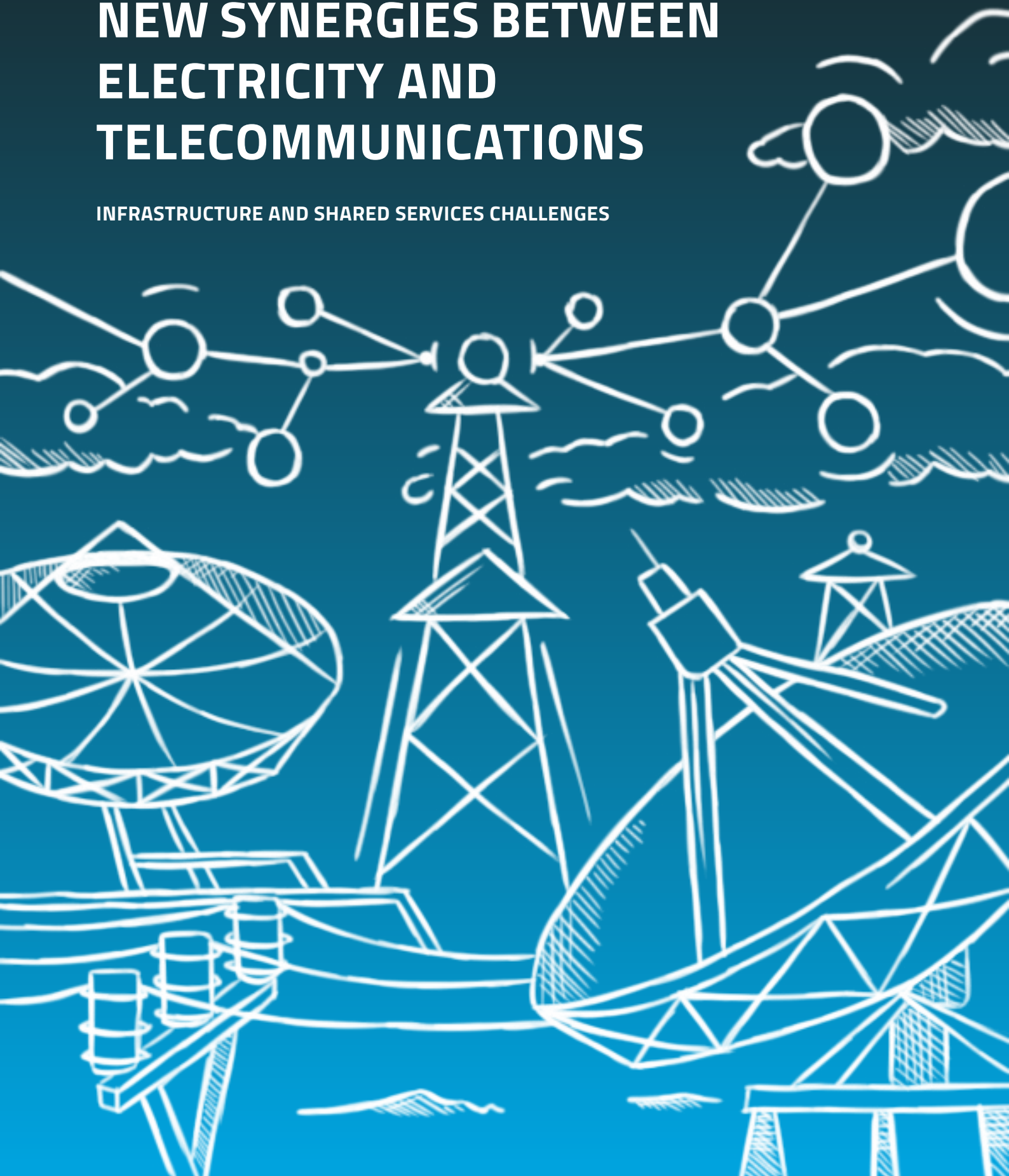
adelat

www.adelat.com

NEW SYNERGIES BETWEEN ELECTRICITY AND TELECOMMUNICATIONS

INFRASTRUCTURE AND SHARED SERVICES CHALLENGES



adelat

AUTHORS AND CONTRIBUTORS

Aldo Pessanha, Alessandra Amaral, Roberto Cajamarca Gómez, Larissa Cunha, Sandra Marcela Quijano López, Claudio Bulacio, Patricio Molina, Hans Rother, Talita Darwiche, Ernesto San Miguel, Fabio Lira, Lucas Noura, Fabiana Susana Passos, Thais Moraes Abadio, Mariana Silva Barreto, Marco Sepulveda, Alejandro Valenzuela, Diego Fernando Echeverri Yepes, Monica Gomez, Romulo Inga, Julio Cesar Lujan Rojas, David Chala.

We thank Átila Branco, CTIO of Fibrasil, for his valuable contribution in reviewing this document

01 INTRODUCTION

Electricity distribution and telecommunications currently play a fundamental role in the functioning of our society and their convergence represents a key opportunity to transform operations, improve access to essential services and promote social and economic development in Latin America.

This relationship takes on even greater significance in the context of the energy transition, as mass electrification, the digitalisation of networks and the deployment of technologies such as fibre optics and 5G, position this integration as a crucial element for taking advantage of the existing synergies between the two sectors, which will allow, on the one hand, enabling the electricity grid for the energy transition and, on the other, helping to close the gap in access to services such as broadband and information technologies, while fostering the resilience and adaptability of infrastructures to future challenges, such as climate change and population growth.

