

NEWSLETTER

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APEX Objective

To facilitate the development and communication of ideas and practices in the operation of global competitive electricity markets. One of its primary intentions is to provide a platform for the sharing of information between its members.

IN THE SPOTLIGHT



**Jaime
Alejandro
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APEX Board Member

Transforming the Electric Market: Colombia's Experience and Its Path Toward Modernization

Introduction

The Colombian electric market stands at a pivotal moment. Modernizing the market is not only a response to the global energy transition but also a strategic necessity to ensure the country's energy security, competitiveness, and sustainability. Colombia's leadership in the region is reflected in its proactive regulatory agenda, robust institutional framework, and commitment to international cooperation. As an active APEX member, Colombia shares its lessons learned and best practices, contributing to the acceleration of the energy transition across Latin America.

The transformation of the Wholesale Energy Market (MEM) is central to this vision. It enables the integration of new technologies, actors, and business models, while ensuring reliability, efficiency, and resilience in the face of climate variability and growing demand.

It is an honor to have been appointed as a member of the APEX Board of Directors. I sincerely appreciate the support and trust of its members, as well as the opportunity to represent XM (Colombian ISO) in a space of significant international relevance. This appointment reaffirms XM's leadership in the energy sector and enables us to strengthen our role in building more integrated, transparent, and efficient markets.

Colombia faces major challenges in its energy transition: integrating new technologies, developing flexible and sustainable markets, and ensuring security and reliability in operations.



**Jaime
Alejandro
Zapata Uribe**
APEX Board Member

Continued – Director's Column

In this context, APEx becomes a strategic ally for sharing experiences, best practices, and innovative solutions that contribute to achieving our objectives and consolidating a robust and competitive market.

The importance of APEx lies in its role as a global platform for knowledge exchange and the promotion of standards that have transformed energy markets in different countries. Its contributions have advanced interoperability, transparency, and the adoption of technologies that enhance efficiency and resilience in the sector. Being part of this network gives us the opportunity to learn from international experiences and apply those lessons in Colombia, accelerating the energy transition and market competitiveness.

I am convinced that this cooperation will be key to driving the transformation of Colombia's electricity sector and creating value for all stakeholders. Thank you once again for your trust; I take on this commitment with responsibility and enthusiasm.



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Transforming the Electric Market: Colombia's Experience and Its Path Toward Modernization

The roadmap to 2030¹, led by XM, is built on international benchmarking, regulatory innovation, and a strong focus on digitalization and talent development.

Needs and Challenges of the Colombian Market

Integration of Renewable Energies:

Colombia is experiencing a rapid increase in non-conventional renewable energy sources, especially solar and wind. By 2033, 87% of new installed capacity is expected to come from these sources, with the Caribbean region leading due to its high solar irradiation and wind potential. This transformation brings technical and market challenges:

- Managing variability and uncertainty in generation.
- Ensuring grid stability during periods of low renewable output.
- Developing advanced forecasting tools and flexible market mechanisms.
- Updating operational protocols to accommodate intermittent resources.

New Roles and Actors:

The market is evolving to include aggregators, prosumers, and storage operators. Regulatory frameworks (e.g., CREG 098/2019) are being updated to enable these actors to participate in new services to enhance technical support for energy system.

Storage and Flexibility:

Storage technologies, particularly battery energy storage systems (BESS), are becoming essential for smoothing renewable generation profiles, providing ancillary services, and supporting grid resilience. This is a step forward to integrate services that provide flexibility to the system, while regulatory adjustments are underway to incentivize investment in these assets.

Financial Sustainability:

Ensuring robust economic signals is critical for attracting investment and mitigating systemic risk. Key actions include updating reliability charges and scarcity pricing, strengthening long-term contracting mechanisms, and enhancing transparency and liquidity in both spot and bilateral markets.

