

SMART GRID FORUM 2025 FINAL REPORT

17th. LATIN AMERICAN SMART GRID FORUM

<p>FÓRUM LATINO-AMERICANO DE SMART GRID</p> <p>SMART GRID 17ª EDIÇÃO</p> <p>4 E 5 DE AGOSTO DE 2025 SÃO PAULO - SP - BRASIL</p> 			
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FINAL REPORT OF THE 17th. SMART GRID FORUM 2025 LATIN AMERICAN SMART GRID FORUM

Summary

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1. Executive Summary

The Smart Grid Forum is an initiative that brings together the community of companies, governments, professionals, associations, consumers, universities and other audiences interested in advanced and innovative technologies that can enable innovative business models and smart energy networks and systems, throughout the business chain, housing generation, transmission, distribution, commercialization and end use of energy, in order to provide broad and unrestricted access to efficient, reliable, resilient, sustainable, safe and economically viable and accessible energy systems to society as a whole, including the most disadvantaged populations.

Participating in the Forum are market-leading companies and professionals who are contributing to the technological and regulatory advancement of the energy sector and the agenda of modernization of electricity systems for the energy transition.

The event is part of the world circuit of relevant International Conferences on the subject. The Forum Conferences always provide guidance and guidelines for action to governments, regulators, energy companies, technology providers and other stakeholders, on the next steps needed for the modernization of energy services in Brazil and Latin America.

The 17th edition of the Smart Grid Forum reaffirmed its relevance as a strategic space for dialogue between regulators, companies, academia, sectoral entities, consumers and international organizations. With the presence of more than 400 professionals from 24 Brazilian states and representatives from 19 countries, the event has consolidated itself as a reference platform to discuss the directions of the modernization of the electricity sector, articulating technical, regulatory and market views.

The 17th Smart Grid Forum addressed key issues for the modernization of electricity grids in Latin America, with a focus on energy transition, integration of renewables, and digitalization of grids. Discussions on concessions, regulation, investments and innovation were also highlighted. Among the main points, the digitalization of networks, smart metering and tariffs, the optimized integration of renewable sources and the growing need for operational and systemic flexibility services due to the growing and rapid penetration of variable renewables in the electricity matrix were discussed, as well as successful case studies and adaptation strategies.

Emphasis was placed on the public policies and partnerships needed to foster advances in the sector, maintain affordable tariffs, reduce energy losses in areas of high social complexity, and ensure a resilient, sustainable, and inclusive energy future, especially in Brazil, where the Federal Government and Aneel are laying the groundwork for the renewal of expiring distribution service concessions in the coming years.

The event featured the presentation of panels and lectures in a single plenary and a qualified exhibition that was attended by twelve high-tech companies that were able to exhibit the latest and most innovative solutions and products offered in the area of connected and integrated electrical power systems: AP Sensing, Megger, S&C, Landis+Gyr, WEG, SIEMENS, Bentley and partners, Micropower, FIT, Hart Br, PEXTRON and AEW.

The event also had the direct sponsorship and/or content contribution of a total of 18 sponsors, including the aforementioned companies, who participated in the exhibition, together with the following additional companies: Schneider Electric, Gridspertise and Thymos Energia. In addition to these companies, the companies LACTEC, Bentley, WEG and Thymos exhibited their skills in leaflet services included in the congressmen's folders.

The event also had the official support of ANEEL, CCEE and EPE, and international support from ADELAT, ARIAE, CIER, COLOMBIA INTELIGENTE, GSEF, IEC and ISGF. The event also had institutional support from 30 other entities and associations in the sector.

Also participating in the panels were 6 residents and 37 speakers / debaters of high visibility, authority and competence in the sector, Brazilian, Latin American and worldwide, and due to the participation of professionals of various nationalities and from 19 different countries and 24 states of Brazil, the event had full simultaneous translation, made by professionals with knowledge and fluency in technical terms of electricity and energy. The biographies of the speakers and moderators can be accessed on the event's website through the speakers link.



The Final Program carried out and the download of authorized lectures can be done through the link: [Program and Downloads](#).

During the two days of the event, about 300 attendees were able to share knowledge and networking and participate in the activities parallel to the conference, with a view to exposure and networking with speakers and moderators during the coffee, lunch and cocktail sessions. There was also a visit by about 100 non-congress professionals to the booths and exhibition, made possible through prior registration at no cost on the event's website.

To carry out the event, the organization involved the direct participation and generation of jobs for 90 professionals in the areas of content, administration, supplies, information technology, operation, master of ceremonies, receptionists, translators, sound and image, photography, press relations, property security, firefighters, cleaning, assembly and disassembly of the exhibition, buffet and documentation. In addition, also considering the companies directly involved as sponsors and supporters, another 80 people participated and collaborated for the success of the event, serving a total audience of 600 people in the two days of the event. In addition, a whole parallel network of partners and external services involved was benefited, such as hotels, transportation, food and leisure, involving an additional contingent estimated at least another 500 professionals indirectly involved.

Finally, in the week of its realization alone, the event generated a total of 6 press releases and agenda notices, with the repercussion of 32 clippings and an estimated value of around R\$ 219 thousand in ad equivalence. The Press Report can be accessed through the link [Repercussion in the press](#).

The Photo Report of the event can be accessed through the links: [Photos 4 Aug](#) and [Photos 5 Aug](#).

The debates unanimously demonstrated that the **digitalization of electricity grids** is irreversible and should be treated as a national priority. The deployment of smart meters, automation systems, advanced sensors, and robust IT infrastructure was pointed out as the basis for building more efficient, resilient grids prepared for the large-scale integration of distributed generation, storage, and electric vehicles. However, it was emphasized that this process must be accompanied by **interoperability standards** and sustainable financing models, capable of reducing the tariff impact and ensuring the scale of investments.

Another central axis was the finding that the **mismatch between technological innovation and regulation** continues to represent a significant risk. The expansion of distributed generation, batteries and new business models in the free market is advancing at a faster pace than the formulation of regulatory frameworks. The need for **regulatory anticipation**

was reinforced, in order to provide legal certainty, avoid distortions in the allocation of costs and allow the benefits of innovation to be effectively shared among all agents.

The Forum also highlighted the urgency of **improving sectoral governance**. The current institutional design, fragmented between different agencies and entities, hinders agile and coordinated decisions on critical issues such as tariffs, quality of service, cybersecurity and integration of new energy resources. There was a consensus that the modernization agenda should be accompanied by a review of roles and competences, greater inter-institutional coordination and *accountability* mechanisms that ensure predictability and trust.

The **review of subsidies** has also emerged as a priority. Current mechanisms, designed in different contexts, generate economic distortions and can discourage efficiency. The need to rethink the subsidy structure based on criteria of tariff justice, competitiveness and stimulus to innovation was defended, in order to preserve the sustainability of the sector and the protection of vulnerable consumers.

In the field of **resilience and reliability**, distributors and experts reinforced that the gains obtained so far need to be expanded in the face of the increase in the severity of climatic events and the growing complexity of the networks. Indicators of continuity of supply, perception of quality by the consumer and metrics of operational robustness should guide both private investments and the regulation of incentives and penalties.

Another striking aspect was the reaffirmation of consumer **centricity**. Since the first edition, the Forum has included representatives of consumer councils, recognizing that the sustainability of any agenda depends on social engagement. In 2025, it was reinforced that market opening, digitalization, and the integration of new resources will only be successful if accompanied by transparent information, participation mechanisms, and guarantees of protection for the end user.

Finally, the importance of **international cooperation** and the exchange of experiences was highlighted. Countries such as Spain, China, and India were cited as references in the integration of distributed generation, storage, and advanced regulation. Brazil must maintain a permanent dialogue with these markets, adapting good practices to their regulatory, economic and social context.

The Forum ended with the commitment to systematize the ideas and recommendations in a report to be sent to the federal government, the National Congress, ANEEL, CCEE, EPE and representative associations, reaffirming its role as a catalyst for the transformations necessary to ensure smarter, more sustainable, reliable and inclusive grids in Brazil.

2. Presentation of the Latin American Smart Grid Forum



The president of the Smart Grid Forum, **Cyro Vicente Boccuzzi**, began his participation by welcoming those present and highlighting that this 17th edition of the Forum marks **18 years of the** initiative's trajectory as a reference space for discussion, integration and promotion of advances in the electricity sector. He pointed out that, throughout this period, the event has consolidated itself as a **strategic platform for dialogue** between government, companies, academia and society, always guided by innovation and the collaborative construction of solutions to energy challenges.

At the opening, Cyro presented an overview of the **evolution of the Forum** since its first edition, recalling that, when it started, the concept of smart grids was still not widespread in Brazil. Over the years, the event has followed and, in many moments, anticipated technological and regulatory trends, addressing topics such as **digitalization, decentralization, decarbonization, market opening, integration of distributed energy resources, and grid resilience.**

He highlighted the **international nature** of the Conference, with the presence of foreign delegations, renowned experts and simultaneous translation to expand the scope of the discussions. According to Cyro, the exchange of experiences with countries that have

already advanced in the implementation of smart grids is essential to accelerate the learning curve and adapt good practices to the Brazilian reality.

Another point emphasized was the **critical and transformative moment** that the Brazilian and global electricity sector is going through, marked by technological, regulatory and climate changes. He highlighted that the **energy transition** is not just a replacement of fossil sources with renewables, but a **systemic transformation**, which requires rethinking the role of distributors, system operators and consumers in the electricity ecosystem. Cyro noted that, more than debating technologies, the Forum seeks **to build bridges between innovation and economic viability**, creating conditions for technological advancement to translate into concrete benefits for consumers and companies.

When addressing the regulatory context, he stressed that the **sectoral reform** underway in Brazil is a unique opportunity to align incentives, promote innovation and create mechanisms that enable sustainable business models for all agents in the electricity chain. In this sense, he advocated that regulation be **adaptive and results-oriented**, allowing controlled experimentation — for example, through **regulatory sandboxes** — to validate solutions before their large-scale adoption.

Cyro also highlighted the importance of **integrated and collaborative planning**, in which companies, regulatory agencies, universities and research centers work together to create long-term solutions. He emphasized that international experience shows that **coordination between transmission and distribution operators** is decisive to ensure efficiency, safety and reliability of the system.

Finally, Boccuzzi reinforced that the success of this transformation depends on the ability **to engage all stakeholders**, promote continuous technical training and create an open innovation environment. In his words, "the future of the electricity sector will be defined by our ability to collaborate, experiment and scale solutions that combine technology, sustainability and value for society".

In his speech, he also thanked the sponsors, institutional supporters, exhibitors and the organizing team, noting that the event is only possible thanks to the **collaboration of multiple actors**. He stressed the importance of each participant making the most of the content, networking opportunities and exposure to technologies, actively contributing with questions, suggestions and new projects.

Closing the opening, Cyro reinforced that the **Smart Grid Forum is more than an event** — it is a space for collective and continuous construction, where strategic visions and practical experiences meet to shape the future of the Brazilian and Latin American electricity sector. In his words, "our goal is that, when leaving here, each one takes not only information, but also inspiration and the will to make it happen".

3. Opening panel: "Advanced Technologies Innovating Energy Business and Markets"

- Agnes Maria de Aragão da Costa, Director, ANEEL
- Adriana Aoki, Engineering and Measurement Product Owner, CCEE
- Frederico de Araújo Teles, Director of the Department of Sectoral Policies, MME
- Marcelo Prais, Advisor to the Planning Board, O N S
- Marcos Madureira, president of ABRADEE
- Reji Kumar Pilai – Chairperson ISGF and GSEF (India)
- Thiago Ivanosky, Director of Economic-Energy and Environmental Studies, EPE
- Moderator: Cyro Vicente Boccuzzi, President, ECOee and Latin American Smart Grid Forum



Thiago Ivanovski Teixeira, Director of Economic and Energy Studies at EPE, structured his presentation around the digital transformation of the electricity sector, but made a point of highlighting that digitalization and advanced data analysis only deliver their full value when integrated into a solid and dynamic energy planning process.

From the beginning, Ivanoski stressed that the sector's planning can no longer be based exclusively on static projections and long-term studies prepared in a timely manner. In a context of rapid technological changes, increased penetration of distributed energy resources, and electric mobility, it is necessary to adopt **continuous and adaptive planning models**, capable of incorporating new variables in real time and responding to unforeseen scenarios.

He emphasized that digitalization, through smart sensors, advanced measurement systems, and data integration platforms, provides valuable inputs for **operational and strategic planning**. By collecting and processing information in real time, it is possible to identify trends, anticipate bottlenecks, and optimize investments more assertively.

One of the central points of his speech was the use of **predictive models and simulations based on artificial intelligence** to predict future demands, assess the integration capacity of new renewable sources and plan grid expansions in an optimized way. Ivanoski pointed out that such tools allow for the simultaneous consideration of technical, economic, and environmental variables, increasing the accuracy and relevance of planning.

He also warned of the need for **alignment between operation planning and expansion planning**, avoiding isolated decisions that may generate inefficiencies or redundancies. According to him, interoperability between asset management, energy dispatch and demand forecasting platforms is a fundamental requirement for planning to be effective.

Ivanoski also noted that modern energy planning needs to integrate the **regulatory, technological, and social dimensions** in a structured way, in order not only to ensure the physical and economic balance of the system, but also to promote the active participation of consumers and the fulfillment of decarbonization goals.

In conclusion, he reinforced that **digital transformation and energy planning are two inseparable pillars**: digitalization provides data and intelligence to improve planning, while robust planning guides investments and defines technological priorities. In his words, "it is not enough to plan for the future — it is necessary to plan with the future happening now, incorporating changes as they arise."



Throughout his presentation, **Marcelo Prais, Advisor to the Planning Board of O N S**, highlighted several **critical aspects for the operation of the National Interconnected System (SIN)**, showing that the growing complexity of the system requires new approaches to maintain reliability and efficiency.

A first point emphasized was the **integration of intermittent renewable sources**, such as solar and wind, whose variability poses challenges to frequency and voltage stability. According to Prais, this characteristic requires improvement of generation and consumption forecasting mechanisms, as well as greater flexibility in the operation to deal with sudden fluctuations in supply and demand.

Another critical aspect addressed was the **coordination between transmission and distribution operation centers**, which is necessary to respond quickly to disturbances and optimize the use of existing infrastructure. Prais pointed out that, without this operational integration, there is a risk of inefficiencies, overloads and delays in the recomposition of the system after adverse events.

He also drew attention to resilience in the **face of extreme weather events**, which have become more frequent and intense, affecting transmission lines, substations and other critical assets. He stressed that the planning of the operation must incorporate contingency scenarios and rapid recovery strategies to reduce impacts on the consumer.

The management of energy flows over long distances was another central point, considering that the SIN connects regions with very different generation and consumption

profiles. Prais mentioned that this characteristic, although it is a strength of the Brazilian system, requires constant monitoring and control to avoid congestion and excessive losses.

In addition, he highlighted the need for technological updating in the supervision and control systems, to allow faster and more accurate decisions. More advanced SCADA and telemetry systems, combined with automation and artificial intelligence, are seen as essential to deal with the multiplicity of variables that affect the balance of the SIN.

Finally, Prais stressed that the integration of distributed energy resources (DERs) into the SIN represents an additional challenge, as it alters traditional flows and requires new strategies for dispatch, protection, and coordination. He emphasized that adapting to this new scenario involves regulatory updating, technological standardization and investments aimed at the intelligent operation of the system.



Executive **Adriana Aoki**, representative of the **Electric Energy Trading Chamber (CCEE)**, presented a comprehensive overview of the actions that the institution has been conducting to **enable the full opening of the electricity market in Brazil**. She stressed that this transformation, which will allow all consumers — residential, commercial and industrial — to choose their energy supplier, is an unprecedented regulatory and operational milestone in the sector.

Right at the beginning, Adriana explained that CCEE has been working on **four strategic axes** to prepare the marketing environment for this change:

- **Technological infrastructure and support systems** – CCEE is developing new digital platforms to facilitate the entry of small consumers and retail agents, with a focus on **simplicity, scalability and transactional security**. These platforms include modules for registration, contract registration, measurement, financial settlement, and communication with other agents in the sector.

- **Improvement of trading rules** – Together with ANEEL and the Ministry of Mines and Energy (MME), the CCEE has been reviewing and simplifying trading procedures to reduce entry barriers. This includes standardizing **contracts**, creating **simplified rules for low-voltage consumers**, and adapting membership processes to allow millions of new customers to participate.

- **Consumer protection and empowerment** – A central point addressed by Adriana was the need to ensure that the total opening of the market is accompanied by **protection mechanisms**, such as supply guarantees, transparency in pricing, and inspection of commercial practices. At the same time, the CCEE is developing **digital tools for simulation and comparison of offers**, allowing consumers to evaluate different supply options in a clear and safe way.

- **Coordination with distributors and operational adaptation** – Adriana highlighted that total openness requires a clear redefinition of the distributors' roles, separating the wire activity (use of the network) from energy trading. To this end, CCEE has been conducting **pilot projects and operational tests** with distributors to validate billing processes, measurement and exchange of consumption data.

During her speech, Adriana also stressed that the CCEE is working to create a **settlement and accounting environment robust** enough to handle the exponential increase in transactions that will come with the entry of millions of consumers. The priority is to ensure **integrity, traceability and efficiency** throughout the marketing cycle.

She reinforced that **consumer education** is a key piece for the success of the opening. Therefore, campaigns and informative materials are underway aimed at the general population, explaining the rights, duties and opportunities of the free market, as well as specific training for traders and new agents.

In conclusion, Adriana stated that the total opening of the Brazilian market is not just a regulatory issue, but a **structural transformation project**, which involves technology, governance, communication and alignment between all links in the electricity chain. In his words, "CCEE is preparing to be the foundation of an inclusive, competitive and secure free market, capable of delivering more options, innovation and efficiency to all consumers in Brazil".



Dr. Agnes da Costa, director of the **National Electric Energy Agency (ANEEL)**, presented a comprehensive overview of the role of regulation in driving the energy transition and modernizing the Brazilian electricity sector. From the beginning, he highlighted that the current moment is marked by a convergence of factors — accelerated technological advancement, new business models, growing share of distributed energy resources (REDS) and demands for sustainability — that challenge traditional regulation and require **an institutional repositioning of ANEEL** to deal with an increasingly dynamic sector.

She emphasized that the role of the regulator, in this context, goes beyond supervising and establishing standards: it is also **to create an environment conducive to innovation**, while ensuring legal certainty and balance between the interests of consumers, investors and concessionaires. He stated that the agency is committed to **adopting adaptive regulation**, capable of responding quickly to market transformations and new technological demands.

One of the central points of his speech was the **regulatory planning aligned with the modernization of the sector**. Dr. Agnes explained that ANEEL has been working to revise regulatory frameworks in order to incorporate digitalization, automation, and integration of DERs, without creating barriers that inhibit investments. He also highlighted that it is essential **to promote interoperability and standardization of technologies**, facilitating the scalability of solutions and avoiding market fragmentation.

The director also addressed the **challenge of low tariffs** in the context of the energy transition. He stressed that technological advancement and the adoption of new solutions cannot result in a disproportionate increase in costs for the consumer. To this end, regulation must be **based on evidence and cost-benefit analyses**, prioritizing investments that bring clear gains in reliability, efficiency, and sustainability.

Another relevant topic was the **regulatory integration between transmission and distribution**, especially in view of the growth of distributed generation and the need for coordination to ensure operational safety. Dr. Agnes highlighted that ANEEL seeks to create conditions for **greater operational flexibility**, allowing for more agile adjustments in the dispatch and management of networks.

Closing his participation, he reinforced that the **gradual opening of the free energy market**, the review of incentives and subsidies and the promotion of greater social participation in the decision-making process are part of the agency's priority agenda. In his view, the **modernization of the electricity sector will only be successful if it is accompanied by modern, participatory and results-oriented regulation**, which maintains the balance between innovation, security of supply and low tariffs.



The president of ABRADÉE, **Marcos Madureira**, began his presentation by highlighting the central role of distributors in the process of transformation and modernization of the Brazilian electricity sector. He emphasized that, even in the face of the structural changes brought about by digitalization, the decentralization of generation and the opening of the

market, distributors will continue to be **responsible for ensuring universal access, quality of supply and the safe operation of distribution networks.**

Madureira stressed that the **energy transition and the total opening of the market** impose new operational, regulatory and economic challenges on distributors. In the scenario of greater participation of distributed generation, storage, and electric mobility, the role of distributors goes beyond the simple transportation of energy: they start to act as **active managers of smart grids**, integrating multiple agents and distributed energy resources (REDs).

He highlighted that the **resilience of the networks** will be a determining factor for the future of the sector, especially in the face of the increase in the frequency and intensity of extreme weather events. Madureira defended the need for **robust and continuous investments** in automation, real-time monitoring and digitalization of processes, in order to reduce the response time to failures, optimize the operation and increase the safety of the system.

Another central point of his speech was the importance of a **modern and stable regulatory framework** that allows distributors to innovate and invest, without compromising low tariffs. He stressed that regulation should recognize the role of distributors in the integration of new technologies and in maintaining supply reliability, creating remuneration mechanisms and incentives in line with these objectives.