Latin America is beginning to experiment, with increasing strength, the expansion and modernization of the electricity distribution infrastructures and telecommunications networks to incorporate new technologies and solutions, which will go hand in hand with important challenges on efficiency and environmental impact, as well as the need to optimize the available resources. Therefore, it is crucial to explore strategies that allow the development and integration of these systems in an effective, sustainable and organized manner, as this will allow to advance more strongly towards the objectives of the energy transition in the region, the path of sustainable economic development and the improvement of people's quality of life.

This paper aims to analyze the dimensions of this relationship, addressing the opportunities and challenges presented by the integration of both sectors. It explores how smart grids and shared infrastructure can accelerate the adoption of renewable energy, improve operational efficiency, and expand access to basic services in isolated communities. In addition, the critical role of collaboration between these sectors in ensuring the resilience and sustainability of the future energy networks is highlighted.

Finally, this analysis presents a series of proposals in the different dimensions of the challenge of integrating both infrastructures, to advance in an orderly and efficient manner, promoting a framework of collaboration between the different actors involved, including electricity distribution operators, telecommunications companies, regulatory authorities and society.

02

DIMENSIONS OF THE ELECTRICITY DISTRIBUTION AND TELECOMMUNICATIONS INFRASTRUCTURES INTEGRATION

Without being an exhaustive list, we consider it important to address, both from a regulatory and operational point of view, the following dimensions in order to advance in a timely, efficient, safe, orderly integration that generates important benefits for society as a whole.

INFRASTRUCTURE SHARING

The sharing of passive infrastructure (such as poles, pipelines and rights-of-way) between electricity distribution service providers and telecommunications companies facilitates the rapid expansion and evolution of both networks and the improvement in the provision of services of each of them, also reducing total costs, especially in regions where the construction of duplicate infrastructure would be unfeasible or economically inefficient. This model allows electric distribution and telecommunications companies to leverage existing assets to significantly reduce the initial costs of deploying new technologies.

From a technical point of view, sharing involves the development of compatible solutions that allow both sectors to use the same infrastructure without interference. For example, poles must be adapted to support both electrical and fibre optic cables, respecting safety standards and the spaces required to avoid technical problems or risks to workers. In addition, underground pipelines must be designed with additional capacity and accesses that facilitate the maintenance of networks in both sectors and that support future demands and technologies, enabling intelligent, digital, and higher-level sharing, in addition to basic technology.

In the regulatory field, infrastructure sharing agreements require clear and detailed frameworks that define the rights, responsibilities, and obligations of each party involved. This includes the equitable distribution of operating costs, such as maintaining poles, ducts, and other shared assets, as well as costs associated with repairing damage or necessary renovations. In addition, it is essential to establish technical criteria that guarantee the safety and functionality of the infrastructure, such as the maximum load allowed on poles and the appropriate materials for underground ducts.

From an economic perspective, creating standardized rates for asset usage is crucial to avoid conflicts between operators. These rates should be based on transparent cost models that include not only routine maintenance, but also long-term infrastructure amortization. It is essential that there is a clear management process so that each party is aware of the use of the involved fees.

On the other hand, it is critical to address fair access to infrastructure in areas of high demand, ensuring that small businesses and new players can also benefit from shared use.

Finally, regulation should include dispute resolution mechanisms that allow parties to resolve disputes quickly and efficiently, avoiding project delays and ensuring a sustainable cooperation environment. Harmonization between technical and economic frameworks will be key to maximizing the benefits of infrastructure sharing across the region.

In some Latin American countries, regulatory advances have been made to harmonize interests and simplify processes for telecommunications companies to access electricity distribution poles, with facilitation of access to rights of way and underground pipelines. This not only promotes an efficient and sustainable use of shared infrastructure, but also allows for a rapid expansion of internet and broadband services, especially in peripheral and rural areas.

Despite these advances, significant challenges remain. In many cases, the lack of technical standards and the absence of regulatory harmonization generate delays in projects and conflicts between actors. Overcoming these challenges requires not only investment in technology, but also greater cooperation between regulatory authorities and companies to establish common standards that maximize the benefits of shared infrastructure.

However, to maximize these benefits, it is essential to establish clear agreements that regulate aspects such as cost sharing, maintenance, and legal liabilities, avoiding disputes. In addition, it is essential to have harmonized regulatory frameworks that facilitate cross-sectoral collaboration and avoid conflicts over the use of and access to shared infrastructure.

> Without being an exhaustive list, we consider it important to address, both from a regulatory and operational point of view

ENERGY AS A TELECOMMUNICATIONS ENABLER

Access to electricity is an essential prerequisite for the operation of telecommunications networks. The lack of energy in rural or peripheral areas not only limits the possibility of connecting their inhabitants with the rest of the world, but also slows down their economic, social and educational development. Stand-alone solutions make it possible to increase electrification and, at the same time, enable antennas and telecommunications systems, repeaters and other critical infrastructures necessary to guarantee connectivity, offering the opportunity to close gaps in broadband access and move more quickly towards next-generation protocols and networks such as 5G networks. This not only facilitates access to the internet and telephony, but also enhances essential services such as telemedicine, online education, banking and digital government, which are key to sustainable development and the reduction of inequality.

