

DISCUSSION MEETING SUMMARY

Study Committee C5

Electricity Markets and Regulation

26 August 2026

Chair: Yannick Phulpin

Secretary: Anthony Giacomoni

Special Reporters: Ivan Pavić (PS1), Vladislav Berezovsky (PS2), Anant Venkateswaran (PS3)

1. INTRODUCTION

The 2026 Group Discussion Meeting (GDM) meeting of Study Committee C5 was held on August 26th in room 352AB at the Palais des Congrès in a morning and afternoon session.

The scope of Study Committee C5 focuses on 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 2026 CIGRE Session, a total of 87 papers were selected based on the three Preferential Subjects (PS).

2. RUNNING OF THE MEETING

The GDM was chaired by the Study Committee Chairperson, *Yannick Phulpin*, with *Ivan Pavić*, *Vladislav Berezovsky*, and *Anant Venkateswaran* as Special Reporters and *Anthony Giacomoni* as Study Committee C5 Secretary.

The Chair opened the session by welcoming the audience and presenting them the status of the work of Study Committee C5.

The audience was informed of the format of the GDM that is based on questions from the Special Reporters on the bases of papers for the 2026 Session. Each of the three sessions had an opening report by the Special Reporter followed by the prepared contributions presented in 3-minute slots.

Spontaneous contributions from the audience were possible at the end of the sessions and were also enabled through use of the Sparkup application to allow questions to be asked and responded to online. The Sparkup application and questions were managed by *Anthony Giacomoni*. The Special Reporter had the closing report at the end of each session.

The Chair closed the session by thanking the audience for their contributions and presenting the awards given to Study Committee C5 in 2026. *Alex Cruickshank* received the Technical Council Award in recognition of his involvement in C5 technical activities. The best paper awards were given to the following papers for each preferential subject.

- PS1: “Assessing capacity accreditation choice on resource mix outcomes” by Genevieve DE MIJOLLA, Maren IHLEMANN, Jo Ann RANOLA, and Aidan TUOHY
- PS2: “Analysis of lost opportunity costs for hydropower under the locational marginal pricing mechanism” by Yi WANG, Zhirun ZHU, Zhifang YANG, and Yang WU
- PS3: “Reforming unscheduled deviations in the GCC power grid: a transition to a 15-minute net deviation regime” by Nasser AL-SHAHRANI, Abdulraheem ALGARNI, and Farooq JAN

3. CONTRIBUTIONS TO PREFERENTIAL SUBJECT 1

Preferential Subject 1 on “Market Designs and Non-Market Approaches to Support the Energy Transition,” covers the following themes:

- Ensuring resource adequacy and supporting investment decisions.
- Cost allocation for the energy transition: who owns and who pays.
- Tradeoffs between markets and regulatory approaches.

A total of 27 papers were selected under Preferential Subject PS1. The papers discuss the following broad areas:

- How the energy transition is driving a profound transformation of electricity systems, requiring new approaches to market design, regulation, and infrastructure development.
- The rapid growth of variable renewable energy sources, electrification, and distributed energy resources in increasing system complexity, introducing greater uncertainty, and challenging traditional energy-only market frameworks.
- The need to better align economic signals with physical system realities, including improved approaches for capacity remuneration, transmission cost allocation, market coupling, congestion management, as well as enhanced pricing structures reflecting temporal and locational system conditions.
- Ensuring investment predictability and financial viability as a critical priority, addressed through long-term contracts, auction mechanisms, and innovative financing solutions.
- The development of markets to incentivize flexibility, storage, demand response, and distributed energy resources.
- The role of non-market measures—such as regulatory frameworks, planning processes, and infrastructure policies—to overcome structural barriers and enable coordinated system evolution.

Five questions were asked in the Special Report to which there were 20 prepared contributions, and these are summarized below.

NGN Showcase presentation for Preferential Subject 1

The discussion for PS1 ended with an NGN Showcase presentation on “Procurement of Ancillary Services from a Market Perspective - Transition to a Market-Based Mechanism in Serbia”, presented by *Kovica Bibić*, Serbia.

Q1.1: How can we increase the pace of regulatory processes, so they keep up to date with state-of-the-art technologies and market needs in power systems?

The discussion included recommendations for increasing the pace of regulatory change including developing agile and adaptive regulatory frameworks, and enabling collaborative market governance. For example, making rules modular, measurable and revisable, incentivizing both innovation and flexibility, matching regulation to market maturity, and adapting regulation based on operational evidence.