Madureira also addressed the issue of **coordination between the different segments of the electricity sector**, advocating a permanent dialogue between transmitters, distributors, traders and the National Electric System Operator (ONS). According to him, the efficient and safe operation of the system depends on **full integration between transmission and distribution**, especially in the dispatch and management of more complex energy flows.

Regarding market **opening**, he emphasized that the process needs to be conducted with planning and caution, ensuring that all consumers, including those with low incomes and remote areas, continue to have **access to reliable service and fair rates**. He warned of the risk that, without adequate compensation mechanisms, the exit of consumers with higher purchasing power to the free market may raise costs for those who remain in the regulated market.

Closing his participation, Marcos Madureira reinforced that distributors have the **technical and operational capacity** to lead the modernization of the electricity grid, but that this advance will depend on **sectoral collaboration, adaptive regulation and continuous investments**. In his words, "the future of the Brazilian electricity sector will be built on smarter, more resilient and inclusive grids — and distributors are the backbone of this transformation."



Reji Kumar, Chairman of the **India Smart Grid Forum (ISGF)**, began his participation by expressing satisfaction and honor to participate in the 17th edition of the **Latin American Smart Grid Forum**. He highlighted that this is one of the most relevant meetings in the world to discuss the modernization of electricity grids, serving as a reference to bring together governmental, regulatory, business, and academic leaders with a focus on concrete solutions for the energy transition.

He began by highlighting the importance of international forums to accelerate the adoption of innovative technologies and business models. In his view, Brazil and India, despite geographical and cultural differences, share a number of structural challenges and strategic opportunities. Among them, he cited:

1. **Integration of variable renewable sources**Kumar noted that both **Brazil and India have ambitious targets for the expansion of solar and wind energy**. However, this rapid penetration requires technical and regulatory solutions to deal with intermittency, maintain system balance, and ensure stability in frequency and voltage. He advocated the use of advanced forecasting systems, active demand management, and flexibility features such as batteries and complementary dispatchable generation.
2. **Digitalization and automation of distribution networks**He emphasized that the **modernization of networks cannot be limited only to the physical expansion of infrastructure**. It is necessary to incorporate smart meters, advanced sensors, real-time control systems and integrated digital platforms. Digitalization, according to Kumar, is the way to transform passive networks into **intelligent networks**,

capable of automatically detecting and reacting to failures, reducing losses and enabling new business models.

3. **Resilience in the face of extreme weather events**Citing recent experiences in **India and observing cases in Brazil, Kumar highlighted that the increased frequency and intensity of extreme weather events represents a growing risk to the continuity of energy supply. He defended investments in underground networks, self-protection systems, micro and mini-grids with the capacity to operate in isolation in emergencies and robust disaster response protocols.**
4. **Adaptive regulation and encouraging innovation**Kumar stressed that, without updated regulatory frameworks, many technological innovations and business models cannot thrive. He suggested that regulatory agencies adopt regulatory sandboxes to test new solutions on a full-scale scale before applying definitive rules. In addition, he defended that public policies should be flexible to keep up with the speed of technological innovation and open to the participation of new agents.
5. **Empowerment and active participation of the consumer**A central point of his speech was the transformation of the role of the consumer into a "prosumer" – capable of generating, storing, managing and trading his own energy. He noted that in India and Brazil, the adoption of **distributed generation, home storage and demand response programs** is already beginning to change the logic of operation of grids, making the consumer an active part of the solution.
6. **Integration of electric vehicles (V2G and V2H)** Kumar addressed the potential of electric vehicles as elements of flexibility, whether returning energy to the grid (**Vehicle-to-Grid**) or powering homes and businesses (**Vehicle-to-Home**). He pointed out that smart charging infrastructure, combined with appropriate incentives, can transform vehicle fleets into large distributed energy banks.
7. **Use of data and artificial intelligence in the electricity sector**He highlighted that the massive collection of data, through sensors and smart meters, is only valuable if accompanied by advanced big data analytics and AI systems capable of extracting insights for operation, planning, and predictive maintenance. He cited cases in India where AI algorithms identified failure patterns before they occurred, preventing blackouts and reducing operational costs.
8. **International cooperation and knowledge transfer**Reji Kumar stressed that **Brazil and India should expand the exchange of practices and technologies, participating in joint projects, training and technical missions. He pointed out that both countries operate large electricity systems, with strong renewable participation and important social demands, and that bilateral cooperation can accelerate results and generate solutions adapted to local conditions.**

In his conclusion, Kumar emphasized that the modernization of the electricity sector is a **multidimensional process** that requires coordinated action between **public policies, regulation, technology, business models and social participation**. He reaffirmed the commitment of the **India Smart Grid Forum** to actively collaborate with Brazil and other Latin American countries, offering not only successful experiences from India, but also a willingness to learn from the solutions developed in the region. He concluded by hoping that the debates in this edition will result in practical and implementable recommendations, capable of accelerating the modernization of the grids and strengthening the resilience of the electricity sector on a global scale.



The **Director of the Department of Sectoral Policies** of the MME, **Frederico de Araujo Teles**, structured his presentation around the **structural reform of the Brazilian electricity sector**, highlighting that the current moment brings together political, economic and technological conditions to promote profound changes, capable of aligning Brazil with the best international practices and preparing the sector for the coming decades.

Right at the beginning, Frederico stressed that the reform should not be understood as an isolated set of regulatory adjustments, but rather as a **systemic and integrated process**, which involves the modernization of regulation, the review of trading mechanisms, the full opening of the market and the adaptation of the operation of the electricity system to the new demands of the energy transition.

Among the pillars **of the reform** that he highlighted are:

1. **Total opening of the market** – Frederico reaffirmed that the MME maintains the goal of allowing all consumers, including residential, to choose their energy supplier, within a competitive and transparent model. To this end, the ministry works in coordination with ANEEL and CCEE to design simplified rules, consumer protection mechanisms, and digital platforms that enable this inclusion.
2. **Separation of activities and net neutrality** – He emphasized that the reform provides for the strengthening of the concept of **separation between the operation of the grid (wire)** and the commercialization of energy, ensuring neutrality and equal treatment between agents. This measure aims to avoid conflicts of interest and ensure that distributors maintain a focus on infrastructure efficiency.
3. **Modernization of governance and regulatory incentives** – Frederico defended that the regulatory framework be adjusted to recognize and encourage investments in innovation, digitalization, storage and integration of distributed energy resources (REDS), without losing sight of tariff moderation.
4. **Operational integration and security of supply** – The reform also includes improvements in the coordination between transmission and distribution, in addition to updating the ONS's operating procedures to deal with bidirectional energy flows and greater variability in generation.
5. **Improvement of price formation mechanisms** – Frederico highlighted the need for greater economic signaling for agents, with prices more adherent to the real operating conditions and the value of energy at different times and regions. This, according to him, will allow more efficient consumption, generation and investment decisions.

Throughout his speech, he reinforced that the **energy transition and the digitalization of networks** cannot advance in a disorderly way. Therefore, the reform needs to establish a **medium and long-term planning**, with clear milestones for the gradual implementation of the changes, ensuring predictability for investors and stability for consumers.

In closing, Frederico said that the **MME sees the reform as a state project, and not just a government project**, in order to ensure its continuity and maturation regardless of political changes. In his words, "the future of the Brazilian electricity sector will depend on our ability to balance innovation, security, competitiveness and inclusion – and the reform is the instrument that will allow us to achieve this balance in a sustainable and lasting way".

Debate, Q&A Session:

At the end of the opening panel of the **Smart Grid Forum 2025**, after the initial presentations, the round table was marked by a moment of convergence between strategic visions, technical challenges and expectations of regulatory advancement. The participants reinforced the importance of aligning planning, operation, and regulation so that the energy transition in Brazil occurs in a coordinated, safe, and sustainable way.

Thiago Ivanoski, from EPE, resumed his initial point that long-term planning needs to consider the accelerated expansion of renewable sources, especially solar and wind, and their impacts on the load curve, the dispatch of plants and the security of supply. He stressed that while Brazil is ahead of many countries in terms of renewable participation, it will be critical to adopt solutions such as storage, demand response, and smart integration of distributed generation to maintain stability and take advantage of the economic opportunities of this expansion.

Marcelo Praes, from ONS, reinforced the operator's view of the short and medium term, highlighting the growing challenge of orchestrating an increasingly decentralized and less directly controllable system. He warned of the urgent need to integrate the operation of transmission and distribution, creating a collaborative model with future DSOs (distribution operators). According to Praes, flexibility will be a key attribute to face increasingly steep loading ramps, and its achievement will require regulatory advances, economic stimuli and new digital platforms that allow for quick and efficient responses.

Reji Kumar, president of the India Smart Grid Forum, brought the international perspective, underlining that Brazil and India share common challenges in integrating renewables, digitalization of grids and inclusion of the consumer as an active agent. He emphasized that technical and regulatory cooperation between countries can accelerate the adoption of solutions that have already proven effective in other markets, and defended that the Forum continues to be a space for the exchange of applied knowledge, with a focus on concrete results.

Marcos Madureira, president of Abradee, stressed the relevance of distributors positioning themselves as protagonists in the modernization of networks, investing in digitalization, automation and active demand management. He recalled that the success of the energy transition depends on a balance between technological innovation, financial sustainability, and legal certainty, without which there will be no scale for the necessary investments.

Frederico de Araújo Telles, from the Ministry of Mines and Energy, closed the panel by reinforcing that the government is committed to regulatory modernization and market opening in a gradual and responsible way. He mentioned measures already in progress, such as the anticipation of contractual amendments for mandatory digitization of networks and progress in discussions on account portability and separation of network and trading activities. Telles said that continuous dialogue with all agents — represented by forums like this — will be essential to calibrate public policies and ensure that modernization brings real benefits to consumers, companies and society as a whole.

Closing the discussions, **Cyro Boccuzzi**, moderator of the panel and organizer of the event, thanked the contribution of the speakers and the public, reinforcing that the points raised in this session will be incorporated into the final report of recommendations of the Forum. He highlighted that everyone's commitment to a qualified and plural debate is what guarantees the relevance of the meeting and the impact of its conclusions on the direction of the Brazilian and Latin American electricity sector.



4. Panel: "Sector Reform and the Future of Smart Grids in Latin America"

Speakers:

- Carlos Alberto Mattar, Superintendent, ANEEL (Brazil) and Coordinator of the Electricity Group of ARIAE (Spain)
- Alessandra Amaral, Executive Director, ADELAT (Peru)
- Juan David Molina, Management Lead, Smart Colombia Alliance (Colombia)
- Túlio Alves, Executive Director, CIER (Uruguay)

Moderator: Luiz Fernando Arruda, Director, ACEE



Carlos Alberto Mattar presented a comprehensive overview of the work of ANEEL (National Electric Energy Agency) for the reform of the electricity sector, especially with regard to the **modernization of transmission and distribution networks**. In summary, the central elements of this plan are presented below

1. Regulatory and Strategic Enhancements: There are **19 regulatory enhancements in progress**, all aimed at the transmission and distribution sectors. These improvements aim to leverage digitalization, introduce more dynamic tariff models, open the market to new agents, and modernize service quality indicators. Among the regulatory actions under development, the following stand out:

- The regulation of **Decree 11,314**, which establishes mechanisms for the renewal of transmission concessions as of 2026 — through bidding — with regulations already in progress.
- Regulatory studies on **distributed generation connection**, addressing topics such as flow reversal, protection and integration of hybrid systems.
- The implementation of **regulatory sandboxes** in the electricity sector, promoting controlled experimentation of innovative solutions.

Update of the **indicators of continuity of energy supply**, considered obsolete because they were defined more than 20 years ago.

- Reformulation of the metering system, with a focus on the energy transition and modernization of the distribution segment.

- Gradual opening of the market: commercial consumers will have access in August 2026; other consumers in December 2027.
- Regulation addressing the **migration of distributors to system operation centers (Distribution Operation System) or DSO** — in line with global best practices.

2. Goals and Evolution Indicators: emphasized the growing expansion of **distributed generation (DG)** in Brazil, with an estimated increase of 3 GW in just four months, totaling about 42 GW of installed capacity and almost 4 million consumer units benefited. He stressed that major challenges persist, such as high investment costs, the need for innovative financing, gaps in professional training, cultural resistance in concessionaires and weaknesses in the communication infrastructure.

3. Political-Regulatory Contextualization and Vision of the Future: ANEEL's regulatory agenda includes:

- **Infrastructure modernization**, driven by aging grids, increased demand, and integration of renewable energy.
- **Tariff flexibility** and adaptation of regulations to the new technological context (smart grid, automation, cybersecurity, storage and IoT).
- **Market opening and new business models**, with active consumers, microgrids and distributed generation as central elements.

In his closing remarks, Carlos Alberto Matar outlined a robust plan for sector reform, with a focus on technological modernization, regulatory innovation, and institutional transformation. The adoption of the 19 regulatory improvements, combined with the expansion of distributed generation and the implementation of advanced metering systems, signals a decisive move towards a more resilient, efficient and sustainable electricity sector. However, he also made it clear that without overcoming financial, institutional-infrastructure, and capacity building challenges, the full achievement of this progress could be compromised.



Alessandra Amaral began by thanking the invitation and contextualized her participation based on the work developed by **ADELAT – Association of Energy Distributors of Latin America**, a young entity, with three years of existence, which currently brings together 24 members among associations and energy distributors from nine countries in the region. The association already represents about 350 TWh of distributed energy per year and its mission is to foster collaboration, the exchange of experiences and the development of studies aimed at the energy transition.

She pointed out that, since its foundation, ADELAT has produced studies on central themes for energy distribution in Latin America, initially addressing the regulatory challenges of distributors and moving on to issues such as electric mobility, extension of concessions, quality, resilience, digitalization and investments. He also mentioned recent work on the convergence between telecommunications and energy, in addition to a study on market opening, timely in view of Provisional Measure 1,300/2025, which provides for the total liberalization of the Brazilian electricity market by 2027.

Amaral pointed out that the energy transition occurs in a context of **digitalization and climate crisis**, which shapes a new consumer profile: more informed, demanding, engaged and willing to generate their own energy, migrate to the free market and actively interact with the system. This scenario brings decentralization, microgrids, electric vehicles, and distributed energy resources, imposing an expanded role on distributors. They are no longer just network operators (DNOs) and assume the functions of **DSOs (Distribution System Operators)**, responsible for ensuring **resilience** in the face of extreme weather events and **flexibility** in the face of the intermittency of renewable sources.

In one of the first studies carried out, ADELAT identified **three major challenges for Latin American distributors**:

1. **Increase quality and resilience** by defining clear KPIs, data series, and methodologies for forecasting and targets, as well as expanding digitalization, automation, and telemetering.
2. **Transform the network into a digital platform**, capable of integrating new actors, technologies, and business models, stimulating regulatory and tariff sandboxes, ensuring cybersecurity, and incorporating circular economy concepts.
3. **Ensure economic efficiency**, given the significant volume of investments required, optimizing resources through demand response, flexible tariffs and efficient use of metering infrastructure.

With the support of a consultancy, the association estimated that, for seven countries, the need for **investment reaches US\$ 289 billion in 17 years** in a total transition scenario, or US\$ 174 billion in partial transition. Brazil alone would account for up to **US\$ 182 billion**, revealing the region's low starting point in relation to digitalization, storage and automation.

The speaker also detailed a study on technologies for digitalization and automation, grouping them into three blocks:

- **Network equipment** (AMI, sensors, transformer automation, drones, storage systems, etc.);
- **IT/OT SYSTEMS** (SCADA, ADMS, GIS, DERMS);
- **Data and connectivity services** (AI, *machine learning*, *big data*, cloud, and cybersecurity).

The **benefits** pointed out range from operational improvements (loss reduction, better asset management, lower OPEX and CAPEX), through economic gains (new business models, greater competitiveness, reduction of delinquency), to social impacts (greater equitable access to energy, support for vulnerable consumers) and environmental impacts (reduction of emissions and energy consumption).

A survey among members revealed timid and fragmented advances: **pilots in some countries** (Argentina, Colombia, Peru), lack of regulatory standards, low investment in telecommunications (as in Guatemala) and concentration of efforts on isolated initiatives. In Brazil, the opportunity for **concession renewals** and **Ordinance 111** stood out, which brought commands for defining digitalization KPIs. He also mentioned the **Brazilian tariff sandboxes** as a positive example for the region.

She cited the case of **Costa Rica**, a country that has already achieved 54% AMI implementation, an experience that will be studied more closely by ADELAT. Other

references came from international markets such as the USA, the United Kingdom, Italy, Germany and Japan.

In closing, Alessandra presented recommendations to leverage the digitalization and automation of networks: involve **all stakeholders** (public authorities, regulators, companies, academia and strategic partners), ensure the engagement of the distributors' top management, ensure adequate remuneration for real costs, review tariff cycles, encourage R&D and adopt privacy and data security standards in line with international best practices. He concluded by reaffirming the need for cooperation and innovation so that Latin America can consistently advance in the energy transition.



Juan David Molina began his presentation by thanking the invitation and explaining his intention to share Colombia's experience in the development of smart grids, highlighting the advances, challenges faced, and lessons learned over the past decade. He recalled that ten years ago the "**Hoja de Ruta Smart Grid 2030**" was launched in the country, conceived as a strategic plan to guide the modernization of the Colombian electricity sector. Today, with five years to go before the established horizon, reality shows results below expectations, which, according to him, it is important to expose not only as self-criticism, but so that it serves as a reference to other countries in the region that face similar barriers.

To situate the audience, Molina presented some figures from the sector. Colombia has about **17 million consumers served by 29 distribution companies**, each with different

challenges – some in dense urban areas, others in more remote rural regions. Despite the size of the market, only **53 thousand consumers have bidirectional meters** and **only 6 thousand effectively participate in the free market**, a number much lower than that registered in Brazil. In terms of infrastructure, the maximum capacity of the system is around **12 GW**, with a strong predominance of hydroelectric generation; solar and wind sources, together, still do not exceed 4% of the matrix.

Revisiting the objectives of the *Hoja de Ruta* established in 2013, Molina recalled that ambitious goals had been set for 2025: 73% advanced metering (AMI) coverage, electric vehicle penetration between 9% and 14% of the fleet, more than 2% distributed generation, between 1% and 3% of grid storage, and the widespread deployment of self-healing technologies). However, the current reality reveals very modest advances: AMI reaches only **3% of consumers**, distributed generation does not exceed **1%**, large-scale storage is practically non-existent, electric vehicles represent less than **0.2% of the fleet** (about 21 thousand units, mostly plug-in hybrids) and only three companies have implemented *self-healing* in some main circuits.

These results, according to Molina, reflect structural and regulatory difficulties. In the field of **advanced metering**, for example, the debate about who should bear the costs of meters has not yet been overcome, and existing legislation lacks clarity and stability. In addition, the interoperability of systems remains an obstacle, whether from a technological, semantic, or telecommunications point of view, preventing the creation of a solid foundation of reliable data. Regarding **the automation of distribution**, he pointed out that telecommunications, essential to enable smart grids, are under the responsibility of another ministry and regulated as a conventional service, which makes it difficult to integrate with the specific needs of the electricity sector. Remuneration methodologies also remain based on traditional models, unsuitable for digital and modern assets.

On electric **vehicles**, Molina explained that low penetration should not obscure the urgency of preparing the grid. The lack of hourly charging mechanisms and specific incentives limits the efficient integration of these vehicles. The charging infrastructure, in turn, grows slowly, imprisoned in the classic dilemma: without vehicles, there is no demand for stations, but without stations, there is no incentive to buy vehicles.

With regard to **distributed energy resources**, he pointed out that protections still follow a logic of unidirectional flows, incompatible with the new bidirectional paradigm of networks. In addition, the studies of the network's hosting capacity are done in a static and limited way, when they should evolve to dynamic methodologies that consider multiple hourly scenarios of generation and demand. For him, the absence of a comprehensive regulatory framework on DER further aggravates the difficulties.

Molina emphasized that overcoming these obstacles requires **structuring actions**. First, it is essential to accelerate the implementation of advanced measurement through robust pilots and massification programs, ensuring not only technological availability, already consolidated internationally, but also social acceptance, especially of residential consumers, who represent the majority of the market. Secondly, he defended the need to

update the regulation to allow adequate remuneration for the new services of local systems and to integrate, in a coherent way, the management of DER, electric vehicles and grid automation. Thirdly, he stressed that smart grids cannot be treated as an isolated issue in the electricity sector, but rather as an integral part of **smart cities**, which requires an **intersectoral public policy**.

Another crucial point raised was **interoperability**, which needs to be accompanied by common information standards, such as the CIM (Common Information Model) model, already adopted internationally. For him, this issue must go hand in hand with **cybersecurity**, both of which are high to a top priority, since a distributor with 100% AMI is radically transformed in relation to the traditional model, starting to operate essentially on data and digital systems. This implies new requirements in telecommunications, technological architecture and adherence to global standards of security and reliability.