The region has made significant progress in this regard. In Brazil, programs such as “Light for All” have electrified isolated communities, allowing not only to improve living conditions, but also to deploy telecommunications networks that connect previously marginalized communities. In Peru and Colombia, innovative microgrid projects with renewable energies have managed to integrate telecommunications base stations in the Amazon region and other rural areas that are difficult to access, transforming these regions by allowing access to basic services and economic opportunities. In Costa Rica, the combination of clean energy and telecommunications technologies has been key to connecting schools, health centers, and entire communities in remote areas, consolidating a replicable model of integration that can serve as a reference for other countries.

However, a number of technical and economic challenges remain. Some of these solutions require energy storage systems, such as batteries, which still have high costs, especially in areas with low economic resources. On the other hand, electrical infrastructures in remote areas face difficulties in accessing maintenance. In addition, the lack of locally trained technical personnel increases dependence on external personnel, making the operation more expensive. Finally, installing distributed generation systems requires significant upfront investments that are not always available to small communities or local governments.

From a regulatory point of view, it is essential to design regulatory frameworks that promote investment in electrification projects to enable telecommunications, through public and private funds or tax incentives that facilitate the implementation of electrical infrastructure, technical training programs for local personnel for the maintenance and operation of these systems, and collaboration between governments, private sector and multilateral organizations to finance and develop electrification and connectivity projects.

ICTS FOR THE DIGITALISATION OF ELECTRICITY DISTRIBUTION

Information and telecommunications technologies (ICT) are essential for the digitalization and modernization of the electricity sector, allowing the implementation of smart grids that significantly improve the efficiency, sustainability and resilience of the electricity system. These networks, enabled by advanced communication systems, make it easier to collect, transmit and exchange information on consumption, generation and quality in real time, allowing for more accurate, automated and resilient operations in the face of contingencies.

One of the main benefits of smart grids is the ability to manage electricity demand efficiently. The installation of smart meters connected through fiber optic networks allows operators to collect real-time information on electricity consumption at different points in the network to proactively balance the load, avoid interruptions, better manage demand at critical times and offer detailed information to users, encouraging more efficient consumption habits. Likewise, the use of sensors and communication devices to collect energy consumption data in real time will promote energy efficiency and sustainability, allowing users to have better information to make decisions about their consumption and optimize energy use, always safeguarding the security and privacy of the data.

Real-time fault detection and location is another advance that can be driven by high-speed telecommunications systems, such as LTE (Long Term Evolution) networks, fiber optics, and satellite communications. The integration of predictive maintenance is also an advantage, as telecommunications allow the continuous transmission of data from IoT sensors installed in critical assets such as transformers, substations and distribution lines. This information, processed using artificial intelligence algorithms and big data

techniques, makes it possible to identify patterns that predict failures before they occur.

Efficient integration of renewables is another key benefit. Telecom-enabled smart grids allow distributed generation to be synchronized with the main grid in real time. This facilitates a greater penetration of clean energies into the electricity system, guaranteeing the stability and reliability of the supply.

Finally, the development of 5G networks and the expansion of fiber optics represent the future of the modernization of the electrical distribution system. 5G networks offer ultra-low latency and unprecedented ability to connect millions of simultaneous devices. This enables new advanced automation applications, such as remote substation control, automatic overload detection, and instant analysis of large volumes of data. These capabilities not only optimize network management, but also increase resilience to extreme events, such as storms or natural disasters.

An example of how collaboration between the two sectors could also contribute significantly to the acceleration of coverage plans and the improvement in the supply of services provided, with clear impacts on accelerating the energy transition and digitalization, occurs in Peru. A successful experience of synergy is the case of Electrodunas, a Peruvian distributor located in Ica, where the company has 1,400 customers with smart metering connected through 4G, which does not have as many resources as 5G. Both the distributor and the communications company saw an opportunity in the shared use of the infrastructure, so they made an agreement through which Electrodunas uses part of the broadband, even with the possibility of expanding fiber optics, while the telecommunications company uses the distribution infrastructure. In a first stage, they are connecting seven (7) commercial and technical offices, as well as fourteen (14) transformer stations for remote control, with the added value of connecting Ica with Lima. The scope of the second stage of the project proposes to connect large energy customers to migrate to online reading and get out of 4G. In the third stage, the distributor's three thousand (3,000) transformers will be connected to fiber optics to achieve a more accurate monitoring of demand. The last stage will be to connect the home meters of those customers who have contracted the fiber optic service.

