C5 - 00

SPECIAL REPORT FOR SC C5

Special Reporters

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Study Committee C5 — Electricity Markets and Regulation — covers the analysis of the impacts on the planning and operation of electric power systems of different market approaches and solutions. This includes new structures, institutions, actors and stakeholders as well as the role of competition and regulation in improving end-to-end efficiency of the electric power system.

For the 2021 session a total of 51 papers were selected based on three preferential subjects (PSs).

PS 1: The changing nature of markets and ancillary requirements

- Market adaptations to handle the value shift between energy and services
- Markets and services to address inertia and resilience
- Role of markets with respect to aggregation and the provision of network services
- Pricing approaches for emerging technologies and impacts of those approaches

PS 2: Changing role of regulators and standards

- Role of regulators in the changing markets
- Evolving policy, standards, and guidelines to address issues affecting markets
- Regulatory policies on transmission and distribution; too little or too much

PS 3: Market designs for coordination of generation and network investments

- Markets and regulations to promote coordinated investments
- Customer-driven market changes – the transition from centralized to distributed planning
- Impacts of the changing nature of customers on investments and markets
- The impact of peer-to-peer trading on the provision of market services

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PARIS GROUP DISCUSSION MEETING (GDM)

1. Contributors should upload their contributions on the *Registration Platform*– "Contributions to Group Discussion Meetings" section- using their existing account and credentials before **July 31, 2021** for *a priori* screening and organization of the Group Discussion Meeting.

Important points:

- *Access to uploading of contributions is only available to duly registered delegates.*
- *Therefore, registration for CIGRE Session should be completed before uploading contribution(s) online.*
- *Register now for the Session Click here*
- *Contributions can be uploaded immediately.*

2. The Special Reporters will review the prepared contributions (power point presentation with max 3 slides and written contributions (max 1000 words per contribution). A guide for contributors as well as templates and sample pages will be available on the CIGRE Centennial website - see Group Discussion Meetings in the top menu bar.
3. Any recommendations or suggestions for changes to contributions will be provided to the contributors by Special Reporters directly on the Registration platform by **August 16, 2021**. Contributors are encouraged to visit their account on Registration Platform for the review comments.
4. On Monday, **August 16, 2021**, all contributors with accepted/finalized contributions will receive the instructions regarding the session. This will include the sequence of the presentations. Note that the recorded version of the contribution will be used if there are technical problems that prevent a contributor providing their contributions live.
5. The General Discussion Meeting for SC C5 will be held on **18th and 19th August 2021**, from 12 PM to 4 PM, Paris time.

PREFERENTIAL SUBJECT 1

The Changing Nature of Markets and Ancillary Requirements

Special Reporter: Dr. Kankar Bhattacharya

- ✓ Market adaptations to handle the value shift between energy and services.
- ✓ Markets and services to address inertia and resilience.
- ✓ Role of markets with respect to aggregation and the provision of network services.
- ✓ Pricing approaches for emerging technologies and impacts of those approaches.

Preferential Subject 1: Paper Summaries

C5–102: Need of Improvements in the Brazilian Energy Market to Consider Separate Prices for Energy and Services

This paper analyzes the Brazilian energy trading model and suggests the need for modifications and increased use of thermal power plants for reliability and ancillary services, requiring adjustments to remuneration for these services. A case study has been presented to demonstrate the new requirements for generation services in the Brazilian system.

C5-103: Market Transformation to Value Energy, Reliability, and Flexibility Services

This paper discusses flexibility products and price formation enhancements developed by MISO for its day-ahead and real-time markets. Products such as Ramp Capability to manage system ramping needs in co-optimization with energy and operating reserves, Short-Term Reserve to procure resource availability, Emergency Pricing to allow emergency resources to set prices, and Reserve Procurement Enhancement to clear reserves in the zone where they are delivered to reflect their zonal clearing prices are discussed.

C5-104: From Services to Markets– System and Market Impacts of Energy Transition in European Markets

The paper evaluates the possibility to substitute ancillary services for short-term markets in the European markets context. How close to real-time operation the short-term markets could function, and whether such substitution could facilitate a cleaner energy system? It is noted that there is a need to move market gate closure times closer to real-time to facilitate trade between market participants.

C5-105: Principles for Allocation of Cross-Zonal Capacities for Exchange of Balancing Capacity or Sharing of Reserves

The paper addresses allocation of cross-zonal capacities to both the electricity and balancing capacity market. It discusses the calculation of market value for energy market and balancing capacity market and the optimal allocation of cross-zonal capacities between these markets.