Closing his presentation, Molina acknowledged that Colombia's numbers are still low and far from the goals set, but insisted that the accumulated experience should serve as a learning experience to correct course and accelerate the process. The vision, according to him, is clear: to achieve a real smart grid, it will be necessary to invest in modern regulation, strengthen interoperability, ensure adequate tariff signals, integrate public policies, and put digitalization at the center of distributors' strategy. Only in this way, he said, will it be possible to turn the goals of the *Hoja de Ruta Smart Grid 2030* into reality and prepare the Colombian system for the energy challenges of the coming decades.



Túlio Alves, Executive Director representing CIER (**Regional Energy Integration Commission**), began by presenting **regional energy integration** as a strategic element to strengthen resilience, reduce costs and support the energy transition. With the positioning of **smart grids** as a technological bridge between the **digitalization of the sector** and **transnational energy integration** and based its presentation on a comparative study conducted by **the SIER Smart Grid Working Group**, covering several Latin American countries.

CIER is a non-profit association created in **1964**. Present in **17 countries**, with 392 GW of installed power, 1,276 TWh of annual consumption, 169 million customers, 466 million inhabitants. 288 members, including generation, transmission, distribution, commercialization companies, ministries, regulators and system operators. Structure in working groups segmented by activity (distribution, transmission, generation, commercialization and corporate area).

Túlio highlighted the guiding principles for the transformation of the sector being: **Traditional 3D's**: Decentralization, Decarbonization and Digitalization. **Expansion to 5D's**: Sustainable Development and Democratization. Evolution of the consumer: from **consumer** to **prosumer** and, more recently, **transhumidor** (consumes, produces and trades energy directly with third parties – *peer-to-peer*).

He complemented the comparative study with a degree of preparation for the DSO model. This methodology is based on the evaluation of 6 technological axes:

1. Advanced Measurement (AMI)
2. Distributed generation (DG)
3. Demand response
4. Energy storage
5. Electric vehicles (EVs)
6. Advanced distribution automation

The maturity scale ranges from **1 to 5** in each axis. Countries analyzed: Argentina, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Panama, Peru, Dominican Republic and Uruguay.

Túlio highlighted the main results being: Uruguay is the most advanced, with an average degree of maturity, close to 100% AMI coverage (1.7M smart meters installed). Countries such as Peru, Colombia, Guatemala, Panama, El Salvador, and Costa Rica have **a low degree of maturity**. Progress depends on **key enablers**: clear public policy, modern regulation, overcoming inhibiting factors, knowledge of the current state and use of reference cases.

Túlio also identified the gaps and enablers. **Gaps are:** Absence of robust regulatory frameworks, lack of specific public policies for DSOs, little regulatory harmonization between countries, low prioritization of demand

response and storage.
Enablers are: Creation of **harmonized international norms and standards** (interoperability, cybersecurity, network architecture), investment in **technical capacity building** and organizational transformation, multilateral financing (IDB, World Bank, CAF) for large projects, use of **regional electricity integration** to increase resilience and efficiency.

Five relevant interconnected systems were identified:

1. **CIEPAC** (Central America)
2. **CINEA** (Andean Region)
3. **CIESUR** (Southern Cone)
4. **Northern Arc** (Brazil–Guianas)
5. Colombia–Panama Interconnection

Take Chile: solar energy spillage equivalent to one month of consumption due to the lack of interconnections with Peru and Argentina.

In his conclusion, Túlio presented his recommendations:

- **Regulatory-Institutional Modernization** defining clear roles for DSOs and TSOs. Create tariff models that reflect network usage and encourage flexibility.
- **Investment in Digitalization** expand AMI, automation and management of DERs, increase interoperability and cybersecurity.
- **Strengthen Demand Response** Migrate from the paradigm "generation follows demand" to "demand follows generation". Introduce dynamic price signaling.
- **Take advantage of Regional Integration**, use interconnections to compensate for renewable variability and increase resilience.
- **Training and R&D** train teams to operate in a digital environment. Foster regional research and technological innovation.

In his conclusion, he highlighted that **Smart Grids** are the essential link between energy transition and regional integration. Without robust distribution, there is no effective energy transition. No Latin American country is fully ripe for digital transformation of the distribution sector. Regional energy integration should be treated as a strategic priority for efficiency, resilience and security of supply.



At the end of the panel, the debate focused on practical issues related to the application of advanced metering technologies and the tariff changes necessary for the smart grid concept to actually fulfill its role. Moderator **Luiz Fernando Arruda** raised a point considered fundamental: the **implementation of the binomial tariff**. He noted that the simple introduction of AMI (advanced metering) systems without a binomial tariff in low voltage generates an incomplete solution. He highlighted that this tariff evolution needs to be thought out and incorporated, as a smart grid system must necessarily allow the use of binomial tariffs to correctly signal the cost of energy and infrastructure. He then took the opportunity to thank the organizer of the Forum, emphasizing that participation in the event, both in lectures and during breaks, is always very enriching for the exchange of information and experiences.

This was followed by a **question addressed to Juan David Molina** about the implementation of flexible tariffs in Colombia and the receptivity of consumers and businesses. Juan explained that in the country the flexible tariff is still linked to a broader structure of **demand response programs**. For about 15 years, there has been a mechanism aimed at critical situations in the system, in which the supply capacity is not sufficient to meet demand. In these cases, the response program is activated, but, according to him, this model is "a little illogical", as it only comes into action in times of emergency. The previous year, Colombia started a pilot program for large users – with a load from 1 MW – who could offer a reduction in consumption in the energy market, but only temporarily. Already in 2025, the Colombian regulator is advancing in defining the rules to structure something very similar to the "regulatory sandbox" that was also tested in Brazil. The idea is to carry

out a first experiment aimed directly at residential consumers, testing differentiated rates by periods of the day, possibly in two or three time slots.

Complementing the discussion, the mistake of believing that the **adoption of the electronic or smart meter, by itself, generates a reduction in energy losses** was highlighted. There was consensus that the equipment is just a tool; The effective reduction of losses depends on their integration into specific projects and programs. Otherwise, its benefit would be limited to reduced reading costs. When electronic metering is used in conjunction with the implementation of **energy balances in feeders and transformers**, and with automation and control systems in metering centers, it can, in fact, contribute to the identification of fraud and operational efficiency. As an example, the experience lived at **CEMIG** was cited, where an integrated measurement center was created that allowed the automated issuance of inspection orders. In this model, smart metering becomes an effective instrument to reduce commercial and technical losses.

With these statements, the moderator thanked the speakers and the audience, reinforcing the importance of the debates and inviting everyone to return after the scheduled break. The final climate was one of mutual recognition of the relevance of the issues discussed and of the decisive role of regulation and integrated management in the success of network digitalization projects.

5. Panel: "The New Competitive Arena in the Energy Sector and Review of the Role of Agents and Regulation: Smart Tariffs and Energy Services"

Speakers:

- Nivalde de Castro, Director GESEL and UFRJ
- Edvaldo Santana, Director of NEAL
- João Carlos de Oliveira Mello, CEO, Thymos Energia
- Ângela Gomes, Director, PSR
- Rodrigo Ferreira, Executive President of ABRACEEL

Mediator: Ricardo Vidnich, from KV Consultoria



Professor **Nivalde de Castro** presented a comprehensive analysis of the current moment of transformation of the Brazilian electricity sector, emphasizing the importance of coordination between public policies, regulation and business strategies so that the energy transition occurs efficiently and sustainably. He began by highlighting that Brazil is in a privileged position on the world stage due to the predominance of renewable sources in its electricity matrix, especially hydroelectricity, which gives the country a solid basis to advance in decarbonization. However, he drew attention to the fact that this competitive advantage does not guarantee, by itself, the success of the transition: a deep modernization of transmission and distribution networks will be necessary, incorporating digital technologies, distributed energy resources and new business models.

Nivalde stressed that the **renewal of distribution concessions** is a crucial moment to reconfigure the obligations of concessionaires. He argued that the new contracts incorporate clear quality targets, resilience indicators in the face of extreme weather events, expansion of digitalization (with smart meters and automation) and the obligation to prepare grids for the growing integration of distributed generation, storage and electric mobility. According to him, the traditional model of passive distributors, focused only on energy delivery, needs to be replaced by an active model of **distribution system operators (DSOs)**, with the ability to manage bidirectional flows, make demand more flexible, and coordinate resources from different agents.

The professor also addressed the issue of **market opening** in Brazil, highlighting that gradual liberalization — already foreseen for commercial and, later, residential consumers

— will bring challenges and opportunities. For him, the expansion of competition will require changes in the tariff structure, new value-added services and investments in technology for measurement, billing and customer relations. He stressed that without a robust advanced measurement system, the full operation of an open and competitive market will be unfeasible.

Another point emphasized was the **integration of distributed energy resources (DERs)**. Nivalde pointed out that the accelerated expansion of distributed photovoltaic generation, associated with the potential of batteries and electric vehicles, requires new protection philosophies, dynamic analyses of the hosting capacity of the grids and a regulation that allows the adequate remuneration of services provided to the grid. He warned of the risk of instability and inefficiency if the integration of these resources occurs without coordinated planning.

The professor also highlighted the importance of **investments in innovation** and the creation of experimental regulatory environments, such as sandboxes, which allow testing solutions on a small scale before their massive implementation. He stressed that, for Brazil, this is an opportunity for accelerated learning, taking advantage of international experiences, but adapting them to the national reality, marked by great regional heterogeneity and socioeconomic inequality.

Finally, Nivalde emphasized that the energy transition and the modernization of the electricity sector should not be seen only from a technological or economic perspective, but as a **national development project**. For him, coordination between government, regulators, companies and research institutions will be decisive to transform the electricity sector into a vector of competitiveness, social inclusion and environmental sustainability. He concluded by reinforcing that the current moment is a "window of opportunity" for the country to redesign its electricity infrastructure and regulatory framework, in order to meet the demands of the coming decades and consolidate itself as an international reference in clean and smart energy.



In his participation in the panel, Professor **Edvaldo Santana** began by thanking Cyro Boccuzzi for the invitation and expressing satisfaction for participating for the first time in the 17th edition of the Forum, alongside colleagues from different generations of the electricity sector, many of whom he knew or worked with throughout his career. He highlighted this generational aspect as symbolic of how much the accumulated experience is mixed with new visions, enriching the debate.

When entering the central theme of his speech, Edvaldo explained that, although he had prepared an exposition the previous week, he preferred to adapt his intervention to what he had heard throughout the day. Thus, he decided to focus his reflections on the issue of **measurement and the role of smart meters**, which, in his assessment, was not well conducted in the Brazilian electricity sector. For him, the lack of evolution in this field is one of the main reasons for the situation of delay in which the country finds itself in relation to the full functioning of a competitive energy market.

He recalled his arrival **at ANEEL in July 2000**, coming from teaching in Santa Catarina, to take over the newly created Superintendence of Market Studies. His mission, then, was precisely to enable the functioning of the energy market, but he confessed to having lived years of frustration, since the system did not comply with the desired logic of competition, in which prices should be formed by supply and demand. For him, this reality remains distant and difficult to implement in Brazil, despite the ongoing projects, including the one coordinated by PSR, which discusses the price-by-offer model.

When recalling the history of **Law No. 9,074/1995**, which created the free market, Edvaldo noted that the opening took place through a "tortoise" inserted in the legislative text, which determined that first the large consumers would be contemplated, leaving the small ones for a later time, "if it worked". This caste logic — initially privileging the large and postponing the inclusion of residential consumers — marked the trajectory of the opening of the market. Subsequently, the 2000 Resolution even provided that in 2005 all consumers would be free, but Law No. 10,848 transferred to the Ministry of Mines and Energy the competence to decide on liberalization, and the promise did not materialize.

For Edvaldo, the big barrier has always been in the **measurement**. In the early 2000s, a smart meter cost about \$250, which, multiplied by the tens of millions of consumer units, generated billions of dollars and discouraged large-scale deployment. However, he criticized this form of calculation, arguing that the cost should be analyzed individually and not by the aggregate amount, since the technology brings direct benefits to the consumer that could justify their own investment. In his view, even larger consumers could have been authorized to purchase the meters on their own and "donate" them to distributors, reducing the amount on their bills. This alternative, however, never advanced.

Edvaldo also reported experiences observed in **R&D projects in Santa Catarina**, where there was cultural resistance to the replacement of the traditional meter. In European colonization communities in the south of the state, consumers did not accept the new equipment because they were surprised by its appearance. The solution found was to install smart meters camouflaged with the "face" of the old meter, which facilitated popular acceptance. This episode served to illustrate how cultural and communicational barriers added to economic and regulatory barriers, slowing down digitalization.

He also recalled that, recently, the sector was faced with two agendas that do not dialogue with each other: on the one hand, a **ministerial ordinance that prioritizes the digitalization of metering**; on the other, **Provisional Measure 1,300**, which provides for the full opening of the low voltage market by December 2027. For Edvaldo, there is no time to reconcile both goals, which exposes the lack of coordination between public policies.

Inspired by the speech of international representatives, such as India, he highlighted the example of that country, which created a national measurement company to quickly enable the massification of smart meters. According to Edvaldo, this idea had already been foreseen in Brazil in the 1990s, during the restructuring of the sector (RE-SEB Report, 1998), but ended up being abandoned after the approval of Law No. 9,648.

In his assessment, true **consumer empowerment** does not occur through distributed generation, as is often claimed, but through **the possibility of choice**, which only becomes feasible through advanced measurement. It is the measurement that allows the consumer to know their consumption in detail, decide how they will use the energy in their home and, above all, choose who to buy from. In countries where competition has reached the residential level, the massification of measurement preceded the opening of the market — exactly the opposite of the logic followed in Brazil.

With a critical tone, he concluded that, as long as the issue of measurement is not faced in a structural way, the country will not move towards a fully competitive market. He reiterated that the cost of the meter, considered in isolation, is low compared to the annual subsidies granted to distributed generation and the free market, and argued that it would make more sense to direct part of these resources to make digitalization viable. Ending his speech, he ironically said that he would pay anyone who found the word "measurement" in some provisional measure or recent law in the electricity sector, such is the negligence of the topic in the formulation of policies.

Finally, he explained that he would need to leave discreetly before the end of the event, as he had booked his flight too early, and said goodbye reinforcing the importance of putting **smart metering back at the center of the regulatory and political agenda** as an essential condition for the future of smart grids and for the real empowerment of the Brazilian consumer.



Executive **João Carlos de Mello** presented a direct and reasoned analysis of the economic and regulatory challenges of modernizing the Brazilian electricity sector, with a special focus on the balance between necessary investments, low tariffs and regulatory predictability. He began his speech by highlighting that the **energy transition** in Brazil — marked by the growing integration of variable renewables, the expansion of distributed generation, and the need for smarter grids — requires not only technology, but, above all, **business models and regulatory frameworks consistent with this new reality**. For him,

it is not enough to set ambitious goals; It is necessary to ensure that the sector has the economic conditions to achieve them in a sustainable way.

João Carlos emphasized that the **renewal of distribution concessions** is a decisive moment to correct historical distortions and align incentives. He defended that the new contracts bring clear commitments to digitalization, automation, and resilience indicators, but warned of the risk of imposing obligations disconnected from the companies' ability to execute or the expected economic return. According to him, the experience of other countries shows that modernization plans without a solid financial foundation tend to generate frustration and, often, results below expectations.

In his assessment, Brazil still lacks **a tariff policy adapted to the new configuration of the sector**. The current tariff structure, designed for a centralized model with unidirectional energy flow, does not reflect the complexity of networks with distributed generation, storage and demand response. Mello advocated the introduction of more granular economic signals — such as hourly or seasonal rates — to induce more efficient behaviors on the part of consumers and to enable innovative business models, such as aggregators and retail traders.

A central point of his speech was the concern with the **economic and financial viability of distributors** in the new scenario. According to him, the opening of the market and the growth of distributed generation tend to reduce the energy billed by distributors, putting pressure on revenues and requiring a review of the remuneration model for the use of the network. He stressed that, without this adjustment, there is a risk of a **vicious circle** : loss of revenue → reduced investment capacity → deterioration of service quality → more customer churn.

João Carlos also addressed the topic of **coordination between regulation and sectoral planning**, noting that, in Brazil, the goals established in public policies are often not synchronized with the investment schedule and tariff cycles. This lack of alignment, according to him, creates insecurity and increases the cost of capital, as investors demand higher returns to compensate for regulatory risk.

In the technological field, he defended the **gradual and planned adoption of AMI, automation and integration of DERs**, prioritizing areas where the cost-benefit is more evident. For Mello, the massification of technologies must be supported by solid technical and financial studies, avoiding the widespread adoption of solutions that may burden the consumer without a proportional return in efficiency or quality.

Closing his speech, João Carlos de Mello reinforced that the success of the modernization of the Brazilian electricity sector will depend on **three essential pillars**:

1. **Stable and predictable regulation**, which provides legal and economic security for investments.

2. **Modern tariff models** that reflect the real cost of the network and encourage efficiency.
3. **Integrated planning**, which aligns public policies, regulation and business strategies in a long-term horizon.

For him, this balanced approach is the only one capable of reconciling technological advancement with low tariffs, preserving the financial sustainability of companies and ensuring the quality of the service provided to society.



Executive **Ângela Gomes** presented a strategic vision on the transformation of the Brazilian electricity sector, focusing on the convergence between technological innovation, operational efficiency and consumer satisfaction. From the beginning of his speech, he highlighted that the energy transition and the digitalization of networks cannot be seen only as a technical challenge, but as an **opportunity for competitive repositioning** for distribution companies and the sector as a whole. He emphasized that international experience demonstrates that successful modernization requires not only investment in infrastructure, but also **cultural change and internal processes** in organizations.

Ângela drew attention to the **centrality of the consumer** in the new business model of the electricity sector. For her, the advancement of distributed generation, storage and electric mobility is empowering the consumer, who starts to act as a prosumer and demand new personalized services. This requires utilities to evolve to **smart grid operator (DSO) models**, with the ability to manage bidirectional flows and offer solutions that integrate energy, data, and flexibility. He stressed that the relationship with the customer must

migrate from a reactive service to a proactive posture, based on real-time data and digital platforms.

In the technological field, he highlighted that **intelligent metering (AMI)**, automation and DERs (Distributed Energy Resources Management Systems – DERMS) management systems are indispensable investments for the operation of complex and distributed networks. However, he warned that the simple implementation of technology does not guarantee results: it is necessary to integrate it with efficient operational processes and trained teams. He defended that the adoption of these solutions should be accompanied by **clear performance indicators** and a strategy for using data for decision-making and continuous improvement.

Ângela also addressed the **regulatory issue**, stating that the evolution of the sector will only be possible with stable, clear rules in line with the technological reality. He pointed out that the current regulatory frameworks are not yet able to fully stimulate the necessary innovation and flexibility, and it is essential to introduce **mechanisms that encourage efficiency and resilience**. He defended the creation of tariff models that reflect the value of the services provided by the network, including those associated with reliability and flexibility.

Another highlight in his speech was the **importance of cybersecurity**. For Ângela, the more digitized and connected networks become, the greater the attack surface and the risk of incidents that can compromise the operation and consumer confidence. He defended that cybersecurity should be treated from the planning of projects, and not as an afterthought, and that it should involve not only technology, but also **training and organizational culture**.

Finally, Ângela Gomes emphasized that the success of the transformation of the Brazilian electricity sector will depend on collaboration **between all actors** — regulators, companies, consumers and technology suppliers. He highlighted that the energy transition is both a challenge and a historic opportunity for Brazil to consolidate its leadership position in clean energy and innovation in Latin America. He closed by reinforcing that, to achieve this goal, it will be necessary to unite **smart investments, regulatory innovation and genuine focus on the consumer** as central elements of the sectoral strategy.



Rodrigo Ferreira, executive president of ABRACEEL, began his speech with a greeting to the organizer of the Forum, emphasizing the importance and persistence of the initiative in keeping the debate on smart grids alive for almost two decades. He emphasized that the resilience of events like this is essential to **raise awareness among authorities and Congress to recognize that Brazil needs to move into the 21st century in terms of modernizing the electricity sector.**

From that point on, he focused on the topic of the **free energy market**, which, in his view, will be the "next big thing" in the sector. He recalled that the Brazilian electricity sector is historically conservative, but that in recent years it has already undergone important changes with the entry of renewable energies, especially wind, and then with distributed generation (DG). For Ferreira, DG is a remarkable advance, as it allowed consumers to generate their own energy, but its regulation in Brazil is distorted: it creates excessive advantages for those who install systems, while penalizing those who do not have access to technology, generating imbalances between consumers.

He then rescued the history of the **free market** in the country. Established by Law No. 9,074 of 1995, authored by Deputy José Carlos Aleluia, the model was designed to progressively expand until it covers all consumers. **In 2005, according to the original schedule, everyone should already be free.** However, the **rationing crisis of 2001 and the new model** implemented by then-minister Dilma Rousseff **reversed the logic, prioritizing centralized long-term auctions and inflation-indexed contracts.** Although

this model has enabled a doubling of Brazil's installed capacity and served as an international reference, it has left as a legacy deep distortions, such as the high costs resulting from inflationary indexation. Ferreira cited the case of the Madeira River plants, which sold energy at artificially low prices in regulated auctions and, after ten years, saw the contracts become much more expensive than the prices practiced in the free market.