03

CHALLENGES FOR INFRASTRUCTURE INTEGRATION

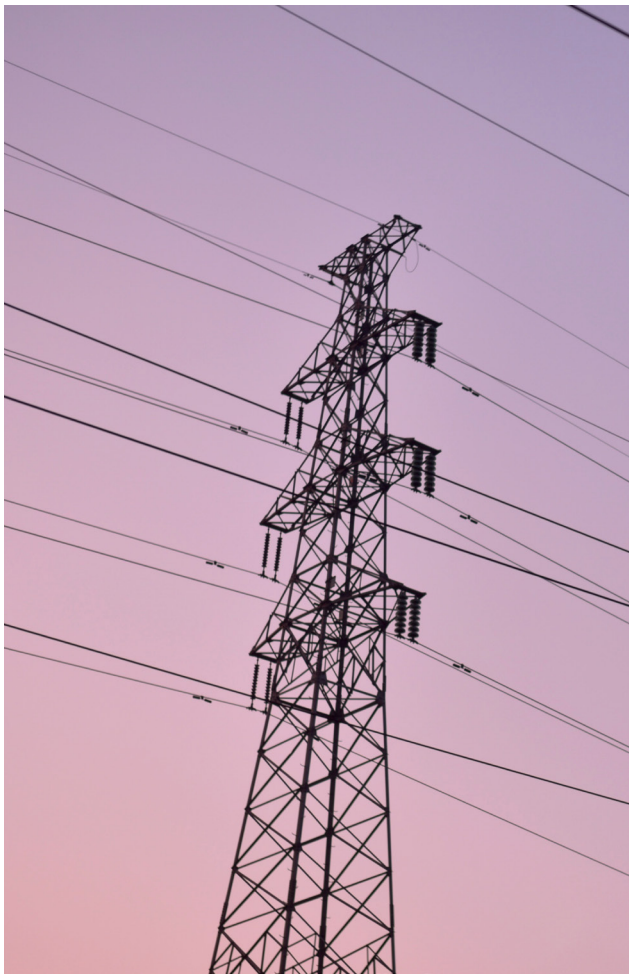
REGULATORY AND JURISDICTIONAL CONFLICTS

The lack of harmonization between the regulatory frameworks of the electricity distribution and telecommunications sectors creates uncertainty and slows down the implementation of joint projects. Differences in priorities, deadlines, and regulations between the two sectors lead to confusion about infrastructure use rights and responsibilities in the event of failures or conflicts. In addition, divergences between national, regional, and local regulations exacerbate the problem, making project planning and execution difficult. This regulatory fragmentation also generates bureaucratic delays, administrative cost overruns, and an unequal distribution of resources, which affects the viability of initiatives that could benefit both sectors and the communities that depend on these services.

An example of these difficulties is the lack of clarity about the rights of way and use of poles or ducts. In some countries, companies face contradictory regulations that slow down the progress of joint projects. In addition, the lack of regulatory frameworks that promote the efficient use of shared infrastructure can lead to protracted legal conflicts, delaying key initiatives.

To overcome these barriers, it is essential to develop integrative policies that establish unified, coherent and flexible regulatory frameworks that facilitate shared use agreements, reducing costs and execution times. These may include clear inter-agency coordination mechanisms, economic incentives to reduce integration costs, and the adoption of international best practices for infrastructure sharing.

In addition to these strategies, additional measures can be implemented to foster transparency and reduce administrative costs associated with regulation. For example, the use of digital platforms can facilitate the issuance of permits, dispute resolution, and the management of joint projects. These tools can be integrated with real-time monitoring systems to ensure regulations are complied with efficiently. This will not only benefit the companies involved, but also the end users, who will enjoy more accessible and efficient services.



TECHNICAL AND INTEROPERABILITY BARRIERS

Technology compatibility and the lack of common standards represent significant barriers to infrastructure integration. For example, poles and ducts used for power grids do not always meet the weight, space, or insulation requirements needed to support telecommunications equipment. In addition, differences in communication protocols between IoT devices in both industries can limit interoperability and increase deployment costs. These technical limitations, combined with the lack of adaptation to the local conditions of each country, increase the complexity and delay the implementation of integration projects.

To mitigate these challenges, it is essential to adopt international standards such as those defined by bodies such as the Institute of Electrical and Electronics Engineers (IEEE) and the International Telecommunication Union (ITU), but also to complement them with specific guidelines adapted to local needs. For example, in countries with high humidity or extreme temperatures, the materials of poles and ducts must be resistant to adverse weather conditions. Likewise, the implementation of innovative solutions such as multifunctional smart poles can optimize shared infrastructure. These posts integrate sensors for environmental monitoring, efficient lighting systems, charging points for electric vehicles and communication antennas. In countries such as Chile, joint technical committees have identified these technologies as a viable option for dense urban areas, while Costa Rica has implemented pilots to evaluate their effectiveness in rural areas.

Another key solution is the interoperability of communication systems. The lack of standardization in IoT protocols can be addressed through common data management platforms that allow devices from different manufacturers and sectors to be integrated. This interoperability will not only reduce operational costs but also make it easier to analyze and optimize shared resources.

Capacity building in technical teams is also crucial, as it ensures that professionals are prepared to manage the technical complexities of cross-sectoral projects. Joint training programs, driven by governments, universities, and the private sector, can accelerate the adoption of technologies and ensure the sustainability of integration projects.

Finally, it is essential to strengthen the links between the electricity distribution and telecommunications sectors through the creation of technological consortia that promote the transfer of knowledge and the development of joint technologies. These consortia could facilitate access to finance for research and development and generate economies of scale that benefit both companies and end-users. Thus, technical integration will be able to advance in a sustainable, efficient manner and adapted to the specific challenges of the region.

INSUFFICIENT REMUNERATION

One of the recurring challenges in shared infrastructure integration is the lack of an adequate remuneration scheme for owners of infrastructure, such as poles and ducts, that does not fully recognize the opportunity costs associated with shared use. This creates disincentives for homeowners to invest in infrastructure maintenance and modernization. For example, in countries where access fees are regulated without considering factors such as amortization, operational risk, and depreciation of assets, owners face difficulties in justifying new investments. This is especially critical in rural areas, where infrastructure wear and tear is greater due to adverse weather conditions and lower user density.