C5-106: System Operator Challenges in Spot Market

This paper examines some of the challenges likely to be faced by the System Operator of Oman, the Oman Electricity Transmission Company (OETC) in meeting the obligations of the newly introduced spot market environment. The key challenges are (a) suitable IT system designed as per Market Rules (b) System Operation procedures (c) manpower requirements and training and (d) procurement of ancillary services which are not covered by Market Rules.

C5-107: Incentivizing Generator Flexibility Investments: A Stochastic Analysis of Various Market Designs

The paper examines the impact of increasing the flexibility of a natural gas combined cycle generator. Using a unit commitment model, flexibility upgrade cases are simulated and system cost reduction and generator revenue changes are estimated. The approach can help market operators to facilitate generator owners to invest in flexibility upgrades that would reduce total system costs.

C5-108: System Services for Power Systems with a High Level of Renewables

The paper describes the implementation of System Services in Ireland that ensures system security with high penetration of renewables. The incentives and the changes in capacity market rules have encouraged conventional units to provide enhanced operational flexibility. Also, an increasing number of system services are now being provided by new resources such as wind, demand response, batteries and interconnectors; non-conventional technologies are being contracted for higher volumes of new services such as fast frequency regulation.

C5-109: Integrating Multi-Period Uncertainty Ramping Reserves into the Irish Balancing Market

The paper discusses the implementation of Ramping Margin (RM) reserves in generation scheduling of Ireland which has helped the system to accommodate non-synchronous capacity from 65% to 75% in 2020. The introduction of RM-reserves requires including additional inter-temporal constraints within the scheduling model, which can be computationally challenging. To address this issue, EirGrid has developed an innovative method of adjusting the RM-reserve requirement after each scheduling run, to take account of changes in generation that are eligible to provide RM-reserve response.

C5-110: Evolutions of Japanese Markets to Secure Appropriate Ancillary Service Corresponding to a Large Amount of RES Installation- Establishment of Capacity Market and Balancing Market

The paper discusses the liberalization of Japanese retail electricity market and the unpredictability of generation cost recovery which has increased due to the declining trend of energy market prices. It is noted that the amount of balancing reserves required to mitigate the RES output fluctuations has been increasing. To that effect, new markets, to secure appropriate reliability and ancillary services in the mid-to-long term, and introduction of a capacity and balancing market, are planned for 2020 and 2021, respectively. The paper discusses the key characteristics of these two markets and compares them to similar markets internationally.

C5-111: Market Integration of HVDC Lines: Cost Savings from Loss Allocation and Redispatching

The paper presents a cost-benefit analysis of utilization of HVDC interconnectors in Nordic countries for reserve procurement towards frequency support, instead of generator re-dispatch, and it is noted that such service requirements from interconnectors will increase in the future. The paper further proposes piecewise-linear loss factors, instead of the TSO proposed linear loss factors for HVDC interconnectors in market clearing, which unfairly penalize one HVDC line over the other with detrimental impacts on the market efficiency.

C5-112: Identifying Emerging Ancillary Services changes in the Australian NEM

The paper discusses the changing market conditions in Australia with increasing penetration of renewables, leading to reduced inertia, increasing ROCOFs and reducing times to reach frequency nadir. It is noted that faster frequency control services will be required in the future and new resources such as batteries, with appropriate incentives, are expected to provide such services. The paper also argues that location of generator contingency is critical since the frequency local to it responds initially, while the other generator rotor angles adjust to the resulting transients. In the future there may be cases where there are sufficient frequency control services to manage the frequency nadir, but the resulting transient flows could result in instability. The paper also notes that with increasing penetration of rooftop PV resources, the grid demand has been reducing in many areas, which can lead to reduced inertia and adverse impact on system stability.

C5-113: Research on Coordination Optimization Strategy of Peak Shaving and Frequency Modulation Auxiliary Service

In this paper a mathematical model for coordinated optimization of peak shaving and frequency regulation market is proposed. System security and unit regulation capabilities are considered in the model to determine the optimal peak and frequency regulation capacity.

C5-114: A World-First: On the Pooling of Battery Energy Storage and Pumped-Hydro

This paper discusses the pooling strategies for battery energy storage systems (BESS) and pumped-hydro plant (PSP) for frequency control reserve (FCR) market in Germany. The pooling strategies are subdivided as cooperative and non-cooperative; cooperative operation reduces the PSP power supply volatility.