Q1.2: How effective are the regulations and rules for battery storage implementation in your jurisdiction, i.e. are there any regulatory bottlenecks for faster storage deployment?

Increasing renewable energy generation is creating operational issues, which battery energy storage systems (BESS) can help solve. However, investors need predictable rules to aid in investing in BESS. Valuing flexibility, reliability and responsiveness are needed to enable large-scale BESS deployment. Unique rules may be needed to incentivize long-duration energy storage resource development.

Q1.3: What are the mechanisms used in your region to solve the issue of geographical distance between renewable-energy-rich areas and energy-intensive centers?

Grid reinforcements are needed in many regions to support the transmission of renewable energy from renewable-rich areas to load centers. Different cost allocation schemes for the grid investments were summarized. Appropriate regulation is important to ensure the needed infrastructure gets built. Grid coordination is also needed to support rapid data center development. BESS are another solution to help maximize the use of current infrastructure.

Q1.4: Are spot markets sufficient to foster investment into new dispatchable generation technologies in your country? If not, what are the mechanisms created to circumvent this issue?

Examples of markets where revenues from only the spot market were not enough to cover the costs of investing in new dispatchable generation technologies were discussed. Complementary revenues, state-based arrangements and capacity remuneration schemes were discussed as possible solutions.

Q1.5: Which concepts are incorporated in your jurisdiction to unlock flexibility for distribution grid purposes, i.e. to solve distribution grid challenges?

Dynamic operating envelopes, virtual power plants and home batteries, grid tariffs and local flexibility markets have all been used to increase flexibility in distribution grids. There is no single product that unlocks flexibility, but three concepts must work together: targets, products and standards.

4. CONTRIBUTIONS TO PREFERENTIAL SUBJECT 2

Preferential Subject 2 on “Developing Reliable Price Signals and Regulations Across the Value Chain,” covers the following themes:

- Tools and approaches for markets to withstand adverse events and shocks.
- Consistent end-to-end price signals to integrate emerging technologies, distributed energy resources and energy communities.

A total of 29 papers were selected under Preferential Subject PS2. The papers discuss the following broad areas:

- Challenges faced by electricity markets due to climate-related shocks, operational uncertainty, decentralization and the rapid integration of flexible and distributed energy resources.
- The interaction between operational reliability measures and market-based price formation.
- Integrating flexible resources and decentralized participation into electricity markets through coherent, end-to-end pricing signals.
- The importance of new coordination models involving aggregators, distribution system operators (DSOs), local flexibility markets, and transactive energy platforms that can enable decentralized optimization while maintaining operational reliability and transparent economic incentives.
- The growing role of retail tariff structures, temporal granularity and prosumer-oriented pricing mechanisms in shaping distributed flexibility and consumer behavior.
- The increasing importance of advanced analytical, monitoring and operational tools that can support electricity markets in the face of growing uncertainty and system complexity.

Four questions were asked in the Special Report to which there were 11 prepared contributions, and these are summarized below.

Q2.1: How can electricity markets provide reliable price signals during periods of scarcity, climate shocks and system stress, while maintaining efficient long-term market incentives?

The Australia NEM has a circuit breaker mechanism where the price is capped if the cumulative price over the past seven days exceeds a threshold. It is periodically reviewed to make sure it sends appropriate price signals.

Q2.2: Which regulatory and market mechanisms are most effective for integrating Distributed Energy Resources while preserving coherent price signals across the wholesale, network and retail levels?

Many distribution utilities are moving away from using static export limits and are moving to dynamic operating envelopes. Virtual power plant (VPP) frameworks are used to allow DER to participate at the wholesale level without onerous generator compliance burdens. Several innovative retail pricing schemes are allowing customers to take advantage of wholesale price volatility if they own the right equipment.

Q2.3: How can regulatory frameworks and price signals encourage operational flexibility, reliability and efficient behavior from market participants without excessive regulatory interventions?

Increasing pricing granularity is necessary to reflect supply-demand conditions and congestion, which vary among regions. Flexible assets must be able to bidirectionally communicate and automatically respond to signals in order to get higher value from flexible assets and dynamic tariffs. Examples where transparent price signals were shown to unlock operational flexibility while preserving market competition were also discussed. It was suggested to regulate the boundary not the operation regarding the right to curtail and that load flexibility needs to be fostered over time.

Q2.4: How can advanced monitoring, probabilistic modelling and risk assessment support adaptive regulation and operational decision-making in increasingly complex electricity systems?