To address this problem, it is essential to develop regulatory frameworks that contemplate remuneration models based not only on direct costs, such as maintenance and operation, but also on the cost of capital invested and the risks associated with shared use. They should also include economic incentives, such as guaranteed rates of return, to foster cross-sectoral collaboration. It is equally important to establish dispute resolution mechanisms, such as specialized arbitrations, that allow the actors involved to resolve disagreements over rates and terms of use efficiently. In addition, international experiences suggest that the implementation of digital platforms for permit and contract management can facilitate transparency and reduce conflicts between parties. It is also possible to establish a value that can be reduced as mutual benefits arise between the telecommunications and electricity distribution sectors.

PROLIFERATION OF TELECOMMUNICATIONS OPERATORS

The emergence of new small operators in the telecommunications sector, while positive for fostering competition, presents significant risks when they do not fully comply with technical and safety regulations. These actors can generate problems such as interference in the operations of the electricity grid, improper use of shared infrastructure and difficulties in technical coordination. For example, in some cases, emerging operators install equipment on distribution poles without respecting load limits or minimum safety distances, which can cause failures in the power grid or increase risks for maintenance workers.

To mitigate these risks, regulatory frameworks must require minimum operating standards, such as compliance with international regulations on electrical safety and telecommunications. Oversight mechanisms should be strengthened through the incorporation of regular inspections and the use of remote monitoring technologies that allow for early identification of non-compliance. It is also necessary to establish certification requirements for new operators, ensuring that they have the necessary technical and operational capacity to integrate into the existing ecosystem without generating disruptions. Specific training programmes aimed at these actors can ensure adequate knowledge of regulations and best practices.

In addition, fostering alliances between large operators and emerging players could facilitate the transfer of knowledge and the adoption of uniform standards in the sector. This collaborative approach will not only reduce the associated risks, but also promote more balanced and sustainable competition, benefiting end users with higher quality and reliable services.

RISKS ASSOCIATED WITH CYBERSECURITY

The integration of power and telecommunications networks exponentially increases the attack surface for cybercriminals. Interconnected systems can be vulnerable to attacks that compromise sensitive data, disrupt power supply, or affect consumer privacy. In addition, the increasing reliance on IoT devices in both industries presents additional risks, as many of these devices lack robust protections against cyberattacks.

To mitigate these risks, it is imperative to develop robust security protocols that include multi-factor authentication mechanisms, advanced encryption, and continuous network monitoring. Companies must take a proactive approach, investing in AI and machine learning solutions that identify and neutralize threats before they materialize. In addition, incident response plans must be implemented that allow companies to act quickly in the event of a security breach, minimizing operational and economic impacts.

Fostering active collaboration between the two sectors is essential to address these threats. Joint cybersecurity bodies in Europe, such as the European ENISA initiative, can serve as a model for implementing similar strategies in Latin America. These models include the creation of shared security operations centers (SOCs) that monitor and protect critical infrastructures in real time. In addition, governments can work on regulatory frameworks that include regular audits, cybersecurity certifications, and the adoption of international best practices for converged infrastructures.

Strengthening cybersecurity also requires education and awareness at all levels of the organizations involved. This includes everything from advanced technical training to awareness campaigns for employees and local communities on the importance of security in digital environments. Investing in early detection technologies, such as threat information and analysis systems (SIEMs), can be key to identifying anomalous patterns and preventing attacks before they impact critical operations.

URBAN AND LANDSCAPE IMPACT

The integration of electricity distribution and telecommunications infrastructure poses significant risks related to the urban and landscape impact of traditional installations and new joint projects. Aerial infrastructures, such as poles and cables, generate visual pollution and saturate urban space, especially in densely populated areas or areas of high historical and landscape value. The lack of clear regulations on the disposal, maintenance and removal of disused assets increases these problems, affecting the quality of the urban environment.

Burying networks emerges as a potential solution, but it also involves significant financial risks due to its high cost. A lack of coordination between local authorities and infrastructure owners can lead to fragmented projects, with excessive costs and limited benefits. In addition, the absence of clear agreements on the management of assets retired before depreciation can lead to economic losses and discourage future investments in integration.

> The integration of power and telecommunications networks exponentially increases the attack surface for cybercriminals

04

REGULATION OF SHARED INFRASTRUCTURES IN LATIN AMERICA

The Latin American regulatory frameworks on the sharing of electricity distribution and telecommunications infrastructures are generally characterized by the lack of adequate regulations and procedures for access, monitoring, control and remuneration of infrastructure sharing, in addition to the non-existent supervision and lack of fines. In addition, they have been focused on large players and do not consider the large number of small telecommunications operators that have emerged in recent years and that do not always follow regulation, which is especially sensitive in countries such as Brazil.

In terms of remuneration, in this country the regulators (ANEEL and ANATEL) defined a single reference price for all companies. This value was defined in 2014 and continues without any update to this day. It has been the subject of lawsuits, since the price that should be agreed bilaterally is questioned, always referring to the reference value of 2014. In addition, there is a need to improve the mechanisms for controlling the shared use of infrastructure. The Brazilian authorities of both sectors (ANEEL and ANATEL) have reviewed the issue through public consultations, with the aim of improving this synergy, regarding the roles and obligations of each party involved.