For him, Brazil is lagging behind in this discussion, but the current moment offers a historic opportunity, since three legislative instruments in progress – **MP 1,300**, **MP 1,304** and a **resurrected bill in the Chamber of Deputies' Mines and Energy Commission** – can finally make it possible to open the market to all consumers, including low-voltage consumers. Ferreira stressed that it is a matter of **the right to choose**: those who want to remain represented by the distributors can do so, but those who wish to migrate to a competitive market must have this option.

Rodrigo made a point of reinforcing that the consumer cannot continue to be treated as an abstract entity in the sector's discussions. The consumer, he pointed out, "is ourselves". And he recalled that, historically, the electricity sector has been concerned with structuring itself to serve itself, leaving its greater mission in the background: to serve society. To illustrate, he mentioned a survey carried out by ABRACEEL with Datafolha, according to which **eight out of ten Brazilians would like to choose their energy supplier**.

In his speech, the executive also established a bridge between market opening and the concepts of **energy transition**. He recalled that Brazil already has a decarbonized electricity matrix, mostly renewable, and that, therefore, it does not face the same challenges as countries such as Germany or Italy. But he stressed that the energy transition is not limited to decarbonization: it also involves **digitalization and decentralization**. These two aspects, in his view, can be achieved with political will, digitalization programs and the expansion of access to the free market.

Ferreira projected a **near-future scenario in which the energy market in Brazil will become more similar to that of developed countries**. He cited examples from Spain and Portugal, where **suppliers offer not only differentiated tariffs, but also aggregated products and services** — from electricians available at any time to vouchers and days of free energy consumption. He explained that, in Brazil, the free market can transform the consumer's relationship with electricity, bringing it closer to the logic of other consumer goods: price, transparency, convenience and additional services.

When addressing **regulatory and institutional challenges**, he highlighted that the **free market, contrary to what some imagine, is also highly regulated**. The difference is in the price, which is freely negotiated. However, he warned of risks, such as the temptation to multiply capacity auctions without clear criteria, imposing undue costs on consumers. He also highlighted emblematic examples of captive market inefficiencies, such as Itaipu, whose amortized energy could be delivered at very low prices to the Brazilian consumer, but remains burdened by subsidies and political arrangements.

Finally, Rodrigo Ferreira spoke about the **preparation of the sector for the opening of Group B**, which covers low voltage. He explained that a true **technological and digital journey will be necessary**, since the consumption profile of these customers is very different from that of current free consumers. This will require digital tools, intuitive platforms, and new marketing and advertising strategies to reach millions of potential customers. He recalled that both the CCEE and ANEEL and the traders have already been preparing: the Chamber has invested in modernization of systems, held relevant public consultations (such as CP 28 and CP 07) and, according to its president, is ready for the opening.

Closing his speech, Ferreira reiterated that the opening of the market is **the commercial model of the energy transition**, because it gives back to the consumer the power of choice and, with that, creates the right incentives for digitalization, decentralization and the expansion of renewable energies. He pointed out that **92% of the renewable projects under development in Brazil are already aimed at the free market**, precisely because it is the consumers who choose, and they tend to prefer cheaper and more sustainable energy. In his assessment, **MP 1,300 represents a consumer milestone**, a first step to correct historical imbalances and inaugurate a new paradigm in the Brazilian electricity sector.



In the final stretch of the panel, the moderator opened the **Q&A session**, highlighting that there were many questions, but that it would be necessary to synthesize due to time. Among the topics raised, two central questions emerged: first, a prospective view of the **next three**

years of the electricity sector; second, a discussion about the **allocation of risks and costs** — whether these should fall on consumers, generators or transmitters.

Professor **Nivalde** was the first to answer, bringing an optimistic perspective, but also critical. He stressed that the process of opening the market should finally take shape in this three-year horizon, becoming a reality for millions of consumers. He recalled that GESEL, the academic group he coordinates, has carried out international comparative studies showing that in several countries liberalization has been long and gradual, while in Brazil it seeks to make this transition at an accelerated pace, reaching about **90 million consumers** in a relatively short time. For him, the opening, if well regulated, will be able to attract investments and generate new opportunities, although it can also expose weaknesses of less structured companies.

Next, Nivalde pointed out another decisive challenge: the issue of **energy storage**. He noted that **generation cuts** have already become more and more frequent, not due to lack of transmission, but due to oversupply in certain periods, especially due to the explosive growth of distributed generation. He recalled that the subsidies granted to this segment proportionally increase the risks of financial imbalance, since DG has become the main source of incentives in the sector, even exceeding the volumes destined to other incentivized energies. In this scenario, he predicted that in three years there will be a significant expansion of **battery** solutions, with applications at multiple scales: from behind-the-meter systems in homes and small businesses to larger installations in distributors and transmitters.

Still on storage, Nivalde highlighted the role of **pumped storage hydroelectric plants** as a complementary alternative. According to him, Brazil has more than 200 hydroelectric plants that could be adapted with upper and lower reservoirs, creating ideal conditions for storing energy on a large scale and for prolonged periods. While batteries lend themselves to short-term solutions — a few hours of compensation — reversible batteries can accumulate energy for days, allowing them to meet demand peaks during the week, especially after periods of low demand and high renewable generation on weekends. He argued that the regulation needs to create clear conditions to make these investments viable, either with the extension of concessions or the requirement of implementation in renewal processes. For him, this is a new horizon for the sector, capable of strengthening the ballast of large generators and giving more security and flexibility to the Brazilian electricity system.

Ângela Gomes then expressed **agreement with Nivalde's statements**, but added an essential point: the need to correct the current **allocation of costs**, which today distorts economic signals and does not adequately reveal the real value of the services provided. In his view, inadequate pricing generates inefficiencies, benefits some agents to the detriment of others and ends up passing on burdens unequally to the final consumer. Adjusting this mechanism, therefore, would be a fundamental step for the near future, allowing greater transparency and fairness in the formation of prices and in the balance between generators, transmitters and users of the system.

This set of interventions made clear the common perception among the debaters: the sector is in full transformation and the next three years will be decisive. On the one hand, the opening of the market promises to finally give the consumer freedom of choice, inserting Brazil in line with international practices. On the other hand, the rapid expansion of renewable and distributed sources requires urgent solutions for storage and for the correct allocation of costs, under penalty of increasing financial and operational risks. The panel thus ended with a message of prudent optimism: the energy transition brings challenges, but also opens up new possibilities for innovation, investment, and structural strengthening of the electricity sector.

6. Panel: Emerging and Scalable Technologies Panel

Speakers:

- Alexandre Taijun O'Hara, Director of Applications - South America
- Daniel Vazquez, Director of LATAM Sales of AP Sensing (Mexico)
- Renata Carnielto Friedmann, Head of Sales Smart Grid Systems at WEG Digital & Sistemas, WEG / V2COM
- Silvio Mattiazzi, Sales Manager for MGA LATAM at Megger
- Marcelo Tomasini, Brand Executive at IBM

Moderator: Marcelo Machado, director of BREE and ABINEE



Expert **Alexandre O'Hara** began his presentation by highlighting the strategic relevance of **asset management and operational reliability** as central elements for the energy transition and the modernization of the electricity sector. He contextualized that, in the current scenario, energy companies face simultaneous pressures: the need to meet demands for growth and diversification of the electricity matrix, the accelerated incorporation of new technologies, and the growing demand for quality and continuity of supply, even in the face of extreme weather events.

According to O'Hara, the digitalization of networks and the application of advanced monitoring and diagnostic tools are key to maximizing the useful life of assets and reducing operating costs. He stressed that **predictive maintenance strategies**, supported by real-time data analysis, IoT sensors, and artificial intelligence, make it possible to identify failures before they become critical, reducing unscheduled downtime and improving operational safety.

O'Hara emphasized the importance of **risk-based management models**, which prioritize investments and interventions at the most critical points of the network, optimizing the use of financial resources. He presented examples of practical cases in which this approach resulted in significant gains in reliability and cost reduction, especially in long-life assets, such as transformers and transmission lines.

Another point addressed was the **integration of operational and corporate data** into single platforms, allowing technical decisions to be aligned with business strategies. For O'Hara, this integrated view is essential for companies to be able to respond quickly to regulatory changes, new market demands, and competitive pressures.

He also highlighted that, in the context of the **energy transition**, companies need to reconcile the efficient operation of existing assets with the incorporation of new elements into the system, such as distributed generation, energy storage, and electric mobility. This implies rethinking processes, empowering teams, and adopting an organizational culture focused on innovation and continuous improvement.

Closing his speech, Alexandre O'Hara reinforced that **strategic asset management**, combining technology, data analysis and risk-based approach, is an indispensable pillar to ensure that the electricity sector advances towards decarbonization and digitalization without compromising reliability and tariff moderation. In his view, companies that manage to integrate these elements will be better prepared to face the challenges and take advantage of the opportunities of the new energy era.



Expert **Daniel Vazquez** structured his presentation around the strategic role of technological innovation and digitalization as catalysts for the modernization of the electricity sector. Early on, he highlighted that the transition to a more flexible, resilient, and decentralized system is not limited to exchanging old equipment for new ones, but involves a **profound paradigm shift** in the way the grid is operated, planned, and integrated with consumers and distributed energy resources.

Vazquez pointed out that the evolution to **smart grids** requires not only the installation of sensors, advanced meters and automation systems, but also the ability to transform the data collected into actionable information. In this sense, he pointed out that **advanced analytics and artificial intelligence** are key elements to anticipate failures, optimize energy flows, manage demand peaks, and safely and efficiently integrate intermittent renewable generation.

Another central point of his speech was the importance of creating **open and interoperable architectures** that allow communication between equipment and platforms from different manufacturers. For him, interoperability is a fundamental condition to avoid technological fragmentation, ensure scalability and allow the continuous incorporation of innovations without the need to replace the entire existing technological park.

Daniel also emphasized that the success of digitalization depends on **technical training and cultural change** within companies. It's not enough to install new tools; It is necessary to prepare teams to operate them fully, integrating technological processes with strategic planning and asset management. He also highlighted that this preparation must include not only engineers and technicians, but also managers, so that corporate decisions are based on data and aligned with operational objectives.

The speaker brought examples of successful applications of **DERs management systems (DERMS)** and **demand response**, highlighting how these solutions can contribute to reducing operating costs, increasing reliability, and creating new business models. He argued that, in Brazil, such technologies can be applied incrementally, prioritizing regions or segments where the cost-benefit is clearer, in order to avoid inefficient investments.

In his final remarks, Daniel Vazquez stressed that digitalization and innovation in the electricity sector must go hand in hand with **public policies and adaptive regulation**, capable of keeping up with the speed of technological evolution. He argued that more flexible regulatory frameworks, combined with mechanisms such as regulatory sandboxes, can accelerate the adoption of new solutions and reduce barriers to innovative business models. He concluded by highlighting that true transformation will only be possible through the integration between technology, regulation and people, ensuring that the modernization of the network brings tangible benefits to the whole society.



Executive **Renata Carnieletto Friedmann** brought a perspective focused on the **integration between energy planning, innovation and sustainability**, emphasizing that the modernization of the electricity sector must be anchored in strategies that reconcile economic efficiency, operational safety and environmental responsibility. Right at the beginning of his speech, he highlighted that Brazil is experiencing a unique moment, with the need to expand and strengthen its networks while meeting decarbonization commitments and expanding the share of variable renewable sources.

Renata stressed that, in this context, **long-term planning** is essential, but it needs to be flexible enough to adapt to the speed of technological changes and new market demands. He advocated that the electricity sector adopt dynamic planning models, which incorporate prospective scenarios and risk analysis, allowing for more agile decisions in the face of uncertainties such as climate variations, regulatory evolution and changes in the consumption profile.

Another central point of his presentation was the importance of integrating **distributed energy resource management (DERs)** and energy storage solutions as structuring elements of smart grids. For her, the decentralization of generation should not be seen as an isolated challenge, but as an opportunity to increase the resilience and efficiency of the system, as long as there is coordination between operators, regulators, and consumers.

Renata also addressed the **regulatory issue**, advocating for more adaptive regulatory frameworks, capable of encouraging innovation and at the same time ensuring stability and predictability for investors. He cited the relevance of instruments such as **regulatory sandboxes**, which allow testing business models and emerging technologies without the burden of immediately fitting into strict rules that may not reflect the reality of solutions still under development.

She emphasized the need to strengthen **governance and intersectoral cooperation**, bringing together government, business, academia and civil society around common agendas for the energy transition. He argued that the transformation of the electricity sector is not just a technical project, but a **collective process**, which requires dialogue, alignment of interests and transparent decision-making mechanisms.

At the end of her speech, Renata Carnieletto Friedmann reinforced that the success of the modernization of Brazilian networks will depend on three pillars: **intelligent planning, applied innovation and collaborative governance**. In his view, if these elements are combined with consistent investments and adaptive regulation, Brazil will be able not only to meet its energy transition goals, but also to consolidate itself as an international reference in the integration of renewables and management of complex grids.



Specialist Silvio Mattiazzi presented a practical and engineering-oriented view of the technical challenges of modernizing electrical grids, with a special focus on the role of testing, diagnosis and monitoring solutions to ensure the **reliability and operational availability** of systems. Right at the beginning of his speech, he stressed that the energy transition and the digitalization of networks do not only mean incorporating new equipment and technologies, but also **ensuring that existing assets operate within optimal standards** throughout their life cycle.

Mattiazzi explained that, as the electrical system becomes more complex, with greater penetration of distributed generation, energy storage and electric mobility, the need for **real-time monitoring** and tools that allow anomalous conditions in assets to be identified in advance grows. For him, corrective maintenance is no longer acceptable as a predominant model: it is essential to migrate to **predictive and condition-based maintenance strategies**, using high-precision data obtained through sensors and specialized equipment.

He highlighted the role of **advanced testing and diagnostics** — such as dielectric testing, partial discharge analysis, thermography, and high-frequency measurements — to detect incipient failures in transformers, cables, circuit breakers, and other critical network components. He presented examples of cases in which the application of these methodologies avoided prolonged interruptions and significantly reduced repair costs, showing that the return on investment in test equipment can be fast and expressive.

Another point addressed was the importance of **integrating testing and monitoring solutions with asset management platforms**, allowing the results obtained in the field to directly feed corporate systems and assist in strategic decision-making on prioritization of investments and replacement of assets. Mattiazzi stressed that this integration is crucial to optimize resources and ensure that each intervention in the network is justified by technical evidence.

Sílvio also drew attention to the **training of teams**, noting that the effectiveness of the tools depends on the ability of professionals to correctly interpret the data and apply the recommendations derived from the analyses. He defended that continuous training and certification programs are an integral part of the maintenance and operation strategy of companies in the sector.

Closing his speech, Sílvio Mattiazzi reinforced that the reliability of the electrical system in a scenario of increasing complexity depends on a **proactive approach**, in which test and diagnostic technology, combined with data management and technical training, acts as a key element to sustain operational safety, quality of supply and economic efficiency in the long term.



Specialist **Marcelo Tomasini** presented an approach aimed at **integrating technological modernization, operational efficiency and economic results**, arguing that the transformation of the electricity sector needs to be conducted with pragmatism, focus on return on investment and alignment with the real needs of the system. Right at the

beginning, he stressed that digitalization and automation should not be treated only as technological trends, but as **strategic tools to increase reliability, reduce costs and increase the flexibility of the operation.**

Tomasini pointed out that the introduction of **smart metering, substation automation, advanced SCADA systems and data analysis platforms** creates conditions for more accurate grid management, especially in a context of increasing penetration of distributed generation and variable energy resources. However, he warned that these investments need to be supported by **robust technical cost-benefit studies**, in order to avoid the adoption of expensive or complex solutions that do not bring proportional benefits to the system.

Another point emphasized was the importance of **integrated asset management processes**, in which data obtained by sensors and monitoring systems are transformed into useful information to guide maintenance, replacements, and expansions. According to him, this integration allows for faster and more assertive decisions, optimizing resources and increasing network availability.

Marcelo also addressed the **issue of interoperability**, arguing that the adoption of open standards and compatibility between systems from different vendors is essential to ensure scalability and longevity of investments. For him, technological fragmentation, with isolated and non-integrable solutions, compromises operational efficiency and increases maintenance costs.

He provided practical examples of cases where the combination of automation, predictive analytics, and demand response has resulted in **significant reductions in outages, better use of existing infrastructure, and postponement of expansion investments.** He highlighted that this approach is particularly relevant in a scenario of budget constraints and growing demand for low tariffs.

In his conclusion, Tomasini reinforced that the modernization of networks must be seen as a **continuous and scalable process**, in which each step generates concrete and measurable gains. He argued that the combination of technology, standardization, efficient asset management and consumer focus is the key to ensuring that the Brazilian electricity sector advances in a sustainable, competitive way and in line with the challenges of the energy transition.



At the end of the last panel of the day, moderated by **Marcelo Machado**, director of BREE and ABINEE, the final discussions took on a very practical tone, focused on the challenges and opportunities of applying new technologies in the electricity sector. Right at the beginning, Marcelo himself launched a question that summarized two central concerns: **what barriers artificial intelligence still encounters to consolidate itself in the native management of the electricity sector and, in parallel, what would be the recommended steps to structure an *effective asset management* roadmap.**

The first to answer was Marcelo Tomasini, who brought his experience to highlight the conservative character of the electricity sector. According to him, this caution in the adoption of new technologies, although often seen as resistance, is also necessary to preserve the security and reliability of the system. Still, he stressed that the sector needs to overcome mistrust and recognize the value that artificial intelligence can add in terms of efficiency and resilience. This change, in his view, depends on firm leadership: it will not be a process built from the bottom up, but rather induced by convincing the top echelon of companies, which must take responsibility for sponsoring the transformation.

Next, he highlighted that the first step of a consistent roadmap should be the definition of clear governance for AI. Each company needs to understand how it intends to use technology, what data will be processed and what goals it intends to achieve. Issues such as privacy, confidentiality of strategic information, and orchestration of different applications need to be addressed before any implementation initiative. From this governance base, the definition of infrastructure demands comes into play: hardware,

sensors, and monitoring systems will only make sense if aligned with a previously established vision.

Marcelo Machado then directed the same question to Daniel and Renata, who brought complementary perspectives. Daniel emphasized that the reliability of new technologies, such as the one he presented, depends above all on the quality of the existing infrastructure. Citing systems based on optical fibers for monitoring, he explained that efficiency is conditioned by the physical state of the cables and the configuration in which they are located, noting that such solutions have been improved since the 1980s and today have the support of advanced software and artificial intelligence to transform temperature and vibration data into useful information for the sector.

Renata, in turn, addressed the importance of planning and aligning expectations between suppliers and concessionaires. She noted that, no matter how robust the technology is, the success of the implementation depends on clarity about what is expected of the project, in what timeframes and with what priorities. This initial definition is crucial to ensure that the agreements established come to fruition. At the same time, he highlighted the relevance of the modular architecture of the solutions, which allows scalability and flexibility in the face of rapid market changes. For her, each concessionaire has specific needs and, therefore, commitment in the design phase of the project is decisive to ensure reliability and compliance with *SLAs – Service Level agreements*.

Next, Silvio was invited to comment on how his company's solution behaves in weather events and whether it could be integrated with existing systems in the network. He explained that the current proposal is not for direct action, but for predictive monitoring: the system indicates the possibility of failures and sends high-quality information to support the decision-making of the operational teams. However, he stressed that integration with systems such as SCADA or substation platforms can significantly expand functionalities, enabling a more efficient and preventive orchestration of the operation.

Finally, Alexandre answered about the cost impacts of the new Koala functionality on his equipment. He clarified that the increase does not reach 10% of the value of the device and that the gain in added value is much higher, mainly due to the possibility of performing predictive maintenance and reducing the impacts of permanent failures. He explained that Koala works in conjunction with other solutions, providing data that enriches the analysis and helps anticipate problems, while autonomous equipment, such as TripSaver 2, continues to play the role of immediate isolation of faults. For him, the most important thing is to understand that there are no mutually exclusive solutions, but complementary technologies that need to be integrated intelligently.

Closing the panel, Marcelo Machado thanked the participation of all the debaters — Marcelo, Silvio, Alexandre, Renata and Daniel — and reinforced that many of them would also be available in the exhibition area, where they could deepen conversations and clarify specific doubts. He highlighted the relevance of the debate, which brought a combination of technical and strategic perspectives on artificial intelligence, monitoring, resilience and

asset management, and thanked the opportunity to conduct the session, registering the honor of participating in such a qualified forum

7. Panel: Electricity Digital Service Technologies

Speakers:

- Felipe Luiz da Silva Bicalho, Engineering and Proposals Coordinator, Siemens
- Sérgio Jacobsen, President Micropower Energy
- Carlos Ohde, President of FIT
- Marcos Aurélio Izumida Martins, Business Development, Gridspertise

Moderator: Luciano Ribeiro



Felipe Luiz da Silva Bicalho began his presentation by highlighting the complex challenges faced by energy distributors in Brazil, involving tariffs, quality of supply, regulatory framework and new types of customers, such as free customers and the expansion of micro and mini distributed generation. He pointed out that the growing regulatory complexity — including Ordinance 111 and the measurement of public lighting — has expanded the obligations of distributors in relation to the collection and analysis of energy quality data from the end customer.