An example was discussed where probabilistic modelling matters when it changes commitment, reserve and fuel-readiness decisions before uncertainty is resolved. Risk concentrates in a few hours, then moves. Metrics that recalibrate themselves with system composition give regulators an adaptive foundation, and, since the critical window itself moves at a measurable rate, accreditation should carry an explicit re-measurement cadence.

5. CONTRIBUTIONS TO PREFERENTIAL SUBJECT 3

Preferential Subject 3 on “Applying Practical Experiences to Emerging Issues,” covers the following themes:

- Integrating various electricity markets with emission reduction approaches and long-term contracts.
- Market designs and products to deal with increasing short-term uncertainty.
- Data analytics in electricity markets, market surveillance and transparency.

A total of 31 papers were selected under Preferential Subject PS3. The papers discuss the following broad areas:

- How electricity markets across regions including India, Latin America, Europe, Africa, China, the GCC, and Russia are evolving to address decarbonization, renewable integration, flexibility needs, operational uncertainty, and digital transformation.
- Practical applications of carbon-aware dispatch, SCED/SCUC frameworks, ancillary services reforms, real-time and balancing markets, cross-border market integration, battery energy storage systems (BESS), VPPs, demand response, shorter settlement intervals, market liquidity

improvements, machine learning, data analytics, market surveillance, and enhanced transparency frameworks.

- The global transition toward more flexible, data-driven, reliable, and sustainable electricity market ecosystems capable of supporting the energy transition.
- The transition from conventional centrally managed power systems toward more dynamic, data-driven, and flexibility-oriented market structures capable of supporting high penetrations of renewable and distributed energy resources.
- Practical experiences from diverse regions that provide valuable lessons on how market operators, regulators, and system planners are adapting operational tools, market structures, and policy frameworks to ensure reliability, transparency, flexibility, and sustainability in increasingly complex power systems.

Five questions were asked in the Special Report to which there were 10 prepared contributions, and these are summarized below.

NGN Showcase presentation for Preferential Subject 3

The discussion for PS3 started with an NGN Showcase presentation on “Reducing Balancing Reserve Requirements for FiT Using Ensemble Forecasts”, presented by Shiho Nakata, Japan.

Q3.1: How can electricity markets balance decarbonization goals with affordability and reliability?

Annual bilateral contracts have been used in Japan to mitigate procurement shortfalls contributing to a stable electricity supply and reducing procurement costs through improved market conditions. Examples of the decoupling of energy and environmental attributes using energy environmental attribute certificates were also discussed.

Q3.2: What market design changes are most effective in managing renewable variability and short-term operational uncertainty?

Moving to more granular market clearing and settlement, wholesale demand response mechanisms, BESS, and fast frequency response services have all been used to effectively manage renewable energy source variability and short-term operational uncertainty.

Q3.3: How can flexibility resources be better integrated into ancillary service and balancing markets?

It is important that heterogeneous physical characteristics are properly modeled through resource-level constraints in a unified clearing framework. For BESS, coordinated SoC-consistent modelling, price-coherent dispatch and real-time reconciliation are what allow BESS flexibility to be fully captured in ancillary service and balancing markets. It is important to value flexibility across ancillary services — not in isolated silos.

Q3.4: What lessons from regional market integration initiatives can improve cross-border flexibility and reserve sharing?

Lessons from cross-border flexibility and reserve sharing from the Eastern Africa Power Pool were discussed. It was found that a structured, inclusive, and iterative approach can successfully align diverse national interests toward a common market vision. Also, that regional integration requires phased design, inclusive governance, a strong legal base, and political will – the EAPP proves it is possible.

Q3.5: How can advanced analytics, AI, and market surveillance tools improve transparency, liquidity, and operational decision-making?

Examples were discussed on how AI can help turn surveillance into action, and not just reporting. AI and machine learning can provide real-time pattern recognition and early warnings for market monitoring before

market clearing, rather than ex-post detection, and also provide predictive and optimized intervention support. It was also discussed how AI can be used to standardize validation rules and forecast REC supply-demand dynamics.

6. CONCLUSION

The session had a total of 41 contributions addressing the three preferential subjects, 20 for PS1, 11 for PS2, and 10 for PS3. There were two NGN Showcase presentations. Contributions were received from over 20 different countries.

Although the agenda was full and focused on the prepared contributions, there was some opportunity for fruitful discussion.

The Chair closed the session by thanking the audience for their contributions and thanking the Special Reporters and SC C5 secretary for their excellent work. The awards given to Study Committee C5 in 2026 were also presented.