On the other hand, in Argentina there is no regulatory framework for shared infrastructure. The few existing regulations are already more than 30 years old and the sharing of infrastructure with the telecommunications service has been based only on the lease of the poles of the overhead power lines for the laying of cables, either cable television and, more currently, fiber optics. However, an initiative was recently launched that considers electricity distributors as eventual Independent Passive Infrastructure Operators (OIIP) (defined as any individual or entity who, without being an ICT Service provider, has aerial, terrestrial or underground infrastructure that serves as support for networks for the provision of such services; and mainly composed of towers, masts, poles, ducts, channels, conduits, cameras, cables, easements, rights of way, fiber optic lines, antennas). Although it is clarified that OIIPs will not require a license, authorization or permit to lease infrastructure, the obligation to notify the communications regulator (Enacom) of the start of their activities, in order to be incorporated into the OIIP Registry, is determined.

In Peru, Resolution 143/2022-CD/OSIPTEL contains a formula for the calculation of infrastructure sharing remuneration that does not cover the real costs incurred by electricity distribution companies, proposing an equivalent of up to 10% with respect to the remuneration prior to the aforementioned standard. Under this argument, telecommunications companies have begun to request the renegotiation of their contracts, being that the telecommunications regulator can issue “sharing mandates” to force the application of the new formula, with an obvious detriment to electricity distribution companies.

In the case of Colombia, despite having advanced regulations by the Communications Regulatory Commission (CRC) on the conditions of access, use and remuneration of infrastructure sharing, the revision of this regulation in the last five (5) years has generated an un-

der-remuneration for energy distributors compared to the efficient and opportunity costs that would be expected for the use of the electrical infrastructure by telecommunications companies. In addition, the regulation has not successfully addressed the need for network standardization and countless cases of inefficient, inappropriate and disorderly use of electricity networks by the telecommunications sector continue to occur.

Finally, in the Chilean context, under the framework of the efficient company model, distributors must operate under a regulatory scheme that prioritizes the minimum cost, limiting the flexibility to incorporate new investments or adapt existing infrastructures to the demands of other sectors, which makes it difficult to implement solutions that are not directly related to the electricity supply. such as shared access to poles and networks for the deployment of fiber optics and 5G technology. This poses challenges in establishing transparent and appropriate tariffs that reflect the actual costs of maintaining and sharing assets.

However, initiatives such as alliances for the deployment of multifunctional poles or the use of digital platforms to manage infrastructure sharing agreements are paving the way towards a more integrated model. For example, Enel Distribución Chile has implemented advanced communication systems for 5G and thus improve communications coverage by taking advantage of the structural safety of electric poles, facilitating their shared use with telecommunications companies.

05
GOOD REGULATORY PRACTICES

To advance in the networks integration it is essential that regulators in the electricity and telecommunications sectors collaborate and in a coordinated manner establish regulatory frameworks that promote this integration in an orderly and efficient manner. In this sense, an ideal regulatory framework to determine the conditions of access, use and remuneration for the use of the infrastructure of the electric power sector must at least consider:

The conditions of access to eligible infrastructure for the deployment of telecommunications networks and services.

The applicable general principles and obligations, such as the efficient use of infrastructure and scarce resources.

Free and fair competition, in addition to non-discriminatory treatment.

An efficient cost-oriented remuneration, which recognizes the opportunity cost and the characteristics of each concession area.

The principles of publicity and transparency.

The emergence of new actors, responsible for the management of telecommunication poles and cables (“single operator”) and also the neutral network providers.

Recent studies and solutions that adopt alternative materials, which facilitate organization and sharing.

The proper use of the infrastructure and the non-degradation of the service of the owner of the infrastructure eligible to be shared.

In addition, it is important to regulate the right to access and use of the infrastructure susceptible to sharing, requests for access and use, adequate coordination between the two sectors for the operation and maintenance of their networks and guarantees that ensure, under principles of proportionality and reasonableness, compliance with the obligations stipulated in the agreement or that derive from the acts of setting conditions of access and use.

Another fundamental aspect that needs to be considered in a regulatory framework on the matter are the technical aspects of the use of electricity grids. Normally, it should seek to regulate the marking on poles and pipes that are used in the sharing of infrastructure, the removal of unmarked or unused elements when the provider of telecommunications networks or services is identified or not, the technical standards for installation and adequate arrangement of elements, as well as the operating protocols on the assets of the other party, taking into account the safety requirements.

Finally, there must be a regulatory scheme that allows sanctions and fines to be applied to those telecommunications companies that carry out network installation without authorization and/or without signing a contract with the electricity network operator or that, having signed a contract, occupy poles not included in the contract.

Among the elements that are necessary for the development of a regulatory framework that organizes this relationship, we can mention the following:

REMUNERATION

Adequate regulation should promote that distribution companies have the necessary incentives to share their infrastructure with the telecommunications sector and, in turn, share with the final consumer of electricity the economic efficiencies represented by the additional income from the rental of assets, translated into possible reliefs in the distribution component of the tariff of the public electricity service. This would complement the benefits already perceived by optimizing investments in infrastructure and enjoying better ornamentation of cities.

As for the remuneration methodology to be defined, in addition to being efficient and recognizing the opportunity cost, it must consider that the replacement values of the electrical assets for both the conduits and poles reflect the costs of the assets that are currently being used. Likewise, the remuneration methodology must consider the useful life, the cost of operation and maintenance, the discount rate of the electricity sector and other costs incurred by the distributors, such as: analysis of the technical feasibility of the requested infrastructure, expenses of inspection of deficiencies of the telecommunications networks, incremental expenses for additional time when changing poles, adaptation of infrastructure to be shared, administrative expenses for the management of sharing contracts, management of the unauthorized supports installed; among others.