A critical point presented was **non-technical losses**, traditionally a major motivator for smart metering projects in the country. Despite years of effort, these losses remain relevant, reinforcing the need for AMI (Advanced Metering Infrastructure) and MDM (Meter Data Management) projects for detection, analysis, and mitigation.

Felipe highlighted a strategic advantage of Brazil: the absence of large massive MDM projects still allows learning from internationally consolidated experiences. He cited examples of projects implemented 10–15 years ago in the United States and Europe, which are now evolving into a **second generation of AMI**, replacing old technologies and adopting more modern, reliable, and cost-effective systems.

He pointed out that, in the past, technology was a significant barrier, with pilot projects using PLC, RF Mesh, cellular networks and other protocols. Today, with consolidated technologies and adequate cost-benefit, it is possible to implement large-scale **projects**. However, this brings new challenges, especially related to the **scalability and performance** of MDM platforms, as data collection has become more frequent—moving from 15-minute or 1-hour resolutions to 5-minute or less intervals. The trend of migration to the cloud also requires compatible platforms, ensuring a smooth and efficient transition.

Interoperability **and neutrality** were highlighted as key requirements. It is no longer feasible to have closed and proprietary systems, as different regions and types of customers demand different technologies. Modern platforms must be able to integrate multiple vendors, communication technologies, and disparate meters, allowing for expansion without being dependent on a single provider.

Felipe emphasized the importance of **regulatory compliance and flexibility**, citing that a global MDM allows you to handle different types of tariffs, data and legal requirements, including the formats required by the CCE for free customers. He also pointed out that the **return on investment (ROI)** goes beyond revenue, involving reduction of delinquency with virtual cut-off and reclosing, combating losses using intelligent algorithms and AI, optimizing workflows and managing assets in the field.

Another critical point addressed was **cybersecurity**, a growing concern in a global context of conflicts and virtual attacks. MDM platforms must adhere to strict standards to protect data and infrastructure, ensuring secure operation of systems connected to measurement devices, networks, and transformers.

Felipe explained that **MDM works as the heart of smart metering**, collecting and validating data from devices in the field, integrating it with other corporate and operation systems (such as SCADA, ADMS, OMS, and EDMS), enabling advanced analytics, outage detection, and consumer engagement. He highlighted the importance of providing near-real-time information to customers, allowing them to know their consumption patterns, choose tariffs, and contribute to demand management.

International examples have reinforced the importance of MDM as an operational and strategic tool. In Texas, USA, MDM integrates data from more than 400 thousand

customers, allowing notifications to be sent about power outages and restoration forecasting, reducing call center overload and improving efficiency in mobilizing field teams. In addition, Felipe presented cases of gas meters with leak sensors, demonstrating how critical events can be handled almost instantaneously, highlighting the importance of **near-real-time processing**.

Finally, he emphasized the automation of processes: more than 99.9% of measurement data problems can be solved directly in MDM, with automatic validation, estimation of missing data, and escalation to field action only when necessary. Thus, MDM not only centralizes and organizes measurement data, but also allows **optimizing the operation, reducing losses, and engaging customers**, consolidating itself as a fundamental piece in the modernization and efficiency of distributors.



Sérgio Jacobsen, President of Micropower Energy, began his presentation by highlighting Micropower Energy as an innovative company in the Brazilian energy sector, mainly due to its ESA Service business model. Unlike the traditional approach of selling projects, Micropower offers rental of energy solutions to customers, while also maintaining the possibility of the traditional model. He pointed out that the company is currently the largest energy trader and the third largest solar energy generator in Brazil, recently acquired by Vibra, offering a complete energy solution, including fossil sources such as diesel and gas, as well as renewables and batteries. Jacobsen also mentioned the partnership with Equinor (formerly Statoil), one of the largest Norwegian oil and gas companies.

An important focus presented was the off-grid market and the use of batteries in regions without an adequate power grid, such as remote agro areas, especially in the Matopiba region (Maranhão, Tocantins, Piauí and Bahia), where agricultural irrigation requires significant energy. The adopted solution combines photovoltaic panels with batteries, ensuring voltage and stability reference, since isolated photovoltaic does not have sufficient inertia. Jacobsen pointed out that these microgrids are already economically viable and in operation, being a replicable model for other industrial sectors besides agribusiness.

Among the emblematic projects, he mentioned:

1. Vale Project – a system with 10 MWh of batteries operating for two years, performing *peak shaving*, providing backup, reactive correction and assisting in the grid during peak hours. The batteries have already processed approximately 1.4 GWh, demonstrating great scale and reliability.
2. Virtual Power Plant (VPP) R&D Ring Project – six 250 kWh batteries connected to the grid feeder, initially focused on correcting power quality, with expansion planned to isolate sections of the grid in case of failures, in combination with photovoltaic sources.
3. Commercial and industrial projects – including a mall with 1.6 kWh Tesla batteries for *peak shaving* and *backup*, and McDonald's de Pinheiros in São Paulo, where the battery will be remobilized to fast-charging stations, balancing demand and relieving the grid.

Jacobsen emphasized that the battery sector is consolidating itself as a commodity, with a wide global offer and manufacturers of different levels, but that Micropower focuses on the development of EMS (Energy Management System), proprietary software that coordinates and optimizes the operation of batteries, integrating different energy sources and ensuring flexibility, efficiency and autonomy. EMS defines when and how batteries should charge or discharge, maximizing the benefit to the grid and the customer.

A critical point addressed was the duck curve and the challenges of energy output from renewables, citing projections by the ONS and PDE for 2027-2029, with ramps of up to 50 GW, highlighting that the curtailment of solar and wind will become increasing, and solutions such as thermal would be less efficient. For Jacobsen, batteries are the ideal solution, offering flexibility, speed of response and ability to act in four quadrants (absorb or supply active and reactive power), meeting both systemic and local demands.

He also pointed out that the application of distributed batteries offers strategic advantages over traditional thermal plants:

- Locational factor – they can be installed next to distributed generators, substations or end consumers, adjusting to local needs.
- Modularity and scalability – systems can range from 250 kW to multiple MW, increasing energy density without the need for large physical areas.
- Autonomy and automation – operate independently, controlled by EMS, and can be dispatched centrally in virtual power plants.
- Ancillary services – include frequency control, reactive correction, operating power reserve, photovoltaic balancing and reverse flow mitigation.

Finally, Jacobsen highlighted the economic and regulatory aspect, stressing that the remuneration of batteries, especially through demand response, is essential to encourage installation with the end consumer, without the need for massive investments in the grid or subsidies. The combination of batteries, electronic meters, and data transparency allows for network optimization, operational efficiency, and customer engagement, making the solution scalable and sustainable.



Carlos Ohde, president of FIT, began his lecture by highlighting the trajectory and role of the institute he directs. He explained that **FIT is a non-profit research institute**, with 22 years of existence, and that today it has three units in Brazil — Sorocaba, Jaguariúna and

Manaus — **in addition to partnerships with universities and research centers, including a collaboration with MIT in the United States focused on artificial intelligence applied to industry.** The FIT team has about 500 employees, with a strong presence in software development, but also working in hardware and automation. To illustrate the institute's innovative spirit, he mentioned the game prepared at its booth, where visitors could have a coffee served by a robot.

Advancing on the central theme, Ohde drew attention to the phenomenon of the "attention economy" and how artificial intelligence has often been the target of sensationalist headlines, sometimes painted as a threat to humanity, sometimes as a tool for interplanetary conquests. **In practice, he pointed out, the contribution of AI to companies tends to be more modest and concrete: efficiency increases in the order of 5% to 10% in certain tasks.** According to him, this does not mean immediate replacement of jobs, but rather **greater individual productivity.** In cases of processes with hundreds of people performing the same function, technology can, in fact, reduce the need for labor. He himself declared himself an intensive user of AI, noting that, at FIT, about 300 of the 500 employees use the technology almost daily.

Ohde pointed out that the **effectiveness of artificial intelligence depends on fundamental factors: the availability and quality of data, the architecture of solutions that ensure security and protection of information, as well as staff training and change management.** Without these elements, he said, it is hardly possible to obtain consistent results. He then explained the different layers of AI: from the broader concept of machines simulating human behavior, through machine learning, deep learning, and generative artificial intelligence, which in recent years has gained great notoriety with tools such as GPT, Gemini, and Grok.

In the speaker's view, generative AIs **are very efficient when working on widely available public data,** which explains their usefulness in tasks such as reporting, automated service by *chatbots*, technical documentation, analysis of large volumes of text, and support in legal compliance. He also highlighted the use of these tools in training and qualification programs, with the possibility of customizing content according to the individual needs of employees. In the case of Machine Learning, the value lies in applications that require internal and exclusive data from companies, such as energy loss and fraud detection, predictive equipment maintenance, and network optimization. On the other hand, he warned of areas where AI should not yet be considered reliable, such as in company mergers, major strategic decisions or ethical dilemmas, due to the scarcity or complexity of data.

When reporting the practical journey of using generative AI, Carlos Ohde described three stages: initial curiosity, recurrent use in specific tasks, and, finally, integration into the routine, when it starts to bring real efficiency gains. He also differentiated generic market tools — such as *Copilot* or solutions embedded in videoconferencing platforms — from customized applications embedded in legacy systems, which offer more concrete competitive advantages. He exemplified the platform developed by FIT for large-scale

automatic translation of documents, capable of converting a 50-page report in less than a minute with 95% accuracy. **He stressed, however, the importance of always having human supervision in the final stage, ensuring quality and correctness.**

Other examples cited were decision support platforms based on companies' internal rules, capable of responding accurately to compliance issues, as well as solutions that capture and disseminate the so-called "tribal knowledge" — knowledge accumulated by specialists and specific areas — so that it is available to all employees. **Finally, he presented a concrete case of the electricity sector: a project to detect fraud in meters in partnership with an energy distributor.** In this example, he explained in detail the steps: data collection, sanitization, labeling (with images of correct and adulterated meters), training and testing of the model, implementation in production and continuous improvement from the increase of the database.

Carlos Ohde concluded by pointing out that artificial intelligence projects have already become common in most companies and have brought significant gains in operational efficiency. Although they do not represent apocalyptic or futuristic revolutions, nor do they put an end to jobs, in his view they are powerful instruments of digital transformation, especially when applied in a practical, planned, and supervised way, ensuring real and sustainable results for business.





Marcos Aurélio Izumida Martins Business Development, from Gridspertise, presented a vision on the use of edge computing applied to intelligent distribution networks. The company, a spin-off of the Enel Group founded in 2021, was born with strong expertise in network operation and has around 500 employees distributed in different countries. Today, Gridspertise has worldwide prominence, with more than 110 million smart meters sold and about 200 customers.

The company's main product is the **QED (*Quant Web Device*)**, a multifunctional device considered innovative for virtualizing functions of various equipment used in the network, such as protection relays, modems and automation systems. Just like a "smartphone of the power grid", QED allows you to install different applications on a single hardware, bringing gains in technical efficiency, cost reduction and greater reliability. Its main feature is **edge computing**, processing data close to sensors, meters, and loads, which ensures quick and safe decisions. In addition, it has an open platform, allowing integration with existing solutions from distributors and partners, fostering co-creation and monetization of technologies.

The device is versatile and can be applied from substations and medium voltage networks to end consumers. Among its functionalities are: automation, monitoring, recloser control, self-healing, microgrid management, demand response, system protection and integration with smart meters. There is also a specific version for low voltage networks, aimed at controlling transformers and managing energy flows.

Use cases are already being applied in Europe and expanding in the Americas, with pilots in Brazil, Colombia and the United States. An example is the replacement of recloser commands by QED, which concentrates functions previously distributed in several pieces of equipment in a single device. Other applications include reverse flow prevention for transmission, control of large consumers, orchestration of distributed energy resources, and protection of microgrids.

In conclusion, Marcos reinforced that QED goes beyond monitoring, also offering predictability and support in decision-making, integrating smart measurement data with automation and maneuvers in real time. The proposal is to offer distributors a robust solution to challenges such as climate resilience, technical losses, stability, digitalization and cybersecurity, consolidating QED as a strategic tool for the future of distribution networks.



The Q&A session, led by Luciano Ribeiro, began with a comment highlighting the richness of the panel, which had addressed topics such as the evolution of MDM, battery integration, resilience and network security, emphasizing that there are already projects underway and attractive costs to make these solutions viable. From there, the round of questions sent by the public began.

The first question came from Gilmar Ogawa, vice president of the Consumer Council of Enel São Paulo, who asked about the need for large volumes of data for artificial intelligence and how to verify the quality and veracity of this information. Carlos Ohde responded by explaining that, in the case of generative AI, fed with public data available on the internet, there is not much control on the part of users, since this process is in the hands of large global companies. In **industrial and commercial applications, it is necessary to work intensively to collect, standardize, and process data, which usually come in different formats and in disorganized records.** He recalled that this is a time-consuming process, but essential to ensure consistent results in machine learning solutions, and also mentioned the possibility of integrating specific bases into generative tools, as in the case of the HAGs mentioned in his lecture.

Next, Luciano brought Tiago Angioletto's question to Sérgio, from Micropower, about the **future of integration between batteries and smart metering.** Sérgio clarified that, in the current scenario, **this integration does not occur directly.** Smart meters act as sensors that power supervisory systems (such as SCADA or MDM), which in turn communicate with centralized control platforms, such as virtual power plants (VPPs). Thus, **the logic of**

dispatching the batteries depends on these intermediate instances, which concentrate and process the data before guiding the operation.

Luciano complemented with a second question directed to the same debater, **asking for details about the business model, deadlines, costs and risks associated with the useful life of the batteries.** Sérgio explained that the company works with two formats: in the case of dealerships, the traditional sales model prevails, as it makes more sense for the logic of asset-based remuneration; **For industrial and agribusiness customers, the most viable model is long-term rental (between 10 and 15 years), structured as "as a service".** The value depends on the size and application of the battery, but it always needs to generate savings in relation to existing alternatives, either by replacing diesel generation or by reducing costs with electric tariffs. He pointed out that, **with the continuous drop in battery CAPEX and the price difference between peak and off-peak hours (TUSD), the viability of these contracts has been growing.** As for the useful life, he said that **manufacturers already offer warranties of up to 20 years,** and that, with proper charging and discharging practices, the batteries can perform even better than projected, something that is already confirmed in units installed five years ago.

The next question was addressed to Marcos Izumida, about the possibility of integrating QED with MDM systems and whether this solution would effectively bring performance gains. He replied that **QED is already capable of virtualizing the concentration of measurements, with ongoing experiments in Italy, and can also replace or accumulate hardware functions in distribution, such as gateways and reclosers,** reducing costs. In addition, he pointed out that, as it operates as an edge computing platform, QED can receive measurement data and algorithms that make it possible to predict loads, generation, and even act on distributed energy resources, including batteries and inverters. This flexibility makes room for advanced applications, although it requires regulatory adaptations, such as sandboxes that allow the experimentation of new models.

Finally, Luciano addressed a question to Felipe about case references in Brazil, considering the international examples he had cited. Felipe reported the case of CPFL as the most emblematic, highlighting that the distributor structured the project gradually. Initially, it focused on Group A, responsible for about half of the concessionaire's revenue, where there was a strong concern about losses. In the second stage, it sought to include free customers, and is currently expanding to Group B, with a goal of 1.6 million consumers to be integrated into MDM in the next five years. He reinforced that this progressive advance was essential to enable investment return and consolidate the platform as a strategic management resource.

Closing the session, Luciano Ribeiro thanked all participants and the public, reinforcing the importance of complying with the time and congratulating the speakers for the quality of their contributions.

8. International Panel on Intelligent Energy Systems

Speakers:

- Ashish Singhal, President, Global Business for Allied Engineering Works (India)
- Junya Takada, Head of Technology, Landis+Gyr (Japan)
- Ravi Seethapathy, America's Ambassador of the Global Smart Energy Federation (Canada)
- Reji Kumar Pilai – Chairperson ISGF and GSEF (India)

Moderator: Maria Tereza Vellano, President of Vellano Smart Energy Consultancy



Ashish Singhal, Global Business President of Allied Engineering Works (India), introduced the AEW company, which is new to the Brazilian market. In India, the company is among the top five meter manufacturers, with the capacity to produce more than 7 million smart meters per year, and is currently experiencing annual growth of more than 100%. The Indian market is considered strategic, with an estimated demand of 250 million smart meters, in which the company already holds more than 10% of the market. AEW provides more than 70% of measurements in the state of Punjab and has expanded its international operations, including the acquisition of a meter company in Thailand in 2025, as well as evaluating investments in Brazil.

The portfolio includes single-range meters, smart meters, three-phase models, LTCT, HTCT, DT, as well as wires, cables, and solar energy and installation solutions. The main focus, however, is on smart meters. The company has developed flexible technology and maintains collaborations with global HES and MDM vendors, such as Trilliant, Cyan Connode, Oracle, and Siemens, although it also has its own system when needed. In addition to energy meters, water and gas meters were developed as part of an integrated platform, as well as new solutions for monitoring the health of distribution transformers.

AEW's production infrastructure includes proprietary SMT lines, PCB board assembly, plastic injection molding, and in-house testing facilities such as impulse and hall testing. The company's proposal is to address the critical infrastructure challenges faced by distributors in several countries. In India, it is estimated that 17% of failures occur in distribution transformers, mainly due to thermal and oil degradation. The absence of adequate monitoring and the difficulty of inspection in remote locations contribute to these failures, which lead to great losses to the concessionaires.

To mitigate these issues, AEW has developed a distribution transformer health monitoring system (DTMS), which allows it to track critical variables such as temperature, oil level, and operating conditions in real time. The system enables the early detection of failures, reducing operation and maintenance costs, in addition to extending the useful life of the equipment. It is a low-cost solution, compatible with the infrastructure already used in HES and MDM systems, and can integrate various sensors, such as heat, oil, fire and security.

DTMS also offers digital outputs capable of triggering automatic commands, such as transformer shutdown in critical situations, and allows multiple alarm levels that guide field teams. The system also includes a mobile application to support utilities, at no additional cost, taking advantage of the platforms already implemented for smart meters. The solution incorporates cellular and bluetooth connectivity, expanding versatility in environments with network restrictions.

Integrable sensors include winding temperature and terminal gauges, oil level sensors, magnetic indicators, and fire detectors. With this, the system seeks to reduce operational risks and increase the reliability of the power grid.

The report highlighted that the introduction of solutions of this type is especially relevant in Brazil, at a time of expansion of smart metering, which has been going beyond the pilot project phase and advancing to large-scale deployments.



Junya Takada, Head of Technology at Landis+Gyr, presented the company's trajectory, which has 129 years of history and has established itself as one of the global leaders in smart metering. Currently, the company has about 30 units in different countries, including Tokyo, and has already deployed approximately 35 million devices, serving more than 3,500 customers worldwide. Landis+Gyr is recognized as a reference in the supply of smart meters, advanced measurement systems (AMI) and integrated data management solutions.

Among the highlights of its performance, the experience in the Tokyo region was highlighted, **where 29 million smart meters were deployed in just seven years, all integrated into a single data system.** This system **collects more than 1.4 billion records daily, with a read success rate of 99.95%, practically close to 100%.** The meters transmit data every 30 minutes, allowing the information to reach the *front-end* system, the MDM and later the traders within the same interval. In addition, the devices send voltage readings every five minutes, enabling distributors to perform detailed analysis in near real-time.

The Japanese model also stands out for the **variety of applications required by the regulation.** The meters are not limited to the traditional function of "*meter to cash*", but are used to expand benefits to the consumer, integrating with electric vehicle chargers, photovoltaic systems, batteries and other distributed energy resources. The communication architecture **includes three routes: "Route A", which directs data to distributors; "Route B", connected to the residential network to support customer services; and "Route IoT", aimed at the integration of water, gas and other Internet of Things devices.**

The Japanese context has posed specific challenges to the stability of the MAI. The climatic diversity is extreme: in the north, in Hokkaido, temperatures are comparable to those in Chicago, while in the south, in Okinawa, they reach levels similar to those of Dallas or even Mexico. These conditions required robust and adaptable solutions. **The Japanese electrical system also has a historical peculiarity: the coexistence of two frequencies, 50 Hz in the northern region and 60 Hz in the southern region, as a result of the different origins of the equipment acquired by Tokyo and Osaka at the beginning of electrification, which have been maintained to this day.**

Another regulatory milestone was the 2011 earthquake and tsunami, which affected the Fukushima nuclear power plant and prompted deep reforms in the electricity sector. **From 2013, the massive deployment of smart meters began; in 2016, the liberalization of the retail market took place; in 2017, the opening of the gas market; and in 2020, the unbundling of utilities, which resulted in the division of Tepco into five companies.** These measures reinforced the transformation of the metering paradigm in Japan, with **the AMI now integrating distribution automation functions, supporting grid reliability, and monitoring distributed resources.**

The monitoring system was designed to ensure strict requirements, such as the SLA of 99.95% of readings, in addition to data collection at different intervals: load profiles every 30 minutes, voltage records every five minutes and instant active and reactive energy readings. The solution is based on IP mesh networks and cellular communication, with evolution from 3G to 4G, but with a strong preference of utilities for closed systems and physical servers. Still, there is already a gradual move towards virtualized platforms and cloud solutions, albeit in private cloud environments within the concessionaires' own data centers.