C5-115: On Lost Profit Calculations and Pricing in Liberalized Power Markets

The paper discusses the concept of convex hull pricing (CHP), which is used in market models with non-convexities and produces a uniform price to minimize the total uplift payments. The paper notes that CHP is used in simplified form in MISO and in NYISO, compensating both consumers and producers for their opportunity cost.

C5-116: Paradigm Shift in Thailand's Energy Sector: Effects from Increased REGs on Conventional Power Plant Operation and Power System Security

The paper examines the impacts of low dispatch levels of conventional power plants in Thailand and the impact on system security, because of the increasing penetration of RES. Appropriate levels of ancillary services and their procurement, considering the technical requirements, are discussed.

C5-117: Transition From Administered To Market Linked Imbalance Handling Mechanism in Indian Power System

This paper discusses the imbalance handling mechanism in India which links the deviation prices with the day-ahead market prices. It is noted that deviation pricing faced multiple challenges in view of the increasing penetration of RES, locational bias, congestion and other factors which lead to it being market linked imbalance handling. It is noted that the frequency profile of the Indian power system has improved significantly with the market-linked imbalance handling mechanism, wherein the nominal frequency is linked to the average day-ahead market clearing price.

C5-118: The Economic and Environmental Value of the Demand Response Market in Korea

This paper examines the economic and environmental value of DR in Korea; the economic value is estimated based on capacity, energy and ancillary services value in wholesale electricity market. The environmental value of DR is estimated based on the marginal emission factor of generators determining the system marginal price. These estimates are useful for setting CO2 emissions reduction targets based on dynamic demand reduction.

C5-119: Experience of Implementation of Reserve Regulation Ancillary Services and Fast Response Ancillary Services in India

The paper discusses the evolution of various frequency control and system balancing strategies used in Indian power system. For instance, in tertiary frequency control the Reserve Regulation Ancillary Services (RRAS) is activated after 15-minutes of despatch while the Fast Response Ancillary Service (FRAS) for harnessing hydro generation flexibility is available within 5-minutes of despatch instruction. The roles of RRAS and FRAS in maintaining secure and reliable grid operation, frequency profile, ramp management and RES integration has been examined through case studies.

C5-120: To Socialise or Not to Socialise the Cost of Imbalances from Non-Programmable Renewable Generation

The paper discusses two economic models for integrating RES in the Portuguese electricity market; first based on guaranteed remuneration with socialised imbalance costs, and the second based on spot market remuneration without socialised deviation costs. The RES were compensated based on a feed-in tariff (FIT) to increase the penetration capacity while their energy is mandatorily bought by the marginal generator. The paper also notes that the PV auction of 2019 allowed mixed bids for guaranteed and general market remuneration.

Preferential Subject 1: Questions

Q1. What is the optimal procurement, contractual, market settlement and design mechanisms that can be put in place to facilitate the increased requirements of flexibility services, driven by the increasing penetration of variable renewables?

Q2. Flexibility resources need to be compensated for their contributions to system operations on a cost and marginal contribution basis. What incentives can be design or pricing schemes developed for these services provided to the system?

Q3. How can new resources such as batteries and other energy storage systems participate in ancillary services provision and what market rules can be reformed or introduced to facilitate their participation in the energy market or other ancillary services market clearing?

Q4. What is the role of demand response markets and capacity markets in long-term system reliability and near-term system security provisions? How is their procurement and pricing impacted by the penetration of variable renewables?

Q5. Frequency regulation ancillary services procurement is a complex task for system operators considering the operation time-frame, market design, pricing, target quantities, and response time. What are the ideal parameters for such services that the system operators must take into consideration in the context of high penetration of variable renewables in power systems?

PREFERENTIAL SUBJECT 2

Changing Role of Regulators and Standards

Special Reporter: Jarrad Wright

Preferential Subject 2 addresses the changing role of regulators and standards as markets evolve, particularly with the introduction of new technologies across generation, transmission and distribution. Fourteen (14) papers comprise PS2 coming from nine (9) countries.

The papers discuss the following main themes:

(i) The use of policies and targets and their interplay with regulatory interventions to increase the use of renewable energy, incentivise new investments and renew existing plant.