BALANCED COEXISTENCE AND DIFFERENTIATED RESPONSIBILITIES

Regulatory frameworks must consider the characteristics of the different agents involved and the emergence of new actors, in order to optimize investments and long-term operating costs for both industries. Both the telecommunications operator and the electricity distributor must be able to choose between investing in their own infrastructure or leasing the service to the other operator, for which it is necessary that there be regulations that provide certainty regarding the effects of one or the other alternative, and guarantees regarding the non-existence of possible competition in the future.

In this regard, it is important to point out the importance of the autonomy and self-sufficiency of the sectors, avoiding creating cross-subsidies between them. In this sense, the telecommunications operator must remunerate the opportunity cost of the infrastructure necessary to provide the telecommunications service, recognizing that the electricity distributor has made substantial investments in assets, which are already in operation for the electricity service and vice versa. In this sense, the opportunity cost would be assumed by the sector that dispenses with implementing the infrastructure on its own.

Regarding the synergies between the sectors, many opportunities can be explored. The sharing of monitoring of fiber boxes and transformers, unification of activation in the event of accidents, failures, collisions, and heavy rains, integration of network management centers, accelerating activations and response times, and unification of the pole relocation system are among some examples of synergies that can be developed.

TECHNICAL AND OPERATIONAL COORDINATION

The regulations must encourage telecommunications operators to comply with the technical and safety standards observed by the distributor, in such a way as to guarantee an orderly installation of the networks with minimum safety distances in the installation, which facilitates the control and use of the infrastructure in applications related to the electricity activity itself.

The foregoing, since the occupation of disorderly infrastructure – or irregular in some cases – brings damage to the distribution system, such as:

Overloading of structures and defaults on payments for each occupied fixation point, ultimately affecting the energy consumer, who ends up bearing the cost of any loss on assets.

Irregular and clandestine occupations, in addition to urban and landscape damage (visual pollution), which cause unfair competition among service providers, since those who monopolize infrastructure without authorization can abuse the dominant power and affect competitiveness in prices and service coverage.

In the financial field, the electricity operator assumes an unmanageable risk when a telecommunications company defaults on payments or simply goes into liquidation.

There is a need to advance in the role of the regulator on shared infrastructure, so as to discourage bad practices such as, for example, the non-removal of disused cables or the installation of networks without authorization from the distributor. In addition, it is necessary to promote the coordination of investments and operation and maintenance plans among telecommunications companies that use the electrical infrastructure. In

this regard, it is important that regulation addresses the following challenges:

Encourage installations exclusively through authorized ducts or poles.

Prevent the multiplication of unused networks and prevent overbooking.

Promote the correct identification of wiring (in use and disuse).

Expedite the standardization of deficiencies and the transfer of networks.

Establish a framework procedure that simplifies and accelerates the authorization of infrastructure sharing between agents.

For their part, distributors must carry out inspections of pre-approved projects, maintain a limit on the occupancy of points in each infrastructure and encourage unification by economic groups. In addition, it is important that they have the necessary information to develop geographic information systems, which allow the identification of shared infrastructure, which would allow better planning of growth and identification of future projects, as well as the supervision and control of the infrastructure.

Finally, it is necessary for telecommunications companies to strengthen the training of the personnel of the contractor companies that access the infrastructure for installation purposes, demanding the appropriate industrial safety tools for the great risks to which they are exposed in their operation, such as electrical risk and height risk, in order to protect both the operational personnel themselves and the citizens who travel near the infrastructure.

> To advance in the networks integration it is essential that regulators in the electricity and telecommunications sectors collaborate and in a coordinated manner establish regulatory frameworks that promote this integration in an orderly and efficient manner

MITIGATION OF URBAN AND LANDSCAPE IMPACT

The integration of distribution and telecommunications infrastructure represents an excellent opportunity to address and mitigate the impact on urban and landscape furniture. This initiative entails the updating of the rules for construction, disposal, reserves, use, operation and dismantling of assets, in accordance with the urban and development plans of the municipalities and the regulation.

To mitigate these risks, it is essential to advance coordination between local governments, national authorities and the sectors involved. This collaboration must be aligned with urban development plans and the specific regulations of each sector, so that the development of large infrastructure works in cities is used as an opportunity to bury the networks, significantly reducing costs and visual pollution, since otherwise it results in an extremely high cost compared to using aerial networks – between 5 to 7 times higher -, which would result in a significant impact on the rates paid by customers. It is important to have previously discussed with the regulator how to proceed with the assets that must be retired before their depreciation, so as not to lose these opportunities due to lack of certainty.

In addition, regulatory frameworks should establish clear procedures for the dismantling and disposal of retired assets prior to depreciation, ensuring adequate compensation for owners; designing policies that encourage the integration of burial projects with other urban infrastructure works, reducing costs and maximizing benefits; and to promote the use of multifunctional poles that combine public lighting, telecommunications and charging points for electric vehicles, minimizing the proliferation of structures.

By adapting these regulations, greater harmony can be achieved between the facilities of both sectors and the urban and natural environment, reducing visual pollution and environmental impact. There are also successful experiences at the international level, such as Enel's Open Fiber in Italy, which closed the gap in access to the broadband network through fiber optics in rural areas and small towns, allowing the rental and sharing of existing electrical infrastructure, such as poles and ducts, to minimize urban interventions and accelerate deployment.