The transition between the first and second generation AMI in Japan was marked by an intermediate period, called "generation 1.5", which allowed pilots to be carried out and gradually adapted to the new requirements. The second generation brought additional functionalities, such as one-minute readings, reactive energy measurements, high-frequency voltage measurements, and full integration with distribution automation and distributed energy resource management (DERMS) systems. To meet the enormous scale of 29 million meters, Japanese distributors adopted strategies such as the selection of bellwether meters, positioned at strategic points in the network, ensuring efficient monitoring without compromising operational viability.

In the conclusion, it was stressed that the future of AMI in Japan will involve greater use of advanced analytics, integration with IoT and DER resources, as well as eventual applications of artificial intelligence and big data. However, the Japanese electricity sector still maintains conservative practices, with a strong presence of its own R&D systems and intensive use of traditional tools, such as spreadsheets. The expectation is that the full adoption of new technologies, such as 5G and large-scale analytics solutions, will occur gradually until 2030, always with caution in the face of costs, cybersecurity and reliability of operations.

The presentation showed that the Japanese experience on a large scale, combined with the high rate of operational success, represents a relevant reference for concessionaires in other countries, including Brazil, especially at a time of expansion of smart metering and the need for integration between telecommunications, management systems and network automation.



Ravi Seethapathy, Ambassador for the Americas of the **Global Smart Energy Federation**, began his presentation by highlighting the **impressive scale of time-of-use data generated by smart metering systems**. Only information considered simple already surpasses, in volume, all annual credit card registrations. This scenario highlights the challenge faced by measurement data management systems (MDMs), which need to be able to store and process increasing amounts of information, respecting legal requirements for preservation for five to seven years, without this becoming unfeasible in terms of capacity and costs.

The discussion advanced to the **future of networks and the impacts of technological transformations in the electricity sector**. Three provocative questions were posed: what would happen if the price of solar energy fell to 1 cent per kWh, if the cost of energy storage was reduced to about 60 to 70 dollars per MWh, and if the efficiency of solar modules evolved from 14% to 40%? These changes could profoundly redefine the networks, regulatory systems, and investments made to date.

Another point addressed was the change in perspective in relation to the electricity sector. Seethapathy argued that **we should no longer talk only about "electrical systems", but about "electrical services"**, in which **reliability is complemented by resilience**, in which

business models need to become more agile, and in which the impacts on workers and consumers must be considered. In this context, the **centrality of the theme of climate change was highlighted.** For the speaker, this is the **biggest global challenge**, although it is often relegated to the background. He cited as an example the Coalition for Disaster Resilient Infrastructure, formed by 53 countries and headquartered in New Delhi, of which Brazil is a member. He also highlighted recent events in India, such as landslides caused by melting snow that destroyed hundreds of homes, illustrating the urgency of the climate issue for energy infrastructure.

The limits of the expansion of the electricity grid **were also discussed.** **Many current assets were acquired 40 or 50 years ago, under environmental conditions different from today**, and today they operate at much higher temperatures, which increases the risk of failures in high-cost equipment, such as transformers and transmission lines. In this sense, the adoption of **real-time monitoring technologies** was presented as a fundamental solution. The use of optical sensors and fiber optic systems, capable of providing tens of thousands of temperature measurement points in a non-intrusive way, was pointed out as a practical example to protect critical assets and avoid financial losses that could compromise heavily leveraged concessionaires.

In the field of innovation, the **need for greater flexibility of the networks** was highlighted. This involves both **load-side and supply-side flexibility.** The traditional view, that the grid passively follows consumption behavior, needs to be reversed: consumers already generate energy on rooftops and rural properties and should be able to sell this energy in decentralized markets. The concept of "grid edge" was presented as an alternative to the centralized model, **transforming the edge of the network into a space for direct transactions, with the potential to create new market models.**

Energy **storage was another highlight.** The initial perception that it would be the most expensive technology was overcome by the consistent drop in prices, of up to 50% per year in the last three years. This trend makes everything from 1 to 4 kW residential solutions to modular multi-megawatt containerized systems feasible. In addition, the need to **integrate load management systems directly into smart meters was pointed out**, which already have the necessary information to autonomously regulate part of consumption.

Seethapathy emphasized that **resistance to allowing distributors to explore services beyond metering belongs to the past.** In a scenario in which residential and commercial consumers become increasingly digitized and connected, it is unthinkable that dealerships will not keep up with this evolution. **Regulation must set clear limits, but it must not prevent innovation.**

The speaker also **highlighted the importance of preparing regulators.** Technological **advancement happens at a much faster pace than the updating of norms and standards.** While millions of solar and storage systems are commercialized, regulatory milestones are coming late. For the sector to move forward, it is essential that regulators are involved, informed, and trained, otherwise the market and consumers will move forward without waiting.

Three strategic fronts for the future were also pointed out: the **intelligent automation of network monitoring**, replacing manual inspections with drones, LIDAR, and sensors; **the development of resilient microgrids**, capable of fragmenting and reintegrating in a synchronized way in failure situations; and the **democratization of energy at the consumer level**, with the diffusion of affordable hybrid inverters, integrated with solar and storage systems.

In his final remarks, Ravi Seethapathy highlighted that concessionaires need to abandon models of increasing investments in heavy and centralized assets ("*heavy assets*") and migrate to integrate lighter structures, such as DERs, focused on innovation and flexibility. He cited as an example pension funds that already invest billions in energy assets and defended that energy companies adopt new forms of financing and operation. The central message was that the electricity sector must be rethought as an integrated system, in which supply, demand, digitalization and customer expectations are aligned to face both the effects of climate change and the transformations brought about by distributed generation and new consumption patterns.



Reji Kumar Pillai, president of the *India Smart Grid Forum* and the *Global Smart Energy Federation*, pointed out that the power transmission and distribution infrastructure was largely built to old standards (1950–1970), which did not consider current climate challenges, such as temperatures above 45°C. Today, there is an urgent need to upgrade grid specifications to support climate change and new energy demands.

He pointed out that monitoring systems (SCADA/EMS) are still based only on traditional electrical parameters, which is no longer enough in the face of the growing presence of renewable sources and inverter-based systems. The adoption of EMT and hybrid models is advocated, which are still little used even in developed countries. Another essential point is the **digitalization of the sector**, for which structured long-term plans are lacking. Although there is a lot of talk about AI, the application still lacks clarity. To contribute, a manual of use cases for AI, ML and robotics in the electricity sector was developed, which will be launched in September and may serve as a world reference.

Pillai also presented new concepts of energy consumers. In addition to the traditional consumers and prosumers (who produce and consume energy), there are "*flexumitors*", users who offer flexibility to the system, for example, storing energy in home batteries and consuming or reselling according to market prices. This concept has already been successfully applied in South Korea and is expected to expand globally.

Another challenge is the capacity building of regulators, who in many countries, including India, have little technical expertise. To this end, a smart *grids* manual was created for policymakers, which has been helping to understand the sector. India also takes delegations of regulators and executives to international events, enabling direct contact with global experiences.

In the practical field, India faces reverse energy flow problems due to the rapid growth of rooftop solar generation. In states like Gujarat, where there are millions of residential solar connections, injecting power during the day, voltage instability and inverter shutdown occur. As a solution, **smart inverters (IEEE 1547-2018 standard)**, battery storage systems, free charging of electric vehicles at times of surplus, and incentives for domestic use of appliances at specific times, even controlled by *smart plugs*, are being implemented.

Battery costs have fallen dramatically: from more than \$100/kWh to about \$36, with a tendency to reach even lower values before 2030. Similarly, solar energy is already the cheapest in history, and could cost as little as 1 cent per kWh in the future. This will make electricity almost free, leaving the main challenge of managing the grid.

Finally, Pillai reinforces that all new technologies – AI, blockchain, electric vehicles, drones, wireless charging and storage systems – will play a crucial role in the energy sector, which is undergoing a profound and accelerated transformation.



The Q&A session, mediated by **Maria Tereza Vellano**, began with a question about the **relationship between the Smart Grid Forum of India and the country's federal government**, seeking to understand whether the entity worked as a public-private partnership and what was its institutional form of action.

In response, it was explained that **the India Smart Grid Forum was established by the Ministry of Energy in 2011 as a non-profit society**. The composition brings together representatives of government agencies, energy distribution and transmission companies, regulatory commissions, academic institutions and industry. Since its creation, **the Forum has acted independently, although it maintains proximity to the government and regulators**. It was reported that, at first, **the government offered development capital, but the entity chose not to use it to preserve autonomy**. Instead, **it supported itself through the contributions of its members and, subsequently, by conducting capacity building programs, workshops, consultancies, and support from foundations that funded projects**.

The trajectory over more than a decade has resulted in about 20 major initiatives, including pilot projects and technical studies, which have consolidated the Forum's credibility. Today, the organization has 73 associated distribution companies, in addition to 27 or 28 transmission companies, including Power Grid Corporation, the largest in the country, in addition to a significant number of generation companies, mainly renewable. It was highlighted that the Indian transmission network has become one of the most modern in the world, with 765 kV, 800 kV high-voltage direct current (HVDC) lines and thousands of phasor measurement units. This infrastructure allowed the interconnection of the entire national territory, ensuring operation at a single frequency and voltage, with no records of major interruptions since the unification.

In distribution, however, the reality is more complex, with 73 companies ranging from large concessionaires, with up to 40 million customers, to small state distributors with less than 1 million consumers. Most still belong to state governments, and the privatization process is advancing slowly due to political and union resistance. One example mentioned was the state of Uttar Pradesh, where it is planned to split a company of 18 million customers into five distributors, which could be privatized. If successful, this experience could pave the way for other similar initiatives in the country.

The major challenge pointed out is the financial imbalance of state-owned distributors, which buy energy at an average cost of more than five rupees per kWh and are able to pass on tariffs of less than four rupees, accumulating significant annual losses. Often, state governments inject resources to cover losses, but unsustainability remains. In this context, the smart metering program has gained prominence: approximately three trillion rupees have been allocated by the Indian government to subsidize the large-scale deployment of smart meters. The initial plan called for 250 million meters, but the target is expected to exceed 350 million due to urban growth and the construction of new buildings.

The report also emphasized that, despite not receiving direct funding from the government, the Forum works closely with regulators, utilities and policymakers, introducing new technologies and testing solutions in pilot projects, such as vehicle-to-grid (V2G) and unified power interfaces. The publication of *White Papers* is a recurring practice, often considered by the public administration. As an example, a recent study on safety risks in solar inverters imported from China, which contained unspecified communication components, capable of being activated remotely, was cited. The alert prompted the Ministry of New and Renewable Energy to impose strict safety standards, mandating that data from new inverters be directed to Indian servers in compliance with IEEE standards.

Another highlight was the smart grids manual developed for regulators and policymakers, considered an important reference to sensitize decision-makers about the need to adopt new technologies and operational practices in the face of the rapid transformation of electricity grids.

Next, Maria Tereza presented the debater with an additional question about the main factors driving the transformation of networks in India and whether there were specific public stimulus policies. The response clarified that there are no direct incentives, but the AMISP (*Automatic Metering Infrastructure Service Provider*) program, which establishes the replacement of infrastructure in all distributors in the country. In this model, large companies invest in modernization, especially in smart meters, and are remunerated over ten years, through the revenue generated. This arrangement has been discussed as a possible reference for other countries, including Brazil, given the difficulty of financing the renovation of the entire electrical infrastructure alone.

At the end of the session, the mediator thanked the participants for their contributions, highlighted the relevance of the reflections presented and closed the debate, inviting those present to continue for the lunch break.

9. Leaders' Panel: Business Transformation and Post-Concession Renewal Investments – Part 1

Speakers:

- Rodrigo Campos Sousa, Digital and Innovation Manager at Equatorial Energia
- Felipe Tenório, Superintendent of Distribution Regulation at LIGHT
- Sávio Ricardo Muniz Aires da Costa, Corporate Manager of Automation and Telecommunications at Energisa Group
- Sergio Milani, Superintendent of Special Projects, Copel

Moderator: Cyro Vicente Boccuzzi, President of ECOEE and the Latin American Smart Grid Forum



Rodrigo Campos Souza, Digital and Innovation manager at Equatorial Energia, began his participation by thanking the invitation and highlighting that it was the first time he had attended the Forum. He stressed the relevance of the event, especially because many of the discussions presented dialogue directly with initiatives already underway in the Equatorial Group. As he explained, the preparation for the current moment of renewal of concessions and transformation of the sector began about three to four years ago, in an internal movement intensified shortly after the pandemic.

The executive described the Equatorial Group as a multi-utility holding company, operating not only in energy distribution, but also in transmission, generation, sanitation,

telecommunications and services. In the energy segment, the company serves 28% of the national territory, representing approximately 15% of the total Brazilian customers and 11% of the energy consumed in the country. Its growth trajectory has been marked by acquisitions, which means that the distributors under its control are in different stages of modernization. Some, such as Goiás and Rio Grande do Sul, are still going through roll-out processes of base systems, while others are already advancing in digital transformation projects.

Souza emphasized that, when analyzing the future challenges, the company identified two strategic horizons: the search for greater efficiency in asset management and the preparation for an eventual performance as a trader, given the prospect of complete market opening. Regardless of how regulation will evolve, he pointed out that operational efficiency is an essential condition, both to reduce risks and costs and to increase customer satisfaction. In this process, the company began to adopt a vision of the central customer, considering him no longer as a captive, but as a free agent, whose loyalty will depend on the quality of service and the experience offered.

Based on this repositioning, the Equatorial Group structured a transformation radar divided into four axes: customer centricity and omnichannel; network modernization and asset management; digitization and data intelligence; and operational excellence. To boost these objectives, an Institute of Science and Technology (ICT) was created, installed in a historic mansion in São Luís do Maranhão, transformed into a coworking and innovation environment, in addition to partnerships with other research centers.

On the customer relationship front, the **Equatorial One** project stood out, focused on artificial intelligence and robotization, with the creation of the virtual assistant Clara, which has already performed more than three million digital services, including support in Libras. Other initiatives include the new virtual self-service agency, omnichannel platforms such as Genesys, and real-time customer experience observability systems, measuring satisfaction and NPS.

In the network modernization axis, the micro networks project, started in 2023 at the Alcântara Launch Center, in Maranhão, was presented. With a capacity of 1 MW, the solution ensures stable and independent supply at critical moments of rocket launch. The initiative was expanded to the Anápolis air base, focused on air defense operations, and is expected to be completed in 2027. Another highlight is the **Atlas project**, focused on optimizing the operation of the distribution network with distributed generation, in partnership with Schneider.

In the area of digitization and data intelligence, the **Smart Collection** was described, which uses artificial intelligence to personalize collection strategies and has already generated a return of more than R\$ 40 million in two years. The **Rally Project**, in turn, covers seven fronts of digitalization of energy recovery and field services. GPS, using satellite images combined with AI algorithms, identifies unregistered buildings and structures, making it possible to regularize clandestine connections; in 2024 alone, almost 3 thousand cases have already been regularized, with the potential to reach 290 thousand.



Among other initiatives, **Virtus**, which creates digital twins of substations for safe training of teams; **Cash Hub**, which identifies new fundraising opportunities; and **Mind**, dedicated to data governance and support for artificial intelligence algorithms, were mentioned. In the field of operation, the Cronos project was highlighted, for the implementation of ADMS systems in all the group's distributors by 2027, already in operation in two concessionaires, with significant results in the reduction of DEC. **SIGA**, aimed at automating the dispatch of teams, reduced the average service time by about 15% and increased the productivity of field teams by 10%.

Souza also mentioned the company's response to climate disasters, citing the flood that hit Equatorial's headquarters in Rio Grande do Sul in 2023, forcing the rapid mobilization of the operations center in just five days. Based on this experience, a risk plan for environmental catastrophes was developed, with algorithms capable of predicting team mobilization and recovery deadlines. Another project, in partnership with IBM, applies artificial intelligence to reduce the points of contact between trees and the power grid by up to 14%.

On the predictive maintenance front, **SINAPSE** uses AI for advanced monitoring, while a new distributed energy resource management project will be tested in Maranhão, evaluating the impact of integrating emerging technologies into the grid.

In his conclusion, Rodrigo Campos Souza pointed out that the Equatorial Group has invested in structuring and experimental projects that position the company consistently in the face of transformations in the sector. Customer centricity, infrastructure modernization, digitalization, and the search for operational excellence form the core of this strategy, which seeks to prepare the company for the challenges of market opening, energy transition, and new social demands.



Felipe Tenorio, Superintendent of Distribution Regulation at LIGHT, began his participation by thanking the invitation and highlighting the long partnership maintained with the Forum. Unlike other speakers, he announced that he would bring to the debate a **more focused look at the role of regulation and the challenges related to the investments necessary for the modernization of the electricity sector.**

The exhibitor briefly introduced the company. For 120 years, Light has been distributing energy to the metropolitan region of Rio de Janeiro, serving 31 municipalities and approximately 12 million inhabitants, equivalent to 4 million consumer units. The concession accounts for approximately 73% of the state's total energy consumption. Among the most relevant assets, the company has one of the largest underground networks in the world — the largest in Latin America — with about 6 thousand kilometers in length. In terms of performance, Light currently boasts the best FEC (Equivalent Interruption Frequency per Consumer Unit) index in Brazil and ranks fourth nationally in the DEC (Equivalent Interruption Duration per Consumer Unit).

According to Tenorio, **perhaps the need to advance in the implementation of smart grids and in the modernization of distribution has never been so evident.** Among the factors that make this movement inevitable, he highlighted **climate change**, which requires **resilience not only from the grids, but also from the operations of the concessionaires**; technological evolution, which increases the demand for energy and brings with it new arrangements, such as batteries and distributed generation; and, above all, the transformation of the **consumer, who has become more empowered and has started to**

demand higher quality. personalization and diversity of services, in line with its experience in other sectors of the economy.

The superintendent related these trends to recent discussions on the renewal of distribution concessions. He recalled a statement by Minister Alexandre Silveira, to CNN Brasil, according to which the new contractual cycle foresees investments of around R\$ 120 billion by 2030, only in the first five years. **To illustrate the magnitude of this volume, he compared it with the net remuneration base of the electricity sector**, currently at R\$ 207 billion: in just five years, **new investments would represent about 60% of this amount.**

However, Tenorio warned that there is a **central obstacle to the feasibility of these contributions: the tariff structure**. Presenting data from Abradee on the evolution of the average residential tariff between 2010 and 2024, he highlighted that **the portion of the tariff allocated to the remuneration of distribution was the one that grew the least in the period, reflecting the rigor of the regulation for efficiency applied in Brazil**. In contrast, **sectoral charges — mainly subsidies — increased by 236%, becoming the main factor of tariff pressure, followed by the cost of purchasing energy (146%) and transmission (98%)**. Inflation in the period was 122%, below the pace of growth in charges. For Tenorio, **this data reveals the strength of regulation in promoting the efficiency of distributors, but also shows that the expansion of subsidies is the main obstacle to low tariffs.**

Currently, approximately **16% of the country's average tariff is committed to subsidies**, a proportion that has grown from the 13.8% recorded in 2023 and tends to increase, since most of the parliamentary amendments to provisional measures 1,300 and 1,304 seek to maintain or expand these benefits. In Tenorio's assessment, **this is the biggest challenge for the effective implementation of smart grids and new investments in networks, as there is no room for the tariff to simultaneously absorb growing subsidies and large-scale contributions.**

The case of Rio de Janeiro was presented as a concrete example of the urgency of this dilemma. The modernization of the network is necessary to serve the entire population, including the most vulnerable, which also demands quality and reliability, but which is unable to withstand significant tariff increases. For the executive, **this demonstrates that the technological transition of the sector inevitably involves the modernization of the Brazilian institutional model.**

Felipe Tenorio argued that **regulation needs to evolve to create clear and objective signals that encourage investments in smart grids**. Today, according to him, the regulatory structure does not directly favor this type of application, which reduces the interest of distributors. At the same time, it is essential to advance in the political debate on the rationalization of subsidies, because, without this adjustment, it will not be possible to recover the investments necessary for the modernization of the sector in the tariff.

He concluded by **reinforcing the importance that the results of forums like this go beyond the technical space and are taken to the National Congress, influencing the regulatory and legislative debate.** For the speaker, only in this way will it be feasible to reconcile the needs of adaptation to climate change, consumer satisfaction and the incorporation of new technologies with the economic sustainability of distributors and low tariffs.



Sávio Ricardo Muniz Aires da Costa, Corporate Manager of Automation and Telecommunications at Energisa Group, began his participation by highlighting that, like Light, Energisa is a century-old company that today presents itself as a broad, diversified and changing energy ecosystem. The group has nine distribution concessions spread across Brazil, 13 transmission concessions, four generation projects associated with these concessions and has been expanding its operations on different fronts. In addition to traditional operations, it has a fintech focused on commercialization and financial services, Reenergisa, dedicated to value-added solutions, and participates in distributed generation with 117 photovoltaic plants. The diversification also includes the companies Essigás and Norgás, responsible for the distribution of natural gas in five states — Espírito Santo and four in the Northeast — and Agrique, focused on the production of biomethane.