(ii) The relative efficiency of market designs and approaches to ensure security of supply — including the use of reliability standards and capacity remuneration mechanisms focusing on customer outcomes.

(iii) The planning and payments for network developments. Regulatory interventions and approaches to enable bulk-transfer transmission investments as markets change and adjust.

(iv) Increasing need for flexibility (particularly on the demand-side)

(v) Improving the understanding of systemic risk in deregulated electricity markets

Preferential Subject 2: Paper Summaries

C5-201: The Benefits of Regulatory and Market Coordination

A clear demonstration of how market-based policies perform relative to technology-based regulatory interventions under uncertainty. The context of multiple criteria being met in power system planning processes (over and above cost) highlights the importance of understanding future uncertainty, which policies would perform better and the resulting appropriate levels of interventions by policymakers and implementation by regulators.

C5-202: Changing Regulatory Frameworks for Transmission Asset Reinforcements and Improvements in Brazil

Discussing an ageing transmission network following liberalisation in the 1990s requiring refurbishment and new investments but not being sufficiently enabled by the regulator at a pace that seems needed. Thus, the authors make recommendations on the existing regulatory framework including regulatory asset management indicators in Brazil to assess appropriate tariffs for transmission assets. In the Brazilian context, several HVDC interconnectors require the regulator to specifically address maintenance, upgrades and related performance criteria.

C5-203: Renewable Energy Auctions and Appropriate Pricing in Brazil

Considering existing hydrological risk in the Brazilian power system, an intentional deployment of wind is an intervention that intends to ensure sufficient supply margin. On wind deployment, this paper highlights the need to include production risk (and related curtailment) in assessing the feasibility of wind investments in Brazil from an investor perspective. It was found that bidding into auctions with deterministic modelling outputs could result in bid prices 20% too high or low (depending on the probability distribution of production estimates).

C5-204: Regulating Economic Incentives for HVDC Interconnectors in Brazil

Describes the core economic signal utilised in Brazil for HVDC investment and maintenance to improve performance of these critical transmission network infrastructure assets – known as "Variable Parcel of Converter Transmission Function", based on IEC/TR 60919-1 and CIGRE Technical Brochure 590 (Protocol for reporting the operational performance of HVDC Transmission Systems). The paper also summarises expectations surrounding the application of the new rules for HVDC assets in the medium-term.

C5-205: Curtailments of Wind Energy in Wind Farms in Brazil

Presents how constrained-off energy events are managed and determined for a specific Southern area of Brazil as a case study. Two methodologies were compared (i) Using wind speed data from wind turbine nacelles (preferred by Brazilian regulator) and (ii) Using separate meteorology mast wind speed data (preferred by wind industry). For the case study, it was found that (i) performs better in terms of wind speed estimations and resulting power production and hence bias correction would be required if (ii) is the preferred methodology. This is primarily driven by a heterogenous wind direction and resulting wake effects on met-masts. Thus, findings would only hold for the region studied (Southern Brazil) but further investigation is being pursued to generalise the findings. It seems that met mast data is sufficient for wind farms in Northern Brazil where homogenous wind directions are more common and this could potentially be applied to other international jurisdictions with similar wind regimes.

C5-208: Irish Experience with New Market Arrangements as Variable Renewable Generation Penetration Increases

Journeys through the experience of the Single Electricity Market in Ireland and Northern Ireland since 2009 from policy goals of increased renewables (particularly wind), energy security, static to dynamic market arrangements and regulation. The multi-stakeholder process followed in Ireland to define the required new market arrangements called Delivering a Secure and Sustainable Electricity System (DS3) includes a range of markets and services (specifically updated capacity market) attempting to reflect the demand for system services as increased levels of variable renewable energy sources are integrated.

C5-209: Renewable Energy Targets and Policies in Turkey and Development of Photovoltaic Solar Energy

This paper reports on the use of policies in Turkey to increase the share of renewable energy in the supply of electricity. It notes that despite the magnitude of the renewable energy potential in Turkey, the majority of electricity production is from fossil sources with significant energy imports. New policies and targets were determined in 2014 to increase the share of renewable energy sources, particularly PV generation and the target values for PV generating capacity and total renewable electricity production were exceeded in 2018. An interesting illustration of how a regulatory framework like a FIT for solar PV accelerated renewable energy deployment allowing policy targets to achieved earlier than expected (a positive) but at the cost of administratively determined FIT prices as technology costs declined even faster (a negative).