06
CONCLUSIONS AND RECOMMENDATIONS

The analysis carried out throughout this document highlights the importance of integration between the electricity distribution and telecommunications sectors as a key driver for sustainable development and infrastructure modernization in Latin America. Multiple benefits of this synergy were identified, including resource optimization, cost reduction, closing digital gaps, and improving the quality of life of communities.

From the point of view of the electricity sector, infrastructure integration not only maximizes the use of scarce resources and reduces costs, but also provides tangible benefits to consumers and the environment. Among other aspects that are strengthened with the integration of electricity distribution and telecommunications infrastructures to be considered are the implementation of technologies such as IoT, artificial intelligence, energy storage systems to improve the stability and reliability of the electricity supply, demand management systems to reduce peak demand and improve energy efficiency and quality of service.

In addition, it was evident that this integration makes it possible to address critical challenges such as electrification and connectivity in rural areas, where intersectoral collaboration can have a transformative impact. On the other hand, the transition to smart grids and the deployment of technologies such as IoT and 5G offer unprecedented opportunities to improve the efficiency and resilience of both sectors.

However, important challenges were also pointed out. Among them, the lack of regulatory harmonization continues to be a significant obstacle, generating uncertainty in joint projects. In addition, the associated technical risks, such as system interoperability and cybersecurity, demand priority attention. Financial barriers, particularly in emerging markets, also limit the scope and speed of implementation of collaborative initiatives.

To ensure a successful integration of these networks, greater collaboration between regulators in the electricity and telecommunications sectors is required, to establish robust, coherent and well-coordinated regulatory frameworks that provide clear rules regarding access to and use of infrastructure, efficient remuneration for its use and the guarantee of non-degradation of service. In addition, the supervision and sanctioning capacities of regulatory agencies must be implemented and strengthened to prevent non-compliance with the rules and mitigate the risks associated with the disorderly proliferation of infrastructures and the lack of common technical standards.

On the other hand, it is essential to advance in the development of a comprehensive business model for infrastructure sharing, promoting sustainable agreements with the telecommunications sector on issues such as the optimization of the use of poles and ducts, standard agreements to maximize available capacity, allow co-investment in critical infrastructures, and establish rates based on real costs and transparency, ensuring an equitable benefit for the parties involved. This can be complemented with the development of digital platforms to manage the sharing of infrastructure, which will simplify operational processes such as the automation of permits, request management, and real-time monitoring of the status of poles, pipelines, and other assets through IoT sensors.

In addition, training and knowledge transfer programs should be implemented to ensure that technical teams are prepared to manage the complexities of integration, addressing areas such as cybersecurity, system interoperability, and predictive maintenance. In addition, resources must be allocated to the research and development of advanced technologies that optimize the management of shared infrastructures.

The integration of the electricity distribution and telecommunications sectors represents a unique opportunity to transform Latin America's infrastructure, generating economic, social and environmental benefits. Electricity distribution companies, telecommunications companies and regulatory authorities have a crucial role to play in leading this process, ensuring that policies, investments and actions are oriented towards inclusive and sustainable development, and incorporate a long-term vision that seeks efficiency, resilience and the well-being of society as a whole.

07
REFERENCES

Comisión de Regulación de Energía y Gas (2024). Documento CREG 074 de 014 “Compartición de infraestructura eléctrica – Condiciones técnicas” Recuperado de: https://gestornormativo.creg.gov.co/gestor/entorno/docs/pdf/doc_creg_0074_2014.pdf.

Comisión de Regulación de Comunicaciones (2020). Resolución 5890 de 2020, “por medio de la cual se definen condiciones de acceso, uso y remuneración para la utilización de la infraestructura del sector de energía eléctrica en el despliegue de redes o la prestación de servicios de telecomunicaciones. Recuperado de: https://www.crcom.gov.co/sites/default/files/normatividad/00005890.pdf.

Deloitte, Association for Progressive Communications - APC (2015). “Unlocking broadband for all. Broadband infrastructure sharing policies and strategies in emerging markets”. Recuperado de: https://www.apc.org/sites/default/files/Unlocking%20broadband%20for%20all%20Full%20report_1.pdf.

Ente Nacional de Comunicaciones (2024). “Compartición de infraestructura pasiva”. Recuperado de: https://www.enacom.gob.ar/comparticion-de-infraestructura-pasiva_p5668.

Martínez, Ricardo et. al (2020). “Transformación digital: compartición de infraestructura en América Latina y el Caribe”. Banco Interamericano de Desarrollo (BID). Recuperado de: https://publications.iadb.org/publications/spanish/document/Transformacion-digital-Comparticion-de-infraestructura-en-America-Latina-y-el-Caribe.pdf.

Osiptel (2022). Resolución N° 143-2022-CD/OSIPTEL. “Norma que establece la oferta referencial de compartición y otras disposiciones aplicables a la compartición de infraestructura eléctrica utilizada para el despliegue de redes de telecomunicaciones”. Recuperado de: chrome- https://www.osiptel.gob.pe/media/eqelaqc1/resol143-2022-cd.pdf.

Soto, Gerardo, et.al (2023). “El uso de infraestructura de electricidad por empresas de telecomunicaciones.” Revista Themis No. 83. Recuperado de: https://dialnet.unirioja.es/descarga/articulo/9720675.pdf.


adelat