Introducing the topic of digital transformation, the executive pointed out that the generation of value from data has become central to the sector's agenda, often associated with the hype of artificial intelligence. He stressed that, **although artificial intelligence brings great expectations, in many cases it is not yet mature to respond in a practical way to all**

the demands of the sector, which requires caution and pragmatism in its application. In this context, he explained that **Energisa has structured a three- to four-year transformation roadmap, considering capacity planning, regulatory changes and enabling technologies**, such as advanced data management, artificial intelligence and digital solutions.

This transformation was organized into four main journeys: **customer experience, efficiency and performance in the field, the modernization of the operation, and the adoption of a data-driven culture**. In customer service, the company developed the **GizaBrain platform**, designed as an **integrated "brain" to unify data and personalize solutions**. This initiative seeks to reconcile different fronts of the group's activities — from energy distribution and revenue protection to the sale of new services and integration with newly created companies, such as Cigás. The platform connects **central systems to internal and external channels, using artificial intelligence agents to support faster, more assertive, and consistent decisions, transforming the way customers relate to each other**.

During the field journey, **innovative initiatives were presented to overcome infrastructure limitations in remote areas**, particularly in regions such as Mato Grosso, characterized by **low or non-existent communication coverage**. In this scenario, the **Connected Fleet** emerges, a solution based on vehicles equipped with **UHF mobile antennas associated with low-orbit satellite technology, such as Starlink**. This innovation, a pioneer in the sector, **creates a mesh network between vehicles, allowing them to function as mobile agencies in places where there is no coverage, ensuring communication and dispatch of work orders directly in the field**. In the first six months of operation, **this solution provided a 21% reduction in the average travel time and a 14% reduction in the average execution time of service orders, even with only 41 vehicles equipped from a fleet of 300 units in Mato Grosso**.

Another field initiative involves **the use of drones for network inspection, increasing operational efficiency**. In environments where the grid infrastructure is consolidated, Energisa sought to face the challenge of increasing resilience without relying on large investments in redundancies. **Based on data analysis, it was possible to identify hidden problems that compromised automation, such as maintenance failures in automated equipment**. In Mato Grosso, for example, among more than 700 reclosers, hundreds of maintenance actions proved necessary, many of them related to basic items such as batteries, antennas and upgrades. **The correction of these failures resulted in an increase in the assertiveness of the commands from 75% to 93%, generating significant gains without the need for high investments**.

In the field of operation, the group has been promoting the implementation of a new integrated ADMS platform, which brings together EMS, SCADA and DMS. The project was divided into phases: three SCADAs have already been delivered in Mato Grosso do Sul, Minas Gerais and in the South-Southeast region (West of São Paulo). In September 2024, the start of the first EMS in Mato Grosso do Sul is planned, consolidating the basis for the group's new operating model. Among the associated innovations, Sávio highlighted

the implementation of digital twins, already used in substations. The first experiment, in partnership with Siemens, reduced TAF-related costs by 15%, TAF-related costs by 25%

The data-driven pillar supports all these transformation fronts. To organize and take advantage of the growing mass of data, the **Energisa Data Platform** was created, focusing on governance, security and integration of information from critical systems such as SCADA and EMS. The company recognizes that **it is not possible to talk about data without considering cybersecurity**, especially in the face of the advancement of cloud solutions. Therefore, **35% of investments in this area have been directed to the protection of infrastructure, while more than 50% of the sector's concerns fall on the risks of vulnerabilities in the electricity grid.**

Sávio also highlighted the importance of **standardization and governance of artificial intelligence within the group**, emphasizing that digital transformation is, above all, driven by people. In this sense, he mentioned the **Rio Pomba Vale project**, in Cataguases (MG), aimed at training professionals in new digital and cybersecurity skills, filling training gaps that the market currently cannot meet alone.

In conclusion, he emphasized that Energisa's transformation is based on the ability to generate value from data, combining governance, technological innovation and people development. The initiatives presented — from the Connected Fleet to GizaBrain, through operational modernization and digital twins — exemplify how the group seeks to consolidate efficiency, resilience and quality in service, preparing for the challenges of digitalization of the Brazilian electricity sector.



Sergio Milani, Superintendent of Special Projects at Copel, began his presentation by highlighting the reach and relevance of the company, which today serves 99% of the municipalities in the state of Paraná, with a total of 5.3 million consumers, distributed in 403 substations. **Copel has more than 12 thousand employees, including its own and outsourced workforce, and operates in a concession area that exceeds 194 thousand kilometers, with more than 216 thousand kilometers of distribution lines, making it the fourth largest distributor in Brazil.**

When addressing the challenges of the sector and the investments made, Milani stressed that Copel **has been promoting significant contributions to the digital transformation and modernization of the operation.** The company's annual investment history shows **a record forecast for 2025, with R\$ 2.5 billion directed to the distributor, even in a year that ends the tariff review cycle.** These investments are **focused on customer experience, electrification, behind-the-meter equipment management and the implementation of innovative smart grid solutions, demonstrating the company's strategic vision.**

The **central highlight of the presentation was Copel's smart meter project, considered the largest in Latin America.** By the end of 2025, the company intends to reach about **2 million installed units, out of the 5.3 million consumer units served.** The project, which began in 2019 with a pilot phase, has evolved through multiple stages and **currently has approximately 85% of its execution completed.** The installation logistics are **complex, especially in the rural region of Paraná, requiring adapted communication**

solutions and innovative strategies, such as **the use of its own radio networks, which currently have more than 15 thousand radios installed.**

The **benefits of this transformation are significant for consumers, who now have access to detailed information on daily and monthly consumption, revenue estimates, comparisons with neighborhoods and history of the last six months.** In addition, **smart meters allow Copel to predict power failures and optimize the deployment of field teams,** avoiding unproductive visits and promoting operational savings and reducing environmental impact.

Milani also detailed the implementation of more than 24,000 automation equipment and 1,200 links with self-healing, responsible for improving the resilience of the network and reducing indicators such as DEC and FEC. He **highlighted the importance of using advanced digital technologies, such as ADMS, MDM, and RPA, integrated into the smart meter management platform, allowing for automation, remote monitoring, and process optimization.** The Clique project, for example, aims to replace Copel's entire ticketing and service system, while Workforce Management initiatives monitor and support the installation of meters in the field.

Another strategic point addressed was **the creation of its own communication network, using optical fibers in OPGW cars, with estimated savings of R\$ 20 million annually in relation to the contracting of links from external operators.** In parallel, **all 403 of Copel's substations are receiving edge protection elements against cyber attacks,** reinforcing the security of critical systems.

In terms of power quality, **Milani emphasized the impact of climatic factors, such as wind gusts and lightning strikes, and explained how the integration of smart meters, network sensors, and artificial intelligence makes it possible to predict events and proactively mobilize teams,** keeping DEC and FEC levels within regulatory targets. **In the rural area, the main challenges are vegetation, load imbalances and lightning discharges, while in the urban area, the company has adopted georeferencing and actions with city halls to optimize the management of trees and clean lanes, according to current legislation.**

Milani also addressed the issue of distributed generation, pointing out challenges such as inversion of power flows and overload in the grid, especially in cases of inadequate equipment homologation. He also highlighted **Copel's leadership in infrastructure sharing, responsible for approximately a third of the national revenue in this segment, generating estimated revenue of R\$ 500 million in 2025, of which about 60% impact tariff moderation, providing a significant discount on the tariff for consumers.**

Finally, Milani cited practical infrastructure organization initiatives, such as cable optimizers and the removal of tons of obsolete cables from networks, reinforcing Copel's commitment to operational efficiency, technological innovation, safety, sustainability and continuous improvement of the customer experience.



The final session of the leaders was led by Cyro Vicente Boccuzzi, who organized the dynamic in a ping-pong format of questions and answers, asking for objectivity in the interventions.

The first question was addressed to **Rodrigo**, from Equatorial, about how the company is dealing with the inversion of flow. The executive explained that the company maintains a working group called *Distribuidora do Futuro*, structured in eight squads, one of which is specific to deal with the flow inversion and the impacts of distributed generation. This committee, active for about a year and a half, is already developing studies in partnership with other institutions and has a superintendent dedicated exclusively to the subject. Rodrigo pointed out that, although he has more recently joined the digitalization front, he could connect interested parties to the person directly responsible, Rubens Briseno, if additional technical details were needed.

Next, Cyro presented a question to **Felipe**, from Light, about which tariff model would be appropriate to absorb investments in smart grid. Felipe pointed out that there is no single ideal fare model. The essential, in his view, is that the regulation allows flexibility, so that each distributor can experiment and apply tariffs compatible with the characteristics of its markets. As an example, he cited the projects underway in the *Tariff Sandbox*, including the *Light Controle initiative*, which tests a fixed invoice with *cashback*. He also mentioned that the decree that established the guidelines for the renewal of concessions already provides for the possibility of differentiated tariffs. However, for him, it is necessary to

move beyond the experimental environment of sandboxes and consolidate regulatory permission for differentiated practices. He illustrated the need for this flexibility with the heterogeneous reality of Rio de Janeiro: neighborhoods with contrasting socioeconomic conditions, such as Rocinha and Leblon, cannot be served homogeneously by the same tariff model.

Then, Cyro addressed **Sávio**, from Energisa, asking about the metering plans and smart tariffs, since his previous presentation had emphasized investments in digitalization, but without detailing this topic. Sávio confirmed that the company has a Measurement Master Plan (PDM), developed since 2021 with the support of external consultancies. The plan calls for the execution of a gradual *roll-out* of smart meters by 2035, including MDM-based technology architecture and last-mile solutions. According to the executive, the company has already carried out several homologations and experiments, but now it is at an inflection point: in view of the imminent opening of the market, it is no longer possible to postpone structural decisions. He acknowledged that the regulatory uncertainty has imposed restrictions so far, but defended the need to start investments in advance so that the distributor is prepared when the liberalization process advances.

Finally, Cyro presented a question to **Sérgio Milani**, from Copel, regarding the tariff impact of the AMI project and the almost two million smart meters under implementation. The question, asked by Manuel Messias, also raised concerns about the risks of disallowance by the regulator. Milani said that Brazil is already about 20 years behind in the adoption of smart meters, due to the absence of clear policies and incentives. He pointed out that Copel started a pilot project in 2018, in Ipiranga, without facing regulatory disallowance, and has been progressively expanding since then. He pointed out that other distributors, such as CPFL, are also moving forward with large-scale projects.

According to Milani, the security of the project is based on the prudent nature of the investments and the benefits for both customers and the distributor. He explained that the cost per point implemented by Copel is far below the reference value established by ANEEL's price database, which increases the margin of return in the tariff review cycle. He acknowledged the possibility of disallowance, but considered the risk small in view of cost competitiveness. He added that Copel is already testing differentiated tariffs through sandboxes, including the binomial tariff for low voltage and a specific model for electric vehicles, made possible by the new meters. These experiences seek to show the regulatory agency the feasibility of smart tariffs that bring direct benefits to customers and strengthen the network's preparation for the market opening scheduled for 2027.

Closing the session, Cyro invited the audience to applaud the presenters and called all the speakers to the stage for a joint photo, marking the closing of the first block of the leader panel.

10. Leaders' Panel: Business Transformation and Post-Concession Renewal Investments – Part 2

Speakers:

- Jader Carneiro, Superintendent of Network Digitalization, NEOENERGIA
- Luis Henrique Ferreira Pinto, Vice President of Regulated Operations, CPFL
- Marcos Campos, Managing Director, EDP SP
- Marney Antunes, Vice President of Distribution, CEMIG
- Tarcísio Rosa, President, CELESC

Moderator: Cyro Vicente Boccuzzi



Jader Carneiro, Neoenergia's Network Digitalization Superintendent, began his presentation by highlighting the company's trajectory and strategic positioning in the Brazilian energy scenario. Neoenergia is part of the Iberdrola Group, a Spanish conglomerate with more than 170 years of history and recognized as a global leader in the electricity sector. In Brazil, Neoenergia operates in the four main segments of the electricity sector: distribution, transmission, generation and commercialization of energy.

In the distribution segment, the company serves about 40 million consumers, having a robust and growing asset base. In the broadcast, the significant growth of the project

portfolio since 2018 stands out, with 18 assets, of which 12 have already been completed and others are in progress. In generation, Neoenergia has a diversified portfolio, including renewable sources, such as solar and wind, as well as hydroelectric plants and the Thermo Pernambuco thermoelectric plant, near Recife. In the trading sector, the company sells about 5.5 TW of energy and serves more than 700 thousand mass customers. With a net revenue of approximately R\$ 47 billion and EBITDA of R\$ 12.5 billion, Neoenergia directly employs around 42 thousand employees, 15,500 of whom are its own and the rest are strategic partners.

In corporate terms, the Iberdrola Group holds 53.5% of Neoenergia's shares, Previ owns about 30%, and approximately 16% are in *free float* on the stock exchange. **Among its distributors, Neoenergia is the largest in Brazil in number of customers, with approximately 17 million units served**, a base that grows by about 1.5 million every five years. **In the last five years, the asset base has grown by R\$ 23 billion, with average annual investments in the order of R\$ 4.5 to 5 billion distributed among the company's five concessionaires**, covering five states and the Federal District.

Carneiro pointed out that the Brazilian electricity sector is undergoing profound transformations, motivated both by changes in the consumer profile and by growing regulatory pressures. The modern consumer demands not only continuous power supply, but also predictability, quality, and reliability, considering the immediate impacts of outages such as digital equipment shutdowns and connectivity disruptions. In addition, **customers now play a greater role, using social networks to report problems, influence communities and demand greater agility and efficiency in service.**

Another challenge highlighted was climate resilience. Carneiro noted that extreme weather events, such as prolonged periods of drought followed by heavy rains with strong winds, have become increasingly frequent, requiring electrical infrastructure to be increasingly robust and adaptable. In parallel, **digitalization and distributed generation, including residential solar, electric vehicles, and storage systems, have profoundly transformed the operation of distribution networks, making digitalization a central strategy to address these challenges.**

Neoenergia currently has **83% of its networks digitized, with the goal of reaching 90% by 2030**, supported by **four strategic pillars: automation of medium and low voltage networks, digitalization of substations, operational digitalization and use of artificial intelligence.** All Neoenergia's substation systems are automated, and the company has more than **18 thousand automated reclosers, 6,500 self-healing link schemes, serving 5.7 million customers.** In addition, **1.8 million customers already use AGR technology, which integrates network intelligence and SCADA for automated operational decisions.** In the last mile, all Group A customers have telemetering, complemented by large projects in strategic locations, such as Atibaia, Fernando de Noronha and Brasília, covering approximately 480 thousand customers with centralized metering, essential for loss management and improvement of the consumer experience.

Among the most relevant projects, Carneiro highlighted *Workforce Management*, in partnership with Salesforce, internally called Rota Neo. It is a system for dispatching and prioritizing occurrences for field teams, with the capacity to manage 12 million annual services, implemented in the cloud with an investment of R\$ 109 million. The *rollout* of the system began in February, in Bahia, and continues to be expanded to all distributors of the group. To support the operation, **Neoenergia carried out a complete mapping of the teams and ensures robust connectivity, using both public cellular networks and low-orbit satellite technology, such as Starlink, for about a thousand teams.**

In Brasília, the company implemented its own multi-service LTE network, taking advantage of the release of the 450 MHz band by Anatel. The network aims to integrate automation, voice and network sensor monitoring, with four sites already in operation and planned expansion to full coverage of the Federal District. **Currently, 50 reclosers and five smart meter concentrators already operate in this network, in the context of the Multilink project.**

Carneiro emphasized that Neoenergia invests in the **interoperability and massification of technologies, developing hybrid remote switching solutions**, working with suppliers of chipsets, communication modules and telecommunications, and incorporating this technology into network sensors, smart meters and remote operation systems.

Finally, the executive reinforced that Neoenergia's strategy is not limited to technology: **the training of teams and the reinvention of processes are central to digital transformation and the improvement of the customer experience.** Regulatory alignment, the predictability of the concession model, and the commitment to ESG are also key to ensuring the attractiveness of investments and the continuity of a reliable, safe, and efficient service for millions of Brazilian consumers.



The Managing Director of EDP São Paulo, **Marcos Campos**, presented a **comprehensive view of the company's direction in relation to future investments in the electricity sector in Brazil**. He began by thanking the opportunity to participate in the forum, highlighting the relevance of the event for the strategic debate of the sector. He stressed that energy is one of the fundamental pillars of national infrastructure, along with highways and other essential sectors, and is therefore a decisive element for the country's economic and sustainable growth.

Before dealing specifically with EDP's investment strategy, **the executive proposed a reflection on structuring policies and the influence of national culture on decision-making and planning processes**. He pointed out that different countries have different time orientations: while **nations such as Japan and China have a strong long-term vision, favoring planning and sustained growth**, countries such as Brazil and the United States tend to prioritize immediate results. **This cultural difference, according to him, directly impacts the way Brazilian managers structure long-term investments, often making it difficult to consolidate robust projects** without compromising the financial sustainability of companies and without passing on excessive costs to consumers.

In this context, **Campos brought the example of Japan, which in 2021 had already achieved practically 100% telemetering, with integrated smart meters and efficient communication, allowing for greater planning and resilience of the system**. The country has also implemented redundancy measures in high and medium voltage networks,

switching systems, and disaster prevention funds, demonstrating maturity in preparing for critical scenarios. On the other hand, he pointed out that Brazil still faces cultural and structural challenges, which need to be overcome to ensure the evolution of the sector.

Moving on to the reality of EDP, the director highlighted the main current challenges: **the increase in climate severity, which requires greater resilience from the networks; the empowerment of stakeholders, with customers and public authorities increasingly demanding; the need for efficiency in the face of pressure for quarterly results; and the energy transition, which accelerates exponentially, driven by distributed generation and other innovations.** To face this scenario, EDP doubled its investments between the 2019–2021 and 2022–2024 trienniums, from R\$ 1.2 billion to R\$ 2.4 billion in São Paulo, in addition to similar investments in Espírito Santo.

The resources have been applied in **three fundamental axes: automation, telecommunications and network expansion.** In automation, the company has increased the number of reclosers by more than 150% since 2020, achieving significant system modernization. This advance was accompanied by the robustness of the telecommunications infrastructure, which reached 97% effectiveness in communication, which is essential for operational efficiency. As for expansion, EDP has been building about two new substations per year in São Paulo and Espírito Santo, strengthening the network's redundancy and resilience capacity.

The executive also highlighted investments in **cybersecurity**, especially after the experience of an attack suffered in Portugal in 2020, which led to the **creation of a modern security operations center (SOC), with strong integration between IT and OT areas.** In addition, the company is implementing an **advanced grid management system (ADMS)**, expected to start operating in 2026, to handle new energy flows, decentralized generation and dynamic pricing.

Looking to the future, Campos emphasized three major trends: **digitalization, resilience and energy transition.** With the opening of the market and increasing digitalization, **new challenges arise related to transparency, availability of real-time data and empowerment of the consumer, who will start to make decisions based on clear and economical tariff signals.** This transformation will require **structural changes in processes, systems, and people, as well as strengthening customer centricity as a strategic factor,** going beyond mere regulatory compliance.

To enable the sustainable adoption of the digital model, EDP's strategy is based on three pillars: **technology, regulation and processes.** In the technological field, **interoperability** to avoid *lock-in* with suppliers, **cybersecurity, big data management and predictive analytics**, as well as the **expansion of IT and Telecom infrastructure** to support massive scale stand out. In the regulatory aspect, the company defends the **construction of a stable, predictable and economically viable regulatory environment**, emphasizing the importance of sectoral forums for discussion and alignment. In **the field of processes, the priority is organizational redesign**, systems integration, and change management, with

teams dedicated to three fronts: core business operation, adoption of technologies already tested in the market, and prospecting for disruptive innovations for the future.

In terms of projected investments, EDP announced the allocation of **R\$ 10 billion by 2030**, of which R\$ 5 billion in São Paulo and R\$ 5 billion in Espírito Santo. These resources aim to consolidate the digitalization of networks, increase the resilience and reliability of the system, and advance the energy transition with the integration of decentralized generation and battery storage.

Finally, **Campos** highlighted that the success of this trajectory depends on the engagement of the entire ecosystem: regulators, academic institutions, suppliers, companies and civil society. He defended the creation of laboratories, partnerships and collaborative environments capable of accelerating innovation and strengthening the competitiveness of the sector. He also stressed the importance of a clear regulatory signal, capable of guiding investments and ensuring predictability.

He concluded by stating that EDP will maintain investments with intensity, but in a structured, responsible and future-oriented manner, reaffirming its commitment to digital transformation, network resilience and customer centricity as fundamental axes for the sustainable development of the Brazilian electricity sector.