Efficient and Reliable Supply of Demand:

Colombia's system must remain resilient to climate variability (e.g., El Niño/La Niña events) and growing demand from electrification. Priorities include expanding and modernizing transmission infrastructure, promoting demand-side participation, and ensuring equitable access and benefits for all consumers. In line with UPME's demand scenarios, demand is expected to grow by 25% by 2033. For this reason, it is important for Colombia to encourage active participation and ensure long-term supply reliability.

¹Ebook_The 2030 Energy Transition Roadmap

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Innovation and Digitalization:

The digital transformation of the market is a cornerstone of modernization, encompassing the deployment of interoperable IT/OT architectures, advanced analytics, and AI for forecasting and market optimization, alongside strengthened cybersecurity and data governance. It also requires mechanisms that ensure the safe and reliable integration of renewables into the system, accommodate the expected increase in new participants and services, and enable full system interoperability—ultimately fostering a market that adapts swiftly to evolving service demands and the challenges of the energy transition.

Progress in Regional Integration:

Colombia is advancing regional integration through leadership in SINEA and participation in SIEPAC, developing cross-border trading mechanisms and harmonizing market rules to enhance regional security and competitiveness. This, in turn, brings significant challenges—not only for Colombia, which will serve as the first regional coordinator of the Andean Regional Short-Term Electricity Market (MAERCP), scheduled to begin operations in July next year, but also for the entire region as it implements its first regional market. This milestone generates high expectations across stakeholders.

Sustainability:

All modernization efforts are aligned with Colombia's commitments under the Paris Agreement. The country has pledged to reduce its greenhouse gas emissions by 51% by 2030 and achieve carbon neutrality by 2050. These goals underscore the importance of advancing market reforms, integrating clean technologies, and strengthening flexibility and resilience to support a sustainable energy transition.

Achievements to Date

International Benchmarking:

XM has conducted comprehensive benchmarking with leading markets, including Chile, Brazil, Spain, Denmark, Canada (IESO Ontario), Australia (AEMO), Korea, and Turkey. Key lessons include the adoption of day-ahead and intraday markets, robust ancillary services, and advanced flexibility management. Equally important, organizational transformation has been central—driven by multidisciplinary teams, agile governance models, and continuous stakeholder engagement. These insights are shaping XM's roadmap toward a more dynamic, resilient, and competitive market aligned with global best practices. For the Colombian market, it has been particularly valuable to learn from the market modernization processes in Canada and Australia, which have provided best practices that enrich the analyses XM is currently developing.

Proactive Role with the Regulator

XM has led the development of technical and market proposals, including binding dispatch and intraday market rules, new ancillary services (inertia, fast frequency response, storage participation), and mechanisms for demand-side integration and DER aggregation.

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Joint Studies and Institutional Coordination:

- **World Bank:** Modernizing Colombia's Electricity Market for the Energy Transition: Driving Flexibility, Resilience, and Competitiveness², strategic analysis on market modernization and financial sustainability.
- **Danish Energy Agency:** Technical cooperation on renewable integration and system flexibility³. The Danish Energy Agency supports Colombia's energy transition through technical cooperation on renewable integration and system flexibility. Key actions include market reform, advanced grid technologies (HVDC, BESS), and knowledge exchange on operational roles, complemented by a roadmap for market design and improved grid planning.
- **EPRI:** A technical assistance agreement was established with EPRI to design and implement training Plan. As part of this initiative, EPRI experts delivered the "Training on Evolving Energy Markets" at XM. The program addressed global market structures, comparisons between European and North American designs, price formation under high renewable penetration, intraday and real-time market models, ancillary services and co-optimization, energy storage participation, demand-side integration, emerging technologies, innovation in market mechanisms, and benchmarking of operational and IT/OT processes for electricity markets.

These collaborations have played a pivotal role in shaping the national roadmap and ensuring alignment with international standards and accelerating implementation. Pilot projects and simulations are being used to validate new market models before full-scale deployment, while training programs with EPRI and other strategic partners strengthen market capabilities and foster technical excellence.

Internal Changes

XM has restructured its market management teams to support modernization, emphasizing multidisciplinary and hybrid skill sets, agile project management, and dedicated cells for regulatory implementation and innovation.

