for high-density urban areas based on real mobility and charging profiles of battery electric vehicles		X		X
142: Flexgrid - development and comparison of distribution network flexibility market architectures				X
182: Revenue potential of different prosumer types at local flexibility markets				X
213: The utilization of demand response programs in renewable-based microgrids: benefits and challenges				X
264: Distribution system operator: The unbundling of the electricity distribution				X
275: Formulation of parametric cost-functions for ancillary services from distributed renewable energy resources in distribution networks				X
332: Demand response modes of use in local energy and flexibility markets, enabling system operator, community and energy provider oriented business models				X
352: Enabling interoperable flexibility and standardized grid support service				X
354 :The procurement of closer to real time DSO flexibility services, whilst minimising the impact on balance responsible parties				X
355: The role of interoperable, agnostic and flexibility enabling interfaces for DSO and system coordination				X
378: Integrated ICT tools to support flexibility management in future distribution networks				X
387: Customer segmentation and targeting for demand response in Thailand				X
433: Analyzing the impact of the customers' decision-making on the implementation of demand response				X
467: Flexicurity: Unlocking the true potential of power market players in the European smart grid era		X		
522: Residential energy communities: How to minimize the investment risk from an investor perspective				X
530: Cost comparison of connected and isolated microgridS in realistic cases including load modeling and demand side management		X		X
531: Global analysis on demand response status and further needs for joint research				X
668: Blockchain for decentralised energy markets				X
718: Unlocking the potential of flexibility		X		

737: A linear model for distributed flexibility markets and DLMPs: A comparison with the SOCP formulation				X
814: Business model for household flexibility - a case study		X		
834: Forming collective self-consumption models: How the end user sees them?				X
857: Implementation of self-consumption and energy communities in Austria's and EU member states' national law: A perspective on system integration and grid tariffs		X		
1038: Optimizing a residential solar PV system based on net-metering approaches				X
1067: Coordination concepts for interactions between energy communities, markets and distribution grids				X
1144: Experience from Norwegian intelligent electricity distribution pilot projects				X

#### **Block 4: Information and digitalization driving the future DSO business**

Digitalization is here to stay, and the use of information and data in combination with new digital solutions, platforms and services have a huge potential to drive efficiency and optimize the DSO business.

Data from smart meters with respect of the European General Data Protection Regulation (GDPR) enables a number of new possibilities.

However, new digital possibilities comes with a drawback; the threat from cyber space.

Below is a short summary of the papers attached to this block;

Paper 36: This paper presents a technique to locate faults by combining smart metering alarm and PLC communication data (path requests).

Paper 109: This paper proposes a qualification verification system using deep learning-based face recognition technology as a legal basis for authorized personnel to perform their assigned duties.

Paper 122: The paper illustrates how the innovative blockchain platform proposed in the project helps the European distributors to implement these use cases in real network and identifies the regulatory parameters that shall support the large scale deployment of the Platone solution.

Paper 329: This paper presents a developed Central Energy Meter application and its pilot installation in the campus of Brno University of Technology, Czech Republic.

Paper 443: In this paper, real measurements of conventional mechanical power-consuming meters for a residential compound's electricity consumption over twelve months were taken and are compared to the prepaid smart meters' readings over the same period for the same residential compound.

Paper 481: In this paper, the authors investigate advanced cyber attack tactics and techniques to exploit Ripple20 and IEC 61850 vulnerabilities through various attack vectors. The presented cyber-physical attack scenarios focus on gaining unauthorised access from pole-mounted reclosers in MV networks to the control centre and substation Operational Technology (OT) systems.

Paper 555: The paper details the comprehensive data use case development the Presumed Open Data project has undertaken and the production of a generic methodology to establish the 'openness' of energy industry data.

Paper 618: This paper presents the software architecture of the Open Innovation Marketplace being developed under the BD4OPEM project, based on the 4+1 View Model methodology of software architecture definition. According to this methodology, the Logical View of the BD4OPEM Platform architecture is structured into four piled up layers and one cross-cut layer addressing the architecture security and privacy needs.

Paper 764: This paper presents a web application for use by half-hourly metered customers which sizes a combined electric vehicle charging, solar photovoltaic and battery energy storage system. The optimisation objective is to maximise self-consumption, thereby alleviating impact on DSO networks without requiring any specific DSO action.

Paper 819: This paper proposes a clustering solution for chosen High Consumption Customers, according to their payment profile, dividing them into groups with similar behaviour and default risk. Different clustering methods were applied for two separate datasets and, from the business perspective, both methods delivered similar conclusions.

Paper 830: This paper presents the process, which led to the founding of the Danish EnergyCERT (Computer Emergency Response Team), which was established in Denmark in April 2020. The

Danish EnergyCERT is established as an independent Center of Excellence focusing on cyber security in the energy sectors (electricity, natural gas and district heating) with a main focus on operational technology (OT) systems.

Paper 839: This paper presents a set of developments that show DSO as a proactive agent of transition by fostering new digitalized services that serve the market and the Customer (videocall support, a token for process status tracking, chatbot, work order tracking).

Paper 853: This paper demonstrates how the DSO can evolve its capacity to bring forward new and exciting developments that are aligned with Customer needs and pave the road for a Customer centric approach able to create value for Customers, DSO, and other market players.

Paper 903: The paper describes the development of the design and implementation of an Integrated Network Model (INM), providing a single source of

truth (SSOT) for asset and connectivity data from a number of legacy asset capture and management systems.

Paper 915: This paper discusses the design and evaluation of internet of things (IoT) applications and business models for the operation and maintenance of future substations from a design-oriented approach.

Paper 962: In this paper a new two-step approach for data protection for publication purpose is presented. The protected aggregated curves obtained with the proposed method can then be published with limited risk of privacy leaks.

Paper 973: This paper discusses the new opportunities which smart metering data analysis may bring to customers and DSOs.

Paper 1090: This paper proposes the design and development of a smart metering system capable of actively and remotely managing energy consumption to enhance user experience and improve energy efficiency.

**Table 4: Papers of Block 4 assigned to the Session**

Paper No. Title	MS a.m.	MS p.m.	RIF	PS
36: Reduction of fault location time and troubleshooting time in low voltage distribution networks by analysis of smart meter PLC communication data traffic and alarm messages				X
109: Development of face recognition system for verification of skilled personnel in construction sites				X
122: Platone: towards a new open DSO platform for digital smart grid services and operation				X
329: Central energy meter for smart buildings				X
443: Energy saving strategy using prepaid smart meter versus conventional meter				X
481: Exploiting Ripple20 to compromise power grid cyber security and impact system operations		X		X
555: Maximising the benefits of open data within the energy industry		X		
618: BD4OPEM H2020 project. The "4+1 view model of software architecture" for enabling AI based services in distribution grids		X		
764: Customer led adoption of away-from-home EV charging with minimal impact on the distribution system - a web app for non-domestic customers				x

819: Data clusterization techniques applied for high consumption customers' installment payment decision				X
830: Danish EnergyCERT – a national cyber center of excellence for energy companies in Denmark				X
839: E-REDES Digital Roadmap to foster digital costumers' experience and digital transformation				X
853: The customer at the centre of everything E-REDES does		X		X
903: The operation and benefits of an integrated network model to enable distribution system operation		X		X
915: A journey towards future substations via an internet of things test environment				X
962: Differential privacy for energy data publication		X		X
973: Smart metering data analysis - benefits for customers and DSOs				X
1090: Design and development of a smart metering system with direct load control devices for energy efficiency and user experience in power distribution utilities				X