C5-210: Sensibilities to Customer Outflows

This paper examines the issues faced by regulators with rising prices to achieve new, renewable technologies on the one hand and increasing adoption of local supplies via microgrids that offer lower prices- the outflow of customers from the main grid raising prices to the remaining customers. The paper proposes that regulators have two key roles: to forecast the potential issue and to prevent the exacerbation of the problem. This should be done by examining true levelized costs, reviewing and improving regulations and providing accurate, economic price signals to consumers- and between the microgrids and the main power system.

C5-211: Market Tools for Managing Thermal Generation Fleet

This paper notes that existing structure of generating capacity in Russia is historically characterized by a significant share of thermal power plants (68%), Hydro (21%) and nuclear (11%). Other renewable sources are less than 1%. The large proportion of plants were constructed between 1960 and 1990. A new wave of investment is underway since 2008-2018 to attract private investment and upgrade older and inefficient plant. A new capacity market to incentivise this investment started in 2016 and supports upgrading of existing plants and development of new plants. This approach appears to be having success.

C5–212: Research of China's Two-tier Spot Market and Its Evolution Path

The paper presents potential issues in the construction of China's unified power spot market starting from the two-tier spot market that accommodates regional specificities as of today. It designs for every step of its development the expected operation mode and trading mechanism. The level of exchanges between provinces resulting from a greater integration of regional spot markets is assessed based on simulations using a simplified representation of the Chinese power system.

C5–213: The Realization of the Fairness and Efficiency Goals in the Electricity Market and its Application in the Guangdong Power Market

This paper proposes a review of different types of mechanisms that could be implemented in China to compensate generators whose profits may be affected by the opening of spot markets. In particular, the paper proposes specific schemes of a Contract for Difference and of a free allowance of Financial Transmission Rights. Those concepts are illustrated with an example.

C5-214: A Novel Demand Response Market Clearing Auction Model for Independent System Operator

This paper presents a market settlement model for demand response (DR) services using a mixed-integer linear programming (MILP) optimization model. The paper presents an algorithm guaranteeing better convergence to carry out the market settlement. The concept of a stepped supply curve relative slope is defined in the algorithm; several features of the DR auction and settlement are demonstrated by numerical examples. The proposed DR auction will typically be conducted in advance, procuring the service for ISOs one year in advance.

C5-215: Financial Systematic Risk Level Model

Applied learnings from the financial sector (from 2008/09 financial crisis), an indicator-based measurement approach is used to estimate the systematic importance, or referred to as the Financial Systematic Risk Level, that every agent in the Columbian electricity market introduces to the entire system. The indicators are chosen to reflect different aspects of what generates negative externalities and makes a participant critical for the stability of the entire system.

C5–216: Categorization Process Assignment of Transmission System Installations after 2016 Legal Reform of General Law on Electrical Services

The paper describes the reforms in the Chilean energy transmission regulatory framework implemented in 2016. The reforms in transmission perform a new categorization in different segments from former one. The target was to extend the central planning to a scheme in which the expansion of all public service electrical installations - national, zonal and generation development poles systems—is planned by the relevant authority. The paper includes the explanation of the impacts of this regulatory change in terms of the categorization process of transmission systems' installations and its payment regime.

C5–217: From a System of Shared Payment between Generators and Customers to a Regime of Payment of Final Customers

The paper describes the change in the remuneration system of the transmission system in Chile and the challenges concerning the payment of transmission networks for generators and customers. The efforts of Chilean regulation were to guarantee a fair payment to end users and to avoid double charges for same transmission service. The paper also describes legal changes implemented through the explanation of modification and implementation process with focus on the transitory mechanism applied for transmission payments from market agent.

Preferential Subject 2: Questions

Q1. What are the best tools to be used by regulators and market developers to ensure existing plant is renewed as required or new plant investments made including timely replacement, improving technical efficiency and adapting to new technologies while ensuring cost effective supply of energy for consumers?

Q2. What tools and methodologies are available and required by market participants to measure the risk levels of market participation in the context of their changing roles, penetration of variable renewables and other regulatory changes?

Q3. New arrangements and methodologies for transmission revenues and payments are a big challenge for modern regulators given the different usage paths from market agents and adjusting market structures. What kind of experiences could be considered successful for changes on transmission regulations to ensure sufficient investment and performance? How long will these changes remain effective? What are the usual barriers faced with transmission regulation changes? Who are the core stakeholders in these considerations?