Strategic Roadmaps and Alliances:

The MEM Roadmap focuses on developing more granular, flexible, and transparent market schemes, while the IT Roadmap drives digitalization, interoperability, and cybersecurity. In parallel, continuous upskilling is promoted through alliances with EPRI, universities, international operators, and partnerships with global organizations to strengthen training, adopt best practices, and define the next steps in market modernization.

² "Modernizing Colombia's Electricity Market for the Energy Transition: Driving Flexibility, Resilience, and Competitiveness" — an initiative funded by the World Bank and coordinated by the Ministry of Mines and Energy currently under development.

³ Strategic sector cooperation on energy between Denmark and Colombia coordinated by the Ministry of Mines and Energy currently under development.

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Additionally, APEX will be a key asset for the Colombian market by enabling connections with successful experiences from other markets that can enrich analyses, best practices and simulations. Its advanced capabilities will support decision-making, validate new market designs, and accelerate the implementation of innovative mechanisms that enhance flexibility and resilience for Colombian energy market.

Milestones, Actions, and Timeline:

A phased approach guides market evolution, with clear milestones for regulatory changes, pilot deployments, technology upgrades, and capacity building, ensuring measurable progress toward 2030 objectives.

New Facilitators, Drivers, and Support Structures for Modernization

Facilitators:

- Adaptive and prospective regulatory framework, with periodic review and pilot windows for new market products.
- Integral digitalization and open data governance, including adoption of international standards and AI.
- Innovative financial instruments: futures, green financing, and risk management tools.
- Active demand-side participation and simplified rules for new actors.

Drivers:

- Accelerated electrification of industry, transport, and new uses (hydrogen, data centers).
- Mass deployment of storage and distributed resources, with clear integration and remuneration rules.
- Technological innovation and new business models (Energy-as-a-Service, virtual aggregation).
- Commitment to decarbonization and sustainability, integrating ESG criteria.

Support Structures:

- Regulatory sandboxes for controlled experimentation of new products and services.
- Centers of excellence and market observatories for applied research and foresight.
- Collaborative platforms and sectoral forums for co-creation and best practice exchange.
- Training and certification programs in digitalization, flexibility, and new business models.
- Regional integration and international cooperation for harmonization and joint projects.

How APEx and Member Power Exchanges Can Complement Colombia's Modernization

With cooperation of workshops, webinars, and a document repository, coordinated between XM and APEx, where experts from member power exchanges share experiences, manuals, case studies, and recommendations on the design, operation, and monitoring of intraday markets and flexibility products (storage, aggregation, demand response).

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Closing: Next Steps

To consolidate modernization, Colombia must:

- Finalize and implement regulatory frameworks for short term and ancillary services markets.
- Accelerate the deployment of digital infrastructure and advanced metering.
- Foster greater demand-side participation and integration of new market actors.
- Deepen regional integration and harmonization of market rules.
- Maintain a strong focus on talent development, innovation, and organizational agility.

APEx and its members are invited to join this journey, acting as strategic partners and catalysts for a flexible, digital, and sustainable electric market in Colombia and the region.

Conclusion

The modernization of Colombia's electric market is a milestone on the path to a more sustainable, efficient, and flexible energy system. This journey, grounded in vision and cooperation, is not an isolated challenge but an opportunity to strengthen regional integration and accelerate the energy transition. Colombia is advancing on its roadmap and reaffirms its commitment to the energy transition. APEx members are invited to share their learnings, best practices, and success stories, generating collaborative spaces that drive sector transformation. International cooperation is essential to address common challenges—such as renewable integration, flexibility management, and financial sustainability—by sharing experiences and generating synergies that accelerate change.



2025 GO15-APEx JOINT CONFERENCE PHOTOS





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APEX

Association of Power Exchanges

JOIN US

If you're interested in contributing to the development and communication of ideas in the operation of global competitive electricity markets, apply to become a member today!



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