Luis Henrique Ferreira Pinto, Vice President of Regulated Operations, began his speech by thanking the invitation and greeting his colleagues present, announcing that he would

share CPFL's experience in the field of digitalization, with emphasis on smart *metering*. He reinforced that **he had just returned from China, after two weeks of technical visits, where he was able to closely observe the large-scale application of these technologies, bringing concrete examples to the Brazilian reality.**

The executive contextualized the relevance of the **CPFL Group**, one of the largest players in the national electricity sector and leader in renewable energy generation, with more than 95% of its matrix in this category. He pointed out that the group's distributors serve highly developed and demanding regions, such as São Paulo and Rio Grande do Sul, in addition to highlighting the connection with **State Grid**, the largest energy company in the world, responsible for serving more than 1.1 billion customers in China. This reference served to underline the long-term vision and stability that characterizes Asian investments, something that, according to him, should be more valued in Brazil.

Ferreira explained that CPFL's distributors serve more than 24 million people in 11 Brazilian states, covering both generation and transmission and services. In the distribution segment, the group has four concessionaires — three in São Paulo and one in Rio Grande do Sul — covering an area of 301 thousand km², with 346 thousand km of networks and almost 700 municipalities. This universe represents about 37% of the national GDP, including highly industrialized regions, agricultural centers of high productivity, universities and research centers. In this scenario, the consumer is described as highly participative and demanding, which imposes constant challenges on distributors.

With average annual investments of R\$ 4 billion in the last seven years, CPFL has become a reference in **network automation and digitalization**. Ferreira highlighted the implementation of **ADMS** in all the group's distributors, allowing the integrated operation of the concessions. This advance proved crucial, for example, in times of crisis in Rio Grande do Sul, when the teams in São Paulo were able to support the local operation simply by changing the communication channel with the control center, operating all systems on a unified platform.

Next, the executive highlighted the main **structural challenges of the distribution sector**, including: **the renewal of concession contracts, now more demanding in terms of service quality; the need for regulatory and legal stability to enable long-term investments; and the imminent opening of the market, which will require the creation of more sophisticated tariffs. such as the binomial tariff and smart models.** According to him, **none of this will be effective without the massive adoption of smart metering, a central piece for modernization.**

When recovering CPFL's trajectory on this topic, Ferreira recalled that the journey began more than 15 years ago, in 2010, when the company decided to implement smart meters in **Group A** (high voltage), even in an unfavorable regulatory scenario. Using mesh networks, the company was able to consolidate this model, which **today covers 100% of Group A consumers in all distributors, including RGE, in Rio Grande do Sul, after the acquisition and integration of AES Sul.** This learning led to the expansion to **Group B** (low voltage), initially through a proof of concept in a city in São Paulo that reflected the

diversity of the customer base. In it, four different communication technologies were tested, in search of the most efficient and adherent to real operating conditions.

Ferreira pointed out that **the main obstacles have always been in regulation**. For years, ANEEL **paid electromechanical meters more favorably than smart ones, discouraging investment in innovation**. To get around this, CPFL **proposed an intercycle tariff recognition model, which would avoid delays of up to five years in the recovery of the investment – considering that the useful life of a smart meter is 13 years**. As a practical solution, the company used the fact that it had four distributors with tariff revisions at different times, starting *rollouts* where there was greater regulatory proximity.

Once the initial barriers were overcome, CPFL began the large-scale expansion to Group B, with the **goal of installing 1.6 million meters in 59 cities in São Paulo**, in stages of 500 thousand units per year. Ferreira highlighted the importance of **interoperability**, achieved with three manufacturers, which reduced costs and avoided dependence on single suppliers. A model with a **single MDC** and proprietary mesh network was also chosen, ensuring greater control over the data.

Among the **benefits of smart metering**, the executive cited: **greater convenience to the customer, elimination of face-to-face readings and cut/reconnect displacements, agility in billing, autonomy to the consumer, meters prepared for distributed generation and reduction of commercial losses**. He highlighted, however, that **projects of this scale require efficient communication with society**, in order to clarify objectives and benefits from the beginning.

Recounting his recent visit to **China's Jiangsu province**, Ferreira described the large-scale operation he witnessed, **with cities of up to 10 million people operating in a fully automated manner**. In these systems, **the combination of smart meters with artificial intelligence allows automatic network reconfiguration, demand management via microgrids, dynamic tariff incentives, and real-time communication with the consumer**, who is informed about occurrences and reestablishments without the need to call *centers*. In addition, the Chinese **have practically eliminated commercial losses**, leaving only technical losses, which are monitored and reduced through accurate measurements — something that, in Brazil, is still a major challenge due to the difficulty of statistically separating technical losses from non-technical losses.

Ferreira concluded by reinforcing that **modern infrastructure** is the most valuable asset of a society and that, without it, there is no development. He argued that, in order to make this modernization viable, **it is essential to create mechanisms to encourage investment, ensure fair tariffs, eliminate inadequate subsidies and promote regulation in line with technological evolution**. He ended by stating that the journey initiated by CPFL should be seen as an example of a necessary transition for Brazil, inspired by the experiences already consolidated in countries such as China.



Marney Antunes, Vice President of Distribution at **CEMIG**, pointed out that the company occupies a differentiated position in relation to other distributors in the electricity sector, similar to that of Copel, as it has already had its concession renewed, valid from 2015 to 2045. However, he emphasized that this condition does not allow for accommodation, since the changes that affect the distributors that are in the process of renewal will also impact CEMIG, making it necessary to maintain investments and management practices in line with the new regulatory requirements.

Antunes pointed out that it is not possible to have separate regulation between companies and, therefore, it is essential that CEMIG is prepared, investing and acting continuously and consistently. The company has a network of 500 thousand kilometers of medium voltage, 400 thousand kilometers of which are in the rural area, of which 300 thousand are single-phase, representing a significant challenge to maintain the quality of the energy supply due to the imbalance.

In terms of investments, in 2019 CEMIG allocated 5% of the total invested by other companies in the sector. Currently, this percentage has been increased to 13%, reflecting the intensification of its investment program, even if it started late. **In the regulatory cycle from 2023 to 2027, the company plans to invest R\$ 21 billion in distribution, with R\$ 4.3 billion expected for 2024 and R\$ 4.7 billion for the current year.** According to Antunes, **the biggest challenge has not been the acquisition of materials or suppliers, but the availability of labor**, a problem partially mitigated by partnerships with the Army, training citizen soldiers to support local contractors.

Among CEMIG's main initiatives, **investments in grid resilience and technological modernization stand out**. The company is building 200 new substations, of which 130 have already been energized, and implementing the Minas Three-Phase program, covering 30 thousand kilometers, inspired by Copel's experiences. In the current cycle, **1,485,000 smart meters are planned, with 400,000 already installed**, in addition to an energy regularization program for 240,000 families that were clandestinely connected. **The automation of the network includes the installation of 16 thousand reclosers, completing 40 thousand in operation.**

Antunes also highlighted the experience with the municipality of Serra da Saudade, the smallest in Brazil, which faced power interruptions of up to three days. To solve this, **CEMIG implemented local microgrids with solar generation and battery storage, ensuring autonomy of 48 hours and reducing costs compared to the traditional dual-power installation, from R\$ 12 million to R\$ 8.5 million. This model will be replicated in 25 additional municipalities**, minimizing reliance on skilled labor and **accelerating the improvement of grid resilience.**

Finally, Antunes commented on the PKDEC indicator (DEC by Set), criticizing the current tariff uniformity that does not consider regional differences in the frequency and duration of interruptions, such as in the metropolitan region compared to more remote areas. He highlighted the need for the company to act to improve these indicators and adapt to the new rules of the sector, ensuring efficiency, quality and fairness in the supply of electricity.



Tarcísio Rosa, President of CELESC, began his presentation by highlighting CELESC's main innovations and projects, emphasizing that he would not go into complex technical details, but that **the advances already made and in progress demonstrate the company's modernization and preparation for the current challenges of the electricity sector.**

The first highlight was the **digital transformation of the billing and customer service system, fully operated through mobile devices. All CELESC commercial services — from new calls and changes of ownership to consumer consultations — can be performed exclusively by cell phone.** This large-scale project required intense effort from the team, which faced significant difficulties during implementation, but managed to complete it successfully. Rosa stressed the importance of the experience acquired by the team, considering it a reference for other distributors, and mentioned the appreciation of the professionals involved in the project, due to the complexity and specialized technical knowledge accumulated.

Another relevant advance was the implementation of systems for asset management and monitoring. The ADMS (*Advanced Distribution Management System*) is in the final phase, allowing the command and operation of all substations from Florianópolis, while the WFM (Workforce Management) organizes and optimizes the company's workforce. Both systems are expected to be fully operational within two years, promoting greater efficiency and control over the operation of the power grid.

Rosa also highlighted **the expansion of infrastructure for electric vehicles in Santa Catarina, with the installation of charging stations in 100 cities by the end of the year, ensuring a maximum distance of 50 kilometers between charging points.** This initiative seeks to support electric mobility and anticipate the growing demand for electric cars in the state.

One of the most critical challenges mentioned was the management of distributed generation and the reverse flow of energy, a result of the rapid growth of photovoltaic sources. The president pointed out that, until recently, the insertion of plants in the grid was done without limits, causing significant operational impacts, including phase imbalances, uncalibrated protections, damage to equipment and risks of shutdowns or near-blackouts. **Currently, 45% of the substations in Santa Catarina have reverse flow at some point, and many of them operate above the projected transformation capacity.**

The complexity increases with the multiplicity of small connected generators, such as residential and commercial photovoltaic systems, which result in thousands of consumer units with decentralized energy injection. **The president emphasized that the solution often pointed out — the use of batteries — needs to be properly planned and regulated. Otherwise, the installation of individual batteries by each generator can generate serious operational problems, both during the day and at night, when the accumulated energy is released into the grid.**

Rosa concluded by highlighting the **urgent need for clear regulation that defines responsibilities, control and operation of batteries and distributed generation**. He warned that **the absence of structured rules puts at risk the investments made by consumers and the safe operation of the electricity system**, which may compromise the financial return of investors in distributed generation. The challenge presented is, therefore, to ensure that there is efficient management, centralized control and precise regulation to balance innovation, operational safety and economic viability of the sector.



At the opening of the final round of considerations, moderator Cyro Vicente Boccuzzi invited each panelist to make a brief last intervention, highlighting relevant points from what had already been discussed throughout the panel.

The first to speak was **Jader**, who highlighted the relevance of the provocations presented by Tarcísio about the next ten years and the inversion of flow, a problem that is already significantly present in all distributors, including Neoenergia. He warned that, without an operation designed to deal with this reality, batteries may soon become an additional challenge, requiring a differentiated performance. Jader also highlighted the importance of observing international experiences, citing Spain as an advanced example, in addition to the impact of knowing the current technological stage of China, mentioned by Luiz Henrique. However, he reiterated that in Brazil the big barrier remains the **regulatory issue: how companies will be remunerated for investments and how tariffs can reflect the new services**. He pointed out that **Neoenergia still has concessionaires in significant network expansion, such as in Bahia and Pernambuco, which consumes a good part of the investment capacity and ends up postponing advances in smart metering**. As

long as there is no more direct and attractive tariff signal, investments will remain conditioned.

Next, **Marcos Campos** emphasized two fundamental points: **interoperability** and **cost**. For him, ensuring technological interoperability is essential so that meters and other systems can be used on a large scale, benefiting all companies at a lower cost. **As for the cost, he warned of the need for caution in investments, since Brazil has the sixth most expensive energy tariff in the world, and any wrong decision can aggravate this situation.** He defended that **technological solutions be adopted with the minimum necessary to meet different realities**, including in remote areas, avoiding excessively burdening digitalization.

Next, **Luiz Henrique Ferreira** reinforced that **all the topics discussed** — flow inversion, distributed generation, *smart meters*, smart grids, battery storage — **presuppose a regulation that goes hand in hand with innovation.** However, **in practice, the opposite occurs: technology advances rapidly, while regulation follows behind, trying to correct already established distortions.** For him, this makes subsequent adjustments difficult and weakens the predictability necessary for investments. Luiz Henrique argued that the government and regulators need to establish **clear and anticipated rules**, so that technological adoption does not continue to run over regulatory frameworks.

Next, **Marney** reinforced this criticism of the regulatory lag, bringing concrete examples. He regretted that distributors **are forced to pay compensation to distributed generators** even in absurd situations, **such as interruptions at dawn, when solar plants are inoperative.** He also highlighted efforts to reduce the **DEC perceived** by consumers — from 18 to about 15 hours in three years — by eliminating momentary interruptions. **This effort increases resilience and improves customer perception, but it is not properly recognized in the current compensation model, which raises doubts about the effectiveness of such investments.** For him, **it is essential to adjust the rules, aligning the objectives of the regulator and distributors, in order to correctly reward initiatives that effectively increase the reliability of the network.**

Finally, **Tarcísio** returned to **the topic of drums, highlighting that this will be the next big challenge.** He recalled that, ten years ago, solar panels were much more expensive and, in a decade, distributed generation has expanded to the point of already causing significant cuts – citing a recent episode in which more than 7 thousand MW were cut by the ONS. **According to him, the same will happen with batteries: prices will fall in the next three to four years, and the sector will need to be prepared to deal with this impact.** He emphasized that this is not a vague forecast, but a clear trend, which will require attention and planning to avoid crises similar to those experienced today with distributed generation.

In closing, Cyro Boccuzzi thanked the contributions and highlighted that the objective of the Forum was fully achieved: to identify and propose collective paths based on the competence and experience gathered. He invited those present to honor the panelists with applause and announced that all discussions would be systematized in a **final report** of the

event. Finally, he invited everyone to take a joint photo, before the draw and the official closing of the activities.

11. Awards for Participating Congressmen



The sponsor Bentley kindly raffled off an Alexa device among the participants present, which ended up being raffled contemplating the Congressman Mr. Ednilson Hausen, from the company Eletron.

12. Closing of the 17th. Smart Grid Forum 2025



At the closing ceremony, **Cyro Vicente Boccuzzi** took the floor to express his satisfaction with the success of another edition of the Smart Grid Forum. He highlighted that the event concluded with a flourish, bringing together a qualified audience that not only absorbed knowledge, but also took with them experiences and concrete memories of this annual meeting already consolidated in the sector's calendar.

He began by **thanking all moderators, panelists and speakers for their valuable contributions, which enriched the debates and consolidated the Forum's reputation as a space for outstanding and respected strategic dialogue on the modernization of the electricity sector.** He reinforced his **thanks to the sponsors, recalling that without this support it would not have been possible to hold the event in its current dimension and quality, which were the great enablers of the edition.** Likewise, he thanked the support of the supporting entities, as well as the magazines and press vehicles that gave visibility and promotional support to the Forum.

Cyro recalled the history of the Smart Grid Forum, **emphasizing that since the first edition, 18 years ago, the event has innovated by bringing consumers to the center of the discussion.** He explained that, **from the beginning, the question "who will pay the bill?" made the presence of counselors and user representatives inevitable, ensuring that the consumer's view was integrated into the debates.** He proudly stated that this pioneering choice resulted in **an expressive and constant participation over the years, something fundamental for the construction of consensus and for the dissemination of knowledge.**

Referring to the closed edition, he highlighted the representativeness achieved: **more than 400 professionals present, coming from 24 Brazilian states and the Federal District, covering practically the entire national territory, in addition to participants from 19 countries, which reinforces the international character of the Forum.**

Cyro also dedicated a special thanks to the organization team, emphasizing that **about 90 people were directly involved, including assemblers, firefighters, security guards, cleaning staff, support staff, sound, translation and audiovisual professionals, press office, in addition to the stage and coordination team, led by Alexandra Mauro, who coordinated the operationalization of the event. He made a point of asking for a round of applause for all these professionals, recognizing that the smooth running of the event depended on this collective work.**

In the end, he stressed that **the closing of each edition does not represent the end, but has always marked the beginning of a new stage.** He explained that **all the content discussed — ideas, proposals and considerations raised throughout the panels — will be consolidated into a final report.** This document, as usual, will be sent to the government, the Ministry of Mines and Energy, ANEEL, companies in the sector, legislators and the two houses of the National Congress.

With these words, he conveyed a message of continuity, commitment and collective mobilization, officially closing the event and reinforcing the importance of the Forum as a reference space for the Brazilian and international electricity sector.

13. Final Conclusions and Recommendations



The Smart Grid Forum 2025 reaffirmed its strategic role as a space for convergence between different agents in the Brazilian electricity sector, promoting debates that allowed the identification of advances, gaps and priorities for the coming years. The panels showed that the energy transition requires an integrated vision, involving regulation, technology, financing, governance, and social participation.

It was clear that the **digitalization of electricity grids** is not only inevitable, but an indispensable condition for the modernization of the sector. The implementation of smart meters, automation systems, sensors, and digital analysis platforms must be conducted on an interoperable basis, in order to ensure scale, economic efficiency, and lower costs for consumers and utilities. It was recommended that investments be planned considering regional particularities, in order to balance quality of service and low tariffs.

The debates also highlighted the **mismatch between technological innovation and regulation**. Distributed energy resources, battery storage and new market models have been advancing faster than current regulations. To avoid distortions and legal uncertainty, it was recommended the adoption of proactive regulation, capable of anticipating clear rules, fair remuneration mechanisms, and incentives for flexibility, ensuring stability for investors, companies, and consumers.

In this context, the need to **improve the governance of the electricity sector** emerged as a priority. The multiplicity of bodies and entities – regulators, policymakers, operators, private agents, and consumers – demands greater coordination, clarity of roles, and institutional alignment. More integrated and transparent governance is essential to accelerate decision-making, reduce information asymmetries, and ensure that public policies are consistent and sustainable.

Another recurring point was the pressure exerted by the **inversion of flows and the increasing operational complexity of the networks**. The diffusion of distributed generation, associated with the future expansion of batteries, will require new paradigms of operation and flexibility. International experiences, especially in Europe and Asia, show that this movement requires advance planning and strong articulation between distributors and system operators.

Resilience **and reliability** were also highlighted as priorities. Despite the advances in the reduction of indicators such as the DEC, there remains a need to align regulatory incentives with the quality perceived by consumers and robustness in the face of extreme weather events. It was recommended that quality metrics evolve to incorporate not only the quantity and duration of outages, but also the structural resilience of the system.

In the economic field, an important consensus was the urgency of **reviewing the subsidy structure of the electricity sector**. Many benefits, created in past contexts, are no longer justified or end up distorting the efficient allocation of resources, placing an unequal burden on consumers. A gradual and transparent review process was recommended, with a focus on directing subsidies only to clearly justified social and public interest policies, freeing up space for priority investments in modernization and innovation.

The need for **new financing models and tariff signaling** that encourage investments in strategic technologies without excessively pressuring the final tariff was also highlighted. Mechanisms for attracting private capital, risk sharing and progressive amortization should be considered as instruments of economic viability.

Finally, the relevance of **active consumer participation was reinforced**. Since the first edition of the Forum, the inclusion of counselors and user representatives has proved to be a differential, and in this edition it has been consolidated as an essential element of legitimacy and balance of sectoral decisions. In addition, the geographic and international diversity of the participants showed that Brazil must seek global solutions adapted to its reality, maintaining constant dialogue with international practices, but anchored in its specific conditions.

One of the potential benefits associated with the full implementation of smart grids is the possibility of **modernizing the tariff model applied to consumer units that have their own generation and that, in certain periods, inject surplus energy into the distribution network**.

It is recommended to evaluate the **compulsory adoption of a binomial tariff, composed of energy and demand portions, as the most appropriate mechanism to reflect the costs and benefits associated with the use of the grid by these consumer-generators**. Such a measure would allow a fairer allocation of burdens and encourage efficiency in consumption and generation.

In addition, **this structure could replace the current logic of taxation of injected and subsequently compensated energy, which generates economic distortions and regulatory conflicts**. With the application of the binomial tariff, it would be possible to relieve microgenerations of this treatment, reducing barriers to its development and providing greater predictability and transparency for consumers, distributors and regulators.

Another critical point identified is the **need to eliminate the insecurity of distributors in relation to the recognition, by regulation, of the investments and expenses associated with the implementation of the Smart Grid**. To ensure **predictability and attractiveness of the projects**, it is recommended that ANEEL establish **clear and objective rules**, based on current legislation, ensuring that such contributions are considered as **prudent investments** and that the **corresponding operating costs are duly recognized** in the tariffs.

This measure would provide **greater legal and regulatory certainty to investors**, reduce risks of underinvestment and accelerate the modernization of distribution networks, to the benefit of quality of service and the insertion of new technologies in the electricity sector.

Thus, the Forum's central recommendations can be summarized in five axes:

1. Accelerate the digitalization of networks with a focus on interoperability and efficiency.
2. Anticipate regulation in the face of new technologies and market models.
3. Strengthen the governance of the electricity sector, integrating institutions and decisions.



4. Review and rationalize subsidies, ensuring economic sustainability and tariff justice.
5. Engage consumers and increase the resilience of the system in the face of the challenges of the energy transition.

Based on these principles, **the Forum is committed** to consolidating its contributions in this report, which will be forwarded to the government, regulators, legislators, companies and civil society, **strengthening its role as a space for formulation and structured dialogue for the future of the Brazilian electricity sector.**



Presentations, Complete Photo Report and other materials
and content can be accessed on the event's website:

www.smartgrid.com.br and on the



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