Q4. How are network users compensated in case of a significant change in network topology or market design when they are exposed to local/regional prices?

Q5. How would one ensure system adequacy as increasing levels of variable renewable energy are integrated? Are markets or regulatory interventions more appropriate?

PREFERENTIAL SUBJECT 3

Market Designs for Coordination of Generation and Network Investments

Special Reporter: João Carlos Mello

Preferential Subject 3 addresses the evolution of coordination of generation and network investment in market design enhancements. The diversity of papers and ideas covers a large of market models worldwide. The solutions addressing regulatory issues and investment requirements are coming from all sectors of the power industry.

The papers discuss different blocks:

(i) Enhancing system monitoring for more security in market transactions;

(ii) Improvement of market solutions for system operator in the context of large integration of renewable energy sources (RES);

(iii) Dealing with flexibility requirements;

(iv) Market relationships of TSO and DSO procurements;

(v) Market involvement of distributed generation (DG);

(vi) Market designs for future system expansions.

Preferential Subject 3: Paper Summaries

C5–301 Latent Clustering Model for Co-optimization of Transmission and Generation Investments Under Uncertainty

The paper presented a proposed methodology for composition of generation planning and transmission using clustering techniques to cover uncertainties on generation connections and operations. The method includes a co-optimization of transmission and generation investment plans considering a wide range of long-term scenarios. An application in the American Western Interconnection in WECC (Western Electricity Coordinating Council) is also presented.

C5–302 Socio-economic competitive costs for flexibility-based alternatives to traditional investments in distribution network capacity

This paper proposes an investigation of flexibility in retail markets compared to the solutions in the bulk network system. The method for calculating socio-economic competitive flexibility costs is included in the assessment. Two case studies involving local distribution network cases in Norway are presented.

C5-303 Development and Impact of Flow-Based Methodology in Core Region

In this paper, the authors described the enhancement of system monitoring for more security in market transactions and explain the development of coupling methodology of transmission and market systems in Europe. The new application is based on Flow-Based methodology. The new application with FB methodology in practice will optimize the allocation of available trading capacity, which in market integration optimizes the efficiency of energy trading by allocating cross-border transmission capacities between coupled day-ahead markets, considering the physical constraint of the network in a more precise and detailed manner, including variable production from renewable energy sources. It is expected that the utilization of cross border capacity will be higher, maintaining the required level of the network security by more efficient congestion management.

C5-304: Improving Wholesale Electricity Market Design for Electric Power Systems with High Shares of Intermittent Renewable Energy Sources

This paper covers a very important issue for operations concerning large integration of renewable energy sources (RES). It is discussed the need for the improvement of market models given the massive entry of new RES and conventional energy decommissioning applied in Italy. The market model debate includes the impact of transmission constraints in prices (central, zonal and nodal prices); ancillary services procurement; dispatch decisions and the improvement of price signals for investment. The management of the central operator to order of the sources in a centralized manner is also included as an important issue in this context. The authors described several requested improvements in the current wholesale electricity market design to cope system security, system adequacy, service quality and economic efficiency in the future.

C5-305: The Consideration of Novel and Flexible Network Usage in Japan - Attempts to Minimize Social Cost by Optimizing Network Investment Considering Generation Curtailment

This paper describes a proposition of network management procedure “Japanese Connect and Manage (C&M) Scheme” to allow the entry of new generators without granting securely access as they can be cut into N-1 contingencies, or even N, congestion situations of transmission system. The market driven for this new arrangement of connections are the intensive entrance of renewable energy sources (RES). The C&M procedure is developed to accept a high number of RES and at the same time suppressing increase of wheeling tariff for all a cost and benefit approach is applied considering reliability relaxation in RES connection.

C5-306: Ancillary Services Market Reform According to the New European Electricity Directive: Open Points for the Design of the Future TSO-DSO Coordination and the DSO’s Procurement of Flexibility Services in the Italian Context

This paper presents the challenges regarding market relationships of TSO and DSO procurements. It is discussed the evolution of the ancillary services market and the necessary integration of the TSO and DSO face in European directives concerning Italian power market. It is suggested an assessment of the market basis and regulatory methods to incorporate the ancillary issues at DSO level. Two-step process is recommended that could be the most "robust" and safe. - first the DSO solve its own "very local" issues, then the remaining available sources of flexibility can be made available for TSO level needs.

C5-307: System Strength, Inertia and Network loss factors - Implications for Power Networks and Renewable generation

The paper presents the debate of the system security weakness with massive renewable integration in the Australian system. The debate on local solutions to mitigate the problem versus a systemic vision is an important point. The allocation of minimum requirements for renewable sources that raise the costs of these versus the broad payment for security by system users is one of the issues of the paper discussions.

C5-308: The Role of Price Signals in the Economically Efficient Integration of Demand Response and Distributed Energy Resources with the Central Electricity Supply System

The paper discusses the market structure for distributed generation participation as a valuable question. It is considered the proposition of price signals for distributed generation (DG), demand response and renewable sources that need to be synchronized with required system attributes instead those to be supplied by generation at wholesale level. A possible application of these concepts in power systems in terms of market design and operations are also discussed.

C5–309: Evaluating Various Battery Behaviours to Maximise Consumer Value Across the Electricity Supply Chain

This paper discusses a proposition for batteries allocation concerning local versus systemic solutions in Australia. Tariff design is considered as a driver of downstream value of Battery Energy Storage Systems (BESS) and the challenge is reconciling wholesale markets with tariff design to maximize BESS value delivered to consumers.

C5–310: Improved Method for Calculating ISKs Based on Node Transmission Contribution

The paper presents a modelling theory of a flow-based injection sensitivities to be applied in the regional interconnections in China to provide basic information for the operation of the day- ahead power market. The target is to improve the power flow calculation accuracy, and it is proposed the application of ISK method based on the contribution of nodes.

C5–311: How to Give a Reasonable Economic Signals Through Transmission Service Cost: Analysis based on Game Theory with the Example of Korean Transmission System

The paper discusses the application of the theory of Aumann-Shapley cooperative games to set the transmission tariffs with the integration of Korean system with other neighbouring countries. The author considers the economic signals given by Aumann-Shapley method are indicating considering the signal for new power plant in the system, which is more useful in selecting the location of them. A real case study with Korean and China interconnections are considered.

C5–312: Markets and Platforms to Coordinate the Procurement of System Services from Large-scale and Small-scale Assets Connected to the Electricity Network

The paper considers the efficiency and the reliability of the electricity system being dependent on an efficient collaboration between different market participants. It is described how the work performed defines the characteristics, functionalities, and potential algorithms to ensure the interoperability of the different markets and platforms developed by TSOs and DSOs across Europe. The proposed system architecture and the description of the blocks, as well as the implementations that are being used in the three demonstrators is also included.

C5–313: Strategy for Northeast Asia Power System Interconnection Technical Assistance to Mongolia General Overview of a Northeast Asia Power Trade

The paper debates the strategy for Northeast Asia Power System Interconnection, in which Mongolia's renewable potential is a real facilitator to design exports to neighboring countries in terms of reducing costs and carbon emissions. An interesting strategy to integrate the production in Mongolia with the operation of other countries with such different market structures is also included.

Preferential Subject 3: Questions

Q1. The management of transmission systems and margins for market transactions has been a concern for operators given the increasing level of uncertainties derived from new supply and demand assets. Must the full open access regulatory target for all market agents be submitted to the operators in advance to ensure system security? Under which conditions should grid expansions and other market flexibilities be considered to overcome barriers to market transactions?

Q2. Grid expansion and the development of new large-scale renewable sites must be rationally established. What are the good practices to incentivize investors to match renewable developments and network capacity requirements?

Q3. The participation of the renewable energy sources (RES) in the breakdown of the total produced electricity is going to increase worldwide. Will enhancements on flexibility procurements by DSOs and TSOs be enough to manage system security? Is the quality for system operation of different services provided from various sources a real barrier? Are market and system operators prepared to collect the genuine flexibility services only in short-term signals, or will mid and long-term investments in new products be required?

Q4. What are the recommended power market reforms to motivate further expansion of renewables? Which market features can better accommodate the development of new renewables and security of supply issues? Are capacity market designs able to deal with system security and RES expansion worldwide?

Q5. What is the importance of flexibility procurement for system operators? Does the concrete feasibility depend on actual transmission and distribution grid infrastructure and on operative conditions? What requirements are there for DSO and TSO coupling for market procurement and coordinated validation of suitable distributed energy resources (DER)?

Q6. How can the market design more efficiently cover the requested operating attributes, such as very fast response, inertia, and system strength?